EI-TC Economic Insights – Trends and Challenges Vol. 13 No. 2 2024 45 - 53

Evaluating Symmetric Causality between External Debt and Macroeconomic Variables in Nigeria

Adeteji Olusegun Okutimiren[1*], Olukayode Emmanuel Maku[2], Oluwaseyi Adedayo Adelowokan[3] and **Festus Olalekan Ogunjobi[4]**

[1] Department of Economics, Faculty of Social Sciences, Olabisi Onabanjo University, Ago-Iwoye, Nigeria
https://orcid.org/0000-0003-4965-3072
e-mail: okutimirenolusegun.odlc@oouagoiwoye.edu.ng

[2] Department of Economics, Faculty of Social Sciences, Olabisi Onabanjo University, Ago-Iwoye, Nigeria
http://orcid.org/0000-0001-9934-5612
e-mail: olukayode.maku@oouagoiwoye.edu.ng

[3] Department of Economics, Faculty of Social Sciences, Olabisi Onabanjo University, Ago-Iwoye, Nigeria
http://orcid.org/0000-0001-7825-1553
e-mail: adelowokan.oluwaseyi@oouagoiwoye.edu.ng

[4] Department of Economics, Faculty of Social Sciences, Olabisi Onabanjo University, Ago-Iwoye, Nigeria
https://orcid.org/0000-0003-2584-5985
e-mail: olalekanogunjobi@yahoo.com

Original research paper

Citation: Okutimiren, A.O., Maku, O.E., Adelowokan, O.A., & Ogunjobi , F.O. (2024). Evaluating Symmetric Causality between External Debt and Macroeconomic Variables in Nigeria. *Economic Insights – Trends and Challenges, 13*(2), 45-53.
https://doi.org/10.51865/EITC.2024.02.04

JEL Classification:
F34; E01; C32.

Abstract: *Within the global economic environment, the common pursuit of sustainable growth, infrastructure development, and poverty reduction prevails. However, the Nigerian government has encountered significant hurdles in its efforts to attain macroeconomic stability and the necessary conditions for economic prosperity. Consequently, the government has turned to external sources, primarily through debt acquisition, as a solution. This reliance on external debt is rooted in Nigeria's struggle to effectively address the savings-investment gap, a challenge driven by various factors, including limited domestic savings, insufficient foreign exchange earnings, poor productivity levels, and inadequate tax revenues. Despite the visible increase in Nigeria's external debt in recent times, noticeable improvements in macroeconomic indicators have remained elusive, raising questions about the effective allocation of these borrowed resources. In response to this discord, this study delves into the complex interaction between external debt and macroeconomic variables within the Nigerian economy. By employing a thorough analysis using the symmetric - Granger (1981) causality framework, covering the period from 1986 to 2020. Except for economic growth, which shows a causal relationship with external debt, the results showed no causal relationship between external debt and investment, economic growth, or exchange rate. Consequently, these results emphasize the importance for the government to explore alternative means of obtaining funds, rather than relying extensively on external debt, especially when pursuing projects with productive objectives.*

Keywords: *External Debt; Macroeconomic Variables; Symmetric Causality; Nigeria.*

[*] Corresponding author

Introduction

The objective of all economies across the globe is to the attainment of sustainable economic growth, promotion of infrastructure development, and alleviating poverty. Nonetheless, the Nigerian government has faced challenges in achieving macroeconomic stability and fulfilling the necessary prerequisites to stimulate economic growth. Consequently, the government has resorted to seeking financial assistance from the external sector, primarily through the acquisition of debt. This reliance on external debt stems from Nigeria's difficulties in effectively managing the gap between savings and investment. Insufficient resources to finance the desired level of economic growth can be attributed to a combination of factors, including limited domestic savings, inadequate foreign exchange receipts, below-average levels of productivity., and insufficient tax revenues (Niyimbanira, 2017; Niyonkuru, 2016; Škare, M., &Družeta, 2016; Dhrifi, 2015; Vellala, *et al.,* 2014).

In the context of developing nations, the utilization of external debt plays a pivotal role in facilitating the financing of capital formation, particularly in cases where internal capital formation is inadequate due to prevailing factors such as low productivity, income levels, and savings (Armstrong & McGee, 2013; La Rocca, *et al*., 2011). Under such circumstances, there arises a pressing need for technical, administrative, and financial support from developed nations endowed with sufficient credit capacity, thereby bridging the resource gap (Zanello, *et al.,* 2016).

Nonetheless, it is essential to acknowledge that external debt presents a substantial impediment to capital formation within developing countries. The intricate dynamics and burdens associated with external debt reveal that it does not significantly contribute to the funding of economic expansion in Nigeria, given that the debt accumulates owing to both service obligations and the principal amount itself (Castel-Branco, 2014; Sulaiman & Azeez, 2012).

Despite the substantial increase in Nigeria's external debt in recent times, there has been a lack of discernible improvement in macroeconomic indicators, indicating that the debt may not have been effectively allocated to sectors that could enhance output and foster desired growth (Marian, 2014). Although external debt is recognized as a significant avenue for promoting growth, it has not yielded the anticipated benefits for Nigeria. Loganathan, Sukemi, and Sanusi (2010) have found that countries accessing external debt tend to exhibit better performance in terms of enhancing macroeconomic variables compared to those that do not.

Moreover, Abdelhafidh (2011) established a long-term relationship between external debt and macroeconomic indicators. However, the literature presents conflicting perspectives on the causal relationship between external debt and macroeconomic variables. In an attempt to address this discrepancy, Evans, Alvina, and Mohammad (2015) explored the short-term causal linkages between external debt and macroeconomic indicators. Against this backdrop, this study aims to comprehensively examine the causal relationship between external debt and macroeconomic variables, contributing to a deeper understanding of their interactions.

The subsequent sections of this paper are structured as follows: Section two aims at presenting a comprehensive review of pertinent insights gleaned from existing literature. Section three delineates the methodological framework and the empirical model employed in this study. In section four, we present the data, results, and engage in an in-depth discussion thereof. Finally, the concluding section encapsulates the findings and provides policy implications derived from the empirical analysis.

Literature Review

External debt pertains to the financial obligations of a government to entities located outside the country, and it can serve as a means to facilitate economic growth and development. The impact of debt, whether positive or negative, hinges on its utilization (Hurley, *et al.,* 2019; Panizza & Presbitero, 2013; Eaton, *et al.,* 1986). Borrowing during periods of economic downturns can potentially aid the economy by sustaining income and expenditure levels. Nevertheless, escalating levels of external debt can pose significant risks, particularly for developing countries (Arellano & Bai, 2017; Barro, 1999). Ensuring economic sustainability necessitates that the government possesses adequate resources to fulfill its responsibilities, carefully assesses the ramifications for macroeconomic variables, and ensures affordability (Adabre & Chan, 2019; Blum & Legey, 2012).

Macroeconomic variables, irrespective of income levels, exert significant influence on the dynamics of economic growth (Chirwa & Odhiambo, 2016). They serve as key indicators of the prevailing economic trends and encompass a wide range of factors that capture the performance, structure, behavior, and decision-making processes of an economy as a whole. Examples of such variables include gross domestic product (GDP), which measures the total value of goods and services produced, exchange rates that determine the value of a country's currency relative to others, inflation rates that reflect changes in the general price level, and terms of trade that depict the ratio of export prices to import prices. These macroeconomic variables are closely monitored by governments as they play a crucial role in formulating policies and managing the overall economy (Rath, *et al.,* 2020; Bilan, *et al.,* 2019).

Empirical evidence strongly suggests that a substantial level of external debt exerts a detrimental influence on economic growth. Notably, Reinhart and Rogoff's (2010) study revealed a significant correlation between elevated external debt levels and diminished rates of economic growth. This adverse association can be attributed to the crowding-out effect, wherein resources are diverted towards servicing and repaying debt, impeding investment and hampering overall economic expansion.

Ogunmuyiwa (2011) conducted a study that encountered difficulties in establishing a clear causal relationship between external debt and economic growth. However, Ajayi and Oke (2012) as well as Folorunso and Felix (2012) found evidence supporting the notion that external debt has a negative impact on growth. Notably, Folorunso and Felix (2012) highlighted the presence of non-linear effects in this relationship.

Between 1970 and 2010, Egbetunde (2012) examined the causal relationship between governmental debt and economic development in Nigeria. The model used was a Vector Autoregressive (VAR) model. The results showed that public debt and economic growth in Nigeria are causally related in both directions however, Ogunmuyiwa (2011) asserted that it is impossible to prove a causal relationship between Nigeria's economic growth and its external debt.

Saad (2012) investigated economic growth, exports, exchange rates, and external debt servicing in Lebanon from 1970 to 2010. They employed VECM and Granger causality methods. Short-term results showed no impact of exports on economic growth. Granger causality tests found bidirectional causality between exports and external debt servicing, shifting to a unidirectional relationship in the long term. In a different vein, Aminu *et al.* (2013) explored the impact of domestic debt on economic growth in Nigeria and found that it can stimulate growth. Onyekwelu *et al.* (2014) focused on examining external debt management strategies in developing economies, a topic particularly relevant to Nigeria given its history of debt accumulation.

In addition to Ogunmuyiwa's (2011) study, Evan *et al.* (2015) found evidence of short-term causal relationships between the external debt and the macroeconomic indicators when they

investigated whether Malaysia's external debt was influenced by these indicators between 1970 and 2013. Adeniran *et al.* (2016) analyzed the impact of external debt on Nigeria's economic growth from 1980 to 2014 using the Vector Error Correction model. The results, obtained through impulse response and variance decomposition, reveal a significant adverse effect: paying external debt service negatively affects Nigeria's real GDP per capita growth, indicating a debt overhang effect. The Granger Causality/Wald test shows a one-way causal relationship, with real GDP influencing external debt stock and external debt service payments influencing real GDP. This unidirectional causality sheds light on the dynamics between economic growth and external debt in Nigeria.

Adeniyi *et al.* (2018) delved into the non-linear relationship between external debt and economic growth, revealing that the impact of external debt on growth is sensitive to various factors, including the measurement of external debt and the consideration of domestic investment. George-Anokwuru and Inimino (2020) investigated the impact of external debt on economic growth specifically in Nigeria, discovering a negative relationship and underscoring the significance of effective debt management.

Antoni (2019) extensively analyzed the impact of macroeconomic indicators on economic growth in the United States and Indonesia between 1998 and 2018 using cointegration tests and the Vector Error Correction Model. The study examined evolving economic dynamics in both nations. In the United States, the results indicated that external debt has a causal effect on economic growth, with exports significantly influencing this relationship. In Indonesia, the study underscores a direct causal link between external debt and economic growth. Furthermore, economic growth in exports plays a crucial role in overall economic development, while foreign direct investment affects growth, external debt, and export dynamics.

Cahyadin and Ratwianingsih (2020) investigated the interplay between external debt, exchange rates, and unemployment in Indonesia, Malaysia, Thailand, and the Philippines between 1980 and 2017. They used the ARDL-ECM and GCT methods to analyze the data, uncovering short-term effects and causal links between external debt, exchange rates, and unemployment. Notably, Indonesia exhibited significant causal relationships, and bidirectional links were observed among these factors in the ASEAN countries studied.

Methodology

According to the Solow-Swan growth model, household saving rates are exogenous and constant. This theory states that a government deficit lowers household savings overall, which in turn affects the amount of money invested in the economy. The level of external debt affects economic growth through its impact on investment. Higher levels of external debt can increase the cost of borrowing, which can reduce investment levels and therefore economic growth. Additionally, higher levels of external debt can increase the risk of default, which can lead to a loss of investor confidence and further reduce investment levels.

To incorporate external debt into the Solow-Swan growth model, the following equation can be used:

$$Y = F(K, L, A, D) \tag{1}$$

Where Y is output, K is capital, L is labour, A is technology, and D is external debt. This equation suggests that output is a function of the level of capital, labour, technology, and external debt. The impact of external debt on economic growth can be analyzed through the investment equation, which is given by:

$$I = S + B + (EX - IM) \tag{2}$$

Where I is investment, S is savings, B is borrowing, EX is exports, and IM is imports. This equation suggests that investment is a function of savings, borrowing, and trade balance.

Higher levels of external debt can increase borrowing levels, which can reduce savings and therefore investment. Additionally, high levels of imports can reduce the trade balance and further reduce investment levels. As a result, external debt can have a negative impact on investment and therefore economic growth. The Solow-Swan growth model can be modified to include external debt as a variable that affects economic growth through its impact on investment. The level of external debt can reduce investment levels by increasing borrowing costs leading to a negative impact on economic growth.

The structural form of the relationship between external debt and macroeconomic variables can be written in a functional form:

$$Y_t = f(a_t X_t) \tag{3}$$

Where Y_t represents macroeconomic variables, X_t represents the external debt variable and a_t are the parameters of interest. Equation (3) can be written in an explicit form as:

$$Y_i = a_t + a_t X_t \tag{4}$$

Introducing other variables as control and bringing in a random term, we can re-write equation (3.9) in econometric form as:

$$Y_t = a_o + a_t X_t + \beta_t Z_t + \mu_t \tag{5}$$

Where X_t and Y_t are as defined earlier, Z_t represents the vector of some control variables selected on the basis of the theoretical and empirical literature, μ_t represents the random / disturbance term and t represents the time dimension.

Thus, following both theoretical and empirical literature and aligning with this study's analytical approach, the empirical model modifies the existing model as used by Boboye and Ojo (2012), Ndibuisi (2017) and other related works such as the more recent one by Ibrahim, *et al* (2018). The equation can therefore be presented such that:

$$gdp = f(edebt, inv, infl, exch) \tag{6}$$

Where: gdp is represents the real gross domestic product, $edebt$ represents the external debt, inv represents government investments, $infl$ represents rate of inflation and $exch$is the real exchange rate.

The dependent and independent variables chosen were based on theoretical and/or empirical justification. However, since external debt is not the only factor affecting output, there is a need to capture other variables in order to avoid model miss-specification error. The inclusion of government investment is in conformity with earlier studies (Gounder, 2001). Other variables used in the model include the debt stock. This variable is a traditional debt indicator that compares a country's debt stock with its productive capacities

To determine the causal relationship between external debt and macroeconomic variables in Nigeria, the Granger causality test was used. For this reason, we estimate the Vector Error Correction Model (VECM) for all the endogenous variables in the model and use it to carry out Granger causality tests over the short and long run. Following VECM model estimated, where $e_{i,t}$ is the innovation at time t and p the lag length,

$$gdp_t = \sum_{i=1}^{p} \delta_{11} gdp_{t-i} + \sum_{i=1}^{p} \delta_{12} edebt_{t-i} + e_{i,t} \tag{7}$$

$$edebt_t = \sum_{i=1}^{p} \delta_{21} edebt_{t-i} + \sum_{i=1}^{p} \delta_{22} gdp_{t-i} + e_{i,t} \tag{8}$$

$$inv_t = \sum_{i=1}^{p} \delta_{31} inv_{t-i} + \sum_{i=1}^{p} \delta_{32} edebt_{t-i} + e_{i,t} \tag{9}$$

$$edebt_t = \sum_{i=1}^{p} \delta_{41} edebt_{t-i} + \sum_{i=1}^{p} \delta_{42} inv_{t-i} + e_{i,t} \tag{10}$$

$$exch_t = \sum_{i=1}^{p} \delta_{51} exch_{t-i} + \sum_{i=1}^{p} \delta_{52} edebt_{t-i} + e_{i,t} \quad (11)$$

$$edebt_t = \sum_{i=1}^{p} \delta_{61} edebt_{t-i} + \sum_{i=1}^{p} \delta_{62} exch_{t-i} + e_{i,t} \quad (12)$$

$$infl_t = \sum_{i=1}^{p} \delta_{71} infl_{t-i} + \sum_{i=1}^{p} \delta_{72} edebt_{t-i} + e_{i,t} \quad (13)$$

$$edebt_t = \sum_{i=1}^{p} \delta_{81} edebt_{t-i} + \sum_{i=1}^{p} \delta_{82} infl_{t-i} + e_{i,t} \quad (14)$$

Table 1. Summary on Data Description and Source

S/N	Description	Units	Source
1.	Economic growth (gdp)	₦' Billion	CBN Statistical Bulletin (2020)
2.	Consumer Price Index ($infl$)	Percent (Rate)	CBN Statistical Bulletin (2020)
3.	External Debt Stock ($edebt$)	₦' Billion	CBN Statistical Bulletin (2020)
4.	Government investment (inv)	₦' Billion	CBN Statistical Bulletin (2020)
5.	Real Exchange Rate ($exch$)	₦' unit	CBN Statistical Bulletin (2020)

Source: Authors' computation, 2023.

Results

Descriptive Statistics

Descriptive statistics and correlation matrix in this study are used to describe the basic features of the data. The correlation coefficient that is seen in Table 2 indicates that there is a positive relationship among the variables with external debt, but this coefficient gives no precise information about the direction and the existence of the causality between the variables. It was revealed from the table that the correlation coefficients among variables are moderate and acceptable which shows no serious problem of multicollinearity.

Most of the variables are negatively skewness indicating that the degree of departure from the symmetry of distribution was negative and also, for the Kurtosis most of the variables were less than 3 revealed that the degrees of peakedness is platykurtic. Juxtaposed against this is the probability value of the Jarque Bera normality test, which is an asymptotic test. It is revealed that the residuals of the variables are not normally distributed at 5% level of significance.

Table 2. Correlation Matrix and Descriptive Statistics

	gdp	$edebt$	$exch$	$infl$	inv
gdp	1	0.70	0.69	0.64	0.60
dsr		-0.40	-0.71	-0.72	-0.69
$edebt$		1	0.72	0.61	0.52
$exch$			1	0.65	0.66
$infl$				1	0.67
inv					1
tot					
Mean	8.70	6.29	3.53	19.14	12.40
Median	8.92	6.45	4.67	12.27	12.70
Skewness	-0.23	-0.96	-0.80	1.78	-0.47
Kurtosis	1.62	3.37	2.36	4.99	1.74
Jarque-Bera	3.52	6.30	5.00	27.16	4.17
p-value	0.17	0.04	0.08	0.00	0.12

Source: Authors' computation, 2023.

From Table 3, it is evident that all the variables exhibit a unit root (non-stationary variables) in their levels, except for the inflation rate. However, when we take the first difference, the presence of a unit root is rejected at the 1% level of significance, transforming these variables

into stationary ones at I(1).These results provide insights into the time series properties of the variables and serve as a basis for conducting further analysis and modeling.

Table 3 ADF and PP Unit Root Tests Results

Variables	**Augmented Dickey Fuller (ADF)**		**Phillips-Perron (PP)**		$i(d)$
	Levels	***1st Diff***	***Levels***	***1st Diff***	
$log(gdp)$	0.0198	-4.3189*	-0.3684	-4.2387*	$i(1)$
$log(edebt)$	-0.9694	-4.7155*	-2.5727	-4.7155*	$i(1)$
$log(inv)$	-0.2918	-4.0554*	-1.0160	-4.0816*	$i(1)$
$infl$	-4.0529**		-2.9087	-10.6913*	$i(0)$
$log(exch)$	-1.2125	-5.6848*	-1.1097	-5.9146*	$i(1)$
Critical Value					
1%	-3.6156	-4.2191	-3.6210	-4.2268	
5%	-2.9411	-3.5331	-2.9434	-3.5366	
10%	-2.6091	-3.1983	-2.6103	-3.2003	

*Note: * significant at 1%; ** significant at 5%; *** significant at 10%. Calculated at trend and intercept and lag lengths selected automatically using Akaike information criterion (AIC).*

Source: Authors' computation, 2023.

We tested the Granger-Wald causality tests to observe the interaction among the variables used. From Table 4, we observed that at a 5% level of significance external debt does not cause economic growth but there exists uni-directional causality from economic growth to external debt contradict the conclusions reached by Ogunmuyiwa (2011) and Egbetunde (2012).

Furthermore, we observed that at a 5% level of significance external debt does not cause investment but there exists uni-directional causality from investment to external debt. The results indicated that economic growth causes external debt, but not vice versa. This suggests that the external debts received by Nigeria are not being utilized properly to foster economic growth.

While there was no causal link between external debt and investment, this suggests that the external debt is being utilized for consumption and debt refinancing rather than investment expenditure. This supports the argument that in the short-run, external debt can contribute to the accumulation of capital stock if directed towards the productive sector. Investment, on the other hand, causes external debt, implying that external debt injection and distribution of assets among surplus funds can help bridge the saving-investment gap is inconsistent with the findings of Evan *et al*., (2015)

Table 4. Granger Causality Wald tests of External Debt and Macroeconomic Variables

Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**	**Decision**
$log(edebt)$ does not Granger Cause $log(gdp)$	37	2.4495	0.1024	Uni-directional
$log(gdp)$does not Granger Cause $log(edebt)$		5.7782	0.0072	
$log(edebt)$ does not Granger Cause $log(exch)$	37	0.5036	0.6090	Neutrality
$log(exch)$ does not Granger Cause $log(edebt)$		3.1556	0.0561	
$log(inv)$ does not Granger Cause $log(edebt)$	37	3.5821	0.0395	Uni-directional
$log(edebt)$ does not Granger Cause $log(inv)$		0.1034	0.9020	
tot does not Granger Cause $log(edebt)$	37	0.1488	0.8623	Neutrality
$log(edebt)$ does not Granger Cause tot		0.0143	0.9857	

Source: Authors' computation, 2023.

Furthermore, no causal relationship was observed between external debt and the real exchange rate. However, the continuous devaluation of the local currency could lead to a higher external debt stock and increased servicing costs. Additionally, devaluation may not necessarily result in

higher interest rates, which could decrease the potential crowding-out effect. The result contradicts the findings conducted by Cahyadin and Ratwianingsih (2020).

Conclusions

This study examined symmetric causality between external debt and macroeconomic variables in Nigeria between 1986 and 2020. The findings suggest a unidirectional causal relationship, with economic growth influencing the accumulation of external debt in Nigeria. However, no evidence of a causal link from external debt to economic growth was observed, indicating that the utilization of debt for stimulating economic expansion is not effectively realized.

Furthermore, no causal relationship was identified between external debt and investment, indicating that the debt is predominantly directed towards consumption and debt servicing rather than productive investment. These findings underscore the importance of enhancing debt management practices, directing resources towards sectors with higher growth potential, and promoting investment and savings as alternatives to relying heavily on external borrowing. The study emphasizes the significance of transparency, accountability, and diversification of funding sources to optimize the benefits of external debt and foster sustainable economic growth.

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