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### EXAMINING THE EFFECT OF GOVERNMENT DEBT ON ECONOMIC GROWTH IN NIGERIA USING THE AUTOREGRESSIVE DISTRIBUTED LAG APPROACH

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*Many economies rely on borrowing as a source of funds. Government debt plays an important role in shaping economic growth, particularly in developing economies. This study examined the relationship between public debt and economic growth in Nigeria using annual time-series data from 1990 to 2022.*

*Economic growth was measured using Real Gross Domestic Product. The Autoregressive Distributed Lag (ARDL) modelling approach was employed. The Augmented Dickey–Fuller (ADF) test was employed to determine the stationarity properties of the variables, while the ARDL bounds test was applied to establish whether a long-run equilibrium relationship existed among them.*

*An Error Correction Model (ECM) was subsequently applied to capture short-run dynamics. The ADF results established stationarity of the variables. The ARDL estimates revealed no short-run effect of borrowing on economic growth. However, a long-run equilibrium between both variables was confirmed from the bounds test. The study concludes that while government borrowing does not significantly stimulate short-run economic growth in Nigeria, it has significant long-run implications.*

#### ABSTRACT

##### 1. Introduction

Many developing countries rely on borrowing to fund major sectors of their economies. If borrowed funds are channeled into the right use, economic growth may be achieved. But if not, the long-run effect may be unpleasant [9], [16]. Nigeria is a typical example of a developing country that does a lot of borrowing to fund economic activities. But the positive reflection of the borrowed funds on economic growth can be argued. Moreover, debt servicing has been a huge distraction to many governments, as it diverts funds that would have been channeled into better use. There have been arguments both for and against government borrowing. [8] and [17] were among researchers who argued in support of borrowing. Meanwhile, [4] and [9] argued against government borrowing.

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[14] noted that moderate borrowing promotes economic growth, while excessive debt reduces economic performance. [16] and [5] observed that countries that borrow much are slow in growth. [3], [18] and [11] reported inconsistent results, meaning the effect of government borrowing depends on the amount borrowed and approach used. The effect of government borrowing on the economy remains inconclusive. To further deal with the topic, the ARDL model by [15] is employable, as it captures short-run dynamics and long-run equilibrium relationships at the same time. Excessive borrowing has been observed to hinder economic growth [9], [16]. [14] studied 93 countries and posited that moderate borrowing promotes economic growth, whereas excessive debt accumulation exerts a negative effect on the economy. Also, [16] studied forty-four countries and concluded that persistently high borrowing generally lowers economic growth, especially if debt exceeds sustainable benchmarks. In the same vein, [5] reported that excessive public debt weakens long-run growth by increasing debt servicing obligations and reducing productive government expenditure. [3] and [18] studied the effect of foreign borrowing on the Nigerian economy, and they reported an inverse relationship between economic growth and borrowing. [11] reported that borrowing positively affects economic growth, although excessive borrowing continued to exert adverse effects on the Nigerian economy. [2] employed annual data covering 1986–2020 and found that domestic and external debt had a positive effect in the short run but a negative long-term effect. [7] investigated the relationship between debt sustainability and economic growth in Nigeria using ARDL models. Their findings revealed that borrowing negatively affected the economy both in the short and long term, whereas improvements in non-oil revenue enhanced long-run economic performance. [13] suggest that borrowing is only advantageous within a certain limit beyond which additional borrowing becomes detrimental to economic performance. Based on the inconsistent findings from previous studies, this study aims to further evaluate the relationship between government debt and economic growth in Nigeria and further examines the effect of government debt on economic growth in Nigeria using annual time series data from 1990 to 2022 within the ARDL framework.

## 2. Materials and Methods

### 2.1 Introduction

The statistical approach employed is presented herewith. Real Gross Domestic Product was used to measure economic growth, as supported by [10]. All analyses were done using **R version 4.3.1**.

### 2.2 Data Source

Annual time series data for 1990–2022 were adopted from the Nigeria Economy Dataset available on Kaggle [1].

### 2.3 ADF test

In [6], stationarity was examined using the ADF unit root test. It is given by:

$$\Delta GDP_t = \alpha + \beta t + \gamma GDP_{t-1} + \sum_{i=1}^p \delta_i \Delta GDP_{t-i} + \varepsilon_t \quad (1)$$

where

$GDP_t$ : Value of GDP at time  $t$

$\Delta GDP_t$ : First difference of the series defined by  $\Delta GDP_t = GDP_t - GDP_{t-1}$

$t$ : Time

$\alpha$ : Constant

$\beta$ : Coefficient of time trend.

$\gamma$ : Coefficient of the lagged level  $GDP_{t-1}$ . Stationarity is established if  $\gamma < 0$ .

$\delta_i$ : Coefficients of lagged differences  $\Delta GDP_{t-i}$ .

$p$ : Number of lagged differences included

$\varepsilon_t$ : Random error term.

## 2.4 ARDL Model

The ARDL modelling approach was employed because it can estimate both the short-term dynamics and the long-term relationship existing between Government Debt and Real GDP [15].

This is given by:

$$GDP_t = \alpha_0 + \sum_{i=1}^p \alpha_i GDP_{t-i} + \sum_{j=0}^q \beta_j Debt_{t-j} + \varepsilon_t \quad (2)$$

Where:

$GDP_t$  = Real Gross Domestic Product

$Debt_t$  = Government Debt

$p, q$  = Optimal Lag lengths

$\alpha_i$  = autoregressive coefficients

$\beta_j$  = distributed lag coefficients

$\varepsilon_t$  = Error term

## 2.5 Test for Cointegration

To check if a long-term relationship exists between Government Debt and GDP, the ARDL Bounds test was carried out. This will be confirmed if the F-statistic exceeds the upper critical bound.

## 2.6 Error Correction Model

The Error Correction Model is given by:

$$\Delta GDP_t = \alpha_0 + \sum \alpha_i \Delta GDP_{t-i} + \sum \beta_i \Delta Debt_{t-i} + \lambda ECM_{t-1} + \varepsilon_t \quad (3)$$

Where:

$GDP_t$  is the GDP at time  $t$

$Debt_t$  is the Debt at time  $t$

$\Delta$ : First difference operator, defined as

$\Delta GDP_t = GDP_t - GDP_{t-1}$

$\alpha_i$ : Coefficients of lagged differences of GDP.

$\beta_i$ : Coefficients of lagged differences of Debt.

$\lambda$ : Speed of adjustment parameter.

It tells us the short-run dynamics between the variables and the speed of adjustment to equilibrium.

## 3. Results and Discussion

### 3.1 Introduction

The results for each test carried out are presented in this section.

### 3.2. Test for Stationarity

Table 4.1 gives the ADF test results

**Table 3.1 ADF Test**

| Variable                 | Level/First Difference | ADF Test Statistic | p-value | Decision                | Order of Integration |
|--------------------------|------------------------|--------------------|---------|-------------------------|----------------------|
| Real GDP                 | Level                  | -3.2999            | –       | Stationary at 10% level | I(0)*                |
| Government Debt          | Level                  | -2.1472            | –       | Non-stationary          | –                    |
| $\Delta$ Real GDP        | First Difference       | -4.8162            | < 0.01  | Stationary              | I(1)                 |
| $\Delta$ Government Debt | First Difference       | -3.3864            | 0.0771  | Stationary at 10% level | I(1)*                |

The result reveals stationarity. This suggests that the ARDL can be employed in the study as recommended by [15].

### 3.3 Estimation of Relationship between Variables

The characteristic relationship between GDP and Government Debt is presented using the ARDL.

**Table 3.2 ARDL Estimates**

| Variable | Coefficient | Std. Error | t-value | p-value | Decision        |
|----------|-------------|------------|---------|---------|-----------------|
| Constant | 53.7378     | 13.6205    | 3.945   | 0.0005  | Significant     |
| GDP(-1)  | 0.4891      | 0.1412     | 3.464   | 0.0019  | Significant     |
| Debt     | 0.0629      | 0.1859     | 0.338   | 0.7377  | Not Significant |
| Debt(-1) | -0.3261     | 0.2503     | -1.303  | 0.2040  | Not Significant |
| Debt(-2) | -0.1244     | 0.1996     | -0.623  | 0.5387  | Not Significant |

Since the lagged value of Real GDP is positive (0.4891) with a p-value of 0.0019, economic growth is steady. As such, previous economic performance influences the present GDP. In contrast, Government debt has a positive coefficient but is statistically insignificant ( $\beta = 0.0629$ ,  $p = 0.7377$ ). Likewise, the first and second lagged debt coefficients are negative but insignificant, implying that in the period under review, Government Debt had no significant short-run effect on the economy.

**Table 3.3: ARDL Summary Statistics**

| Statistic               | Value      |
|-------------------------|------------|
| Number of Observations  | 31         |
| Residual Standard Error | 9.296      |
| Multiple $R^2$          | 0.7246     |
| Adjusted $R^2$          | 0.6822     |
| F-statistic             | 17.10      |
| F-statistic p-value     | 0.00000055 |

From the table, the model explains **72.46%** of the variation in Real GDP. The overall F-statistic of **17.10** with  $p < 0.001$  shows that the Government debt significantly reflects changes in Real GDP.

**Table 3.4: ARDL Bounds Test**

| Test          | F-Statistic | p-value | Decision                                       |
|---------------|-------------|---------|------------------------------------------------|
| Bounds F-test | 8.8936      | 0.0043  | Reject the null hypothesis of no cointegration |

The F-statistic (8.8936) is greater than the upper critical bound at the 5% significance level. This informs the decision of cointegration.

**Table 3.5: ECM Estimates**

| Variable            | Coefficient | Std. Error | t-value | p-value | Decision        |
|---------------------|-------------|------------|---------|---------|-----------------|
| Constant            | 53.7378     | 13.6205    | 3.945   | 0.0005  | Significant     |
| ECM(-1)* (L(GDP,1)) | -0.5109     | 0.1412     | -3.618  | 0.0013  | Significant     |
| Debt(-1)            | -0.3875     | 0.1075     | -3.605  | 0.0013  | Significant     |
| $\Delta$ Debt       | 0.0629      | 0.1859     | 0.338   | 0.7377  | Not Significant |
| $\Delta$ Debt(-1)   | 0.1244      | 0.1996     | 0.623   | 0.5387  | Not Significant |

**Table 4.6: ECM Summary**

| Statistic               | Value  |
|-------------------------|--------|
| Residual Standard Error | 9.296  |
| Multiple $R^2$          | 0.4634 |
| Adjusted $R^2$          | 0.3809 |
| F-statistic             | 5.614  |
| p-value                 | 0.0021 |

From the ECM, the magnitude of  $-0.5109$  implies that approximately **51%** of any disequilibrium from the previous year is corrected in the current year. Thus, following a shock, the system converges toward its long-run equilibrium at a relatively moderate rate.

The lagged value of Government Debt has a negative and statistically significant effect on Real GDP, while the contemporaneous and first-differenced Government Debt variables are statistically insignificant, suggesting that Government Debt does not exert a significant short-term effect on Real GDP during the study period.

The ECM is statistically significant ( $F = 5.614$ ,  $p = 0.0021$ ). This reveals that the explanatory variables jointly explain short-run variations in Real GDP. As the ECM coefficient is negative, a stable long-run equilibrium relationship is confirmed.

#### 4 Discussion

This study examined the effect of government debt on economic growth in Nigeria using the ARDL approach. The ADF test established that Real GDP was integrated of order zero,  $I(0)$ , while Government Debt was integrated of order one,  $I(1)$ . Since the variables were integrated of mixed orders, applying the ARDL approach was in order, consistent with the methodology proposed by [15].

The results revealed that increases in government borrowing did not produce a significant short-run effect on economic growth during the study period. The ARDL Bounds Test produced an F-statistic of 8.8936, which was statistically significant, indicating the existence of a long-run equilibrium relationship between Government Debt and Real GDP. This finding implies that although government debt may not significantly influence economic growth in the short run, a stable long-run relationship exists between the variables. The ECM result shows the existence of long-run equilibrium as the coefficient of the error correction term was negative ( $-0.5109$ ) and statistically significant.

The results from the ECM revealed that the lagged value of Government Debt had a negative and statistically significant effect on Real GDP, while the short-run differenced debt variables remained statistically insignificant. This suggests that although government borrowing may not produce immediate effects on economic growth, prolonged accumulation of debt may eventually exert adverse effects on economic performance. This finding is consistent with the studies of [3], [18 and [12], who reported that rising debt servicing obligations and debt overhang reduce investment and constrain long-run economic growth in Nigeria.

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