Abstract. The study examined the impact of external debt on economic growth in Nigeria using Extended Hausman Rodrick Valesco growth diagnostic framework and Three Gap Model. Annual time series data sourced from the Central Bank of Nigeria statistical bulletin between 1981-2018 was regressed using the Augmented Dickey Fuller test (ADF) to check the stationary properties of the series, and the Engel-Granger Co-integration test to estimate the long-run relationship of the variables. The results show that external debt had negative impact on the Nigerian economy.

Keywords. External debt, Economic growth, Economic development, Johansen Cointegration, Time series models, Nigeria.

JEL. F34, F43, F63, C01.

1. Introduction

In recent decades, many developing countries have resorted to huge borrowing from local and foreign nations, creating another burden for the future generation. Interestingly, many of these countries are hard hit by the recent financial crises, which forced them to bail out private interests to prevent a profound economic disaster. However, some economists have suggested it would be better to forgo growth rather than minimise the rate of debts (Shobande, 2018). Some further argued that when debt reaches a certain level, it begins to have adverse effect; debt servicing becomes a huge burden and the debtor nations find themselves on the wrong side of the debt-lafer curve, with debt crowding out investment and growth.

According to Omoleye, Sharma, Ngussam, & Ezeonu (2006), Nigeria is the largest debtor nation in the Sub-Saharan Africa. The genesis of Nigeria’s external debt can be traced to 1958 when 28 million US dollars was contracted from the World Bank for railway construction. Between 1958 and 1977, the need for external debt was on the low side, however due to the fall in oil prices in 1978, which exerted a negative influence on government finances, it became necessary to borrow to correct balance of payments’ difficulties and finance projects. The first major borrowing of
one billion US dollars referred to as Jumbo loan was contracted from the international capital market (ICM) in 1978 (Adesola, 2009). The spate of borrowing increased thereafter with the entry of state governments into external loan contractual obligation.

In 1986, Nigeria had to adopt a World Bank/International Monetary Fund (IMF) sponsored Structural Adjustment Programme (SAP), with a view to revamping the economy, making the country better-able to service her debt (Ayadi & Ayadi, 2008). Today, the increasing fiscal deficits driven by higher level of external debt servicing remains a major threat to national growth as the resultant effect of large accumulation of debt exposes the nation to high debt burden. According to statistics, Nigeria is about the richest on the continent of Africa, yet due to the numerous macro-economic problems, such as inflation, unemployment, sole dependency on crude oil as a major source of revenue, corruption and mounting external debt and debt service payment, majority of her citizenry fall below the poverty line.

This study therefore seeks to empirically investigate the consequential effects of external debt on output growth in Nigeria. In assessing this relationship, the study considered the theoretical appealing of the Hausman Rodrick Valesco Diagnostic Theory as a yardstick for investigating the trend, structure and causes of debt accumulation in Nigeria. On a second thought, the methodological issues surrounding debt–growth relationship and adapted model that was comprehensive enough in capturing external debt and other structural parameters that explained the economic behavioral patterns of external debt in Nigeria in recent years, were considered. The findings of this study provide better strategic options to tackle debt “bondage” in Nigeria and enhance macroeconomic reality.

The rest of this paper is presented in four sections. Section two focuses on the theoretical underpinnings as well as a review of previous studies while section three provides a robust description of the theoretical architecture and research methodology. Section four shows the analysis and empirical result of the study while discussion and possible policy recommendation were discussed in section five.

2. Previous work

According to Shobande (2015) the contributions of theoretical work in understanding the linked between external debt and output growth is not matched by empirical studies. Shobande (2018) noted that despite studies on relationship between external debt and economic growth has been exhaustively discussed, mixed results were reported. Thus, this underscores the importance and relevance of this subject. From the extensive literature, it is acknowledged that external debt affects economic growth through various channels. First, it could impact growth through the current stock of debt (Taylor, 2010). Second, it could impact growth through past accumulated debt and third, through debt service ratio. The second and third channels govern the debt overhang and crowding out.

hypothesis. For instance, several studies have examined the debt-growth relationship through its link with investment. One of such studies is Bauerfreund (1989) estimated the computable general equilibrium model for external debt payment and investment in Turkey and reported that external debt payments obligations reduced investment levels.

Savvides (1992) analysed the impact of debt on the economic performance of 43 highly indebted less developed countries. He used cross-sectional data and employed the two-stage limited dependent variable model method. The study concluded that debt overhang has significant negative effect on investment rates and future economic growth. Cohen (1993) estimated an investment equation for 81 developing countries for the period 1965 to 1987 using the ordinary least square method, he found that debt servicing crowded out investment; but debt stock does not affect investment and GNP growth rates in highly rescheduling developing countries.

Warner (1992) analysed the effect of debt crisis on investment in 13 less developed countries for the period 1982-1989 using ordinary least square estimation technique. He argued that external debt does not have a significant effect on investment; that the declining investment in these countries is partly due to declining export prices, high world interest rates and sluggish growth. Deshpande’s (1997) study focused on the validity of the debt overhang hypothesis in Algeria, Argentina, Ivory Coast, Egypt, Honduras, Kenya, Mexico, Morroco, Peru, Philippines, Sierra Leone, Venezuela and Zambia. He argued that the adjustment measures applied by these countries often have negative impact on investment and growth potential.

The causality between external debt and economic retardation in Bangladesh was given attention by Chowdhury (1994). Using data from Indonesia, Malaysia, Philippines, South Korea. Sri Lanka, and Thailand for the period 1970-1988, he found that external debt has a positive effect on GNP growth rate in Bangladesh, Indonesia and South Korea. In the case of Philippines, the result indicated a positive effect of GNP growth rate on external debt accumulation. The results also show a bi-directional relationship between external debt and economic growth for Malaysia and Philippines. In a related study, Amoateng & Arnoako (1996) investigated the relationship between external debt and growth for 35 African countries using Granger causality test. Their results showed a positive relationship between foreign debt service and economic growth.

Karagol (2002) investigated the relationship between external debt and economic growth for Turkey during the period 1956-1996. The Granger causality test showed a one-way negative relationship from debt service to economic growth. Ajsafe et al.’s (2006) work investigated the causal relationship between external debt and foreign private investment in Nigeria. They found using co integration test that there was no long run relationship between external debt and foreign private investment in

Nigeria. The causality result showed a bi-directional relationship between the two variables.

Smyth & Hsing (1995) examined the impact of federal government’s debt on economic growth. They also investigated if the optimal debt ratio exists. They found that the debt/GDP ratio corresponding to the maximum GOP growth rate was found to be 38.4 percent. They posited that between the 1980s and early 1990s, debt ratio rose but was below 38.4 percent. They, therefore, concluded that external debt stimulates economic growth during this period, but it was expected to hurt economic growth after 1993. Karagol (2004) investigated the impact of debt on growth in a cross-country study and found that the decline in investment and growth performance of highly indebted countries could be attributed partly to the problem of debt overhang. The study added that there was no generalized conclusion on the impact of debt on economic growth as country-specific factors play important role in the relationship.

Cunningham (1993) examined the relationship between debt burden and economic growth for sixteen highly indebted nations during the period 1971-1987. He concluded that external debt burden had strong negative impact on economic growth during the period 1971-1979. Similarly, using data from 1970 to 1986, Osei (2000) analysed the impact of foreign debt on the economy of Ghana using data from 1983 to 1990. Using debt service ratio and debt-GNP ratio, the paper found that Ghana’s external debt has negatively impacted on the growth of its economy. Clement, Bhattacharya & Nguyen (2003) examined the path through which external debt impacts economic growth in low income countries. They found that a substantial reduction in the stock of external debt would directly increase per capita income by 1 percent point per annum. They also noted that reductions in external debt service would boost economic growth through its effects on public investment. They further claimed that if half of debt service resources were directed towards public investment, economic growth would increase in some countries by an additional 0.5 percent point per annum.

Rais & Anwar (2012) examined the impact of public debt on economic growth in Pakistan from 1972 to 2010. They found that both domestic and foreign debt have negative effects on economic growth in the country. Essien & Onwioduokit (1998) tested the impact of foreign debt on economic growth in Nigeria. They posited that the debt burden and its servicing limits Nigeria’s access to foreign exchange to finance importation of capital goods and other materials needed for economic growth. They found evidence for the validity of the debt overhang theory in Nigeria. Iyoha (1999) used simulation approach to investigate the impact of external debt on economic growth in sub-Saharan African countries for the period 1970 to 1994. The study found that debt overhang undermined investment through both a disincentive and crowding out effect. Simulation results showed that reducing debt stock by 20 would have increased investment and growth by 18 and 1 respectively during the 1987-1994 periods.

Audu (2004) performed a comprehensive study on the impact of external debt on economic growth and public investment in Nigeria using the ordinary least square and taking cognizance of the non-stationary nature of economic time-series. The results revealed that debt servicing has significant negative effect on economic growth in Nigeria. Contrary to expectation and in line with past studies (Cohen, 1993), the study also found that accumulated debt engenders growth in Nigeria thereby contradicting the debt overhang hypothesis.

Osinubi & Olaleru (2006) investigated the link between budget deficits, external debt and economic growth in Nigeria using data from 1970 to 2003. Like Smyth & Hsing (1995), the result confirmed that the effect of external debt on economic growth in Nigeria is not linear.

A dynamic study by Dinneya (2006) examined the impact of external debt on economic growth under different political regime. By examining the link between democracy, external debt and growth in Nigeria, he established that the political leadership under which external debts are contracted and utilized could have a significant influence on the impact of debt on economic growth. The result shows that the impact of external debt on economic growth is mixed. However, democracy and political conditionality does not have significant impact on the effectiveness of debt.

Adepoju, Salau & Obayelu (2007) examined the effect of external debt on sustainable economic growth and development in Nigeria. They found that access to external finance is important for the economic development of a nation. They, however, concluded that failure to service the debt obligations as in the case of Nigeria is inimical to economic growth and development and may also undermine efforts to access external finance and assistance in the future.

Adesola (2009) examined the impact of debt servicing on economic growth in Nigeria using data from 1981 to 2004. He disaggregated the payments made to the various multilateral financial creditors and regressed the resulting data on GDP and gross capital formation. He found that payment made to Paris Club and promissory notes holders have positive effect on economic growth and gross capital formation while payments made to London Club and other creditors exerts negative effects on GDP and gross capital formation.

Ayadi & Ayadi (2010) used the ordinary least square and generalized least square methods to investigate the impact of external debt and its servicing requirements on economic growth in Nigeria and South Africa. They found that external debt had a negative impact on economic growth in the two countries but added that South Africa was better than Nigeria in the application and utilization of loans. Their findings also supported Smyth & Hsing (1995) and Osinubi & Olaleru (2006) findings that debt promotes growth to a certain point after which its effect becomes counter-productive.

Ogunmuyiwa’s (2011) examined whether external debt promotes economic growth in developing countries using Nigeria as a case study. He
used the Augmented Dickey Fuller test, Granger causality, Johansen co-integration test and error correction methods to analyze time-series data from 1970 to 2007. His study revealed that no causality exist between debt and economic growth and the relationship between the two variables was weak and insignificant. Abubakar (2011) added a new dimension to the literature on the effect of external debt and economic development, using Nigeria as a case study and causality and regression as the technique, the study examined the impact of external debt on population in poverty, life expectancy, unemployment, GDP per capita and literacy rates. The results indicate external debt improves life expectancy and reduce the population living below the poverty line. Further results show that external debt has a negative effect on literacy rate and GDP per capita. There was also found an evidence for unemployment -reducing effect of external debt, although not significant.

Okonkwo & Odularu (2012) considered the link between external debt, debt burden and economic growth in selected West African countries for the period 1970 to 2007. This study initially employed the vector autoregressive model and found that the relationship between debt and growth was difficult to estimate. Thus, the Engel-Granger cointegration technique shows external debt stock and burden exert negative effect on growth. Contrary to expectation, the result also shows that external debt stimulates investment.

Chauvin & Kraay (2005) sampled 62 low-income countries on the extent to which debt relief induces government to embark on social spending. They conclude that the marginal benefits of debt relief may not be same in Africa, Latin America and Asia. Lora & Olivera (2006) tested the crowding out effect of public debt on social services between 1985 and 2003 and found that the effect comes mostly from stock of debt and not debt service. Thus, if Lora & Olivera’s (2006) results hold for Africa, beneficiaries of debt relief should have increased their expenditure in the social sector (Dessy & Vencatachellum, 2007).

Dessy & Vencatachellum’s (2007) study showed that if a government has a high discount factor, it would rather consume than invest once debt relief was granted. This is particularly true of most developing countries that have high marginal propensity to import. Cooper & Sachs (1985) and Arslanalp & Henry (2004) who argued that the problem faced by debt-relieved countries is the lack of good institutions. Thus, if the status-quo remains the same, the new debt-relief initiative would not achieve their objectives to increase growth promoting expenditure in these countries. Similar studies that have found relationship between debt and growth include Cohen (1995), Bovenszttern (1990), Elbadawi et al., (1997) and Patillo et al., (2002, 2003).

El-Shibly & Thirlwal (1981) used the two-gap model to investigate the dominant resource constraints in Sudan on two alternative growth rate assumptions. First, 5.5 per cent per annum being the historical average between 1960-75 and second, 7.5 per cent, being the target of the Sudanese
six-year plan, 1977/1978-1982/83 was used. Their result was also consistent with the original Chenery hypothesis. However, in estimating the Investment-Savings gap and the Export-Import gap, the authors treated the two gaps as being mutually exclusive, whereas they are not.

The devaluation of the country’s currency could not lead to continuously growing GDP growth rates. But after the year 2000, when the country’s debt burden had substantially fallen, the country’s falling GDP ratio could not be justified by high foreign debt burden. Dijkstra (2000), claimed that the World Bank has contributed to the debt overhang in developing countries. She argued that this institution, by monopolizing the dual role of creditor and controller in the international finance framework, faces an obligation to finance failing economies. In Niall Ferguson’s forward in *Dead Aid*, Moyo (2009) he supported this notion as he condemned concessional loans. He claimed that they are awarded under relatively easy terms, which reduced the distinction between these loans and aid. This distinction problem made government control difficult, and suppressed government’s motivation to save and invest. He further suggested that aid provided in kind kills the motivation of developing countries to persist in the learning process which eventually enforces GDP growth.

Matuka & Osafo (2018) employed a co-integration analysis and an error correction methodology to examine the impact of external debt on economic growth in Ghana using annual time series from 1970-2017. Their estimates show that our normalized long-run co-integrating growth equation coefficients do not differ from our short-run vector error correction coefficients for our variables of interest. The study reported that external debt inflows stimulate growth in Ghana both in the long-run and short-run. Secondly, our study also confirmed the crowding out effect, debt overhang effect and the non-linear effect of external debt on economic growth in Ghana.

Complication arises from two sources. Firstly, that there are different opinions about the definition of terms such as debt, growth, exchange rate and condition for growth. Secondly, there are different interpretations about relationship between variables in growth theory especially those that are passive and active. Models usage has been subject to criticism.

3. Research method

3.1. Theoretical framework

The growth diagnostic theory developed by Hausman, Rodrick, Valesco (2008), Henceforth HRV, is the foundation of this work. The study proposed a pragmatic way of identifying the main reason for low level of economic growth in under-developed countries and possible transformation strategies. They observed that LDCs are faced with macroeconomics instability, unstable and stubborn fiscal problem, corruption, low productivity, financial instability, weak institution and

market failure. HRV argued that debt level must be manageable as well as reform institution, if a meaningful development must occur. The approach further suggested an analytical framework for identifying the most binding constraints that hamper economic growth in specific country at a specific point in time, thus allowing policymakers to prioritize those reforms that relax the binding constraints.

3.2. Empirical strategy
In this study, the three gap model developed by Solimano (1990) is used to examine the selected macroeconomic constrained. The model has been used by Bacha (1990), Taylor (1993), and Sogotemi (2000) to investigate debt cum growth relationship. However, the analysis used here drew heavily on the methodological framework by Redshirt (2005) who specified the three-gap model as: Fiscal, Saving and Exchange rate constrained. He further stated that fiscal constrained is intended to reflect the impact of availability of resource to finance public investment through external debt. Saving domestically and externally are also used to show low saving potential of the undeveloped economy. Foreign exchange also shows the gap in import and export (Matuka & Asafo, 2018).

The Model
Given the above and considering the work of Matuka & Asafo (2018) the baseline of this present study is in the stated below:

\[ y = f(ed, ge, inf, pds) \] (1)
\[ y_t = \beta_0 + \beta_1 ed_t + \beta_2 ge_t + \beta_3 inf_t + \beta_4 pds_t + \mu_t \] (2)

Where: the endogenous variable as \( y \) = real Gross Domestic Product while the exogenous variables are \( ed_t \) = external debt stock, \( inf \) = inflation rate, \( pds \) = external debt service payment, \( ge \) = government expenditure and \( \mu_t \) = error term. \( \beta_0 \) = constant and \( \beta_{1-4} \) = the marginal effect of each exogenous variables.

Estimation techniques
The time series properties of the variables incorporated in multiple regression model (2) is examined using the Augmented Dickey-Fuller unit root test in order to determine the long-run convergence of each series to its true mean. The test involves the estimation of equations with drift and trends as proposed by Dickey & Fuller (1988). The test equations are expressed as:

\[ \Delta Z_t = \eta_0 + \eta_1 Z_{t-1} + \sum_{i=1}^{n} \pi_i \Delta Z_{t-i} + \nu_t \] (3)
\[ \Delta Z_t = \eta_0 + \eta_1 Z_{t-1} + \eta_1 t + \sum_{i=1}^{n} \pi_i \Delta Z_{t-i} + \nu_t \] (4)

\( H_0 : \eta_1 = 0 \)
\( H_1 : \eta_1 < 0 \)

The time series variable is represented by $Z_t$ and $\nu_t$ as time and residual respectively. Equation (3) and (4) are the test model with intercept only, and linear trend respectively (Shobande & Etukomen, 2018; Shobande, 2018).

The specified multiple regression model (2) is estimated through the use of Ordinary Least Square Estimator and other time series diagnostic tests are employed such as Ramsey RESET test for the entire structural stability of the model in line with underlining classical assumptions; residual diagnostic tests like Histogram normality test, Breusch Godfrey serial correlation LM test, Breusch-Pagan-Godfrey (BPG) and ARCH Heteroskedasticity tests; and Variance Inflation Factors (VIF) test to examine the level at which the estimated coefficient variance is inflated due to multicollinearity.

3.3. Descriptive statistics

The summary statistics indicated that the average value of gross domestic product growth rate ($Y$) stood at 14.11%. This implies that Nigerian economy grew at an average value of 14.11% annually between 1981 and 2012. Also, the average values of external debt (ED), government expenditure (GE), inflation rate (INF), and public debt servicing (PDS) stood at 12.8%, 12.37%, 2.75%, and 10.54% respectively.

Table 1. Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>ed</th>
<th>ge</th>
<th>inf</th>
<th>pds</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>12.76</td>
<td>12.37</td>
<td>2.75</td>
<td>10.53</td>
<td>14.12</td>
</tr>
<tr>
<td>Median</td>
<td>13.29</td>
<td>12.73</td>
<td>2.54</td>
<td>10.88</td>
<td>14.81</td>
</tr>
<tr>
<td>Maximum</td>
<td>15.40</td>
<td>15.37</td>
<td>4.29</td>
<td>13.18</td>
<td>17.04</td>
</tr>
<tr>
<td>Minimum</td>
<td>7.75</td>
<td>9.17</td>
<td>1.54</td>
<td>6.91</td>
<td>10.77</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>1.99</td>
<td>2.09</td>
<td>0.80</td>
<td>2.08</td>
<td>2.24</td>
</tr>
<tr>
<td>Sum Sq. Dev.</td>
<td>118.51</td>
<td>131.45</td>
<td>19.32</td>
<td>130.18</td>
<td>151.02</td>
</tr>
<tr>
<td>Observations</td>
<td>37</td>
<td>37</td>
<td>37</td>
<td>37</td>
<td>37</td>
</tr>
</tbody>
</table>

Source: Authors computation

Table 1. showed that the standard deviation of gross domestic product growth rate ($Y$) stood at 2.24%. It means that annual deviation of annual gross domestic product growth rate ($Y$) from its long-mean is 2.24% every year. Also, deviation of external debt and other macroeconomic indicators such as external debt (ED), government expenditure (GE), inflation rate (INF), and public debt servicing (PDS) from their long-run mean are 1.99%, 2.09%, 0.8% and 2.08% respectively.

Similarly, the time series plot of gross domestic product growth rate ($Y$), external debt (ED), government expenditure (GE), inflation rate (INF), and public debt servicing (PDS) are presented on Table 1. A closer look at GDP growth rate trend indicated a cyclical growth pattern between 1981 and 2018. That implying that GDP growth rate in Nigeria had not been consistent and indicating varying rate of growth. However, there is clear evidence from Table 1 that the GDP growth rate increased not in real value...
during the post-2009 crisis, while the external debt was not impressive throughout the reviewed periods as its trend increased overtime.

3.4. Unit root test analysis
The stationary test results of the incorporated times series variables in the regression model is presented in Table 2 using the Augmented Dickey-Fuller (ADF) unit-root test. The test results indicated that the inflation rate (INF) is stationary, mean reverting and convergence towards its long-run equilibrium. Then, the series was integrated of order zero i.e. I(0).

<table>
<thead>
<tr>
<th>Series</th>
<th>T-ADF Statistics</th>
<th>Critical Value</th>
<th>Order of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>ly</td>
<td>-4.065274</td>
<td>1% level: -4.309824</td>
<td>I(1)</td>
</tr>
<tr>
<td></td>
<td>(0.0174)</td>
<td>5% level: -3.574244</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% level: -3.221728</td>
<td></td>
</tr>
<tr>
<td>led</td>
<td>-4.485011</td>
<td>1% level: -4.296729</td>
<td>I(1)</td>
</tr>
<tr>
<td></td>
<td>(0.0064)</td>
<td>5% level: -3.568379</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% level: -3.218382</td>
<td></td>
</tr>
<tr>
<td>lge</td>
<td>-4.384070</td>
<td>1% level: -4.309824</td>
<td>I(1)</td>
</tr>
<tr>
<td></td>
<td>(0.0084)</td>
<td>5% level: -3.574244</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% level: -3.221728</td>
<td></td>
</tr>
<tr>
<td>inf</td>
<td>-3.880622</td>
<td>1% level: -4.296729</td>
<td>I(0)</td>
</tr>
<tr>
<td></td>
<td>(0.0257)</td>
<td>5% level: -3.568379</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% level: -3.218382</td>
<td></td>
</tr>
<tr>
<td>lpsd</td>
<td>-7.075995</td>
<td>1% level: -4.296729</td>
<td>I(1)</td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>5% level: -3.568379</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% level: -3.218382</td>
<td></td>
</tr>
</tbody>
</table>

Source: Extracted from Appendix.

The test result indicated that all the time series variable i.e. changes in gross domestic product growth rate (Y), external debt (ED), government expenditure (GE) and public debt servicing (PDS) were not stationary at levels i.e. first-difference of these series are mean reverting and stationary. Then, the series was integrated of order one i.e. I(1). Although, econometric literature has indicated that linearly combining or regressing both stationary and non-stationary series on non-stationary time series might yield spurious regression and render estimated parameters inefficient, this argument prompted the cointegration test to examine if the linear combination of our considered macroeconomic variables yielded stationary residual.

4.5. Cointegration and long-run estimates
The long-run relationship among external debt, other macroeconomic variables and economic growth in Nigeria between 1981 and 2018 was examined using the Engle-Granger cointegration technique and the test results are shown in Table 3.
The cointegration result presented in Table 3 indicated that the estimated residual (ECM) from the main empirical model was found to be stationary at level. This showed that the null hypothesis “no cointegration” was rejected at 5% significance level. This implies that there existed long-run relationships among external debt (ED), government expenditure (GE), inflation rate (INF), public debt servicing (PDS) and real gross domestic product (Y) in Nigeria between 1981 and 2018. Thus, there was long-run relationship between external debt vis-à-vis economic growth in Nigeria.

The cointegrating equation was estimated using the ordinary least square (OLS) method and the long-run estimates are presented in Table 4.

The estimates of the long-run model that captured the effect of external debt on economic growth in Nigeria between 1981 and 2018 indicated that government expenditure (GE), inflation rate (INF) and public debt servicing (PDS) exert positive effect on real gross domestic product (Y) in Nigeria during the reviewed period. All the variables were found to be in line with the a priori expectation except for inflation rate and public debt servicing. In magnitude term, a 1% increase in inflation rate (INF), changed in government expenditure (GE) by 0.001%, and public debt servicing (PDS) by 10% enhanced economic growth proxy by real gross domestic product (Y) by 1.12% respectively. Thus, external debt (ED) was found to exert negative impact on economic growth (Real gross domestic product (Y)) which was not in line with theoretical expectation. In magnitude, a 1%
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percentage increase in external debt (ED) deteriorates economic growth proxy (Real gross domestic product (Y)) by 0.63%.

In term of the significance of the estimated parameters for the considered variables, the t-statistics results are presented in Table 4. The results showed that the estimated parameter for government expenditure (GE) was found to be statistically significant at 5% critical level because their p-values are less than 0.05. Other variables’ parameters i.e. inflation rate (INF), public debt servicing (PDS) and external debt (ED) were statistically insignificant at 0.05 and 0.10 critical regions.

Although, the F-statistic result indicated that the external debt and other indicators were simultaneously significant at 5%, this prompted the rejection of the null hypothesis (external debt has no significant effect on economic growth in Nigeria). The adjusted R-squared result revealed that 98.9% of the total variation in economic growth is accounted by changes in inflation rate (INF), government expenditure (GE), public debt servicing (PDS) and external debt (ED) during the review period. The Durbin-Watson test result reveals that there is presence of moderate positive serial correlation among the residuals, because of the d-value (1.3923) was less than two. Also, the result is not spurious since coefficient of determination was not greater than Durbin-Watson value.

3.6. Linear error correction mechanism (ECM) analysis

The short-run analysis of the relationship between external debt and economic growth in Nigeria between 1981 and 2018 was examined using error correction mechanism (ECM) model and the estimated results were shown in Table 5.

**Table 5. Short run linear error correction estimates**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.142876</td>
<td>0.045422</td>
<td>3.145548</td>
<td>0.0044</td>
</tr>
<tr>
<td>D(LNED)</td>
<td>-0.113688</td>
<td>0.066117</td>
<td>-1.719493</td>
<td>0.0984</td>
</tr>
<tr>
<td>D(LNGE)</td>
<td>0.422712</td>
<td>0.175668</td>
<td>2.406310</td>
<td>0.0242</td>
</tr>
<tr>
<td>D(INF)</td>
<td>0.001186</td>
<td>0.001752</td>
<td>0.677081</td>
<td>0.5048</td>
</tr>
<tr>
<td>D(LNPDS)</td>
<td>0.041347</td>
<td>0.062563</td>
<td>0.660891</td>
<td>0.5150</td>
</tr>
<tr>
<td>ECM (-1)</td>
<td>-0.494606</td>
<td>0.196037</td>
<td>-2.523021</td>
<td>0.0187</td>
</tr>
</tbody>
</table>

| R-squared    | 0.7881      |
| Adjusted R-squared | 0.6398  |
| S.E. of regression | 0.1711   |
| F-statistic   | 11.9428     |
| Prob(F-statistic) | 0.0000 |
| Durbin-Watson stat | 1.7387   |

**Source:** Extracted from Appendix.

There is a clear evidence of reserve effect in the short-run compared to the long-run estimates presented in Table 5. All the variables still maintained their respective signs and statistical significance at both 5% except for external debt which became significant at 0.10. However, the O.A. Shobande, & A.S. Adedokun, JEB, 6(4), 2019, p.340-356.
ECM reported that the model was free from autocorrelation problem since the value of Durbin-Watson was approximately two. However, the coefficient of determination with a value of 64.0% was still lower than the Durbin-Watson value, which denoted the non-spuriousness of the model.

The first-lag of the error correction term (ECT) was found to be statistically significant at 0.05 and correctly signed with the co-efficient of -0.4946 implying that there is long run relationship among the variables. Also, it further showed that 49.5% of the distortion in the short-run was corrected in the first year in attaining equilibrium or sustainable economic growth on the basis of the changes in external debt and its other macroeconomic indicators in Nigeria.

3.7. Higher-order test

The Breusch-Godfrey serial correlation test result from Table 6 reported that we do not reject the null hypothesis “no serial correlation” at 5% significance level, and likewise for the Breusch-Pagan-Godfrey heteroskedasticity test, the result indicated that we do not reject the null hypothesis “no heteroskedasticity” at 5% significance level.

Table 6. Post-test: Serial Correlation LM Test

<table>
<thead>
<tr>
<th>Test Description</th>
<th>F-statistic</th>
<th>Prob. F(2,22)</th>
<th>Obs*R-squared</th>
<th>Prob. Chi-Square(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breusch-Godfrey Serial Correlation LM Test:</td>
<td>0.242526</td>
<td>0.7867</td>
<td>0.647167</td>
<td>0.7236</td>
</tr>
<tr>
<td>Heteroskedasticity Test: Breusch-Pagan-Godfrey</td>
<td>1.469073</td>
<td>0.2367</td>
<td>7.030096</td>
<td>0.2184</td>
</tr>
</tbody>
</table>

Source: Extracted from Appendix.

Table 6 below reports the probability value of the Jarque-Bera statistic (0.40975), which showed that the estimated residual series was normally distributed with zero mean and constant variance. This tended to improve the reliability of the estimated parameters and thus, necessitated other residual diagnostic test such as higher order serial correlation and heteroskedasticity tests.

4. Concluding remarks

Considering the observed nature of the effect of external debt on economic growth rate in Nigeria during the period under reviewed (1981-2018), the following strategic policy options are proffered: the government should be more careful on terms and agreement of interest on debt and cost of its debt service payments so that it would not retard the growth rate of the Nigerian economy. The federal government should ensure that debt is used in financing developmental projects meant for economic prosperity and standard of living improvement; and strategic macroeconomic policies should be instituted in order to encourage domestic private investment at home and abroad because of its significant capacity to enhance the growth of the Nigerian economy.
References


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Soludo, C.C. (2003). Debt poverty and inequality. in O. Iweala, & A. Muntar (Eds), The Debt Trap in Nigeria, (pp.23-74), Africa World Press NJ.


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