# Asymmetric Relationships between Government Spending and Economic Growth in Nigeria: Wagner's Law and Keynes' Hypothesis

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**Abstract:**
This study examined the relationship between public expenditure and economic growth in Nigeria from 1981 to 2021 using linear and non-linear autoregressive distributed lag (ARDL and NARDL) bounds models based on Wagner's law and Keynes's hypothesis. The results showed the presence of a long-term relationship between government expenditure and economic growth, with evidence of both linear and nonlinear relationships. The study also found evidence of short and long-run asymmetric impacts of government spending and economic growth, possibly due to various government policies and economic events. The study confirmed the validity of Wagner's law, which suggests a unidirectional causality from economic growth to government spending, while Keynes's hypothesis was supported by evidence of a unidirectional causal relationship running from government expenditure to economic growth. The study recommends that fiscal authorities consider the presence of asymmetries in the adjustment processes of government expenditure and economic growth when formulating fiscal policies to promote economic growth and development.

**Keywords:**
Government Expenditure, Economic Growth, Nigeria, Linearity, Non-linearity.
**JEL. Classification:** C50, E61, E62

## 1. Introduction:

Public spending or government expenditure is a vital tool used by governments to stimulate economic growth and development. The general assumption is that when governments spend more, economic growth should follow suit. However, this relationship has been subject to intense debates over the years, with some arguing that the relationship is not straightforward, and other factors such as institutional quality, political instability, and corruption can interfere. Nigeria is not an exception to this debate as the country has continued to experience an increase in public spending over the years, yet meaningful economic growth and development have not been realized (Nadabo & Salisu, 2021; Nwude & Bolouрremo, 2018; Babatunde, 2018).

Wagner's Law suggests that as the economy grows, government expenditure also grows due to the increasing demands of the population for public goods and services (Arestis et al., 2021). Empirical studies show that Wagner's Law applies in various countries, such as Spain (Jaén-garcía, 2011), Greece (Antonis et al., 2013), Turkey (Bayrakdar et al., 2015), Romania (Wang et al., 2016), Nigeria (Iyoboyi, 2018; Nwude & Boloupremo, 2018), Pakistan (Munir & Ali, 2019), and Egypt (Eldemerdash & Ahmed, 2019). On the other hand, Keynesian economics argues that government expenditure can stimulate economic growth by increasing aggregate demand and promoting investment. Empirical studies reveal that Keynes' Hypothesis also occurs in several countries such as Nigeria (Babatunde, 2018), Turkey (Karahan & Colak, 2019), Armenia, and Spain (Sedrakyan & Varela-Candamio, 2019).

However, from the empirical perspective, there are also diverse conclusions regarding the exact direction of causality between public expenditure and economic growth. Precisely, studies conducted on the theme in developed and developing countries, including Nigeria, found the unidirectional, bi-directional, and neutral or independent relationship between government spending and economic growth (Ahuja & Pandit, 2020; Akinlo & Jemiluyi, 2018; Al-Yousif, 2000; Cooray, 2009; Devajaran, Swaroop & Zou 1996; Gisore, et al, 2014; Kalebe, 2015; Kimaro, Keong, & Sea, 2017; Nurudeen & Abdullahi, 2010; Thabane & Lebina, 2016; Bhattacharyya, 2019). The results of these studies are mixed and inconclusive, perhaps, due to the application of different methods, data sets, time frames, and country peculiarities.

By and large, it can be argued that both theoretical prepositions and empirical evidence on the relationship between government spending and economic growth often conflict with economic realities on the ground, especially in most developing countries, including Nigeria. Most researchers neglect to recognize the possibility of a nonlinear (asymmetric) relationship between government expenditure and economic growth. Indeed, nonlinearities exist in most macroeconomic variables primarily due to structural breaks (various developments in the phases of the economic circle and policy changes, and so on). So far, few studies have supported the presence of nonlinear Nexus between government expenditure and economic growth outside Nigeria (Ageli, 2013; Hercowitz & Stawczynski, 2004; Bonsjack, 2018; Ampah, 2018).

In Nigeria, Akinlo & Jemiluyi (2018) and Nadabo and Salisu (2021) are the only known studies to our knowledge that used the nonlinear autoregressive distributed lag (NARDL) bounds co-integration approach to examine the relationship between government spending and economic growth in Nigeria for the period from 1960-2016 and 1970-2019. Their study has specific weaknesses. First, it focused only on Wagner's law and neglected the Keynes hypothesis. Second, the authors only applied the NARDL co-integration approach but neglected to employ its counterpart, the linear ARDL co-integration approach, to analyze the relationship between government spending and economic growth nexus. To address these weaknesses, this study applied both ARDL and NARDL for integrated approaches based on Wagner's law and Keynes's hypothesis. The study contributes to the existing literature by exploring the symmetric and asymmetric nexus between government expenditures and economic growth in Nigeria for the period 1981-2021. The study's main objective is to explore the symmetric and asymmetric nexus between government expenditures and economic growth in Nigeria. The specific objectives to:

i. To establish the presence or otherwise of linear and nonlinear relationships between government spending and economic growth in Nigeria.
ii. To investigate the validity of Wagner's law and Keynes's hypothesis in Nigeria.

## 2. Literature Review:

### 2.1 Theoretical Literature

**Wagner's Theory of Public Expenditure**

Wagner (1883) postulated the law of increasing public expenditure. It predicts that higher growth rates will lead to higher levels of government expenditure. The central premise of the Wagner law is that government spending does not play a significant role in economic growth; hence it is not suitable as a policy instrument. In the final analysis, Wagner (1883) envisaged unilateral causality that runs from economic growth to government spending (expenditure). This suggests that economic growth influences the dynamics of government expenditure.

**Keynesian Theory on Public Expenditure**

Keynes (1936) regards public expenditures as an exogenous factor that can be utilized to promote economic growth. He recommends using expansionary fiscal policy or increased government spending, especially during the recession, contributing positively to economic growth. In particular, increased government consumption is likely to increase employment, profitability, and investment through multiplier effects on aggregate demand. He concludes that government expenditure can stimulate aggregate demand, leading to an increase in output on the size expenditure multiplier.

**2.2 Empirical Literature:**

Studies on the Effect of Government Expenditure on Economic Growth

Nurudeen and Abdullahi (2010) analyzed Government Expenditure on Economic Growth in Nigeria for the period the 1970-2008 periods. The results reveal that government total capital expenditure, total recurrent expenditures, and government expenditure on education negatively affect economic growth

Fasoranti (2012) used the Ordinary Least Squares (OLS) method to examine the effects of government expenditures on infrastructure on the growth of the Nigerian economy over the period 1977- 2009. The results reveal the presence of a long-run relationship between economic growth and government expenditure.

Patricia and Izuchukwu (2013) used Johansen co-integration and ECM methods to analyze the impact of government expenditure on economic growth in Nigeria from 1977 to 2012. The results indicate that total expenditure on education is highly and statistically significant and positively affects Nigeria's economic growth in the long run.

Oni & Ozemhoka (2014) assessed the impact of public expenditure on the growth of the Nigerian economy, it covers the period of 1981-2011, and the OLS method of econometric technique was used. The result indicates that there is a positive relationship between the dependent and independent variables.

Adamu and Hajara (2015) examined the impact of public expenditure on economic growth in Nigeria using ordinary least square multiple regression for the period 1970-2012. The results show a positive and insignificant relationship between capital expenditure and economic growth, while recurrent expenditure has a significant positive impact on economic growth.

Idenyi, Obinna, Promise, and Ogbonnaya (2016) study the impact of government expenditure on economic growth in Nigeria from 1980 – 2015, using the Johansen co-integration technique. The study results indicate a negative relationship between government capital expenditure, unemployment, and economic growth. A positive correlation was found among recurrent government expenditure, inflation, and economic growth.

Idris and Bakar (2017) applied the ARDL co-integration approach to explore the relationship between government expenditure and economic growth in Nigeria from 1980 to 2015, using the ARDL model. The result reveals a positive and significant relationship between public spending on economic growth in Nigeria.

Akinlo and Jemiluyi (2018) assessed the relationship between government expenditure and economic growth in Nigeria using nonlinear ARDL for the period 1960-2016, and the findings show the existence of co-integration and nonlinear relation between government expenditure and economic growth in both the long and short run. Iyoboyi (2018) tested for the validity of Wagner's law in the presence of structural breaks from 1981-2015 using ECM framework. The findings reveal that both Wagner's law and Keynesian hypothesis are valid for Nigeria.

Mohammed et al., (2021) study the Public Expenditure and Economic Growth in Nigeria. Using Smooth Transition Regression (STR) model was employed to help accomplish the objective of the study s for the period 1981-2017. The findings public expenditure was found to exhibit a positive and significant impact on economic growth in both directions.

Nadabo and Salisu (2021) study the nexus between government expenditure and economic growth in Nigeria using nonlinear ARDL for the period 1970 to 2019, and the results illustrated that a positive change in government spending has a positive and statistically significant effect on economic growth while a negative change has no significant impact on economic growth during the study period.

**Studies on the Effect of Economic Growth on Government Expenditure**

Ansari, Gordon, and Akuamoah (1997) studied the growth-expenditure hypothesis to test using 'Granger and Holmes-Hulton analysis'. The study was done in Ghana, Kenya, and South Africa. Their findings did not support Keynes's hypothesis for these countries.

Ighodaro and Oriakhi (2010) analysed the effect of economic growth on government expenditure in Nigeria between 1961-2007 using a co-integration approach. The findings confirm the validity of the Keynesian hypothesis in Nigeria.

Ebaid and Bahari (2019) assessed the effect of economic growth on government expenditure in Kuwait between 1970-2015 using the Granger non-causality test. Their empirical results support the unidirectional causality running from government spending to economic growth.

## 3. Methodology

### 3.1 Theoretical Framework

The theoretical frameworks for this study are based on the two main perceptive of theories regarding the relationship between public expenditure and economic growth. The first is Wagner's hypothesis or Wagner's Law (Wagner, 1876), and the second is the Keynesian hypothesis (Keynes, 1936). These two theories perceive the functional relationship between these two variables from a different perspective. Wagner's law argues that public expenditure is an endogenous factor driven by national income growth. In contrast, the Keynesian hypothesis postulates that economic growth occurs due to rising private and public expenditure, with public expenditure considered an independent/exogenous variable to influence economic growth. Furthermore, in Wagner's law, the causality runs from economic growth to public expenditure, while in Keynesian theory, the direction of causality is the opposite, making the two theories fundamentally different.

### 3.2 Model Specification

**Basic Models**

Following Peacock-Wiseman as further elaborated by Iyoboyi (2018) and Nadabo & Salisu (2021). The basic functional models for Wagner and Keynes's hypothesis are specified in equations 1 and 2, respectively:

$$GEX_t = f(GDP_t) \quad (1)$$

$$GDP_t = f(GEX_t) \quad (2)$$

DPt is the gross domestic product (economic growth) at the time, t; while GEXt is the government expenditure. The functional models in equations (1) and (2), which represent Wagner's law and Keynes's hypothesis, respectively, can be rewritten in the following mathematical forms:

$$GEX_t = \alpha_0 + \alpha_1 GDP_t \qquad (3)$$

$$GDPC_t = \beta_0 + \beta_1 GEXP_t \qquad (4)$$

Equations 3 and 4 represent the mathematical representations of Wagner's law and Keynes's hypothesis, respectively.

Furthermore, oil revenue is also another important determinant of economic growth and government expenditure. Akinlo (2012) argued that oil revenue could cause growth in the economy. Besides, the non-oil revenue was also crucial in determining economic growth in the economy, as Abogan, Akinola, and Baruwa (2013) revealed. Therefore, equations 3 and 4 can also be transformed into econometric models and in logarithmic as follows:

$$lgex_t = \alpha_0 + \alpha_2 lgdp_t + \alpha_3 loilr_t + \alpha_4 lnoilr_t + \mu_t \qquad (5)$$

$$lgdp_t = \beta_0 + \beta_2 lgex_t + \beta_3 loilr_t + \beta_4 lnoilr_t + \varepsilon_t \qquad (6)$$

Where: $\alpha_0$ and $\beta_0$ are the constant terms; $l$ stands for natural logarithms whereas $\mu_t$ and $\varepsilon_t$ Equations 5 and 6 are the error terms, which are assumed to be white noise.

Autoregressive Regressive Distrusted Lag (ARDL) Models.

By implementing Pesaran, Shin, and Smith's (2001) methodology, equations 5 and 6 can be transformed into the following ARDL models:

$$\Delta lgex_t = \alpha_0 + \alpha_1\, lgex_{t-1} + \alpha_2\, lgdp_{t-1} + \sum_{i=1}^{p} \alpha_3\, \Delta lgex_{t-i} + \sum_{i=0}^{q} \alpha_4\, \Delta lgdp_{t-i} + \sum_{i=0}^{q} \alpha_4\, \Delta loilr_{t-i} + \sum_{i=0}^{q} \alpha_4\, \Delta lnoilr_{t-i} + \mu_t \qquad (7)$$

$$\Delta lgdp_t = \beta_0 + \beta_1 lgdp_{t-1} + \beta_2 lgex_{t-1} + \sum_{i=1}^{p} \beta_3\, \Delta lgdp_{t-i} + \sum_{i=0}^{q} \beta_4\, \Delta lgex_{t-i} + \sum_{i=0}^{q} \alpha_4\, \Delta loilr_{t-i} + \sum_{i=0}^{q} \alpha_4\, \Delta lnoilr_{t-i} + \varepsilon_t \qquad (8)$$

Where: Δ denotes the first difference operator; p is the maximum lag order selected by Akaike's Information Criterion (AIC); α_(0 )is the constant term ; α_1 and α_2stand for the long-run coefficients; α_3 and α_4 are short-run coefficients while μ_tThe white noise error term in equation 7 represents the ARDL model for Wagner's law. Also, β_0is the constant term; β_1 and β_2stand for the long-run coefficients; β_3 and β_4 are short-run coefficients whereas ε_tThe white noise error term in equation 8 represents the ARDL model for the Keynes hypothesis.

Also, the following short-run dynamics and Error Correction Models (ARDL-ECMs) are specified and are estimated once the presence of counteraction between government spending and economic growth is established:

$$\Delta lgex_t = \varphi_0 + \varphi_1 ECT_{(t-1)} + \sum_{i=1}^{p} \varphi_2\, \Delta lgex_{t-i} + \sum_{i=0}^{q} \varphi_3\, \Delta lgdp_{t-i} + \xi_t \qquad (9)$$

$$\Delta lgdp_t = \lambda_0 + \lambda_1 ECT_{(t-1)} + \sum_{i=1}^{p} \lambda_2 \Delta lgdp_{t-i} + \sum_{i=0}^{q} \lambda_3 \Delta lgex_{t-i} + \Omega_t \quad (10)$$

Where: φ_0 is the constant term; φ_1 is the coefficient of one period-lagged error term, 〖ECT〗_((t-1)) which also represents the long-term dynamics while φ_2 and φ_3 The short-run coefficients on government expenditure and gross domestic product (economic growth) in equation 9 for Wagner's law. More so, in equation10, λ_0 is the constant term; λ_1 is the coefficient of one period-lagged error term 〖ECT〗_((t-1))which also represents the long dynamics; while λ_2 and λ_3 are the short-run coefficients on the gross domestic product (economic growth) and government expenditure, respectively. Equations 9 and 10 represent the short-run ARDL-ECMs for Wagner's law and Keynes's hypothesis, respectively.

Non-linear autoregressive Regressive Distributed Lag (NARDL) Models

Equations 7 and 8 represent linear ARDL models, while equations 9 and 10 areARDL-ECMs. However, an alternative approach proposed by Shin et al. (2014) is used to capture the possible asymmetries of government expenditure and economic growth. This approach is called the Non-linear Autoregressive Distributed Lag (NARDL) bounds test to cointegration, which is an extension of the ARDL approach developed by Pesaran et al. (2011). Accordingly, following Shin et al. (2013), the basic linear models in equations 5 and 6 can are remodeled to account for the possible presence of asymmetries between government expenditure and economic growth for Wagnerlaw and Keynes hypothesis as follows:

$$lgex_t = \alpha_0 + \alpha_1^+ lgdp_t^+ + \alpha_1^- lgdp_t^- + \eta_t \quad (11)$$

$$lgdp_t = \beta_0 + \beta_1^+ lgex_t^+ + \beta_2^- lgex_t^- + u_t \quad (12)$$

Where α_0 represents the constant term and 〖α_1〗 ^(+ )and 〖α_2〗 ^(- )represent the long-run coefficients on the positive change (l 〖gdp〗 _t^(+ )) and negative (l 〖gdp〗 _t^-) changes in the gross domestic product (economic growth) for the Wagner model in equation 11. Similarly, in equation 12,which represents the Keynes hypothesis,β_0represents the constant term while 〖β_1〗 ^(+ )and 〖β_2〗 ^(- ) represent the long coefficients attached to the positive (l 〖gex〗 _t^(+ )) and negative (l 〖gex〗 _t^-) changes in government expenditure. These changes (positive and negative) in the gross domestic product (lgdp) are defined as follows:

$$lgdp\_pos_t = \sum_{i=1}^{t} \Delta\, lgdp\_pos_i = \sum_{i=1}^{t} max\ (\Delta lgdp_i, 0) \quad (13)$$

$$lgdp\_neg_t = \sum_{i=1}^{t} \Delta\, lgdp\_neg_i = \sum_{i=1}^{t} min\ (\Delta lgd_i, 0) \quad (14)$$

Where: Δ denotes the first difference and $lgdp\_pos_t$ and $lgdp\_neg_t$ Are the natural logs of positive and negative changes in gross domestic product, respectively. Hence, replacing $lgdp_{t-1}$(in equation 7) with $lgdp\_pos_t$ and $lgdp\_neg_t$ (in equations 13 and 14 respectively), we derive the NARDL model (in equation 15) for Wagner's law.

In the same vein, in equation 12, which represents the Keyne hypothesis, $\beta_0$ *is* the constant term while$\beta_1{}^{+}$ and $\beta_2{}^{-}$ represent the long coefficients attached to the positive ($lgex_t^{+}$ ) and negative ($lgex_t^{-}$) changes in government expenditure which are defined in equations 15 and 16, respectively.

$$lgex\_pos_t = \sum_{i=1}^{t} \Delta\, lgex\_pos_i = \sum_{i=1}^{t} max\ (\Delta lgex_i, 0) \qquad (15)$$

$$lgex\_neg_t = \sum_{i=1}^{t} \Delta\, lgex\_neg_i = \sum_{i=1}^{t} min\ (\Delta lgex_i, 0) \qquad (16)$$

Where: Δ denotes first difference, $lgex\_pos_t$ and $lgex_neg_t$Are the natural logs of positive and negative changes in government expenditure, respectively. Therefore, by substituting $lgex_{t-1}$ (in equation 8) with $lgdp\_pos_t$ and $lgdp\_neg_t$ (in equations 15 and 16 respectively), we derive the NARDL model in equation 17 for Wagner's law.

In the same vein, substituting $lgex_{t-1}$ (in equation 12) with $lgex\_pos_t$ and $lgex\_neg_t$ (in equations 15 and 16 respectively), we arrive at the NARDL model (in equation 18) for the Keynes hypothesis.

For clarity, the NARDL models for Wagner's law and Keynes's hypothesis in equations 17 and 18, respectively, are represented as follows:

$$\Delta lgex_t = \gamma_0 + \gamma_1 lgex_{t-1} + \gamma_2 lgdp^{+}_{t-1} + \gamma_3\, lgdp^{-}_{t-1} + \sum_{i=1}^{p} \theta_1 \Delta\, lgex_{t-1} + \sum_{i=0}^{q} \theta_2 \Delta\, lgdp\_pos_{t-0} + \sum_{i=0}^{r} \theta_3 \Delta\, lgdp\_neg_{t-0} + \eta_t \qquad (17)$$

$$\Delta lgdp_t = \delta_0 + \delta_1 lgdp_{t-1} + \delta_2 lgex^{+}_{t-1} + \delta_3 lgex^{-}_{t-1} + \sum_{i=1}^{p} \sigma_1 \Delta\, lgdp_{t-1} + \sum_{i=0}^{q} \sigma_2 \Delta\, lgex\_pos_{t-0} + \sum_{i=0}^{r} \sigma_3 \Delta\, lgex\_neg_{t-0} + \varepsilon_t \qquad (18)$$

Equation 17 includes the long-run coefficients γ_1, γ_2, and γ_3 on the previous year's positive and negative changes in government expenditure, as well as short-run coefficients ϴ_1, ϴ_21, and ϴ_3. Equation 18 has long-run coefficients δ_1, δ_2, and δ_3 on the previous year's changes in gross domestic product, and optimal lags p, q, and r, are determined using the Akaike Information Criterion. Equations 19 and 20 specify short-run and error correction models for both Wagner's law and Keynes's hypothesis.

$$\Delta lgex_t = \varpi_0 + \sum_{i=1}^{p-1} \varpi_1 s\Delta lgex_{t-i} + \sum_{i=0}^{q-1} \varpi_2 \Delta lgdp^+_t + \sum_{i=0}^{r-1} \varpi_3 \Delta lgex^-_t + \pi ECT_{t-1} \quad (19)$$

$$\Delta lgdp_t = {}_0 + \sum_{i=1}^{p-1} {}_1 \Delta lgdp_{t-i} + \sum_{i=0}^{q-1} {}_2 \Delta lgex^+_t + \sum_{i=0}^{r-1} {}_3 \Delta lgex^-_t + \Omega ECT_{t-1} \quad (20)$$

Where: $\varpi_0$is the constant term; $\varpi$, $\varpi_2$and $\varpi_3$ are the short-run coefficients and $\pi$ is the speed of adjustment attached to the $ECT_{t-1}$, which also represents the long-run dynamics in equation 19). Similarly, ${}_0$ is the constant term, while ${}_1$, ${}_2$, and ${}_3$The short-run coefficients are to be estimated and $\Omega$ is the speed of adjustment attached to the $ECT_{t-1}$ (the residual obtained), representing the long-run dynamics in equation 20.

Where: ϖ_0is the constant term; ϖ, ϖ_2and ϖ_3 are the short-run coefficients and π is the speed of adjustment attached to the ECTt-1, which also represents the long-run dynamics in equation 19). Similarly, φ_0 is the constant term, while 〖φ〗_1, φ_2, and φ_3The short-run coefficients are to be Estimated and Ω is the speed of adjustment attached to the ECTt-1 (the residual obtained), representing the long-run dynamics in equation 20.

**3.3 Data Source:**

This study employs secondary data covering the period 1981 to 2021. The data were sourced from the World Development Indicators of the World Bank (WDI, 2022) and the Central Bank of Nigeria (CBN 2022). The study uses two significant variables, namely gross domestic product (GDP), government expenditure (GEX), and two other control variables, Oil Revenue (OILR) and Non-oil revenue (NOILR)

**Results and Discussions:**

**4.1 Descriptive Statistics of Variables Table**

**4.1**: **Descriptive Statistics of Variables of the Study**

| **Variable** | **Mean** | **Median** | | **Max** | **Min** | **Std. Dev.** | **Skewness** | **Kurtosis** | **Jacque-Bera** | **Prob.** | **Observ** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GDP | 31.04 | 30.78 | | 31.19 | 30.24 | 0.50 | 0.37 | 1.61 | 4.04 | 0.14 | 40 |
| GEXP | 30.48 | 30.86 | | 31.60 | 29.43 | 0.60 | 0.26 | 1.52 | 3.97 | 0.15 | 40 |

**Source**: Author's computation (2022)

Table 4.1 provides descriptive statistics for the variables, based on 40 observations spanning the period of 1981-2021. The mean or average value for the gross domestic product is N31.04 billion, while government expenditure has a mean of N30.48 billion. The median values for gross domestic product and government expenditure are N30.78 billion and N30.86 billion, respectively. The minimum and Maximum values for the gross domestic product are N30.24 billion and N31.19 billion, respectively, while those for government expenditure are N29.43 billion and N31.60 billion, respectively. The low standard deviation values indicate minimum volatility throughout the study, and the positive skewness and platykurtic kurtosis values suggest that both variables are positively skewed. The Jarque-Bera statistics and p-values show that both variables are normally distributed.

## 4.2 Correlation Analysis

**Table 4.2: Correlation matrix**

| Variable | LGDP | LGEX |
|---|---|---|
| LGDP | 1.0000 | 0.977 |
| LGEX | 0.977 | 1.0000 |

**Source**: Author's computation (2022)

The correlation matrix in Table 4.2 shows the relationship between the log of gross domestic product (LGDP) and the log of government expenditure (LGEX) for the period 1981–2021. It shows that the variables have a positive and near-perfect relationship during the period under review.

## 4.3 Unit Root Test Results

To test or ascertain the data's stationarity properties, the study carried out Augmented Dickey-Fuller (ADF) and PP tests. The tests in Table 4.3 show that the log of gross domestic product (LGDP) and the log of government expenditure (LGEX) are not stationary at this level. Still, they became stationary after taking their first difference.

**Table 4.3**: **Unit Root Test Results (with intercept only)**

| | ADF | | PP | | |
|---|---|---|---|---|---|
| **Variables** | **Level** | **First Difference** | **Level** | **First difference** | **Stationarity** |
| LGDP | -1.611 | -7421** | -1.010 | -3.385 | I(1) |
| LGEX | -3.646 | -7422*** | -3.730 | -5.743*** | I(1) |
| LOILR | | | -0.782 | -6.962*** | I(1) |
| LNOILR | -0.405 | -5.486*** | 2.763 | -8.565*** | I(1) |

Note: **and *** denote rejection of the null hypothesis at 5 % and 1% levels.

**Source**: Author's Computation (2022)

**Table 4.4: Counteraction Results for ARDL and NARDL Models**

| | Function | Model | F-Stat. | k | n | Signify. | 1(0) | 1(1) |
|---|---|---|---|---|---|---|---|---|
| **Panel A**: **ARDL** | Lgex = f(lgdp) | Wagner | 4..248 | 1 | 40 | 10%<br>5%<br>1% | 4.04<br>4.94<br>6.84 | 4.78<br>5.73<br>7.84 |
| | Lgdp = f(lgex) | Keynes | 3.924 | 1 | 40 | 10%<br>5%<br>1% | 4.04<br>4.94<br>6.84 | 4.78<br>5.73<br>7.84 |
| **Panel B**: **NARDL** | Lgex = f(lgdp) | Wagner | 5.017 | 2 | 37 | 10%<br>5%<br>1% | 3.17<br>3.79<br>5.15 | 4.14<br>4.85<br>6.36 |
| | Lgdp = f(lgex) | Keynes | 5.386 | 2 | 35 | 10%<br>5%<br>1% | 3.17<br>3.79<br>4.15 | 4.14<br>4.85<br>6.36 |

Notes: i. F-Stat stands for F- Statistics, ii. k is the number of the parameter(s) included in the model, excluding constant, iii. n represents the number of observations, iv. Akaike Info. Criterion is used in estimating the ARDL models and v. Case 3: Pesaran (2011) critical values (unrestricted constant and no trend).
***Source:*** Author's computation (2022).

**Table 4.4** shows the counteraction results for both the ARDL and NARDL models for two hypotheses: Wagner's law and Keynes's hypothesis. Panel A of the table presents the ARDL results, while Panel B presents the NARDL results. For the ARDL model for Wagner's law, the F-statistic is 4.248, which is in between the upper and lower bound critical values at a 10% significance level. This suggests that there is inconclusive counteraction or a long-run relationship between government expenditure and economic growth. Similarly, for the ARDL model for Keynes's hypothesis, the F-statistic is 3.924, which is less than the lower bound I(0) critical value at a 10% significance level. This suggests no counteraction between government expenditure and economic growth for the ARDL model regarding Keynes's hypothesis.

Moving to Panel B, the NARDL model for Wagner's law has an F-statistic of 5.017, which is higher than the upper bound critical value at a 5% significance level. This implies non-linear counteraction or a long-run relationship between government expenditure and economic growth for the NARDL model for Wagner's law. Similarly, for the NARDL model regarding Keynes's hypothesis, the F-statistic is 5.386, which is also higher than the upper bound critical value at a 5% significance level. This implies non-linear solid counteraction between government expenditure and economic growth for the NARDL model regarding Keynes's hypothesis.

### 4.5 Long Run Coefficients for ARDL and NARDL Models

**Table 4.5: Long run Coefficients for ARDL and NARDL Model**

| | **Model** | **Regressor** | **Coeff.** | **Std. Err** | **t-stat.** | **Prob.** | **Validity** |
|---|---|---|---|---|---|---|---|
| **Panel A**: ARDL | Wagner's: Dependent variable is LGEX | LGDP | 1.271*** | 0.076 | 16.666 | 0.000 | Yes |
| | Keynes hypothesis: dependent variable LGDP | LGEX | 0.768*** | 0.062 | 12.368 | 0.000 | Yes |
| **Panel B**: NARDL | | | | | | | |
| | Wagner's: Dependent variable is LGEX | LGDP_POS<br>LGDP_NEG | 1.144***<br>-1.408 | 0.123<br>3.357 | 9.273<br>-0.432 | 0.000<br>0.678 | Yes<br>No |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Keynes hypothesis: Dependent variable LGDP | LGEX_POS<br>LGEX_NEG | 0.632***<br>-0.497 | 0.078<br>0.497 | 8.143<br>-0.999 | 0.000<br>0.330 | Yes<br>No |
| | | | | | | | |

**Notes**: Akaike Information Criterion (AIC) is used to choose the optimum lag length, and denote statistical significance at 10%, 5%, and 1% significance levels respectively.

**Source**: Author's Computation (2022).

In Panel A, for the ARDL model, the estimated long-run coefficient for Wagner's law (LGDP) is 1.271. This suggests that a 1% increase in gross domestic product will, on average, increase government expenditure by about 1.27% ceteris paribus. Similarly, for Keynes's hypothesis, the estimated long-run coefficient for government expenditure (LGEX) is 0.768. This finding indicates that a 1% increase in government expenditure will cause the economy to grow by about 0.768% ceteris paribus.

In Panel B, for the NARDL model for Wagner's law, the estimated long-run coefficient for positive changes in the gross domestic product (LGDP_POS) is 1.144. This implies that a 1% increase in economic growth will lead to an average rise of 1.14% in government expenditure ceteris paribus. However, the estimated long-run coefficient for negative changes in gross domestic Product (LGDP_NEG) is -1.408, which is negative and statistically significant at a 1% level. This indicates that a 1% decrease in economic growth will, on average, lead to a increase of 1.408% in government expenditure ceteris paribus.

For the NARDL model regarding Keynes's hypothesis, the estimated long-run coefficient for positive changes in government expenditure (LGEX_POS) is 0.632. This suggests that a 1% increase in government expenditure will lead to an average rise of 0.632% in economic growth

Ceteris paribus. However, the estimated long-run coefficient for negative changes in government expenditure (LGEX_NEG) is -0.497, which is negative but statistically insignificant. This implies that a 1% decrease in government expenditure will lead to an increase in economic growth by 1% increase.

**Table 4.6**: **Short Run/ECM coefficients**

| | Model | Variable | Coefficient | Std. Err | t-stat. | Prob. |
|---|---|---|---|---|---|---|
| **Panel A**: ARDL | Wagner's: Dependent variable is D(LGEX) | C | -1.1882*** | 0.626 | -3.007 | 0.005 |
| | | d(lgdp) | 1.179*** | 0.357 | 3.354 | 0.002 |
| | | $ECT_{t-1}$ | -0.270* | 0.110 | -2.958 | 0.056 |
| | Keynes hypothesis: Dependent variable D(LGDP) | C | 1.004*** | 0.373 | 2.923 | 0.007 |
| | | d(lgdp(-1)) | 0.113 | 0.128 | 0.883 | 0.344 |
| | | d(lgdp(-2)) | 0.289** | 0.121 | 2.391 | 0.024 |
| | | d(lgex) | 0.195*** | 0.047 | 4.136 | 0.000 |
| | | $ECT_{t-1}$ | -0.137*** | 0.048 | -2.849 | 0.008 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Panel B**: NARDL | Wagner: dependent variable is D(LGEX) | C | 11.817*** | 3.396 | 3.480 | 0.002 |
| | | d(lgdp_pos) | 1.135*** | 0.120 | 9.448 | 0.000 |
| | | d(lgdp_pos (-1)) | -1.441 | 3.334 | -0.432 | 0.553 |
| | | $ECT_{t-1}$ | -0.399*** | 0.101 | -4.007 | 0.004 |
| | Keynes: Dependent variable is D(LGDP) | C | 9.476** | 2.539 | 3.733 | 0.001 |
| | | d(lgdp-1)) | 0.107 | 0.122 | 0.878 | 0.390 |
| | | d(lgdp(-2)) | 0.355*** | 0.110 | 3.227 | 0.004 |
| | | d(lgdp(-3)) | -0.205* | 0.112 | -1.831 | 0.082 |
| | | d(lgex_pos) | 0.162*** | 0.043 | 3.773 | 0.001 |
| | | d(lgex_pos (-1)) | 0.127** | 0.486 | 2.618 | 0.016 |
| | | d(lgex_neg) | 0.222** | 0.095 | 2.332 | 0.030 |
| | | d(lgex_pos (-1)) | -0.310*** | 0.078 | -3.963 | 0.000 |
| | | d(lgex_pos (-2)) | 0.060 | 0.077 | 0.771 | 0.450 |
| | | d(lgex_pos (-3)) | -0.257* | 0.073 | -3.351 | 0.022 |
| | | $ECT_{t-1}$ | 0.312*** | 0.060 | -3.641 | 0.002 |

**Notes**: The ultimatum lags length are chosen by Akaike Information Criterion (AIC), and denote statistical significance at 10%, 5%, and 1% significance level. Source: Author's computation (2022).

The upper part of Panel A of Table 4.6 depicts that the coefficient (0.27) on the Error Correction Term, $ECT_{t-1}$ in the ARDL model for Wagner's law is statistically significant at 10% and negative as suggested by theory. This outcome confirms the presence of counteraction (long-run relationship) between government expenditure and economic growth and confirms the existence of causality that runs from economic growth to government expenditure, thereby affirming the validity of Wagner's law in the long run. This finding conforms with most empirical evidence in the literature (Bayrak and Esen, 2014; Akinlo, 2013; Olomola, 2004). The result also illustrates that the speed of adjustment toward the long run is relatively low as about 27% of the short run in disequilibrium is corrected annually.

In the lower part of Panel, A of Table 4.6, the coefficient (-0.13.7) of $ECT_{t-1}$ in the ARDL model for Keynes's hypothesis is also negative and statistically significant at 1%. This means that the speed of adjustment for this model is deficient, as about 14% of the short-run's disequilibrium will be corrected. However, this speed is much lower than the one reported by the ARDL model for Wagner's hypothesis. Furthermore, the negative sign and statistical significance of $ECT_{t-1}$ in the ARDL model for Keynes's hypothesis affirms the presence of counteraction (long-run relationship) between government and economic growth and causality that runs from government expenditure to economic growth, thereby validating the Keynes hypothesis in the long run. also, the short-run coefficient (0.195) of the current year's government expenditure (dlgex) is positive and statistically significant at a 1% significance level. This implies that a 1% change in government expenditure will, on average, increase economic growth by about 2% ceteris paribus.

The upper portion of Panel 4.6B shows that the coefficient (-0.399) on ECT (-1) in the NARDL model for Wagner's law is negative and statistically significant at 1%. This implies that about 40% of the short-run disequilibrium is corrected per annum. It also confirms the existence of non-linear long-run relationships between government expenditure and economic growth and the validity of Wagner's law in the long run. Furthermore, the results in the lower part of Panel 4.6B indicate that the value (-0.312) on the ECT (-1) in the NARDL model for the Keynes hypothesis is statistically significant at 1% and negative as expected. This result illustrates that about 31% of the short-run disequilibrium will be corrected in a year

### 4.7 Diagnostic Tests Results

**Table 4.7**: Diagnostic Test Results

| | **Model** | **BP** | **BPG** | **JB** | **Ramsy-Reset** | **P-value** |
|---|---|---|---|---|---|---|
| **Panel A**: ARDL | Wagner's law | 1.097 (0.385) | 1.775 (0.620) | 6.427 (0.040) | 6.014 (0.019) | |
| | $R^2$<br>Adj. $R^2$<br>F-stat<br>DW | | | | | 0.499<br>0.469<br>17.043 (0.000)<br>2.335 |
| **Panel B**: ARDL | Keynes hypothesis | 2.449 (0.293) | 2.019 (0.847) | 13..130 (0.001) | 0.311 (0.581) | |
| | $R^2$<br>Adj. $R^2$<br>F-stat<br>DW | | | | | 0.500<br>0.436<br>0.320 (0.777)<br>2.098 |
| **Panel C**: NARDL | Wagner's law | 3.026 (0.220) | 5.475 (0.361) | 5.887 (0.053) | 3.394 (0.076) | |
| | $R^2$<br>Adj. $R^2$<br>F-stat<br>DW | | | | | 0.515<br>0.470<br>11.359 (0.000)<br>2.072 |
| **Panel D**: NARDL | Keynes hypothesis | 2.811 (0.245) | 9.202 (0.758) | 5.193 0.075 | 0.219 (0.645) | |
| | $R^2$<br>Adj. $R^2$<br>F-stat<br>DW | | | | | 0.829<br>0.744<br>9.731 (0.000)<br>2.182 |

**Notes**: The optimum lags lengths are chosen by Akaike Information Criterion (AIC) *, and denote statistical significance at 10%, 5%, and 1% significance level. **Source**: Author's computation (2022).

In the same vein, all other models in Panels A, B, C, and D, the NARDL models have passed all the diagnostic tests (serial Correlation, heteroscedasticity, normality, and Ramsey Reset).

## 5. Conclusions, And Policy Recommendations:

The study finds evidence of both linear and non-linear long-run relationships between government expenditures and economic growth, with evidence of short and long-run asymmetric impacts of government spending and economic growth. The study also confirms the validity of Wagner's law and Keynes's hypothesis. The study makes the following recommendations. Government spending should be focused on priority or critical sectors of the economy (education, health, agriculture, manufacturing, and research and development. Fiscal authorities may consider spending more on capital projects to provide a conducive environment for business activities to flourish in the economy.

- Government spending should be subjected to due process (accountability and transparency); otherwise, the efficacy of public expenditure in promoting economic growth will be jeopardized.
- The government should consider the presence of asymmetries in the relationship between public spending and economic growth when formulating fiscal policy by always employing economic development experts to guide through policy meticulously.

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