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**IMPACT OF DEFENCE SPENDING, INTERNAL THREAT,
POLITICAL INSTABILITY AND ARMS IMPORTATION
ON ECONOMIC GROWTH IN NIGERIA**

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UUM
Universiti Utara Malaysia

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**IMPACT OF DEFENCE SPENDING, INTERNAL THREATS, POLITICAL
INSTABILITY AND ARMS IMPORTATION ON ECONOMIC GROWTH
IN NIGERIA**

By



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**Thesis Submitted to
School of Economics, Finance and Banking,
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in Fulfilment of the Requirement for the Degree of Doctor of Philosophy**



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ABSTRACT

The existence of internal threat, political instability and arms importation has led to the rise in defence expenditure in Nigeria. Whether defence expenditure, with or without threat has a benign or malign impact on the economic growth, is a matter that needs rigorous academic investigation. The objective of this study include examining the impacts of defence expenditure on economic growth in the presence of threats, political instability and arms importation in Nigeria. It also examines the impacts of defence research and development, defence components on the Nigeria`s economic growth. In addition it examines the asymmetric causal relationship between defence expenditure and economic growth in Nigeria. Using the robust Autoregressive Distributive Lag (ARDL) model, and asymmetric causality approach. The results reveal that defence expenditure-internal threat and defence-political instability interactions both have positive and significant impacts on economic growth. On the contrary, it reveals that defence arms import interaction has a significant and negative impact on growth in Nigeria. However, the impact of defence Research and Development on economic growth it is not significant as a result of insufficient funding. The result furthermore found that the causation between defence expenditure on economic growth in Nigeria is unidirectional from defence to economic growth. This implies that defence expenditure stimulates growth during the time of threat and civil unrest. The study recommends a revisit on the funding of defence sector in Nigeria. The current defence budget is grossly inadequate for the defence, considering the threats in Nigeria since it independence and recent threats such as the “Boko Haram” and Niger Delta Militancy among others. Regarding the defence R&D, proper funding, as well as management should be considered on Defence Industrial Cooperation of Nigeria to avoid over dependence on foreign sources.

Keywords: defence, internal threat, economic growth, autoregressive distributive lag model

ABSTRAK

Kewujudan ancaman dalaman, ketidakstabilan politik, dan pengimportan senjata telah meningkatkan perbelanjaan pertahanan di Nigeria. Sama ada perbelanjaan pertahanan, dengan atau tanpa ancaman mempunyai kesan benigna atau buruk terhadap pertumbuhan ekonomi, adalah satu perkara yang memerlukan siasatan akademik yang padu. Kajian ini mengkaji kesan perbelanjaan pertahanan terhadap pertumbuhan ekonomi dalam situasi wujudnya ancaman, ketidakstabilan politik, dan pengimportan senjata di Nigeria. Ia juga menyiasat impak penyelidikan dan pembangunan pertahanan, iaitu komponen pertahanan, terhadap pertumbuhan ekonomi Nigeria. Selain itu, ia turut menilai hubungan sebab dan akibat yang asimetri antara perbelanjaan pertahanan dan pertumbuhan ekonomi di Nigeria. Menggunakan model Autoregresif Lag Teredar (ARDL) yang jitu dan pendekatan sebab akibat asimetri, keputusan kajian mendedahkan bahawa interaksi perbelanjaan pertahanan-ancaman dalaman dan pertahanan-ketidakstabilan politik mempunyai kesan positif dan signifikan terhadap pertumbuhan ekonomi. Sebaliknya, interaksi import senjata pertahanan mempunyai kesan yang signifikan dan negatif terhadap pertumbuhan. Walau bagaimanapun, kesan penyelidikan pertahanan dan pembangunan terhadap pertumbuhan ekonomi tidak signifikan akibat pembiayaan yang tidak mencukupi. Hasil kajian juga mendapati kesan perbelanjaan pertahanan terhadap pertumbuhan ekonomi adalah satu arah, yang menunjukkan bahawa perbelanjaan pertahanan merangsang pertumbuhan pada zaman ancaman dan rusuhan awam. Kajian ini mencadangkan penerokaan semula terhadap pembiayaan sektor pertahanan di Nigeria. Bajet pertahanan semasa adalah tidak memadai untuk pertahanan disebabkan oleh ancaman di Nigeria sejak kemerdekaan dan ancaman baru-baru ini seperti Boko Haram dan Militan Delta Niger antara lainnya. Mengenai penyelidikan dan pembangunan pertahanan, pembiayaan yang betul serta pengurusan perlu mempertimbang Kerjasama Pertahanan Industri Nigeria untuk mengelakkan terlalu bergantung kepada sumber luar.

Kata kunci: perbelanjaan pertahanan, ancaman dalaman, pertumbuhan ekonomi, model autoregresif lag teredar

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
APC	Arewa People's Congress
ARDL	Autoregressive Distributed Lag
BRIC	Britain Russia, India and China
CBN	Central Bank of Nigeria
COMA	Coalition for Militant Action
CUSUM	Cumulative sum of Recursive Residuals
CUSUMQ	Cumulative sum of Recursive Residuals Square
DH	Defence Headquarters
DICON	Defence Industrial Cooperation of Nigeria
ECT	Error Correction Term
FDI	Foreign Direct Investment
GPI	Global Peace Index
ICRG	International Country Risk Guide
IMF	International Monetary Fund
IVF	Iduwini Volunteer Force
LDCs	Less Developed Countries
MASSOB	Movement for the Actualization of the Sovereign State of Biafra
MEND	Movement for the Emancipation of the Niger Delta
MINT	Mexico, Indonesia, Nigeria and Turkey
MoD	Ministry of Defence
MOSOP	Movement for the Survival of the Ogoni People
MSSND	Movement for the Self-governing State of the Niger Delta
NDA	Nigerian Defence Academy
NDCG	Niger Delta Coastal Guerillas
NDMFS	Niger Delta Militant Force Squad
NDPSF	Niger Delta People's Salvation Front
NHIS	National Health Insurance Scheme
NPC	National Planning Commission
OECD	Organization of Economic Cooperation and Development
OPC	Oodua People's Congress
OPEC	Organization Petroleum Exporting Countries
PKO's	Peace Keeping Operations
PPF	Production Possibility Frontier
R&D	Research and Development
SAARC	South Asian Association for Regional Cooperation
SAP	Structural Adjustment Programmes
SIPRI	Stockholm International Peace Research Institute
TCC	Troops Contributing Countries
TRADOC	Training and Doctrine
UN	United Nations
UNAMSIL	United Nations Mission in Sierra Leon

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Economic growth is a much-desired goal of every nation of the world. The need to study economic growth in countries became more attractive at the end of the Second World War. Then it became glaring that some nations experienced growth while others experienced either very minimal or no growth or even negative growth (Easterly, 2001). The search for economic growth started from the works of Adam Smith, who led an enquiry into the 'Wealth of Nations' and Thomas Malthus, who postulated that population growth would affect economic growth. To the view of scholars, such as Lucas (1988) and Rostow (1960), investment in dams, roads and machines would lead to growth in backwards countries. Solow (1956) however, argues that investment in tools would not lead to growth, but it is technological change that would stimulate growth in a weak economy. This debate persists where economists built more sophisticated models in which one or more of the factors are endogenously determined (Todaro & Smith, 2003).

While the search for economic growth continues, there has been rising debate over the impact of government expenditure on economic growth. Barro (1989) for instance, found the coefficient of government expenditure on economic growth frequently non-significant. When the impact of government expenditure is narrowed down to the field of defence expenditure on growth, an array of conclusions are reached using varying empirical and statistical methods. From the time Benoit (1973)

delivers a seminal paper on defence expenditure and growth, a host of scholars prove on the impact of defence expenditure on growth have also been investigated. The direction of causation, the budgetary trade-offs between defence expenditure and other sectors, such as health and education which are considered the key players to any economic growth. These studies adopt various models, such as the Feder-Ram model (1986), Harrod-Domar model (1956), augmented Solow model and the Barro growth model to test the impact of defence spending on economic growth (Todaro & Smith, 2003).

After its fifty three years of independence, Nigeria is still regarded as a poor country. The economy is rank low in all socio-economic indicators. Nigeria is a poor country with abundance natural and human resources. This scenario could be attributed to security challenges that bedeviled the country since independence. Until now, Nigeria pays severe costs for socio-economic development as a result of insecurity. It is argued that no nation can achieve economic development in the presence of an environment of socio and physical insecurity (Eweten, 2014).

For several decades Nigeria has witnessed and still witnessing internal violence, crises and terrorism activities, than external vices. These internal threats pose serious challenges to socio-economic development. The alarming rate of insecurity has manifested in terrorist actions (such as Boko Haram and Niger Delta Militancy) in different parts of the country, caused unpleasant consequences detrimental to the nation`s economy, growth and development (Olukayode & Urhie, 2014).

However, the Niger Delta Militants claim cutting of the crude oil production in Nigerian by 30%. In 2006, \$1 billion oil proceeds has been lost within three month and over 29 Nigerian military were killed by the militants. By July 2007, 200,000 barrels of crude oil per day were stopped by the Militants activities and insurgent attacks. There has not been exact records of the oil stolen daily in the Niger Delta, though it has been estimated as somewhere between 200,000 to 300,000 barrels per day. Illegal oil bunkering between 2003 and 2008 has caused a loss to the Nigerian economy totaling approximately \$50 billion. The condition across the oilfields is now as tense as during the onset of the Nigerian civil war in 1967 (Courson, 2007). In addressing the issue of insecurity, since the inception of democracy in 1999 in Nigeria, various governments initiated different policy measures. Despite these efforts, it has fail to yield the desired results and Nigeria is among the low-ranking countries in the Global Peace Index (Brown, 2014). The persistent vulnerability and sense of continuous fear of threats in Nigeria and globally have given rise to an extraordinary surge in defence expenditure worldwide.

The world's defence expenditure has increased significantly. However, there have been variations among regions and countries around the globe in the scale and economic burden of defence expenditure. Although the surprising scale of defence expenditure raises a lot of questions of affordability and sustainability. Defence expenditure impact on economic growth and weakening contributions to the fiscal deficit have also been criticized for perceived inadequacies of defence preparedness and insufficient resources (Anyanwu & Aiyedogbon, 2011). There are calls for growth seeking countries to notice the policy advice made by civil society

organizations and international institutions, to reduce their spending on the defence sector. Such spending are to be channeled to non-defence sectors, such as health and education.

The trends and pattern of defence expenditure, however, reveals that this is not the case (Stockholm International Peace Research Institute [SIPRI], 2014). Despite the calls by the international communities for defence expenditure cut, the world's defence expenditure as of 1988 stood as \$1 trillion. It then reached \$1.118 trillion as at 1996, signifying 2.5% of the global Gross Domestic Product (GDP) (Blomberg, 1996). The World's defence spending in 2007 and 2010 reached \$1.339 and \$1,630 trillion respectively representing 2.6% of the world's GDP. The increase was solely due to the increase in defence spending by the United States of America (USA) ' compared to the rest of the world.

By 2012, the world's defence expenditure stood at \$1.756 trillion representing 2.5% of GDP or \$249 for each person in the world. In 2013, it was \$1.750 trillion recording a fall of 1.9 % in real terms since 2001 (SIPRI, 2014). In 2014 world defence expenditure is estimated as \$1776 billion, then deceases to \$1676 billion in 2015, this figure is equals to 2.3% of the world GDP. The trend of the global defence expenditure is depicted in Figure (1.1). The world total defence expenditure fell to 0.4 percent in real terms between 2013 and 2014 (SIPRI, 2015).

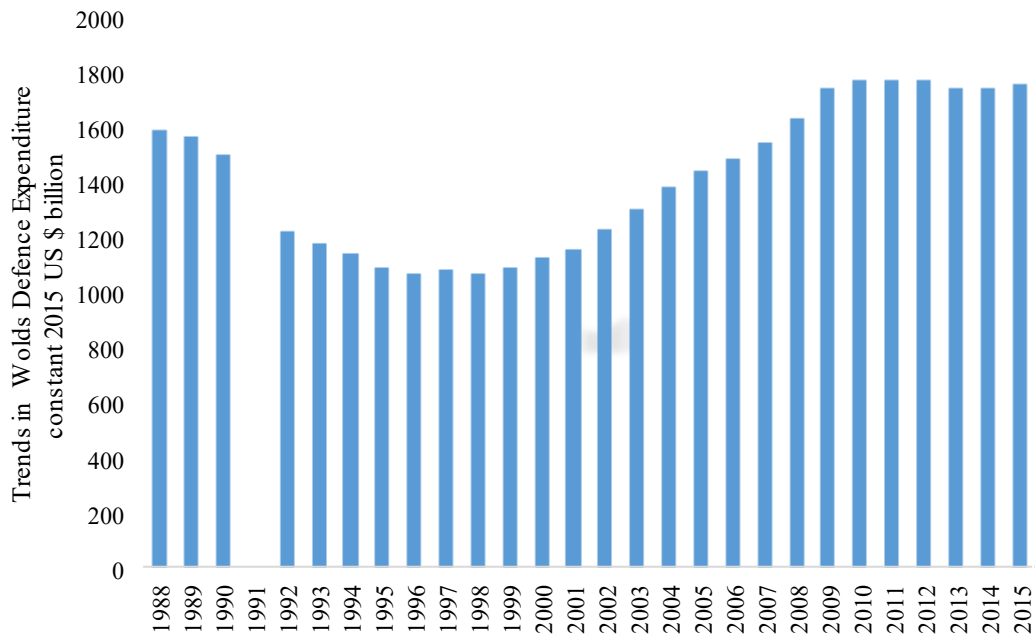


Figure 1.1
Trends in World Military Expenditure

Source: SIPRI Fact Sheet

Note: The totals are based on the data on 172 states in the SIPRI Military Expenditure Database, <<http://www.sipri.org/databases/milex/>>. The absence of data for the Soviet Union in 1991 means that no total can be calculated for that year.

The distribution of the worldwide defence expenditure in 2014 indicates what might be the beginning of a shift from the Western countries to other parts of the World, precisely Eastern Europe and some developing countries. In fact, military expenditure over the world, excluding the USA, has increased by 1.8%. The four highest spenders are the USA, 36%, China, 13%, and Saudi Arabia 5.2% and Russia, 4.0%. While Saudi Arabia leads the United Kingdom (UK), Japan and France and the rest of the world, accounting for 19%. Indeed, China, Russia and Saudi Arabia have doubled their defence spending since 2004.

There are no much changes in the countries that comprised the top 15 defence spenders in 2015 over the years. The USA has defence expenditure of \$596 billion, it

retains the world's largest defence spender and it nearly three times that of China which is second in the world ranking. Nonetheless, Saudi Arabia surpassed Russia to become the third-largest spender in the world. The fall in oil prices meant that Russia's increase of 7.5 per cent in 2015 was considerably lower than projected in its budget. However, the 2016 budget shows a relative decrease in defence expenditure. Yet, Russia and Saudi Arabia besides USA and China recorded highest levels of defence expenditure as a share of their GDP since 1990 with 5.4% and (13.7%) for Russia and Saudi Arabia, respectively. See Table 1.1.

Table 1.1
The World 15 Countries with the highest Defence Expenditure and Nigeria

Rank	Country	Spending in billion USD	World share 2015 (%)	Spending as a share of GDP
1	USA	597	36	3.3
2	China	215	13	1.9
3	Saudi Arabia	87.2	5.2	13.7
4	Russia	66.4	4.0	5.4
5	UK	55.5	3.3	2.0
6	India	51.3	3.1	2.3
7	France	50.9	3.0	2.1
8	Japan	40.9	2.4	1.0
9	Germany	30.4	2.4	1.2
10	South Korea	36.4	2.2	2.6
11	Brazil	24.6	1.5	1.4
12	Italy	23.8	1.4	1.3
13	Australia	23.6	1.4	1.9
14	UAE	22.8	1.4	5.7
15	Israel	16.1	1.0	5.4
44	Nigeria	2.33	0.2	0.8
Total top15		1350	81	
World total		1676	100	2.3

Source: SIPRI 2015

Similarly defence expenditure in the sub-Saharan Africa is recently dominated by a fall in spending due to decreasing oil revenues, which is the main revenue to some countries Nigeria inclusive. For example Nigeria's defence expenditure fell by 2.5 per cent between 2014 and 2015, it account for only 0.8% of the Nigeria's GDP

despite the ongoing military operations against Boko Haram SIPRI (2015). However, going by its history from 1961, the year after independence, Nigeria's defence expenditure stood for only 0.1% of the GDP and this low trend continued throughout most of the period of the First National Development plan (1962-1968). The low priority given to the defence sector during this period was due to the fact that the role of the armed forces was considered minimal and the country was largely at peace within and with its neighbors. In addition, the armed forces were seen as inconsequential to the attainment of foreign policy objectives (CIA world Factbook, 2014).

From the time the civil war broke out in 1967, defence expenditure expectantly increased very sharply, starting from 3.91% of the GDP and peaking at 10.14% of the GDP in 1969. The sharp rise in defence expenditure during the civil war was largely due to weapon procurement and the enlargement of the armed forces with its associated costs such as provision of accommodation, salaries, feeding, kitting and so on. The size of the military forces rose drastically from 10,000 men to about 300,000 men at the height of the civil war (CIA world Factbook, 2014).

Figure 1.2, reveals that defence expenditure stood as 0.8% of the Nigeria's GDP in the late eighties. It subsequently rises to 0.9% around early nineties. Subsequently, it rises again to 0.93% around 1993 to 1994 and drops to 0.78% in 1995. Defence expenditure in Nigeria rises decreases to 0.57% in 1996, it decreases till 1998. With the inception of democratic dispensation in 1999, defence expenditure in Nigeria increases to 1.42%, it maintains the average of 0.9% of the GDP.

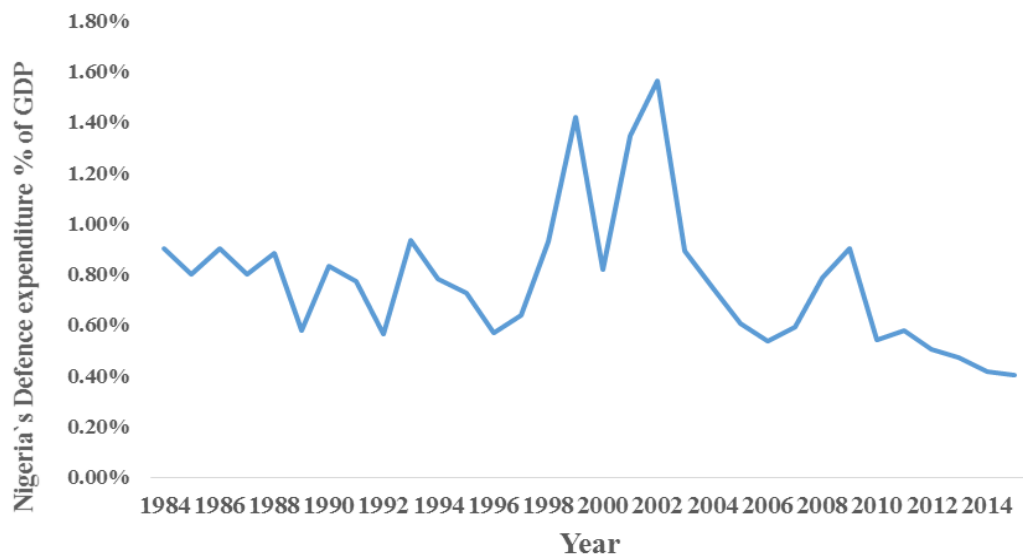


Figure 1.2
Budgetary Allocation to Defence in Nigeria

However, in monetary terms defence allocation rose from ₦63471 million in 2001 to ₦108, 147 million in 2002. This increase was mainly due to the fact that military has been use to curb crimes and other militia activities in the Niger Delta region. The period also witnessed the Liberia’s civil war in which Nigeria actively participated, armed robbery as well as, and other violent crimes in Nigeria. By the year 2003, allocations to defence fell again to ₦61723 million. This was due largely to a reduction in Nigeria’s participation in Peace Support Operations (PSOs) and the shift in government perception from the need for external security to internal security as witnessed by the increase in allocation to internal security (Mezue, 2005).

The combination of rising internal security demands, Nigeria’s role in regional peacekeeping missions and high oil revenues partly explained the growth in spending on defence in Nigeria, particularly for 2007. The oil-rich Niger Delta region has

increasingly been the scene of armed violence from non-state actors. This is one of the reasons for the Nigerian Government's investment in maritime capabilities, which are intended particularly for the surveillance of the Niger Delta region. Construction began in 2006 on a naval surveillance system, intended to protect Nigeria's coastline and offshore oil platforms. This program was complemented in 2007 with the acquisition of equipment such as modern patrol boats, to provide security for the oil companies operating in the region. The Nigerian Government allocated 2 billion naira (\$16 million) for this purpose in 2007, a decision that attracted strong domestic criticism.

Due to the increased militant activities in the Niger Delta, the 2008 budget made provisions for a total sum of ~~N~~444.60 billion for the military and the Police. This was with the intention to enhance the capacity and preparedness of the security services and in line with President Yar adua's Seven Point agenda. This amount was meant to provide Nigeria's security services with all requisite force enablers and multipliers, including arms and ammunition, improved information and telecommunications equipment and facilities, riot control equipment, training and retraining, and sundry logistics support. It was also meant for rehabilitating the residential and office accommodation of the security services (Musa Yar' Adua's Budget Speech 2008).

The trend in defence expenditure in Nigeria is thus largely driven not only by the growth in the economy, but also based on the internal threat perceptions of the leadership as well as the political and Afri-centric foreign policy objectives of the country (Olofin, 2012). Despite the increase in the internal threat in Nigeria defence

expenditure as a proportion to the GDP continue to decline (Magbadebo, 2012). It can be summarized that defense expenditure on average in Nigeria accounted for about 0.7 % of the Nigeria`s GDP (Anyanwu, Egwaikhde & Aiyedogbon, 2012).

Though defence is not considered productive in the economic sense, however it is has been established that a strong defence is necessary to assure security. Which is very crucial for the economic growth of the nation (Erdogdu, 2008). Nwanegbo and Odigbo (2013) and Chandler (2007) argue that scholars have identified strong connection between security and economic growth and development. It is believed that development is not attainable in any country where there are conflicts, crises and war. In the studies of Stan (2004) and Chandler, there is a consensus that development and security are two, but inseparable variables, that affect each other.

The Nigerian defence has been contending both external as well as internal threats to security. The external threats being faced by the Nigerian defence among others includes: the persistent attacks, forceful tax collections by the militia groups of the neighboring countries (such as Niger, Chad and Cameroon) on the Nigerian nationals on the neighboring borders, water piracy and illegal smuggling. However, the internal threats in Nigeria include the civil war, ethnic and religious violence, the armed militia groups, illegal arms trafficking, and the pipeline vandalism as well wilful destruction of public goods (Omede 2012). Instances of Defence Internal Security Operations in Nigeria 1960 to date are presented in Table 1.2.

Escalating terrorism, regional conflicts as well as instability across the globe in the current years have necessitated greater domestic security and defence outlays in both developed as well as developing economies (Yakovlev, 2004). The causes of these conflicts range from resource conflicts to power tussle disputes. There has been not only a change in the nature of wars and conflicts, but also in the technological, political, economic, industrial and military compositions. These trends affect the way budgets are allocated and inevitably, the amount that goes to defence expenditure. Defence expenditure has implications for economic growth and needs to be analysed explicitly as a significant input to the political process engaged to determine the composition of public spending (Matthews, 2001).

Scholars offer detailed and various channels through which defence influences economic growth. These channels are broadly grouped into three, they are: demand, supply and security channels (Dunne *et al.*, 2005). First on the demand channel, defence expenditure influences growth through the Keynesian multiplier effect, which is also depend upon the defence composition.

The demand channel proposes that an increase in defence expenditure stimulates aggregate demand through capacity utilization and reduced unemployment. In this regard defence expenditure is considered growth stimulating. In many developing economies such as Nigeria defence expenditure is seen as a means of enhancing infrastructure as well as human capital development through training which contributes to the future growth and development.

Table 1.2

Instances of Defence Internal Security Operations in Nigeria 1960 to Date

Serial	Government/Regime	Period	Area of action
1.	Abubakar Tafawa Balewa	October 1960- January 15, 1960-July 1966	1). Quelling of the Tiv uprising 1960-64 2). Implementation of Emergency rule in Western Region in 1962 3). Western region election crisis 1965-1966
2.	General J.T.U. Aguiyi Ironsi	January 15, 1966	Overtaken by interregnum
3.	General Yakubu Gowon	July 29, 1960- July 29, 1975	1). Maintenance of Law and order during the 1966 crisis, especially violence in the north 2). Quelling the Biafra rebellion 1967-1970e north. 3). Joint Military Police anti- robbery patrol
4.	General Murtala Mohammed/Olusegun Obasanjo	July 29, 1975- October 1, 1979	1). Quelling students riots (Ali must Go)
5.	Alhaji Shehu Shagari	October 1, 1979- December 31st 1983	1). Anti-smuggling campaigns Lagos. Management of Ogunpa Flood disaster of 1981 at Ibadan. 2). Maitatsine religious crisis in Kano, Bauchi, Kaduna, etc. 3). 1983 General Elections crisis
6.	General Muhammadu Buhari	Dec. 31, 1983- August 31 1985	1). Joint Police Military Security Task Force
7.	General Ibrahim Babangida	August 27, 1985- August 26, 1993	1). Quelling the anti-SAP riots of 1989 2). Quelling the Zango-kataf mini-war of 1992 3). Quelling of June 12 protests of 1993 4). Joint Police-Military Security Task Forces
7.	Chief Ernest Shonekan	Aug. 26, 1993- Nov. 17, 1998	Joint Police-Military Security Task Force
8.	General Sani Abacha	November 17, 1993-June 8, 1998	1). Quelling of Ogoni uprising of 1993-1994 2). Joint Police-Military Security Task Forces.
9.	General Abdulsalami Abubakar	June 8, 1998- May 29, 1999	1). Joint Police-Military Security Task Force
10.	Chief Olusegun Obasanjo	May 29, 199- May 29, 2007	1). Odi crisis, 1999 2). Onitsha disturbances, 2006 3). Niger Delta crisis, 1999-2009 4). Ikeja Bomb blasts, 2001 5). Ife-Modakeke crisis, 1999 – 2000 6). Plateau state (Jos) crisis 7). Sharia & Religious Crisis in the North
11.	Alhaji Umaru Yar'Adua	May 29, 2007 - May 5, 2010	1). Quelling of Islamic insurgency in Borno (Maiduguri) 2009 2). Jos crisis
12.	Dr Good luck Jonathan	July 29, 1960- July 29, 1975	1). Boko Haram crisis (to date) Jos crisis (to date) 3). Post – elections crisis (April 2011)

Source: Okoli, Al Chukwuma, Orinya, Sunday "Evaluating the Strategic Efficacy of Military Involvement in Internal Security Operations (ISOPs) in Nigeria.

However it has been argued that defence expenditure has opportunity cost and may results to crowding out of the investments opportunities such as education and health which are considered human capital. The magnitude of this crowding-out depends on the prior utilization of resources. An already constraint country has to cut its budget on the other aspects of expenses, or put more taxes to finance an increasing defence burden. Or the government must make a mixed decision between high debt, higher taxes or cut in other expenses. Obviously, it may not be so simple to conclude whether the net effect of higher defence expenditure on output and growth is negative or positive in the demand channel specification (Dunne *et al.*, 2005).

Second on the supply channel, the defence contests with other civil sectors for physical capital labor, human capital, technology as well as the available natural resources. Any resource utilized by the defence will not be available for usage for the civil sector. Number of opportunity costs related to a higher defence spending include: crowding-out of the public and private investments; adverse balance of payments in arms importing countries, inefficient bureaucracies, fewer civilian public sector services, depleted R&D activities, and the diversion of skilled workforce in the civilian sector. On the other hand, it can be argued that defence R&D spending can result in the development of new technology that can spill over to the private sector Mylonidis (2006). Dunne *et al.* (2005) argued that defence training can make workers more productive in a case they return to civilian sector, while defence R&D can lead to spin-offs. Some proponents of defence expenditure argue that some typical researches cannot be effectively carried out by the civil and private sector due to the nature of the high-risk environment as well as the public-good

characteristics of the final product. Hence, defence R&D then can be a net producer of positive technological externalities.

Stroup and Heckelman (2001), points that the net effect of defence expenditure on growth is described a non-linear and concave function, hence the defence sector exhibits diminishing marginal productivity. It therefore implies that at a low levels of defence expenditure the net effect of defence expenditure on growth is positive, while after a certain point, economic growth declines as defence expenditure continues to grow and can even become negative. Additionally, Dunne *et al.* (2005) points that mobilization and ideological fervour can lead to an increase in the mobilization of factors of production, mostly during times of a perceived threat, possibly leading to greater output especially when these resources are not fully utilize fully for defence reasons. By implication mobilization effort at best has a positive impact on growth in the short run.

Third in the case of security channel, defence expenditure nurtures security of persons and property rights against threat both domestic and foreign, which are essential to the operation of markets and to the incentives to innovate and invest. This argument is dated back to the time of Adam Smith who pointed out that the first two duties of the state are to protect its citizens from foreign and domestic threats. It has been established in the literature that threats and lack of security are two major obstacles to development in many poor countries. However, when expenditures defence is not born out of the basic security needs and are due to corruption then, defence expenditures may lead to arms race or militancy. In line with this argument

Aizenman and Glick (2006) argue that economic growth is stimulated with defence spending when there is high threat, likewise economic growth decreases in the existence of higher defence expenditure when a country experiences high corruption. In this regard, low defence expenditure could be desirable and could lead to positive security effects on economic growth.

However, when it is narrowed down to the case of Nigeria scholars argue that unless the defence sector is adequately equipped and its capability enhanced, Nigeria's resources and national interests may be in jeopardy (Sarah & Olu-coris, 2012 and Edame & Nwankwo, 2013). Inadequate or excessive allocations to the defence sector could hinder economic growth in Nigeria. This research analyses the impact of defence expenditures on the Nigerian economy in the presence of threats, political instability and excessive arm importation.

1.2 Economic Highlight of Defence in Nigeria

The involvement of the Armed Forces in the internal security operations has been inevitable due to the higher level of internal threats and political instability that persistently reveal itself in Nigeria. This has been the case ever since Nigeria was established, and it has continued throughout the colonial era. The recent incidence of Boko Haram and Niger Delta Militancy observed in the country have further justified the need for the armed forces involvement in the provision of internal security in Nigeria. Military forces have come to remain as an integral part of Nigeria's internal security structure going by the degree of current threats in the North–Eastern part of Nigeria as well as the Niger Delta region (Azinge, 2013; Brown, 2014). It is argued

that with the phenomenal increase in defence expenditure in Nigeria, one would expect the level of security to be high, thereby deterring conflicts such as political instability and creating an environment where economic growth can thrive. Some believe that defence allocation in Nigeria has been inadequate over time.

Although since the Nigerian Civil War, there has not been any external war that has shaken the territorial integrity of Nigeria, there have been several ethnic, religious, economic and political conflicts, the indices referred to as measures of political instability (Barro,1991). These conflicts have adversely and severely affected the productive capacity of Nigeria and by extension its economic growth. This has become evident in the face of the insecurity in the Niger Delta where Nigeria's growth in output is being jeopardized by security problems. Boko Haram conflicts in other parts of the country have led to human and physical capital loss and stifled economic activities (Blessing, 2002; Ogomogunam & David, 2014; Michael, 2014).

Political instability and economic growth are deeply interconnected. In the sense that political instability reduces investment and the speed of economic growth and development. In Nigeria, instability has reduced significantly the rate of savings, investment both domestic and foreign. Despite the increase in growth rate in the recent years, economic indices that depicts development have been very poor in Nigeria. Unemployment has been on the increase, as a result of troubled environment that deters job opportunities. Farm lands have been abandoned, and companies deserted as a result of political instability. The decline in the foreign investments as a result of the political instability combined with the impact of the global oil crises has

led to the short down of tens of thousands of investment in Nigeria (Omoyibo and Akpomera, 2013). It has been established that political instability affect economic growth negatively as it affects policies. Political instability has negative impacts on productive economic decisions such as saving and investment (Alesina, 1996).

The Oil production which is the main stay of Nigeria's economy has drastically reduced due to the kidnappings of oil workers in the Niger Delta region. Nigeria is therefore estimated to be losing about 600,000 barrels of oil on the daily basis due to the illegal oil bunkering amounting to about N3.7 trillion yearly (Adegbami, 2013). The trend of kidnapping and abduction of foreigners has forced businessmen and women, manufacturing companies and all sort of investors to relocate to other neighboring countries entirely. For example, the Nigeria Breweries Limited (NBL), Seven-Up PLC, Michelin, UNILEVER PLC, Paterson Zochonis (PZ) PLC have either relocated to neighboring countries or change location within Nigeria. (Nwagboso, 2012).

Linking the ongoing debate to economic growth, defence expenditure, internal threat and political instability in Nigeria, it is glaring that growth in the GDP has been affected by the frequent occurrences of internal threats and political instability that emanates since independence till date. For instance, within the period covered by this study, Oil production, agricultural activities as well as other economic activities have been affected by the activities of the Niger delta and Boko Haram among other militant groups. The growth in the oil sector was hampered by supply disruptions arising from the oil theft and pipeline vandalisation. Similarly, the security issues in

the North eastern part of Nigeria have effected farm production, which gave rise to an increase in food prices and destruction of the economic as well as commercial activities (Nwagboso, 2012).

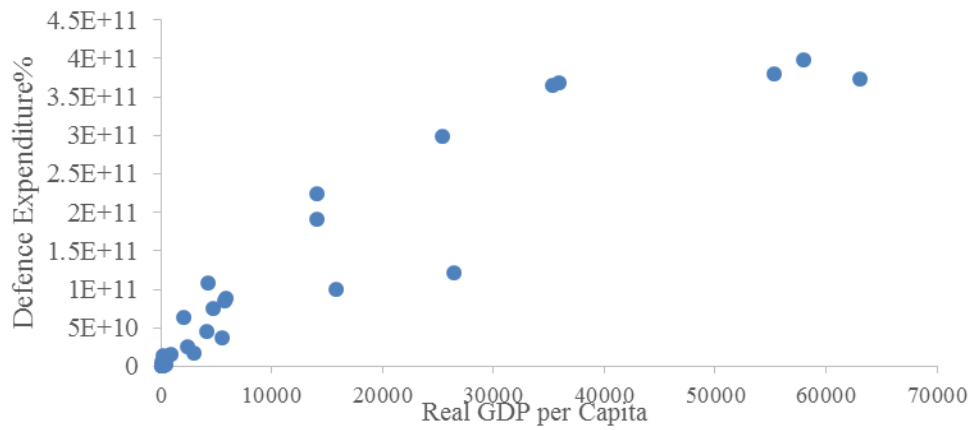


Figure 3a
Defence Expenditure, Real GDP Per Capita in Nigeria

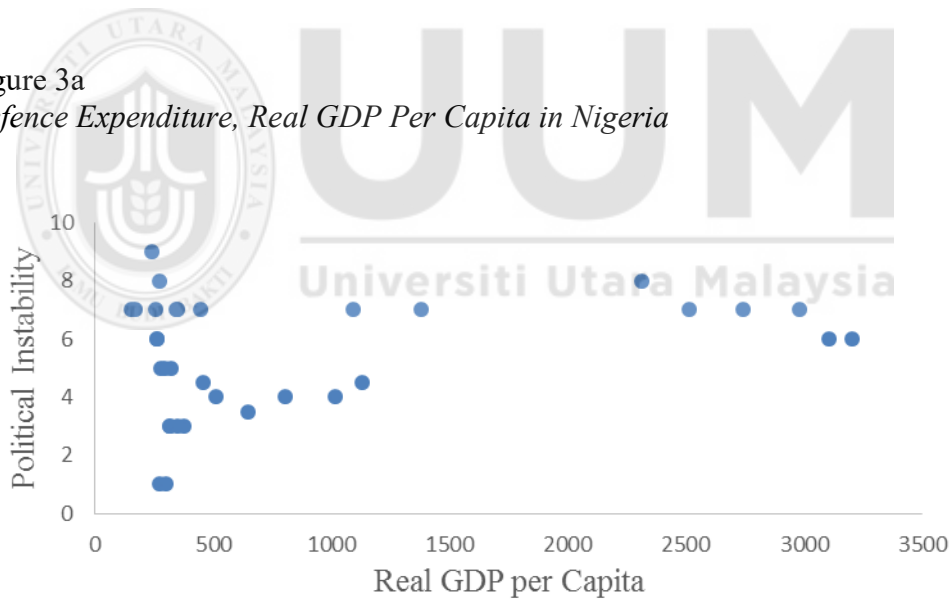


Figure 3b
Political Instability and Real GDP Per Capita in Nigeria

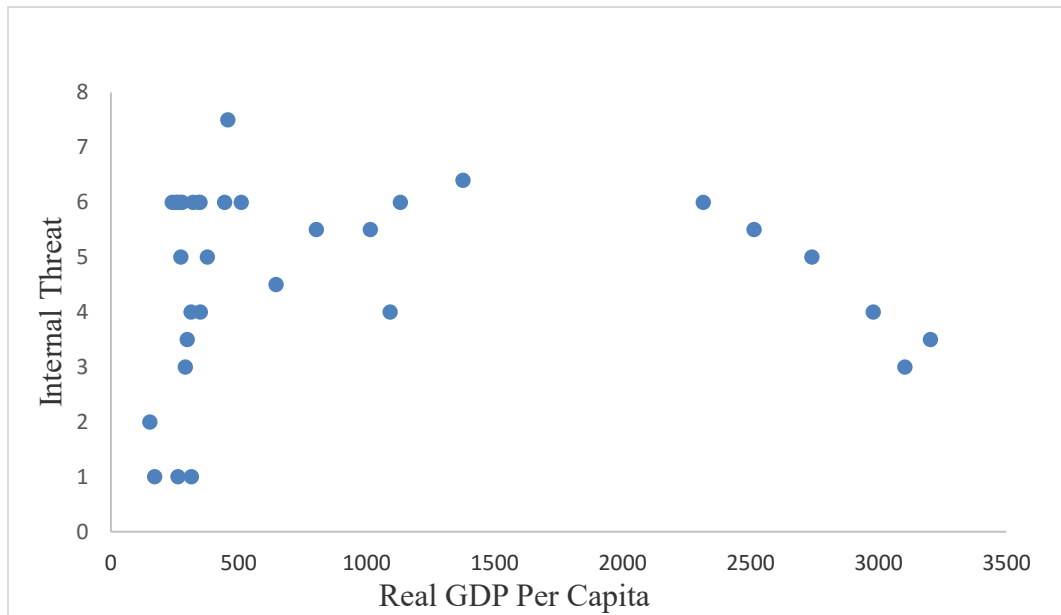


Figure 3c
Internal Threat and Real GDP Per Capita in Nigeria

Figures 3 (a-c) depicts the link between political instability, internal threat and real GDP per capita in Nigeria respectively. While the first figure (a) depicts a concave shape relationship between defence expenditure and real GDP per capita. The second and the third Figures (b and c) indicate inverse relationship between political instability, internal threat and real GDP per capita in Nigeria. Since these are only preliminary test regarding the relationship, further analysis is required to draw conclusion with regard to these relationships.

From 1983 to 1984 economic growth in Nigeria was negative which was associated to high political instability and internal conflicts in the Niger delta regions, while defence expenditure as a percentage to GDP was averaged of 0.8%. Moreover, the growth in the GDP later increases from 1990 to 1991 and still falls back as of 1991 till 2002 this was equally associated to the conflicts in the Niger delta which continues throughout

1990's with still defence expenditure on average remains 0.8% to 0.9% of the GDP. The introduction of the Niger delta development Commission (NDDC) as well as the provision of the amnesty program to the militant groups reduces the militant activities which led to the GDP growth from 2000 to 2005.

Thereafter the activities of the Boko haram from 2006 till date affects the economic growth afterward. From 2005, when the Boko Haram's begins and increases its violent uprising in July 2008 to 2009 and its unexpected rebirth, following its mass prison breaks in 2010 contributed to the decline in the GDP growth. This is better explain considering its increasing sophistication of attacks, initially on the soft targets and progresses in 2011 to include suicide bombings on police buildings, market places, banks and car parks. The number of deaths attributed to the activities of the Boko Haram in Nigeria has increased by 317 % in 2014 (Global Terrorism Index, 2015). The insecurity has crippled businesses and agricultural activities in Nigeria, it has been attributed as the reason for low economic growth from 2005 till date. The defence expenditure at the same time remains minimal, as it maintains on average 0.8% and it has never exceed 1% throughout the period.

Narrowing to the issue of defence expenditure components such as defence R&D and arms importation in Nigeria. In the Nigeria's transformation agenda defence R&D was marked as one of the projects government prioritized. Funds are allocated to defence research institutions such as Nigerian defence academy, National Defence College, Institute of army education and Defence Industrial Cooperation among many. It was expected that the spill over impact of this research institutions would

contribute to the Nigerian economy as enshrined in the economic transformation blueprint. In such a way that Nigeria was expected to be self-sufficient in its defence gadget production. It was Meant to provide arms requirement to some agencies such as; Army, Navy, Air force, Police, Customs, civil defence among many (Magbadebo, 2012).

Defence Industrial Cooperation of Nigeria (DICON) was expected to provide small arms requirement for the local need as well as for export. Unfortunately this was not the case, in spite this, Nigeria has been defending on massive arms importation over years. This became so alarming during the recent fight against Boko Haram insurgent, of which out of desperation Nigerian delegates got arrested and detained in the South Africa. For the claimed that the officials have not declared on the entry the funds meant for the procurement of arms and ammunition. This made Nigeria a laughing paraphernalia in the international community.

Moreover, arms importation totally is not seen a bad deal, because it normally comes with some advantages such as technology transfer, training among others. But arms importation can be a problems if it leads to over dependency. Nigeria has become so over dependent on foreign arms not only from developed countries, but also from developing countries such as South Africa and Brazil. Between the year 2006 to 2015 arms importation to African countries has significantly increased by 19%. While the sub-Saharan African countries account for 41% of the Africa's total, Nigeria alone account for 11% of the sub-Saharan 41%. In their join military campaign against Boko Haram, Nigeria, Chad, Cameroun and Niger Republic

account for 0.6% of the global arms import between 2011 to 2015 Wezeman and Wezeman (2015). It is very clear that arms importation exerts more pressure on Nigeria's foreign reserve. In its quest to fight Boko Haram, Nigeria has expended much in arms procurement. This became more evident when the Nigeria's leadership blamed The United State of America for its unwillingness to sell arms and ammunition for Nigeria for its war against Boko Haram, which the Nigerian government claimed is not a threat to Nigeria alone, but to the whole world (Magbadebo, 2012).

Having discussed that it is essential to highlight the relationship between internal threat, political instability and some important macroeconomic variables in Nigeria. Table 1.3 depicts an inverse relationship between the growth in foreign direct investments, trades and internal threat as well as political instability in Nigeria. Meaning to say the periods of high internal threat as well as political instability are associated with low growth in the FDI in Nigeria and vice-versa. From 1984 to 1994 the growth in the FDI was minimal due to the high level of internal threat and political instability. The subsequent period from 1994 till 2009 has an increase in the FDI in Nigeria, this period was associated with low level of internal threat and political instability. However, from 2009 till date with the intensification of Boko Haram and Niger delta militants activities in Nigeria, foreign direct investment has been on the significant decrease.

Table 1.3
Defence Expenditure, Threats Foreign Direct Investment and Trade in Nigeria

Year	DE	FDI	INF	PI	THR	TRD	PPG
1983	0.284973	1.027979	13.76747	5	5	27.03717	2.607462
1984	0.209121	0.663717	13.26743	5	6	23.60888	2.629913
1985	0.017691	1.681726	5.542339	5	6	25.90006	2.635056
1986	0.164949	0.932437	11.63000	3	6	23.71676	2.616184
1987	0.080196	2.534126	67.39822	4	6	41.64666	2.582376
1988	0.831413	1.627125	22.92167	5	6	35.31198	2.548466
1989	0.831412	1.776141	45.04047	6	6	30.39176	2.523839
1990	0.550314	1.911375	9.290849	7	6	23.03022	2.505938
1991	0.791688	1.600578	17.60477	7	6	34.87606	2.497035
1992	0.733885	1.060113	68.06319	7	9	61.03097	2.495003
1993	0.540827	1.520921	26.1324	5	10	58.10985	2.49554
1994	0.892286	1.83256	31.00914	5	11	42.30887	2.496716
1995	0.743689	3.780688	113.0764	6	11	59.76783	2.500294
1996	0.697015	4.554308	32.72709	9	11	57.69099	2.506007
1997	0.548403	4.297446	1.013132	9	8	76.85999	2.513898
1998	0.616523	3.284921	-5.66569	11	7	66.17325	2.521883
1999	0.893408	2.80149	17.05014	11	8.5	55.84639	2.531932
2000	1.370673	2.457935	35.22953	9	7	71.38053	2.547768
2001	0.794729	3.697521	-0.32262	9	8	81.81285	2.570243
2002	1.292833	3.170063	39.89666	7.5	4.5	43.38364	2.596229
2003	1.517185	2.964105	11.14094	8	6	75.2189	2.620386
2004	0.868307	2.133331	-0.15775	8.5	7.5	48.44813	2.640346
2005	0.728541	4.438849	22.0244	8	6.5	50.74836	2.657618
2006	0.600638	3.33798	17.33778	8	6.5	44.60931	2.671499
2007	0.533694	3.62567	4.770742	7.5	6	44.46291	2.681133
2008	0.583547	3.93945	10.8353	5	5.4	44.97297	2.689512
2009	0.776457	5.04766	-4.32057	5	4	41.80285	2.692684
2010	0.887702	1.632849	10.82208	5	6	42.65138	2.683651
2011	0.539231	2.147237	9.510096	3.5	5.5	52.79410	2.660487
2012	0.579227	1.533762	9.271245	4	5	44.38014	2.690487
2013	0.502541	1.08024	5.873296	3	4	31.04886	2.560487
2014	0.469695	0.818972	4.662624	4	3.5	30.88519	2.530487
2015	0.459794	0.798673	4.562628	6	3	30.44529	2.540486

Note: DE, FDI, INF, PI, THR, TRD and PPG denote: Defence Expenditure, Foreign Direct Investment, Political Instability, Internal Threat, Trade and Population Growth.

Source: World Bank Indicators 2015, ICRG & SIPRI

Likewise also the volume of trade in Nigeria has equally shown a decrease with high level of internal threat in Nigeria. However, from 1984 to 1991 and from 2006 to 2014 the volumes of trade in Nigeria remain minimal in the presence of high internal threat and political instability when compared with that of 1992 to 2001 then there was minimal threat. Furthermore, since the attainment of independence in 1960, the unemployment rate has been on the upward trend. According to Lawson (2007), there has been no consistent trend on unemployment rates in Nigeria. High unemployment in one or two years is a times followed by a decline in the subsequent years, but unemployment in Nigeria is high in the time of conflict and political instability.

Defence expenditure in Nigeria as a percentage of the GDP has been on the decline over time. Despite the fact that Nigeria is faced by insecurity, its defence expenditure as percentage to GDP as compared to even other peaceful countries remain very minimal, it maintains an average of 0.7% over three decades (SIPRI, 2015). The foreign direct investment has been on the declines, some gigantic businesses such as Nigeria Breweries Limited (NBL), Seven-Up PLC, Michelin, UNILEVER PLC, Paterson Zochonis (PZ) PLC etc. have left Nigeria to some neighbouring countries. Which has led to the cut of workers and let the growth of unemployment level at its high rate over time. Internal conflicts and political instability have been high in Nigeria, it has been argued that these ugly scenarios have led to the decrease in investment, savings and growth in Nigeria.

Internal conflicts and political instability have been high in Nigeria, it has been argued that these ugly scenario have led to the decrease in investment, savings and growth in Nigeria. They have cause not only physical capital lost, but at the same time human capital. While trading has been obstructed due to the poor security and perceived threat to life and property right. For the increasing need for progress, unity, as well as economic development to permit an investment friendly environment. The budgetary allocation to defence in Nigeria has to be increased and properly channeled to raise development in Nigeria. It has been argued that to enhance the combat readiness of the Nigerian defence forces, so as to contain the internal threats efficiently, defence allocation has to be increased to enhance defence research and development and human capital development (Edame & Nwankwo 2013; Sarah & Olu-coris, 2012; Omitoogun, 2003; Omede, 2012; Imobighe, 1987; Omede, 2011; Nwanegbo & Odigbo, 2013). Onoja, a former director general ministry of defence Nigeria, stressed the importance of defence as:

“The role of defence in a political, socio-cultural and economic life of any nation is of paramount importance. In most developed countries example US, China and UK a greater part of their budget allocation are marked out for procurement, research and development of defence hardware in order to strengthen their defence base. The reason is that any organized society, security and stability are considered to be major contribution to healthy economy. A country that lacks political, economic and social stability endangers her economic base as well as growth and development”.

He further made an emphasis regarding the importance of defence and why it is necessary for better defence allocation in Nigeria:

“A nation free from external and internal threat has greater opportunity to expand its economic base through the attraction of foreign investment, proper planning and controlling of its activities. Essentially, defence is concerned with the protection of the state interest, the citizens, trade and investment. The role of defence is to defend the nation from threat, maintain peace and stability and enforce discipline.....internal threat like religious, socio-political unrest should also considered in determining defence allocation”.

In the extant literature, there is still no consensus in respect of defence expenditure and economic growth relationship. While many scholars argue that defence spending can stimulate growth through aggregate demand and by providing security, others see it as just a means of diverting economic resources away from the productive sectors (Apanisile & Okunlola, 2014).

However, as a measure of employing the best use of limited resources in Nigeria, prioritizing projects must take into account needs assessment. Authorities are to determine which projects/activities to start, which among the on-going projects should continue, which of these projects should be revamped and which projects to stop. It is on this note scholars agree that when expenditures defence is not born out of the basic security needs and are due to corruption then, defence expenditures may lead to arms race or militancy. In line with this argument Aizenman and Glick (2006) argue that economic growth is stimulated with optimum defence expenditure when there is high threat. Likewise they argue that defence expenditure decreases economic growth without threat.

However, as establish in the literature reasons for the conflicting findings between defence expenditure and economic growth are associated with diverse social, economic and institutional factors uniquely associated with different countries (Dunne, 2011; Araujo & Shikida, 2008; Antonakis, 1997). It has been argued that part of the major inadequacies of the conventional economic approaches is attributed to the fact that the analysis has focused on the wrong elements and models that do not adequately fit sometimes with the developing economies (Blomberg, 1996). Another important issue is that the impact of defence expenditure on economic

growth is basically studied at aggregate level without taking account of disaggregated components on which the expenditure is incurred.

1.3 Problem Statement

The previous studies conducted in the field of defence economics especially in developing countries are limited to either testing for causality between defence expenditure and economic growth, or examining the impact of defence expenditure on economic growth using aggregated values. Additionally, these studies do not adequately address the impact of defence expenditure in the presence of threat, political instability and arms importations especially in developing countries. However, few studies attempted only to examine the impact of defence expenditure in presence of external threats (Linpow & Antinori, 1995; Collier & Hoeffler, 2002; Aizeman & Glick, 2006; Araujo & Shikida, 2007; Yang, Trumbull, Yang & Huang, 2011). Scholars argue that, future studies should examine the impact of defence expenditure on economic growth in Nigeria and elsewhere taking into cognisance the internal threats (Aizeiman and Glick, 2006; Mezue, 2005).

It has been argued that increase in defence expenditure in presence of political instability decreases political instability and increases growth (Blomberg, 1996; Erdogdu, 2008). Political economists argue that security of persons, and property rights are crucial factors that determines private investments. Therefore policy makers that target higher employment, low inflation and economic growth are saddle with the responsibility of creating stable political as well as economic environment that guarantee security.

Owing to the fact that political instability has been one of the major problems to economic growth in Nigeria since its independence, this study examines the impact of defence expenditure in the presence of political instability in Nigeria. Previous studies on defence economics restrict themselves to only classical economic approach. They do not include political factors behind defence expenditure especially in developing countries like Nigeria. Where they do, they refer to political factors as authoritarian regime, coups, election times, duration of the governments' coalitions and so on (Blomberg, 1996; Fosu, 2001; Alesina *et al.*, 1991)

Secondly, literature on defence economics has not disaggregate defence expenditure components. Ram (1996), Aizeman and Glick (2006) has recommended assessing the impact of defence expenditure on the disaggregated components. This is because the impact of defence expenditure may be different if defence expenditure is disaggregated as against the usual aggregated components. This approach is an extension to the aggregated approach predominantly used on defence expenditure and economic growth literature. Hence, this study examines the impact of arms importation, defence R&D, sectoral allocation on the economic growth in Nigeria. Besides, only very few studies in the field of defence economics examine this area (Hartley, 2006; Chu & Lai, 2012). To the best of my knowledge this study is the first attempt that examines the impact of defence components such as arms importation, defence R&D, sectoral allocation on economic growth in a developing economy like Nigeria.

Previous studies (Iles Hatemi, Chang, Chen, Lin & Gupta, 2015) employ asymptotic Granger causality in establishing the causal relationship between defence expenditure

and economic growth. However, Hatemi *et al.*, (2015) examines the top six defense suppliers which are developed economies, using asymmetric causality. Therefore there is need to access defence expenditure in Nigeria using the asymmetric causality in Nigeria to determine causality in both good and bad times. This is in addition to asymptotic Granger and modified Toda & Yamamoto dynamic Granger causality test, using ARDL models to remedy the shortcomings of the traditional Cointegration Analysis in the presence of small sample size and mixture of integration order.

The situation in each country in other dimensions (economically, socially, or institutionally), if properly judged, will tell a certain diversity of results, which can ultimately be related to the defence expenditures of that country (Araujo & Shikida, 2008; Antonakis, 1997). Fruitful steps that might be significant for future research should consider time series analysis which takes care of peculiarities of an individual country. This is more reasonable when making inferences on a country specific. Generalization cannot be made regarding defence expenditure and economic growth relationship, by using a cross-sectional analysis, which cannot address some of the country specifics. More often, the effects of defence expenditure are examined on physical and human capital separately, while productivity could be raised employing both of them. Therefore, assessing their interactive impacts are better than their additive impacts (Antonakis, 1997; Chan, 1995; Erdogdu, 2008). The study will help policy makers in their decision towards changes in defence policies especially in Nigeria, facing political instability and internal conflicts. Finally, knowing the causal relationship among the variables of interest would also help the policymakers to take decision during the time of boom and time of recession regarding defence policies.

1.4 Research Questions

In the light of these problems, the study identified and seek answer to the following research questions:

1. What is the interactional impact of defence expenditure and threats, political instability and arms importation on economic growth in Nigeria?
2. Does defence research and development (R&D), and defence sectoral allocations have impacts on the Nigeria's economic growth?
3. Does defence expenditure in Nigeria causes economic growth or vice visa?

1.5 Research Objectives

The general objective of the study is to analyses the impact of defence expenditure and threat on economic growth using disaggregated component in Nigeria from 1980-2014. This objective is further translated into the following specific objectives:

1. To examine the interactional impact of defence expenditure and threats, political instability and arms importation on economic growth in Nigeria.
2. To determine the effects of defence research and development (R&D), and the effects of defence sectoral allocations on the Nigeria's economic growth.
3. To determine the causal relationship between defence expenditure and the economic growth in Nigeria.

1.6 Significance of the Study

The question of the relevance of defence expenditure in a developing country like Nigeria has been questioned by several scholars. However, with the growing internal threats and political instability in Nigeria, there is a need to revisit this arguement.

Most pertinent of these threats have been the constant bombardment of oil facilities in the Niger Delta area as well as the activities of Boko Haram among many in Nigeria. These threats have significantly brought the much flourished economic base to its lowest, as a result of both physical as well as human capital lost. While some argue that defence in Nigeria has not been well financed, other see it as just a means of diverting resources from productive sector to unproductive sector.

Therefore, an explicit analysis of the impact of defence expenditure on economic growth in Nigeria should indeed be a significant contribution to the Nigerian leadership involved in determining the appropriate composition of public expenditure to ensure rapid economic growth. Dealing with the scares resources and couple with the crash in the global oil market, making wrong project choices or any ineffective use of limited resources has its opportunity cost. In the long run it could hinder the realization of national objectives in Nigeria. Therefore, understanding the vital link between effective public expenditure management and national security objectives is particularly relevant for leadership at the strategic level. Whether defence expenditure, with/without threat plays a benign or malign role on the economic growth in Nigeria, is a matter that needs rigorous academic work investigation.

This work provide such an analysis which is expected to serve as a useful tool to the executive and legislative arms as well as relevant institutions of the government involved in the budgetary processes. It is equally beneficial to all other sectors involved in budgeting and planning, in particular to those in National Planning Commission, Ministry of Finance and Ministry of Defence. Policy makers that target higher employment, savings and Investments, low inflation and economic growth are saddle with the responsibility of creating stable political as well as economic

environment that guarantee security. The findings would be helpful in making rational allocation to defence, where it is proven to have some adverse effects, then reduction becomes an economic and political issue.

1.7 Scope of the Study

The study covers the period 1983-2015. The period is chosen base on the availability of data considered adequate for a time series analysis (Hakkio & Rush, 1991). The research is concerned with the expenditure within the defence sector, threats and political instability and their effects on economic growth in Nigeria. In addition, the study examines the impacts of the disaggregate defence expenditure components on economic growth. Data is accessed from the SIPRI, World Bank Development Indicators Data Bank, Nigerian Ministry of Defence. Finally, data on threat and political instability are obtained from the International Country Risk Guide (ICRG).

1.8 Organization of the Research

This study comprises of five chapters: Chapter one-introduces the entire thesis. The chapter covers the background and motivation of the study, statement of the problem, research objectives, significance of the research, scope of the study, organization of thesis and conclusion.

Chapter two hosts literature review. The chapter covers the theoretical frameworks, empirical literature review as well as the gaps in the literature reviewed. Chapter three contains methodological issues of the study. Models of defence expenditure and economic growth are discussed. Methodologies used in the course of the study are equally discussed. These Models are Autoregressive Distributed Lags (ARDL)

Model and Asymmetric Causality Test. Finally, the regression model for analyzing the impact of defence expenditure on economic growth are well specified. Data analysis and results discussion were carried out in Chapter four. Finally, the Chapter five-consists of summary of the main findings, the conclusion, policy implications, and limitations of this study as well as recommendations for future research.

1.9 Conclusion

This chapter highlights the background of the study, the problems that necessitate the need for the study, the scope of the study and the justification of the research study. The aim is to examine the relationship between defence expenditure threats and economic growth in Nigeria, using a desegregate approach.



CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews both theoretical and empirical literature related to the study. It also discusses the existing gaps in the literature. Finally the chapter ends with conclusion.

2.2 Theoretical Frame Work

This chapter constitutes the review of the previous literature related to defence expenditure and economic growth. For the interpretation of the results of any empirical study, it is essential to back it with a theory. For research on the economic effects of defence expenditure, it seems rather not simple for the fact that much of economic theories does not have an explicit role for defence spending as a distinctive economic activity. Yet, this has not hindered the development of theoretical analyses regarding defence expenditure and growth nexus. There have been prominent models on defence-growth literature adopted on both developed and developing countries in establishing this relationship. These include: Feder-Ram model; standard neoclassical growth model; augmented Solow model, as well as Endogenous growth model (i.e Barro model). Below are the review of the theories employed in the previous studies.

2.2.1 Feder-Ram Model

The Feder-Ram 1983 model represents a typical supply-based model of defence and economic growth. The Feder-Ram model was initially developed to model the effect

of exports on economic growth in the developing countries. It was later adapted by Biswas and Ram 1986 in a cross-country study of the impact of defence on economic growth. A host of variations on the Feder-Ram model exist in the literature, depending on the pattern of externalities, and the number of sectors included (Dunne *et al.*, 2004).

The popularity of the approach lies in the appearance of the direct link between theory and econometric specification. The basic model distinguishes between the defence and civilian output in which both sectors employ homogeneous labour and capital. Military production has external effects on national production. The model assumes that the economy has two sectors, namely the civilian sector and the defence sector. Externalities emanate from the defence sector to the civilian sector, meanwhile the main inputs to the industries are capital (K) and labour (L). The econometric form of the model is given in equation 2.1

$$D = D(L_D, K_D) : C = C(L_C, K_C, D) = D^\theta c(L_C, K_C) \quad [2.1]$$

While the resource constraints are:

$$L = \sum_{i \in S} L_i, K = \sum_{i \in S} K_i, S = \{D, C\} \quad [2.2]$$

Domestic income is given as:

$$Y = C + D \quad [2.3]$$

The butter and guns in [2.3] is only viable when C and D (civil and defence sector) are in monetary output (values) not only output quantities. The price normalization in the eqn 2.3 can be written as:

$$Y = P_C C_r(L_C K_C D) + P_D D_r(L_D K_D) \quad [2.3']$$

Where P_D and P_C implies monetary prices to the real output quantities D_r, C_r . This model shows the marginal values of both labour and capital that differs across the

sectors i.e

$$\frac{D_L}{C_L} = \frac{D_K}{C_K} = 1 + \mu \quad [2.4]$$

This can be re-written as:

$$\frac{P_D D r_L}{P_C C r_L} = \frac{P_D D r_k}{P_C C r_k} = 1 + \mu \quad [2.5]$$

The 2.5 highlights comparison of marginal factors productiveness across sectors depends upon their prices used. The equations from proportional differentiation equation 3.5 with 3.3 and 3.4 is given as:

$$\hat{Y} = \frac{C_L L}{Y} L + C_K \frac{1}{Y} + \left(\frac{\mu}{1-\mu} + C_D \right) \frac{D}{Y} \hat{M} \quad [2.6]$$

While $\hat{}$ notation indicates proportional rates of change, $1 = \partial K$ denotes net investment. If the final term equation 2.6 indicates a constant elasticity of C with respect to D , equation 2.7 can be written as:

$$\hat{Y} = \frac{C_L L}{Y} \hat{L} + C_K \frac{1}{Y} + \left(\frac{\mu}{1-\mu} + \theta \right) \frac{M}{Y} \hat{M} + \theta \hat{M} \quad [2.7]$$

This shows separate identification of externality effect and the marginal factor productivity differential effects. It has been argued that without a strong competitive pressure to induce efficiency in the management, the marginal productiveness is lower in the defence sector.

Dunne, Smith & Willenbockel (2005) argue that the results in the defence economics literature have been dominated by the Feder-Ram model, finding a significant effect of defence spending on growth. In contrast, the mainstream economic growth literature has not found defence spending to be an important determinant of

economic growth. Dunne & Perlo-Freeman (2003) criticizes the Feder-Ram model as being prone to theoretical misinterpretation and also suffering severe econometric problems, particularly simultaneity bias and lack of dynamics. In addition, it provides too narrow list of possible factors that have influence on growth. They thus conclude that the Feder-Ram model should be avoided in the defence economics.

2.2.2 Standard Neoclassical Model of Demand for Defence

The demand for defence from the mainstream economic theory supports the view that economic growth is stimulated by the increase in defence expenditure. The theory is an extension of the basic demand theory for an economic product in the neoclassical micro economics. According to the basic microeconomic theory of demand for a product, the demand by a rational consumer is derived from a utility maximization function with a budget constraint. The consumer demand function for a particular product is derived from the first order maximization condition, which is a function of a consumer's income and product's price (Atesoglu, 2013, Batchelor *et al.*, 2002).

Considering defense expenditure as public good and by permitting the influence of allies to defence expenditure in utility function. The inclusion of the contributions of allies in the determinants of demand for defense expenditure to a state's income and price. The theory of demand for defence expenditure further accepts that security to be a function for society. Meanwhile, security is assumed to be a function of defence expenditure of the state income, the allies, and enemies. This assumption necessitates a demand for defence expenditure function. In which defence expenditure is a function of defence expenditure by allies, adversaries, price, and a state's income.

The standard neoclassical model of demand for defence expenditure as outlined by smith (1989, 1990) is given as:

$$W = D(S, C, N, X) \quad [2.8]$$

Where W is welfare is a function of S security, C , consumption, N , population and X other control variables. The equation above is maximize subject to budget constraints. Y is a nominal aggregate income, P_D and P_C are the prices of defence expenditure and civil consumption. Then security function is given as:

$$S = s(D, ..Dn, Zs) \quad [2.9]$$

The security is a function of defence expenditure of income, allies and enemies of other factors. Put this into optimization function, defence expenditure is:

$$D = D(P_D P_C, Y, N, D_n Z_s) \quad [2.10]$$

For simplicity ignoring N_n Z_s and Z and following Smith (1995). Assuming a state is not aggressive, security function becomes:

$$S = D - \overset{*}{D} = D(\beta_0 + \beta_1 D_1) \quad [2.11]$$

Where $\overset{*}{D}$ forces a country needs to resist an assault/attack from its enemy. It comprises of fixed element unrelated to opponent forces (β_0) and the size of opposition (β_1). Using the langerarian method, given the linear expenditure system equation for D and C .

$$D = (1 - \alpha)Y / P_D + \alpha(\beta_0 + \beta_1 D_1) \quad [2.12]$$

and

$$D = (\alpha / P_c)[Y - P_D(\beta_0 + \beta_1 D_1)] \quad [2.13]$$

This determines expenditure as a function of income, price, preference and strategic parameter. For more realistic assumption that security depends on defence purpose

rather than expenditure. Stock of defence expenditure is defined as: depreciation sum of past expenditure

$$K_t = (1 - \delta)K_{t-1} + D_t \quad [2.14]$$

Where δ denotes depreciation rate, extending it to other country it gives:

$$S_t = K_t - (\beta_0 + \beta_1 + K_{1t}) = D_t - D_t^* \quad [2.15]$$

where

$$D_t^* = \beta_0 + \beta_1 + [D_{1t} + (1 - \delta)K_{1t} - 1] - (1 - \delta)K_{t-1} \quad [2.16]$$

Therefore demand function is:

$$D_t = (1 - \alpha)(Y / P_0) + \alpha D_t^* \quad [2.17]$$

Since stock are not involved, they can be therefore substituted as follows:

$$K_t = D_t(1 - (1 - \delta)L) \quad [2.18]$$

where L depicts the lag operator, in that:

$$Lx_t = X_{t-1} \quad [2.19]$$

Multiply through by: $(1 - (1 - \delta)L)$ and re-arranging, it gives a demand equation as:

$$D_t = +\alpha\beta_0\delta + (1 - \alpha)(Y / P_D)_t + \alpha\beta_1 D_{1t} + (1 - \alpha)(1 - \delta) [D_{t-1} - Y(Y / P_D)_{t-1}] \quad [2.20]$$

This model assumes that an increase in income results to an expansion of a budget, thereby stimulates the demand for all goods both public and private to increase. The demand for defence therefore implies that economic growth is stimulated through expansion in income due to an expansion in defence expenditure (Atesoglu, 2013). The Neoclassicals hold largely the supply-side argument, where defence expenditure provides social security which is considered a pure public good. This characteristic thus makes it imperative that defence is provided through government expenditure (Harris & Kelly, 1988; Smith, 1980; Smith, 1995; Smith & Smith, 1980; Dunne, &

Perlo-Freeman, 2003). However, Neoclassicals have been attacked for being more historic only able to validate observable actions and more on the supply side.

2.2.3 Augmented Solow Model

This model is introduced by Mankiw, Romer & Weil 1990, it is used to measure the effect of defence expenditure on growth. Its key assumption is that defence spending share $D = M/Y$ affects factor productivity via a level effect on the efficiency parameter that controls the labour, augmenting technical change. Like the Feder (1983) model, the dependent variable is the growth rate and it is a function of the share of investment and the rate of growth of the labour force. Unlike the Feder-Ram model, it is a one sector model; there is only one single good produced. The model employs an aggregate neoclassical production with labour augmenting technological progress:

$$Y_t = K_t^\alpha [A(t)L(t)]^{1-\alpha} \quad [2.20]$$

Where Y denotes real income aggregate, K represent real capital stock, L represent labour and A deficit technological parameter. The equation then becomes:

$$A(t) = A_0 e^{gt} m(t) \theta \quad [2.21]$$

While g depicts exogenous rate of Harrod-neutral technical progress, m stands for the share of military expenditure in GDP. This specification implies that a parameter change in m does not affect the long run steady state growth rate, rather it has a permanent level impact on per capita income, in the steady state growth path. Likewise along transitory growth rate to the new steady state equilibrium. In line with the standard Solow model of an exogenous saving rate S , the constant labour force growth rate n with a given depreciation of capital d , a dynamic accumulation of capital is described as:

$$\dot{K} = s k_e^\alpha - (g+n+\delta)k_e \Leftrightarrow \frac{\partial \ln k_e}{\partial t} = s e^{(\alpha-1)\ln k_e} - (g+n+\delta) \quad [2.22]$$

While $k_e : k/(AL)$ depicts the effectiveness of capital-labour ratio, α is the constant capital-output elasticity. The steady state level of k_e is given as:

$$k_e^* = \left[\frac{s}{g+n+\delta} \right]^{1/(1-\alpha)} \quad [2.23]$$

Using truncated Taylor series equation 2.23 is linearized around the steady state and using equation 2.24 it becomes:

$$\frac{\partial \ln k_e}{\partial t} = (\alpha-1)(g+n+\delta)[\ln k_e(t) - \ln k_e^*] \quad [2.24]$$

Since:

$$\ln y_e = \ln[y/(AL)] = \alpha \ln k_e \quad [2.25]$$

$$\frac{\partial \ln y_e}{\partial t} = (\alpha-1)(g+n+\delta)[\ln y_e(t) - \ln y_e^*] \quad [2.26]$$

where the steady state level of output per effective labour is:

$$y_e^* = \left[\frac{s}{g+n+\delta} \right]^{\alpha/(1-\alpha)} \quad [2.27]$$

Equation 2.26 approximates the transition dynamics of output per effective labour unit to a steady state. To operationalize 2.27 for empirical work, it is integrated forward from t-1 to t and get:

$$\ln(y_t) = e^z \ln y(t-1) + (1-e^z) \ln y_e^*, Z \equiv (\alpha-1)(n+g+\delta) \quad [2.28]$$

Using: y_e is related to observable per capital income $y=y/l$ via

$$\ln(y_t) = e^z \ln y(t-1) + (1-e^z) \left[\ln A_0 + \frac{\alpha}{1-\alpha} [\ln s - \ln(n+g+\delta)] \right] + \theta \ln m(t) - e^z \theta \ln m(t-1) + (t-(t-1)e^z)g \quad [2.29]$$

Note that in the steady state per capita income evolves according to

$$\ln y^*(t) = \ln y_e^* + \ln A_0 + \theta \ln m^* + g \quad [2.30]$$

Hence θ represents the elasticity of a steady state income with respect to the long run defence expenditure share: i.e a permanent one percent increase in m shifts the steady state per capital income path by θ percent.

The standard neoclassical growth model of Solow (1956) and Swan (1956) is extended to incorporate the linkages between defence spending, productive investment and the growth of capacity output. First, the basic neoclassical growth equation is expanded to include the investment ratio and the defence expenditure ratio as a determinant of capacity production. Second, a distinct investment function in which several standard factors determine the ratio of investment to GDP, and also by the fraction of GDP that is dedicated to defence spending, is specified.

In principle, because the theory is so tight, these issues could be explicitly investigated. However, because the theory is so tight, it excludes a range of other variables, e.g. institutions, which many economists think important. Therefore, more recent empirical work on growth has used more ad hoc models looking for variables that are not only significantly, but are robustly related to growth, in the sense that they are significant whatever the specification. Dunne et. al., (2004) maintains that although the augmented Solow model has fewer theoretical weaknesses than the Feder-Ram model, it is too narrow given the range of variables that have been found as significant determinants of growth. And it is implausible that the primary effect of the share of military expenditure is through technology.

Furthermore, the extension of the augmented Solow growth model in Goel & Ram (1994) and Goel, Payne & Ram (2008) has incorporated defence R&D. The aggregate production function is deduced to form a model that incorporated defence R&D as:

$$Y = (L, K, R) \quad [2.31]$$

Where Y is output, L is labour, K is capital and R depicts $R&D$ as another form of capital aside the tradition input: labour and physical capital. The $R&D$ is the stock of the research and development. It enters as production input in the sense that it affects total output in the quantities of labour and capital. Taking the differential on both sides of equation we have the following growth equation:

$$\dot{Y}_t = \beta_L \dot{L}_t + \alpha_K \left(\frac{I_K}{Y} \right)_t + \alpha_R \left(\frac{I_R}{Y} \right)_t \quad [2.32]$$

Where \dot{Y}_t and \dot{L}_t are the rates of increase in the aggregate output as well as labour force in a period t . The $\left(i.e. \frac{\partial_K}{Y} \& \frac{\partial_L}{L} \right)$ and I_K (which is equals to $\hat{\partial}_K$) is the conventional aggregate investment, I_R depicts $R&D$ expenditure. It is assumed that the increase in the $R&D$ stock ($\hat{\partial}_K$), β_L is the elasticity of output with respect to labour α_K and α_R depict marginal product of conventional capital and $R&D$ expenditure respectively. In addition of the constant term (α) as well as stochastic error component (μ) in equation, it yields the following econometric model:

$$\dot{Y}_t = \alpha + \beta_L \dot{L}_t + \alpha_K \left(\frac{I_K}{Y} \right)_t + \alpha_R \left(\frac{I_R}{Y} \right)_t + \mu \quad [2.33]$$

Despite the difficulties related with this model as emphasized in Goel, Payne & Ram (2008), the model provides justly and reasonable framework for a preliminary

assessment of the role of defence *R&D* in economic growth model. To have more glaring picture of this relationship Figure 2.1 depicts the impacts of defence expenditure and economic growth

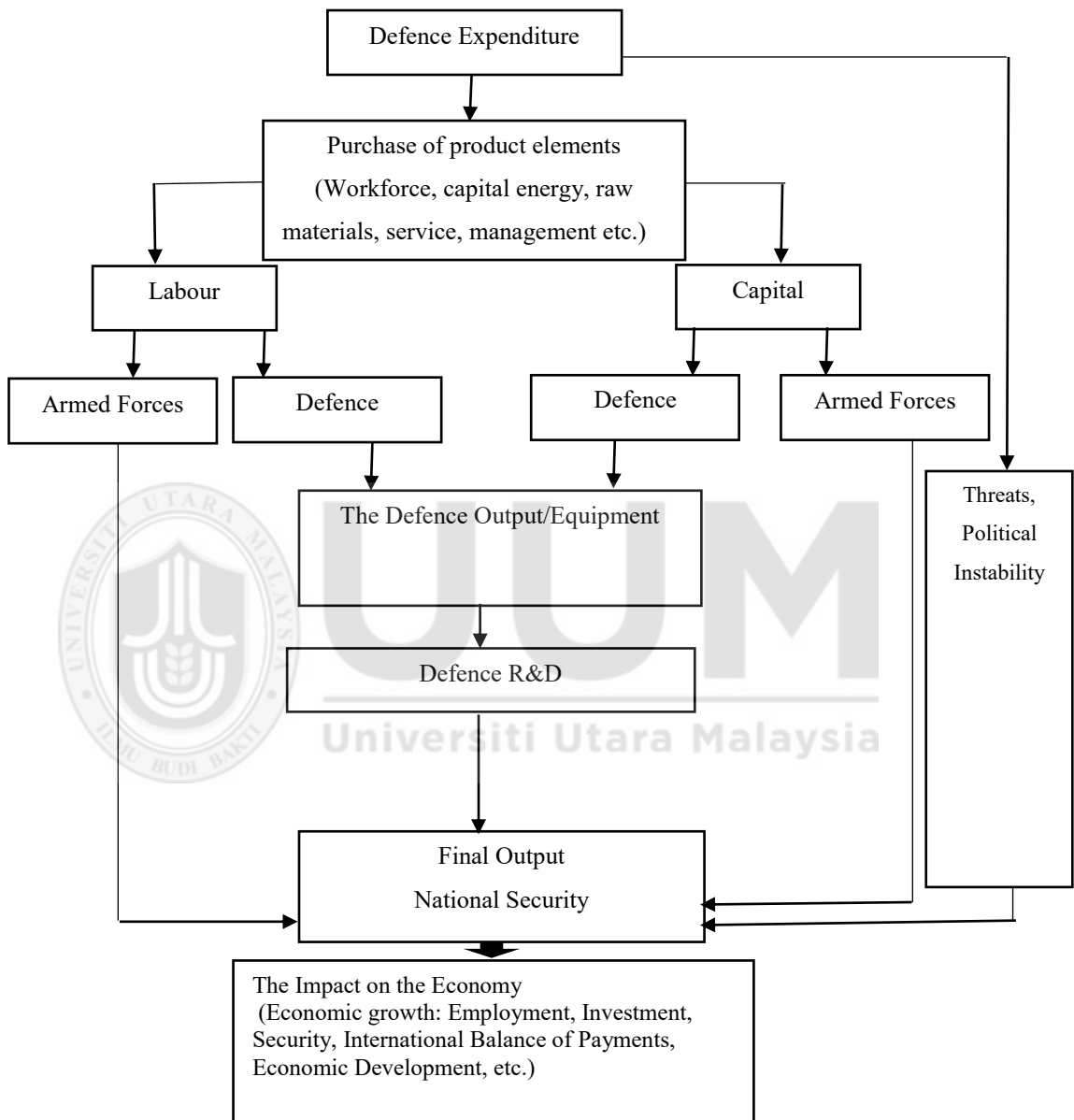


Figure 2.1

The Effect of Defense Expenditure on Economic Growth

Source: Sandler, T. & Hartley, K. (1995). *The Economics of Defence*, Cambridge University Press.

2.2.4 Endogenous/Barro Growth Model

The model is extended by Aizenman and Glick (2003; 2006) is an interaction of growth, defence expenditure and external threats to account for the impact of defence expenditure on growth, it was developed by Barro and Sala-i-Martin (2007) model. The assumptions made in this model are zero population growth; and output per worker is influenced positively by infrastructure supplied by the public sector and negatively by the magnitude of the external threat. Aizeiman and Glick started first by investigating the conjecture that defence expenditure in growth equation is non-linear function of an effective threat by either foreign or an internal force. Accordingly, threat without defence expenditure for defence security infacts negatively on the economy, while defence expenditure without the presence of threat reduces growth. But defence expenditure in the presence of sufficient threat increases growth. As specified below:

$$\frac{\partial g}{\partial df} = b_1 + b_2 thr; b_1 < 0, b_2 > 0 \quad [2.34]$$

$$\frac{\partial g}{\partial df} = c_1 + c_2 thr; c_1 < 0, c_2 > 0 \quad [2.35]$$

It therefore suggest a growth model is specified as:

$$gy = b_1 df + b_2(thr)(df) + c_1 thr + \beta X; b_1 < 0, c_1 < 0, b_2 > 0 \quad [2.36]$$

Given X as a set of explanatory variables, therefore, the direct effect of defence expenditure and threats effect on economic growth are thus assumes negative, while the interaction between defence and threat is positive. It simply assumes zero population growths. Infrastructure supply by public sector has a positive impact on output per worker, and it is negatively affected by the internal threat, political instability and arms importation. Output can be written in reduced form as:

$$y = A(K)^{1-\alpha} (g)^{\alpha} f \quad [2.37]$$

where A denotes indigenous productivity factor, K is capital/labour ratio, g = is the ratio of government spending on infrastructure in relation to labour, $1-f$ depicts the output cost of the threats posed by internal conflicts or all other conflicts. It is assumed that this burden is negative on defence expenditure and positive on the intensity of the threat. In functional form, it is written as:

$$f(de, th) = \frac{de}{de + th}; f_{de} > 0, f_{th} < 0, f(0, th) = 0, f(\infty, th) = 10 < f < 1 \quad [2.37]$$

Where de refers to domestic defence expenditure and thr is the internal threat level. This model is based on certain consideration: Threat, political instability and arms procurement may be introduced in the model as part of the activities absorbs fiscal expenditure on defence and non-defence government spending at a rate hence, output with, threat political instability is:

$$y = A(k)^{1-\alpha} (g [1 - s_c])^{\alpha} \frac{de [1 - sc]}{de [1 - sc] + th} \quad [2.38]$$

We represent the ratio of defence to non-defence infrastructure expenditure by $de = \Phi g$. Therefore, the aggregate fiscal outlay on both defence and non-defence expenditure is $(1 + \Phi)$. The rest of the model's specification is identical to that of Barro (1995) and Aizeiman and Glick (2006). Here, it assumes capital does not depreciate. The fiscal burden is financed by a proportional tax rate. In the absence of threats, the optimal level of defence expenditure is zero; then the output cost of threats is zero ($f = 1$). The presence of threats and any hostile activity implies positive defence expenditure and output cost ($f < 1$), it adds to non-linearity multiplicative term (f) to output. This in turn adds to the consideration of an optimal tax and expenditure rate, summarised as:

$$\alpha\hat{\Phi} = 1 - f = \frac{th}{d\hat{e}(1 - s_c) + th} \quad [2.39]$$

Where: $d\hat{e} = \frac{\hat{\Phi}\hat{\tau}\hat{y}}{1 + \hat{\Phi}}$. [2.40]

The optimal ratio of defence to non-defence expenditure $\hat{\Phi}$ times the output share of defence expenditure (α) equals the output cost of internal threat $1 - f$ that is in turn equal to the magnitude of domestic threat to . Thus, we may determine as:

$$\frac{\partial \hat{y}}{\partial \hat{\Phi}} < 0 \text{ and } \frac{\partial^2 \hat{y}}{\partial \hat{\Phi} \partial th} > 0 \quad [2.41]$$

Therefore confirming the non-linearity in theoretical form between growth, defence expenditure and political instability as conjectured by Aizeiman (2006) and Lin and Lee (2012).

2.2.5 Wagner's Versus Keynesian Law

The phenomenon of defence expenditure and economic growth has been a contending one among researchers in respect of the causality or effect of one over the other. While Wagnerians, contends that economic growth Causes defence expenditure like all other public expenditures. Keynesians argue that prudence public expenditure stimulates economic activities. That is expansionary policies stimulates economic growth especially in the presence of unutilised resources. Therefore defence expenditure like all other expenses stimulate economic growth. The Wagner's law and the Keynesian law, therefore present two opposite arguments in terms of the relationship between economic growth and defence expenditure. While Wagner contend the causal relationship runs from growth to defence expenditure Keynesian contends that defence expenditure causes economic growth (Bagdigen & Cetintas, 2004).

Therefore, in this study the Wagnerian Law is tested against the alternative Keynesian hypothesis of the relationship between defence expenditure and economic growth. The Wagnerian position implies that economic growth leads to an increase in government spending. More importantly, this view suggests that defence expenditure like all other public spending plays no role in economic growth and hence cannot be relied upon as a policy instrument. To Keynesian proposition, on the other hand, defence expenditure is like all other treats of public expenditure and hence is autonomous and exogenously given. The causation under the Keynesian hypothesis runs from growth in government spending to economic growth. These two hypotheses are tested extensively.

2.3 Empirical Literature Review

Ever since the early work of Benoit (1973 and 1978), there appeared large number of research studies regarding defence spending and economic growth. Benoit found positive impact of defence expenditure on economic growth in 44 developing countries. This findings has explored research interest in defence economics. In contrast to this popular notion id that defence expenditure retards economic growth due to its crowding-out effect on productive expenditure such as health and education. Studies have been conducted on both developed and developing economies applying all sort of methods, using simple to complex methods.

The literature on defence expenditure and economic growth has been divergent yielding all sorts of results and a whole range of conclusions. What follows in this section is a categorization and a review of the literature where defence expenditure and economic growth both in developed and developing economies. In the literature,

the findings on the relationship between defence expenditure and economic growth have been inconsistent. Scholars examine the relationship between defence spending and economic growth, employing variety of methods. The review of the literature below shows the relationship between defence expenditure and economic growth in the developed economies and developing economies as well as in Nigeria.

In a survey on literature on defence expenditure and economic growth in developed countries volume of studies are reviewed (Mehanna, 2004; Cuaresma *et al.*, 2004; Bachelor, Dunne and Saal, 2000; Antonakis, 1999; Hou & Chen, 2014; Ando, 2009; Landau, 1996; Heo, 2005; Malizard, 2014; Awaworyi & Yew, 2014; Dunne & Smith, 1990; Wang, Shyu & Chou, 2012; Zhang *et al.*, 2016; Araujo and Shikida, 2008; Dudzeviciute, Peleckis & Peleckiene, 2016; Wolde-Rufael & Yemane, 2016; Shahbaz *et al.*, 2013; Hatemi-J. *et al.*, 2015; Khalid & Mustapha, 2014; Chang, Fang, Wen, & Liu 2001; Lai, Huang & Wei-yang, 2004; Masih, Masih & Hassan, 1997; Cappelen *et al.*, 1984; ward *et al.*, 1993; Heo and Ye, 2016) among others.

In the case of US, Mehanna (2004), employs a parsimonious new growth model to investigate the link between defence expenditure and economic growth in the United States over the period 1959–2001 employing a more robust estimation technique. Using Johansen co-integration and error correction method, VAR model and innovation accounting techniques. The study reveals that that defence expenditure and growth have neither a statistical nor an economic impact on each other. The study suggests that current U.S. political debates opposing or favoring defence expenditure on the grounds of its economic merit are irrelevant. Heo (2009), employs both Feder Ram and augmented Solow models in investigating the relationship

between United States defence expenditure and economic growth, Spanning from 1954 to 2005. The study shows that US defence does not affect significantly the US economic growth. The same findings has been revealed in Cuaresma *et al.* (2004) who investigates the relationship between spending on defence and economic growth in the USA, in which GDP used as a proxy for growth and defence expenditure, and Debt.

Similarly, Atesoglu and Muller (1990) investigates the possible connections between defence expenditure and economic growth base on two sector production function. Concerning the possibility of defence expenditure cut in the US. The study shows that there is exist positive and significant relationship between defence expenditure and economic growth. It further shows that there is no significant changes in economic growth as a result of changes in defence expenditure. In addition unless if there are large and sustained defence expenditure cuts, the impact of changes in defence expenditure on US economic growth is minimal. The same was found by Khalid and Mustapha (2014) in China using ARDL approach to cointegration; the result shows that the long-run relationship is inconclusive between defence expenditure and economic growth in China.

Dunne and Smith (1990) study 18 OECD countries using VAR model estimates. While they examines the employment effects of military expenditure on the employment generation in 11 OECD countries. Using simple dynamic reduced form regressions. The finding does not suggests that military expenditure has any significant influence on the rate of unemployment in these countries. By implication when analyzing unemployment in OECD no much account is to be reserved for

military. Equally the fear that the reductions in the military share is associated with unemployment rate is erroneous.

Ward *et al.* (1993), examines a trade-off between defence expenditure and economic growth a Taiwan experience. The study used production function, to explore both direct and indirect impact of defence and non-defence expenditure on economic growth. The findings revealed that Taiwan had an opportunity cost of high defence burden to civilian sector of the economy, which has high marginal productivity compared to defence sector.

Similarly Ando (2009) study economic growth equation based on Feder's model to assess the impact of defence expenditure in the 109 Organization of Economic Cooperation and Development (OECD) countries. Positive impact was observed on the economic growth in the 109 countries under study. It further reveals that increase in defence expenditure caused an increase in the economic growth of the OECD countries. The same is also observe by Landau (1996) in 17 wealthy OECD countries between 1950-1990 using OLS method. The study shows that military spending had both negative and positive impact on growth. In a similar study in the USA, Heo (2005) uses single-equation estimations and joint estimate called seemingly unrelated regression (SUR). The Study reveals that defence spending has an adverse, indirect effect on economic growth through investment and export; while the direct impact of defence expenditure on growth was rather small.

Heo and Ye (2016), mixed both demand and supply side models to examined the direct and indirect linkages between defence expenditure and economic growth for

161 countries spanning from 1990-2012. The study conducted a comprehensive analysis on defence expenditure and economic growth nexus in the aftermath of cold world war. The findings show that the global defence spending to a greater extent dampens private investments, but nevertheless it reduces the level of unemployment. Hence the direct impact of defence expenditure and economic growth is at best minimal.

Lee and Chen (2007) re-examines long run relationship as well as causal relationship between economic growth and defence expenditure in a sample of 27 OECD countries and 62 non-OECD countries, using the data between 1988 to 2003. The study uses both time series data and cross-sectional data in examining the causal relationship between defence and economic growth. The findings show that there exists positive long run relationship between economic growth and defence expenditure in the OECD countries. Conversely, it shows negative relationship in the non OECD countries. Furthermore, when dynamic panel-based model was used, it reveal that economic growth and defence expenditure do not depicts any short run causal relationship. But it does shows long run bidirectional relationship in both the non OECD and OECD countries.

Augier *et al.*, (2015) examines if defence spending impacts on China's economic growth. Analysing a recently published data from 1952 to 2012 on government and defence expenditure. Moreover, employing both Feder-Ram and augmented Solow model to explore the relationship between defence expenditure and economic growth. The augmented Solow model, however shows that a percentage increase in defense stimulates the China's economic growth by approximately 0.15–0.19%. The

augmented Solow appears to explain the impact of defence expenditure on economic growth in the case of China better than Feder-Ram.

Alptekin and Levine (2012), made a meta-analysis on 32 empirical works, to examine the overall effect of defence expenditure on economic growth. Using fixed and random effect analysis. The findings revealed that there exists positive net defence effect on economic growth. The net effect was found positive, and the magnitude was found small. The study revealed that the main source of variations are attributed to time, sample and functional form. Destek (2016) examines the causal relationship between defence expenditure and economic growth in G6 countries, using asymmetric causality approach developed by Hatemi J. (2012). The result shows that high defence expenditure affects economic growth negatively in the case of UK, Germany, and France. Likewise, in the case of Canada and Italy neutrality hypothesis is supported.

Malizard (2014) examines the effects of defence expenditure on aggregate output in France, covering the period 1980 - 2010, using a Keynesian model. The variables employ are the real GDP, the log of interest rate and log of non-military expenditure. The study reveal that defence spending stimulate output, even if non-military expenditure exert higher impact. The uniqueness of the contribution came from the use of disaggregated data that allowed the use of characterize composition effects of defence expenditure. Using the Malmquite Productivity Index (MPI) and bootstrapping in establishing statistical inferences in providing effective analyses of the defence expenditure in OECD countries' productivity from 1993-2009. The study observed that the MPI average with the defence expenditure was higher compared to

that without defence spending. By extension, the analysis indicates appropriate defence expenditure can stimulate regional productivity, especially in Oceania Asia and Europe. It was further confirm that if defence spending is strategically embarked on by the government, it will help in improving economic productive capacity Wang, Shyu & Chou, (2012).

Awaworyi and Yew (2014) use a sample of 243 meta-observations drawn from 42 primary studies. The study examines the relationship between military expenditure and economic growth. The finding reports growth-retarding effects of defence expenditure on economic growth. It further reveals that positive effects of defence expenditure on growth are peculiar to developed countries than developing countries.

On the same vein, Araujo and Shikida (2008) study the impact of military expenditure, threats and economic growth using Penn world data. The findings reveal an adverse relationship between defence expenditure and economic growth. In the same vein, Bachelor, Dunne and Saal (2000) confirms that defence expenditure has at best no effect on growth, but it may likely have an adverse impact. This is because for sure, there is no evidence of a positive impact of defence expenditure on growth. In the same vein, Antonakis (1999) investigates the growth effects of military spending in Greece over the post-war period. The study reveals that the combined effect of defence expenditure on output growth rate is negative, independent of the level of significance used in calculating the relevant multiplier. Further evidence by Hou and Chen (2014) on 21 OECD Countries, using income per capita as a proxy for growth, investment, rate of labour and military variables, confirmed that military burden appears to have an adverse effect on growth.

Cappelen *et al.* (1984) made a comparative analysis between industrialized economies in respect of defence burden and economic growth. The findings revealed that while countries with high defence burden tends to experience lower economic growth compared with countries with low defence burden. On Contrast, longitudinal data further revealed that economic growth tends to be high in a period of high defence expenditure. To further overcome this contradiction, the study used both pool cross section as well as longitudinal data spanning from 1960 to 1980 of the 17 OECD countries. Using the data on economic growth, investment, defence expenditure, manufacturing out-put for the whole countries, defence expenditure was found to have positive impact on manufacturing, but negative impact on investment. While the overall effect is found negative except on the Mediterranean countries.

Zhang *et al.*, (2016), study a causal relationship between defence expenditure and debt burden in 11 OECD economies using causality analysis on both cross-sectional and heterogeneity across countries. The empirical findings show that there is unidirectional causality from defence to debt burden US, Japan and Portugal; one-way causation from debt burden to defence expenditure for both UK and Canada. There is also bidirectional causation in the case of Spain; and the rest of countries. The study have not find any significant relationship between defence spending and debt burden. The empirical result does not support the consistent results on the relationship between defence expenditure and debt burden in the 11 OECD countries.

Dudzeviciute, Peleckis & Peleckiene (2016), investigates the relationships of defense expenditure and economic growth in the European Union (EU) countries, considering the level of these countries' economic development between 2004 and

2013. The causality test, reveals that the direction is from defense expenditure to economic growth in the group of countries with a very high level of economic growth. But, in the countries with mid-level of economic growth the causality is from economic growth to defense expenditure. For the rest of the countries, no causal relationship has been established. However, the study emphasized that every country is unique decline or increase in economic growth do not imply immediate change in defense expenditure. Threats perception is the most the most important factor.

Wolde-Rufael & Yemane (2016), studies a long-run and the causal relationship between defence expenditure and income distribution in the South Korean economy for the period between 1965 and 2011. It applies the bounds test approach to cointegration. The study found a long-run relationship between military expenditure and the Gini coefficient with defence expenditure having a positive and a statistically significant impact on income inequality. The result also reveals that a unidirectional causality running from defence expenditure to income inequality. Shahbaz et, al., (2013), using ADRL bound testing approach on Portuguese economy, found U-shaped relationship between defence spending and economic growth. The Granger causality confirms the causality running from defence to economic growth. The study concludes that defence spending can play a significant role in Portuguese economy.

Desli *et al.* (2016), examines the dynamic interaction between defence expenditure and economic growth of 138 countries from 1988 to 2013. Employing wide range of methodologies in examining both the short run and long run relationship, three groups are considered among these countries, based on income level as well as

developmental stage. The study shows that there are no evidence of short run causality between defence and economic growth in developed countries. However there exist an evidence of causality in developing countries. Adding that this interaction is more prominent in a period prior to economic crises.

Still on developed economies, Hatemi-J. *et al.* (2015) re-examine military expenditures-growth relationship for the top 6 world defence dealers from 1988-2013. Using asymmetric Granger causality the results shows that the defence expenditure-led premise held in Japan and China. Conversely, the growth-led proposition is maintained in the other four countries (i.e. USA, Russia, Saudi Arabia and France). With the exception of Saudi Arabia, which its strong economy is by no means expansion of defence expenditure. For China and Japan it has been a matter of using their limited resources for attaining their policies. They spend more as they perceived threat. The findings explain useful insight on the behavior of defence suppliers. The study examines defence spending and economic growth in these countries using augmented Solow-Swan model with both panel and time series methods.

Lai, Huang and Wei-yang (2004), employs both linear and non-linear models to examine the relationship of China's national defence and that of Taiwan. Employing data from 1953 to 2000, using series: defense expenditure, export, import and GDP. The study reveals that China's defense expenditure led to Taiwan's defence expenditure. The study also shows that there exists a phenomenon arms race between these countries. While on one hand, there exists a feedback relations between economic growth and defense expenditure growth in Taiwan. On the other hand,

unidirectional causality from defence to economic growth has been found in the China's national defense.

Khalid and Mustapha (2014) re-examine the relationship between military expenditure and economic growth in China. Using ARDL approach and Granger causality techniques, the study observes unidirectional relationship running from GDP to military spending in China. Chang, Fang, Wen, & Liu (2001) use VAR model in the study conducted on China and Taiwan. The Granger causality result suggests unidirectional causality running from economic growth to defence expenditure.

In the other studies regarding China, Wolde-Rufael (2001) uses GDP as a proxy for economic growth and defence expenditure as an independent variable. Employing Granger's causality test, the result shows that there is a unidirectional Granger causality running from defence spending to economic growth, implying defence spending promotes economic growth in China.

Masih, Masih and Hassan, (1997) apply VAR modelling technique on their study on main land China. The result shows a significant positive and unidirectional causality from defence spending to economic growth. Equally Shahbaz, Afza, & Shabbir (2013) studies causal relationship between defence expenditure and economic growth in Portugal. Using real defence expenditure, spending per capita, real trade per capita and real GDP, the study confirms unidirectional causality from defence spending to economic growth, which implies that defence spending can play a significant role in economic growth in Portugal.

Still on the causality perspective, Yuan *et al.* (2014), Jayewardena (2013) use aggregate data as well as disaggregate data with the sub-categories of five national expenses, including national defence, human resource expenditure, physical resource expenditure, net interest payment and other expenses. The results of their study reveal that total federal government spending is more consistent with the Keynesian theory. While there are diversified causal relationships among five subcategories of federal expenditures. Chowdhury (1991) reports that the share of government capital expenditures in GDP are positively and significantly correlated with economic growth, but current spending is insignificant. Secondly, at the sectoral level, government investment and total expenditure in education are the only expenses that are considerably linked to growth. Gregoriou and Ghosh (2009) examine the impact of government outlay on growth in a heterogeneous panel for 15 developing countries. The result shows that countries with substantial government spending have high growth effects that vary considerably across the nations.

Essien (1997) uses the Engle-Granger two-step procedure and asymptotic Granger causality tests but found that the variables, public spending and real income, could not be co-integrated and hence could not establish a long-run relationship. In addition, the causality tests show that public expenditure did not cause growth in income, and there was no feedback mechanism. Aregbeyen (2006) examines the validity of Wagner's Law against the contending Keynesian proposition using two variants of the models for investigating Wagner's Law. The first related public spending to national income while the second relates to non-transfer public expenditure to national income. Using the Johansen cointegration and Granger

causality test, the result shows uni-directional causality from national income to government spending, indicating that Wagner's Law holds.

Al-jarrah (2005) study the causal relationship between economic growth in oil-rich countries and non-oil rich countries and defence expenditure in Saudi Arabia from 1970 - 2003. The study uses real growth rate as a proxy for economic growth with defence expenditure as independent variable. The result reveals the presence of cointegration between defence expenditure and real growth. Equally, it shows the existence of bidirectional causality between growth and defence expenditure. Tiwari and Shahbaz (2013) also examine the relationship between defence expenditure and economic growth in India, using Granger-causality test in VCM framework. The study found bi-directional causality between GDP and defence expenditure. Ayea *et al.* (2014) found evidence of bidirectional Granger causality in South Africa, when he re-examines previous literature on the milex-growth nexus on South Africa and considered the possible structural breaks by applying newly developed econometric methods using full sample bootstrap Granger non-causality tests.

Unless in the case of some few studies that shows neutrality between defence expenditure and economic growth in developed countries (Mehanna, 2004; Heo, 2009; Cuaresma, 2004; Atesoglu and Muller, 1990; Bachelor *et al.*, 2000; Dunne and Smith, 1990), literature on the impact of defence expenditure in developed countries have a mixed result. Little out of this literature reviewed shows positive impact of defence expenditure in developed countries (Ando, 2009; landau, 1996; Heo and Ye, 2016; Lee and Chen, 2002, Alptekin and Levine, 2012; Malizar, 2014; Awaworyi and Yew 2014). The bulk of this literature reviewed shows negative impact of

defence expenditure on growth in developed countries (Batchelor *et al.*, 2000; Antonakis, 1999; Hou and Chen, 2014 Cappelen *et al.*, 1984 ward *et al.*, 1993; lee and Chen, 2007).

In a survey on the literature on defence expenditure and economic growth on developing economies volume of studies are reviewed, starting with the work of Benoit's (1973 and 1978). Benoit seminal study on defence and economic growth in developing countries pioneers a string of work in the area of defence expenditure. The study points out that defence spending stimulates economic growth in third world countries. He based his conclusions on a cross-sectional analysis of 44 countries over five years. Benoit's finding is that there exists a positive correlation between the rate of growth and the defence burden. Defining GDP as Y, civilian output as V and defence spending as D, Benoit defined $Y = D + V$. Benoit argues that after controlling for the effects of investment and bilateral economic assistance, the impact of defence expenditure on the growth of civilian GNP was positive. Although the result from a longer period did not confirm a positive relationship, Benoit concluded that a positive relationship does exist.

However, survey of the literatures on defence expenditure and economic growth in developing economies are reviewed (Iftikhar and Ali, 2012; Shahbaz, Afzah and Shabbir, 2013; Zaman *et al.*, 2013; Habibullah *et al.*, 2008; Dakurah *et al.*, 2001; Mosikari & Matiwa, 2014; Gisore, Kiprop, Kalio, & Ochieng, 2014; Jalil, Abbasi & Bibi, 2016; Masih *et al.*, 1997; Deger, 1986; Stroup and Heckelman, 2001; Yildirim, & Ocal, 2014; Batchelor, Dunne & Saal, 2000; Halicioglu 2003; Dunne & Vougas, 1999; Agostino, Dunne and Pieroni 2013) among others.

However, Habibullah *et al.* (2008), examines the relationship between military expenditure and economic growth in selected Asian countries for the period 1989 to 2004. Employing panel cointegration test, the study reveals that economic growth and military expenditures are cointegrated. When applying the panel error-correction technique, the empirical result shows that defense expenditure and economic growth in the Asian economies under studied are not connected. Smaldone (2006) examines some of the empirical irregularities in the economic growth and defence expenditure literature in the developing economies reference to African countries. The study shows that African countries invest in defence sector lower than the global standard, and it corresponds to its security as well as political realities. The study shows that there exist no one size fits all policy regarding defence and growth in African countries. By and large the study conclude that reduction in the defence spending is more appealing if channelled to projects that stimulates growth and development.

It was equally observed in Gisore, Kiprop, Kalio, and Ochieng (2014) that the expenses on health and defence have a positive and statistically significant effect on growth. In contrast, education and agriculture expenditures were insignificant. This study suggests that for east Africa, the policy of increasing spending on health and defence budget to promote economic growth, but fewer funds should be channel towards other sectors. So also Shahbaz *et al.*, (2011) employs ARDL bounds testing approach to co-integrate for a long- run and error correction method for a short span of time. The estimated coefficient of government non-military expenditure show a positive impact of defence expenditure on economic growth. An inverse relationship was also witnessed between real interest rate and economic growth. Lin & lee

(2012), analyses the impact of home defence expenditure and foreign threat on economic growth in an endogenous growth model with the supply-side and demand-side. The study found that an increase in home defence expenditure impacts on economic growth through three channels namely crowding-out effect, the spin-off effect, and the resource mobilization effect. While the net effect which depends on these three channels is ambiguous. Hence, the study shows that there occurs an optimal defence burden of which stimulates the economic growth rate.

Similarly, Zaman, Iqtidar, Khan and Ahmad, (2013) study the effect of military spending and economic growth and foreign debt using Pedroni's cointegration approach. The study reveals that economic growth and military expenditures have a statistically negative and positive effect on foreign debt. Dakurah *et al.*, (2001) observe a positive impact on defence expenditure on economic growth in a study conducted in 62 developing countries. The result further observes unidirectional causality in 23 countries, either from defence expenditure to economic growth or from growth to defence. The study conjectured that defence expenditure raises economic growth, the net effect is that defence expenditure and growth are related due to demand expansion in developing countries.

On the contrast Iftikhar and Ali (2012) argue that the impact of defence burden on economic growth variables, such as income inequality, in 80 developing and developed countries. The result suggested an adverse relationship between growth with income inequality and defence burdens in these countries. Shahbaz, Afzah and Shabbir (2013) studies military expenditure and economic growth of Pakistan using ARDL bounds testing approach for long and short-run terms. The empirical evidence

reveals a stable cointegration relationship between defence spending and economic growth. The study also indicates an increase in defence expenditure retards the pace of economic growth. Khilji *et al.*, (2015) examines the impacts of defence spending on the economic growth of Pakistan from 1972 to 1995. The findings reveal bi-directional causality between defence burden and economic growth. It further shows that defence expenditure exert negative influence on the Pakistan's economic growth. While the saving ration is affected positively by defence expenditure, the overall defence effect diminishes statistically.

Similarly, Phiri and Andrew (2016), investigates defence expenditure and economic growth nexus in South Africa, using annual data from 1988 to 2014. Applying logistic smooth transition regression (LSTR) model, the study found that the relationship between defence and economic growth in South Africa is U shaped in nature. Thus the study recommends a cut in defence expenditure, which should equally be channeled to other productive sectors.

Hou and Chen (2012), investigates the effect of defence expenditure on growth in 35 developing countries from the year 1975 to 2009. Employing generalized method of moment estimators and applying the augmented Solow growth model. The result show that defence expenditure has a significant negative impact on economic growth. Moreover, Deger (1986) formulates a detailed study aimed at identifying the specific factors involved in the relationship between military spending and growth. He argues that military burden, savings and investment and overall growth are interdependent factors and require a simultaneous equations system based on a properly specified theory. One possible source of growth is the creation of additional

aggregate demand. The study further concludes that the growth equation, independent of savings, is consistent with Benoit's findings that military spending does accelerate economic growth through aggregate demand stimulation. However, when this effect was combined with the negative crowd out effect on aggregate savings which results from a resource trade-off with the civilian economy in a simultaneous model identifying all three variables, the sum of the positive and negative impacts yield an overall negative effect on growth.

Smyth and Narayan (2009) conduct a panel analysis of military expenditure and external debt nexus in six Middle Eastern countries, using OLS and unrestricted distributed lag model for export. The result reveals that the overall economic effects of defence spending on growth are negative. Stroup and Heckelman (2001) points that the impact of defence using economy's labor force on growth might be non-linear depending on the overall quality of human capital, higher educational pursue, the displacement cost of defence on young men. Stroup and Heckelman in the study on Africa and Latin America provide empirical support that recruitment to the defence has high and negative impacts on economic growth in economies which have high educational attainments.

Furthermore, Batchelor *et al.* (2002) uses fixed-effect model. The study shows that military spending unequivocally has a negative impact on growth of Sub-Saharan African (SSA) countries. Adebisi & Oladele (2004) study public education expenditure and defence spending: an empirical investigation. Integrated disparate implications from the defence economics literature into a Barro-style model of economic growth that controls for political and economic institutional variation

across countries. A panel data analysis of 44 countries in Africa and Latin America from 1975 to 1989 reveals that the defence expenditure's impact on economic growth is non-linear. However, low levels of military spending increased economic growth but higher levels of military expenditure decrease growth. The study further discovers that the influence of military labour use on growth is non-linear and reveal a greater hindrance to economic growth in those countries with relatively higher levels of adult male education achievement. Agostino, Dunne and Pieroni (2013) found that the damaging effects of military expenditure on growth in Africa are significantly underestimated in most studies.

Kwang-Hae, (1998) study the relationship between defence expenditure, technological change and economic growth in the Eastern Asian countries between 1961 and 1990. The study reveals that when technological progress is factored in these countries, they are hurt by defence expenditure. Reduction in the defence expenditure is beneficial to economic prosperity in the region.

Dakurah *et al.* (2001) observe a positive impact on defence expenditure on economic growth in a study conducted in 62 developing countries. The result further observes unidirectional causality in 23 countries, either from defence expenditure to economic growth or from growth to defence. The study conjectured that defence expenditure raises economic growth, the net effect is that defence expenditure and growth are related due to demand expansion in developing countries.

In the same vein, Mosikari & Matiwa (2014) investigates the relationship between economic growth and defence expenditure in South Africa, considering pure

economic factors. The variables employed in the study are government spending on military, government spending on education, government spending on health, population growth and GDP per capita. After observing long-run relationship between defence expenditure and economic growth. Military spending is found to have Granger caused GDP in South Africa.

Jalil, Abbasi and Bibi (2016), the study investigates a long run relationship between India and Pakistan defence expenditure and economic growth, using Celemente-reyes approach. Using ARDL approach of bound tests, the study reveals that, there has been positive relationship between Indian's defence expenditure and that of Pakistan. As times goes on these relationship turns negative. While there exist no long run relationship, in the short run defence expenditure leads to economic growth in both countries. Heo and Khilji *et al.*, (2015) examines the impacts of defence spending on the economic growth of Pakistan from 1972 to 1995. The findings reveal bi-directional causality between defence burden and economic growth. It further shows that defence expenditure exert negative influence on the Pakistan's economic growth. While the saving ration is affected positively by defence expenditure, the overall defence effect diminishes statistically.

Yildirim, & Ocal (2014) examines augmented Solow defence growth models. In addition to population, capital and military expenditure variables, control variables were also employed in the models. After a traditional OLS regression analysis, spatial error, spatial lag and GS-2SLS models are also estimated. The findings reveal that there is a strong relationship between military expenditure and economic growth

in the 133 countries studied. Halicioglu (2003). Finally, a unidirectional causal relationship running from military spending to economic growth has been found.

Batchelor, Dunne and Saal (2000), study demand for military spending in South Africa, using OLS modelling. The findings suggests that South African military spending could be explained by a number of country-specific factors that have a mixed result of both negative and positive impacts. Dunne & Vougas (1999) analyses South African data using standard pre-cointegration Granger causality techniques and modern VAR techniques. The results indicates a significantly negative impact of defence spending on growth in South Africa. Masih, Masih and Hassan (1997), using Granger causality, also observes that the relationship between defence spending and economic growth cannot be generalized across countries. The actual relationship differs between countries as a result of a variety of factors.

Similarly, Roux (1994) examines the relationship between defence expenditure, human capital expenditure and economic growth in South Africa, using defence expenditure, annual growth rate, government spending and expenditure on education. Education spending was treated as the dependent variable in two regression analyses. The first regression was run using the defence and education expenditures as percentages of total government spending. In the second regression, the two terms were expressed as a share of GDP. The result reveals that developing nations with higher literacy rates shows higher tendency to grow at a faster rate, at the same time achieving higher physical investment rates. To the contrary, the poor economic performances of most SSA countries can be attributed, in part at least, to the markedly low levels of literacy and the dearth of skilled and experienced workers.

Furthermore, Batchelor *et al.* (2002) uses fixed-effect model. The study shows that military spending unequivocally has a negative impact on growth of Sub-Saharan African (SSA) countries. Lindhauer and Velenchik (1992) contends through empirical evidence that there is no strong relationship between government expenditure and economic growth. Rather factors, such as ideology, demographics, and positive income elasticity for public goods, the increasing cost of public goods relative to private products and perhaps development theory and practice, explain economic growth in developing countries. Thus, the relationship between government expenditure and economic growth is inconclusive. Oriavwote and Eshenake (2013), using a VAR model, show that shocks in expenditure on defence did not significantly clarify changes in the level of economic growth. A similar work was conducted in Nigeria by Adebisi and Oladele (2005) using VAR model, reveals that the impact of defence expenditure both in the short and long run on the Nigeria's stock of human capital, particularly education, has been positive.

Regarding defence expenditure and economic growth very few studies found positive relationship (Benoit, 1973; Benoit, 1978; Shahbaz *et al.*, 2011 among others). Dominantly literature found negative relationship between defence expenditure and economic growth (Iftikar Ali, 2012; Khilji *et al.*, 2015, Agostino *et al.*, 2013 among others).

Recently studies consider the concept of threat in the defence expenditure and economic growth analysis (Aizeman & Glick, 2006; Musayev, 2016; Mezue, 2005; Araujo and Shikida 2008; Yang *et al.*, 2011; lin and lee, 2011). However, Aizeman & Glick, (2006) empirically suggest non-linear interaction between defence

expenditure and threat. The study further shows that both threat and defence expenditure have negative impact on growth, but their interaction terms exert positive impacts on economic growth. Lin and lee (2011) examines the impact of defence expenditure and external threat on economic growth using an endogenous model involving both demand and supply side. The study shows that domestic defence spending affect growth via three known channels i.e crowding-out, spin-off as well as resource mobilization. It further shows that the net effect is ambiguous, though it depends on the risk preference. There are optimal defence burden, risk-loving, risk neutral as well as risk averse agent. By and large, the study conclude that the more defence spending base on optimal choice the more decrease in home consumption which speed up the home consumption.

Araujo and Shikida (2008) re-examine the impact of defence expenditure in presence of threat and good governance. A group of scholars argue that defence expenditure in presence of threat has positive impact on economic growth. In this study by employing an improve methodologies, it reveals that defence expenditure in presence of internal threat (interaction term) propose by previous studies is still negative. But the control variables such as population growth, education, threat investment have their expected signs and similar to the previous study it holds on the non-linearity of the defence expenditure. Similarly, Yang *et al.* (2011) examine the impact of defence expenditure and economic growth in a cross countries analysis considering income as well as threat levels. The findings reveal that defence expenditure has negative and significant impact on economic growth in 23 countries with low income level. Similarly in a group of countries with high income level, no significant relationship exists even if the threats level is high.

Karagianni and Pempetzoglu (2007) study linear and non-linear Granger causality to determine the causal relationship between defense expenditure and economic growth in Turkey from 1949 to 2004. The study reveals support both linear and non-linear causality between defence expenditures and economic. The study are that both useful in theoretical and empirical research by regulators and policy maker.

The study of Mezue (2005) shows that increase defence expenditure in Nigeria since 1999 is not as a result of economic growth, but rather due to threats emanating from the Nigerian security environment. He also brought out the fact that the long years of military incursion into politics in Nigeria slow down the process of establishing oversight and control over defence budget and management. His work support the defence economy as a derivative of the defence appropriation; the creation of jobs, defence-based industries and an overall moderation of poverty and underdevelopment in the country. According to Musayev (2016), the impact of defence expenditure on growth is generally negative. Nevertheless, Musayev argues that it is not significantly harmful to countries facing higher internal threats and for countries with large natural resource wealth once corruption levels are accounted for.

With regards to the defence expenditure, political instability and economic growth, very few studies have been conducted (Blomberg, 1996; Alesina, 1996; Fosu, 1996; Aizeman & Glick (2006). However, Blomberg (1996) found empirical support that political instability inhibits growth while defence expenditure decreases growth. Moreover increase in defence expenditure in the presence of political instability decreases political instability and increases growth. The defence sector may also provide security from external threats by regional neighbors that could discourage

confidence in production and accumulation. Higher defence expenditure is necessary for a lower incidence of armed conflict and a higher degree of security as the armed forces help to prevent political instability through deterrence, their internal security roles, positive effects on nationhood and collective security in the region (Skons et, al. 2008).

Similarly, Alesina (1996) investigates the relationship between economic growth and political instability in a sample of 113 countries from 1950 to 1982. His finding reveals that countries with high political instability have lower economic growth compared with countries with the high political stability. Fosu (1996), conducted a study on the impact of political instability and economic growth in the sub-Saharan African countries. His finding suggest that political instability have played significant role. That is why some sub-Saharan African countries remain stagnant. He further emphasized that any policy aimed at improving economic growth in this region must address political instability problems.

Seiglie (1998) argues that the Ricardian equivalence is no longer applicable as it is recognize that government performs as an intermediary on the provision of national security. Thus, defence expenditure is positively national debt, and as well protecting savings. The findings show that defence expenditure has negative impact on saving and the saving rate. More generally, the study stresses that while developing theory on taxation, the composition of public expenditure plays an essential role.

Balan (2015), investigates the causal relationship between political instability, defence expenditure and economic growth for 12 MENAT countries between 1988 to

2013. Employing panel data approach, which take into consideration slope heterogeneity as well as cross-sectional dependencies amount the countries. The study found a positive causal relationship between political stability, defence expenditure and growth in case in Lebanon, positive causal relationship was also found in the case of Jordan, Lebanon Saudi Arabia, Morocco and Turkey running from political stability to economic growth. Whereas there is positive causal relationship between economic growth to political stability in the case of Egypt, Turkey and Israel.

In respect to defence R&D, Goel, Payne and Ram (2008), investigates the contribution of the R&D growth using disaggregated data of USA from 1953 to 2000. The study examines the R&D growth nexus by considering the roles of federal, defence R&D, non-federal outlays. Using bounds-testing and ARDL procedures. The study revealed that federal R&D including defence R&D exert more role than non-federal R&D in growth. The study indicates the need for appropriate policy involvements for a substantial augmentation of defense R&D and non-defense R&D expenditure.

Chakrabarti and Anyanwu (1993), study examines the impact of defence expenditure and its relationship with defence R&D as well as economic performance. And the indirect relationship between scientific skills and innovations. The study revealed that there are no statistical evidence showing direct relationship between defence R&D and the economy. The non-R&D defence expenditure appears to have no any significance impact on the major components to civil sector performance. The policy

recommends that the technical spillovers may be limited a specific defence expenditure, not aggregate defence spending.

Similarly, Wang *et al.* (2013) re-examines the heterogeneous impact of research and development of high-tech sectors and economic growth for Taiwan and 23 OECD countries, between 1991 and 2006. Taking into consideration the common findings in the literature that suggest R&D has positive impact on the economic growth. Adopting quantile regression analysis in exploring the relative effect of R&D to growth in the countries stated. The finding shows that the impact of R&D in the high-tech varied across countries with the level of per capita. While high-tech R&D expenditure has significant positive impact on economic growth in the highest quantile, the all sector R&D expenditure has significant negative impact on economic growth in the middle income countries. Falk (2007) provides a recent estimation for the impact of R&D spending on the long run economic growth. Using the data for the OECD countries from 1970 to 2004, employing a dynamic model with panel data, the study investigates whether R&D spending on high—tech has impact on economic growth via labour force population. The findings reveal that the high-tech research and development and business research and development spending's have significant and positive impact on GDP per capita in the countries studied.

Chu and Lai (2012) study the implication of welfare and growth. It develops a research and development growth model that shows the effect of defence technology on: security and aggregate productivity through spinoff. The study revealed that defence has a U shape effect on growth, and growth maximising defence research

and development increases spin-off effect. Regarding the welfare-maximising defence research and development, it increases security-enhancing impact of defence technology.

Saidu (2008) however use simple regression methods to establish that a negative relationship exists between defence expenditure and national development in Nigeria. He attributed these results to challenges, such as the lack of a viable defence industry in the country; low level of private sector participation in the local manufacture of military equipment; inadequate attention to defence related research and development; and low social mobilization and integration of the Armed Forces, among others. Both of these works however are simplistic in their approach as they do not take into consideration the problems inherent in time series data, and as such, have a tendency for arriving at spurious results.

With regards to arms importation, defence expenditure and growth, only very few studies examine the relationship between arm trade and economic growth. Yakovlev (2007), study arms trade, defence expenditure and economic growth for 28 countries using balance panel data. The study establishes non-linearity relationship, using Solow and Barro models. The result found find that higher defence expenditure net arms exports separately lead to lower economic growth, but higher defence expenditure is found less detrimental to growth when a particular country is a net arms exporter.

Kollias, Messis, Mylonidis & Paleologou (2009) empirically examines the efficiency of counter-terrorism measures and particularly domestic security investment

expenditure in Greece. Employing data from 1974-2004. The study investigates if the investment spending has been effective means to counter terrorism. The results suggest that investment in security has a weak negative impact on internal terrorist actions. The policy implication is that investment in counter-terrorism either on infrastructure or equipment has potentials to be very effective measure for the fight against terrorist.

When the impact of defence expenditure is narrowed down the Nigeria's case, an array of conclusion are made. For example, Omojimate (2012) reveals that there is a significant and positive relationship between defence expenditure and education expenditures on Nigeria in a study conducted between 1976 and 2006. The result reveals a negative and significant relationship between expenditures on education and economic growth as well as defence spending and economic growth. This signifies that the levels of the funding of the two sectors are inadequate to make a significant impact on Nigeria's economic growth. The paper further recommends increased funding for the education and defence sectors.

Similarly, Adebisi and Oladele (2004) conduct analysis on the relationship between defence expenditure and public expenditure on education from 1970 and 2003 in Nigeria. Their findings reveal positive and statistically significant relationship between defence expenditure and public expenditure on education using the techniques employed. The study was concerned only with public expenditures on education, excluding the private. The study concludes that defence modernizing effect have enhances the productive capability in Nigeria. Further, the impact of defence expenditure on Nigeria's stock of human capital in Nigeria, particularly

education, has been positive both in the short and long run. Waya (2005) analyses the trends and patterns of defence spending and related it to economic growth in Nigeria. He used econometric analysis to measure the impact of defence expenditures on the Nigerian economy using indices, such as GDP, inflation and employment rates. The study concludes that there is a significantly positive effect on defence expenditures on Nigerian GDP growth. Defence expenditures were also seen to influence the economic variables, such as inflation and employment.

Olaniyi (2000) uses the two-stage least square method to determine the relationship between defence expenditure and economic development in Nigeria. The study examines the linkages between defence spending and the socio-economic sectors of the Nigerian economy and determining the direction of causality. The analysis shows that expenditure on military capital has no significant effect on productivity and that military capital is less productive than civilian capital in the economy. Defence spending is also found to respond negatively to national income.

Other researchers in Nigeria include Hedima (1995), Ajobena (1995), Ajumobi (1996), and Balogun (2004); Apanisile and Okunlola (2014). Hedima (1995) carries out a qualitative analysis for achieving optimal defence spending in a declining economy and identified the need for Nigeria to shift away from wholly weapon procurement to a situation where the military sector is used in production of some of the hardware they require. He also identifies the need to trim down the size of the force level to suit the security requirements of the country. However, Apanisile and Okunlola (2014) examines the impact of defence expenditure on GDP in Nigeria in the long run and short run period. The study equally examines if defence expenditure

is economically contributing to GDP or otherwise. Using bounds test approach to co-integration, the result reveals that defence expenditure has significant and negative effect on the GDP in the short-run. Contrary it has significant and positive effect in the long-run in Nigeria. Furthermore, capital and labour both have positive and significant effects in the short-run and the long run. Finally, it concludes that government can reduce expenditure on defense and give more emphasis on human capital development, as defence expenditure contributes nothing to the GDP in the short-run.

Ajobena (1995) advise the Federal Government of Nigeria to identify areas that constitute a drain on defence expenditure. One key area is in cutting down on personnel, but with an expandable capacity through an organized reserve force of men who could be called upon to augment the active duty force should there be need to employ the forces in combat. This is in recognition of the growing contest for resources between defence and other socio-economic developmental needs of the economy. On his part, Ajumobi (1996) reveals a comprehensive analysis of the economics of defence in Nigeria. The study reveals that the belief defence expenditures are unnecessarily high is not borne out of facts if set against the perception of threat in the West African sub-region, in particular and the geopolitical status in sub-Saharan Africa (SSA) and the world in general.

Similarly, Balogun (2004) examines the budgetary techniques, the institutional structures, programs and construction of defence budgeting appropriate to meet the requirements of a modern military. The analyses the budgetary allocations to the defence sector, as well as the actual releases made to the military by the Ministry of

Finance between 1999 and 2003. Based on the data collected and analysed, the study indicates that budgetary allocations to the defence sector has been consistently imbalanced in favor of current allocations and mainly in support of personnel costs. For this reason, he concluded that budgetary allocations to the defence sector could not be said to have enhanced the virility and firepower of the armed forces between 1999 and 2003.

2.4 Gaps in the Literature

From the above empirical evidences, both in the developed and developing economies, mixed results are found regarding the relationship between defence expenditure and economic growth, as well as the causality between the two concepts. A group of scholars (Benoit,1973; Benoit,1978; Dakurah *et al.*, 2001; Mosikari & Matiwa, 2014; Gisore *et al.*, 2014; Jalil, Abbasi & Bibi, 2016; Lin & Lee, 2012; Wolde-Rufael, 2001; Ando; 2009; Malizard,2014; Shabaz *et al.*, 2013; Oriavwote and Eshenake, 2013; Anyanwu and Aiyedogbon, 2011; Sarah *et al.*, 2012; Adebisi and Oladele, 2005; Masih, Masih and Hassan, 1997; Atesoglu, 2013) argue that defence expenditure is positively related to economic growth.

On the contrary, another group of scholars argue that defence expenditure has negative impact on economic growth due to its opportunity cost (Araujo and Shikida,2008; Dunne and Smith, 1990; Hou and Chen, 2014; Iftikar and Ali, 2012; Shahbaz, Afza & Shabbir, 2011; Zaman *et al.*, 2013; Batchelor *et al.*, 2000, Smyth and Narayan, 2009; Landau 1996; Heo, 2005; Hatemi *et al.*, 2015; Chang *et al.*, 2001; Wolde-Rufael *et al.*, 2016; Dakurah *et al.*, 2001; Jalil *et al.*, 2016; Iftikar Ali,

2012; Deger, 1986; Dunne and Vougas., 1999 Agostino *et al.*,2015; Phiri and Andrew, 2016; Batchelor *et al.*, 2002; Heo,2005; Musayev, 2016 among others)

Moreover, in contrast some studies could not establish any meaningful relationship between defence expenditure and economic growth (Biswas and Ram, 1986; Huang and Mintz, 1991; Habibullah, 2008; Hirnissa *et al.*, 2009; Olaniyi, 2000; Mehanna, 2004; Smaldone, 2006; Batchelor *et al.*, 2000). On the causal relationship, divergent findings have also been found regarding defence expenditure and economic growth, whether it is bidirectional or unidirectional. Bidirectional causation is observed from defence spending to growth (Hirnissa *et al.*, 2009; Masih *et al.*, 1997; Shahbaz *et al.*, 2013; Wolde-Rufael, 2001). On the other hand, growth is also found to have cause defence spending (Khalid and Mustapha, 2014; Chang *et al.*, 2001 among others). A neutral causal relationship between the variables was also documented (Hirnissa *et al.*, 2009; Oriavwote and Eshenake, 2013; Adebisi and Oladele, 2005; Masih *et al.*, 1997; Khalid and Mustapha, 2014) among others.

Recently, studies have found that the relationship between defence expenditure and economic growth is a non-linear one, especially in the presence of threat and political instability (Stroup and Heckelman, 2001; Blomberg, 1996; Kiragianni and Pempetzogdu 2007; Aizeman and Glick, 2006; Masih *et al.*, 2001; Alesina, 1996; Fosu, 2001; Ajumobi 1996; Mezue, 2005; Saidu, 2008).

Furthermore, recently scholars argue that defence expenditure in the presence of political instability stimulates economic growth (Blomberg, 1996; Alesina, 1996;

Fosu, 2000; Aizeman and Glick 2006). Based on the above literature review, the following gaps need to be filled with rigorous research:

First, as established in the literature that security and economic growth and development are two but inseparable variables that affect each other. This study examines the impact of defence expenditure in the presence internal threats and political instability on Nigeria's economic growth. The previous study do not examines the impact of defence expenditure in the presence of internal threat. Those attempted (Aizeiman & Glick, 2003: 2006, Araujo & Shikida, 2008 Blomberg 1996 etc.) only examine the impact of defence expenditure in the presence of external threat. Aizeiman (2006), argues that threats and political instability have negative impacts on growth; equally, defence expenditure has a negative impact on growth, while defence expenditure in the presence of high threats and political instability stimulates economic growth.

Due to the existence of political instability and internal threat as a result of the activities of Boko Haram and Niger Delta Militants in Nigeria, it has become a necessity to access the impact of defence activities in Nigeria and to offer solution. According to Ajumobi (1996) and Mezue (2005) any analysis of defence expenditure in Nigeria needs to incorporate the threats emanating from the Nigerian security environment. Musayev (2016), argue that though defence expenditure has negative effects on economic growth, but it is harmful to countries with higher internal threat. This study is, for this reason, an attempt to fill these gaps.

Second, previous studies examine the impact of defence expenditure taking only the aggregate components. Albeit, some disaggregated components give a better understanding of the impact of defence expenditure as some component may have positive effects while others may have negative effects on growth Aizeiman (2006), Ram (1995) and Erdogdu (2008) suggest that an assessment of defence expenditure should go beyond defence-growth relationship; it should aim at disaggregating defence components to isolate relative impact of various defence components on growth as compositions and components of defence expenditure varies between countries. Therefore, this study examines the impacts of defence arms importations as well as defence R&D on the Nigeria's economic growth. Third, the study re-examines the previous inconsistencies and mixed results found in the relationship and causation between defence expenditure and economic growth in Nigeria, using asymmetric causality test.

2.5 Conclusion

The above review of the literature captures findings of some previous studies on defence expenditure and economic growth in Nigeria and elsewhere. The findings are not only conflicting but also mixed. While some studies have observed a negative relationship between defence spending and economic growth, some have established positive relationship. Likewise, on causality, three dimensions of causality have been observed in these studies: bidirectional, unidirectional and no-causality. Lastly, this section ends with the possible gaps established from the reviewed literature, which also serves as the basis and the genesis of this work.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter discusses the theoretical framework as well as the model specification used in the study. The analysis of Nigeria's defence expenditure, threats and economic growth is conducted using ARDL model. Furthermore, the same ARDL model is used to estimate the defence research and development model. The causality is investigated using asymmetric causality test. Justification of variables is also discussed in this chapter.

3.2 Model Specification

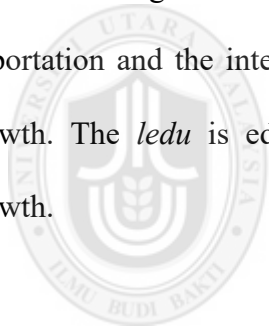
3.2.1 Defence Expenditure and Economic Growth Models

The model specified in Equations 3.1 is adopted from Aizenman and Glick (2006), Yakovlev (2007), Blomberg (1996), Erdogdu, (2008) and Burrell (1997). The model establishes interactional relationships between defence expenditure and threats, arms importation and political instability and their impact on economic growth. The model is therefore, an extension of Aizeiman and Glick (2006), Blomberg (1996), Yakovlev (2007), which is the Cobb-Douglas production function. The model is employed to achieve objective one.

$$\begin{aligned} lrgdpk_t = & a_0 + a_1lde_t + a_2thr_t + a_3lai_t + a_4pi_t + a_5(lde_t * thr_t) + a_6(lde_t * lai_t) \\ & + a_7(lde_t * pi_t) + a_8ledu_t + \mu_t \end{aligned} \quad [3.1]$$

We expect that $a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8 > 0$. The symbol a_0 is the intercept, μ_t is the error term it is expected to be normally distributed where $lrgdpk$ is the real gross

domestic product per capita, it is a proxy for growth. *Thr* stands for internal threats, it has been argued that threat is negatively related to economic growth. The *lde* is the log of defence expenditure as a ratio of GDP, scholars largely believed that defence expenditure has negative impact on economic growth. The *lde*thr* is the log of interaction term between defence and internal threat. It is recently argued that defence expenditure and threat interaction has a positive impact on the economic growth. *Pi* denotes political instability, is argued to be negatively related to economic growth. The *lde*pi* represents the log of the interaction term between political instability and defence expenditure. The political instability and defence expenditure interaction term is argued to have positive relationship with economic growth. The *lai* denotes log of arms importation, the priory expectation is that both arms importation and the interaction term *lde*lai* are negatively related to the economic growth. The *ledu* is education is expected to be positively related to economic growth.



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The model of interaction of growth, defence expenditure and threats, political instability and arms importation is an extension of Aizeman and Glick (2006). It simply assumes zero population growths. Infrastructure supply by public sector has a positive impact on output per worker, and it is negatively affected by the internal threat, political instability and arms importation. Output can be written in reduced form as:

$$y = A(K)^{1-\alpha} (g)^{\alpha} f \quad [3.2]$$

Where A denotes indigenous productivity factor, K is capital/labour ratio, g = is the ratio of government spending on infrastructure in relation to labour, 1-f depicts the output cost of the threats posed by internal conflicts or all other conflicts. It is

assumed that this burden is negative on defence expenditure and positive on the intensity of the threat. In functional form, it is written as:

$$f(de, th) = \frac{de}{de + th}; f_{de} > 0, f_{th} < 0, f(0, th) = 0, f(\infty, th) = 10 < f < 1 \quad [3.3]$$

Where de refers to domestic defence expenditure and thr is the internal threat level. This model is based on certain consideration: Threat, political instability and arms procurement may be introduced in the model as part of the activities absorbs fiscal expenditure on defence and non-defence government spending at a rate hence, output with, threat political instability is:

$$y = A(k)^{1-\alpha} (g[1-s_c])^\alpha \frac{de[1-sc]}{de[1-sc] + th} \quad [3.4]$$

We represent the ratio of defence to non-defence infrastructure expenditure by $de = \Phi g$. Therefore, the aggregate fiscal outlay on both defence and non-defence expenditure is $(1 + \Phi)$. The rest of the model's specification is identical to that of Barro (1995) and Aizeiman and Glick (2006). Here, it assumes capital does not depreciate. The fiscal burden is financed by a proportional tax rate. In the absence of threats, the optimal level of defence expenditure is zero; then the output cost of threats is zero ($f = 1$). The presence of threats and any hostile activity implies positive defence expenditure and output cost ($f < 1$), it adds to non-linearity multiplicative term (f) to output. This in turn adds to the consideration of an optimal tax and expenditure rate, summarised as:

$$\alpha \hat{\Phi} = 1 - f = \frac{th}{d\hat{e}(1-s_c) + th} \quad [3.5]$$

where: $d\hat{e} = \frac{\hat{\Phi} \hat{\tau} \hat{y}}{1 + \hat{\Phi}}$. The optimal ratio of defence to non-defence expenditure $\hat{\Phi}$

times the output share of defence expenditure (α) equals the output cost of internal

threat $1 - f$ that is in turn equal to the magnitude of domestic threat to . Thus, we may determine that $\frac{\partial \hat{\gamma}}{\partial \hat{\Phi}} < 0$ and $\frac{\partial^2 \hat{\gamma}}{\partial \hat{\Phi} \partial th} > 0$. Therefore confirming the non-linearity in theoretical form between growth, defence expenditure and political instability as conjectured by Aizeiman (2006) and Lin and Lee (2012).

3.2.1.1 Estimation Procedure

The aim of this section is to explain the relevant econometric procedures used in estimating the relationship of interest. To determine the interaction relationship between defence expenditure, threat, political instability, arms procurement and economic growth, both in the short-run and long-run, Pesaran and Shin Smith (2001) model of Autoregressive Distributed Lag (ARDL) is used. The model examine the long-run relationship, irrespective of whether the variables are stationary in levels, different or mutually integrated (Bahmani-Oskooee & Wing, 2002). To take care of short-term deviations, while determining the long-run cointegration, an error correction representation is included in the ARDL model (Pesaran, Shin & Smith, 2001). The model provides efficient and unbiased estimation even if the sample size employed is small (Narayan, 2005). The following steps were followed in the estimation process of the ARDL model.

3.2.1.2 Unit Root Test

Unit root and co-integration tests are considered preliminary analyses of time series data and are imperative for proper modelling while they both have significant economic interpretations. The unit root analysis is carried out using Augmented Dickey-Fuller (ADF) test proposed in Dickey and Fuller (1979). Despite the fact that

ARDL frame work does not necessarily require the variables be tested for unit root, but testing for the order of integration is necessary in order to determine whether ARDL approach is suitable or not (Pesaran & Shin, 1998). This is to ensure that the maximum order of integration is determine not beyond I (1) order. The ADF test is conducted on three different equations specified below:

$$\Delta lrgdpk_t = \mu + \alpha lrgdpk_{t-1} + \sum_{i=1}^k \beta \Delta lrgdpk_{t-i} + \varepsilon_t \quad [3.6]$$

$$\Delta lrgdpk_t = \mu + \beta t + \alpha lrgdpk_{t-1} + \sum_{i=1}^k \beta \Delta lrgdpk_{t-i} + \varepsilon_t \quad [3.7]$$

$$\Delta lrgdpk_t = \alpha lrgdpk_{t-1} + \sum_{i=1}^k \beta \Delta lrgdpk_{t-i} + \varepsilon_t \quad [3.8]$$

Where Δ represents the difference factor, $lrgdpk_t$ is the series under test, μ is the intercept term, t is the time trend, $lrgdpk_{t-1}$ is the lag variable being tested, k denotes lag length, $\Delta lrgdpk_{t-i}$ means first difference lagged series usually taken to eliminate the problem of serial correlation (Dickey & Fuller, 1979) and ε_t is the white noise process with $\varepsilon_t \sim iid(0, \sigma^2)$. The term k in this case is automatically determined using Schwarz Information Criterion (SIC) to get the optimal lag length and ensure white noise process of the residual ε_t .

The null hypothesis of the ADF test indicates that the series are associated with a unit root, that is, $\alpha = 0$ while the alternative is that the series is stationary ($\alpha < 0$). Accordingly, if the t -statistic is less than the test critical values at the appropriate significance level, then the hypothesis $\alpha = 0$ is rejected, and the series is considered to be stationary, that is $\alpha < 0$ or otherwise.

3.2.1.3 ARDL Bounds Testing Approach

According to Pesaran *et al.* (2001), testing for the cointegration between defence expenditure, threat, political instability, arms procurement and economic growth, both in the short-run and long-run, is done by estimating the following ARDL unrestricted error-correction model (UECM) as well as the significance F - joint test on the lagged one period of the level variables as follows:

$$\begin{aligned}
 \Delta lrgdpk_t = & \omega_0 + \sum_{i=1}^{n-1} \omega_{1i} \Delta lrgdpk_{t-i} + \sum_{i=0}^{n-1} \omega_{2i} \Delta lde_{t-i} + \sum_{i=0}^{n-1} \omega_{3i} \Delta thr_{t-i} + \sum_{i=0}^{n-1} \omega_{4i} \Delta lai_{t-i} \\
 & + \sum_{i=0}^{n-1} \omega_{5i} \Delta pi_{t-i} + \sum_{i=0}^{n-1} \omega_{6i} \Delta (lde * thr)_{t-i} + \sum_{i=0}^{n-1} \omega_{7i} \Delta (lde * lai)_{t-i} + \\
 & \sum_{i=0}^{n-1} \omega_{8i} \Delta (lde * pi)_{t-i} + \sum_{i=0}^{n-1} \omega_{9i} \Delta ledu_{t-i} + \delta_1 lrgdpk_{t-1} + \delta_2 lde_{t-1} + \quad [3.9] \\
 & \delta_3 thr_{t-1} + \delta_4 lai_{t-1} + \delta_5 pi_{t-1} + \delta_6 (lde * thr)_{t-1} + \delta_7 (lde * lai)_{t-1} \\
 & + \delta_8 (lde * pi)_{t-1} + \delta_9 ledu_{t-1} + \mu_t
 \end{aligned}$$

Where the symbol Δ , is the difference operator. The long-run relationship between the variables is determined by the joint significance test of the following hypothesis: a null no cointegration given by: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = \delta_8 = \delta_9 = 0$ can be tested against their alternative hypothesis that suggest the presence of cointegration as: $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq \delta_7 \neq \delta_8 \neq \delta_9 \neq 0$. If the upper bound critical value falls below the calculated F -statistic values, the null hypotheses of no relationship are rejected, and cointegration exists among the variables that give the opportunity to estimate both long and short-run coefficients. The null hypotheses cannot be rejected if the lower bound is above the F -statistic.

Furthermore, cointegration 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) argue 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 adopt a small sample size critical values computed in Narayan (2005) for the bound testing process.

3.2.1.4 Long Run Relationship

From equation (3.9), the long run equation presented in equations 3.1 can be derived, when:

$$\begin{aligned} a_0 = 1/\varphi_1, a_1 = -\varphi_2/\varphi_1, a_2 = -\varphi_3/\varphi_1, a_3 = -\varphi_4/\varphi_1, a_4 = -\varphi_5/\varphi_1, a_5 = -\varphi_6/\varphi_1, \\ a_6 = -\varphi_7/\varphi_1, a_7 = -\varphi_8/\varphi_1, a_8 = -\varphi_9/\varphi_1, \end{aligned} \quad [3.10]$$

Where

$$\begin{aligned} \varphi_1 = -(1 - \sum_{i=1}^n w_{1i}), \varphi_2 = \sum_{i=1}^n w_{2i}, \varphi_3 = \sum_{i=1}^n w_{3i}, \varphi_4 = \sum_{i=1}^n w_{4i}, \\ \varphi_5 = \sum_{i=1}^n w_{5i}, \varphi_6 = \sum_{i=1}^n w_{6i}, \varphi_7 = \sum_{i=1}^n w_{7i}, \varphi_8 = \sum_{i=1}^n w_{8i}, \\ \varphi_9 = \sum_{i=1}^n w_{9i} \end{aligned} \quad [3.11]$$

Furthermore, a dynamic error correction model is estimated to determine the long-run and short-run relationship among the integrated variables (Engle & Granger, 1987). While the long-term dynamism is explained by the error correction term which further proves the existence of long-run relationship by its significant negative value, the short-run behaviour is described by the lagged terms' individual coefficients of the estimate.

3.2.1.5 Short Run Relationship

To estimate the short-run model for the relationship among the variables, is in line with the Pesaran *et al.* (2001). The following ARDL model is to be regressed.

$$\begin{aligned}
lrgdpk_t = & \psi_0 + \sum_{i=1}^n \rho_{1i} lrgdpk_{t-i} + \sum_{i=0}^n \rho_{2i} lde_{t-i} + \sum_{i=0}^n \rho_{3i} thr_{t-i} \\
& + \sum_{i=0}^n \rho_{4i} lai_{t-i} + \sum_{i=0}^n \rho_{5i} pi_{t-i} + \sum_{i=0}^n \rho_{6i} (lde * thr)_{t-i} \\
& + \sum_{i=0}^n \rho_{7i} (lde * pi)_{t-i} + \sum_{i=0}^n \rho_{8i} (lde * lai)_{t-i} \\
& + \sum_{i=0}^n \rho_{9i} ledu_{t-i} + \varepsilon_t
\end{aligned} \tag{3.13}$$

Equally, the long run model can be derived from model 3.13 as:

$$\begin{aligned}
\alpha_0 = \frac{\varphi_0}{1 - \sum \rho_{1i}}, \quad \alpha_1 = \frac{\sum \varphi_{2i}}{1 - \sum \rho_{1i}}, \quad \alpha_2 = \frac{\sum \varphi_{3i}}{1 - \sum \rho_{1i}}, \quad \alpha_3 = \frac{\sum \varphi_{4i}}{1 - \sum \rho_{1i}}, \\
\alpha_4 = \frac{\sum \varphi_{5i}}{1 - \sum \rho_{1i}}, \quad \alpha_5 = \frac{\sum \varphi_{6i}}{1 - \sum \rho_{1i}}, \quad \alpha_6 = \frac{\sum \varphi_{7i}}{1 - \sum \rho_{1i}}, \quad \alpha_7 = \frac{\sum \varphi_{8i}}{1 - \sum \rho_{1i}}, \\
\text{and } \alpha_8 = \frac{\sum \varphi_{9i}}{1 - \sum \rho_{1i}},
\end{aligned} \tag{3.14}$$

The error correction representation is algebraically determined as shown in Equation

3.15.

$$\begin{aligned}
\Delta lrgdpk_t = & \sigma_0 + \sum_{i=1}^{n-1} \sigma_{1i} \Delta lrgdpk_{t-i} + \sum_{i=0}^{n-1} \sigma_{2i} \Delta lde_{t-i} + \sum_{i=0}^{n-1} \sigma_{3i} \Delta thr_{t-i} \\
& + \sum_{i=0}^{n-1} \sigma_{4i} \Delta lai_{t-i} + \sum_{i=0}^{n-1} \sigma_{5i} \Delta pi_{t-i} + \sum_{i=0}^{n-1} \sigma_{6i} \Delta (lde * thr)_{t-i} + \\
& \sum_{i=0}^{n-1} \sigma_{7i} \Delta (lde * lai)_{t-i} + \sum_{i=0}^{n-1} \sigma_{8i} \Delta (lde * pi)_{t-i} + \sum_{i=0}^{n-1} \sigma_{9i} \Delta ledu_{t-i} \\
& + \psi ect_{t-1} + \mu_t
\end{aligned} \tag{3.15}$$

Where the term ect_{t-1} represents error correction term which determines the magnitude of speed of adjustment. The error correction term measure the effectiveness of the feedback or adjustment mechanism in stabilizing disequilibrium in the model. In other words, it describes how disequilibrium in the model instantaneously converge to equilibrium after a given shock in the economy.

Furthermore, a negative significant coefficient of the ect_{t-1} 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_{t-1} term the better the speed of

adjustment. The symbol Δ denotes difference operator while the other variables were earlier explained in Equations [3.13]. The error term ect_{t-1} is the residual of the long run model of equation (3.1) lagged one period, so that:

$$\begin{aligned} ect_{t-1} = \mu_{t-1} = & lrgdpk_{t-1} - a_0 - a_1lde_{t-1} - a_2thr_{t-1} - a_3lai_{t-1} \\ & - a_4pi_{t-1} - a_5(lde * thr)_{t-1} - a_6(lde * lai)_{t-1} \\ & - a_7(lde * pi)_{t-1} - a_8ledu_{t-1} \end{aligned} \quad [3.16]$$

3.2.2 Research and Development (R&D) Model

According to Hartley (2006) defence research and development enhances a nation's defence capability by improving its national security via the use of technology, other than increasing the quantity of defence equipment. Defence R&D has equally an opportunity cost regarding the use of the scarce resources, assets and personnel it employs, which could have been used for civilian research.

Theories of economic growth draw attention to an endogenous technological change in explaining the growth path of world economies. Pioneered by Romer (1986), R&D has led to technological innovation using both human capital and existing knowledge stock. R&D is utilized in the production function of final goods leading to endogenous innovation that enables sustainable economic growth. In an attempt to disaggregate defence expenditure in Nigeria, this study intends to examine the relative contribution of defence R&D on Nigeria's economic growth. R&D in Nigeria has for long been financed, in form of human capital development, through defence institutions and defence Industrial Corporation of Nigeria (DICON). Though defence R&D has clear opportunity costs as a result of the use of scarce resources, both human and materials, that could be employed on civil research. Nevertheless,

there are also possible beneficial externalities via technical spill-overs for the civilian sector (Goolsbee, 1998).

However, while there exist many examples of those spin-offs, there are very few studies that carry such studies in Nigeria. This study adopts growth model by Goel & Ram (1994) and extended by Goel, Payne and Ram (2008). Goel, Payne and Ram growth model is derived from a conventional production function it is as follows:

$$Y = (L, K, R) \quad [3.15]$$

Where Y is output, L is labour, K is capital and R&D as another form of capital aside the tradition input: labour and physical. The growth equation is written as follows:

$$Y = (L, K, R \& D) \quad [3.16]$$

$$lrgdpk_t = \beta_0 + \beta_1 llft_t + \beta_2 linv_t + \beta_3 lrd_t + \varepsilon_t \quad [3.17]$$

We expect that $\beta_0, \beta_1, \beta_2, \beta_3, > 0$. The symbol β_0 is the intercept, ε_t is the error term it is expected to be normally distributed. Where *lrgdpk* is the real gross domestic product per capita, *llft* indicates labour force total, *linv* signifies capital stock proxy (fixed capital formation), *lrd* is the defence research and development. The prior expectation is that the labour force should impact positively on economic growth especially in Nigeria, like wise investment equally expected to relate positively on Nigeria's economic growth. The defence reseach and development is also expected to impact positively on the Nigeria's economic growth.

Where Y is output, L is labour, K is capital and RD is research and development. After RD as another form of capital asides the traditional input: labour and physical capital. The growth equation is written as follows:

$$Y_t = \alpha + \beta_L L_t^* + \alpha_K \left(\frac{I_K}{Y} \right)_t + \alpha_L \left(\frac{I_R}{Y} \right)_t + \mu_t \quad [3.18]$$

where Y_t^* and L_t^* are rates of increase in the aggregate output as well as labour force in a period t . $\left(\frac{I_K}{Y} \right)_t$ and $\left(\frac{I_R}{Y} \right)_t$ are shares of conventional investment as well as defence RD expenditures in aggregate output, which α and μ denotes error term. Despite the noticeable difficulties associated with the model, it provides a fairly rational framework for initial justification of the role of defence RD in economic growth. Therefore this study adopt this model to determine the impact of defence RD to the economic growth in Nigeria. In extension to RD , is the defence sectoral allocation on: EXA=Army; EXN=Navy and the EXAF=Air force, to examines the impact of sectoral defence allocation on the Nigeria's economic growth.

3.2.2.1 Estimation Procedure

The aim of this section is to explain the relevant econometric procedures used in the time series data analysis. To determine the interaction relationship between defence expenditure, threat, political instability, arms procurement and economic growth, both in the short-run and long-run, Pesaran and Shin's (1998) model of Autoregressive Distributed Lag (ARDL) is used in the study. The model examine the long-run relationship, irrespective of whether the variables are stationary in levels, different or mutually integrated (Bahmani-Oskooee & Wing Ng, 2002). To take care of short-term deviations, while determining the long-run cointegration, an error correction representation is included in the ARDL model (Pesaran Shin & Smith 2001). The model provides 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.

3.2.2.2 Unit Root Test

The stationarity test is a preliminary investigation in the analyses of time series data and is imperative for proper estimation and highly important in economic interpretations. The prerequisite for time series variables stationarity or nonstationarity is noted in econometric (Nelson & Plosser, 1982). Time series data that are often nonstationary has been generally seen as a problem in empirical analysis (Nelson & Plosser, 1982). Using non-stationary variables may lead to spurious regression results from which further inference is worthless. Thus, the unit root analysis in this case is conducted using the renowned ADF method specified in Equations 3.5 specified under section 3.3.1.2 The study conducts the unit root test to ensure that the maximum order of integration is determine not beyond first difference.

3.2.2.3 ARDL Bounds Testing Approach

According to pesaran *et al.* (2001), testing for the cointegration among given set of variables can be attained by using the bound test approach. This is done by estimating the following ARDL unrestricted error-correction model (UECM) as well as the significance *F*- joint test on the lagged one period of the level variables as follows:

$$\begin{aligned} \Delta lrgdpk_t = & \alpha_0 + \sum_{i=1}^{n-1} \alpha_{1i} \Delta lrgdpk_{t-i} + \sum_{i=1}^{n-1} \alpha_{2i} \Delta llft_{t-i} + \sum_{i=0}^{n-1} \alpha_{3i} \Delta linv_{t-i} + \sum_{i=0}^{n-1} \alpha_{4i} \Delta lrd_{t-i} \\ & + \psi_1 lrgdpk_{t-1} + \psi_2 llft_{t-1} + \psi_3 linv_{t-1} + \psi_4 lrd_{t-1} + \mu_t \end{aligned} \quad [3.19]$$

Where the symbol Δ , is the difference operator. The long-run relationship between the variables is determined by the joint significance test of the following hypothesis: a null hypothesis of no cointegration given by. $\psi_1 = \psi_2 = \psi_3 = \psi_4 = 0$ is be tested against their alternative hypothesis that proposed the presence of cointegration as: $\psi_1 \neq \psi_2 \neq \psi_3 \neq \psi_4 \neq 0$. Similarly, if the upper bound critical value falls below the calculated F -statistic values, the null hypotheses of no relationship are rejected, and cointegration exists among the variables that give the opportunity to estimate both long and short-run coefficients. The null hypotheses cannot be rejected if the lower bound is above the F -statistic.

Furthermore, cointegration 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) argue 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 adopt a small sample size critical values computed in Narayan (2005) for the bound testing process.

3.2.2.4 Long Run Relationship

From the equation (3.19), the long run equation as presented in equations 3.17 can be derived when:

$$\beta_0 = 1/\eta_1, \beta_1 = -\eta_2/\eta_1, \beta_2 = -\eta_3/\eta_1, \beta_3 = -\eta_4/\eta_1 \quad [3.20]$$

Where

$$\eta_1 = -(1 - \sum_{i=1}^n \alpha_{1i}), \eta_2 = \sum_{i=1}^n \alpha_{2i}, \eta_3 = \sum_{i=1}^n \alpha_{3i}, \text{ and } \eta_4 = \sum_{i=1}^n \alpha_{4i}$$

Furthermore, a dynamic error correction model is estimated to determine the long-run and short-run relationship among the integrated variables (Engle & Granger, 1987). While the long-term dynamism is explained by the error correction term which further proves the existence of long-run relationship by its significant negative value, the short-run behaviour is described by the lagged terms' individual coefficients of the estimate.

3.2.2.5 Short Run Relationship

To estimate the short run model, Pesaran *et al.* (2001) proposed to regress the following ARDL model:

$$\begin{aligned} lrgdpk_t = & \mathcal{G}_0 + \sum_{i=1}^n \mathcal{G}_{1i} lrgdpk_{t-i} + \sum_{i=0}^n \mathcal{G}_{2i} llft_{t-i} + \sum_{i=0}^n \mathcal{G}_{3i} linv_{t-i} \\ & + \sum_{i=0}^n \mathcal{G}_{4i} lrd_{t-i} + \varepsilon_t \end{aligned} \quad [3.22]$$

Furthermore, the long run model can be equally derived from model 3.22.

$$\text{Where } \beta_0 = \frac{\mathcal{G}_0}{1 - \sum \mathcal{G}_{1i}}, \beta_1 = \frac{\sum \mathcal{G}_{2i}}{1 - \sum \mathcal{G}_{1i}}, \beta_2 = \frac{\sum \mathcal{G}_{3i}}{1 - \sum \mathcal{G}_{1i}}, \text{ and } \beta_3 = \frac{\sum \mathcal{G}_{4i}}{1 - \sum \mathcal{G}_{1i}},$$

While the short run or the error correction model is as follows;

$$\begin{aligned} \Delta lrgdpk_t = & \sigma_0 + \sum_{i=1}^{n-1} \sigma_{1i} \Delta lrgdpk_{t-i} + \sum_{i=0}^{n-1} \sigma_{2i} \Delta llft_{t-i} + \sum_{i=0}^{n-1} \sigma_{3i} \Delta linv_{t-i} + \\ & \sum_{i=0}^{n-1} \sigma_{4i} \Delta lrd_{t-i} + \psi ect_{t-1} + \mu_t \end{aligned} \quad [3.23]$$

Where the term ect_{t-1} represents error correction term which determines the magnitude of speed of adjustment. The error correction term measure the effectiveness of the feedback or adjustment mechanism in stabilizing disequilibrium in the model. In other words, it describes how disequilibrium in the model instantaneously converge to equilibrium after a given shock in the economy. The ect_t is the residual of the long run model of equation (3.9) lagged one period, so that:

$$ect_{t-1} = \varepsilon_{t-1} = lrgdpk_{t-1} - \beta_0 - \beta_1 lft_{t-1} - \beta_2 linv_{t-1} - \beta_3 lrd_{t-1} \quad [3.24]$$

The symbol *ect* is the coefficient of the error- correction term, it indicates the speed of adjustment. It suggest cointegration when it is negative, significant and lower than minus two. Furthermore, a 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 the speed of adjustment.

3.2.3 Asymmetric Causality Test

For the test of causality on defence expenditure and economic growth in Nigeria, the study uses asymmetric causality test in addition to the standard short-run granger causality and augmented Toda & Yamamoto granger causality. In the case of linear granger causality, the standard Granger causality test assumes that the information for the prediction of the variables X_t and Z_t is contained in the time-series data of these variables. The test involves estimating the following regressions: Assuming Z stands for variable *lrgdpk* and X stands for *lde*, therefore:

$$lrgdpk_t = \sum_{i=1}^k \varpi_i lrgdpk_{t-i} + \sum_{j=1}^k \sigma_j lde_{t-j} + \mu_t \quad [3.31]$$

$$lde_t = \sum_{i=1}^m \alpha_i lde_{t-i} + \sum_{j=1}^m \beta_j rlgdpk_{t-j} + \mu_t \quad [3.32]$$

Equation 3.31 proposes that current value of *lde* is related to past values of *lde* as well as of *lrgdpk*. Equation 3.32 proposes a similar behaviour for *lrgdpk*. Generally, if *lrgdpk* granger causes *lde*, then changes in *lrgdpk* should precede changes in *lde*. Therefore, in a regression of *lde* on other variables (including its own past values) by

including the past or lagged values of $lrgdpk$ and it significantly improves the prediction of lde , then we can say that $lrgdpk$ granger causes lde . A similar definition if lde Granger causes $lrgdpk$. On the other hand the Toda-Yamamoto (1995) augmented granger causality test is established on the following equations:

$$lde_t = \vartheta + \sum_{i=1}^{h+d} \delta_i lde_{t-i} + \sum_{j=1}^{k+d} \varpi_j lrgdpk_{t-j} + \mu_t \quad [3.33]$$

$$lrgdpk_t = \vartheta + \sum_{i=1}^{h+d} \lambda_i lrgdpk_{t-i} + \sum_{j=1}^{k+d} \eta_j lde_{t-j} + \mu_t \quad [3.34]$$

In this case d is the maximal order of integration of the variables in the system, while h and k depicts the optimal lag length of $lrgdpk$ and lde . And μ represents the error term that presumed to be white noise with zero mean, constant variance and no autocorrelation. Thereafter, the next is to determine the maximal order of integration d , which is expected to be in the model with a total of $(k + d)$ lags

However, the asymmetric causality proposed in Hatemi-J (2012) is tested based on Equations 3.35 and 3.36 for the positive and negative components respectively.

$$x_t^+ = \nu + A_1 x_{t-1}^+ + \dots + A_p x_{t-p}^+ + \mu_1^+ \quad [3.35]$$

$$x_t^- = \nu + A_1 x_{t-1}^- + \dots + A_p x_{t-p}^- + \mu_1^- \quad [3.36]$$

Where y_t^+ a 2x1 vector of the variables and ν is 2x1 vector of the intercepts. Also μ_1^+ is the 2x1 vector of error terms (consistent with various variables representing the sum of positive shocks). A_r is the 2x2 matrix of the lag order parameter r ($r=1, \dots, p$). For the lag length maximisation, the following equation is employed

to select optimal lag order:

$$HJC = \ln(\det \Omega_j) + j \left[\frac{n^2 \ln T + 2n^2 \ln(\ln T)}{2T} \right] \dots \dots \dots j=0 \dots p, \quad [3.37]$$

where: \ln is the natural logarithm, $\det \Omega_j$ = determinant of estimated variance and covariance matrix of lag order j , n is the number of equations in the model, and T denotes number of observations for estimating the VAR model. After choosing the optimal lag order, the null hypothesis k^{th} component of y_t^+ non-Granger cause w^{th} elements of y_t^+ . This is tested using the following hypothesis: H_0 : Row w , column k element in the $A_r = 0$ for $r = 1 \dots p$

The Wald test is defined in a matrix notations as presented in the equations that follows

$$X := (x_1^+ \dots x_T^+) \quad (n \times T) \text{ matrix,}$$

$$D := (v, A_1, \dots, A_p, \dots, A_{p+d}) \quad (n \times (1 + n(p+d))) \text{ matrix,} \quad [4.36]$$

$$Z_t := \begin{pmatrix} 1 \\ x_t^+ \\ x_{t-1}^+ \\ \vdots \\ x_{t-p-d+1}^+ \end{pmatrix} \quad ((1 + np) \times 1) \text{ Matrix, for } t = 1 \dots, T \quad [4.37]$$

$$Z = (Z_0, \dots, Z_{T-1}) \quad ((1 + n(p+d)) \times T) \text{ Matrix, and} \quad [3.38]$$

$$\delta := (\varepsilon_1^+ \dots \varepsilon_T^+) \quad (n \times T) \quad [3.39]$$

For the test of the null hypothesis of non-Granger causality, $H_0: C\beta = 0$, is tested by the following test method:

$$MWALD = (C\beta) \left[C(Z'Z)^{-1} \otimes S_U C' \right]^{-1} (C\beta), \quad [3.40]$$

Where: \otimes = Multiplication operator of element by element (Kronecker product). C is a $p \times n$ ($1+nd$) matrix. Each p row of C is linked to zero restrictions of one parameter in β . Element in each row of C has the value of one provided the related parameter in β is zero in the null hypothesis or has the value of zero without given restriction under the null hypothesis. S_U is the estimated variance covariance matrix of residuals in equations. While, $\beta = \text{vec}(D)$, vec represents the column-stacking operator. The null hypothesis of no Granger causality is rejected if the calculated MWALD statistics is found to be greater than the critical values.

3.3 Justification of Variables

3.3.1 Real Gross Domestic Product Per Capita

Real Gross Domestic Product (RGDPK) per capita measures a country's economic performance. It takes into account the per person GDP in the economy. Many studies in the field of defence economics employ real GDP per capita as a proxy for growth (Barro, 1991; Habibullah *et al.*, 2008; Khalid and Mustapha, 2014; Tiwari, 2014; Hasseb, 2014 and Yuan *et. al.* 2014 among others).

3.3.2 Threats

Escalating threats both internal and external around the world in the recent years have necessitate reseach studies on many developing as well as developed economies. Threat mars domestic as well as foreign investments, it therefore affects economic growth negatively. Studies recently have incorporated threat components into growth regressions. This is to assess the impact of threats on economic

performance in a particular country. Studies have established negative relationship between threat and economic growth. These studies include; Aizeiman and Glick (2006); Araujo and Shikida (2008), Musayev (2016) and Yang, Trumbull, Yang and Huang, (2011). Employing internal threat index by ICRG, this study expect negative impact of internal threat on economic growth in Nigeria.

3.3.3 Defence Expenditure

While defence expenditure takes a significant share of the world's resources, its economic impact has recently become a topic of debate in the economic literature. However, defence expenditure is considered a public good in both Neoclassical and New Classical economic theories. Studies examines the relationship between economic growth and defence expenditure using GDP growth with mixed result. While some found positive relationship between defence expenditure and economic growth (Anyanwu & Aiyedogon, 2011; Ando, 2004; Awaworyi & Yew, 2014; Dakurah *et al.*, 2001; Masih *et al.*, 1997 ; others found negative relationship (Dunne, 2011; Hou & Chen, 2014; Zaman *et al.*, 2013; Araujo & Shikida, 2008). But dominantly literature in defence-growth relationship found negative impact of defence spending on growth. Therefore, this study expect either a negative effect of defence expenditure on economic growth in Nigeria.

3.3.4 Defence Expenditure Threats Interaction

Internal threats, as well as external threats, have the ability to mar production and thus negatively affect economic growth. Scholars have argued that threats without expenditure for defence reduces growth; while defence expenditure without threats would reduce growth. However, defence spending in the presence of sufficiently

large threats increases growth. (Aizenman & Glick, 2003; Araujo & Shikida, 2008; Musayev, 2016; Yang *et al.*, 2011). It is thus expected that the interactive effect of threat and defence burden would exert a positive impact on economic growth, while threat and defence burden on their own are both expected to have adverse impact on economic growth.

This study uses the defence expenditure variable as well as internal threats to establish the interactional component, as proposed by Aizeiman and Glick (2006). It is argued by Collier and Hoeffler (2002) that the main obstacle in the field of defence economic analysis is the credible estimate of the internal threat. Adding that as civil wars are now more common than the international conflicts, an omission of the internal threat is a serious impediment on any global analysis of defence expenditure. The study hereby expect positive impact of defence-internal threat interaction on economic growth in Nigeria.

3.3.5 Political Instability

The mainstream economic literature stress the impacts of political instability on growth. Political instability has been argued to be an important factor resulting to socio-economic uncertainty. By and large, political instability affects consumption and investment decisions of economic agents as well the decisions of monetary and fiscal policy makers. The argument is that higher political instability leads to uncertainty hence, generates a risky atmosphere for economic activities and agents. To evade risks, economic agents turn out to be scared in the implementation of any project. Hence, political instability has serious and negative consequences to productivity, security of property, physical and human capital, as well as economic

growth. Thus, we expect a negative relationship between Political Instability and economic growth. Earlier studies that modeled the linkages between defence expenditure and economic growth include Blomberg (1996), Alesina *et al.*(1991), Fosu (1996), Yildirim, Sezgin, & Öcal, (2005) Seiglie (1998) and Erdogdu (2007) among others.

3.3.6 Political Instability and Defence Expenditure Interaction

While political instability has negative impact on economic growth, scholars argue that defence expenditure in the presence of political instability stimulate economic growth. The interaction between political instability with defence expenditure and economic growth has been established in Aizeiman & Glick (2006), Blomberg (1996), and Erdogdu (2007) among others. It is expected therefore, the interaction impact between defence expenditure in the presence of political instability and economic growth to be positive.

3.3.7 Defence Research and Development

It has been argued that defence technology enhances national security and at the same time improves the utility of households like consumption in public goods. Hartley (2006) contends that defence research and development increases nation's defence capability by improving national security via technology not necessarily increasing the quantity of arsenals. Furthermore, like all other public goods, defence technology improves overall productivity via improvement of general-purpose technologies that has civil applications.

The inclusion of the defence R&D in these study is due to the fact that security components have been fully incorporated into the planned transformations of the Nigeria's economy. This was initiated in the blueprint which came up as a result of the outcome of series interactive activities between the relevant officials in the Ministry of Defence (MoD) and that of National Planning Commission (NPC) (Magbadelo, 2012). Various studies have examined the effects of defence R&D on economic growth. The unit used in measuring defence R&D in studies such as: Goel and Ram (1994, Goel, Payne and Ram (1995), Chu and Lai (2009), and Chu and Lai (2012) is defence R&D expenditure. It has been argued in Ram (1995) that the growth impact of different components of defence expenditure might be different even if the aggregate defence expenditure neither stimulates nor hurts growth. The study therefore expect positive impact of defence R&D in Nigeria.

3.3.8 Arms Procurement

Studies have mainly concentrated on the defence expenditure-growth relationship rather than arms importation. This is because in most cases, it is hard to come up with reliable data on arms importation as defence budget on procurement are not often disclosed (Perlo-freeman & Perdomo, 2008). Arms importation in Nigeria, form one of the components of defence expenditure and is a very important variable of the overall defence activity (Skons, 2008).

One of the possible disaggregation of defence expenditure components is the arms importations among others (Ram 1995). Using an approach by Yakovlev (2007) and Aizeiman and Glick (2006) this study examines the impact of arms importation on economic growth. Furthermore, the study establishes an interaction between arms

importation with defence expenditure and its impact on economic growth. The impact of arms importation as well as its interaction with defence expenditure on economic growth is expected to be negative in Nigeria.

3.3.9 Investment

Growth models accept that the rate of growth of an economy is determined by the accumulation of physical and human capital. The only difference between the old and new theories is that the new growth theories broaden the meaning and composition of capital in the growth process to include both human and physical capital (Kayode & Oyeranti, 2004). Positive relationship between investment and economic growth has been established theoretically and empirically in the literature through the combined effect of the accelerator and multiplier forces. However, it has also been determined that capital accumulation without the appropriate human capital, policies and conducive macroeconomic environment, may not lead to economic growth.

Nevertheless, while some studies show a significant positive impact of economic growth on defence expenditure and investment, other findings do not point any consistent relation between defence expenditure to either growth or investment. While others argued that there exists a tradeoff between defence expenditure and economic growth (Kollias & Paleologou, 2010), Dakurah, Davies & Sampath, 2001). As a control variable, the study uses investment to ascertain whether there exist a trade-off between defence expenditure and investment.

3.3.10 Labour Force Total

Population growth presents a paradox. The population-poverty cycle theory is the main argument advanced by economists who feel that too rapid population growth yields negative economic consequences, and thus, should be a real cause of concern for developing countries. Rapid population growth is said to impact negatively on economic growth through reduction in the per capita income growth, especially in countries that are already poor, on agriculture and experiencing pressures on land and natural resources.

Those that argue that population growth is not a real problem assert that population growth is not the real problem but other issues and that population growth is in fact desirable (Todaro & Smith, 2003). Increase in population and the labour force can raise living standards through the learning, specialization and scale economies that larger numbers, wider markets and a higher volume of output, make possible. The relationship between labour force and economic growth is thus defined by whether changes in output per worker due to population growth, are positive or negative (Thirwall, 1999).

3.4 Sources of Data

The study uses annual data spanning from 1983 to 2015. The data on real GDP per capita, data on share of defence expenditure to GDP on Nigeria, population growth, education as well as investment are sourced from World Development Indicators (WDIs). Furthermore, data on defence arms importation is retrieved from Stockholm International Peace Research Institute (SIPRI) and Nigeria's Ministry of defence (MoD). Data on internal threat and political instability are obtained from international country risk guide. Lastly, data on defence R&D as percentage of DGP

and sectoral allocation are extracted from the annual publications of the national bureau of statistics and ministry of defence budget of the federal republic of Nigeria. All the variables less the internal threats and political instability are transformed into natural logarithms.

Table 3.1
Data and Variable Description

Variable	Description definitions	Expected Signs	Source
Objective 1: interaction between defence, internal threat, political instability arms importation and economic growth			
lrgdpk	Real GDP per capita	NA	World Data Bank
thr	Internal conflict: Civil disorder, Civil War and terrorism	Negative	International Country Risk Guide
lde	Log of Defence expenditure ratio of the GDP	Negative	Nigerian Ministry of defence/SIPRI
pi	Political Instability comprises of Government unity, legislative strength and Popular support	Negative	International Country Risk Guide
lai	Funds spend on arms procurement	Negative	Nigerian Ministry of defence (MoD)
lde*thr	Defence expenditure in the present of internal threat	Positive	International Country Risk Guide
lde*pi	Defence expenditure in the presence of political instability	Positive	International Country Risk Guide
lde*lai	Defence expenditure in presence of arms importation	Negative	International Country Risk Guide/world Bank
ledu	Secondary school enrollment ratio (%)	Positive	World Data Bank
Objective 2: Impact of Defence R&D on the Nigeria's Economic Growth			
lrgdpk	Real GDP per capita	NA	World Data Bank
lrd	Defence research and development (funds allocated for research purposes to defence research institutions and DICON) as % GDP.	Positive	Ministry of defence(MoD)
llft	Labour force Total	Positive	World Data Bank
linv	Gross private fixed investment as % of GDP	Positive	World Data Bank
lexa	Defence Expenditure on Army GDP ratio	Positive/negative	Nigerian Ministry of defence (MoD)
lexn	Defence Expenditure on Army GDP ratio	Positive/negative	Nigerian Ministry of defence (MoD)
lexaf	Defence Expenditure on Army GDP ratio	Positive/negative	Nigerian Ministry of defence (MoD)
Objective 3: Causality between Defence Expenditure and Economic Growth			
lrgdpk	Real GDP per capita	NA	World Data Bank
lde	Log of Defence expenditure ratio of the GDP	Negative	Ministry of defence (MoD)

Note: lrgdpk is the log of real GDP per capita; lde is the log of defence expenditure; thr measures internal threat; ledu is a proxy for secondary school enrolment; linv is the proxy investment with fixed capital formation; llft is the labour force total; lai is arms import, lrd is defence research and development; pi is political instability; lde*thr is defence-threat interaction term; lde*pi is defence political stability interaction term; lde*lai is defence-arms import interaction term. The thr and pi are given in index obtained from International Country Risk Guide (ICRG); lexa is defence expenditure on army; lexn is defence expenditure on navy; lexaf is defence expenditure on air force.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the results and discussions of the study. The chapter is divided into two. The first part covers the descriptive statistics. It comprises of the graphical plots of the variables and correlation analysis. The second section is econometric analysis, it comprises of: the unit root analysis;; the analysis on the interaction terms; the impact of the defence R&D on the Nigeria's economic growth as well as asymmetric causality between defence expenditure and economic growth in Nigeria.

4.2 Preliminary Analysis

Prior to the data analysis, it is imperative to highlight the nature and characteristics of the series that lead to the use of the methodology employed in this study. In the first place, graphical plots of the data are presented so as to detect the behavior of the series. The summary of the descriptive statistics is also presented. This gives an idea on the variability in the data as well as its distribution. Furthermore, the magnitude and direction of the association of the variables employed in this study were analysed using correlations coefficient. This gives an insight on the type of relationships that prevails among these variables. The analyses are presented in the following sub-sections.

4.2.1 Graphical Plots of the Variables

The examination of the trend and pattern of the variables has been conducted. The data are plotted in Figure 4.1, it unveils high fluctuations in some variables, therefore

indicating that the data might be non-stationary in its level form. All the variables have an intercept and trend.

The movement in the series generally exhibits their relative behavior under the period of this study. Most of the series fluctuates, depicting slopes. The graphical plots of the time series variables in natural logarithm, for the period between 1983 to 2015, are presented in Figure 4.1. Yet, line graphs only, are not enough to give true or exact properties of the data. Hence, descriptive statistics is also conducted. The results of the descriptive statistics are presented in the next sub-section.

4.2.2 Descriptive Statistics

Before proceeding to empirical analysis, it is equally important to analyse the descriptive statistics for better understanding of the properties of the series. The summary of statistic is shown in Table 4.1. The descriptive analysis indicates that, the average *lrgdpk* in Nigeria between 1983 to 2015 stands at 6.51 billion. The maximum *lrgdpk* is 7.00 billion with the minimum *lrgdpk* of 6.20 billion. Furthermore, the standard deviation of the *lrgdpk* is 0.26 billion for the period under study. This truly shows a typical trend of *lrgdpk* in Nigeria which has been affected seriously by the uncertain environment.

Defence expenditure in Nigeria equally experienced the same pattern during the period under review. On the average defence expenditure in Nigeria remains high, it stands as ₦23.50 billion. While the maximum defence spending is ₦27.60 billion and the minimum defence spending in Nigeria stood as ₦16.38 billion and its deviation during this period stands as ₦2.91 billion. On the average, the defence

R&D stands as ₦17.40 billion, while the maximum stands as ₦18.69 and minimum stands as ₦15.20 with deviations as ₦0.88. On the average, lexn, lexaf and lexa stand as ₦4.46, ₦4.46 and ₦4.45 respectively. With the minimum of ₦4.29, ₦4.31 and ₦4.29 respectively. They attained the maximum of ₦4.54, ₦4.54 and ₦4.57 respectively.

The risk index provides the means of assessing internal threat and political stability of a particular country. It is done on the basis of assigning risk index to a particular country. The higher the political risk index the lower the risk and the lower the risk index the higher the political risk. By implication Nigeria on the minimum has been highly politically unstable with political risk index of averaging 1.00 out of the maximum score of 12. On the average also, it remains unstable with political risk index of 5.43. The maximum index is 9.00. This simply shows that Nigeria has experienced relative peace some times within the period.

With respect to the internal conflict variable, the lower the internal index value, the higher the internal conflict and vice-versa. The average internal conflict index in Nigeria is 4.99, signifying that Nigeria on the average experienced serious internal conflicts within the time covered by this study. The maximum internal conflict index in Nigeria is 7.50, denoting that Nigeria experienced a mild internal conflicts in some time during the period covered the study. Arms importation on the average stood at ₦17.18 billion, with the maximum value of ₦20.18 billion and minimum of ₦13.81 billion. Deviation of arms importation expenditure in Nigeria from the mean is reasonably large within this period, meaning that expenditure on arms import was

higher in some periods than the other. This signifies that more expenditure is made during the period of conflicts.

Furthermore, the skewness measured the symmetry of the data. Skewness is the asymmetry in a typical statistical distribution, in which the curve of a given series appears to be distorted/skewed either to the right or to the left. It can be measured to define the magnitude to which a typical distribution varies from the normal to the right (positive values), and to the left (negative values). From Table 4.1, all the variables except for $lrgdpk$, $ledu$, π and $lde*lai$ are negatively skewed. This implies that the absolute values of these variables are highly skewed to the left, except for $ledu$, thr , π and $lde*lai$ that are skewed to the right. The most highly skewed series are $ledu$ and $lrgdpk$. While the least skewed series is $lexa$ and $lde*lai$ as shown in the Table 4.1.

Another important feature is the flatness or Peakedness which is measured by kurtosis. Kurtosis can be flat (negative values) or peak (positive values). Table 4.1 shows that the series have high positive kurtosis values, which means that they have high and sharp peak or are leptokurtic. Therefore the kurtosis statistic also indicates the normality of the data. Subsequently, the Jarque-Bera statistics equally shows that the variables under study are not normally distributed except for the $ledu$, thr , $lde*\pi$, $lde*lai$ and $lde*thr$. Thus, the effectiveness of these tests become less effective if the time series data becomes highly correlated (Bai & Ng, 2005). Moreover, it has been established that raw time series data is hardly normally distributed (Swift & Janacek, 1991).

4.2.3 Correlation Analysis

Linear relationship among the pairs of the variables are computed to examine the direction and magnitude of association between them. In order to observe the possibility of getting redundant variables in the estimation. Multicollinearity is a statistical problem that can lead to over estimation of the standard errors which can lead to smaller t -statistic which consequently leads to the case of size distortion. The correlation among the regressors helps in predicting the possibility of having multicollinearity in the model. From Table 4.2, the probability values indicate that, the null hypotheses of no correlation between the pair of the variables are mostly rejected. Furthermore, most of the coefficients are within the threshold limit of 0.80 as in Kennedy (2008) and Sufian & Habibullah (2010). The analysis indicates the absence of multicollinearity except for the pair for $lde*pi$ and pi , $ledu$ with $llft$, $lrgdpk$ with $ledu$ and $llft$ with lde which are highly correlated with lde at 0.822, 0.845, 0.727 and 0.843 respectively. However, these series are not in the same model.

This preliminary result is an indication that there would be possible relationship among the variables. Nonetheless, this cannot be used for causality and other inferential inferences because it gives only the magnitude of pairwise association in a linear sense which may change when non-normality exist (Cohen & Lea, 2004). However, this study rigorously investigates the relationship among these variables.

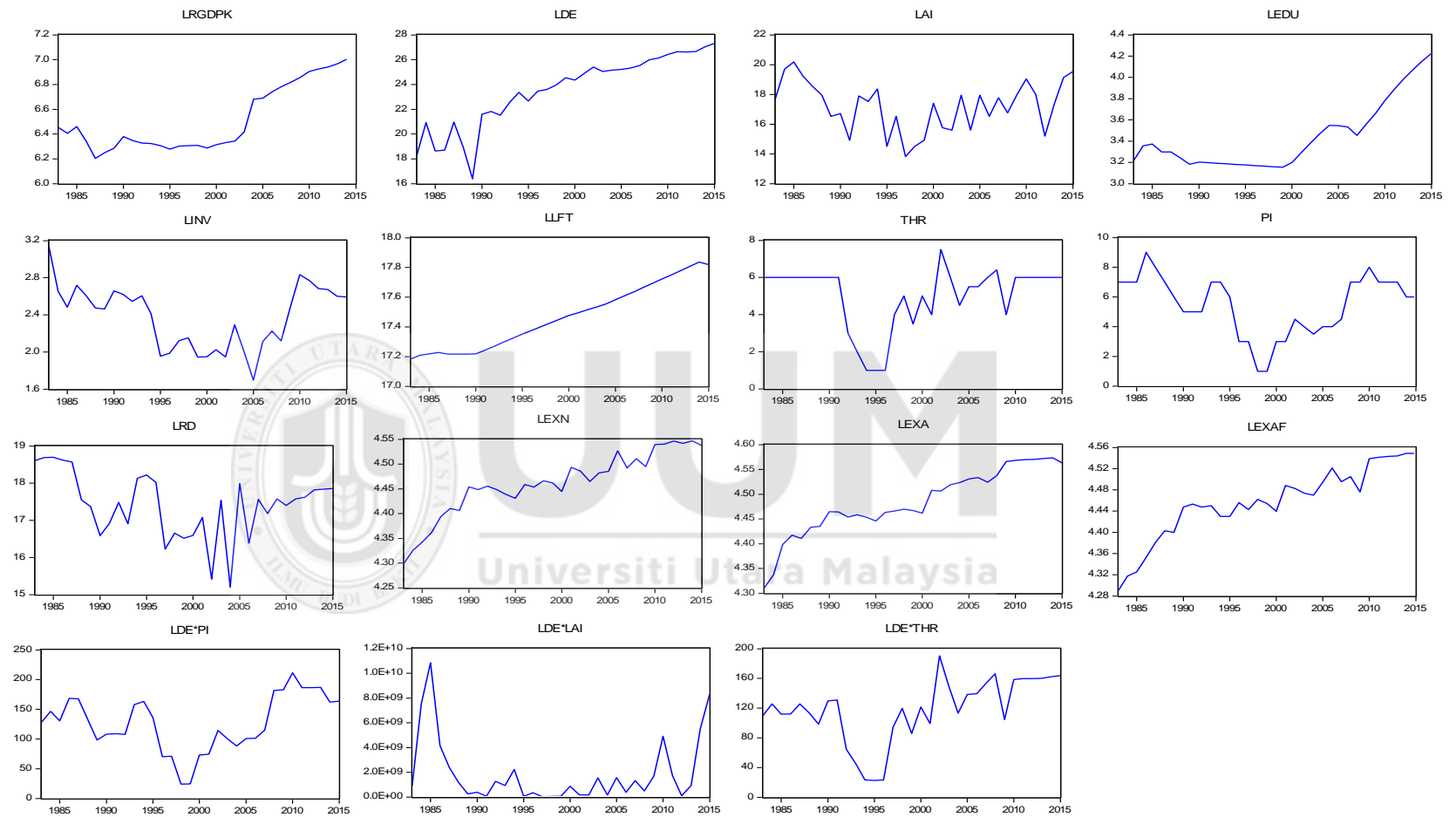


Figure 4.1
Graphical Plots of the Data

Table 4.1
Summary of Descriptive Statistics: 1983-2015

	LRGDPK	LDE	LAI	LEDU	LINV	LLFT	THR	PI	LRD	LEXA	LEXN	LEXAF	LDE*PI	LDE*LAI	LDE*THR
Mean	6.51	23.50	17.18	3.43	2.38	17.45	4.99	5.43	17.40	4.48	4.46	4.45	11.26	25.00	11.31
Median	6.36	24.34	17.52	3.29	2.47	17.44	6.00	6.00	17.55	4.47	4.46	4.45	12.40	24.70	11.80
Maximum	7.00	27.31	20.18	4.22	3.13	17.84	7.50	9.00	18.69	4.57	4.55	4.55	14.71	33.20	14.00
Minimum	6.203	16.38	13.81	3.15	1.69	17.18	1.00	1.00	15.20	4.31	4.30	4.29	5.55	19.8	7.00
Std. Dev.	0.261	2.91	1.66	0.31	0.33	0.21	1.69	2.01	0.88	0.07	0.06	0.07	2.48	3.40	1.78
Skewness	0.72	-0.76	-0.24	1.17	-0.07	0.31	-1.28	-0.51	-0.59	-0.53	-0.70	-0.69	-0.69	0.42	-0.55
Kurtosis	1.88	2.61	2.18	3.22	2.21	1.79	3.61	2.48	3.04	3.05	3.11	3.05	2.22	2.3	2.33
Jarque-Bera	4.43	3.35	1.20	7.61	0.87	2.46	9.50	1.78	1.93	1.50	2.62	2.55	14.04	14.04	14.04
Probability	0.109	0.18	0.54	0.02	0.64	0.29	0.00	0.41	0.38	0.47	0.27	0.28	0.01	0.00	0.00
Observations	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33

Note: LRGDPK is the log of real GDP per capita from 1983-2015; LDE is the defence expenditure; LAI is arms import; LEDU is a proxy for secondary school enrolment; LINV is the proxy investment with fixed capital formation; LLFT is the log of labour force total; THR measures internal threat; PI measures political instability; LRD is defence research and development; LEXA defence expenditure on the army; LEXN measures defence expenditure on the navy; LEXAF defence expenditure on the Air force; LDE*THR is defence-threat interaction term; LDE*PI is defence political stability interaction term; LDE*LAI is defence-arms import interaction term. Std. Dev. is the standard deviation; Min. is the minimum; Max. is the maximum; J. B Stat. is the Jarque-Bera statistic. The p-value is the probability value of the Jarque-Bera statistic. LAI, LRD, LEXA, LEXN, and LEXAF are expressed in local currency in millions. While LDE is expressed in local currency in Billions. The THR and PI are given in index obtained from International Country Risk Guide (ICRG) The number of observations in this study is 33 for each variable.

Table 4.2
Correlation Matrix for Variables

Variables	LRGDPK	LDE	LAI	LEDU	LINV	LLFT	THR	PI	LRD	LEXA	LEXN	LEXAF	LDE*PI	LDE*LAI	LDE*THR
LDE	0.664 (0.000)	1.000 ...													
LAI	0.220 (0.226)	-0.203 (0.26)	1.000 ...												
LEDU	0.727 (0.000)	0.636 (0.000)	0.270 (0.135)	1.000 ...											
LINV	0.212 (0.244)	-0.318 (0.077)	0.481 (0.005)	0.263 (0.147)	1.000 ...										
LLFT	0.843 (0.000)	0.904 (0.000)	-0.055 (0.763)	0.845 (0.000)	-0.146 (0.426)	1.000 ...									
THR	0.353 (0.048)	-0.011 (0.954)	0.239 (0.188)	0.407 (0.021)	0.297 (0.099)	0.194 (0.287)	1.000 ...								
PI	0.272 (0.133)	-0.266 (0.141)	0.630 (0.000)	0.335 (0.061)	0.719 (0.000)	-0.064 (0.729)	0.224 (0.218)	1.000 ...							
LRD	0.023 (0.901)	-0.372 (0.036)	0.635 (0.000)	0.087 (0.635)	0.465 (0.007)	-0.225 (0.215)	-0.054 (0.771)	0.604 (0.000)	1.000 ...						
LEXA	0.740 (0.000)	0.858 (0.000)	-0.155 (0.396)	0.725 (0.000)	-0.215 (0.237)	0.910 (0.000)	0.117 (0.525)	-0.109 (0.554)	-0.374 (0.035)	1.000 ...					
LEXN	0.664 (0.000)	0.876 (0.000)	-0.278 (0.124)	0.646 (0.000)	-0.243 (0.180)	0.873 (0.000)	0.032 (0.861)	-0.212 (0.245)	-0.449 (0.010)	0.765 (0.000)	1.000 ...				
LEXAF	0.656 (0.000)	0.873 (0.000)	-0.274 (0.129)	0.643 (0.000)	-0.244 (0.179)	0.868 (0.000)	0.040 (0.827)	-0.218 (0.231)	-0.432 (0.014)	0.959 (0.000)	0.996 (0.000)	1.000 ...			
LDE*PI	0.551 (0.001)	0.131 (0.474)	0.549 (0.001)	0.600 (0.000)	0.623 (0.000)	0.299 (0.096)	0.213 (0.242)	0.822 (0.000)	0.463 (0.008)	0.242 (0.181)	0.150 (0.411)	0.143 (0.434)	1.000 ...		
LDE*LAI	0.144 (0.433)	-0.230 (0.206)	0.776 (0.000)	0.216 (0.234)	0.355 (0.046)	-0.113 (0.538)	0.230 (0.205)	0.459 (0.008)	0.554 (0.001)	-0.246 (0.175)	-0.360 (0.043)	-0.366 (0.039)	0.365 (0.040)	1.000 ...	
LDE*THR	0.583 (0.001)	0.380 (0.032)	0.142 (0.43)	0.625 (0.000)	0.155 (0.396)	0.530 (0.002)	0.920 (0.000)	0.112 (0.541)	-0.194 (0.289)	0.441 (0.011)	0.375 (0.035)	0.382 (0.031)	0.258 (0.154)	0.122 (0.505)	1.000 ...

Note: LRGDPK, LDE, LAI, LEDU, LINV, LLFT, THR, PI, LRD, LEXA, LEXN, LEXAF, LDE*PI and LDE*LAI and LDE*THR. Represent log of Real Gross Domestic Product per capita, log of Defence Expenditure percentage of GDP, log of Arms Import, log of Edu proxy by Secondary School Enrolment,, log of capital fixed formation as proxy for Investment, log labour force total, internal threat index, Political instability index log of defence Reseach and Development, log of expenditure army, log of expenditure navy, log of expenditure air force, log of Defence-Political instability-interaction term, log of Defence-arms import interaction term and log of Defence-threat interaction term. The variables in parenthesis are the probability values of the correlation coefficients.

Furthermore, correlation analysis is computed for all the interaction terms, using the variables from which the interactions terms are calculated. This is to examine whether the inclusion of each interaction term may lead to multicollinearity. The results presented in Table 5.2 indicate that: lde is found correlated with lde*thr, lde*pi and lde*lai by 0.69, 0.88 and 0.73 respectively. Furthermore, pi is found highly correlated with lde*pi with the coefficient 0.93. Thr is found also correlated with lde*thr. Nonetheless, it is, observed that the correlation coefficients except for lde and lde*pi and pi and lde*pi are below the multicollinearity threshold value of 0.80 level of association (Kennedy, 20008 and Sufian & Habibullah, 2010).

4.3 Defence Expenditure-Interaction Terms and Economic Growth

This sub-section section aimed at finding the impact of defence expenditure and internal threat on economic growth in Nigeria, defence expenditure and political instability interaction and its economic impact on the Nigeria`s economic growth as well as the impact of defence expenditure and arms importation interaction on economic growth in Nigeria.

4.3.1 Unit Root Test

The test for unit root is one of the pre-requisites in the analysis of time series models. In this study, the stationarity properties is examined using the traditional augmented Dickey and Fuller (1979) unit root test. The test assumes that time series shocks are temporal and do not have long run effect on the series (Glynn *et al.*, 2007). Tables 4.3 presents the estimations of the ADF unit root test for all the variables employed in the study. These comprise of natural logarithms of real per capita gross domestic

products (lrgdpk), defence expenditure (lde), education expenditure (ledu), investment (linv), arms importation (lai), research and development (lrd), total labour force (llft), gross capital formation (linv), the interaction terms of defence expenditure with threat, arms importation and political instability. Furthermore, the series also include threat (thr) and political instability (pi) indices collected from international country risk guide (ICRG) database.

Table 4.3
Augmented Dickey-Fuller Unit Root Test

Series	Intercept without trend (Model A)		Intercept with trend (Model B)	
	Level	First difference	Level	First difference
lrgdpk	-0.951(0)	-5.185(0)***	-1.849(0)	-5.092(0)***
lde	-2.146(0)	-6.665(0)***	-1.639(0)	-6.860(1)***
ledu	2.443(7)	0.936(6)	-2.452(1)	-0.648(7)
linv	-1.952(0)*	-5.591(0)***	-2.318(0)	-6.566(1)***
lai	-3.255(0)**	-8.893(0)***	-3.950(0)**	-9.047(0)***
thr	-2.294(0)	-6.713(0)***	-2.362(0)	-6.667(0)***
pi	-1.733(0)	-4.962(0)***	-1.639(0)	-4.931(0)***
lde*thr	-2.140(0)	-7.056(0)***	-2.716(0)	-7.005(0)***
lde*lai	-1.409(4)	-2.637(3)*	-1.930(4)	-3.761(3)**
lde*pi	-1.625(0)	-5.084(0)***	-1.763(0)	-5.059(0)***
lrd	-2.069(1)	-13.792(0)***	-1.620(1)	-14.080(0)***
llft	1.543(0)	-1.740(0)	-2.391(0)	-3.635(0)**
lexa	-2.678(0)*	-5.121(0)***	-3.655(0)**	-5.395(8)***
lexn	-1.427(4)	-7.431(0)***	-3.511(0)*	-3.411(3)*
lexaf	-2.292(1)	-8.331(0)***	-3.737(0)**	-3.292(3)*

Note: ***, ** 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. The lag length is automatically determined based on Schwarz Information Criterion (BIC). They are presented in parentheses against each *t*-statistic. Where lrgdpk, lde, ledu, linv, lai, thr, pi, lde*thr, lde*lai, lde*pi, lrd, llft, lexa, lexn and lexaf: denote log of: real gross domestic product per capita, defence expenditure, education, investment, arms importation, threat, political instability, defence-threat interaction, defence-arms importation interaction, defence-political instability interaction, defence research and development, labour force total, expenditure on army, expenditure on the navy and expenditure on air force.

The ADF results show that the dependent variables, *lrgdpk* is non-stationary at level. This is found true irrespective of considering intercept with and without trend models. Nonetheless, the variable is found stationary after converting it into first difference. The series is stationary at one percent level of significance. Most of the other variables depicted in Table 4.5 are also found stationary after taking the first difference except *lai* which establish level stationarity under both model A and B. The *linv* is stationary at first difference under both models (model A and B) at one percent level of significance. The *lai* is level stationary at five percent under model A. Besides, the *lai* are found trend stationary at five percent under intercept with trend model (model B).

However, the other variables in the table are consistently stationary at first difference. The variable of defence expenditure (*lde*) is stationary at 10 percent level of significance under model A and found to be trend stationary at one percent level of significance. The *ledu* is only stationary at five percent under the intercept without trend model. However, the series, *ledu* is not stationary under the intercept with trend model. This is justified by the fact that the data generating process of the series is best described by random walk distribution. The *thr*, *pi*, *lrd* and *linv* variables are significant and stationary after conversion into first difference under both models, A and B. They are found significantly different from zero (0) at one percent level of significant. The natural logarithms of the interaction terms of defence expenditure (*de*) with threat (*thr*), political instability (*pi*) and arms importation also become stationary under both models, A and B at one percent level of significant except for the interaction term of defence expenditure and arms importation which is found

stationary at 10 percent and five percent under model A and model B respectively. The level $l1ft$ series is found not stationary under model A, but become stationary at first difference at least at five percent level of significance. This is evident from the trending characteristics of the series without much evidence of intercept term.

Therefore, the unit root properties of the series indicate that both the variables of defence expenditure and economic growth as well as research and development models are characterized by mixture of integration order of $I(0)$ and $I(1)$ relationship. Nonetheless, none of the series is found stationary beyond the first difference order of integration. This means that the test rejected the null hypothesis that the series are associated with unit root at first difference for all variables in the model.

However, it has been argued that the ADF unit root test is associated with an inherent shortcoming which emanates from the assumption that existence of shocks in the data generating process is only temporal and it does not affect the long run movement of the series (Perron, 1989). To ensure robustness of the stationarity properties of the series, Phillips and Peron (PP) unit root test is also employed in addition to ADF. The use of PP unit root test to further confirm the stationarity of the employed series is very vital, especially for time series data of the developing economies such as Nigeria. The results of the PP unit root test is depicted in Table 4.4. The PP unit root test results depicted in Table 4.4 indicate that the results are similar to the ADF test. It also indicates that $lrgdpk$ is stationary after conversion into first difference under both models, A and B.

Table 4.4
Phillips and Peron (PP) Unit Root Test

Series	Intercept without trend (Model A)		Intercept with trend (Model B)	
	Level	First difference	Level	First difference
lrgdpk	-0.749(2)	-9.893(3)***	-2.850(7)	-9.815(5)***
lde	-2.033(2)	-6.664(1)***	-1.442(2)***	-6.879(1)***
ledu	0.075(0)	-5.556(0)***	-0.578(0)	-6.056(0)***
linv	-1.952(0)	-5.753(3)***	-2.359(2)	-5.985(2)***
lai	-3.272(2)**	-10.615(15)***	-3.161(2)	-27.978(30)***
thr	-2.293(2)	-6.727(2)***	-2.304(1)	-6.733(3)***
pi	-1.733(0)	-4.984(2)***	-1.639(0)	-4.928(5)**
lde*thr	-2.047(2)	-7.437(4)***	-2.655(1)	-7.509(5)***
lde*lai	-2.254(4)	-5.725(5)***	-2.043(4)	-13.488(25)***
lde*pi	-1.735(1)	-5.086(1)***	-1.861(1)	-5.063(2)***
lrd	-3.956(1)***	-13.276(3)***	-4.139(2)**	-25.593(9)***
llft	1.047(3)	-2.952(2)*	-2.345(1)	-4.748(2)***
lexa	-2.706(1)*	-5.102(1)***	-3.655(3)**	-5.391(0)***
lexn	-2.578(6)	-8.483(5)***	-3.731(7)**	-9.287(8)***
lexaf	-2.207(11)	-7.866(7)***	-3.428(6)*	-8.549(10)***

Note: ***, ** 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. The lag length is automatically determined based on Schwarz Information Criterion (BIC). They are presented in parentheses against each *t*-statistic. Where lrgdpk, lde, ledu, linv, lai, thr, pi, lde*thr, lde*lai, lde*pi, lrd, llft, lexa, lexn and lexaf: denote log of: real gross domestic product per capita, defence expenditure, education proxy by secondary school enrolment, investment, arms importation, threat, political instability, defence-threat interaction, defence-arms importation interaction, defence-political instability interaction, defence research and development, labour force total, expenditure on army, expenditure on the navy and expenditure on air force.

The series is similarly found stationary at 10 percent level of significance. The major difference between the results of the two unit root tests (ADF and PP) is that in addition to linv and lai which are stationary at level in the ADF test, here lrd is found level stationary under both models, A and B. However, the variable ledu is also stationary under both models, A and B in PP unit root test. The rest of the series exhibit similar behaviour as in ADF test results.

Conclusively, the two different test results reveal evidence of mixture of integration order. This means that the variables are integrated at different order. That is, integrated at level $I(0)$ and at first difference $I(1)$. This is an important and necessary condition for the use of ARDL technique. The findings from both ADF and PP unit root tests for both defence expenditure and economic growth model as well as defence research and development model necessitate the use of ARDL modelling to handle the mixture of relationship. The implication of this suggestion is that there is possibility of long run relationship among these variables. Thus, the next task is to test for the existence of cointegration or long run relationship amongst these variables.

4.3.2 Test for Cointegration

To examine the long run and short run relationship among the variables under consideration using ARDL bound test by Pesaran *et al.* (2001), there is a need to get the order of integration of the variables. The main argument is that variables have to be integrated at level $I(0)$ or at first difference $I(1)$ and or the mixture of relationship not beyond, otherwise the idea of F-statistics in the cointegration analysis is invalid. The appropriate lag length is chosen using BIC, this is because the computation of the F-statistics requires the selection of the lag order in the model (Feridun and Shahbaz, 2010). The argument is based on the basis that if the calculated F-statistic is greater than the upper critical bound value, then the long run relationship exist.

On the contrary, if the calculated F- statistic value is found smaller than the lower critical bound value, then the long run relationship does not exist. Furthermore, if the computed value of the F-statistic lies in between the range of lower and upper value

then the long run relationship is inconclusive (Mintz & Chi Huang, 1990). Table 4.5 reveals that there exist a cointegrating vector in the model. The cointegration is obtained when *lrgdpk* is considered as dependent a variables in the modeling process.

Table 4.5
ARDL Bound Test Result for the Long Run Relationship

Critical value bounds of the F-statistics: $F_{lrgdpk} (lrgdpk/ lde, lai, pi, thr, lde*thr, lde*lai, lde*pi, ledu)$						
F-statistics	1% critical value		5% critical value		10% critical value	
5.085**	1(0)	1(1)	1(0)	1(0)	1(0)	1(0)
	4.537	6.370	3.125	4.608	2.578	3.457

Note: ** represent significance level at 5%. The critical values are based on Narayan (2005), case III for T = 33 due to the small sample size of the study.

The cointegration is established at 5% levels of significance for *lrgdpk* under Narayan (2005) critical values respectively. Therefore, Table 4.5 provides the evidence of the existence of long-run relationship between defence expenditure, internal threat, political instability and arms importation and economic growth. Consequently, the study discovers that real per capita growth in Nigeria depends on the changes in the defence expenditure, arms importation, internal threat and political instability as presented in Table 4.5.

4.3.3 Long Run Relationship

The long run relationship result depicted in Table 4.6 shows five alternative model estimated for this study. The five models in the table compare the impact of arms importation, political instability and internal threat as well as their interaction terms on the real per capita growth of Nigerian economy. The variables are interchanged at different models before arriving at the final model where all of the variables are inserted in to the model. Precisely, model 1 is a direct relationship when there is no Arms importation, internal threat and political instability and their respective interaction terms. Model 2 includes threat and political instability without arms

importation and its interaction terms. Model 3 considers threats and arms importation without political instability and its interaction term. Model 4 is a model without threats and its interaction term. The final model consists of all variables of arms importation, political instability and threats as well as their interaction terms to fully represent the prevailing Nigerian situation. The control variables in the models have the expected signs and statistically significant when all the variables are included in the model (model 5) except for *ledu* which is not statistically significant although it carries the appropriate sign.

Table 4.6
Long Run Coefficients

Variable	Model 1 (1,0,0)	Model 2 (1,0,0,0,0,0,0)	Model 3 (1,1,2,2,2,1,0)	Model 4 (1,0,0,0,0,0,0)	Model 5 (2,2,2,2,1,2,2,2,2)
<i>lde</i>	-0.033 (0.024)	0.072 (0.107)	-2.708** (1.145)	-0.567 (0.662)	-2.319*** (0.356)
<i>lai</i>	-	-	54.379** (23.263)	12.765 (14.433)	-51.504*** (7.964)
<i>pi</i>	-	-0.308 (0.340)	-	-0.271 (0.279)	-0.295*** (0.611)
<i>thr</i>	-	-0.131 (0.216)	0.596* (0.329)	-	-0.365*** (0.065)
<i>lde*thr</i>	-	0.396 (0.656)	-1.872* (1.012)	-	0.761*** (0.162)
<i>lde*pi</i>	-	0.913 (0.997)	-	0.801 (0.820)	0.906*** (0.188)
<i>lde*lai</i>	-	-	-54.356** (23.269)	-12.749 (14.423)	-51.326*** (7.945)
<i>ledu</i>	0.821*** (0.986)	1.476 (0.986)	-0.905 (0.690)	0.916 (0.706)	0.046 (0.183)
<i>const</i>	2.979*** (0.656)	-0.570 (4.332)	112.621*** (51.251)	27.710 (29.330)	106.135*** (16.131)

Note: ***, ** & * represent significance level at 1%, 5% and 10% respectively. The figures in parenthesis are the standard errors of the estimates. Model 1 is a direct relationship when there is no Arms importation, threat and political instability and their respective interaction terms. Model 2 includes threat and political instability without arms importation and its interaction terms. Model 3 considers threats and arms importation without political instability and its interaction term. Model 4 is a model without threats and its interaction term. The final model consists of all variables of arms importation, political instability and threats as well as their interaction terms to fully represent the Nigerian situation. Where *lrgdpk*, *lde*, *lai*, *pi*, *thr*, *lde*thr*, *lde*pi*, *lde*lai* and *ledu* denote log of: real gross domestic product per capita, defence expenditure, arms importation, political instability, threat, defence-threat interaction, defence-political instability interaction, defence-arms importation interaction and education.

The direct relationship indicates that *lde* is negatively related to real per capita gross domestic products. This generally hold true irrespective of the specified models (model 1 to model 5) except when threat and political instability are included in the model without arms importation and its interaction terms. However, the coefficient is found positive but statistically not significant. Models 1 and 4 show negative but not significant coefficients of *lde*. This is in line with findings of Barro (1991) and Barro and Sala-i-Martins (1995) who fail to establish evidence of significant relationship between defence expenditure and economic growth. More specifically the results relates to that of Aizenman and Glick (2006) when they also estimated their models without interaction term of threat and defence expenditure.

Nevertheless, the estimated coefficient of *lde* becomes statistically significant when political instability, threat and arms importation as well as their interaction terms are accounted for in the model (see model 5). Furthermore, the size of the coefficient increases given a more realistic scenario for Nigerian economy as depicted in model 5 (See Appendix A). The coefficient suggests that a percentage point increase in military expenditure will lead to decrease in the level of real per capita economic growth by 2.32 percent. The statistical significance and increase in the magnitude of the coefficient of military expenditure may not be unconnected to including the threat, political instability and arms importation.

The other control variable in the model, human capital proxied by *ledu* is generally positively related to the real per capita growth of the economy although not

statistically significant in most of the models except for the direct relationship where it is found significant at 1% level. The results are mostly similar although the interest of this study is model 5 where all the variables (arms importation, internal threats and political instability) are included to represent the present situation of the Nigerian economy. The coefficient indicates that one percentage point increase in *ledu* will lead to increase in the level of economic growth by 0.05 percent. The positive relationship is as expected and in line with previous findings such as Aizenman and Glick (2006) and Yang *et al.* (2011).

Moreover, the result indicates that *thr* has a significant and direct negative effect on the *lrgdpk*. The coefficient of *thr* is found to be -0.37 and significant at 1% conventional level of significance. This implies that an index increase in the internal threat will lead to decrease in the real per capita growth by 0.37 %. The result evidently support the conjecture of this study following Aizenman and Glick (2006). Impliedly the result suggests that an increase in Nigeria's internal threat will significantly reduce the real economic growth of the country. Interestingly, the finding is not first in its kind. The result is similar to that reported in Aizenman and Glick (2006) and Yang *et al.* (2011).

However, the included interaction term of defence expenditure and threats in the model reveals a positive effect on real per capita economic growth. The estimated coefficient is statistically significant at one percent conventional level of significance. This is in line with a priori expectation. It shows that real per capita growth increases with defence expenditure if and only if internal threats is present.

Impliedly, the presence of internal threat in the economy increases the marginal impact of defence expenditure on real per capita economic growth. In other words, the result reveals that a one billion naira increase in defence expenditure in the presence of internal threat leads to about 0.76% increase in the per capita growth in Nigeria. The obtained result is similar to the findings of Araujo and Shikida (2008), Aizeiman and Glick (2003; 2006) and Yang *et al.* (2011).

Looking at the coefficients of lde and $lde*thr$, the result indicates that for the levels of internal threat less than (greater than) the value of 3.047, derived through dividing the coefficient of direct relationship with threat and defence expenditure interaction term ($2.319/0.761$) greater defence expenditure is associated with overall negative (positive) effect on real per capita economic growth. However, the effect of one percentage point increase in defence expenditure on economic growth varies with the level of internal threat in the economy.

It has been established in the literature that defence expenditure alone has a negative impact on economic growth, likewise political instability. However, defence expenditure in the presence of political instability has positive impact on the economic growth. The fact that Nigeria has been politically instable over time, the study seeks to examine the interaction effect of defence expenditure and political instability on Nigeria's economic growth. The situation in each country economically, socially and institutionally if properly judged, tells a certain diversity of results, which can ultimately be related to the defence expenditures of each country (Araujo & Shikida, 2008).

The coefficient of political instability is statistically significant at one percent and negatively related to real per capita growth. The result reveals that an increase in the political instability will lead to about 0.30% decrease in the real per capita growth. The findings support the assumption of this study following Blomberg (1996) Erdogdu, (2008). Thus, the result advocates that an increase in political instability at least in the Nigerian context will significantly lead to decrease in the real economic growth of the country. The finding of this study is similarly reported in Araujo & Shikida (2008) and Erdoglu (2008).

Nevertheless, the interaction term of political instability and defence expenditure yield a positive relationship with the real per capita economic growth. The coefficient is statistically significant at one percent conventional level of significance. This is in line with a priori expectation. The result of the coefficient indicates that the Nigeria's real per capita growth increases in defence expenditure if and only if political instability is taken into consideration. Otherwise, the parameter estimate of direct relationship between political instability and real per capita growth will expectedly remain negative. Meaning that, the existence of political instability in the economy algebraically increase the marginal impact of defence expenditure on real per capita economic growth.

On the other hand, the estimated coefficient shows that a percentage point increase in defence expenditure in the presence of political instability would increase the per capita growth in Nigeria by almost one (precisely, 0.91) percentage point . The

finding of this study is similar to that of previous studies such as Araujo and Shikida (2008).

Based on the coefficients of lde and $lde*pi$, the findings shows that for the levels of political instability below (above) 0.326 (0.295/0.906), more defence expenditure will lead to an overall negative (positive) impact on real per capita economic growth. Similarly, the impact of one percentage point increase in defence expenditure on economic growth varies with the level of the country's political instability.

Another issue examined in the model is related to interaction impact of defence expenditure and arms importation on economic growth in Nigeria. It is argued that strong investment in defence RD can make a country to be one of the leading defence arms and defence technology exporter. Nigeria has been financing defence RD through its Defence Industrial Cooperation and many other means over time, but still imports arms, ammunition and other defence gadgets. However, it is argued that the concept of comparative advantage encourages an economy to concentrate on producing what it has advantage over other economies. Therefore, this study investigates whether Nigeria's defence arms importation has significant impact on the economic growth.

The result presented in model 5 also presents the long run result of direct and interaction term relationships. The estimates show that lai has a negative and significant effect on real economic growth at 5 % level of significance. The coefficient of lai is found to be -51.504, which signifies that a million Naira increase

in arms importation will tend to reduce the level of real per capita economic growth by 51.5% point. The result further shows that the defence expenditure-arms importation $lde*lai$ interaction term has a significant and negative effect on real per capita economic growth at 1% conventional level of significance. The coefficient of the interaction term designates that the economy's real per capita growth decreases with defence expenditure if and only if arms importation is considered in the model. Irrespective of whether direct or interaction term of arms importation and defence expenditure, the effect remains negative. Meaning that, increase in arms importation in the economy will algebraically decrease the marginal impact of defence expenditure on real per capita economic growth. The finding of this study is in line with the result stated in Yakovlev (2007).

It is also important to emphasized that based on the relations between arms importation and its interaction term with real economic growth, the estimates indicate that for the magnitude of arms importation higher (lower) than 1.003 million Naira, 1.003 (51.504/51.326), additional defence expenditure will lead to an overall negative (positive) impact on real per capita economic growth.

4.3.4 Short Run Relationship

Table 4.7 presents the short run dynamics of the regression results. The estimated short run coefficients are found very similar to their long run counterpart. This is particularly true in terms of sign of the effect with little variation in magnitude. The control variables in the models have the expected signs and statistically significant when all the variables are included in the model (model 5(See Appendix A)). In the

short run ledu is also statistically significant at five percent level which is not statistically significant under the long run model depicted in Table 4.6.

The coefficient of the error correction term (ect), -0.676 is statistically significant at 1% conventional level of significance. This further indicates the existence of the long run cointegration between the variables under consideration. It equally depicts that about 68% of the disequilibrium that occurs as a result of shocks in the short run is automatically adjusted back to the equilibrium position in the long run. The coefficient of the ect -0.676 suggests a reasonable high speed of adjustment processes. Impliedly, 68% the previous year's disequilibrium adjusts and turns back towards the long run equilibrium in the current year. The estimates also show evidence of conditional convergence in the model. This is depicted by the coefficient of the change in the lag dependent variable (Δlrgdpk). The coefficient is an evidence proving that an economy with low initial level of income grows more rapidly than one with high initial level of income. This finding is similar to the result reported in Aizenman and Glick (2006).

Furthermore, the short run result establishes that change in thr has a negative and significant effect on change in lrgdpk growth at one percent level of significant. The coefficient of thr signifies that an index increase in internal threat leads to about 0.14% decrease in the real per capita economic growth. However, the interaction term, change in $\text{lde}*\text{thr}$ has a significant and positive effect on real per capita growth at five percent conventional level of significant.

Table 4.7
Short Run Coefficient

Variable	Model 1 (1,0,0)	Model 2 (1,0,0,0,0,0,0)	Model 3 (1,1,2,2,2,1,0)	Model 4 (1,0,0,0,0,0,0)	Model 5 (2,2,2,2,1,2,2,2,2)
Δlrgdpk	-	-	-	-	-0.547*** (0.159)
Δlde	-0.008 (0.005)	0.010 (0.009)	-0.042** (0.123)	-0.090 (0.096)	-0.716*** (0.176)
Δlai	-	-	0.017* (0.009)	2.031 (1.977)	-15.395*** (3.585)
Δpi	-	-0.044** (0.019)	-	-0.043** (0.019)	-0.054** (0.022)
Δthr	-	-0.019 (0.029)	-0.124*** (0.027)	-	-0.136*** (0.031)
$\Delta (\text{lde}*\text{thr})$	-	0.057 (0.089)	0.377*** (0.091)	-	0.244** (0.081)
$\Delta (\text{lde}*\text{pi})$	-	0.132* (0.067)	-	-0.127* (0.653)	0.350*** (0.080)
$\Delta (\text{lde}*\text{lai})$	-	-	-1.149 (2.360)	-2.023 (1.976)	15.353*** (3.581)
Δledu	0.206* (0.102)	0.213* (0.107)	-0.229* (0.690)	0.146 (0.114)	0.743** (0.263)
ect_{t-1}	-0.251** (0.121)	-0.144 (0.130)	-0.253** (0.101)	-0.159 (0.128)	-0.676*** (0.150)

Note: ***, ** & * represent significance level at 1%, 5% and 10% respectively. The figures in parenthesis are the standard errors of the estimates. Model 1 is a direct relationship when there is no Arms importation, threat and political instability and their respective interaction terms. Model 2 includes threat and political instability without arms importation and its interaction terms. Model 3 considers threats and arms importation without political instability and its interaction term. Model 4 is a model without threats and its interaction term. The final model consists of all variables of arms importation, political instability and threats as well as their interaction terms to fully represent the Nigerian situation. Where lrgdpk , lde , lai , pi , thr , $\text{lde}*\text{thr}$, $\text{lde}*\text{pi}$, $\text{lde}*\text{lai}$, ledu and ect , denote log of : real gross domestic product per capita, defence expenditure, arms importation, political instability, threat, defence-threat interaction, defence-political instability interaction, defence-arms importation interaction, education and error correction term.

The result shows that even in the short run the real per capita growth only increases with defence expenditure if and only if internal threats is existent. The result proves that irrespective of time horizon, the presence of internal threat in the economy algebraically increase the marginal impact of defence expenditure on real per capita economic growth. Alternatively, the coefficient reveals that in the short run a one million naira increase in defence expenditure in the presence of a high internal threat in Nigeria results to an increase in the real per capita growth by 0.24 %. These

findings are similar to those in the previous studies like that of Khalid and Mustapha (2014). However, unlike in the long run the short run result indicates that for the levels of internal threat below (above) the value of 2.934, (0.716/0.244) greater defence expenditure is associated with overall negative (positive) effect on real per capita economic growth. Therefore, lesser level of internal threat is considered in the short run for higher defence expenditure to be associated with positive effect on the real per capita growth. The result might be explained that the activities of Boko Haram., Niger Delta militancy as well as ethnic and religious crises have a negative impact on the Nigeria's economic growth. (Aizeiman & Glick, 2006; Yang *et al.* 2011; Araujo & Shikida, 2008; Musayev, 2016).

Moreover, the short run result establishes that changes in political instability has a negative and significant effect on changes in the real per capita growth at five percent conventional level of significance. The coefficient of suggests that a point increase in political instability (π) index leads to about 0.05 % decrease in the real per capita economic growth in Nigeria. Nevertheless, changes in interaction term between defence expenditure and economic growth, $\text{lde}*\pi$ has a significant and positive effect on changes in real per capita economic growth. The coefficient is statistically significant at 1% level of significance.

Just like in the long run, the short run result also reveals that the real per capita growth tend to increase with increase in defence expenditure if and only if there exist political instability in the economy. Regardless of whether long run or short run, the existence of political instability in the economy algebraically increase the marginal

impact of defence spending on real per capita economic growth in Nigeria. It implies that a one million naira increase in defence in the presence of high political instability in Nigeria leads to about 0.35% increase in the real per capita economic growth. By implication defence expenditure in Nigeria in the presence of high political instability is stimulating economic growth.

Interestingly, it is pertinent to mention that the short run result indicates that for the levels of political instability lower (higher) than 2.046 ($0.716/0.350$) larger defence expenditure will lead to an overall negative (positive) impact on real per capita economic growth. Thus, in the short run, smaller level of political instability is assumed in the short run for higher defence expenditure to positively affect the real per capita growth in the Nigerian context.

Likewise, the results shows that the coefficient of the changes in arms importation shows that 1% point increase in arms importation will lead to decrease in the real per capita economic growth in Nigeria by 15.40 % points. The coefficient is statistically significant at one percent level of significant. It therefore, indicates that increase in the level of arms importation negatively affects the economy. On the contrary the coefficient of the interaction term $lde*lai$ is found significant and positively related to the real per capita growth at 1% level of significance.

The result provides that the real per capita growth increases with increase in defence expenditure if and only if there greater arms importation in the economy. This may particularly hold true due to the theory of comparative advantage especially in the

short run when factors of production are not flexible to accommodate shocks. Furthermore, this result might be due to prevailing Nigerian situation considered in model 5. Thus, arms importation in the economy algebraically increase the marginal impact of defence spending on real per capita economic growth in Nigeria. In reality the finding reveals that a one million naira increase in defence on arms importation in Nigeria will lead to about 15.35 % increase in the real per capita economic growth.

Nonetheless, the short run result specifies that for the levels of arms importation below the value of 0.046 of one billion ($0.716/15.353$) greater defence expenditure will lead to a negative effect on the Nigeria's real per capita economic growth. Therefore, only expenditure on arms importation worth 46.635 million naira that will lead to greater economic growth. However, this result only exist in the short run when importing defence gadgets is more economical than embarking on production through DICON. However, the result in Table 4.6 already reveals that in the long run increase in arms importation does not in any way lead to higher per capita economic growth in Nigeria. Hence, it is better to embark on defence gadgets production in the long run compared to importing.

4.3.5 Diagnostic Analysis

The adequacy of the model is verified by the diagnostic and stability tests. The diagnostic tests are presented in Table 4.8. The test statistics indicate that the null hypothesis of no serial correlation, homoscedasticity and stability of coefficients are not rejected at any conventional level of significance as presented in Table 4.8. This is an indication that the coefficients of the estimated model are robust and free from

the problems of serial correlation, model misspecification, non-normality of residuals and heteroscedasticity.

Table 4.8

Diagnostic Tests

Test Statistics	Chi-square/LM Test	Probability Value
Serial Correlation	2.4862	0.115
Functional Form	0.0347	0.852
Normality	3.9834	0.136
Heteroscedasticity	0.0689	0.793

Note: Serial correlation is determine using Lagrange multiplier test of residual, functional form base on Ramsey's RESET test, normality base on skewness and kurtosis and Heteroscedasticity based on squared residuals on squared fitted values.

The consistency and validity of the diagnostic results are further assessed by the stability test using cumulative sum of recursive residuals (CUSUM), and the cumulative sum of squares of recursive residuals (CUSUMQ). The results show evidence of the adequacy of the above estimated long run model. The graphs depicted in Figures 4.2a and 4.2b show that the series are within the critical bound at five percent significant level. Therefore, the study concludes and confirms the stability of the model over the period of the study. Hence the model is reliable in explaining deviations in the Nigeria's real per capita economic growth.

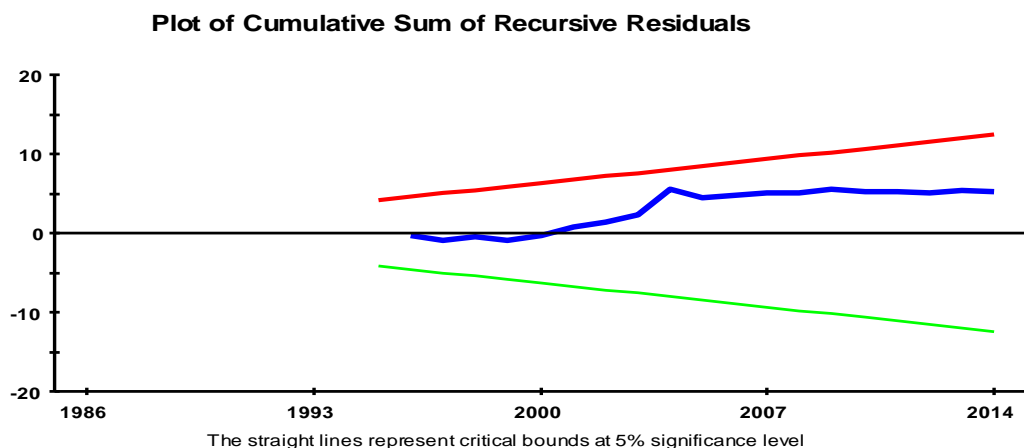


Figure 4.2a

Plot of Cumulative Sum of Recursive Residual

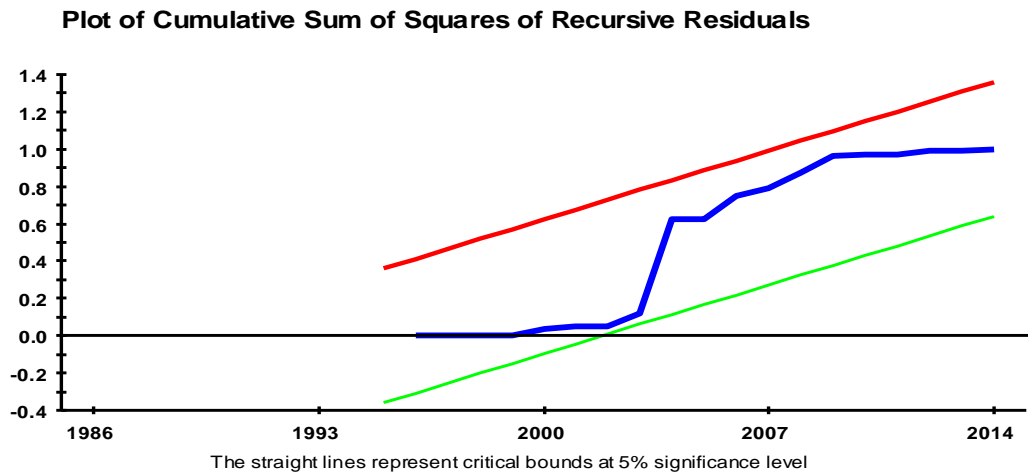


Figure 4.2b
Plot of Cumulative Sum of Squares of Recursive Residual

4.4 Defence Research and Development

Defence R&D has clear opportunity costs based on the fact that it uses scarce scientific personnel, funds, assets that could be employed in order alternative researches. Nevertheless there are other possible beneficial ways in which defence R&D externalities may spill-over and affect positively the civilian economy (Goolsbee, 1998). Yet, while there are so many ways of such spin-offs, there are still few studies that look at the impact of defence R&D and its impact on the economic growth. As such, this study is an attempt to access the impact of defence R&D on the Nigeria's economic growth. The analysis starts with the test of the unit root to determine the stationarity of the series.

4.4.1 Unit Root Test

This sub-section begins with the analysis of the unit root results for the variables employed in the defence R&D model. This is because inferences to be drawn from time series result are sensitive to stationarity analysis. Therefore, the properties of the time series are carefully evaluated using both ADF and PP unit root tests. The series are converted into natural logarithm before the unit root tests are performed. The result of the test is presented in Table 4.3 and Table 4.4 for ADF and PP tests respectively. The results show that the variables of real per capita economic growth and research and development models are characterized by mixture of integration order of $I(0)$ and $I(1)$ relationship. Nonetheless, none of the series is found stationary beyond the first difference order of integration. This means that the test rejected the null hypothesis that the series are associated with unit root at first difference for all variables in the model (see analysis under Tables 4.3 and 4.4 for detailed analysis).

Therefore, the two different test results reveal evidence of mixture of integration order. This means that the variables are integrated at different order. This is an important and necessary condition for the use of ARDL technique. The findings from both ADF and PP unit root tests for defence research and development model also necessitate the use of ARDL modelling to handle the mixture of relationship. As earlier stated elsewhere in the text, the implication of this suggestion is that there is possibility of cointegration among these variables. Thus, the next task is to test for the existence of cointegration/long run relationship amongst the series.

4.4.2 Test for Cointegration

The appropriate lag length is chosen based on Schwarz Bayesian Criterion (SBC). This is a necessary condition in examining the long run and short run relationship among the variables under consideration using ARDL bound test by Pesaran *et al.* (2001). The order of integration of the variables in the model is established as mixture of I(0) and I(1). The main argument is that variables have to be integrated at level 1(0) or at first difference 1(1) and or the mixture of relationship not beyond, otherwise the idea of F-statistics in the cointegration analysis is invalid.

It is pertinent to mention that cointegration is established among the series if the calculated F- statistic is beyond the upper critical values at any conventional levels of significance. However, if the value F- statistic is found less than the lower critical bound value, then the long run relationship does not exist. Besides, if the computed value of the F-statistic lies in between the range of lower and upper value then the long run relationship is inconclusive at least using the ARDL bound cointegration approach (Mintz & Chi Huang, 1990).

Table 4.9
ARDL Bound Test Result for the Long Run Relationship

Critical value bounds of the F-statistics: F _{lrgdpk} (lrgdpk/ llft, linv, lrd)						
Fstatistics	1% critical value		5% critical value		10% critical value	
	1(0)	1(1)	1(0)	1(0)	1(0)	1(0)
4.846**	4.537	6.370	3.125	4.608	2.578	3.457

Note: ** represent significance level at 5%. The critical values are based on Narayan (2005), case III for T = 33 due to the small sample size of the study

The result presented in Table 4.9 shows that there exist a cointegrating vector in the model. The cointegration is only established when lrgdpk is considered as dependent variables in the modeling process. The cointegration is obtained at five percent level

of significance. Thus, Table 4.9 provides evidence of the existence of long-run relationship between defence research and development and real per capita economic growth. So, the study determines that in the Nigerian context, real per capita growth depends on the changes in the defence research and development, Investment and labour force total.

4.4.3 Long Run Relationship

The result of the long run coefficients for defence research and development model is presented in Table 4.10. The table presents the results in two alternative models. Specifically, model 1 depicts a direct relationship between defence research and development and real per capita economic growth with only control variables. Whereas, model 2 (see Appendix B) presents the disaggregated expenditure on defence which includes defence expenditure on army, air force and navy as well as the control variables.

The control variables, natural logarithm of labour force total and investment in the models have the expected signs and statistically significant at 1 % and 10 % levels of significance respectively under both models A and B (see Appendix B). Under model A, the coefficient of $\ln lft$ reveals that in the long run situation, a percentage point increase in labour force will lead to increase in real per capita economic growth by 23.012 % points. This result implies, the labour force increase leads to the increase in real per capita economic growth. This is an indication that with the population of over 180 million people,

Table 4.10

Long Run Coefficients: Defence Research and Development Model

Variables	Model A	Model B
	ARDL (1,2,0,0)	ARDL (1,2,0,0,0,0)
Llft	23.012*** (6.579)	7.815*** (1.537)
Linv	-0.735* (0.367)	-0.191* (0.102)
Lrd	-0.288* (0.162)	-
Lexa	-	3.231* (1.551)
Lexaf	-	-3.129 (2.961)
Lexn	-	3.157 (3.050)
Const	-8.447** (3.835)	-15.071*** (1.901)

Note: ***, ** & * represent significance level at 1%, 5% and 10% respectively. The figures in parenthesis are the standard errors of the estimates. Model 1 is a direct relationship when only defence research and development while Model 2 includes military expenditure on army, air force and navy without an aggregate expenditure on defence research and development. Where *llft* is the log of labour force total, *linv* is the log of fixed capital formation proxy for investment, *lrd* is defence research and development, *lexa*, log of expenditure on the army, *lexaf* is the log of the expenditure on the air force, *lexn* is the log on the expenditure on the navy and *const* stands for the constant term.

Nigeria is to be a labour intensive economy which receive its major source of GDP from agriculture. The contribution of agriculture largely comes from peasant farming and mining which depend on the population growth of a given nation. Therefore, the positive relationship might not be unconnected to the contribution of agriculture to GDP in Nigeria.

However, the result reveals that *linv* is negative and statistically significant. The result shows that a percentage increase in investment will lead to about 0.735 % decrease in real per capita economic growth. The result on this coefficient can be easily attributed to the security threats in Nigeria. This might be the reason for the declines in capital formation at least in Nigerian context.

The coefficient of defence research and development indicates a negative relationship with real per capita economic growth. It indicates that one percentage point increase in lrd will lead to decrease in the real per capita economic growth by 0.288 % point. This might be explained by the inadequate funding of defence research and development in Nigeria. The inadequate funding in the Nigerian context may explain the reason why the spill-over effect of the defence rd has no significant impact on the lrgdpk in Nigeria. This may be a clear judgment on why defence establishments such as DICON in Nigeria could not meet even the domestic supply of small defence equipment.

Subsequently, externalities spill-over to the civilian economy may not be experienced. By and large, this can be also attributed to the reason why Nigeria remains importer of defence equipment rather than exporter, thereby eroding the foreign reserve of the economy and foreign exchange earnings. The inclusion of the defence R&D in a planned transformations of the Nigeria's economy has just being a dream (Omojimite, 2012; Saidu, 2008; Oshanupin, 2012; Magbadelo, 2012). On the contrary, when the aggregated defence expenditure on research and development is excluded and disaggregated sectoral allocation is considered instead (see model B) the estimated coefficients reveal that $lexa$ and $lexn$ are positively related to real per capita growth although the coefficient of $lexn$ is statistically not significant. However, the coefficient of $lexaf$ is found negatively related to real per capita economic growth although it is not significantly different from zero. Nevertheless, the result indicates that one percent increase in $lexa$ in relation to GDP will lead to

increase in the real per capita economic growth of Nigeria by 3.231 percentage points. The positive response indicates that expenditure on Army leads to positive changes in the real per capita economic growth of Nigeria.

The enormous contribution of the Nigerian army to the economic growth is largely due to the fact that it participates actively in the maintenance of peace and security both within and outside the borders of the country. Land army also has been a source of revenue to the government. It is ranked among the five top ranking armies in the Peace Support Operations (PSOs), which has been a reasonable source of revenue to the government. The percentage of soldiers' allowance when aggregated makes a significant amount of foreign exchange earnings. For United Nation Mission in Sieraleon (UNAMSIL) alone, the UN soldier allowance to the Troop Contributing Country (TCC) amount to \$1,349 per soldier monthly. Out of this amount, Nigeria pays \$600.00 on a flat rate to soldiers, retaining in its treasury about US \$740 per each soldier. Though the amount held by the government differs per mission. For mission in Liberia allowance paid to individual peacekeepers was only \$1,000 (Sule, 2013).

Furthermore, this scenario is convincing owing to the fact that expenditure on the Nigerian Army facilitates their role of one of the troop contributing countries (TCC). Due to its membership in the United Nations (UN) and African Union (AU), their function includes maintaining regional security in the West African countries as well as Africa as a whole. Therefore, the remittance by the Army has significant multiplier effect on the Nigeria's GDP growth.

Both expenditure on air force and navy are found statistically not significant in the long run. This is not surprising due to the fact that Nigeria faces no external aggression that may necessitate naval and air force intervention. The cases so far that involved the naval intervention include patrol against sea pirates and smugglers. These are very insignificant to make any reasonable impact on the Nigeria's economy. Furthermore, the contribution of the Nigerian Air force has been negative. This can be understood through the fact that the only contribution of the Nigerian Air force has been in the fight against terror (Boko Haram). This is seen statistically insufficient to justify the allocation made to Nigerian air force in ensuring positive per capita economic growth. Moreover, the essence of realizing greater contribution from army might be based on simple argument that, Nigeria has been prone to civil unrest from its independence to date. The recent Boko Haram terrorism and Niger Delta Militancy is a clear evidence to this argument. These two terrorist groups led to loss of thousands of lives and \$ billions (see Sule, 2013; Omojimite, 2012; Oshanupin, 2012; Magbadelo, 2012).

4.4.4 Short Run Relationship

The short run estimated coefficients are presented in Table 4.11. The result obtained in the short run analysis are found very similar to their long run counterpart. This is particularly true in terms of sign of the coefficients with insignificant variation in size. Similarly, the control variables in the short run models have the expected signs and statistically significant just as in the long run models. Unlike in the long run estimates, the short run coefficient of investment is found statistically significant at

five percent level which is only statistically significant at 10 % under the long run model.

The error correction term (ect), measures the degree of adjustment in the deviations that occurred in the previous period. The coefficient of the ect is statistically significant at 10 % and 1% conventional level of significance under models A and B respectively (see Appendix B). The negative and significance of the ect further indicates the existence of the long run relationship between the variables of defence research and development model. The coefficients indicate that about 16 % of the disequilibrium that occurs as a result of shocks in the short run is automatically adjusted back to the equilibrium position in the long run when aggregate defence research and development is considered. Similarly, the coefficient of the ect -0.540 under model B suggests a reasonable high speed of adjustment processes. It implies that, 54 % the previous year's disequilibrium adjusts back to long run equilibrium. This hold true when disaggregated expenditure on defence (lexa, lexaf and lexn) is considered in the model.

The most important distinction between the long and short run estimates is that of the lag changes in llft. In the short run, the result indicates that in addition to the instantaneous effect of the llft which is similar to that of the long run situation, the lag changes in the llft is negative and statistically significant at one percent level of significance under both models A and B (see Appendix B).

Table 4.11
Short Run Coefficients: Defence Research and Development Model

Variables	Model A	Model B
	ARDL (1,2,0,0)	ARDL (1,2,0,0,0,0)
Δ lrgdpk	10.748*** (3.484)	13.261*** (4.564)
Δ lft	-11.744*** (3.637)	-13.923*** (3.906)
Δ linv	-0.119** (0.052)	-0.103** (0.049)
Δ lrd	-0.047*** (0.012)	-
Δ lexa	-	1.743** (0.735)
Δ lexaf	-	-1.688 (1.486)
Δ lexn	-	1.703 (1.608)
ect _{t-1}	-0.162* (0.081)	-0.540*** (0.126)

Note: ***, ** & * represent significance level at 1%, 5% and 10% respectively. The figures in parenthesis are the standard errors of the estimates. Model 1 is a direct relationship when only defence research and development while Model 2 includes military expenditure on army, air force and navy without an aggregate expenditure on defence research and development. Where lrgdpk denotes real gross domestic product per capita, llft is the log of labour force total, linv is the log of fixed capital formation proxy for investment, lrd is defence research and development, lexa, log of expenditure on the army, lexaf is the log of the expenditure on the air force, lexn is the log on the expenditure on the navy and const stands for the constant term.

The coefficients reveals that a percentage point increase in the changes in llft will lead to decrease in the real per capita economic growth by 11.744 % and 13. 923 % for models A and B respectively.

The implication of this result is that, though Nigeria is a labour intensive economy, overpopulation seems to exert too much pressure on the economic growth and development. Furthermore, the continuous improvement in the level of technology can also decrease the significance of the labour intensity of the Nigerian economy at least in the short run condition.

4.4.5 Diagnostic Analysis

The validity and consistency of the estimated coefficients are examined based on chi square and Lagrange Multiplier (LM) test as well as stability test. The results of the diagnostic tests are presented in Table 4.12. The null hypothesis states that the residuals have no serial correlation, normally distributed, and homoscedastic as well as linearly formulated. The test statistics indicate that the null hypothesis of no serial correlation, homoscedasticity and stability of coefficients are not rejected at any conventional level of significance. Therefore, the results of the diagnostic test indicates that the coefficients of the estimated model are not associated with the problems of serial correlation, model misspecification, non-normality of residuals and heteroscedasticity.

Table 4.12
Diagnostic Tests

Test Statistics	Chi-square/LM Test	Probability Value
Serial Correlation	0.003	0.955
Functional Form	0.800	0.371
Normality	3.510	0.173
Heteroskedasticity	0.440	0.834

Note: Serial correlation is determine using Lagrange multiplier test of residual, functional form base on Ramsey's RESET test, normality base on skewness and kurtosis and Heteroskedasticity based on squared residuals on squared fitted values

The stability of the estimated coefficients is evaluated using cumulative sum of recursive residuals (CUSUM), and the cumulative sum of squares of recursive residuals (CUSUMQ). The results evidently reveals that the estimated coefficients are stable over the period under study. The graphs depicted in Figures 4.3a and 4.3b show that the series are within the critical bound at five percent significant level.

Thus, the variables in defence research and development model are reliable in explaining deviations in the real per capita economic growth in Nigeria.

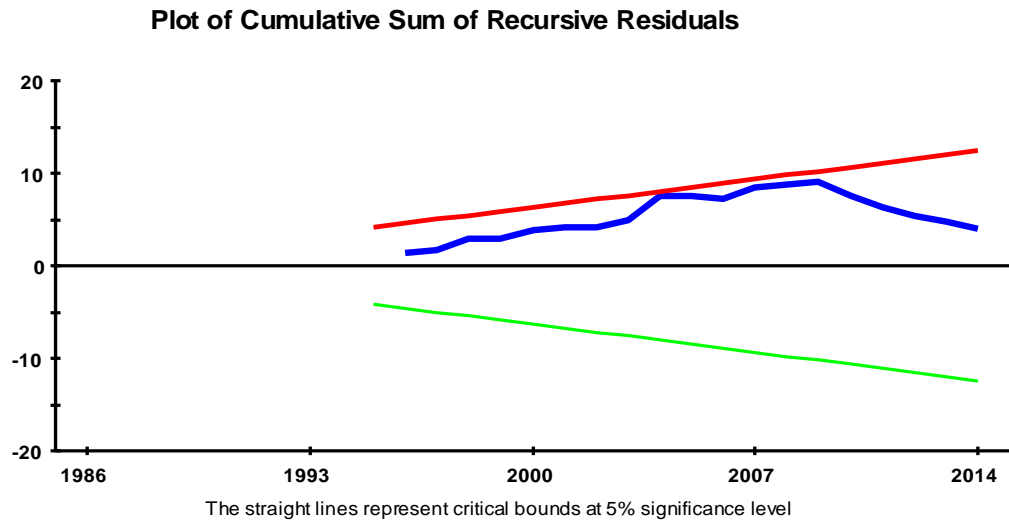


Figure 4.3a
Plot of Cumulative Sum of Recursive Residual

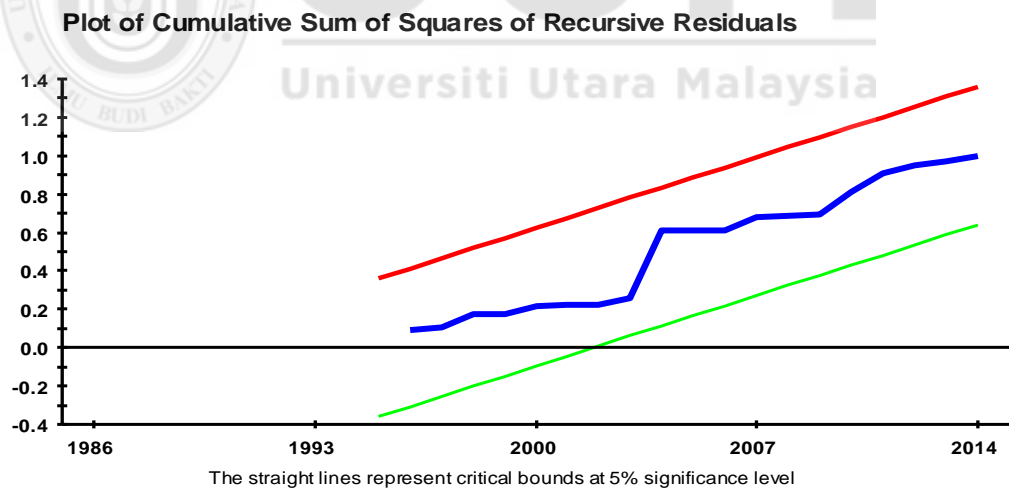


Figure 4.3b
Plot of Cumulative Sum of Squares of Recursive Residual

4.5 Asymmetric Causality Analysis

The study determines causality between defence expenditure and economic growth for Nigeria. To accomplish this objective, the study utilizes a recent approach of asymmetric Granger-causality developed and introduced in Hatemi-J. (2012). The asymmetric causality is developed with the idea that positive and negative shocks might possess different causality impacts. This study adopts the new approach of asymmetric Granger-causality in addition to the dynamic Toda and Yamamoto (1995) causality approach and the traditional Granger causality which dominates the field of defence economic in Nigeria and elsewhere. However, the traditional Granger causality analysis is associated with independence of nuisance parameter estimates, size distortion, and spurious conclusion based on the asymptotic distribution (Toda & Yamamoto, 1995 & Guru-Gharana, 2012). Furthermore, if normality assumption is not met, and the effect of autoregressive conditional heteroskedasticity exist, the usual asymptotic distribution theory will not be appropriate (Hatemi-J & Irandoust, 2006; Hatemi-J, 2012). The estimation is carried out under the following sub-sections.

4.5.1 Unit Root Analysis

This sub-section tests the stationarity of the data using ADF and PP test. This is to determine the order of integration for the lag augmentation in the model. The methodology of Toda & Yamamoto (1995) and asymmetric causality are applicable regardless of the integration properties of the variables (Toda & Yamamoto, 1995 and Hacker & Hatemi-J, 2006). However, the unit root test is conducted in order to

determine the maximum order of integration. Tables 4.3 and 4.4 present the ADF and PP test results. The tables are made up two models each; the constant without trend and constant with trend models.

The unit root results show that the *lrgdpk* variable is stationary at level at 10% significance level. However, the series proved to have no unit root after transformation into first difference. Therefore, the variables are stationary at most at first difference. Since the test rejects the null hypothesis that the series are $I(1)$, the estimation reveals that the maximum order of integration in the VAR ($P+d_{\max}$) is one.

4.5.2 Estimation of Granger, Toda-Yamamoto and Asymmetric Causality

This sub-section investigates the causal relationship between defence expenditure and economic growth in Nigeria. The study compares among the asymptotic, Toda-Yamamoto and asymmetric causality. The new approach, that is, the asymmetric causality considers the impact of cumulative positive and negative shocks and the mixture of cumulative shocks of the lags of one variable on the other. However, most of the previous literature in this context uses traditional approach based on asymptotic distribution. This study contributes to the existing literature especially in the field of defence economics in Nigeria by analyzing the impact of both cumulative positive and negative shocks as well as the combination of the cumulative shocks. This means that it distinguishes the influence of defence expenditure on economic growth during both boom and recession as well as the combination of positive and negative shocks (high and low defence expenditure during economic boom and economic recession). Furthermore, the two later methodologies are better in the

presence of ARCH effect and non-normality of residuals (Hacker & Hatemi J, 2006).

Table 4.13 presents the diagnostic test for normality and ARCH effect in the model (see Appendix C).

Table 4.13
Diagnostic Tests

Test	statistics	Probability
Autocorrelation	5.355	0.8023
ARCH Effect	123.556	0.1002
Normality	1826.568	0.0000

Source: Researcher's Computation

Based on the results in Table 4.13, it can be concluded that the residuals of the series are not normally distributed and there exists no ARCH effect in the model. Consequently, it is essential to make use of the bootstrap simulation method, as described in the previous section, in order to obtain reliable estimates. The comparative result among the asymptotic Granger, Toda-Yamamoto and asymmetric causality is presented in Table 4.13.

The result shown in Table 4.14 reveals no causation between *lde* and *lrgdpk* using the traditional Granger causality test. Therefore, the null hypotheses of no Granger causality running from *lde* to *lrgdpk* and vice versa is not rejected based on the probability values of 0.473 and 0.480. Furthermore, the MWALD statistic indicates a unidirectional causality running from *lde* to *lrgdpk*. It therefore implies that the Toda-Yamamoto causality test, establishes one way causation running from *lde* to *lrgdpk*. This is statistically significant at 5% level of significance. This result is similarly found in Shahbaz (2011).

Table 4.14
Toda-Yamamoto/Granger Causality (Modified WALD) Test Result

Hypothesis	Granger Causality	MWALD Toda-Yamamoto	WALD Test Asymmetric	1%	5%	10%
$lde \Rightarrow lrgdpk$	1.499(0.473)	5.014**(0.0185)				
$lde^+ \Rightarrow lrgdpk^+$			5.493*	10.733	6.489	4.874
$lde^- \Rightarrow lrgdpk^-$			0.248	20.967	3.986	1.630
$lde^+ \Rightarrow lrgdpk^-$			0.032	12.808	4.843	2.674
$lde^- \Rightarrow lrgdpk^+$			0.005	12.714	4.851	2.598
$lrgdpk \Rightarrow lde$	1.441(0.486)	0.957(0.620)				
$lrgdpk^+ \Rightarrow lde^+$			1.234	11.466	6.574	4.744
$lrgdpk^- \Rightarrow lde^-$			0.145	20.966	3.926	1.794
$lrgdpk^+ \Rightarrow lde^-$			0.123	18.078	7.980	4.965
$lrgdpk^- \Rightarrow lde^+$			0.104	18.028	7.561	4.838

Note: The figures in parenthesis under column 2 and 3 represent the probability values that correspond to the Chi-Square values. Column 4 shows the WALD statistics of the asymmetric causality test. ** and * represent significance level at 5% and 10% respectively.

The result further shows that there exist an evidence of asymmetric Granger-causality from lde to $lrgdpk$ during the good time (that is during the period of optimal security/peace and the period of economic boom). By implication the result establishes unidirectional causality running from lde to $lrgdpk$ during good time. The difference between the asymmetric causality result and that of Toda-Yamamoto modified Wald test is that the later could not distinguish between the periods of the causation whether it occurs during economic boom or economic recession. The test could not also take into account whether it happens during high defence expenditure as a result of threat and instability or not. Thus, the superiority of the asymmetric causality over the alternative is in distinguishing between the cumulative positive and negative shocks. The test also allows for test between mixture of positive and negative cumulative shocks. The result is in line with the previous studies such as

Hatemi-J, *et al.* (2015). However, there exist no evidence of causality in the mixture of cumulative shocks among the variables. This implies that, there is no causal relationship between defence expenditure during peace and stability and economic growth during economic recession and vice versa. Similarly, the result could not establish any evidence of causation between economic growth during economic boom and defence expenditure during threat and instability. The reverse also does not hold true at least using Nigerian data.

The findings based on asymmetric causality is an additional dimension to the field of defence economics literature especially related to the impact of defence expenditure on economic growth. The aggregated impact of defence expenditure is splited to depict both cumulative negative and positive shocks as well as the mixture of the cumulative positive and negative shocks among the series.

On one hand, it can simply be interpreted as defence expenditure like all other public spending in Nigeria stimulates economic growth. This only exists in the good times, that is, during economic boom and peace/security. The result is in line with Keynesian preposition that public spending stimulates economic growth. During good times the expenditure on defence is used to ensure conducive atmosphere and security which also attracts investors to invest into the economy. The multiplier effect of investment from abroad as a result of peace and security also stimulates economic growth during boom period. This in turns stimulates economic growth through its multiplier effect. On the other way round and more specifically for Nigeria, defence expenditure stimulates economic activities as it deters the activities

of the deadly Boko Haram and Niger-Delta militants in the North-East and the South-Eastern parts of country respectively.

However, there is no evidence of causality running from economic growth to defence expenditure in Nigeria irrespective of the period under consideration. Therefore, the finding of this study does not support the Wagner's prepositions that as an economy develops higher, the government need to spend more to ensure security, law and order and to deter any internal and external aggression against the state at least for Nigeria. Therefore, the finding is a further indication of exogeneity of the variables employed in the model.

4.6 Discussion of Results

The results of the data analysis reveals that defence expenditure, internal threat, political instability as well as arms importation have negative impacts on the Nigeria's economic growth. However, defence expenditure-internal threat interaction and defence expenditure and political instability interaction both have significant and positive impact on the Nigeria's economic growth. The implication of the results is that despite the fact that expenditure on defence, internal threat, political instability and arms importation negatively affects economic growth, however, defence expenditure in the presence of internal threat and political crises stimulates economic growth. Provision of sufficient security could lead to more economic activities such as: domestic and foreign investments, crude oil marketing, agricultural activities among others. This further increases the domestic investment and productivity, higher employment generation opportunities and incomes to the citizens, which in

the long run increases economic growth. The signs of the coefficients of threat and political stability show that lesser threats and political instability lead to higher economic growth. This is because, lesser political instability and threats encourage the inflow of foreign direct investments (FDI) because foreign investors are assured that they can go for their legitimate businesses with ease and security.

Secondly, defence expenditure on arms importation is found negative and insignificantly related to economic growth in Nigeria. The impact of defence expenditure-arms interaction on economic growth exerts negative pressure on the Nigeria's economic growth. Thus, a considerable amount of social services fund goes for importation of arms. The DICON which was established in 1964 to provide ammunition, weapons and other light defence hardware has not been successful in achieving its mandate (Magbadelo, 2012). The technical capability of the Nigerian defence has been constrained as a result of over dependence on the imported technologies of which alternatively can be made locally. Importation is not something totally wrong especially for country receiving technical supports from friendly nations, but it is a problem if the receiving country becomes so desperate and extremely dependent on such foreign sources for defence operations. This has brought a shame to Nigeria when South African authorities apprehended and detain Nigerians accused for not declaring the monies meant for arms purchase in South Africa in the month of September 2014 (Premium Times, 2014).

Thirdly, the impact of defence research and development on Nigeria economic growth is found insignificant. This indicates that the inclusion of defence into the

economic transformation blueprint by the National Planning Commission (NPC) has fail and to achieve the desired results. The transformation agenda of which defence research and development and defence industrial base are set to achieve is not realised. Using defence research and development to enhances nation's defence capability and improve national security via the use of technology is not realised rather, it increases the costs of the defence management. This is an explanation of why Nigeria depends more on arms importation than exportation (see Omojimate, 2012; Magbadelo, 2012).

Fourthly, the sectoral allocation for the land army appears to have more impact on the economic growth, than the navy and air force. This is basically the fact that land army performs most of the security tasks in and outside Nigeria. Furthermore, army participation in the PSOs, attracts remittances accruing to the Nigerian government. Nigeria mobilize, deploys and sustains many battalions of land army in the peacekeeping operations in Congo, Angola, Liberia, Yugoslavia, Rwanda, Mali, Sierra Leone and Sudan. Presently Nigeria has about 6,000 troop deployed to 12 United Nation (UN) missions globally (Magbadelo, 2012). Therefore, the remittances of the troops into Nigeria when aggregated makes a significant amount of foreign exchange earnings to Nigeria (Sule, 2013). So also, Nigerian army participates in the PSOs more than the navy and air force, it has been a dominant source of revenue in the PSOs to the government.

Fifthly, the asymmetric causality between economic growth and defence expenditure in Nigeria is found unidirectional. The causation from defence expenditure to

economic growth can be seen as the role of defence sector in promoting peace and security in Nigeria during the period of economic boom. Defence has been used to deter the activities of *Boko Haram* and Niger Delta militant and it has succeeded in quenching many conflicts in Nigeria. Scholars argue that defence expenditure creates jobs, it increase aggregate demand and employment, defence also engages in research and development, provision and creating infrastructure which helps for economic growth and development (DeGrasse, 1993 and Deger, 1986). The externality effects of security in creating an enabling environment in Nigeria has provide evidence for the validity of Keynesian preposition. Defence like all other public expenditure stimulates economic growth.

Furthermore, increase in the access to education and investments raise productivity and then economic growth in Nigeria. Therefore, defence expenditure itself is not economically productive, but found productive in the presence of internal conflict, political instability especially in a highly endowed natural resource country like Nigeria. In addition, since internal threats as well as political instability are associated with capital flight, declines in the domestic and the foreign investments, inadequate defence and security funding is detrimental to economic growth and development.

4.7 Chapter Summary

The findings in this chapter reveal that defence expenditure in the absence of internal threat, political instability and arms import impacts negatively on Nigeria's economic growth. Conversely, defence expenditure in the presence of the internal threat and

political instability have positive impact on the economic growth. Defence research and development in Nigeria has insignificant impact on economic growth. The disaggregated defence allocation results reveal that, defence allocation on the land army has more contribution to the economic growth in Nigeria over the Nigerian navy and the air force. Finally, the causality results reveal that there exists unidirectional asymmetric causality between defence expenditure and the economic growth.



CHAPTER FIVE

SUMMARY, POLICY IMPLICATION AND RECOMMENDATION

5.1 Introduction

This chapter presents the summary of the major findings, the policy implications, the limitation of the study, recommendations for future research and lastly conclusions.

5.2 Summary of Findings

This study is set primarily to investigate the impacts of defence expenditure in the presence of internal threat, political instability on the economic growth in Nigeria. The study also examines the impact of the aggregated and disaggregated components of defence expenditure on economic growth as well as examining the causality between defence expenditure and economic growth in Nigeria from 1983 to 2015. The study uses ARDL, and Asymmetric causality test approaches. It employs both absolute and orthogonalised values of the interaction term in the analysis of the interacted variables in order to check the robustness of the results. The findings reveal that defence expenditure has negative impact on the Nigeria's economic growth, so also threats, political instability and arms importation. On the contrary, the study shows that defence expenditure in the presence of internal threats and political instability is productive in Nigeria.

On the causal relationship between defence expenditure and economic growth in Nigeria, the asymmetric causality establishes unidirectional causation. However, the causation from defence expenditure to economic growth happens during the good

time. The trends of defence expenditure in Nigeria therefore, lends credence to Keynes theory. This indicates that during the economic prosperity fund has been allocated to defence in Nigeria to ensure security against internal and external aggressions. On the other hand resources are made available during recessions to finance defence and ensure security and maintains law and order. This is true when activities of Niger Delta Militants hinder oil production which has been the main source of revenue to the Nigerian government.

5.3 Policy Implication

The study established that defence expenditure in the presence of threat and political instability is positively related to economic growth and defence expenditure on arms import in Nigeria negatively affects economic growth. Furthermore, the study equally established a unidirectional causation between defence expenditure and growth in a good times. This study recommends the followings:

First, policy makers in Nigeria should implement an increase in defence allocation in the Nigeria's yearly budget in order to improve the defence readiness. This is to enable the armed forces contain not only the internal threat which is the major challenge facing the unity of Nigeria today, but also the external threat. There is no amount of resources spends on the defence in Nigeria would be much, bearing in mind the significance of security.

Secondly, Nigerian government should reduce political instability by providing sufficient security. The study stress that the idea of budget allocations to defence

should not be simply based on the expansions in the national income alone, since defence financing is more related to the needs that arise at some particular time. Realistically, on the strategic appraisal of the defence necessities on a regular and periodic basis. On this note decision makers are to make choices that are consistent with policies and economic objectives. That is while enhancing security the government should with all seriousness employ other measures to reduce the menace of political instability by improving social welfare, providing employment, raising savings among others. Political stability in Nigeria can be attained through improvements in incomes, and general welfare of the citizens (Adelman & Morris, 1967 and Helliwell, 1994) as well as provision of enabling environment for citizens to participate in socio-economic and political activities.

Third, the none-significance of defence research and development is basically related to insufficient funding of the related defence research and development activities. Therefore, there is a need for more efficient, sound management and sufficient financing for defence Industrial Cooperation, and other defence institutions and collaborations. Training and Doctrine (TRADOC) is to be made a defence tri-service institution, and a center for defence research and development. Meanwhile Nigerian government should also set aside at least a minimum of 10% of the annual defence capital budget for research and development (Magbadeko, 2012).

Moreover, the system of defence acquisition in Nigeria should be reviewed. Nigeria should not continue importing all its defence gadgets including light defence hardware and still expect its defense's technical capability to improve. Arms

importation has negative effect on the economic growth in Nigeria. Technological know-how of the Nigerian defence is constrained due to its over dependency on the imported gadgets which could have been sourced locally. It is not wrong for Nigeria to receive technological aid from the developed friendly countries, but it is worrisome when it becomes extremely dependent on those foreign friendly countries. For the avoidance of over reliance on the foreign sources and aids, which are motivated by the foreign bureaucracy as well as foreign politics, Nigeria should strive to be self-dependent as far as security needs are concerned. This is to avoid a desperate and overzealous need for assistance and intervention from the foreign bodies as witnessed in the fight against the *Boko Haram* Terrorist.

Fourth, policies to reinforce the capacity and readiness of the security agencies to enable them become more active in handling threats and ensuring security and peace should be enacted. This involves among other things, provision of adequate equipment and logistics, enhancement of the intelligence-gathering as well as joint trainings on the counter-insurgency operations. The level to which the defence forces will be capable to dislodge terrorist networks depends on the armed forces operational capacity. This reduces occurrences of killing of the innocent citizens and distortion of economic activities which negatively affects economic growth (Brown, 2014).

Furthermore, funds earmarked for security purposes have to be diligently and efficiently utilized. The so called “security vote” has to be removed, monies allocated for security have to be accounted for. Serious sanctions should be put in

place for those found wanting in siphoning or mismanagement of the funds meant for the security. This practice of shielding the defence procurement from the curious public, has led to the instances of some procurements for defence are carried out only politically without any importance to the service itself.

Finally, the unidirectional asymmetric causality between economic growth and defence expenditure in Nigeria has policy implication as; the causation from defence expenditure to economic growth signify the role of defence sector in promoting peace and security in Nigeria which results to economic boom. It signifies the externality effects of security in creating an enabling environment in Nigeria, it validates the Keynesian preposition in Nigeria. Therefore since a strong defence is not made over night, resources should be made sufficient and available for defence purposes during the boom. So that other sector will not be deprived of resources during recession, when defence may need to be finance in the time of threats.

5.4 Limitation of the Study

This study focuses mainly on investigating the impact of Nigeria's defence expenditure at its aggregate and disaggregate components on the economic growth. It specifically examines the impacts of defence expenditure in the presence of internal threat, political instability and arms import on the Nigeria's economic growth. This study is constrained by the availability of similar data on other countries particularly the African countries. Thus, it induces the researcher to focus on Nigeria alone. Access to data and information regarding defence activities worldwide has always been shrouded with a secrecy in spite of the so called freedom of information.

Unavailability of data has limit this study from disaggregating oil GDP from non-oil GDP and to relate it with defence expenditure. Last but not the least, insufficient data has also limited this study to carry out a sort of micro study on defence sector in Nigeria. This include using the revenue generation in the defence sector and compare it with the amount spent on the defence sector. This analysis could isolate a direct economic contribution of the defence activities in Nigeria.

5.5 Recommendation for Future Research

Going by the limitation in this study, the following recommendations are offered for future researches. First, this research uses a time series analysis of defence expenditure and its impact on economic growth in Nigeria. Similar study can also be extended to look at the impacts of defence expenditure on economic growth on other West African countries when the data become available.

Secondly analysis could be carried out by disaggregating oil GDP from non-oil GDP and finding out the impact of defence expenditure on the economic growth. A sort of microeconomic study of the defence sector in Nigeria would also be interesting. Considering the revenue generation in the defence sector and compare it with the amount spent on the defence sector. Such an analysis would isolate a direct economic contribution of the defence activities in Nigeria and their impact on the economic growth.

5.6 Conclusion

The study investigates the impacts of defence expenditure in the presence of internal threat and political instability using aggregate and disaggregate defence expenditure approach in Nigeria. From the period 1983–2015, the analysis employed more improved methodologies. The study uncovers the magnitude and the effect of the internal threat, political instability and arms importation on the Nigeria's economic growth. However, the study reveals that defence expenditure in the presence of internal threat as well as political instability stimulates economic growth. It further unveils that the impacts of defence expenditure on arms importation on the economic growth in Nigeria is negative and significant.

Furthermore, the study isolates the impact of the defence research and development as well as defence sectoral allocation on the economic growth in Nigeria. The result reveals that defence allocation on research and development is insignificant over time. The defence expenditure allocation to the land army stimulates economic growth more than that of the navy and air force. On the aspect of the causal relationship, the study finds bidirectional causation between defence expenditure and economic growth in good and bad times in Nigeria. The causality that runs from economic growth to defence expenditure only occur in good time. On the contrary, the causation that runs from defence to economic growth exists only in the bad time.

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APPENDICES

Appendix A

Economic Growth Model

Autoregressive Distributed Lag Estimates

ARDL(2,2,2,2,1,2,2,2,2) selected based on Schwarz Bayesian Criterion

Dependent variable is LRGDPK

30 observations used for estimation from 1985 to 2014

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LRGDPK(-1)	-.22327	.22533	-.99085[.378]
LRGDPK(-2)	.54713	.15868	3.4480[.026]
LDE	.071255	.12119	.58796[.588]
LDE(-1)	-.92304	.15321	-6.0247[.004]
LDE(-2)	-.71640	.17637	-4.0619[.015]
LAI	.54872	2.3368	.23482[.826]
LAI(-1)	18.8811	3.0750	6.1402[.004]
LAI(-2)	15.3946	3.5852	4.2939[.013]
PI	-.030959	.018709	-1.6547[.173]
PI(-1)	-.11410	.026987	-4.2282[.013]
PI(-2)	-.054297	.021906	-2.4787[.068]
THR	-.13571	.031182	-4.3521[.012]
THR(-1)	-.11118	.029936	-3.7139[.021]
LDETHR	.24389	.080631	3.0248[.039]
LDETHR(-1)	.35524	.12305	2.8870[.045]
LDETHR(-2)	-.084378	.054376	-1.5518[.196]
LDEPI	.11730	.089878	1.3051[.262]
LDEPI(-1)	.14550	.078070	1.8637[.136]
LDEPI(-2)	.34999	.079839	4.3838[.012]
LDEAI	-.50746	2.3343	-.21739[.839]
LDEAI(-1)	-18.8437	3.0721	-6.1338[.004]
LDEAI(-2)	-15.3528	3.5813	-4.2869[.013]
LEDU	.74256	.26272	2.8265[.048]
LEDU(-1)	-1.3985	.37957	-3.6846[.021]
LEDU(-2)	.68682	.22451	3.0593[.038]
INPT	71.7628	12.0927	5.9344[.004]

R-Squared	.99837	R-Bar-Squared	.98816
S.E. of Regression	.029264	F-Stat. F(25,4)	97.8230[.000]
Mean of Dependent Variable	6.5142	S.D. of Dependent Variable	.26895
Residual Sum of Squares	.0034254	Equation Log-likelihood	93.5978
Akaike Info. Criterion	67.5978	Schwarz Bayesian Criterion	49.3822
DW-statistic	3.1059		

Testing for existence of a level relationship among the variables in the ARDL model

F-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
8.5486	2.8218	4.3963	2.3301	3.7152

W-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
76.9375	25.3963	39.5670	20.9707	33.4365

Diagnostic Tests

Test Statistics	LM Version	F Version
* A: Serial Correlation*CHSQ(1) =	2.4862[.115]*F(1,2)	= .18073[.712]*
* B: Functional Form *CHSQ(1) =	.034747[.852]*F(1,3)	= .0034787[.957]*

```

*
* C:Normality          *CHSQ(2) = 3.9834[.136]*          Not applicable          *
*
* D:Heteroscedasticity*CHSQ(1) = .068930[.793]*F(1,27) = .064329[.802]*
*****
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals

```

Estimated Long Run Coefficients using the ARDL Approach
ARDL(2,2,2,2,1,2,2,2,2) selected based on Schwarz Bayesian Criterion

```

*****
Dependent variable is LRGDPK
30 observations used for estimation from 1985 to 2014
*****

```

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LDE	-2.3193	.35570	-6.5205[.003]
LAI	51.5043	7.9648	6.4665[.003]
PI	-.29485	.061146	-4.8220[.009]
THR	-.36514	.064642	-5.6487[.005]
LDE_THR	.76130	.16246	4.6860[.009]
LDE_PI	.90631	.18769	4.8287[.008]
LDE_LAI	-51.3263	7.9445	-6.4606[.003]
LEDU	.045627	.18305	.24926[.815]
INPT	106.1354	16.1307	6.5797[.003]

```

*****

```

Testing for existence of a level relationship among the variables in the ARDL model

```

*****
F-statistic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound
8.5486      2.8218      4.3963      2.3301      3.7152

W-statistic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound
76.9375     25.3963     39.5670     20.9707     33.4365

```

If the statistic lies between the bounds, the test is inconclusive. If it is above the upper bound, the null hypothesis of no level effect is rejected. If it is below the lower bound, the null hypothesis of no level effect can't be rejected. The critical value bounds are computed by stochastic simulations using 20000 replications.

Error Correction Representation for the Selected ARDL Model
ARDL(2,2,2,2,1,2,2,2,2) selected based on Schwarz Bayesian Criterion

```

*****
Dependent variable is dLRGDPK
30 observations used for estimation from 1985 to 2014
*****

```

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dLRGDPK1	-.54713	.15868	-3.4480[.005]
dLDE	.071255	.12119	.58796[.567]
dLDE1	-.71640	.17637	-4.0619[.002]
dLAI	.54872	2.3368	.23482[.818]
dLAI1	-15.3946	3.5852	-4.2939[.001]
dPI	-.030959	.018709	-1.6547[.124]
dPI1	-.054297	.021906	-2.4787[.029]
dTHR	-.13571	.031182	-4.3521[.001]
dLDETHR	.24389	.080631	3.0248[.011]
dLDETHR1	.084378	.054376	1.5518[.147]
dLDEPI	.11730	.089878	1.3051[.216]
dLDEPI1	-.34999	.079839	-4.3838[.001]
dLDEAI	-.50746	2.3343	-.21739[.832]
dLDEAI1	15.3528	3.5813	4.2869[.001]
dLEDU	.74256	.26272	2.8265[.015]
dLEDU1	-.68682	.22451	-3.0593[.010]
ecm(-1)	-.67614	.15000	-4.5076[.001]

```

*****

```

Appendix B

Research and Development Model

```

Autoregressive Distributed Lag Estimates
ARDL(1,2,0,0) selected based on Schwarz Bayesian Criterion
*****
Dependent variable is LRGDPK
31 observations used for estimation from 1984 to 2014
*****
Regressor          Coefficient      Standard Error      T-Ratio[Prob]
LRGDPK(-1)         .84832           .10765              7.8806[.000]
LLFT               24.5563          4.3913              5.5921[.000]
LLFT(-1)           -41.8992         7.6338              -5.4886[.000]
LLFT(-2)           23.9600          4.2660              5.6165[.000]
LINV               .17553           .090313             1.9435[.063]
LRD                -.042581         .011518             -3.6968[.001]
INPT               .91337           .51293              1.7807[.087]
*****
R-Squared          .96490           R-Bar-Squared       .95950
S.E. of Regression .053359          F-Stat.             F(4,26)             178.6763[.000]
Mean of Dependent Variable 6.5107           S.D. of Dependent Variable .26514
Residual Sum of Squares .074027          Equation Log-likelihood 49.5912
Akaike Info. Criterion 44.5912          Schwarz Bayesian Criterion 41.0062
DW-statistic       1.7379           Durbin's h-statistic .91141[.362]
*****

Testing for existence of a level relationship among the variables in the ARDL model
*****
F-statistic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound
7.0973      3.7320           5.0460           3.0233           4.1943

W-statistic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound
4.3890      14.9281          20.1841          12.0933          16.7770
*****
If the statistic lies between the bounds, the test is inconclusive. If it is
above the upper bound, the null hypothesis of no level effect is rejected. If
it is below the lower bound, the null hypothesis of no level effect can't be
rejected. The critical value bounds are computed by stochastic simulations
using 20000 replications.
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Diagnostic Tests
*****
* Test Statistics * LM Version * F Version *
*****
* A:Serial Correlation*CHSQ(1) = .72142[.396]*F(1,25) = .59566[.447]*
*
* B:Functional Form *CHSQ(1) = 1.3947[.238]*F(1,25) = 1.1778[.288]*
*
* C:Normality *CHSQ(2) = .33719[.845]* Not applicable *
*
* D:Heteroscedasticity*CHSQ(1) = .61783[.432]*F(1,29) = .58973[.449]*
*****
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

```

Estimated Long Run Coefficients using the ARDL Approach
 ARDL(1,2,0,0) selected based on Schwarz Bayesian Criterion

 Dependent variable is LRGDPK
 30 observations used for estimation from 1985 to 2014

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LLFT	23.0122	6.5785	3.4981[.002]
LINV	-.73512	.36742	-2.0008[.057]
LRD	-.28833	.16231	-1.7764[.089]
INPT	-8.4469	3.8348	-2.2027[.038]

Testing for existence of a level relationship among the variables in the ARDL model

F-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
2.2360	3.7038	5.0495	3.0123	4.1752

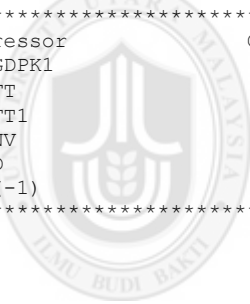
W-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
8.9439	14.8151	20.1980	12.0492	16.7008

 If the statistic lies between the bounds, the test is inconclusive. If it is above the upper bound, the null hypothesis of no level effect is rejected. If it is below the lower bound, the null hypothesis of no level effect can't be rejected. The critical value bounds are computed by stochastic simulations using 20000 replications.

Error Correction Representation for the Selected ARDL Model
 ARDL(1,1,2,0,0) selected based on Schwarz Bayesian Criterion

 Dependent variable is dLRGDPK
 30 observations used for estimation from 1985 to 2014

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dLRGDPK1	-.54713	.15868	-3.4480[.005]
dLLFT	10.7477	3.4844	3.0845[.005]
dLLFT1	-11.7444	3.6366	-3.2295[.004]
dLINV	-.11887	.051638	-2.3019[.030]
dLRD	-.046621	.012458	-3.7424[.001]
ecm(-1)	-.16170	.080840	-2.0002[.057]



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Model B

Autoregressive Distributed Lag Estimates

ARDL(1,2,0,0,0,0) selected based on Schwarz Bayesian Criterion

```

*****
Dependent variable is LRGDPK
30 observations used for estimation from 1985 to 2014
*****
Regressor          Coefficient          Standard Error          T-Ratio[Prob]
LRGDPK(-1)         .46048                .12583                  3.6595[.001]
LLFT               13.2610               4.5643                  2.9054[.008]
LLFT(-1)          -22.9682              7.3133                  -3.1406[.005]
LLFT(-2)          13.9233               3.9062                  3.5644[.002]
LINV              -.10289               .048722                 -2.1119[.047]
LEXA              1.7432                .73503                  2.3716[.027]
LEXAF             -1.6882               1.4861                  -1.1360[.269]
LEXN              1.7032                1.6081                  1.0591[.302]
INPT              -8.1306               1.5588                  -5.2159[.000]
*****
R-Squared          .97896                R-Bar-Squared          .97094
S.E. of Regression .045849               F-Stat.                F(8,21)                122.1135[.000]
Mean of Dependent Variable 6.5142                S.D. of Dependent Variable .26895
Residual Sum of Squares .044144               Equation Log-likelihood 55.2542
Akaike Info. Criterion 46.2542               Schwarz Bayesian Criterion 39.9488
DW-statistic       1.9716                Durbin's h-statistic   .10725[.915]
*****

```

Testing for existence of a level relationship among the variables in the ARDL model

```

*****
F-statistic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound
4.9350      3.1173          4.6127          2.5745          3.8443

W-statistic 95% Lower Bound 95% Upper Bound 90% Lower Bound 90% Upper Bound
29.6103     18.7037         27.6759         15.4469         23.0660

```

If the statistic lies between the bounds, the test is inconclusive. If it is above the upper bound, the null hypothesis of no level effect is rejected. If it is below the lower bound, the null hypothesis of no level effect can't be rejected. The critical value bounds are computed by stochastic simulations using 20000 replications.

Diagnostic Tests

```

*****
* Test Statistics * LM Version * F Version *
*****
* A:Serial Correlation*CHSQ(1) = .0031882[.955]*F(1,20) = .0021257[.964]*
* * * * *
* B:Functional Form *CHSQ(1) = .80002[.371]*F(1,20) = .54796[.468]*
* * * * *
* C:Normality *CHSQ(2) = 3.5095[.173]* Not applicable *
* * * * *
* D:Heteroscedasticity*CHSQ(1) = .044002[.834]*F(1,28) = .041129[.841]*
*****
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

```

Estimated Long Run Coefficients using the ARDL Approach
 ARDL(1,2,0,0,0) selected based on Schwarz Bayesian Criterion

 Dependent variable is LRGDPK
 30 observations used for estimation from 1985 to 2014

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LLFT	7.8146	1.5371	5.0838[.000]
LINV	-.19071	.10184	-1.8727[.075]
LEXA	3.2311	1.5513	2.0829[.050]
LEXAF	-3.1291	2.9606	-1.0569[.303]
LEXN	3.1568	3.0496	1.0352[.312]
INPT	-15.0701	1.9005	-7.9296[.000]

Testing for existence of a level relationship among the variables in the ARDL model

F-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
4.9350	3.1173	4.6127	2.5745	3.8443

W-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
29.6103	18.7037	27.6759	15.4469	23.0660

If the statistic lies between the bounds, the test is inconclusive. If it is above the upper bound, the null hypothesis of no level effect is rejected. If it is below the lower bound, the null hypothesis of no level effect can't be rejected. The critical value bounds are computed by stochastic simulations using 20000 replications.

Error Correction Representation for the Selected ARDL Model
 ARDL(1,2,0,0,0) selected based on Schwarz Bayesian Criterion

 Dependent variable is dLRGDPK
 30 observations used for estimation from 1985 to 2014

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dLRGDPK1	-.44713	.15868	-3.4480[.005]
dLLFT	13.2610	4.5643	2.9054[.008]
dLLFT1	-13.9233	3.9062	-3.5644[.002]
dLINV	-.10289	.048722	-2.1119[.046]
dLEXA	1.7432	.73503	2.3716[.027]
dLEXAF	-1.6882	1.4861	-1.1360[.268]
dLEXN	1.7032	1.6081	1.0591[.301]
ecm(-1)	-.53952	.12583	-4.2876[.000]

Appendix C

Asymmetric Causality

DE+ to GDP+

This program performs an asymmetric causality test developed by Hatemi-J (2012).

Reference: Hatemi-J (2012) Asymmetric Causality Tests with an Application, Empirical Economics, 43:447_456

This program code is the copyright of the authors. Applications are allowed only if proper reference and acknowledgments are provided. For non-Commercial applications only.

No performance guarantee is made. Bug reports are welcome.

AhatTU=

-3.4235088e+010	1.0090531	35.334215	4.2893255e+010	-0.10510747	-71.811229	-4.0487966e+010	0.092886632
3.1117674e+008	0.00011692263	1.6629096	-2.1101154e+008	-0.00082807344	-0.46311271	2.0094870e+008	0.00067728830
0.23426455	-6.9186569e-015	-4.6536320e-012	1.2499832	1.6740568e-014	6.0311661e-012	-0.30826727	2.1965732e-014

AhatTR=

-3.5988419e+010	0.96806206	0.00000000	4.6567596e+010	-0.037566640	0.00000000	-4.7037692e+010	0.069872302
3.1117674e+008	0.00011692263	1.6629096	-2.1101154e+008	-0.00082807344	-0.46311271	2.0094870e+008	0.00067728830
0.23426455	-6.9186569e-015	-4.6536320e-012	1.2499832	1.6740568e-014	6.0311661e-012	-0.30826727	2.1965732e-014

Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 2.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 2.000
additional lags=1.000

Wstat = 5.493

Wcriticalvals=

10.733

6.489

4.874

DE- to GDP-

This program performs an asymmetric causality test developed by Hatemi-J (2012).

Reference: Hatemi-J (2012) Asymmetric Causality Tests with an Application, Empirical Economics, 43:447_456

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AhatTU=

3.5270072e+009	0.90023908	-1.4528217	-5.4341599e+008	-0.026937212	3.5054291	1.9541471e+009
84521635.	-0.0011371703	1.0795248	-1.6420204e+008	0.00071734546	-0.085823360	2.2372328e+008
-0.16367251	-4.0926558e-013	-8.7648350e-012	1.2740392	1.8080829e-013	1.4353625e-011	-0.28874489

AhatTR=

3.4130834e+009	0.90009028	0.00000000	-3.0898607e+008	-0.025719292	2.0489361	1.6369805e+009
84521635.	-0.0011371703	1.0795248	-1.6420204e+008	0.00071734546	-0.085823360	2.2372328e+008
-0.16367251	-4.0926558e-013	-8.7648350e-012	1.2740392	1.8080829e-013	1.4353625e-011	-0.28874489

Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 1.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 1.000
additional lags=1.000

Wstat = 0.248

Wcriticalvals=

20.976

3.986

1.630

DE+ to GDP-

This program performs an asymmetric causality test developed by Hatemi-J (2012).

Reference: Hatemi-J (2012) Asymmetric Causality Tests with an Application, Empirical Economics, 43:447_456

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AhatTU=

9.1663097e+009	0.81712759	-4.5361582	6.0945202e+010	0.10526717	51.650915	-5.7652022e+010
-1.1914355e+008	-0.00027341947	1.0920909	42281196.	0.00029422555	-0.11315874	20439625.
0.22390637	1.8354227e-015	-7.0936017e-012	1.2551992	1.7744331e-014	5.4520903e-012	-0.28572687

AhatTR=

1.0687393e+010	0.81487290	0.00000000	5.7428947e+010	0.10743971	47.256223	-5.4534834e+010
-1.1914355e+008	-0.00027341947	1.0920909	42281196.	0.00029422555	-0.11315874	20439625.
0.22390637	1.8354227e-015	-7.0936017e-012	1.2551992	1.7744331e-014	5.4520903e-012	-0.28572687

Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 1.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 1.000
additional lags=1.000

Wstat = 0.032

Wcriticalvals=

12.808

4.843

2.674

DE- to GDP+

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AhatTU=

-4.5245367e+010	0.81221691	1.6864994	5.0949606e+010	0.11110042	47.769040	-5.6016106e+010
73436426.	-0.00023554493	1.0872450	-1.4635815e+008	0.00028296827	-0.11973666	2.0245962e+008
-0.16983602	5.3316763e-014	-9.7610322e-012	1.2723172	-5.8023644e-014	1.3377251e-011	-0.28892188

AhatTR=

-4.5108970e+010	0.81318819	0.00000000	5.0651513e+010	0.11023630	49.379056	-5.5626778e+010
73436426.	-0.00023554493	1.0872450	-1.4635815e+008	0.00028296827	-0.11973666	2.0245962e+008
-0.16983602	5.3316763e-014	-9.7610322e-012	1.2723172	-5.8023644e-014	1.3377251e-011	-0.28892188

Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 1.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 1.000
additional lags=1.000
Wstat = 0.005
Wcriticalvals=
12.714
4.851
2.598

GDP+ to DE+

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Reference: Hatemi-J (2012) Asymmetric Causality Tests with an Application, Empirical Economics, 43:447_456

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AhatTU=

3.1117674e+008	1.6629096	0.00011692262	-2.1101154e+008	-0.46311271	-0.00082807345	2.0094870e+008	-0.17516685
-3.4235088e+010	35.334215	1.0090531	4.2893255e+010	-71.811229	-0.10510747	-4.0487966e+010	37.138261
0.23426455	-4.6536320e-012	-6.9186574e-015	1.2499832	6.0311662e-012	1.6740567e-014	-0.30826727	-2.6742868e-012

AhatTR=

3.1863978e+008	1.6449330	0.00000000	-2.0085200e+008	-0.42784977	0.00000000	1.5785145e+008	-0.19447531
-							
-3.4235088e+010	35.334215	1.0090531	4.2893255e+010	-71.811229	-0.10510747	-4.0487966e+010	37.138261
0.23426455	-4.6536320e-012	-6.9186574e-015	1.2499832	6.0311662e-012	1.6740567e-014	-0.30826727	-2.6742868e-012

Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 2.000

Varorder chosen by information criterion (excluding augmentation lag(s)) is 2.000

additional lags=1.000

Wstat = 1.234

Wcriticalvals=

11.466

6.574

4.744

GDP- to DE-

This program performs an asymmetric causality test developed by Hatemi-J (2012).

Reference: Hatemi-J (2012) Asymmetric Causality Tests with an Application, Empirical Economics, 43:447_456

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AhatTU=

84521635.	1.0795248	-0.0011371703	-1.6420204e+008	-0.085823360	0.00071734546	2.2372328e+008
3.5270072e+009	-1.4528217	0.90023908	-5.4341599e+008	3.5054291	-0.026937212	1.9541471e+009
-0.16367251	-8.7648350e-012	-4.0926558e-013	1.2740392	1.4353625e-011	1.8080829e-013	-0.28874489

AhatTR=

79301327.	1.0794111	0.00000000	-1.7102882e+008	-0.087793269	-0.00029091346	2.2901594e+008
3.5270072e+009	-1.4528217	0.90023908	-5.4341599e+008	3.5054291	-0.026937212	1.9541471e+009
-0.16367251	-8.7648350e-012	-4.0926558e-013	1.2740392	1.4353625e-011	1.8080829e-013	-0.28874489

Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 1.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 1.000
additional lags=1.000
Wstat = 0.145
Wcriticalvals=
20.966
3.926
1.794

GDP+ to DE-

This program performs an asymmetric causality test developed by Hatemi-J (2012).

Reference: Hatemi-J (2012) Asymmetric Causality Tests with an Application, Empirical Economics, 43:447_456

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AhatTU=

2.5487545e+008	1.6439418	-0.0014416043	-1.6116037e+008	-0.42952527	-1.6664417e-005	1.4457694e+008	-0.19143700	.
-3.3638170e+009	-1.5327630	0.95655738	7.0822117e+008	1.9838225	0.0026030504	-3.1546114e+009	-0.35007233	-
0.25594971	-4.1477742e-012	-1.9591629e-013	1.2455471	4.9968646e-012	2.3821748e-013	-0.30871794	-4.1028943e-013	

AhatTR=

2.7266800e+008	1.6459022	0.00000000	-1.7714361e+008	-0.42918714	0.00000000	1.4912189e+008	-0.19406135	-
-3.3638170e+009	-1.5327630	0.95655738	7.0822117e+008	1.9838225	0.0026030504	-3.1546114e+009	-0.35007233	-
0.25594971	-4.1477742e-012	-1.9591629e-013	1.2455471	4.9968646e-012	2.3821748e-013	-0.30871794	-4.1028943e-013	

Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 2.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 2.000
additional lags=1.000
Wstat = 0.123
Wcriticalvals=
18.078
7.980
4.965

GDP- to DE+

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AhatTU=

-2.7253824e+008	1.6521820	-0.0011958954	-7.8135559e+008	-0.44010476	-0.00027723355	4.5290815e+008	-0.19051167	-
5.6882348e+009	-1.5525218	0.94060663	2.6175988e+009	1.9841414	0.00054161131	-1.8196876e+009	-0.28667062	-
-0.17239514	-7.8331183e-012	-3.0556835e-013	1.2897090	1.1605222e-011	7.7969372e-014	-0.33977152	-3.2285125e-012	-

AhatTR=

-2.8875444e+008	1.6537892	0.00000000	-7.8602631e+008	-0.43932069	0.00000000	4.4646671e+008	-0.19330443	-
5.6882348e+009	-1.5525218	0.94060663	2.6175988e+009	1.9841414	0.00054161131	-1.8196876e+009	-0.28667062	-
-0.17239514	-7.8331183e-012	-3.0556835e-013	1.2897090	1.1605222e-011	7.7969372e-014	-0.33977152	-3.2285125e-012	-

Information criterion used; lags based on that =Hatemi-J Criterion (HJC) 2.000
Varorder chosen by information criterion (excluding augmentation lag(s)) is 2.000
additional lags=1.000
Wstat = 0.104
Wcriticalvals=
18.028
7.561
4.838

