
Analysis of External Debt Dynamics and Capital Accumulation in Nigeria; a Co-Integration Approach

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ABSTRACT

When greater percentages of foreign reserves (Gross Capital Accumulation) are consumed in meeting external debt servicing, credit worthiness is eroded, causing reduction in access to external financial resources which impede economic growth rate. This study, examines the effects of external debt dynamics proxy by external debt stock (DS) and servicing (XDS) on the Nigeria external reserves (EXR) as a proxy for capital accumulation. The study spanned between 1981 to 2010 using the Nigeria time series data. The study used the correlation regression model to estimates the OLS, unit root, co-integration and ECM estimation techniques to explore the influence of the explanatory variables on the dependent variable. The result indicates presence of a negative relationship among our studied variables. Debts stock (DS) and servicing were found to account for significant changes in the Nigeria external reserves position up to 92% and was significant at 5% level. Applying the ADF test the variables were also found to be stationary at first difference. The Johansen test using both the trace and maximum Elgin statistics shows a stable long-run equilibrium relationship among the variable. The ECM coefficient confirms that EXR adjust fairly to the influence of (DS and XDS). Hence, there is therefore, need for government to curtail contracting foreign debt, the need for efficient management of external reserves to avoid looming risk of running out of capital stock.

KEY WORDS: *External Debt Stock, External Debt Servicing, Capital Accumulation/Stock.*

INTRODUCTION

In traditional economy management, nation builds up foreign reserves to back-up their currency. In the early stage of macro-economy management gold was used as a standard to backup national currency Omoh (2012). Today countries accumulate sufficient foreign reserves to serve as a hedge against unforeseen volatility and maintenance of national capital stock. The important of foreign exchange reserves as a source of financing imbalance cannot be over emphasized. Nigeria has been building her foreign reserves to a point that it was

above global bench mark for at least three months to support her exports, but what is her position now in the face of dwindling economic, continue fall of the naira equivalent to the dollar, the fall in the oil price in the international market among other things. It is against this back drop that this study became imperative to investigate the implications of external debt dynamics on the Nigeria capital stock. No wonder George (2007) maintained that the reserves position of Nigeria at any given time is a reflection of the circumstances prevailing in the international oil market. The foreign exchange reserves in Nigeria decreased to 28, 200 USD million in January from 29130 USD million in December 2015. The foreign exchange reserves in Nigeria averaged 10235.05 USD million in 1960 and reaches an all-time height of 62081.86 USD million in September 2008 and recorded low of 63.22 USD million in June 1968. According to CBN Economic Calendar and News the devastating trend is eminent in 2016 (CBN Economic Calendar and News 2016). Economic theory postulates that reasonable level of borrowing promotes economic growth through factor accumulation and productive growth. It is often argued that if borrowed funds are channel toward productive investment by debtor nations they will enjoy macro-economic stability and accelerate economic growth. And also will be able to service and settle their debt obligations without falling back on capital reserves.

External debt stock and its commitment servicing obligation become a burden and retard economic growth in African countries, Nigeria not being an exception because contracted loans are not optimally deployed to yield desire result.

The debt overhang hypothesis noted that external debt servicing ratio to capital accumulation (reserve) is a standard measure of economic growth and is very popular among development economist. Nakatamia Herera (2007) holds that external debt acts as a major constraint to capital formation in developing countries while adding that the debt service burden and dynamics showed that they do not contribute significantly to financing economic development in developing economies. Erdal karagol (2010) argued that debt servicing burden has a negative impact on investment and capital accumulation. According to him, greater percentage of foreign currency goes to meet debt servicing thereby causing a reduction in external capital. Obaseki (2007) had noted that the use of external reserves to settle foreign exchange is counter-productive and that the stocks of external reserves remain an important source for financing imbalances. Others held that external reserves can be put to intervene in the foreign exchange market, to guides against unforeseen volatility and maintain a national wealth for future generations. Following the decline in the Nigeria external reserves, decline in oil price in the international market, and a drop in her reserves position from 29130 USD million to 28200 USD million between

January and December 2015 there is need considering the analysis of external debt dynamics on capital stock in Nigeria. It is often argued that high debt/servicing and stock depletes foreign reserves position of debtor's country.

OBJECTIVE OF THE STUDY

The major purpose of this study is to empirically investigate the effect of external debt stock and servicing on capital accumulation in Nigeria. It will actually ascertain the implications of increased percentage of foreign reserves for servicing external obligations. Specifically, the study will reveal the effect of external debt stock and external debt servicing payments on external reserves in Nigeria.

THEORETICAL FRAMEWORK/LITERATURE

Under the classical theory, economic development is understood as economic growth and capital formation. The key to economic growth under this theory is capital formation. Harold (1939) and Domar (1946) capture the effect of capital formation on any economy in the Harod-Domar model derive thus;

$$S = sy \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad 1.$$

S = Total national savings

s = average rate of savings

Y = national income or output

Define $k = \frac{K}{Y}$ (k assumed as constant)

Where k = capital-output ratio and

K = total capital stock

Incorporating I (investment)

$$I = \Delta k \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad 2.$$

From equation (1) above

$$K = ky = k \Delta y \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad 3.$$

Obtaining macro-economic equilibrium we have

$$S = I = s = \Delta k \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad 4.$$

Given equation (1), (iii), (iv) and (v)

$$S = sy - \Delta k = k \Delta y \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad 5.$$

Hence $= \frac{s}{k} = \frac{\Delta y}{y} = g$ inversely g can be obtain - - - 6.

By $g = \frac{s}{k}$ where g is rate of growth of national income equation (7) implies that the rate of growth of national income is a function of the average rate of savings and capital-output ratio. The Harold-Domar model is really a mathematical statement stressing that savings rate is critically related to the capital-output ratio, implying that the higher the rate of savings, the higher the growth of national income and vice visa.

Fapetu, O and Oloyode, J.A. (2014). Examine Foreign Exchange Management and the Nigeria Economic Growth (1960-2012). The study employed the OLS estimation technique within the error correction model (ECM) framework and the Johansen co-integration test. The result revealed a unique long-run relationship between income, external reserves, exports, inflation, interest rate and FDI. The result also show that the explanatory variables account for 99% variations in GDP. The result indicates that exports and FDI were statistically significant determinants of economic growth. However, the rate of imports and inflation were found to be non significant.

Atifkhan, Jadoon, Seyeda, Azra Batool and Tahir, Mehmood (2014) studied the impact of foreign debt servicing on per-capital income and growth rate; a case study of Pakistan within 1981-2010. The study employed the auto regression distributive lag (ARDL) of co-integration. Their results confirm that foreign debt servicing has adverse significant effect on per-capital income on the Pakistan economic growth rate in both short and long-run.

Osuyi, C.C. and Ebiringa, O.T. (2012). Analyze the Effect of External Reserves Management on macro-economic stability of Nigeria; The relationship between the macro-economic stability of Nigeria. The study used VAR model to show a long-run relationship between the macro-economic variables and external reserves management. Their results showed a significant influence of GDP, CPG and NCPG by nature, pattern and level of capital goods (CGP) and Non capital goods (NCPG).

Alasan, A and shaibi, I.O. (2011) Examined the external reserves management and economic development in Nigeria (1980-2008). The statistical result analyzed revealed that there is a significant statistical relationship between effective external reserves management and economic development. This prompted their invitation of the Nigeria government for efficient management of the external reserves such that risks are controlled in a prudent manner and also to generate reasonable earnings over the medium through a long-term.

Erdal Karagol (2010) examined the causality analysis of external debt servicing and GNP; the case of turkey, the study confirms a negative impact of external

debt servicing burden on investment and capital accumulation. According to him, greater percentages of reserves goes for servicing debt obligation, it causes reduction in external capital stock and decreases credit worthiness.

Dijkstra and Hemes (2001) concluded by applying orthogonal least squares (OLS) techniques that uncertainly measure of total debt and long-term debt servicing payments by 104 HIPCs has negative and statistically significant relationship with economic growth for the period 1970-1998.

Hunt (2007) and Sachs (2003) Argued that growth will not take off until capital stock has risen to a given threshold. As capital stock rises and investment and output rises, in a vicious circle, the saving level will also continue to rise. After a given level, the rise in both capital stock and savings will be sufficient to engender self- sustaining growth. Serieus and Sammy (2001) analyzed how debts burden affects economic growth of 53 lower and middle countries both directly and indirectly within the period of 1970-1999. The authors also confirm that external debt servicing negatively affects investments and economic growth.

METHODOLOGY

This study employed annual time series Nigeria data from the central bank of Nigeria statistical bulletin. The study span between 1981 to 2010. In order to achieve the objectives of this study, the ordinary least square (OLS), Johansen co-integration test within the framework of the error correction model were used to estimate the influence of external debt stock and servicing on the Nigeria external reserves position. Our choice of these statistical tools; OLS, unit roots, and ECM was to test the magnitude of relationship, ADF unit roots to test the behaviour of the data, and the co-integration estimation test the short and long-run equilibrium relationship between the correlates. These econometric methods are considered appropriate not only because they are widely used in research of this nature but because they have a number of advantages such as unbiased, consistency and minimum variance advantage over others. The study model the relationship between our studied variables simply stated as;

$$EXR = f (DS, XDS) \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad 8.$$

Transforming equation 8 above into a linearised function we derive;

$$EXR_t = \beta_0 + \beta_1 DS_t + \beta_2 X DS_t + \mu \quad - \quad - \quad - \quad - \quad - \quad - \quad 9.$$

Log linearising equation 9 we have;

$$\text{Log } EXR_t = \beta_0 + \beta_2 \text{ log } DS_t + \beta_2 \text{ log } XDS_t + \mu \quad - \quad - \quad - \quad 10.$$

Where

EXR	=	External Reserves
DS	=	External Debt Stock
XDS	=	External Debt Servicing
β_0	=	The constant or the intercept
$\beta_1 - \beta_2$	=	The coefficient of the explanatory variables
μ_t	=	Disturbance error term.

Aprior expectation” there should be a positive relationship between external debt, stock and foreign reserves ($a_2 < 0$). Whereas external debt servicing is expected to correlate negatively ($a_2 < 0$).

ESTIMATION PROCEDURE

Ordinary Least Square (OLS)

The ordinary least square regression model is used to show the explanatory power of the explanatory variables and the level of significance as well as whether there exist serial correlation to call for stationarity test. (unit roots).

Unit Roots

Most time series variables are said to be non-stationary and using a non-stationary variables in the model might lead to spurious regressions (Granger 1974). The regression is for all the series using the augmented Dickey-Fuller (ADF) to test presence of unit roots in the variables. This involves test for the order of integration of the individual series under consideration

Co-integration

The theory of co-integration according to Granger and Engel (1987) addressed the issue of integrating short-run dynamics with long-run equilibrium. Logically, the theory demonstrates that if two variables are co-integrated, it implies that there is a meaningful long-run relationship between them; the short-run dynamics can be described by the error correction model (ECM). The basic idea behind co-integration is that, if in the long-run two or more series moves closely together, even though the series themselves are trended the different between them is constant; therefore, it is possible to regard these series as defining a long-run equilibrium relationship as the difference between them is stationary.

ERROR CORRECTION MODEL (ECM)

As said early, when the result of co-integration test is proven then, the existence of co-integration is established, the construction of error correction mechanism is necessary to model or describe the dynamic of the short run relationship to long-run equilibrium state. However, the greater the coefficients of the parameter, the higher the speed of adjustment of the model from short run to long run equilibrium. The individual influence of the co-integrated variable can only be separated with the error correction technique through an error correction model stated as;

$$\left[\eta m \log RPC_t = a_1 + \sum_{t=2}^n \omega_1 \eta m z_t e - (\lambda ECM_{t-1} + V \Delta t) \right]$$

Where λECM = The error correction mechanism.

λ = the magnitude of error corrected each period specified, it is apriori form so as to restore $\eta m z_t$ to equilibrium, where z_t represents the explanatory variables.

RESULT AND DISCUSSION

ORDINARY LEAST SQUARE (OLS) REGRESSION RESULTS LOG (EXR)

TABLE 1

Dependent Variable: LOG(EXR)				
Method: Least Squares				
Date: 01/10/13 Time: 16:55				
Sample: 1981 2010				
Included observations: 30				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.214521	1.084246	2.042453	0.0510
LOG(DS)	-0.254376	0.171936	1.479485	0.1506
LOG(XDS)	1.631869	0.167701	9.730810	0.0000
R-squared	0.919031	Mean dependent var	11.53126	
Adjusted R-squared	0.913034	S.D. dependent var	3.056817	
S.E. of regression	0.901457	Akaike info criterion	2.725031	
Sum squared resid	21.94087	Schwarz criterion	2.865151	
Log likelihood	-37.87546	F-statistic	153.2312	

Durbin-Watson stat	1.181391	Prob(F-statistic)	0.000000

Table 2: UNIT ROOT TEST OF VARIABLES USING ADF TEST (1980-2009)

VARIABLES	AT LEVELS	ORDER OF INTEGRATION	1 ST DIFFERENCE	ORDER OF INTEGRATION
ΔLN (EXP)	-0.586500	1(0)	-6.276974	1(1)
ΔLN(DS)	-3.215252	1(0)	-4.112140	1(1)
ΔLN (XDS)	-1.653212	1(0)	-5.761876	1(1)
ΔLN (EXR)	-0.586500	1(0)	-6.276974	1(1)
ΔLN(EXPOR T)	-0.556275	1(0)	4.693829	1(1)

Critical value at levels: 1%=-3.679322, 5%=-2.967767, 10%=-2.622989 at 1st difference, 1%=-3.276974, 5%=-2.971853, 10%=-2.625121

**Table.3: JOHANSEN COINTEGRATION TESTS RESULT (1981-2009)
JOHANSEN COINTEGRATION RESULT**

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized	Trace	Statistic	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.808500	83.82124	29.79707	0.0000
At most 1 *	0.630134	40.84668	15.49471	0.0000
At most 2 *	0.438089	14.98670	3.841466	0.0001
Trace test indicates 3 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized	Max-Eigen	Statistic	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.808500	42.97457	21.13162	0.0000

At most 1 *	0.630134	25.85998	14.26460	0.0005
At most 2 *	0.438089	14.98670	3.841466	0.0001
Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table 4: THE PARSIMONIOUS ERROR CORRECTION MODEL

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.271286	0.227217	1.193949	0.2499
D(LOG(EXR(-5)))	-0.170709	0.219542	-0.777566	0.4482
D(LOG(EXR(-6)))	0.223110	0.208600	1.069557	0.3007
D(LOG(DS))	-0.114377	0.250843	-0.455970	0.6545
D(LOG(DS(-6)))	-0.400887	0.339759	-1.179916	0.2553
D(LOG(XDS))	0.686208	0.246231	2.786851	0.0132
ECM(-1)	-0.338965	0.165052	-2.053683	0.0467
R-squared	0.419337	Mean dependent var		0.294796
Adjusted R-squared	0.201588	S.D. dependent var		0.685966
S.E. of regression	0.612937	Akaike info criterion		2.104682
Sum squared resid	6.011076	Schwarz criterion		2.250267
Log likelihood	-17.20385	F-statistic		2.925782
Durbin-Watson stat	1.818940	Prob(F-statistic)		0.038093

RESULTS AND DISCUSSION

Both linear and log-linear were tried and the one that fits the regression in terms of R^2 t-test would be used, from the result, the log-linear model is preferred since it has high R^2 and most parameters are significant. Also, the log-linear was chosen judged in terms of goodness of fit, precision of estimates and a tolerable level of multilinearity. The relative statistics of log-linear shows superiority over the linear.

The equation of external reserves (EXR) shows a high explanatory power of the explanatory variables. The coefficient of multiple determinations R^2 of 0.919 or 92% indicates that about 92% variation in the observed behaviour in the

dependent variables is jointly explained by the dependent variable. The remaining 0.08% may be better accounted for by other omitted variables represented by the stochastic error term. The high R^2 indicates that the model fits the data well and is statistically robust. The D.W. statistics of 1.18 is relatively low indicating the existence of serial correlation. The unit roots result shows that only log (DS) is stationary at level while all were found to be stationary at first difference of order 1. At order 1 (1), the D.W. statistics of 2.15 is high indicating absence of serial correlation in the model. The Johansen co-integration test the result shows that the model was significant at 5% level, using both the Trace and Maximum Eigen statistics and the critical values. The over-paramatized resulting to the parsimonious error correction (ECM) indicates that the coefficient of determination R^2 (0.42) OR 42% power of the independent variables (EXR) was low as well as the value of D.W. of 0.038093. The overall model result show the existence of long-run equilibrium relationship among the variable with a positive sign (0.038093) of adjustment implying its significance level.

SUMMARY AND CONCLUSION

This paper investigates external debt dynamics and capital accumulation in Nigeria within the period (1981-2010). The estimated results pointed out that external debt dynamics; external debt stock and servicing has a negative effect on capital stock (Reserves) in Nigeria. This implies that increased debt stock and its concomitant servicing obligation depletes the Nigeria external reserves since most of the country's capital stock goes for debt servicing.

The result further shows a long-run relationship between external debt dynamics and capital accumulation in Nigeria.

RECOMMENDATIONS

our results shows that external debt stock as well its servicing obligation erode external capital stock, therefore, effort should be directed at increasing productive investment with external finance, use of domestic finance instead of external to offset trade bills since greater percentage of trade bills are offset using capital stock, need to improve the competitiveness of the economy in order to improve macro-imbalances to help mobilizes domestic resources instead of depending on external loan.

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