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Debt-Growth Bond in Nigeria: Structural Break Analysis

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Abstract
This study examined the structural break relationship between external debt and economic growth from 1985 to 2016 with a view to examine the effect of external debt relief on economic growth in Nigeria. The study used the ordinary least square technique. In addition, it employed the chow test and also adopted the similarity of error variances test in its analysis. From the results and analysis, it was revealed that external debt stock (EXD) is positively and insignificantly related to RGDP. It was concluded that the 2005 external debt relief did significantly caused a change in external debt, external debt service relations with economic growth in Nigeria. Based on these findings, the study suggested that external finance should be used only for projects of highest priority. Spending of external debt on productive self-liquidating investments must be strictly adhered to while projects to be financed with external loan must be properly appraised.

Keywords: Debt, Growth, Structural Break, Similarity of Error Variances Test, Nigeria

1. Introduction

The motive behind external debt is to boost economic growth and development of any nation but as a result of future high debt service payments, it poses a serious threat to the economy of that nation. Economic researchers have therefore sought out to investigate the implication of external debt burden on the economies of debtor nations and have come up with diverse views (Safdariand Mehrizi, 2011; Ejigayehu, 2013). Base on the empirical analysis of (Elbadawi et al., 1997; Pattilo et al., 2004; Clements et al., 2003) that the debt-growth relationship follows a bell-shaped curve where, beyond a certain threshold, the impact of debt on growth becomes negative. This suggests that debt relief can reduce the debt stock below that peak threshold, which helps to reinstate the incentives to invest. This threshold is similar to the debt overhang that Nigeria has experienced which led to the 1999 struggle for debt relief.

Many studies have been conducted in Nigeria to investigate whether or not debt relief granted to Nigeria is effective in improving its economic growth(Fosu, 2007;Omotola and Saliub, 2011;Ekperiware and Oladeji, 2012).Bakare (2010) investigated whether or not debt relief granted to Nigeria is effective in improving its economic growth and development. The results show that debt overhang problem of Nigeria had been alleviated by the debt forgiveness but the growth indicator was not positively influenced by the debt service relief which one would expect. The answer to the question of the study –if debt relief has brought an improvement to the economic performance of the nation so far is therefore disillusioning. All in all, the findings suggest that the debt relief has not led to high economic growth in Nigeria. This result is similar to what were found in similar studies for some highly indebted countries, which have received debt relief.

The review of empirical and methodological issues show that authors have used paired sample t-test statistics, to using Ordinary Least Squares method (OLS), to using quarterly time series in studying the debt relief granted to Nigeria effective in improving economic growth. However, this study examined the structural break relationship between external debt and economic growth from 1985 to 2016 with a view to examine the effect of external debt relief on economic growth in Nigeria.

2. Research Methodology

This study relies heavily on data collected from secondary sources covering the period 1985-2016. The choice of this period is because Nigerian external debt really began to mount within this period and the 1999 struggle for debt relief that finally came in 2005. To be précised, from 1985 to2005 is the period preceding the October 2005 external

debt cancellation and from 2006 to 2016 is the post debt cancellation period. The period is furthermore justified because of availability of data. The data were collected from Statistical Bulletin of the Central Bank of Nigeria. Annual time series of external debt, external debt service, exchange rate and real gross domestic product (RGDP) were used to determine the structural break effect of external debt on economic growth in Nigeria as a result of debt relief. The time series variables when used in their explosive form often leads to spurious regression results which mislead policy. In view of the above, this study adopted Augmented Dicky Fuller (ADF) test for unit root in order to attain stationarity of the series. Thereafter, the study used the ordinary least square technique because of its qualities: best linear unbiased estimates. In addition, the study employed the chow test and also adopted the similarity of error variances test in its analysis. The chow test is a test that determines if the coefficients from two regression analyses are the same where each of the equations represents a different group. The null hypothesis is then tested by running three (3) regressions: one for each group and one for the entire sample. Thereafter, the F-test is employed to determine if the models are significantly different from one another. The analysis was conducted with the use of E-views software.

2.1 Model Specification

The relationship between economic development and public debt in developing countries has largely been based on a standard production function model:

Y = F(K,L) ----------(1)

Where Y, L and K are measures of output, capital and labor respectively. According to debt overhang theory, if the debt of a country is more than its repayment capacities, this discrepancy will negatively affect investment and the ability to work and therefore affect the growth of the economy. The present study includes external debt, external debt service and exchange rate in the growth function. The study extended the function from Eq (1) to Eq (2) as:

Y= F(External debt, External debt service, Exchange rate) ---------- (2)

In Eq (2), the variables are used in order to determine the individual effects on economic growth. This study therefore adopts the Cobb-Douglas production function to establish the output equation for Nigeria for the 30 years period, 1985 to 2014.

$$RGDP_t = A_t ExD_t^{\alpha} EDS_t^{\beta} ExR_t^{\gamma} \quad \ldots\ldots\ldots (3)$$

Where α, β and γ are treated as the elasticity coefficients of the external debt service and exchange rate respectively by undertaking a simple manipulation of taking the natural logarithms on both sides, Eq (3) is re-written econometrically as:

$$In\ RGDP_t = A_t + lnExD_t + Bln\ EDS_t + \gamma ExR_t + \mu_t \quad \ldots\ldots\ldots\ldots (4)$$

Two periods were observed: Pre and post 2005 external debt relief periods. Thus, we have 3 possible regression specifications:

Time period 1985-2005

$\log Y_t = a_0 + a_1 \log W_t + a_2 \log X_t + a_3 Z_t \ldots + \mu_{1t}$ ---------- (5)

Time period 2005-2016

$\log Y_t = b_0 + b_1 \log W_t + b_2 \log X_t + b_3 Z_t \ldots + \mu_{2t}$ ---------- (6)

Time period 1985-2016

$\log Y_t = c_0 + c_1 \log W_t + c_2 \log X_t + c_3 Z_t \ldots + \mu_t$ ---------- (7)

Where:Y_t = Real Gross Domestic Product (RGDP); W_t = External Debt Stock (EXD); X_t = External Debt Service (EDS); Z_t = Exchange Rate (EXR); μ_t = Error Term; $a_1 \ldots a_n, b_1 \ldots b_n, c_1 \ldots c_n$= Slopes of the variables for estimation; a_0, b_0, c_0= Constant factors.

Real Gross Domestic Product is a measure that reflects the value of goods and services produced in a given year. It is used to capture economic growth in this study because it is adjusted for inflation and as such provide a more accurate figure. External Debt Stock is the amount at which the debt was contracted and it is used as a proxy for capturing external debt burden. External Debt Service Payment is the amount used in repaying the external debt it is also. It is also used as proxy for capturing external debt burden. Exchange rate is the price of a nation's currency in terms of another currency. It is included in the model because it is a macroeconomic indicator and it is also a monetary aggregate in the open economy. Real Gross Domestic Product (RGDP), External Debt Stock (EXD) and External Debt Service Payment (EDS) were logged due to the large nature of their values. Exchange Rate (EXR) was not logged because it is a rate. The signs of these variables are based on apriori expectation. That is, the

direction of the relationship between the respective independent variables and the explained variable is according to their relationship in standard economic theory. As such, the following should be expected:

$a_1, b_1, c_1>0$; $a_2, b_2, c_2<0$; $a_3, b_3, c_3>0$

3. Results and Discussion

3.1 Chow Test Estimation Result

Between 1985 and 2005

LOG (RGDP) = 5.359553+0.028237LOG (EXD) + 0.078189LOG (EDS)
+0.001124(EXR)

t= (46.63572) (0.906126) (2.612029) (1.849598)

R^2_1=0.923 RSS_1=0.080745

With n-p = 21-4 = 8 degrees of freedom.

Between 2005 and 2016

LOG (RGDP) = 6.042885+0.221290LOG (EXD)-0.407947LOG (EDS)
+0.106639(EXR)

t= (-0.798684) (0.245013) (-0.918506) (2.237796)

R^2_2=0.777 RSS_2=11.57505

With m-p = 10-4 = 6 degrees of freedom.

Between 1985 to 2016

LOG (RGDP) =7.013861+0.063843LOG (EXD)-0.777105LOG (EDS)
+0.032633(EXR)

t= (5.645435) (0.241586) (-3.457135) (6.721853)

R^2=0.666 RSS=35.90344

With (n + m – 2p) = 21+10-4 degrees of freedom.

In the preceding regressions, the figures in parentheses are the estimated T values and the formula for calculating the F statistics is as thus:

$$F = \frac{(e^1 e - e_1^1 e_1 - e_2^1 e_2)/p}{(e_1^1 e_1 + e_2^1 e_2)n + m - 2p}$$

Where

$$e_1' e_1 = Residual\ Sum\ of\ Squares 1$$

$e_2^1 e_2$= Residual Sum of Squares 2

$e^1 e$ = Residual Sum of Squares (Pooled)

P = number of parameters

n = number of observation 1

m = number of observation 2.

3.1.1 Testing the Similarity of Error Variances

A crucial requirement underlying the usage of chow test and to rely on the result is that the error variances in the regressions 1 and 2 are the same (Gujarati and Sangeetha, 2007). Since we cannot observe the true error variances of group 1 and 2, we can observe their estimates from the RSS given in regression 1 and 2.

$$\tilde{\delta}_1^2 = \frac{e_1' e_1}{n-3} = \frac{0.080745}{21-3} = \frac{0.080745}{18} = 0.0044858$$

$$\tilde{\delta}_2^2 = \frac{e_2' e_2}{m-3} = \frac{11.57505}{10-3} = \frac{11.57505}{7} = 1.6535786$$

$$F = \frac{\tilde{\delta}_1^2}{\tilde{\delta}_2^2} = \frac{0.0044858}{1.6535786} = 0.0027$$

Since the F calculated (0.0027) is not greater than the critical F value (2.80), the null hypothesis of similarity of error variances is not to be rejected. This means that the error variances of the two sub period are statistically the same (that is, the sub regressions are from the same sampled population) and the chow test has been validly used.

3.1.2 Discussion of Chow Test Result

The computed F value is obtained as follows:

$$F = \frac{(35.90344 - 0.080745 - 11.57505)/4}{(0.080745 + 11.57505)/(31-8)}$$

$$= \frac{24.247645/4}{11.655795/23}$$

$$= \frac{6.0619}{0.5068} = 11.96$$

5 per cent critical F value $F_{(4,23)}$=2.80

Since the computed F value 11.96 is greater than the critical F value 2.80, the 2005 external debt relief did significantly caused a change in how external debt, external debt service and exchange rate relate with economic growth in Nigeria. The null hypothesis of no structural break between 1985 and 2016 is rejected. The chow test therefore seems to support our earlier hunch that the external debt-economic growth relation has undergone a structural change in Nigeria over the period 1985 to 2016 because of the 2005 external debt relief granted to Nigeria. It shows that the present external debt of Nigeria because of the debt relief has reduced the amount allotted for external debt servicing in the country. This has provided resources to growth enhancing investments in the country.

3.2 Regression Results

Table 1: 1985 to 2005

VARIABLE	COEFFICIENT	STANDARD ERROR	T-STATISTICS	PROBABILITY
C	5.359553	0.114924	46.63572	0.0000
LOG(EXD)	0.028237	0.031163	0.906126	0.3775
LOG(EDS)	0.078189	0.029934	2.612029	0.0182
EXR	0.001124	0.000608	1.849598	0.0818

Source: Computation using Eviews software

R^2 = 0.923377; $\bar{R}^2$ = 0.909856; F = 68.28892; DW = 1.107439

Table 2: 2005 to 2016

VARIABLE	COEFFICIENT	STANDARD ERROR	t-statistics	PROBABILITY
C	-6.042885	7.566057	-0.798684	0.4549
LOG(EXD)	0.221290	0.903175	0.245013	0.8146
LOG(EDS)	-0.407947	0.444142	-0.918506	0.3938
EXR	0.106639	0.047654	2.237796	0.0665

Source: Computation using Eviews software

R^2 = 0.777130; $\bar{R}^2$ = 0.665695; F = 6.973852; DW = 2.394464

Table 3: 1985 to 2016

VARIABLE	COEFFICIENT	STANDARD ERROR	t-statistics	PROBABILITY
C	7.013861	1.242395	5.645435	0.0000
LOG(EXD)	0.063843	0.264265	0.241586	0.8110
LOG(EDS)	-0.777105	0.224783	-3.457135	0.0019
EXR	0.032633	0.004855	6.721853	0.0000

Source: Computation using Eviews software

R^2 = 0.665763; $\bar{R}^2$ = 0.627197; F = 17.26304; DW = 1.784465

3.2.1 Discussion of Regression Results

From the results above, the first regression (Table 1: 1985-2005) shows that the constant parameter is positively related to real gross domestic product (LRGDP) which implies that when other variables are held constant, the RGDP will increase by the value of 5.359533 units. The result shows that external debt stock (EXD) is positively related to RGDP. This conforms to apriori expectation. The implication is that holding other variables constant, a unit increase in EXD will lead to increase in RGDP by 0.028237 units. This positive relationship is because as at this period, government spending remained high and much of the projects were financed through external borrowing (Adebiyi and Olowookere, 2013).However, EXD is statistically insignificant at any conventional level (1%,5% or 10%) indicating that EXD has no significant influence on economic growth in Nigeria. This is because before the debt relief government spending on some important projects were undertaken without sufficient attention being paid either to their economic viability or to the executive capacity of government (Adebiyi and Olowookere, 2013). The estimated results further showed that there is a positive relationship between RGDP and EDS (External Debt Servicing) indicating that a unit increase in EDS will lead to an increase in RGDP by 0.078189 units. This is

because various debt management strategies and measures were undertaken (Adepoju*et al.*, 2007). It also shows that EDS is statistically significant at 5 percent level. This result, however, does not comply with the apriori expectation. Furthermore, the result indicates positive significant relationship between exchange rate (EXR) and economic growth with a coefficient value of 0.01124, indicating that given other variables, a unit increase in Exchange Rate will lead to 0.001124 units increase in RGDP. This relationship is statistically significant at 10% level. This is because exchange rate has been on an increase and as the Naira exchange rate to the dollar increases, import is discouraged and export is encouraged thereby encouraging economic growth (Jhingan, 2005). The adjusted R2 of 0.923 shows that 92.3 percent of changes in the country's Real Gross Domestic Product is explained by the model. The Durbin Watson statistic of 1.107 suggests the presence of serial correlation and the F-ratio of 68.28892 confirms the overall significance of the explanatory variables taken together.

Table 2(second regression: v2005-2014) shows that the constant parameter is negatively related to real gross domestic product (RGDP) which implies that when other variables are held constant, the RGDP will decrease by the value of 6.042885 units. The result shows that external debt stock (EXD) is positively related to RGDP. It reveals that a unit rise in EXD will lead to a fall in RGDP by 0.221290 units. The magnitude of EXD is slightly larger than experienced in Table 1.This positive relationship is because since after the debt relief, available statistics show that the external debt stock of Nigeria has been on the increase. This is because of the 2009 global financial and economic crises which was precipitated by the collapse of the sub-prime lending market in the united states (Romanus, 2014). As a result the benefits of the debt cancellation which was expected to manifest after a couple of years is wiped up. Nonetheless, EXD is statistically insignificant at any conventional level indicating that EXD has no significant influence on economic growth in Nigeria as was shown in Table 1 earlier.

The result further indicated that there is an inverse relationship between RGDP and external debt service (EDS) indicating that a unit rise in EDS will cause to fall in RGDP by 0.407947 units. The negative sign displayed by (EDS) is contrary to what was exhibited in Table 1.Nevertheless, EDS is statistically insignificant meaning that the EDS does not really influence economic growth. This is contrary to earlier report depicted in Table 1 where it showed statistical significance. This is attributed to the fact that after the debt relief, Nigeria has serviced its external debt with less service cost. The debt relief which was supposed to manifest has been wiped up by the 2009 global financial and economic crisis (Romanus, 2014).

Furthermore, the result in Table 2 indicates that exchange rate (EXR) has positive impact on economic growth. It shows that a unit increase in exchange rate will lead to 0.106639 unit increase in RGDP. It also shows that exchange rate is statically insignificant. Concerning the test of individual significance, most of the explanatory variables did not performed well with the exception of exchange rate (EXR). They all failed the t–test of significance at both the 1 percent, 5 percent and 10 percent levels of significance as reflected in Table 2 above. This reveals the presence of multicolinearity among the variables in the estimated model. However, the Durbin Watson (DW) statistic of 2.394 indicates the absence of serial correlation. The adjusted R^2 value of 0.666 revealed that over 66.6 percent of the variation in RGDP was best explained by the independent variables after taking into consideration the degree of freedom.

The 3rd regression (Table 3: 1985-2016) suggested that the constant parameter is positively related to real gross domestic product (RGDP) which implies that when other variables are held constant, the RGDP will increase by the value of 7.013861 units. The result shows that external stock (EXD) is positively related to RGDP. As indicated, a unit increase in, will lead to increase in RGDP by 0.063843 units. Statistically, EXD is insignificant at any conventional level as shown in Tables 1 and 2. The results in Table 3 further indicated that there is an inversely significant between RGDP and external debt service (EDS). As shown, a unit increase in EDS leads to a decrease in RGDP by 0.777105 units. Nonetheless, the sign borne by the parameter estimate of debt service (EDS) does conform to the a priori expectation. Furthermore, the result indicates existence of positive significant relation between exchange rate (EXR) and economic growth. It reveals that a unit increase in exchange rate will lead to 0.032633 unit increase in RGDP. The overall model is statistically significant judging with the results of F-statistics. The adjusted R^2 value of 0.627 shows that 62.7 percent of the total variation is accounted for by the independent variables. The value of the Durbin-Watson (1. 784) statistics shows that there exist minimal serial or auto-correlation. In the three models, the R^2 were 0.923377, 0.777130 and 0.665763 respectively. This indicates that the independent variables explain the variation in RGDP in the tune of 92 per cent, 78 per cent and 67 per cent respectively. That is 92 per cent, 78 per cent and 67 per cent of the variations in RGDP is explained by the exogenous variables in the three models.

4. Conclusion and Policy Implication

This study examined the structural break relationship between external debt and economic growth from 1985 to 2016 with a view to examine the effect of external debt relief on economic growth in Nigeria. From the results and analysis, it was concluded that the 2005 external debt relief did significantly cause a change in external debt, external debt service relations with economic growth in Nigeria as shown by the chow test. Based on these findings, the study suggested that external finance should be used only for projects of highest priority. Spending of external debt on productive self-liquidating investments must be strictly adhered to while projects to be financed with external loan must be properly appraised.

The government should ensure that the money saved from debt relief is invested in changing the lives of millions of people in Nigeria by providing more educational and health facilities and at most provide job opportunities for the growing population.

The government should intensify its effort at diversifying the economy so that the increase in exchange rate will encourage economic growth rather than discouraging it. There should be a ban or embargo on importation of some certain goods which the country can produce. Hence, firm export promotion and import reduction policies.

References

Adebiyi, W. K., and Olowookere, J. K. (2013). Managing Nigerian debt: The practical solutions. *Research Journal of Finance and Accounting, 4*(19), 75-80.

Adepoju, A. A., Salau, A. S., and Obayelu, A. E. (2007).The effects of external debt management on sustainable economic growth and development: Lessons from Nigeria. Munich Personal RePEc Archive (MPRA), 2147. Retrieved from http://mpra.ub.uni-muenchen.de/2147/

Bakare, A. S, (2010). Debt Forgiveness and its Impact on the Growth of Nigerian economy: An

Empirical Study,*Pakistan Journal of Social Sciences*,7 (2), 2-8.

Clements, B., Bhattacharya, R., and Quoc, N. T. (2005). Can debt Relief Boast Growth in Poor Countries? *International Monetary Fund (IMF),* (34), Washington DC.

Ejigayehu, D.A. (2013). "The Effect of External Debt in Economic Growth".*Journal of the Department of Economics Sodertorn University.*

Ekperiware, M.C., and Oladeji, S.I. (2012)."External Debt Relief and Economic Growth in Nigeria".*American Journal of Economics.2*(7), 195 - 205.

Elbadawi, I., A., Benno, J., Ndulu, C., and Njuguna, N. (1997).Debt Overhang and Economic Growth in Sub-Saharan Africa. In I. Zubair, and K. Ravi (Eds.), *External Finance for Low-Incme Countries* (PP. 49-76). IMF.

Fosu A.K. (2007). The External Debt-Servicing Constraint and Public Expenditure Composition: Evidence from African Economies, Research Paper, UNU-WIDER, United Nations University (UNU) 2007/36, http://www.econstor.eu/handle/10419/63373

Jhingan, M. L. (2005). The Economics of Development and Planning.(38thed.). 605-616: Vrinda Publications (P) LTD.

Gujarati, N., D., and Sangeetha.(2007). *Basic econometrics 4/e.*The Mc-GrawHill Companies.

Omotola, J. S., and Saliub, H. (2011). Foreign Aid, Debt Relief and Africa's Development: Problems and Prospects, Department of Political Science and Public Administration, Redeemer's University Redemption City, Mowe, Ogun State, and Department of Political Science, University of Ilorin, Nigeria.

Pattillo, C., Helene, P., and Luca, R. (2004). What are the Channels through which External Debt Affects Growth. International Monetary Fund.

Romanus, O. O. (2014). External Debt Crisis, Debt Relief and Economic Growth : Lessons from Nigeria. *European Journal of Business and Management, 6*(33), 85-88.

Safdari, M., and Mehrizi, M.A. (2011)."External Debt and Economic Growth in Iran". *Journal of Economic and International Finance*, 3(5),16-25.

Sulaiman, L. A., and Azeez, B. A. (2012).Effect of External Debt on Economic Growth of Nigeria. *Journal of Economic and Sustainable Development, 3*(8), 66-77.

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