

Analysis of Debt Sustainability in Nigeria: Present Value Budget Constraint (PVBC) Approach

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Abstract

The recent re-accumulation of debt in Highly Indebted Poor Countries (HIPC) and Low Income Countries (LICs) is an increasing phenomenon and the need to address the argument for country's specific peculiarities in the case of Nigeria cannot be over emphasized. This study analysed debt sustainability in Nigeria using the present value budget constraint (PVBC) approach for the period 1986-2015. Secondary data on government revenue and government expenditure were sourced from the Statistical Bulletin of the Central Bank of Nigeria (2016 Edition). Data collected were analysed using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests and Engle-Granger (1988) cointegration test. The study found that both government revenue and government expenditure were integrated of order one, that is, I(1) series and the Engle-Granger (1988) cointegration test showed the presence of long run relationship between government revenue and government expenditure at 5% critical level which suggest the existence of debt sustainability in Nigeria. The study concluded that there is a possibility of strong debt sustainability in Nigeria.

Keywords

Debt Sustainability, Unit-Root Test, Cointegration Test

1. Introduction

In the last twenty years several developing countries have accumulated large debt which hampers economic growth and serve as constraints to poverty alleviation. High debt burden negatively affect economic growth through the effects of debt overhang hypothesis and liquidity constraints. These factors theoretically explain how a large debt stock and debt service among developing countries could crowd-in investment and reduce economic growth [3]. Therefore, debt sustainability is seen as the ability of countries to meet the current and future external debt service obligations in full, without recourse to debt rescheduling or accumulation of arrears and without compromising growth [28].

In the same vein, [25] revealed that public debt among countries can be regarded as sustainable when the primary balance needed to at least stabilize debt under both the baseline and realistic shock scenarios is economically and politically feasible, such that the level of debt is consistent

with an acceptably low rollover risk and with preserving potential growth at a satisfactory level. Conversely, if no realistic adjustment in the primary balance i.e., one that is both economically and politically feasible can bring debt to below such a level, public debt would be considered unsustainable. Thus, the higher the level of public debt in developing countries, the more likely that fiscal policy and public debt are unsustainable. This is because, a higher debt requires a higher primary surplus to sustain it. Globally, higher debt is usually associated with lower growth and higher interest rates, thus requiring an even higher primary balance to service it.

Most empirical studies from both developed and developing countries on debt sustainability emphasized that debt is sustainable provided it is channeled to growth-enhancing assets that generate the export income to repay the debt back. In fact, [6], [11], [35] and [42] defend the increase in non-traditional sources of finance, such as loans from China, on the grounds that the growth effects of new lending (that is contributing to better infrastructure), as well as terms

of trade and export performance, have to be weighed against higher debt and worsened grant elements. Conversely, borrowing for low-return spending at real interest rates that exceed longer-term economic growth, with repayments that spikes in a given time period, reflects poor economic management, and can lead to insolvency and liquidity crises among countries [5].

Several studies have expressed concern over the recent and rapid accumulation of increasingly non-concessional debt in several highly indebted poor countries (HIPC). In particular, they argue that accumulation of new debt among HIPC may be unsustainable given the persistence of structural deficiencies of several HIPC ([4]; [15]; [46]; [48]). Since several low income countries (LICs) may not be in a position to generate sufficient revenues to repay the debt incurred, exposing them to greater solvency and liquidity risks. This study is motivated by the recent re-accumulation of debt in developing countries and the need to factor in the argument for country's specific peculiarities as emphasized by [14]. Hence, the study on the level of debt sustainability given the persistent current account deficits as a major constraint to debt sustainability among HIPC and Nigeria in particular.

2. Literature Review

The issue of debt sustainability is widely debated in the theoretical and empirical literature and there are different perspectives to debt sustainability, depending on the economic targets and on the consideration of lender's and borrower's behavior. The highly indebted poor countries (HIPC) initiative is based mainly on the debt sustainability analysis (DSA), which concerns the behavior of the borrower country and its willingness and ability to meet its debt obligations. However, the notion of debt sustainability globally is quite complex and it should generally consider both the behavior of the borrower and the lender [3].

Large part of the theoretical and the empirical analysis of debt sustainability in the countries of the world focused on the capacity of the debtor country to service its debt, ignoring the effect that debt and deficit have on other economic variables and development objectives [1]. A broad classification distinguishes between a simple debt capacity analysis (fiscal sustainability) which constitutes the major framework for analyzing debt sustainability [8] and more complex view that involves the assessment of some basic development targets (economic sustainability) and also the poverty approach to debt sustainability which emphasizes the resource endowment of countries necessary to satisfy essential human needs [17].

The accounting (borrower-based) approach state that a fiscal deficit is sustainable if it generates a constant debt to GDP ratio [10]. This approach is at the root of the debt sustainability analysis (DSA) adopted by the HIPC initiative and measures the ability of countries to meet current and future external debt service obligations. The level of primary surplus (or deficit) which stabilizes the debt to GDP ratio (b) is given by:

$$SURP_t = \frac{r_t - g_t}{1 + g_t} b \quad (1)$$

Where r is the real interest rate and g is the rate of growth of GDP. As long as the economy grows at a rate higher than the interest rate, it is possible to run sustainable primary deficit [1]. In other words, what really matter is the capacity of countries to raise revenues that could balance the expansion of the stock of debt. Since in LICs international grants represent a substantial fraction of GDP, [8] argues that the previous condition should be less stringent and take into account of the grant element, so that the primary surplus is equal to the right-hand side of the equation (1) minus the ratio of grant over GDP.

In the Present Value Constraint (PVC) Approach (or lender-based approach) a government is solvent if the flow of expected value of future resources is at least equal to the face value of the stock of debt:

$$B_0 = \sum_{t=1}^{\infty} \frac{SURP_t}{(1+r)^t} \quad (2)$$

Where B is the initial stock of debt, r is the real interest rate and $SURP$ are the future surpluses. This criterion is different from the accounting approach, which imposes an upper bound to the debt to GDP ratio. Under the usual assumption of r greater than GDP growth, the PVC requires only the real growth rate of debt lower than real interest rate. If the rate of growth of debt is between the real interest rate and the rate of growth of GDP, the PVC is satisfied, but the debt to GDP ratio can grow over time.

In the same vein, the IMF – World Bank sustainability adopted the accounting identity to calculate the future evolution of the debt to GDP ratio and several stress tests are run to evaluate sustainability of debt among countries. However, this framework has been subject to some criticisms in the area of implied exogeneity of the main policy variables and great reliance on projections; lack of attention paid to domestic debt dynamics and substitution effects between external and domestic debt stock of countries ([47]; [2]; [34]; [41]); and the need to for an explicit consideration of an adequate level of indebtedness as a function of the specific institutional and economic characteristics of a country ([32]; [50]; [45]; and [33]).

[27] proposed a new debt sustainable framework which addresses some of the short comings outlined by [14]. The new framework approved in April 2005 and subject to review in April and November, 2006 is regarded as a forward looking approach that aims to guide borrowing and lending decisions for low income countries on terms that allow borrowing countries to devote resources toward achieving Millennium Development Goals (MDGs) while also staying within their means to repay loans. By accounting for each country's specific circumstances, the PVC framework tries to help borrowing countries balance their need for funds with their current and prospective ability to repay their debts. Linking a country's borrowing potentials to its current and

prospective ability to service should help countries avoid accumulating excess debts [49]. Hence, with respect to the debt sustainability analysis carried out under the HIPC initiative, some number of improvements were recorded which includes the determination of country-specific debt and debt-service thresholds depending on the country's institutional quality and the country's risk to debt distress depends on its debt ratios. As a result HIPC countries are classified as low/medium/high risk or in debt distress and they will receive the specific grant/loan mix in future IDA allocations according to their performance under the debt sustainability analysis [1].

The World Bank-IMF sustainability approach was criticized on the fact that DSA does not sufficiently consider the current account balance and foreign exchange constraint in a fully-fledged budget constraint. In fact, the new framework for LICs recognizes the importance of exogenous shocks on the capacity of repaying debt, but they were evaluated only in a partial equilibrium, thus, not considering any feedback effect. Besides, [43] outlines that in order to stabilize the debt ratio to a certain threshold, a country could have to run a trade (or primary) surplus that, given the expectation on interest rates and economic growth, is practically unfeasible (see: [19]). In addition, [9] suggests a market value approach to debt sustainability to take account of the risk of non-payment. Thus, debt should be measured at its market value (which is smaller than its face value and its present value), including *"arrears, rescheduling and 'constrained' refinancing of various sorts"* [9].

The study by [18] acknowledges that debt ratios among countries do not take into consideration the impact of changes in the currency composition or in the maturity structure of public debt, which instead clearly affect the sovereign risk of the outstanding debt. [18] note that in poor countries political risks and economic volatility due to the unstable environment and large debt burden are factors that should be considered to run stress tests about debt sustainability. Their proposal for a risk-based framework that builds on the contingent-claim approach overcome this drawback and that it is able to evaluate the impact of number of shocks.

[25] used the risk base approach to analyze public debt sustainability in market-access countries and found that the approach balances the need for more in-depth assessments of sustainability risks in situations where they are warranted with the need to contain the use of staff resources. An excel-based template has been developed to facilitate the preparation of debt sustainability analysis and should be used by all Market-Access Countries. Specifically, all MACs are required to conduct a basic DSA, comparing the baseline with alternative scenarios of member countries.

Similarly, [39] also examined debt sustainability in HIPC countries in a new age of choice. The study found that debt ratios have declined in HIPC countries and that since HIPC countries are quite resilient to the financial crisis shocks and having more fiscal space for social spending. The study identified four elements of the changing landscape of development finance which poses a

threat for debt sustainability in HIPC countries. The study by [15] identified persistent current account deficits as a significant constraint on the debt sustainability of most HIPC countries. Given that the current account measures changes in the net external position with the rest of the world, the natural consequence of some countries running persistent deficits is that they have to borrow to finance them. [29] found that out of 31 HIPC countries only Bolivia had a current account surplus on average between 2001 and 2011 while 22 had a current account deficit of more than 5% of their GDP over the decade.

In order to factor in the argument of country's specific peculiarities as emphasized by [14], several empirical analyses were then carried out by the IMF in the following years. For instance, [23] examined public debt sustainability analysis under the debt sustainability framework for low income countries (LICs). A case of Republic of Tajikistan while using the risk based approach and found that Tajikistan's risk of debt distress remains high. Under the baseline scenario, external debt burden indicators in present value terms remain below their respective indicative thresholds, with the exception of the debt-to-exports ratio. Stress tests within the public DSA demonstrate the sensitivity of the fiscal position with respect to a slightly lower long run growth rate and the necessity of the assumed fiscal consolidation. The DSA results thus underscore the need for planned fiscal consolidation, caution in contracting new debt and careful cost-benefit assessment of large-scale investment projects, to make sure that external resources are used productively. Furthermore, a one-off increase in the government's debt obligations, would push the debt-to-GDP ratio higher, but would not put the country on an unsustainable debt path in the long run. Also, [23] assert that sound macroeconomic policies and acceleration of structural reforms would be needed to strengthen Tajikistan's growth potential and safeguard external stability.

Similarly, [24] investigate debt sustainability analysis on Lesotho. The study revealed that Lesotho remains at moderate risk of debt distress. Though, in the near term, new non-concessional loans to finance some key infrastructure projects are expected to temporarily raise debt ratios, most debt sustainability indicators are below the indicative thresholds. As a small open economy, Lesotho is vulnerable to adverse global or regional shocks. The risks appear manageable over the medium-term if the authorities are able to continue with fiscal adjustment in the coming years, while maintaining a sufficient international reserve buffer to protect the exchange rate peg. The results of this analysis underscore the critical need to realign spending with its sustainable level consistent with the expected long-run level of SACU revenue, while moving forward with structural reforms to boost productivity and competitiveness to accelerate medium-term growth.

Furthermore, [22] looked at debt sustainability analysis on Mongolia using the risk based approach. The findings of the study revealed that based on the LIC-DSA analytical framework and a broader coverage of public debt than previously used, this debt sustainability analysis (DSA)

concludes that Mongolia is at high risk of public debt distress under the baseline scenario. This is not because debt is on an ever-increasing path over the medium-term, but rather because key debt indicators are currently elevated and, while expected to decline over time, would still remain above the relevant thresholds for a number of years.

In the same vein, [21] carried out debt sustainability analysis on Nigeria. The study conducted by IMF on Nigeria revealed that the country is at a low risk of public debt distress under both the baseline macroeconomic assumptions and in stress scenarios. This holds even with a baseline scenario incorporating the sharp decline in oil prices in late 2014. Overall public debt is at a low risk of distress under the baseline, with implementation of the authorities' fiscal consolidation plans important for maintaining public debt sustainability. Stress scenarios suggest that a permanent shock to economic growth or a further decline in global oil prices would put pressure on the debt ratio unless offsetting measures were taken. In particular, the public debt service-to-revenue ratio is high, underlining the importance of mobilizing revenues. Data deficiencies suggest caution, especially regarding large errors and omissions in the balance of payments (possibly reflecting an underestimation of current account debit transactions) which lead to large observed residuals in the external DSA presentation.

In general, improving a negative current account in a low-income country with undiversified exports might take time, implying a process of structural change in the composition of exports and possibly also of imports, which is much more complicated than achieving a higher growth rate for a few years [48]. Thus, substantial debt reduction to make debt manageable needs to go hand in hand with collective effort to enable debtor countries to generate the surpluses they need to repay new debt.

The sustainability of new external debt commitments also remains vulnerable to external shocks such as natural disasters or volatile commodity prices [29]. Another potential threat to debt sustainability identified in the literature is the increasing use of riskier sources of debt financing such as public private partnerships (PPPs) (some of which can result in fiscal risks and contingent liabilities) and foreign borrowing on less concessional terms ([4]; [26])

3. Method

[40] and [36] posited that the starting point of debt sustainability is the government's budget constraint, which requires that current spending on goods and services plus the costs of servicing current debt equals current tax revenue plus the issuance of new debt. However, [38] advocate the use of the Present Value Budget Constraint (PVBC) approach because it does not make assumption that liabilities can continue to grow at the growth rate of the economy. The PVBC for assessing debt sustainability involves econometric testing of the PVBC or of the no-ponzi game (NPG) condition for a set of time series data on government expenditure, revenue, deficits and/or debt. This involves tests

of stationarity and co-integration analysis (see: [37]). The initial analysis of the PVBC is the government budget constraint given in equation (3):

$$G_t + R_t + r_t D_{t-1} = D_t - D_{t-1} \quad (3)$$

Where: D_t = debt stock at period t , R_t = government revenue at period t , G_t = government expenditure at period t , and r_t = return on government debt in period t

Let,

$$P_t = R_t - G_t \quad (4)$$

Substituting equation (4) into equation (3) and rearranging result in equation (5):

$$D_{t-1} = D_t(1+r)^{-1} + P_t(1+r)^{-1} \quad (5)$$

Substituting recursively forward for N periods gives the inter-temporal budget constraint in equation (6):

$$D_t = (1+r)^{-N(-1)} D_N + \sum_{i=1}^N (1+r)^{-i} P_{t+i} \quad (6)$$

By letting $N \rightarrow \infty$ the limiting value of the equation (6) can be expressed as follows:

$$D_t = \lim_{N \rightarrow \infty} \left[(1+r)^{-N(-1)} D_N \right] + \sum_{i=1}^N \left[(1+r)^{-i} P_{t+i} \right] \quad (7)$$

Equation (7) states that the current debt stock is equal to the present value of the debt stock in limit plus the present value of the future primary surplus. A sustainable debt policy should ensure that the "no Ponzi game (NPG) condition holds, that is, the present value of the stock of debt goes to zero in the limit. Thus,

$$\lim_{N \rightarrow \infty} \left[(1+r)^{-N(-1)} D_N \right] = 0 \quad (8)$$

Equation (8) represents the NPG condition, and the implication of this equation is that in the long run, debt cannot grow at the rate equal to, or higher than interest rate. Substituting equation (8) and (7) gives the PVBC equation as follows:

$$D_t = \sum_{i=1}^N \left[(1+r)^{-i} P_{t+i} \right] \quad (9)$$

Equation (9), which represent the PVBC, showed that the government debt at any point in time must equal the present value of the future primary surplus (or deficit). The implication is that debt cannot be continuously rolled over, that is payment of the principal must take place at some point.

The PVBC approach to evaluating debt sustainability involves econometric techniques of stationarity tests and cointegration analysis. The starting point for these tests is to take the first difference of equation (7) to get an empirical testable representation of the intertemporal government

budget constraint.

$$\Delta D_t = \lim_{N \rightarrow \infty} \left[(1+r)^{-N(-1)} \Delta D_N \right] + \sum_{i=1}^N \left[(1+r)^{-i} (\Delta R_{t+i+1} - \Delta G_{t+i+1}) \right] \quad (10)$$

Assuming the real interest rate is stationary, with mean, r , and the defining $E_t = G_t + (r_t - r) D_{t-1}$ and an additional definition, $GG_t = G_t + r_t D_{t-1}$, and assuming the NPG in equation (8) is satisfied, the intertemporal budget constraint may also be written as:

$$GG_t - R_t = \sum_{i=1}^N \left[(1+r)^{-i} (\Delta R_{t+i+1} - \Delta E_{t+i+1}) \right] \quad (11)$$

The procedure to assess the sustainability of the intertemporal government budget constraint therefore involves testing the following cointegration regression:

$$R_t = \alpha + \beta GG_t + \mu_t \quad (12)$$

Where: R_t = Government Revenue (Rev), GG_t = Government Expenditure (GE) and U_t = Error term

Equation (12) forms the basis for testing the sustainability hypothesis in Nigeria where GG_t and R_t must be cointegrated in the PVBC model. If the null hypothesis of no cointegration, that is, that the two variables are not cointegrated is rejected, this implies that one should accept the alternative hypothesis of cointegration. If there is cointegration, it implies that PVBC holds and external debt is sustainable, otherwise PVBC does not hold and external debt is not sustainable in Nigeria.

3.1. Unit Root Tests

The study would test for the stationarity of all the variables used for the study. This is necessary given the recent innovation in econometric modelling which has indicated that many macroeconomic time series are not stationary at levels and that many time series are most adequately represented by first difference ([13]). A variable that is integrated of order 1 is denoted by $I(1)$ series, alternatively such a variable is said to be non-stationary. To test for the existence of the unit root in data series, this study employs Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP)

tests. The choice of these tests statistic is informed by the fact that these tests control for higher order autocorrelation. Also, inadequate accounting for unit root can lead to estimates which may appeared to be significant and meaningful but in reality are meaningless and insignificant ([20]).

The regression form of the ADF unit root test is stated below:

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 t + \sum_{i=1}^n \alpha_i \Delta Y_{t-i} + \mu_i \quad (13)$$

Where: $\beta_{1,2}$ = the regression coefficients with β_0 as the intercept, t = linear trend, n = number of lagged differences, μ = the error term and Δ = the first difference operator.

3.2. Cointegration Test

The cointegration test will be used to establish the existence of longrun relationship between government revenues and government expenditures in Nigeria. The aim is to assess the extent of debt sustainability through cointegration test. For the purpose of this study, we follow the [16] procedure.

The cointegration equation is specified as follows:

$$Y_t = \alpha_i + \sum_{i=1}^n \beta_i X_{t-i} + V_t \quad (14)$$

Where: Y_t and X_t = dependent and independent variable, while, i = lag length, V_t = residual and β_i = parameter coefficient respectively.

4. Result

The unit root test for stationarity in Table 1 was based on the ADF and PP tests. The results revealed that all the variables are not stationary but their stationarity were induced after first difference. The ADF and PP test applied to the variables fail to reject the null hypothesis of non-stationarity for all the variables.

Table 1. Unit Root Tests.

Augmented Dickey-Fuller (ADF) Test			Phillips-Perron (PP) Test		
Variables	Level	1 st Difference	Status	Level	1 st Difference
ln(Rev)	-1.345894	-4.954777*	I(1)	-1.458693	-4.954777*
ln(GE)	-1.333397	-5.180056*	I(1)	-1.385961	-5.179938*
Critical Values	Level	1 st Difference		Level	1 st Difference
1%	-3.679322	-3.689194		-3.679322	-3.689194
5%	-2.967767	-2.971853		-2.967767	-2.971853
10%	-2.622989	-2.625121		-2.622989	-2.625121

Source: Authors' Computation, 2017.

Note: * = 1%, ** = 5% and *** = 10% significant level. For the augmented Dickey-Fuller (ADF) test, the automatic maximum lag length based on Schwarz information criterion is applied while for the Phillips-Perron (PP) test, the automatic maximum lag length based on Newey-West Bandwidth is applied.

Having established the order of integration of the data series, this study determined the number of cointegration vectors between the variables. Since the variables are found

to be integrated of order one, that is $I(1)$ as shown in Table 1 (Augmented Dickey-Fuller and Phillips-Perron Tests). It implies *a priori* that equilibrium exists among the variables.

Therefore, since the main focus of the study is to determine the extent of debt sustainability in Nigeria, we conduct a cointegration test in line with [16] procedure by subjecting the residual of the longrun regression of between government revenue ($\ln Rev$) and government expenditure ($\ln GE$) to Augmented Dickey-Fuller test at level.

Table 2. Cointegration Test: Engle-Granger (1987) Procedure.

Variables	Dickey-Fuller Test		Phillips-Perron Test	
	Level	Status	Level	Status
$\ln(Ect)$	-3.397308**	$I(0)$	-3.357211**	$I(0)$
Critical Values	Level		Level	Status
1%	-3.679322		-3.679322	
5%	-2.967767		-2.967767	
10%	-2.622989		-2.622989	

Source: Authors' Computation, 2017.

Note: * = 1%, ** = 5% and *** = 10% significant level. For the augmented Dickey-Fuller (ADF) test, the automatic maximum lag length based on Schwarz information criterion is applied while for the Phillips-Perron (PP) test, the automatic maximum lag length based on Newey-West Bandwidth is applied.

The result of the cointegration test revealed that the residual of the longrun regression between government revenue ($\ln Rev$) and government expenditure ($\ln GE$) is stationary at 5% critical level. Which suggests the possibility of strong sustainability of debt in Nigeria which is in line with the empirical study by ([21]; [25]). Furthermore, given that the value of β in the long run regression is statistically significant and comparing this with the PBVC sustainability criteria where $\beta=1$ means that β is statistically significant as stated by ([38]).

5. Conclusion

The result from this study confirms the sustainability of debt in Nigeria, however, the sustainability is constantly been threatened by continuous increase in government expenditure over the years which further increase the rate of debt accumulation both at state and national level. Therefore, the sustainability of debt in the near future is doubtful, hence, the need to further increase the revenue base and/or reduce the total expenditure of the country in other for the debt stock of the country to remain stable. On this note, the study suggest that the government and its agencies should take proactive measures to avoid accumulating unnecessary debts that might lead the country's debt stock deepening into unsustainable.

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