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Aggregate Public Debt Burden And The Growth Of A Fragile Economy: The Nigerian Experience

Angela Chibuzor Nwali[1], Friday Edwin Nkwede[2]
[1](Department of Economics, Leeds University Business School,University of Leeds, Leeds,United Kingdom)
[2](Department of Accountancy, Banking & Finance,Faculty of Management Sciences,Ebonyi State University, Abakaliki, Nigeria)

Abstract: *This study empirically investigates the combine influence of two components of public debt (internal and external public debt) burden on the growth of Nigerian emerging and fragile economy. The study adopts descriptive research design and an econometric estimation approach anchored on Vector Error Correction Estimation (VECM) in determining the impact of public debt accumulation on the long-run economic growth in Nigeria. Time series data which covered the periods of 1961-2013 as variously sourced were employed in the study. The empirical results from the study confirmed that public debt has a negative short-run and long-run impact on the Nigerian economic growth and the adjustment process from the result indicates a low speed of adjustment for the errors in the previous year to be corrected in equilibrium. The study's existing findings are consistent with prior studies in other economies. The policy implication of this current finding is that an accumulation of public debts daunt the growth of Nigerian economy. The paper suggests that policy makers should always strive to ensure that debt-GDP ratio does not go beyond international ratio for debt sustainability in Nigeria.*

Keywords: *Borrowing, Burden, debt, Economy, Nigeria.*

I. Introduction

Debt burden and economic growth has been one of the topical issues in developing economies. Nigeria like other less developed economies has not been left behind in this recent discussion of public debt-growth nexus and the developing economies. Nigeria has always resorted to budget deficit as a way of stabilizing the economy which has resulted to the accumulation of debt to the detriment of the economy's growth (Ajayi, 1997). This has given a lot of concern that one might argue whether the economy can grow well as to maintain its debt obligations and as well maintain adequate domestic investment needed for the economy's growth. The extent to which this economic condition (growth) improves depends highly on the optimality of these sources of funds and other macro-economic factors such as interest rate, exchange rate, inflation rate, among others. Public debt, no doubt has been studied extensively; but the subject matter mater needs to be further explored for evident reasons. First, the Nigerian economy is not only an emerging economy but indeed fragile, to a large extent that annual borrowing has become inevitable. Second, empirical evidences (with particular reference to Nigeria) rarely address the subject matter on aggregate basis.(eg, see Kanu et al, 2014; Muritah, 2012; Utimi, 2014; Woo and Kuma, 2010; Sheikh et al, 2010; Pattllo et al, 2002; Ohwofasa et al, 2012; Ogunmuyi, 2011 among others). Therefore, gagging the combined implication of this debt burden on the growth of Nigerian economy will fill evident gape in the existing literature.

Essentially, borrowing by any economy can occur when the country need to carry out productive investment but have inadequate internal revenue (Ezeabasili, *et al.* 2011). Such debt can become a burden to the economy when government in an attempt to enhance development through borrowing, has no adequate revenue source in the economy to meet up with these debt obligations. As Cecchetti *et al.* (2011) opined debt like any other form of financing is one of the bed-rocks of any modern economy and its growth. They argued that a poor country will remain poor without finance but with debt, they can borrow with repayment in future time in order to carry out some activities which wouldn't have been possible because of capital inadequacy. However, they argued that although debt can improve the welfare of an economy, it can be problematic when it is used injudiciously, as it limits the economy's ability to discharge its duties to the citizens. Lora & Olivera (2007) as well noted the way through which debt stock affects a country's growth rate. They argued that debt service payment reduces the availability of the economy's fund to embark on projects and other social expenditure as to enhance growth. In other words, they see debt as a two edge-sword which can do a good work and as well hurt when handled roughly. As Woo & Kumar (2010) stated in their study, high level of public debt can reduce capital accumulation and productivity because it can raise the long term interest rate, future taxes and inflation which leads to economic uncertainty thereby hampering the economy's growth.

According to Ajayi (1997), Nigeria was the top heavily indebted country in sub-Saharan African with external debt of about US$33billion followed by Cote d'Ivoire with about US$19billion. This is irrespective of

its domestic borrowing. In this regard, this study seeks to address the question, why has Nigeria as one of the major oil producing economies engaged in so much public debt accumulation? Has public debt actually helped the economy to improve its growth rate? In order to answer these questions, an empirical investigation is carried out to ascertain the implication of public debt burden on the Nigerian economic growth.

II. Public Debt Trends In Nigeria

To Sulaiman (2012); and Kanu *et al.* (2014), Nigeria public debt dated back to 1958 when US$ 28 million was borrowed for railway construction. The public debt burden according to Kumar & Guidotti (1991) can also be traced to the 1982 external debt crisis, as it acerbated a rise in the domestic debt of most developing economies of which Nigeria happens to be among. This rise with the rescheduling of these debts, the interest and amortisation payment by these countries led to the debt burden in these economies. Ajayi (1989) cited in Adofu & Abula (2010), Nigerian public debt burden can be traced to early 1980's as a result of fiscal expansion embarked on during the oil boom period in the 1970's, which the government was unable to change when the oil boom eventual declined in 1981. This decline led to more debt accumulation and is attributed to the negative oil price shock from the international market. Government instead of reversing its fiscal expansion resorted to borrowing both internally and externally in order to finance its rising expenditure. This led to reduction in foreign exchange and consequently, balance of payment pressure (Ajayi &Oke, 2012). This increasing debt became a crisis in the economy in that government generated revenue was unable to pay-off the debt obligations thereby thwarting the economy's growth (Erhieyovwe and Onovwoakpoma, 2013).

As noted by Reinhart & Rogoff (2010b), leaders (politicians) often take unnecessary risks in accumulating and piling-up public debt knowing that they may not feel the impact since it takes quit time for the problem to start materialising. This happens to be evidence in Nigeria, where leaders care less about the consequences of the debt accumulation. Adofu & Abula (2010) equally argued that public debt in Nigeria is not often used for its intended projects because of corruption. This has worsened the already depressed economy and has equally resulted to big political, social and economic costs (Erhieyovwe & Onovwoakpoma, 2013).

To Erhieyovwe & Onovwoakpoma (2013), Nigerian public debt in 1960 stood at $69.7 million but rose in 1970 to $246.0 million and in 1977 to $3,146.0 million. The total public debt stock according to Obadan, (2005) cited in Erhieyovwe & Onovwoakpoma (2013) declined in 1975 and 1976 by 10.3% and 20.7% respectively but the average growth of public debt between 1970 and 1977 still remain at the high rate of 5.9%. In 1979, Nigeria public debt stood at $1611.5 billion with over $5 billion in foreign reserve but in 1990, it stood at $298,614.4 billion (Erhieyovwe & Onovwoakpoma, 2013). Nigeria public debt stock stood at $1billion in 1971 but rose to $33.4billion in 1991 and has always been on the increasing side (Ayandiji, 2010 cited in Erhieyovwe & Onovwoakpoma, 2013). The country's stock of debt rose to $716,815.6 billion in 1995 but decreased to $489269.6 billion in 2004 and rose again to $26,950,072 billion in 2005 not because of increased borrowing but highly as a result of penalties, surcharges and interests (Erhieyovwe & Onovwoakpoma, 2013). They concluded by saying that this is nothing but a 'Debt Trap' in the sense that it is very difficult to pay off such debt even if the country managed to pay all the charges including that of default, but thanks to the debt relief granted to the country in 2005, which was indeed a great relief for Nigeria.

III. Literature Review

3.1 Conceptual Review- the Concept of Debt/public debt

Debt according to Ogba (2014) is a contractual obligation of owing or borrowing with a promise of repayment at a future period. Utomi (2014) defined debt as the act of borrowing which can be domestic or external. It can be referred to as resources in use in a given organisation that is neither contributed nor owned by the organisation's owner (Erhieyovwe & Onovwoakpoma, 2013). A country's Public debts are broadly made up of domestic and external debt and are sometimes incurred when the economy need to cover large fiscal deficits (Edo, 2002). Erhieyovwe & Onovwoakpoma (2013) defined public debt as debts incurred through borrowing by the economy's government in both domestic and international market. Emmanuel (2012) while explaining the reasons behind Nigeria's public borrowing asserts that Nigeria borrow in order to close financial gap between savings and investment as well as to finance its budget deficit. He relates this to the 'Big-Push' theory of economic growth and development postulated by Rosenstein-Rodan, which requires a certain level of resource to be put in government intensive project if the objective is to be achieved. Public debt therefore, is borrowing by government of a country in order to carry out public expenditure. Emmanuel (2012) defined Nigeria's domestic debt as debt instruments by the federal government which are denominated in local currency, consisting mainly of Nigerian Treasury Bills (TBs), Nigerian Treasury Certificates (TSs), Treasury Bonds (TBs), and Federal Government Development Stocks (FGDSs). On the other hand, Loganathan *et al*. (2010) defined external debt as money borrowed from abroad and argued that it can hamper countries growth level when it increases.

In view points above, it means that every sovereign nation should be capable of achieving economic growth with debt when it borrows wisely, manage efficiently and invest the fund in productive projects that generate revenue in excess of cost of borrowing such fund. This will then make repayments less of a burden and as well reduce some adverse restrictions from the lenders of such fund especially multilateral loans, thereby enhancing the economy's growth**.**

IV. Empirical Review

4.1 Evidence on threshold/non-linear relationship between public debt and growth

While investigating the impact of high public debt on economic growth in advanced and emerging market for the period 1970–2007, Woo & Kumar (2010) using panel data, found an inverse relationship and some evidence of non-linearity between initial public debt-to-GDP ratio and the economies' subsequent growth. They assert that after controlling for other economic growth determinants that a 10-percent increase from the initial debt-to-GDP ratio leads to a 0.2% decrease in per capital GDP growth. They further argued that the impact is found to be higher in the emerging than in the advanced economies. They also argue that high public debt is likely to lead to higher long-term interest rate; future distortionary taxes; inflation; uncertainty and making the economy vulnerable to crises, which will all negatively affect the economy's capital accumulation, productivity and economic growth.

In support of this view, Adam (2011) while analysing the implications of high government debt on the optimal conduct of both monetary and fiscal policy in some selected OECD economies using a standard monetary policy model; demonstrates that government debt have an adverse effect on public spending thus having additional adverse effects on labour supply and output. He argued that government in an attempt to reduce the debt overtime will give rise to higher tax rate and also higher risk to fiscal budget. Greiner (2012) who studied how public debt affect the long-run allocation of resource, using basic AK endogenous-growth model, argue that high public debt-to-GDP ratio can negatively affect long-run economic growth by crowding out private investment. He argued that this can occur only if government tries to meet its inter-temporal budget constrain by reducing public spending, but if it adjust transfers that such impact will never exist.

With stress on the threshold model, Reinhart & Rogoff (2010a); and (2010b) investigated the effect of public debt on the economic growth of 20 advanced countries and 44 countries (respectively), for the period 1790-2009. Their result found a weak relationship between debt and long-run economic growth for a debt-GDP-ratio below 90% but have a strong negative relationship at a threshold for debt above 90% of GDP. In their 2010b study, they found that emerging economies have a lower threshold of 60% for its total external debt after which their growth rate starts decreasing annually. They argued that there is possibility of country specific issues and also the fact that high debt ratio lead to tighter fiscal policies which leads to economic risks and consequently lower growth rate. Again, Balassone *et al.* (2011) analysed debt-to-GDP ratio and per capital GDP in Italy in the period 1861–2009 and found that public debt has a negative impact on the economy's growth at the threshold of debt-to-GDP ratio above 100%. They argued that this effect exist through reduced investment and also that the effect is stronger for public external debt compared to domestic debt possibly because of the effect of stringent rules by foreign lenders as suggested by some studies above.

Furthermore, Balazs (2013) replicated Reinhart & Rogoff (2010), putting their dataset to a formal econometrics test using a nonlinear threshold model. They argued that although nonlinear relationship exist between public debt and economic growth, that the turning point starts at a lower debt- to- GDP ratio from 20% to 60%, (than suggested by Reinhart & Rogoff) beyond which public debt negatively impact on GDP. He argued that the negative non-linear relationship between the variables is sensitive to the choice of modelling, time, country, data frequency and other factors.

A mixed evidence of this non-linear relationship between the variables for two developing countries was found by Ayadi & Ayadi (2008) in their comparative analysis for Nigeria and South Africa. Using OLS and GLS for the period 1994–2007 they found that external debt positively impacted on Nigeria up to a certain point where the impact became negative but no evidence of such non-linearity was found for South Africa as debt strongly impacted on the economy's output positively. In other words they found a non-linear relationship between debt and growth in Nigeria and no such relationship in South Africa, which they argued could possibly be because the later country efficiently managed their own debt than Nigeria. Similarly, Dreger & Reimers (2013) analysed the relationship between public debt-to-GDP ratio for euro member economies and some other industrial economies, differentiating between sustainable and non-sustainable debts periods. They found that the negative relationship between debt-to-GDP ratio is only limited to euro member economies and at non-sustainable level of public debt but found no such evidence in the industrial countries. Their study confirmed the existence of non-linear relationship between the variables but it all depends on the country's macroeconomic condition.

4.2 Critical Review of Threshold Studies

While some studies have suggested non-linearity between debt and economic growth, some other studies have countered such evidence. Schclarek (2005) in his study of the relationship between public debt and economic growth using a panel of 83 countries (24 advanced and 59 developing countries) for the period 1970-2002 demonstrated that there is no robust evidence that high public debt leads to lower growth rate in the advanced economies but there is a negative and significant effect of high government debt on developing economies' growth rate. He argued that this effect is mainly from external debt accumulation and affect mainly the economy's capital accumulation growth rather than total factor productivity. In their own analysis, Kourtellos *et al.* (2013) investigated high public debt and economic growth in multiple regimes using augmented/threshold Solow growth model and panel regression method and argued in favour of negative threshold effect of high public debt on economic growth only in countries with Low–Democratic Regime, while such relationship does not exist in high quality institutions. They suggest that the relationship depend highly on the quality of the economy's institution and that policy makers should avoid austerity measures that will be detrimental to the stability of their economies' type.

Furthermore, Eberhardt (2013) using novel time series method to investigate four OECD economies (United State, Great Britain, Sweden and Japan) for the period 1800s–2010 found no evidence of long-run relationship between high public debt and economic growth. Their finding suggests that the said relationship could be possibly depending on country's macro-economic environment, since they found not even an identical equilibrium debt-growth relationship among the economies they studied. Similarly, Herndon *et al* (2014) replicated Reinhart & Rogoff (2010a & 2010b) and objected the authors claims of 90% debt-to-GDP threshold as they found no evidence for such relationship in that boundary. They argued that the findings of Reinhart & Rogoff was inaccurate due to some selection bias, measurement and coding errors, that the relationship varies significantly between country and time periods.Additionally, Lof & Malinen (2014) and Panizza & Presbitero (2014) analysed 20 developed countries using panel vector auto-regression; and some selected OECD economies using ordinary least square (OLS) and instrumental variable approach respectively. After correcting for endogeneity, they found no clear evidence of casual effect of public debt on economic growth in advance economies. Although Panizza & Presbitero admitted that the case might be different for developing economies, as they confirmed country-specific unsustainable level of debt. From the review above, public debt is suggested to exert a negative influence on economic growth most especially in developing economies. As noted above, non-linear relationship between the variable as both reviewed in the threshold analysis and equally in the critical review which suggest such evidence only in developing economies.

However, Teles & Mussolini (2014) analysed OECD and some selected non-OECD economies and argued that increase in debt size can impact on a country's economic growth positively. They argued that the only way public debt can negatively affect economic performance is when it affect the productivity of public expenditures. Nevertheless, this evidence of positive impact could possibly be as a result of including developed economies in the study, which their impact in the study could have possibly outweighed that of the developing economies. Therefore, developing economies is worth studying specifically in order to investigate more of this impact.

4.3 Studies for Nigerian Economy

Studying the Nigerian economy, Adofu and Abula (2010) analysed the impact of domestic debt on Nigeria economic growth for the period 1986–2005, using OLS; and Ezeabasili *et al* (2011) analysed external debt and total debt servicing for the period 1975–2006 using ECM. They all found that debts and its servicing have negatively affected the economy's growth for the periods they studied. Likewise, Muritala (2012) investigated Nigeria economy for the period 1980–2010 using OLS technique and found that external debt has negatively affected the economy's growth but argued that debt servicing has positive impact on its growth. Nevertheless, Muritala admitted the weakness of the technique used in the analysis.

Further, Emmanuel (2012) analysed the value and proportional impact of public debt on Nigerian economic growth for the period 1975-2005, using vector error correction model (VECM). He found that public debt has a short-run positive impact but a long-run negative impact on the economy's growth. He maintained that high debt servicing obligation and its burden especially external debt servicing reduces the economy's available funds for investment resulting to more difficulties in servicing the debt. In addition, Ebi et al (2013) analysed the potency of external and domestic debt on Nigeria macro-economic variables for the period 1970–2011 using ECM. They found that external debt crowd-out domestic investment and lowers economic growth while domestic debt stimulates the growth rate. Again, Uma *et al* (2013) studied the influence of public debt on Nigeria economic growth for the period 1970–2010 using OLS technique. They found that both domestic and external debt has a negative (although insignificant) impact on the economy's growth. They attributed this to mismanagement and equally the fact that repayments of debts and its charges limits the available funds which would be used to support other interdependent sectors that are paramount to the economy's growth.

Additionally, Tajudeen (2012), using Vector Auto regression (VAR) and Granger Causality techniques for the period 1970-2010,found that public debt has a positive impact on Nigerian economic growth in the long-run, if the loan is channeled to development projects. Similarly Ohwofasa et al (2012); Sulaiman (2012); and Erhieyovwe & Onovwoakpoma (2013) using OLS technique for the period 1986–2011; ECM for 1970–2010; and OLS & co-integration technique respectively, independently argued that external debt has positively impacted on the economy's growth, although insignificant in Sulaiman's study.

However, Ogunmuyiwa (2011) using VECM to investigate the relationship between external debt and economic growth for the period 1970–2007 argued that causation does not run between the variables, and suggest no evidence of long-run relationship between them. He argued that external debt is not a specific determining factor for economic growth or slowdown. In other words, his study suggests the existence of other determining factors for economic growth other than external debt alone. In their investigation of the relationship between various components of external debt and Nigeria economic growth for the period 1969–2011, Kanu et al (2014) using OLS and VAR found no significant long-run relationship between the variables. While studying Nigeria for the period 1980–2012 using VECM, Utomi (2014) found no significant long-run relationship between external debt stock and economic growth and equally found evidence of bi-directional relationship between the variables.

The above Nigerian studies have either focused on domestic or external debt impact on economic growth individually. Few others which have incorporated the two components have either failed to incorporate some other major control variables leading to potential biases, or have used an inappropriate methodology which could not properly address some errors, such as endogeneity and reverse causality between these variables.

V. Research Methodology

5.1 Data and Research Design

As highlighted earlier, this study focuses on empirical investigation of the impact of public debt burden (both domestic and foreign public debt) on the growth of Nigerian economy; to address the question of how have public debt accumulations and its servicing impacted on Nigerian economy. The study uses secondary (time series) data for the period 1961-2013 sourced from Central Bank of Nigeria (CBN) statistical bulletins and annual reports and World Bank development indicator for the periods under study.

5.2 Justification of research variables

In other to capture public debt impact on Nigerian economic growth, RGDP is used as a proxy for economic growth. This represents the dependent variable knowing that GDP is mostly used as the standard measure for a country's growth (Enu 2009 cited in Kanu et al. 2014). This is for the fact that GDP is seen as a better representative of a country's productive capacity (Cordella 2005 cited in Cholifihani 2008). External debt outstanding; domestic debt outstanding; and public debt servicing is used to capture public debt accumulation and its burden on the economy and represent the independent variables. External debt and its servicing according to Cholifihani (2008) and Hameed et al. (2008) reduces a country's capital stock since it represent a transfer of wealth, thus hampering the economy's growth. Other controlling variables used in the estimation include; Exchange rate which its fluctuation determines the value for capital flight; and Interest rate for borrowing these debt. Public investment is also considered necessary for the fact that its level determines GDP to a great extent as have suggested by crowding out theory, and its level according to Ajayi (1997) is expected to be affected by public debt servicing. And as suggested by Amakom (2005), public debt can be effective in achieving economic growth when it is efficiently used for productive investments.

In other words, external debt; domestic debt; public debt servicing; exchange rate; interest rate; and public investment are the independent variables regressed on RGDP (dependent variable). RGDP which are GDP values adjusted for inflation effect is used for the analyses in order to determine the actual performance of the economy.The use of lagged value(s) to address endogeneity problem with time series was also justified in the work of Cecchetti *et al.* (2011) and Panizza & Presbitero (2014). This lagged value(s) are determined using lag selection criteria.

5.3 Model specification

For the purpose of achieving the objective of this study, a regression model is specified to estimate the value impacts of the variables on Real GDP (RGDP). Proportional impact analysis is done descriptively. According to Jones (1998), a typical growth model with aggregate production function describes how economic units transform factor inputs into economic output. The production function is presented thus:

$$\boldsymbol{Y = AF(K, L)} \text{.....} \quad \textbf{(1)}$$

Where *Y* represent real output (RGPD), *K* and *L* represent quantity of capital and labour respectively, used for the production while *A* captures the economy's productivity.
This production function is assumed to have the Augmented Cobb-Douglas functional form which assumes production to grow in a contact exponential rate and is represented as:

$$Y = AL^{\alpha}K^{\beta}e^{u} \text{.....(2)}$$

From function (2) above, the variables for this study can be fitted in thus:

$$RGDP=\alpha REXTDBT^{\beta 1}RDMDBT^{\beta 2}RDBTSERV^{\beta 3}RINTR^{\beta 4}REXCR^{\beta 5}RINVEST^{\beta 6}\mu \text{.....(3)}$$

Where:
RGPD = Real gross domestic product
RExtdbt = Real external debt outstanding
RDmdbt = Real domestic debt outstanding
RDbtserv = Real public debt servicing
RExcr = Real Nigerian exchange rate
RIntr = Real interest rate
RInvest = Real public investment
α and $\beta_1 - \beta_6$ = the parameters to be estimated which signifies the intercept and the slopes of the regressors on the dependent variable.

5.4 Model Transformation

Knowing well the characteristic of time series data which is always associated with a strong trend, coupled with the non-linearity of parameter associated with Cobb Douglas function (Asteriou & Hall 2007), it is considered necessary to transform the data and this function to it natural logarithmic form. This is a way of linearizing its exponential trend as well as the function in other to aid an easy estimation and get a clear result. In order to address the problem of endogeneity and reverse causality between GDP and public debt, lagged value(s) of these variables (dependent and independent) were used as the regressors in the model and are all regressed against RGDP.

The above function is linearized to give the natural logarithm of the variables thus:

$$logY = A + \alpha logL + \beta logK + e \text{ .....(4)}$$

5.5: Estimation Technique

In the econometrics estimation, a Vector Error Correction Model (VECM) is employed in order to investigate the impact of public debt accumulation on long-run economic growth of Nigerian. VECM is considered necessary in order to take account of some issues associated with time series data as this has been justified and considered to be more acceptable method to deal with the nature of time series estimation (Kennedy 2008). Both the lagged value(s) of independent and that of dependent variable are used as the regressors in the estimation. The use of lag is considered knowing that these variables sometimes, do not significantly affect economic activities until after some period of time. In other words, VECM allows the use of both short-run disequilibrium dynamics as well as the long-run information of the variables of interest. Some diagnostic test carried out to test the time series properties of these variables under study include: Unit Root test (ADF/Phillips-Perron); Johansen test of co-integration; Lagrange multiplier (LM) test; and Johansen normality test.

In order to avoid a spurious regression, ADF/Phillip-Perron Unit Root test is necessary considering the trended nature of most time series data over time, which is sometimes not removed entirely even after getting their natural logarithms (Asteriou & Hall 2007). It is therefore necessary to test for the data stationarity to ascertain the constancy of the mean and variances of these variables irrespective of time (i.e. variables' order of integration). If the data are not stationary after testing, they can be differenced (variables' yearly change) in order to entirely remove the trend component. In testing the presence of a unit root in the variables, it was deemed necessary to use both ADF and Phillips-Perron (P-P) test for comparison and accuracy reason. This is for the fact that ADF correct higher order serial-autocorrelation associated with variables while P-P correct serial correlation of the error term thereby modifying the t-statistics of the ADF.
Johansen test of co-integration was also considered necessary in order to ascertain the order of co-integration among the variables and determining the existence of long-run equilibrium relationship between the independent variables and the dependent variable. As know with the assumptions of classical linear regression model

(CLRM), it is expected that the variance-covariance matrix of the disturbance vector are spherical. This means that the residuals should be distributed with constant variance and as well not correlated with each other. Lagrange multiplier (LM) test is therefore used to determine the distribution of the error term in order to avoid a wrong inference from the regression result. Lastly, Johansen normality test is conducted to determine whether the population which the error term is drawn has a zero mean (normally distributed) or otherwise, as suggested by one of the CLRM assumption**.**

5.6 VECM specification

In a more general form, the VECM specification is presented thus:

$$\Delta Y_t = \mu + \sum_{i=1}^{n-1} a_i \, \Delta Y_{t-i} + \sum_{i=0}^{n-1} \gamma_i \, \Delta X_{t-i} - \pi \hat{e}_{t-1} + \varepsilon \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where

ΔY_t = change in the dependent variable (RGDP)

The left hand side denotes vector of the independent variables used in the estimation which includes lagged value of dependent variable (ΔY_{t-1}).

$\hat{e}$ = disequilibrium error

π = error correction coefficient which denotes the magnitude/speed of equilibrium adjustment.

$\varepsilon_{\varepsilon t}$ = the error term which captures every other explanatory variables that affect Nigerian economic growth that are not incorporated in the model

t = time (year t).

a_i and γ_i = the parameters to be estimated which signifies the slope of the different regressors on the dependent variable and

n = number of observations.

VI. Discussion Of Results

6.1 Discussion Of VECM Estimation

Before VECM estimation was carried out, the necessary procedures were taken so as to avoid a spurious regression and to be able to come up with the right judgement and conclusion concerning the result. These steps start with selection of the appropriate lag(s) to use, using the lag selection criterion; testing the stationarity of the variables to be sure they have no unit root using both the ADF and Phillips-Perron (P-P) test. Thirdly, the existence of co-integration among the variables was ascertained using Johansen co-integration test to be sure the variables have long-run association; and finally carrying out the VECM model to ascertain the validity of such long-run relationship among the variables.

6.2 Lag Selection

For the purpose of avoiding a spurious regression and to efficiently test the hypothesised theory in the previous section, it is necessary to determine the time series properties of the variables used for this study. In order to do this, the stationarity of the logarithmic values of the variables was tested and they were found to be non-stationary. Following this, the next step taken to make these variables stationary is differencing them in other to eliminate their trend nature which according to Asteriou & Hall (2007) is the reason behind them being non-stationary. Before this differencing, the selection criteria for number of lags to be used for both the stationarity test and the regression was determined using the lag selection order criteria as indicated in the Table I.

Table I: Lag Selection Order Criteria

Lag	LL	LR	Df	p	FPE	AIC	HQIC	SBIC
0	11.0152				.049797	-.163884	-.061348	.106376
1	29.7369	37.443*	1	0.000	.024182*	-.887219*	-.770035*	-.578351*
2	30.0162	.55861	1	0.455	.024935	-.857803	-.725971	-.510326
3	30.8742	1.716	1	0.190	.02512	-.852007	-.705526	-.465921
4	30.9148	.08134	1	0.775	.026175	-.81285	-.651722	-.388156

From table I above, all the criteria (FPE, AIC, HQIC, and SBIC) indicated a maximum of I year lag and as such, 1 year lag of each of the variables is used for the test.

6.3 Unit Root Test

In order to aid accuracy and comparison and to boast the confidence in the result, Augmented Dickey-Fuller (ADF) and Philips-Perron (P-P) tests is used for determining the stationarity (order of integration) of the variables, both at logarithmic and differenced values. The test result is presented in Table II.

Table II: ADF and P-P Unit Root Test for Value-impact Variables

Variables	ADF		P-P	
	Log level	First dff.	Log level	First dff.
LNRGDP	-0.215	-4.316***	-0.039	-5.671***
LNREXTDBT	-1.223	-4.211***	-1.359	-5.352***
LNRDMDBT	-1.814	-4.645***	-2.274	-5.976***
LNRDSERV	-1.466	-6.127***	-1.365	-8.463***
LNRINVEST	-1.373	-4.038***	-1.193	-7.469***
LNREXRATE	0.406	-3.341***	0.834	-4.760***
RINTRATE	-4.383***	-7.536***	-3.991	-7.118***

Note: the critical values for this test at 1% = -3.580; 5% = -2.930; and 10% = -2.600.

H0: the variables are non-stationary. For the variables to be stationary, the t-statistics must be less than the critical value in absolute term. From Table II above, the result of the unit root test shows that all the variables except interest rate have a unit root at their logarithmic values but became stationary after their first differencing. Interest rate result shows stationarity at it logarithmic value in both ADP and P-P test. Thus all the other variables are integrated of order one denoted as $I(1)$, while interest rate is integrated in the order zero denoted as $I(0)$. The values with three asterisks indicate the stationarity of these variables at both levels of significant. In other words, the null hypothesis of non-stationarity is rejected at all levels after first differencing.

6.4 Co-Integration Test

In order to determine the existence of a long-run relationship (co-integration) among the variables under study, Johansen test for co-integration was carried out. This was done using the logarithmic values of the variables apart from interest rate which does not need to be logged as it is in rate. In determining this relationship, the maximum rank column (i.e. column one) is used as the null hypothesis of how many co-integrating equation that exists among the variables. The decision rule is to accept the first rank which its trace statistic is lower than the 5% critical value.

Table III: Johansen Co-integration Test

Maximum Rank	Parms	LL	Eigenvalue	Trace Statistics	5% Critical Value
0	7	-294.97038	.	153.7597	124.24
1	20	-271.25091	0.59840	106.3208	94.15
2	31	-252.97027	0.50495	69.7595	68.52
3	40	-238.71011	0.42217	41.2392*	47.21
4	47	-229.44808	0.29969	22.7151	29.68
5	52	-223.79104	0.19554	11.4011	15.41
6	55	-219.86963	0.14000	3.5582	3.76
7	56	-218.09051	0.06614		

From Table III, the trace statistics shows the existence of three (3) co-integrating equation among the variables as indicated by asterisks, as the trace statistics became less than 5% critical value from the third rank. This test established the existence of a long run relationship among the variables; hence it proceeds to VECM estimation**.**

6.5 Empirical Results

After establishing the existence of long-run relationship among the variables with the co-integration test above, VECM was estimated and is used to determine the dynamic behavior of the variables in the model. The adjustment coefficient in VECM model indicates the speed of adjustment of dependent variable from its short-run to long-run equilibrium. It shows how slow or fast the errors in the variables converge from its short-run position to long-run equilibrium. This equally validates the existence of a long-run relationship between the variables as suggested by the co-integration test. Thus, the a priori expectation of this model is $-1 \leq VECM \leq 0$, meaning that the coefficient of the target equation (i.e. RGDP) in VECM must be negative and significant shows that there is indeed existence of an errors which tend to be corrected as equilibrium converges. The higher the coefficient of the error term in negative direction or the more close the coefficient is to -1, the higher the speed of adjustment. See the result in Table IV below.

Table IV: VECM Estimation Result for RGDP Model, lag = 1

Variable	Coefficient	Std. error	t-stat	p-value
CE_1	-0.3044304	0.08198	-3.71	0.000
D_LNREXDBT (-1)	-0.6506345	0.2303336	-2.82.	0.005
D_LNRDMDBT (-1)	-0.154367	0.1033741	-1.49	0.135
D_LNRDSERV (-1)	-1.085482	0.4247358	-2.56	0.011
D_LNRINVEST (-1)	0.2725532	0.1764277	1.54	0.122
D_LNREXRATE (-1)	-0.3251297	0.1481815	-2.19	0.028
D_RINTRATE (-1)	2.623807	7.548487	0.35	0.728
R^2 (CE_1) = 0.6677 (67%)				

As known with VECM, all the variables are expressed as a function of its own lagged value(s). From Table IV above the target model in the estimation is the first model (CE_1) which is for RGDP. As can be seen, the coefficient of the error-correction is -0.3044304 with a t-statistics of -3.71 and probability value (p-value) of 0.000. This indicates the robustness of the coefficient that it does not occur by chance since the t-statistics and p-value shows that it is significant at both 5% and 1% significant level. The value of the adjustment coefficient, --0.3044304 implies that the system's adjustment mechanism is slow, showing that only 30% of the previous year's error in the system are corrected in the current year.

The coefficients against each of the independent variable in the table explain the short-run effect of each of them. The t-statistics of external debt domestic debt, debt serving, investment, exchange rate and interest rate, are -2.82, -1.49, -2.56, 1.54, -2.19 and 0.35 respectively. This result of external debt, domestic debt, debt serving, investment, is in conformity with a prior expectations while that of interest rate was is expected to be negative but turned out positive. However, only external debt, debt serving and exchange rate coefficient is significant at all levels showing their strong negative impact on the economy's growth. This insignificancy of other variables in the short-run explains the earlier point of this work that most of the effects of these independent variables on the dependent variable are not immediately felt in the economy but after some period.

VII. Conclusion

The primary focus of this study aimed at investigating the impact of public debt on Nigeria economic growth. Specifically, investigation was carried out on the long-run effect of public debt on the economy's GDP, using data for the period 1961-2013. This empirical investigation was carried out using VECM technique, since Johansen co-integration test confirmed the existence of long-run relationship between the variables of interest. As can be seen from our model in this work, it is plausible to infer that public debt can deter economy growth both in the short-run and in the long-run. The magnitude of adjustment in disequilibrium caused by public debt and other control variables on the economy's growth is revealed in the adjustment coefficient with the value -0.3044304. This indicates a very low speed of adjustment which should always be at the mind of policy makers and thus should always try to avoid circumstance which will make debt contraction a burden to the economy. This finding of the long-run relationship is in conformity with the study of Emmanuel (2012) and Ebi (2013) but against Uma et al. (2013) finding of insignificant result and Tajudeen (2012) finding of a long-run positive relationship between public debt and economic growth. Meanwhile, other channels through which both domestic and external debt can affect the economic growth in Nigeria is recommended for further research.

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Appendix 1: Real data (Million Naira), 1961 – 2013 (53 Observations)

YEAR	R.GDP	R.EXTDBT	R.DMDBT	R.D.SERV	R.INVEST.	R.INT.RATE	R.EX.RATE
1961	2359.53276	49.73485747	53.28235082	0	66.99266314	-1.399147235	0.003679177
1962	2595.66933	71.52679805	84.79692767	0	63.83252108	-0.385632346	0.003830161
1963	2753.806901	93.82209518	101.6864033	0	63.82380678	6.694655352	0.003682244
1964	2892.288737	101.8156784	136.3005057	0	76.41422047	3.643206854	0.003665822
1965	3107.638455	90.3013785	183.4006309	0	79.51957178	0.896541262	0.00375362
1966	3371.989262	104.6327828	227.6102743	0	77.80514514	-4.690346084	0.003997785
1967	2750.392827	131.8841638	237.5593601	0	91.21679908	8.726336765	0.00374487
1968	2654.080256	141.1172934	450.3103491	0	131.0353455	5.226059059	0.003576208
1969	3546.180118	175.6454695	665.214753	91.79923626	122.6720748	-5.655979203	0.003737056
1970	5275.819856	174.8250317	1089.909198	151.6482275	187.612234	-9.257079925	0.004014499
1971	6643.187646	178.2930122	1225.577176	81.4953886	173.3986942	-11.49911485	0.004457742
1972	7178.877571	265.281375	986.1155932	67.22925208	450.7586015	1.042350248	0.004120107
1973	8619.587829	276.5498951	1055.863305	74.65548812	564.9847442	-0.902664454	0.004088401
1974	18796.28845	321.9407746	1260.601842	74.61356911	1221.757251	-8.174393177	0.003974625
1975	21434.28117	349.2326503	1672.304389	108.4128336	3201.582088	-29.96418832	0.004764609
1976	26592.61583	373.712339	2620.675235	918.2788561	4031.72364	-20.8	0.005702079
1977	31434.41007	364.1046739	3397.412743	133.6845564	4990.95659	-11.08783406	0.006340675
1978	34425.56354	1247.947982	4797.737563	308.20458	5182.756575	-16.70924574	0.007064096
1979	41819.27167	1605.532768	7187.287243	228.6003684	4203.875592	-6.709730621	0.006743223
1980	49430.28343	1859.200882	8182.157042	255.9040425	10121.92861	-3.97226199	0.005914119
1981	47385.67019	2319.74513	11137.60267	1022.361592	6534.731583	-14.81282291	0.007317057
1982	48809.70509	8772.745658	14928.21028	1160.995708	6383.253219	0.302252753	0.008092988
1983	52761.65632	10508.84024	22076.74093	1000.524011	4853.894587	-15.21233155	0.010392087
1984	59165.75524	14695.24892	25475.42322	1225.856078	4068.688683	-7.820533286	0.012419694
1985	67349.93059	17158.28433	27719.18919	1592.838546	5419.747082	2.564655172	0.015023164
1986	68545.94623	41092.08487	28191.50336	1617.407792	8452.682819	4.282848546	0.030608347
1987	104205.9494	99815.05777	36433.56416	3890.979989	6310.915125	1.459677419	0.075159875
1988	137019.3319	131966.5179	46331.02401	9101.468681	8216.216453	-41.76122478	0.126137041
1989	211988.1098	235060.8133	46005.85308	12979.23663	14700.58397	-31.96668812	0.293901205
1990	261187.9619	291513.6963	82093.46374	23255.83337	23476.75222	11.13559969	0.326765167

Appendix 1 cont'd

YEAR	R.GDP	R.EXTDBT	R.DMDBT	R.D.SERV	R.INVEST.	R.INT.RATE	R.EX.RATE
1991	303777.8627	319654.8872	113085.8658	25706.78754	27581.67874	1.493026896	0.436732542
1992	512227.2161	523431.5541	171149.9421	18657.6852	38241.29851	-27.08884272	1.069908891
1993	643610.8497	595871.6282	257715.841	76308.36361	51293.31682	-31.16525283	2.083412345
1994	819378.9275	590782.7859	371128.2741	44981.9265	64575.32578	-43.53170891	3.178451855
1995	1652643.355	612826.4495	408400.1076	43648.26265	103557.4232	-59.3355023	5.319109682
1996	2216328.279	506224.9193	344395.2795	43500.88512	174607.3334	-15.76829268	6.67680929
1997	2262981.466	481297.6594	405233.6418	55355.34587	217781.1459	4.970125786	7.081331224
1998	2146164.602	501603.6031	444402.6844	51026.32041	244864.4166	4.313621876	7.670128276
1999	2496639.228	2014634.901	621269.8922	24109.08939	389289.1093	11.38162661	33.76363556
2000	3528262.541	2385002.183	691660.3112	100907.6769	184378.4747	6.566707844	38.46515151
2001	3486977.483	2344011.346	750497.5441	114692.6976	323745.3916	-4.563646209	48.63698214
2002	4934641.916	2807625.547	832389.8408	116942.3643	229426.8481	6.123420797	58.58390167
2003	5824907.223	3073613.25	862799.5911	249488.1598	165878.012	1.718216387	70.00427122
2004	7479875.98	3205538.133	850676.1747	250727.9581	230274.737	0.001966182	80.62857677
2005	8998242.175	1664185.726	787349.6772	243269.0922	320787.1331	-4.863493366	90.79714729
2006	11113236.02	270256.394	1246342.237	149252.8506	330672.1132	4.010473483	93.30497904
2007	12104500.78	252598.4479	1723804.811	125237.965	444938.0116	3.367776348	93.48669627
2008	13585592	292583.974	1297429.937	213152.6787	537293.5433	-1.767983518	94.65547471
2009	13192977.55	314170.7196	1717629.967	133977.7234	613401.3048	-4.097672747	133.0843531
2010	16992377.07	344918.745	2275910	207810.85	441937.25	-7.590201844	150.298025
2011	17743179.65	425368.1695	2666846.359	250038.3031	435659.954	-1.650792594	166.2666018
2012	18069212.39	457658.3292	2913571.452	302732.5425	389870.4627	-0.217007178	185.2413158
2013	18046964.03	590543.4084	3030324.439	352496.0139	471810.8705	3.524172715	198.672946

Source: Central Bank of Nigeria (CBN) Statistical Bulletin 2010; 2011; 2012; & 2013 and World Bank (WB) Data Base.

Appendix 2: Summary Statistics of the Regression Variables

Variables	Observation	Mean	Std. Dev	Min	Max
RGDP	53	3197940	5525109	2359.533	1.81e+07
REXTDBT	53	479911	843004.5	49.73486	3205538

RDMDBT	53	474717.4	788078.5	53.28235	3030324
RDSERV	53	61384.22	94489.13	0	352496
RINVEST	53	123686.6	175768.5	63.82381	613401.3
RINTRATE	53	-6.622194	14.67337	-59.3355	11.38163
REXRATE	53	29.63024	53.68451	0.0035762	198.6729

Appendix 3: Real variables as a ratio of RGDP (1961-2013

YEAR	RGDP	RGDP.GRTH	REDT-RGDP	RDDT-RGDP	RTDBT-GDP	RD.SV-RGDP	RINV-RGDP
1961	2359.53276	-	2.107826529	2.25817381	4.366000339	0	2.839234288
1962	2595.66933	10.00776823	2.755620573	3.266861719	6.022482291	0	2.459193101
1963	2753.806901	6.092361967	3.406996154	3.692575659	7.099571812	0	2.317657305
1964	2892.288737	5.028741727	3.520245992	4.712548369	8.232794362	0	2.641998342
1965	3107.638455	7.445650728	2.905787781	5.901607717	8.807395498	0	2.558842444
1966	3371.989262	8.506485263	3.102998696	6.750029631	9.853028328	0	2.307395994
1967	2750.392827	-18.4341167	4.795102812	8.637288382	13.43239119	0	3.316500763
1968	2654.080256	-3.50177507	5.316994202	16.96671937	22.28371358	0	4.937128228
1969	3546.180118	33.61239207	4.953089342	18.75862846	23.7117178	2.588679458	3.45927366
1970	5275.819856	48.77472888	3.313703584	20.65857492	23.9722785	2.874401166	3.556077332
1971	6643.187646	25.91763606	2.683847299	18.44863101	21.13247831	1.226751267	2.610173059
1972	7178.877571	8.063748222	3.695304348	13.73634783	17.43165217	0.936486957	6.278956522
1973	8619.587829	20.06873977	3.208388853	12.24957998	15.45796883	0.866114362	6.554660796
1974	18796.28845	118.0648172	1.712789073	6.706652996	8.419442069	0.396959056	6.499992031
1975	21434.28117	14.03464696	1.629318229	7.802008266	9.431326495	0.505791786	14.93673645
1976	26592.61583	24.06581596	1.405323723	9.854898262	11.26022199	3.453134742	15.1610645
1977	31434.41007	18.20728833	1.158299688	10.80794179	11.96624148	0.425280946	15.87736681
1978	34425.56354	9.515538733	3.625061885	13.9365549	17.56161679	0.895278242	15.0549651
1979	41819.27167	21.4773772	3.839217433	17.18654332	21.02576076	0.546638809	10.052484
1980	49430.28343	18.19977121	3.761258793	16.55292358	20.31418237	0.51770701	20.477181
1981	47385.67019	-4.13635751	4.895457044	23.50415774	28.39961478	2.157533254	13.79052265
1982	48809.70509	3.005201551	17.97336338	30.58451235	48.55787572	2.378616519	13.07783607
1983	52761.65632	8.096650501	19.91757078	41.84239554	61.75996632	1.89630895	9.199663022
1984	59165.75524	12.13778975	24.83742303	43.0577166	67.89513964	2.071901343	6.876762861
1985	67349.93059	13.83262213	25.47632073	41.15696772	66.63328844	2.365018838	8.047145757
1986	68545.94623	1.775823126	59.94823491	41.12789291	101.0761278	2.359596564	12.33141168
1987	104205.9494	52.02350411	95.78633308	34.96303654	130.7493696	3.733932671	6.056194644
1988	137019.3319	31.48897231	96.31233495	33.81349431	130.1258293	6.642470484	5.996392142
1989	211988.1098	54.71401505	110.8839611	21.70209127	132.5860524	6.122624823	6.934626657
1990	261187.9619	23.20877909	111.6106938	31.43079916	143.0414929	8.903868769	8.988451093

Appendix 3 cont'd.

YEAR	RGDP	RGDP.GRTH	REDT-RGDP	RDDB-RGDP	RTPDT-GDP	RD.SV-RGDP	RINV-RGDP
1991	303777.8627	16.30622655	105.2265245	37.2264999	142.4530244	8.462363684	9.079555202
1992	512227.2161	68.61900715	102.1873765	33.41289504	135.6002716	3.642462683	7.46569048
1993	643610.8497	25.64948316	92.58259529	40.04218405	132.6247793	11.85628919	7.969616555
1994	819378.9275	27.30968223	72.10129113	45.29385144	117.3951426	5.489758766	7.881008849
1995	1652643.355	101.6946372	37.08159099	24.71193233	61.79352332	2.641118092	6.266168853
1996	2216328.279	34.10808039	22.84070117	15.53900127	38.37970244	1.96274557	7.878225215
1997	2262981.466	2.104976352	21.26829878	17.90706853	39.1753673	2.44612458	9.623638073
1998	2146164.602	-5.16207776	23.37209376	20.70683133	44.07892509	2.377558569	11.40939592
1999	2496639.228	16.33027705	80.69387352	24.8842478	105.5781213	0.965661723	15.59252554
2000	3528262.541	41.32048	67.59707236	19.60342529	87.20049765	2.859982094	5.225758362
2001	3486977.483	-1.17012431	67.22186644	21.52286752	88.74473396	3.289172303	9.284413024
2002	4934641.916	41.51631148	56.89623673	16.86829267	73.76452941	2.369824726	4.649310974
2003	5824907.223	18.04113291	52.76673314	14.81224607	67.57897921	4.283126756	2.84773655
2004	7479875.98	28.41193334	42.85549843	11.3728647	54.22836312	3.352033627	3.078590309
2005	8998242.175	20.29934986	18.49456475	8.750038752	27.2446035	2.703517948	3.564997772
2006	11113236.02	23.5045224	2.431842475	11.21493537	13.64677784	1.343018814	2.975479982
2007	12104500.78	8.919677033	2.086814256	14.24102358	16.32783783	1.034639654	3.675806376
2008	13585592	12.23587194	2.153634336	9.550043434	11.70367777	1.568961284	3.954877663
2009	13192977.55	-2.88993257	2.381348095	13.01927453	15.40062263	1.015523015	4.649453108
2010	16992377.07	28.79865065	2.029843992	13.39371173	15.42355572	1.222965152	2.6007971
2011	17743179.65	4.418467082	2.397361566	15.03026183	17.4276234	1.409207977	2.455365738
2012	18069212.39	1.837510236	2.532807293	16.12450719	18.65731448	1.675405302	2.157650561
2013	18046964.03	-0.12312856	3.27225902	16.79132531	20.06358433	1.95321503	2.614350367

Source: CBN Statistical Bulletin 2010; 2011; 2012; & 2013 and WB Data Base.