EFFECT OF INCOME ON GOVERNMENT EXPENDITURE IN NIGERIA: MUSGRAVE'S U-SHAPED QUADRATIC APPROACH

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ABSTRACT

This study examines the effect of income on government expenditure in Nigeria using annual time series data for a period of 62 years (1961-2023). To ensure the robustness of the results this paper employs the Autoregressive Distributive Lag (ARDL) model. The unit root properties of the variables was utilized using Augmented Dickey Fuller (ADF) and the results indicate that most of the variables were stationary at level while others at first difference. The results of the cointegration tests suggest rejection of the null hypothesis of no long run relation among the variables of each equation. The study adopts Musgrave's U-Shaped Quadratic Approach as its benchmark. The findings revealed that total revenue, aggregate income, per capita income, revenue per capita and population contribute to the expansion of government expenditure while the civilian regime dummy variable indicates that the government expenditure is lower during the civilian era than during a military regime in all estimations; election year is not associated with higher government expenditure. The study recommends the increasing state expenditure to maintain aggregate demand. Also, regulatory authorities should realize the inevitability of the need for additional governmental services that would be demand-driven. Lastly, the policy makers or regulatory authorities need to understand when the expenditure is overblown so as to take appropriate measures as a corrective action.

Keywords: *ARDL, Government Expenditure, Income, Per Capita Income, Proposition*
JEL classification: 01, E62

Introduction

Government expenditure has been considered as an important instrument used in the process of development both in the developed and developing countries. Investigating government expenditure has become an important research area in the public finance. the pattern of government spending pattern is not only projected to ensure stabilization but also to spur economic growth and expand employment opportunities especially in developing countries (World Bank, 2015). The relative size of public sector has shown promising growth in both developing and developed countries of the world Hafeez, Imtiaz, and Mashood (2007).

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The study observed that after the World War II, every country had tried to achieve rapid economic growth and a sharp increase in public expenditures as well as in GDP for over the past few decades. Adolph Wagner (1893) was among the first who observed the increasing public spending and this phenomenon has received considerable attention from economists and practitioners of public finance over the years. Wagner investigated general causes that might be responsible for a rising trend in government expenditures and explains reasons why the rate of growth of expenditures in a community should be faster than the rate of growth of community output. The researchers had paid more attention to the positive relationship between public expenditure and GDP. Several attempts have been made to confirm the presence of Wagner's Law by explaining the reasons for increase in government expenditure. Also, different models and propositions have been put forward in many empirical studies. The investigation of government expenditure has been treated theoretically and empirically. The theoretical foundation of this can be traced as far back as the time of Wagner (1883), Keynes (1936), Peacock and Wise-man (1961) and later to Musgrave (1969).

In explaining the causes of the increase in public expenditure. Many studies have used different econometric models in the empirical analyses but most of the techniques produced results that are problematic, particularly for developing countries. This study is unique in examining the Musgrave's U-Shaped Quadratic effect of income on government expenditure in Nigeria. Increase in public expenditures have been observed for the past a decade and to Cutting spending has been a major source of policy concern by finding possible ways of reducing the persistent rise in the cost of governance by means of cutting down government spending. Over the past two decades, federal government expenditure in Nigeria has continued to increase rapidly. Nigerian statistics show that total government expenditure was N14,968.50 billion by 1980, rose to N60,268.20 billion by 1990 and , that by 2006, the total expenditure was N417, 000.00 billion and, by 2008, the total government expenditure was N600,000.00 billion (CBN, 2017). These show that the Federal government expenditure (even after being converted into real per capita terms) has continued to grow over the years. Given this observation, the study specifically attempts to explain the reason for the ever-increasing government size in Nigeria over the period 1961-2023.

The danger posed by persistent increase in public spending to the government budget engenders the need to examine the applicability of the Musgrave theory of public expenditure growth in explaining the increase in government expenditure in general and, particularly, in Nigeria. In other words, it becomes desirable to carry out research directed at identifying the factors that influence government expenditure using the Musgrave quadratic model. The study tries to test whether Wagner's Law holds in Nigeria using the Musgrave theory of public expenditure in explaining the increase in government expenditure in Nigeria.

This paper focuses on examining the effect of income on government expenditure. This study is very vital since it verifies the effect of income on government expenditure using Musgrave's U-Shaped Approach. The rest of the paper is organized as follows. In the next section, is the review of the empirical literature.

Section three (3) discusses data and methodology adopted. Section four (4) discusses the results of the estimations while section five (5) provides conclusions and policy recommendations.

2 Literature Review

John & Monday (2023) examine the relationship between government expenditure and economic growth in Nigeria from 1980 to 2020 with the aid of Auto-regressive Distributive Lag (ARDL) model to ascertain the long and short-run relationship as well as the speed of adjustment. There is evidence of no long-run relationship among the variables using the bound test but the short-run result reported all study variables, EDUC, DFC, HLT and TCE are positive and significant except water resource (WTR) expenditure that showed insignificant relationship with RGDP, either at the current year or previous year period. Based on the findings it is recommended that the budgetary allocation of the country should be increased to enable the citizens to have good drinking water. These findings are not in line with the Musgrave propositions both at previous and current year.

Okerekeoti (2022), examined the effect of government expenditure on education on economic growth of Nigeria covered the period of 1999 to 2020, using Auto regressive distributive lag. The finding shows that there is a positive and significant effect between government expenditure on education and RGDP at 5% level of significance. In this case, it means that as the level of income improves, the expenditure on education also increases. This actually followed the stages of income proposed by Musgrave.

Edame and Akpan (2013) empirically examine the structure and growth of federal government expenditure in Nigeria over the period of 1970 to 2009, using ordinary least squares (OLS) regression technique as the main method of data estimation. The results show that fiscal deficit, government revenue and gross domestic product positively affect the growth of government expenditure while public debt servicing is inversely related to growth in government expenditure, which is contrary to an economic logic that suggests the existence of a positive relationship between the duo. This is in line with the result of Okerekeoti (2022).

Daniel (2013) provides an empirical analysis of the long run implications of trade openness, foreign aid and democracy for the fulfillment of Wagner's law in the West African Monetary Zone (WAMZ), using panel data techniques and annual data for the period 1980-2008. The results clearly indicate that once trade openness, foreign aid and democracy have been catered for, Wagner's law becomes a reality for WAMZ countries. The result reveals that, per capita income, foreign aid and democracy have the potential to increase the size of the public sector in WAMZ countries in the long run. This paper therefore, finds evidence that income has a serious effect on government expenditure but not specified stages of income.

Furthermore, Shonchoy (2010) empirically investigates the recent pattern of government expenditure for developing countries using a panel data set for 111 developing countries from 1984 to 2004 and estimates the effects of possible determinants which may have influenced government expenditure. The study finds evidence that institutional variables and political as well as governance variables significantly influence government expenditure. The paper also finds new evidence of Wagner's law which states that willingness to pay and peoples' demand for services are income-elastic and, hence, that the expansion of public economy is influenced by the greater economic affluence of a nation.

Alfred and Mi (2010) investigate the determinants of government size at the provincial level in China for the period 1998–2006. The Study employs a provincial-level panel data set from mainland China. This study reports that there is absence of Wagner’s law for China. Also, both revenue decentralization and expenditure decentralization contribute to the expansion of China’s government. The result shows that both openness to trade and FDI have negative and significant coefficients and the estimated coefficients for real GDP per capita are negative and significant. Also, both expenditure decentralization and revenue decentralization have significant positive coefficients while the estimated coefficients for vertical imbalance are not significant. In addition, due to the relatively short duration chosen and the data for a cross-section of countries employed to investigate the public expenditure growth, the study may not be reliable. Nevertheless, the study has made a good step for its inclusion of important variables like GDP per capital but the evidence does not follow Musgrave propositions.

In a study conducted for Nigeria, Clement and Dickson (2010), in addition to total government expenditure, use disaggregated government expenditure data from 1961-2007. Specifically, the government expenditure was disaggregated into expenditure on general administration and community and social services to see whether economic growth may have significant impacts on them while investigating if government expenditure pattern in Nigeria follows Wagner’s law. All the variables used were found to be I(1) and long run relationships exist between the dependent and the independent variables except in the case where only GDP was used as the independent variable. It was reported that Wagner’s hypothesis does not hold in all the estimations. Rather, it was the Keynesian hypothesis that was validated in all cases. In the causality test, none of the variables Granger-causes each other, meaning that the variables are mutually independent. This study provides a good attempt by disaggregating the public expenditure into functional subhead categories. In addition, the study also shows improvement by addressing the issue of causality with time series analysis. But, with the findings, is unable to validate the presence of Wagner and Musgrave propositions in all the estimations.

Looking at the case of the US, Liu, Hsu & Younis (2008) examine the causal relationship between GDP and public expenditure data from 1947–2002. The result reveals that growth of GDP does not cause expansion of government expenditure while total government expenditure causes growth of GDP. Thus, judging from the causality test; Keynesian hypothesis has more influence compared to Wagner’s law. But, the study made a remarkable attempt to test for causality for using time series annual data which covered a longer period when compared with other studies, but not justified the propositions of Musgrave as that of Clement and Dickson (2010).

In the case of Pakistan, Hafeez, Imtiaz and Mashood (2007) test the existence of Wagner's Law for the period of 1972–2004, using Johansen and Juselius (1990) cointegration approach to investigate the long-run relationship between government expenditures and its determinants. Short-run dynamics are estimated by using the Error Correction Mechanism (ECM) and various diagnostics and the stability tests are used to examine the existence of the relationship between variables. They find a long-run relationship between government expenditures and the determinants like per capita income, openness of Pakistan's economy, and the level of financial development. They opine that the existence of this relationship has far reaching implications for policy makers in designing the expenditure policy of the government in Pakistan as well as for other developing countries. This result is also in line with Okerekeoti and Daniel. The evidence supports Musgrave's proposition.

In another study, Vergue (2006) who empirically examines which components of public expenditure are privileged by government in election time, using non-causality modeling approach include, data on 42 developing countries from 1975-2001. The findings establish evidence of electoral impact on the allocation of public expenditure. The result shows that public expenditure shifts towards more visible current expenditure, in particular wages and subsidies in an election year, but away from capital expenditure. The findings also provide that electoral impacts on the allocation of public spending are likely to endure even though countries gain experience in electoral politics. This is a good attempt by disaggregating the public expenditure into different components and using long time period data in the estimation but did not test for causality.

The study on the determinants of government size includes Naved and Fareed (2005), who investigated the long-run relationship between government size and per capita income for D-8 member countries (Iran, Malaysia, Nigeria, Bangladesh, Egypt, Indonesia, Pakistan and Turkey) using Musgrave (1969) spanning from 1973-2002. The study employs standard cointegration technique and standard Granger procedure and the results reveal the absence of a long-run relationship between government size and per capita income for the D-8 member countries. They also find that, in the short-run, government size does not cause per capita income in the D-8 member countries, except in Iran where a bi directional short-run causality between government size and per capita income was observed. Thus, the results confirm that the Musgrave effect holds only in the case of Iran. However, the study made a good effort by adopting the standard Granger causality test.

3 Methodology

Data

As noted by Kojo and Yemane (2013), different authors have used different mathematical forms for testing Wagner's law. Below are the six popular variants of the Law that have been identified (see, Akitoby et al., 2006; Payne et al., 2006; Mohammadi, et. al. 2009).

The Musgrave's theory of public expenditure and growth explained that, at low level of per capita income, the demand for public services tend to be very low, arguing that such income is devoted to satisfying primary needs and it is only when the per capita income starts to rise above these level of low income that the demand for services provided by the public sector such as education, health, and transports starts to rise, thereby forcing government to increase expenditure on them. The theory concludes that with high per capita income, in developed countries, the rate of public spending falls as most basic wants are being satisfied. The econometric models that capture this Musgrave proposition are as specified in Equations (3.3a) to (3.3e) below:

$$lnG_t = \alpha_0 + \alpha_1 lnY_t + \alpha_2 (lnY_t)^2 + \alpha_3 lnR_t + \alpha_4 lnFD_t + \alpha_5 lnP_t + \alpha_6 lnURB_t + \alpha_7 POLR_t + \alpha_8 ELEC_t + \varepsilon_t .. (3.3a)$$

$$lnG_t = \alpha_0 + \alpha_1 lnY_t + \alpha_2 (lnY_t)^2 + \alpha_3 lnR_t + \alpha_4 lnFD_t + \alpha_5 lnP_t + \alpha_6 lnURB_t + \alpha_7 POLR_t + \alpha_8 ELEC_t + \varepsilon_t .. (3.3a)$$

$$\ln\left(\frac{G}{Y}\right)_t = \beta_0 + \beta_1 lnY_t + \beta_2 (lnY_t)^2 + \beta_3 \ln\left(\frac{R}{Y}\right)_t + \beta_4 ln\left(\frac{FD}{Y}\right)_t + \beta_5 lnP_t + \beta_6 lnURB_t + \beta_7 POLR_t + \beta_8 ELEC_t + \varepsilon_t .. (3.3b)$$

$$\ln\left(\frac{G}{Y}\right)_t = \beta_0 + \beta_1 lnY_t + \beta_2 (lnY_t)^2 + \beta_3 \ln\left(\frac{R}{Y}\right)_t + \beta_4 ln\left(\frac{FD}{Y}\right)_t + \beta_5 lnP_t + \beta_6 lnURB_t + \beta_7 POLR_t + \beta_8 ELEC_t + \varepsilon_t .. (3.3b)$$

$$lnG_t = \omega_0 + \omega_1 \ln\left(\frac{Y}{P}\right)_t + \omega_2 \left(ln\frac{Y}{P}\right)^2{}_t + \omega_3 lnR_t + \omega_4 lnFD_t + \omega_5 lnP_t + \omega_6 lnURB_t + \omega_7 POLR_t + \omega_8 ELEC_t + \varepsilon_t .. (3.3c)$$

$$lnG_t = \omega_0 + \omega_1 \ln\left(\frac{Y}{P}\right)_t + \omega_2 \left(ln\frac{Y}{P}\right)^2{}_t + \omega_3 lnR_t + \omega_4 lnFD_t + \omega_5 lnP_t + \omega_6 lnURB_t + \omega_7 POLR_t + \omega_8 ELEC_t + \varepsilon_t .. (3.3c)$$

$$\ln\left(\frac{G}{P}\right)_t = \psi_0 + \psi_1 \ln\left(\frac{Y}{P}\right)_t + \psi_2 \left(ln\frac{Y}{P}\right)^2{}_t + \psi_3 \ln\left(\frac{R}{P}\right)_t + \psi_4 ln\left(\frac{FD}{P}\right)_t + \psi_5 lnP_t + \psi_6 lnURB_t + \psi_7 POLR_t + \psi_8 ELEC_t + \varepsilon_t \ldots\ldots (3.3d)$$

$$\ln\left(\frac{G}{P}\right)_t = \psi_0 + \psi_1 \ln\left(\frac{Y}{P}\right)_t + \psi_2 \left(ln\frac{Y}{P}\right)^2{}_t + \psi_3 \ln\left(\frac{R}{P}\right)_t + \psi_4 ln\left(\frac{FD}{P}\right)_t + \psi_5 lnP_t + \psi_6 lnURB_t + \psi_7 POLR_t + \psi_8 ELEC_t + \varepsilon_t \ldots\ldots (3.3d)$$

$$ln\left(\frac{G}{Y}\right)_t = \delta_0 + \delta_1 \ln\left(\frac{Y}{P}\right)_t + \delta_2 \left(ln\frac{Y}{P}\right)^2{}_t + \delta_3 \ln\left(\frac{R}{Y}\right)_t + \delta_4 ln\left(\frac{FD}{Y}\right)_t + \delta_5 lnP_t + \delta_6 POLR_t + \delta_7 lnURB_t + \delta_8 ELEC_t + \varepsilon_t \ldots\ldots (3.3e)$$

$$ln\left(\frac{G}{Y}\right)_t = \delta_0 + \delta_1 \ln\left(\frac{Y}{P}\right)_t + \delta_2 \left(ln\frac{Y}{P}\right)^2{}_t + \delta_3 \ln\left(\frac{R}{Y}\right)_t + \delta_4 ln\left(\frac{FD}{Y}\right)_t + \delta_5 lnP_t + \delta_6 POLR_t + \delta_7 lnURB_t + \delta_8 ELEC_t + \varepsilon_t \ldots\ldots (3.3e)$$

where: $(lnY)^2{}_t (lnY)^2{}_t$ and $(ln\frac{Y}{P})^2{}_t (ln\frac{Y}{P})^2{}_t$ = squares of the logarithm of income and of per capita income respectively while other variables are defined in connection with the previous Equations (3.2a) to (3.2e). In principle, it should be $\ln(\frac{Y^2}{P})_t \ln(\frac{Y^2}{P})_t$ but due to the econometric impossibility of including $\frac{Y}{P}$ and $\frac{Y^2}{P}\frac{Y}{P}$ and $\frac{Y^2}{P}$ (which is mathematically the same as ($2lnY/P2lnY/P$) in the same equation (as perfect multicollinearity would result), it is the square of $ln\frac{Y}{P}ln\frac{Y}{P}$, i.e. ($ln\frac{Y}{P}ln\frac{Y}{P}$)^2, that is used in place of $ln(\frac{Y^2}{P})ln(\frac{Y^2}{P})$. The same applies to the square of $\ln(\frac{Y}{P})\ln(\frac{Y}{P})$ in other equations.

It only has to be pointed out here that the squared term of the income variable is included so as to test for the inverted U-relationship. Accordingly, we posit that the coefficient of the income variable to be positive as before and that of its squared term to be opposite in sign, i.e. to be negative. The estimates of all the five equations are as later reported in Table 4. The study uses annual time series data, covers the period 1961 to 2023.

4 Empirical Results

Unit Root Test

This section presents the unit root test, using the Augmented Dickey-Fuller procedure. The test was carried out to examine the stationary nature of each of the variables used in the models of this research work in order to avoid the consequence of having a spurious regression result arising from conducting Ordinary Least Squares method with non-stationary series. The test was carried out for all the variables employed in the different models and the results are as presented in Table 4.3

Table 4.1: Augmented Dickey Fuller Unit Root Test for the Variables

Variables	Stationary	t-statistic	Crit. Val. at 5% level	P-value	Order of Integration	Conclusion
lnG	At level	-2.341*	-2.917	0.163	Not Stationary	I(1)
	At First Diff.	-8.579**	-2.917	0.000	Stationary	
lnG/P	At level	-2.225*	-2,917	0.200	Not Stationary	I(1)
	At First Diff.	-8.493**	-2.918	0.000	Stationary	
lnG/Y	At level	-2.699*	-2,917	0.081	Not Stationary	I(1)
	At First Diff.	-9.253**	-2.918	0.000	Stationary	
lnY	At level	0.435*	-2.916	0.983	Not Stationary	I(1)
	At First Diff.	-4.586**	-2.918	0.001	Stationary	
lnY/P	At level	-1.586*	-2.918	0.483	Not Stationary	I(1)
	At First Diff.	-4.575**	-2.918	0.001	Stationary	
lnR	At level	-2.530*	-2.917	0.114	Not Stationary	I(1)
	At First Diff.	-8.044**	-2.918	0.000	Stationary	
lnR/P	At level	-2.968**	-2.917	0.044	Stationary	I(0)
lnR/Y	At level	-3.438**	-2.917	0.014	Stationary	I(0)
lnP	At level	-2.287*	-2.917	0.999	Not Stationary	I(1)
	At First Diff.	-6.033**	-2.918	0.000	Stationary	
lnURB	At level	-0.701*	-2.918	0.838	Not Stationary	I(1)
	At first Diff	-3.031**	-2.918	0.047	Stationary	
lnFD	At level	-3.544**	-2.917	0.010	Stationary	I(0)
lnFD/Y	At level	-5.897**	-2.921	0.000	Stationary	I(0)
lnFD/P	At level	-0.547*	-2.921	0.873	Not Stationary	I(1)
	At First Diff.	-6.165**	-2.921	0.000	Stationary	

Source: Author's Computations, 2025

Explanatory Note: In the table above,. indicate rejection of the null hypothesis at the 5% level of significance (i.e. not significant at level) while ** indicates acceptance of the null hypothesis at the 5% level of significance using critical values from MacKinnon (1996).*

The decision rule of ADF is to reject the null hypothesis that a variable has unit root (i.e. the variable is a non-stationary series) if p-value is less than the critical value at 5% significance level (or if t-statistic is greater than the 5% critical value) and accept null hypothesis if otherwise. The result clearly suggests a failure to reject null hypothesis at level for all variables i.e. each of their t-statistics is lower than the critical values and their respective p-values are higher than 0.05. The only exceptions are $\ln\left(\frac{R}{P}\right)\ln\left(\frac{R}{P}\right)$, $\ln\left(\frac{R}{Y}\right)\ln\left(\frac{R}{Y}\right)$, FD and $\ln\left(\frac{FD}{Y}\right)\ln\left(\frac{FD}{Y}\right)$ where their t-statistic values exceed the critical values that the null hypothesis of stationarity is accepted for them.

The implication of this result is that using Ordinary Least Squares (OLS) method to estimate the parameters will lead to spurious regression results if there is no long run cointegration. This necessitates the test of cointegration to check if at all there is a long-run relationship among the non-stationary variables used in the model. Given the order of integration of these variables as pointed out in the above paragraph and, following the previous explanation in Section 3, an appropriate technique to be used to conduct the cointegration test is the ARDL bound test approach to cointegration, the outcome of which are presented and discussed below.

ARDL Bound Test Results

This section presents and discusses the results of the tests of cointegration for the variables in the different versions of Wagner's Law and Musgrave quadratic effect models in order to verify if there exist long-run relationships among each equation and its explanatory variables. The result is evaluated at 5% significance level, implying that 5% level is taken to be the cut-off.

Table 4.2: **Results of Cointegration Test**

Musgrave Type Equations 3.3a to 3.3e	
5%	**F-stat**
Equations 3.3a for G	
2.22	3.78*
3.39	
Equations 3.3b for G/Y	
2.22	**5.39***
3.39	
Equations 3.3c for G	
2.22	7.80*
3.39	
Equations 3.3d for G/P	
2.22	**5.79***
3.39	

Source: Author's Computations, 2025

*Explanatory Notes: In the Table above, the equations specified is Benchmarks Musgrave type. I(0) and I(1) denote critical bound values to accept or reject the null hypothesis at 5% significance, * denotes rejection of null hypothesis, ** denotes acceptance of null hypothesis and *** denotes inconclusive whether to accept or reject.*

Following the decision rule stated earlier in Section 3, the results of the cointegration tests presented in Table 4.2, the F-statistic values of the tests are greater than both I(0) and I(1) critical value bounds at 5% level of significance in all the tests which is a condition for rejecting the null hypothesis of no long run relation among the variables of each equation. A conclusion is therefore reached that there exist long-run relationships among the non-stationary series in all equations.

Estimates of the Musgrave Quadratic Effect Regression Equations

Following the discussion in Section 3, five versions of the model (which are Equations 3.3a to 3.3e of Section 3) are estimated and the results are presented in Table 4.8. This Table 4.8 presents only the long run coefficients of the ARDL regression. The result is evaluated at 5% significance level, implying that 5% level is taken to be the cut-off.

Table 4.3: ARDL Estimates of the Musgrave's Quadratic Effect Regression Equations

	Equation 3.3a for G			Equation 3.3b for G/Y			Equation 3.3c for G			Equation 3.3d for G/P			Equation 3.3e for G/Y		
Varible	**Coff.**	**t-stat.**	**Prob.**	**Coff.**	**t-stat.**	**Prob.**	**Coff.**	**t-stat.**	**Prob.**	**Coff.**	**t-stat.**	**Prob.**	**Coff.**	**t-stat.**	**Prob.**
lnY	37.915	2.944	0.008	33.737	2.429	0.023	-	-	-	-	-	-	-	-	-
(lnY)^2	-1.494	-2.907	0.009	-1.325	-2.386	0.026	-	-	-	-	-	-	-	-	-
Ln(Y/P)	-	-	-	-	-		24.31	1.543	0.132	54.262	3.378	0.002	33.737	2.429	0.023
(lnY/P)^2	-	-	-	-	-	-	-0.96	-1.52	0.137	-2.109	-3.278	0.003	-1.325	-2.38	0.026
lnR	0.790	12.582	0.000	-	-	-	0.738	9.426	0.000	-	-	-	-	-	-
Ln(R/Y)	-	-	-	0.7586	15.695	0.000	-	-	-	-	-	-	0.785	15.7	0.000
Ln(R/P)	-	-	-	-	-	-	-	-	-	0.583	10.338	0.000	-	-	-
lnFD	0.272	5.558	0.000	-	-	-	0.179	3.62	0.001	-	-	-	-	-	-
Ln(FD/Y)	-	-	-	4.074	2.7087	0.012	-	-	-	-	-	-	0.232	5.921	0.000
Ln(FD/P)	-	-	-	-	-	-	-	-	-	0.177	3.654	0.001	-	-	-
lnP	4.1046	3.519	0.002	0.232	5.921	0.018	7.474	4.628	0.000	3.985	2.255	0.034	4.074	2.708	0.012
lnURB	-4.362	-3.328	0.003	-4.361	-2.543	0.018	-8.344	-4.53	0.000	-4.373	-2.163	0.041	-4.361	-2.54	0.018
POLR	-0.442	-8.608	0.000	-0.47	-7.152	0.000	-0.61	-7.69	0.000	-0.422	-5.441	0.000	-0.47	-7.15	0.000
ELEC	0.0177	0.608	0.600	0.018	0.516	0.61	0.073	1.144	0.026	0.027	0.645	0.525	0.018	0.516	0.610
C	-303.38	-3.538	0.003	-275.3	-3.026	0.006	-261.7	-2.41	0.021	-407.0	-384	0.000	-275.3	-3.02	0.006
D.W	1.896			2.129			2.002			2.078			2.129		
R^2	0.976			0.956			0.958			0.959			0.956		
Adj. R^2	0.933			0.898			0.938			0.906			0.898		
Prob.(F-Stat)	0.000			0.000			0.000			0.000			0/000		

Source: Author's computation, 2025

Explanatory Note: In the table above, lnR, lnFD, lnP, lnURB, lnY and (lnY)^2 lnY/P, (lnY/P)^{2}are natural logarithms of revenue, fiscal deficit, population,degree of Urbanization, aggregate income, aggregate income squared, per capital income and per capital income squared. Others are political regime(POLR) and election year (ELEC) dummy variables A parameter estimate is deemed to be statistically significant if its P-value is 0.05 or less.

4 Discussion of the Results

The Section discusses diagnostic and robustness test carried out. Having presented and evaluated cointegration that reveal long-run relationship among variables, the study further evaluates the robustness and diagnostic tests sequentially below:

The R-squared and adjusted R-squared values reported for all the equations in the table indicates high percentage variations in the dependent variable (i.e. government expenditure) being explained by the explanatory variables. The results indicate that the F-statistics of the R^2 values in all models are statistically significant, judging from the very low p-values associated with the F-statistics. This implies that the overall models have good fits.

The performance of all explanatory variables, with the exception of income (viz: Y, $\frac{YY}{PP}$) and its squared terms, are broadly the same as for the previous Table 4.6 estimates that have been discussed already. No remarkable differences exist. This is not surprising as the only difference between the Table 4.6 estimates and the present one under discussion is simply the inclusion of the squared term of the income variable - $\ln Y^2$ or ($ln\frac{Y}{P}ln\frac{Y}{P}$)^2 - which need not make a significant impact on the coefficients of other explanatory variables. Accordingly, and for the sake of brevity, the study refrains from belaboring an evaluation of the performance of these explanatory variables, and, instead, focuses on the performance of the income (or per capita income, as applicable) and its squared term.

The positive coefficients of lnY and $ln\frac{Y}{P}ln\frac{Y}{P}$ in the models are 37.915, 33.737, 24.310, 54.262 and 33.737, with respective p-values of 0.008, 0.023, 0.132, 0.002 and 0.023, indicating that the coefficients are statistically significant at 5 % level in all cases except one (i.e., the coefficient of $ln\frac{Y}{P}ln\frac{Y}{P}$, which is 24.31, with P-value of 0.132 in Equation 3.3c). The conclusion, therefore, is that aggregate income, per capita income and their squares have positive effects on the government size, with a percent increase in lnY leading to 37.91 percent increase in G, and to 33.73 percent increase in $\frac{GG}{YY}$ as well as a percent increase in $ln\frac{Y}{P}ln\frac{Y}{P}$ leading to 54.26 percent increase in $\frac{GG}{PP}$ and a percent increase $ln\frac{Y}{P}ln\frac{Y}{P}$ leading to 33.73 percent increase in $\frac{GG}{YY}$ respectively. Concerning the squared terms, the coefficients of $(\ln Y)^2$ and ($ln\frac{Y}{P}ln\frac{Y}{P}$)^2 in the models are -1.494, -1.325, -0.961, -2.109 and -1.325, with respective p-values of 0.009, 0.026, 0.137, 0.003 and 0.026, indicating that the coefficients are negative and statistically significant at 5 % level in all cases except one – i.e., the coefficient of ($ln\frac{Y}{P}ln\frac{Y}{P}$)^2, which is -0.961, with a P-value of 0.132 in Equation 3.3c) . The conclusion, therefore, is that the square of aggregate income and per capita income has negative effects on the government size. It is interesting to note that, as expected, the sign of the coefficients are opposite to that of the unsquared income variables Y and $\frac{YY}{PP}$. This conclusion is in line with what is postulated in Section 3 and it vindicates the hypothesis of inverted U-shaped relationship between government size and the level of development, as proposed by Musgrave. In short, the prediction of Musgrave theory is robustly supported.

In the five equations for Musgrave quadratic effect estimated, the coefficients of the income and its per capita are positive while their squared are negative in all equations (except aggregate government expenditure) (as expected) but they are statistically significant. Also, the magnitudes and signs of the coefficients of other explanatory variables are broadly the as in the benchmark equations. Also, the alternative expressions of government revenue, fiscal deficit and its various concepts and population have positive effects on the size of government while the civilian regime dummy variable and degree of urbanization have negative effects on the size of government and dummy variable for the years of election has no effect on the size of government.

5 Conclusion

The study has empirically examined the determinants of government size, using Musgrave quadratic effect estimation, the coefficients of the income and its per capita are positive while their squared are negative in all equations (except aggregate government expenditure) (as expected) but they are statistically significant. Also, the magnitudes and signs of the coefficients of other explanatory variables are broadly the same as in the benchmark equations.

The ARDL cointegration technique is used in determining the long run relationship between series with different order of integration (Pesaran and Shin, 1999, and Pesaran et al. 2001). The findings relating to adjustment from short-run to long-run situation indicates that the models adjust back to equilibrium in the long run, with short-run disequilibrium being corrected within a year. Summarily, the results obtained indicate that all variables are the driving force of government expenditures.

Musgrave quadratic effect also reveals that income and its per capita terms and their squared have positive and negative effects on the size of government on aggregate and as a ratio of GDP suggest an inverted U-shaped relationship between per capita income and the government expenditure as proposed by Musgrave. Also, the alternative expressions of government revenue, fiscal deficit and its various concepts and population have positive effects on the size of government while the civilian regime dummy variable and degree of urbanization have negative effects on the size of government and dummy variable for the years of election has no effect on the size of government.

The finding of Quadratic effect is in line with what is postulated in Section 3 and it vindicates the hypothesis of inverted U-shaped relationship between government size and the level of development, as proposed by Musgrave. In short, the prediction of Musgrave theory is robustly supported.

In view of the evidence emanating from findings in all the estimate, the study is therefore recommending that

1. The regulatory authorities, such as the National Assembly, should realize that as the economy of a country improves or per capita income rises, there is tendency for government expenditure per capita to go up and this understanding will guide them in providing their oversight functions because there will be the need for additional governmental services that would be demand-driven.
2. Also, based on the positive or negative effects of all expressions of revenue and fiscal deficit on the government size, the policy makers or regulatory authorities need to understand when the expenditure is overblown so as to take appropriate measures as a corrective action.
3. Furthermore, the positive effect of population size on the size of government expenditure of various categories (except government consumption expenditure) should serve as a guide to the policy makers or regulatory authorities concerning whether population reduction programmes or legislation is required in the country in order to contain the size of government expenditure.
4. The evidence from the study that Wagner's Law holds in the Nigeria case, based on the size and magnitude of the interpretations of Wagner's Law by various propositions specified, it is only the Musgrave (1969) and Mann (1980) that are supported by Nigerian data. The study also upholds the Musgrave theory of public expenditure which suggests that as economic development proceeds, the pattern of expenditure also changes and the tendency towards secular stagnation can be checked by the state by increasing state expenditure to maintain aggregate demand. Therefore, these theories that are supported by our findings should further be strengthened by other studies on government size.

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