Does Optimal Government Size Exist for Developing Economies? The Case of Nigeria

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Abstract:
Government size, its roles and the efficiency of the public sector has becomes a more important issue recently especially when the financial crisis has covered severely almost allEconomies worldwide. Using time-series techniques, this study empirically tests the validity of existing theory (Barro, 1990; and Armey, 1995) which stipulates there is a nonlinear relationship between government size and economic growth; such that government spending is growth-enhancing at low levels but growth-retarding at high levels, with the optimal size occurring somewhere in between. This study employed three estimation equations. First, for the size of government, two measures are considered as follows: (i) share of total expenditures to gross domestic product, (ii) share of recurrent expenditures to gross domestic product. Second, the study adopted real GDP (without government expenditure component), as a variant measure of economic growth other than the real total GDP, in estimating the optimal level of government expenditure. The study is based on annual Nigeria country-level data for the period 1970 to 2012. Estimation results show that the inverted U-shaped curve exists for the two measures of government size and the estimated optimum shares are 19.81% and 10.98% respectively. Finally, with the adoption of real GDP (without government expenditure component),the optimum government size was found to be 12.58% of GDP. Our analysis shows that the actual share of government spending on average (2000 - 2012) is about 13.4%.This study adds to the literature confirming that the optimal government size exists not only for developed economies, but also for developing economy like Nigeria. Thus a public intervention threshold level that fosters economic growth is a reality; beyond this point economic growth should be left in the hands of the private sector. This finding has a significant implication for the appraisal of government spending and budgetary policy design.

Key-words: *Public Expenditure, Economic Growth, Optimum Level, Fully Modified OLS*

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1. Introduction

In the 1960s, growth theory consisted mainly of the neoclassical model, also known as the exogenous growth model, as developed by Ramsey (1928), Solow (1956), Swan (1956), Cass (1965), and Koopmans (1965). One feature of this model is the convergence property. The neoclassical model implies that countries with similar production technologies as well as comparable saving and population growth rates should converge to similar steady-state levels of per capita income. This convergence property means that poor countries starting with a relatively low standard of living and a lower capital/labor ratio will grow faster during the transition as they catch up with the rich countries, but ultimately both groups will arrive at the same level of per capita income.Based on this theory, it is obvious that government policy cannot affect growth rate, except temporarily during the transition of economies to their steady state. The government might be able to affect GDP per capita (and thus is the growth rate) but growth rate always returns to the level determined by the technological progress, as an economy can only witness a permanent growth in GDP when there is a technological development that increases productivity of labour.

According to Agénor&Montiel (2008)it is a well-documented fact that there is a wide dispersion of output growth rates across countries, rich and poor. Countries that at one time had similar levels of per capita income have subsequently followed very divergent patterns, with some seemingly caught in an long-term stagnation and others able to sustain high growth rates. The contrast between the postwar experiences of the developing countries of Asia and Africa is particularly striking in this regard.For instance, they asserted that in the 1960s, average real per capita incomes in Asian and African countries were roughly similar and thirty years later, income per capita had more than tripled in Asia while it had risen only moderately in Africa. This posed a doubt and challenge on the capability of neoclassical growth model (which attribute growth to exogenous technological progress) in explaining the wide disparities in the pace of economic growth across regions and countries. The obvious shortcoming of the neoclassical theory is that the long-run per capita growth rate is determined entirely by an element, *the rate of technological progress*, that comes from outside of the model paved way for new growth theory.

The new growth theory, also known as the endogenous growth model, was pioneered by Romer (1986), Lucas (1988), Barro (1990), Rebelo (1991) and Grossman and Helpman (1991). The theory devoted considerable efforts to understanding the sources of growth and explaining the divergent patterns observed across countries and it has highlighted the existence of a variety of "endogenous" mechanisms that foster economic growth, and has suggested new roles for public policy. In these frameworks, the long-term growth rate depends on governmental actions, such as taxation, maintenance of law andorder, provision of infrastructure services, protection of intellectual property rights, and regulations of international trade, financial markets, andother aspects of the economy. The government therefore has great potentialfor good or ill through its influence on the long-term rate of growth (Barro, 2013).

The initial empirical works on the government sector as determinant of economic growth applied a linear model framework using a Cobb Douglas production function first developed by Feder (1982) and adapted by Ram (1986) (Dalamagas 2000, p.278). These studies and the following ones found opposite clear-cut effects, either positive or negative.For instance, some authors found out that the effect of government expenditure on economic growth is negative or insignificant (Laudau, 1983, Hansson and Henrekson (1994), Dar and

AmirKhalkhali (2002),Taban,2010; Vu Le and Suruga, 2005), others believed that the impact is positive and significant (Komain and Brahmasrene, 2007, Alexiou, 2009; Belgrave and Craigwell, 1995). In Nigeria, studies conducted to validate the relationship between government expenditure and economic growth is also mixed.Among such studies that have support for the Wagner's Law are; Essien (1997), Aregbeyen, (2006), Akpan (2011), Ogbonna (2012), OriakhiandArodoye (2013). Muse, Olorunleke and Alimi (2013) suggested that there no long-run relationship between government expenditure and economic growth, however, they found a weak empirical support in the proposition by Keynes that public expenditure is an exogenous factor and a policy instrument for increasing national income in the short run. Aigbokhan (1996) study reported a bi-directional causality between government total expenditure and national income and studies like Olukayode (2009) and NurudeenandUsman (2010) found inconsistent relationship.Given that the economic literature supplies numerous and conflicting views, the empirical literature investigated the possibility of a nonlinear relationship, assuming that government size has a positive effect on growth but only to a certain extent. This possibility arises from combining both theories of market failures (which justified State interventionism) and State failures (harmful effect of the State's activity and expansion)toaccount for an inverted U-shaped relation between government size and GDP growth (see Facchini and Melki(2011) for theoretical justification for a non-linear relationship between government size and economic growth).

In Nigeria, government expenditure has continued to rise due to the huge receipts from production and sales of crude oil, and the increased demand for public goods like roads, communication, power, defense, education, health and other infrastructure that complement private sector productive activities. Available statistics show that total government expenditure (capital and recurrent) and its components have continued to rise in the last two decades base on the premise that the country has a weak infrastructural base, hence government has to play a greater role in stimulating and engendering economic growth in the face of market imperfections. However, it becomes imperative to determine what the optimum government spending should be. It is believes that expanding government size (government expenditure) beyond a threshold limit has diminishing returns effect and over-expanding government size will cause a crowded-out effect to private investment. In addition, government expenditure often turns into inefficient expenditure which will cause a distorted allocation of the resources as well as corruption. While expanding government expenditure, a government needs more taxes to support the expenditure, but expanding taxes will gradually damage the economy (Landau, 1983; Engen and Skinner, 1991; Folster and Henrekson, 2001; Dar and Amirkhalkhali, 2002).

Therefore ascertaining the optimal size of government is necessary because of the strong theoretical assertion backed by empirical and statistical evidence that as governments grows; the law of diminishing returns starts operating in the sense that up to a point, government expenditure will boost economic growth, but past some point, the extra spending is mostly wasted (Barro, 1990).

The main thrust of this study is to examine two main issues related to government expenditure and economic growth in Nigeria. The first issue is whether governmentexpenditure increases or decreases economic growth. If government spendingin Nigeria has a significant positive impact on economic growth at a macro-level, it may explain the long, more or less steady, rise in government spendingas a fraction of Gross Domestic Product (GDP). The second issue deals with thepossibility of empirically verifying the existence of the so-called 'Armey curve' or 'BARS' curve in the context of Nigeria. The curve, as defined in the literature, claims an inverted U-shaped relationship between government size, i.e., government expenditure as a percentage of GDP, and economic growth.

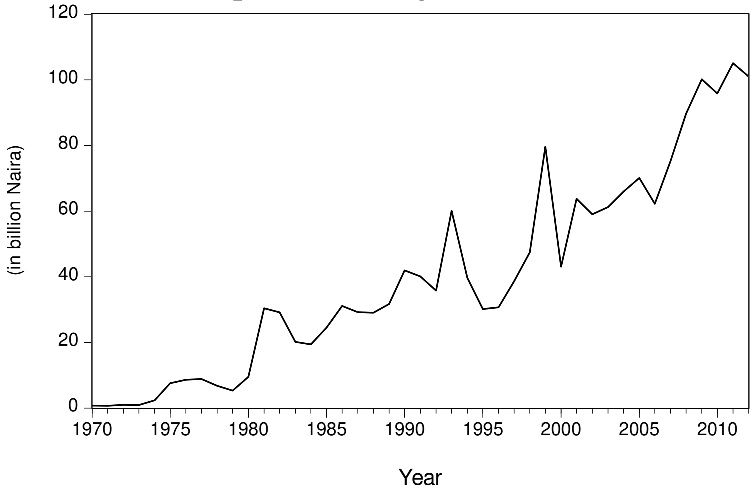
There a plethora of empirical studies on most of the advanced economies especially United State of America but studies on developing economies, Africa in particular is very scarce. To best of our knowledge there is only one study onconducted on Nigeria by Chukwuemeka and Moses (2012) and it did not make any reference to previous studies. This study of optimal government spending level is particularly important to provide a further empirical evidence on Nigeria economy and it is expected that the results obtained in the context of Nigeria could be of relevance to other developing countries, or at least to those with similar economic structures or size.

The rest of the article is structured as follows. Section 2 provides an overview of trends in government spending patterns and economic growth indicators in Nigeria while the Theoretical Background and Review of Literature on Optimal Size of Government and the Armey Curve is briefly considered in Sections 3. Section 4 specifies the methodology used in the study and data sources and Section 5provides empirical findings of the existence of such a relationship in Nigeria over long periods(1970-2012). Section 6 provides a policyperspective to these results, and Section 8 concludes.

2. Government Expenditure and Economic Growth Trends in Nigeria

The magnitude of public expenditure is one of the applied ways to measure the size of government in the whole economy. Hence, it is necessary to compare the magnitude with something else that can enable us to get a glance idea about its size of public sector. In Figure 1, we introduce a time series data of public expenditure in a real term for the period of 1970-2012.

Figure 1: Real Government Expenditure, Nigeria (1970 - 2012)



The trends of two selected economic growth indicators, Real GDP with and without government component are presented if Figure 2a and 2b. The growth indicators show a similar trend over the period under study with similar fluctuation and minor shocks. For example the end of civil war 1979 paved way for productive absorption capacity and government effort was geared toward nation rebuilding.

Figure 2a: Real GDP for Nigeria (1970 - 2012)

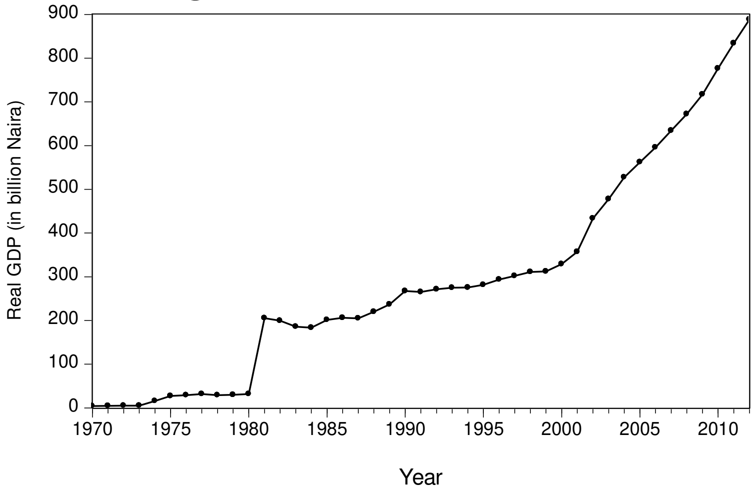
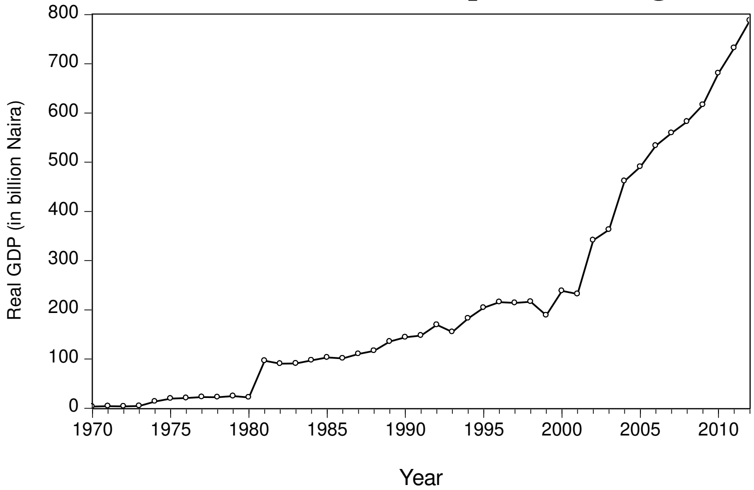
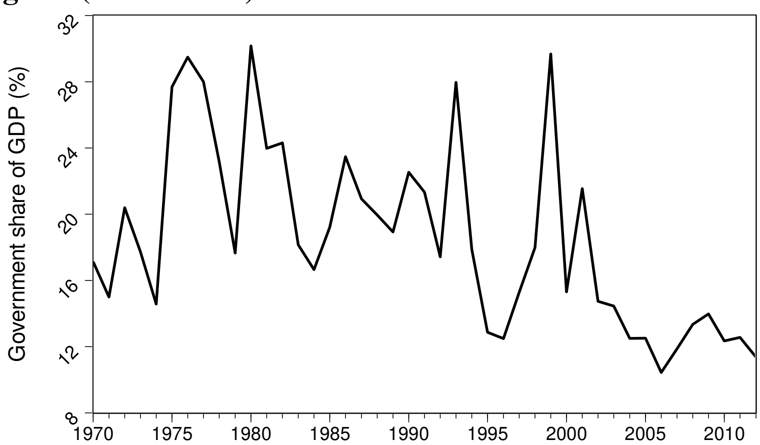


Figure 2b: Real GDP without Government Component for Nigeria (1970 - 2012)



Comparing long-run increases in public expenditure with the trend of real gross domestic product, it seems that the variables of interest have a one-way directional trend which gives impression of what Wagner's law suggests. However, this is an early assumption and cannot be ascertain yet. Therefore, we need to measure in percentage the ratio of public expenditure to GDP, which would provide us an indication of resources the whole economy can make available to the public sector. These ratios are presented with Figure 3.

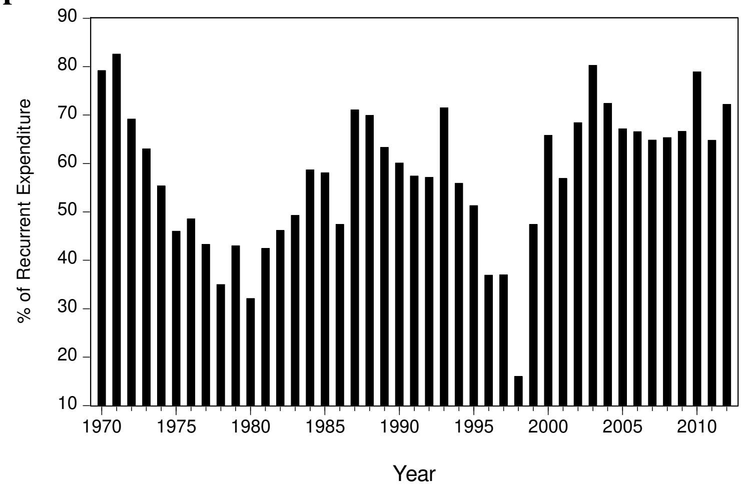
Figure 3: The Trend of the Ratio of Government Expenditure to Nominal GDP In Nigeria (1970 - 2012)



As seen in the figure 3, public expenditure as a ratio to GDP reached peaks of 20.4% in 1972, 29.5% in 1976, 30.2% in 1980, 23.5% in 1986, 22.5% in 1990, 34.2% in 1993, 29.7% in 1999 and 21.5% in 2001. During the period of 1970 – 2012, public expenditure of Nigeria was on average 18.57 percent of GDP, lowest at 10.4 % in 2006 and highest at 30.2% in 1980. The ratio of public expenditure to GDP depicted in Figure 3 provides yet inconclusive analysis with regard to which hypothesis actually fit into Nigeria economy.

We presented in Figure 4 Recurrent Government Expenditure as a percentage of Total Government Expenditures. The decomposition of total government expenditure into recurrent and capital public spending revealed that over the year the proportion of government spending devoted to building infrastructure and other economic activities has been negligible. For instance, between year 2000 and 2012, on average about 70 percent of total government expenditures went into recurrent expenditure.

Figure 4: Recurrent Government Expenditure as a percentage of Total Government Expenditures

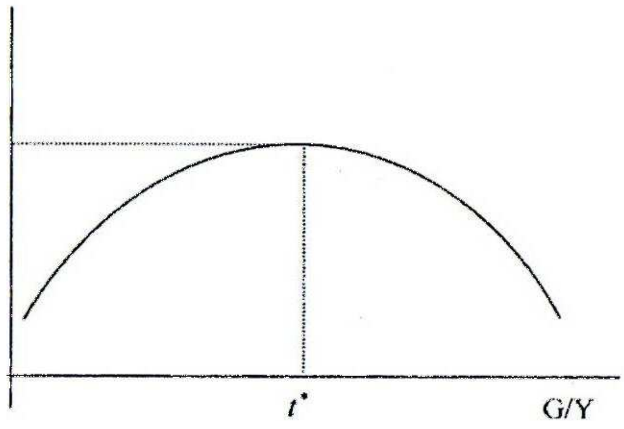


3. Theoretical Background and Review of Literature on Optimal Size of Government and the BARS Curve

Barro (1989) Armey et al. (1995) and Rahn et al. (1996) and Scully (1998, 2003)did theoretical and empirical research and popularized the existence of an optimalsize of government as depicted by an inverted U curve (therefore, we will refer to itas “BARS" Curve” after Barro, Armey, Rahn, and Scully). BARS argues that non-existence of government causes a state of anarchy, an order of violence in which everyone can steal the assets of weaker persons with impunity.The absence of rule of law and protection of property rights and the lack of collective infrastructure lead to poor productivity and consequently, there is little incentive to save and invest thus low levels of wealth creation. Likewise, in a case where all economic decisions are made by government, output per capita is also low (Pevcin, 2004). It however implies that no economy can obtain a significant level of economic growth without a government intervention and contribution and excessively large governments have tendency to become increasingly less productive, consequently reducing output growth; and output should be high when there is a mix of private and government initiative regarding the allocation of resources, output will tend to grow(Facchini and Melki, 2011). Inthis context, government involvement in the economy is a necessary but not asufficient condition for growth.

Government can have a positive influence on economic growth until a certain scope and beyond it, it can become harmful. Thus, an optimal size of government would exist. Figure 1 represents the Armey curve and t* is the threshold value.

Fig.1. BARS Curve



As the size ofgovernment, measured on the horizontal axis, expands from zero (completeanarchy), initially the growth rate of the economy—measured on the vertical axis—increases. The curve has a concave shape due to decreasing marginal returns: a proportional increase in government spending yields a less than proportional increase in economic growth. With accrued positive externalities, an additional percentage rise in government contribution to economic activities still creates higher economic efficiency (i.e., a positive slope). At some point, however, the marginal benefits from increased government spending become zero. The growth-enhancing features of government begin to diminish when the adverse effect of government expansions result in a reduction of output growth.(Herath, 2012).

The literature regarding government expenditure and economic growthincludes studies that assume a linear as well as a nonlinear relationship betweengovernment expenditure and economic growth. Most of the studies are basedon linear models. Facchini and Melki,(2011) reported that among the 64 studies of their sample 47 of them tested only a linearrelationship between government size and growth, while 17 tested a non-linear model.

Among studies that subscribe to non-linear forms of relationships are Sheehey (1993), Armey (1995), Tanzi and Zee (1997),Vedder and Gallaway (1998), Giavazzi et al. (2000),Gupta et.al. (2001), Ekinci (2011), among others. We present in Table 2 some of the finding of studies that estimated a non-linearrelationship between government activity and its performance.

Table 2.Studies estimating a non-linear model

Author(s)	Period	Country/Panel	Optimal Size
Chao and Gruber (1998)	1929 – 1996	Canada	27%
Scully (2000)	1995	22 OECDE/112 countries	20.2 – 22.3%
Afonso et al. (2003)	1990-2000	23 OECD	35%
Mavrov (2007)	1990-2004	Bulgaria	21.42%
Pevcin (2004)	1950-1996	12 EU countries	36-42%
Sheehey (1993)		Panel	15%
Chobanov and Mladenova (2009)	1970-2009	28 EU countries	25.%
Forte and Magazzino (2010)	1970-2009	27 EU countries	35.39-43.50%

Vedder and Gallaway (1998)	1947-1997	US	17.45%
Chen and Lee (2005)		Taiwan	22.83%
Mutascu and Milos (2009)	1999-2008	EU-15	30.42%
Write and MOesen (2009)		23 OECD countries	41.22%
Chukwuemeka and Moses (2012)	1970-2006	Nigeria	23%
Lewis-Bonoe et al (2004)	1975-2002	Carribean	10 -16%

4. DATA AND METHODS

4.1 Model Specification

In our model, the dependent variable is the annual GDP (y) and main independent variable is the size of government (g). Government size is represented by total government expenditure as a percentage of output (GDP), and the growth of the economy is represented by growth of total output (real GDP).

This study followed the model of Herath (2012), which specified the relationship between government size and economic growth as;

$$y_t - y_{t-1} = \phi_1 + \phi_2 g_t + \phi_3 g_t^2 + \phi_4 i_t + \phi_5 c_t + \phi_6 o_t + \varepsilon_t \quad (1)$$

The model added some traditional variables of the literature on the growth-expenditure relationship as controlled variables (Bairam 1990; Dalamagas 2000). These explanatory variablesinclude the investment share of GDP (*i*), the consumption share of GDP (*c*), and the openness of the economy (*o*), in addition to the government share of GDP (*g*) and the square term of government share of GDP (g^2). The inclusion of the variable g^2assists in empirically verifying or invalidating the phenomenon of the Armey curve within this framework.

We modified equation (1) by adding a standard variable measuring the total population of the country (*p*).

$$y_t - y_{t-1} = \phi_1 + \phi_2 g_t + \phi_3 g_t^2 + \phi_4 i_t + \phi_5 c_t + \phi_6 o_t + \phi_7 p_t + \varepsilon_t \quad (2)$$

The positive coefficient of the linear *g*term is related to the constructive effects of government spending on output, and the expected negative coefficient of thesquared*g*term is related to the negative effects of increased government size. ϕ_2 and ϕ_3 are coefficients of government size and the square of government size over time while ε_t is the error term or the white noise. It is expected that the linear term g_t, would have a positive sign and is designed to show beneficial effects of government spending on output (real GDP growth). On the contrary, the squared term,g_t^2, is expected to have negative sign and should measure any adverse effects associated with increased government size. This regression equation specified in equation (2) is a quadratic function ora second-degree polynomial function, because it includes both the linear term and the squared term of *g* in the estimation equation. Since the second-degree polynomial function is linear in the parameters, i.e., ϕs, it does not present any special estimation problems and can be estimated using the Ordinary Least Squares (OLS) estimation technique.

This study employed three estimation equations. First, for the size of government, two measures are considered as follows: (i) share of total expenditures to gross domestic product, (ii) share of recurrent expenditures to gross domestic product. Second, the study adopted real GDP (without government expenditure component), as a variant measure of economic growth other than the real total GDP, in estimating the optimal level of government expenditure. This estimation equation is based on the work of Herath (2012), who adopted an alternative way of examining the relationship between government size and economic growth by slightly adjusting real GDP (economic growth measure) order to incorporate important theoretical contributionsof Wagner's law effect and Baumol's cost disease into the analysis and applied real GDP without the government expenditure component to capture the economic growth.According to Herath (2012) it offers two distinctive advantages: first, it confirms that any causality present between government expenditure and real GDP is in the direction from government expenditure to real GDP; second, the new real GDP series employed here is the productive output flow since the less productive government sector is eliminated.

4.2 Data and Sources

This study is based on annual Nigeria country-level data obtained from Central Bank of Nigeria (CBN) Statistical Bulletin, Fact Sheet of the Bureau of National Statistics various issues and IMF. This study used an annual data series spanning long historical sample in the context of Nigeria (1970 - 2012). The real GDP growth is calculated from GDP, and the GDP deflator. Data for the following variables is presented as percentages; the investment share of GDP (*i*), and the consumption share of GDP (*c*). The government share of GDP (g) is total government expenditure divided by GDP, and the openness indicator (*o*) is total exports plus imports divided by GDP (total trade as a percentage of GDP).

4.3 Preliminary Tests.

In this study, we first examine the stationarity of our variables. A non-stationary time series has a different mean at different points in time, and its variance increases with the sample size (Harris and Sollis (2003). A characteristic of non- stationary time series is very crucial in the sense that the linear combinations of these time series make spurious regression. In the case of spurious regression, t-values of the coefficients are highly significant, coefficient of determination (R^2) is very close to one and the Durbin Watson (DW) statistic value is very low, which often lead investigators to commit a high frequency of Type 1 errors (Granger and Newbold, 1974). In that case, the results of the estimation of the coefficient became biased. Therefore it is necessary to detect the existence of stationarity or non-stationarity in the series to avoid spurious regression. For this, the unit root tests are conducted using DF-GLS, and Ng-Perron. If a unit root is detected for more than one variable, we further conduct the test for cointegration.

Second, cointegration tests are conducted to see if there is a long-run or equilibrium relationship between the variables. Two popular cointegration tests, namely, the Engel-Granger (EG) test and the Johansen test are used. The EG test is contained in Engel and Granger (1987) while the Johansen test is found in Johansen (1988) and Johansen and Juselius (1990). The EG test involves testing for stationarity of the residuals. If the residuals are stationary at level, it implies that the variables under consideration are cointegrated. The EG approach could exhibit some degree of bias arising from the stationarity test of the residuals from the chosen equation. The EG test assumes one cointegrating vector in systems with more than two variables and it assumes arbitrary normalization of the cointegrating vector. Besides, the EG test is not very powerful and robust when compared with the Johansen cointegration test. Thus, it is necessary to complement the EG test with the Johansen test.

5. ESTIMATION RESULTS AND DISCUSSION

In congruence with the methodological framework discuss earlier, we will estimate three regression equations using the fully modified OLS (FMOLS)estimation technique and formulated as follow;

First Equation:

$$y1_t = \phi_1 + \phi_2 g_t + \phi_3 g_t^2 + \phi_4 i_t + \phi_5 c_t + \phi_6 o_t + \phi_7 p_t + \varepsilon_t \quad (7)$$

Second Equation:

$$y2_t = \phi_1 + \phi_2 g_t + \phi_3 g_t^2 + \phi_4 i_t + \phi_5 c_t + \phi_6 o_t + \phi_7 p_t + \varepsilon_t \quad (8)$$

Third Equation

$$y1_t = \phi_1 + \phi_2 g_t^* + \phi_3 g_t^{*2} + \phi_4 i_t + \phi_5 c_t + \phi_6 o_t + \phi_7 p_t + \varepsilon_t \quad (9)$$

where: y1 = real GDP growth with government component
y2 = real GDP growth without government component
g = total government expenditure share of GDP
gt*= recurrent government expenditure share of GDP
g^2 = square term of total government expenditure share of GDP
gt^{*2} = square term of recurrent government expenditure share of GDP
i = Investment share of GDP
c = Private Consumption share of GDP
o = Trade Openness share of GDP
p = Population

Test of Stationarity

In order to establish the order of integration of the variables in our data set, we employed DF-GLS, and Ng-Perron tests. Table 1 and Table 2 present the results for the unit root tests.

Table 1. DF-GLS Unit Root Test		
Variables	DF-GLS at level	DF-GLS at first difference
y1	-5.046063***	-
y2	-1.771484*	-
g	-3.483666***	-
g*	-3.942806***	-
g^2	-3.881162***	-
g^{*2}	-4.523733***	
i	-0.834920	-2.814650***
c	-1.537991	-10.14966***
o	-1.421373	-10.03969***
p	1.641743*	

*Mackinnon (1996); [a](1%), [b](5%) and [c](10%)

Table 2: Ng-Perron Unit Root Test (at level)				
	MZa	MZt	MSB	MPT
y1	-19.5213***	-3.06526	0.15702	1.46354
y2	-4.50041	-1.34665	0.29923	5.71362
g	-15.1154***	-2.69547	0.17833	1.82247
g*	-16.6842***	-2.84455	0.17049	1.62977
g^2	-16.6559***	-2.85446	0.17138	1.58695
g^{*2}	-18.5830***	-3.00667	0.16180	1.46774
i	-1.37648	-0.74923	0.54431	15.7779
c	-4.18647	-1.40753	0.33621	5.90493
o	-4.21488	-1.37585	0.32643	5.91700
p	-1.11629	-0.39217	0.35132	11.0009
Ng-Perron at first difference				

	MZa	MZt	MSB	MPT
y1	-	-	-	-
y2	-8.05969*	-2.00686	0.24900	3.04203
g	-	-	-	-
g^2	-	-	-	-
i	-13.3388**	-2.58248	0.19361	1.83688
c	-16.4233***	-2.84673	0.17334	1.56188
o	-16.5763***	-2.86184	0.17265	1.54137
p	15.1534***	3.28810	0.21684	18.8818

Note: *Ng-Perron (2001, Table 1) &*Mackinnon (1996); [a](1%), [b](5%) and [c](10%)

Table - 1 shows that under DF-GLS unit root test, our main variables (growth of real GDP and government share of GDP) are stationary at levelwhilethe control variables become stationary after first difference. When Ng-Perron unit root was employed, all the series, except *y2, i, c, o* and *p*variables, are stationary at level but they become stationary after taking their first difference i.e. I(1). Hence, we conclude that these variables are integrated of order one I(1), it therefore necessary to determine whether there is at least one linear combination of the variables that is l(0).

Results of Cointegration Tests

The Engle-Granger (EG) test presented in table 3 shows that the residuals from the three measures of output growth (equations 7 -9) are stationary at level, as a result, the variables in question are cointegrated.

Table 3: Stationarity Test of the Residual				
from equation (7)				
Variable	ADF	PP	KPSS	Order of Integration
Residual	-6.600270***	-11.64851***	0.321866***	I(0)
from equation (8)				
	-7.323143***	-7.264094***	0.061413***	I(0)
from equation (9)				
Residual	-7.57990***	-15.30620***	0.390832***	I(0)

To complement the EG test, the Johansen test is conducted and reported in Tables 4. Empirical findings show that both the maximum eigenvalue and the trace tests reject the null hypothesis of no cointegration at both 1 percent and 5 percent significance levels according to critical value estimates, except for equations(7)& (9) where maximum eigenvalue statistics result show a cointegration rank of zero. Thus maximum order of integration for the variables in the system is one. The results above are based on the assumptions of linear deterministic trend and lag interval in first difference of 1 to 1. Overall, the Engle-Granger (EG) and the Johansen cointegration tests suggest that there exist a sustainable cum long-run equilibrium relationship among the variables, thus the need to establish direction of causality.

Table 4: Result of Cointegration Test							
		Equation (7)		Equation (8)		Equation (9)	
	Null Hypothesis	Test Statistics	Probability Value	Test Statistics	Probability Value	Test Statistics	Probability Value
Lags	1						
Trace Statistics	r=0	133.4375	0.0153	140.5594	0.0044	137.9179	0.0071
	r=1	90.62462	0.1070	89.25280	0.1288	95.7536	0.0639
Max-Eigen Statistics	r=0	42.81283	0.1113	51.30658	0.0132	43.7439	0.0903
	r≤1	33.23024	0.2403	27.79164	0.5767	33.1833	0.2426
Trace	No of Vectors	1		1		1	
Max-Eigen	No of Vectors	0		1		0	

Next step is to examine the marginal impacts of government spending, square term of government spending, investment, private consumption, trade openness and population on growth of real GDP in Nigeria.

Table 5: ESTIMATED LONG RUN COEFFICIENTS OF EQUATION (7)

Dependent Variable: the growth of real GDP (with government component)						
	Model 1		Model 2		Model 3	
Variables	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	-244.8304	0.0073***	-208.0256	0.0175**	-210.1763	0.0110**
G	9.1547	0.1400	10.5140	0.0910*	10.4864	0.0790*
g^2	-0.2418	0.1015	-0.2656	0.0742*	-0.2648	0.0628*
I	2.7566	0.0010***	2.0582	0.0021***	2.0743	0.0013***
C	0.7598	0.1679				
O	-0.0661	0.8321	-0.0463	0.8834		
P	0.9268	0.0002***	0.9791	0.0001***	0.9760	0.0001***
R^2	0.3148		0.3058		0.3073	
Durbin-Watson stat.	2.1147		2.1057		2.1055	

We first presented the result of the full model (Model 1), using all the explanatory variables and found that only the coefficients of investment and population are statistically significant. We then left out the explanatory variables of the model step by step, eliminating the least significant variable, until all the included variables are significant at the 10% level or better. This procedureled to the reduced models, Model 2 and Model 3. The coefficients of all the parameter estimates in Model 1, except openness (o), have the correct signs as posed in theory. Trade openness that is theorized as pro-growth has a negative sign, thus suggesting that openness is a drag on economic growth in Nigeria. One plausible reason for this negative effect on growth rate might be dominant of agricultural products in Nigeria non-oil export and un-competitiveness of her export goods. More importantly, in the parsimonious model (model 2), government share of GDP hasthe expected positive coefficient, which is significant at the 10% level, and the squareterm of government share of GDP has the expected negative coefficient with asignificance level of 10%. More so, the coefficient of the investment share ofGDP is positive and significant, in line with the expectation that investment is a spur to the Nigerian economy.

The parsimonious model of model 3 is preferred to model 2 based on two reasons. First the fact that there is improvement in the P-values of the parameter estimates of model 3 over model 2.Second, there is a little improvement on the coefficient of determination (R^2), about 0.15% rise over model 2. Although the explanatory power of the model is low, its highly significant parameter estimates demonstrate that aconsiderable part of the variation of real GDP growth is explained by government shareof GDP, square term of government share of GDP, investment share of GDP and population.The reduced form regression equation derived from the first regression estimationis given as

$$y1_t = -21.1763 + 10.4864g_t - 0.2648g_t^2 + 2.0743i_t + 0.9760p_t \qquad (10)$$

This finding implies that holding all other variables constant, a unit increase in the size of federal government spending as a ratio of GDP leads to an increase of 10.4864 units in real gross domestic producti.e 1%rise in share of government expenditures to GDP will increase the real output of the nation by about N10.5 billion.The parameter estimate of the square of government expenditures as a percentage of GDP is in line with economic a priori expectation. It also validates the argument made by Devarajan et al (1996), that increase in government expenditures beyond a threshold could have a negative impact on growth if the share of the expenditures is already high. We found that, a unit increase in the square of government expenditure as a percentage of GDP leads to a decrease of 0.2648 units in real gross domestic product.

Table 6: ESTIMATED LONG RUN COEFFICIENTS OF EQUATION (8)

Dependent Variable: the growth of real GDP (without government component)						
	Model 1		Model 2		Model 3	
Variables	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Constant	-37.2083	0.6008	-49.7073	0.4728	-72.07465	0.2844
g	1.5922	0.7506	1.8550	0.7108	2.9042	0.55.77
g^2	-0.0800	0.5014	-0.0862	0.4713	-0.1154	0.3290
i	0.8761	0.1716	1.0168	0.0539*	1.2078	0.0221**
c	-0.1240	0.7809				
o	-0.2370	0.3568	-0.2342	0.3684		
p	0.5950	0.0030***	0.5927	0.0027***	0.5795	0.0028***
R^2 Durbin-Watson stat.	0.4295 2.3625		0.4253 2.3903		0.4188 2.4245	

We followed the same procedure in estimating the full model (Model 1), and the reduced models, Model 2 and Model 3. We report the result in Table 6 and we found that our main variable of interest g and g^2 are not statistically significant in the three models. The estimates of investment and population variables are significant, although lower in magnitude when compare with estimation of equation (7). The result of model 3 is chosen based on the fact P-values of the individual parameter estimates are better. The estimation of the second regression equation provides this reduced form equation:

$$y2_t = -72.0746 + 2.9042g_t - 0.1154g_t^2 + 1,2078i_t + 0.5795p_t \qquad (11)$$

This finding suggests that real gross domestic product will increase by N2.90 billion if the share of government expenditures to GDP rises by 1%.

Table 7: ESTIMATED LONG RUN COEFFICIENTS OF EQUATION (9)

Dependent Variable: the growth of real GDP (with government component)				
	Model 1		Model 2	
Variables	Coefficient	P-value	Coefficient	P-value
Constant	-217.3662	0.0005***	-208.2920	0.0004***
g*	11.3034	0.0261**	10.6738	0.0271**
g^{*2}	-0.5183	0.0215**	-0.4861	0.0243**
i	2.2127	0.0012***	2.1281	0.0017***
c	1.0378	0.0467**	1.0321	0.0476**
o	0.0350	0.9052	-	-
p	0.7434	0.0001***	0.7185	0.001***
R^2 Durbin-Watson stat.	0.3110 2.4263		0.3122 2.4173	

Using the same procedure, we estimated the regression equation (9) and reported the result in Table 7. We found that all variablesin the equation are statistically significant at 5% level except trade openness variable (*o*) in the full model. We then left out this explanatory variable (*o*) and obtain a reduced form model (Model 2). The results of the parameter estimates are still significant at 5% level, with an improvement in the coefficient of determination. This finding suggests that real gross domestic products will increase by about N10.67 billion if the share of government expenditures to GDP rises by 1%. The estimation of the third regression equation provides this reduced form equation:

$$y1_t = -208.292 + 10.6738g_t^* - 0.4861_t^{*2} + 2.2127i_t + 1.0350c_t + 0.7434p_t \qquad (12)$$

7. POLICY IMPLICATION

In this section, we shall analyze the policy perspective to our findings in attempt to answer the second research question of this study.The properties of the estimatedparameters of the quadratic equation provide evidence to prove theexistence of the Armey curve. In order to establish this invertedU-shaped curve, the coefficient of the linear term of government share of GDP (*g*)needs to be positive and the coefficient of the square term of government share ofGDP (g^2) needs to be negative.Following our earlier discuss of BARS curve, since the squared term increases in value faster than the linear term, it follows that the presenceof negative effects from government spending will eventually outweighs the positiveeffect, producing a downward-sloping portion.

Our results thus support the statistical estimation of the BARS curve, and they provide a framework to approximately compute the specific pointwhere output is maximised.To calculate the optimal level of government size, we use partial differentiation.This study calculates the first partial derivative of growth of real GDP with respect to *g,* assuming that the other independent variables inthe function, i.e., investment share of GDP and population, are held constant.

$$y1_t = \phi_1 + \phi_2 g_t + \phi_3 g_t^2 + \phi_4 i_t + \phi_7 p_t$$
$$\frac{\partial y1}{\partial g} = \phi_2 - 2(\phi_3 g_t)$$
$$\phi_2 - 2\phi_3 g_t) = 0$$
$$g_t = \frac{\phi 2}{2(\phi 3)}$$

a. $y1_t = -21.1763 + 10.4864g_t - 0.2648g_t^2 + 2.0743i_t + 0.9760p_t$ (from 10)

Since $\phi_2 = 10.4864$ and $\phi_3 = 0.2648$

$$g_t = \frac{10.4864}{2(0.2648)} = 19.8$$

b. $y2_t = -72.0746 + 2.9042g_t - 0.1154g_t^2 + 1,2078i_t + 0.5795p_t$ (from 11)

Since $\phi_2 = 2.9042$ and $\phi_3 = 0.1154$

$$g_t = \frac{2.9042}{2(0.1154)} = 12.58$$

c. $y1_t = -208.292 + 10.6738g_t^* - 0.4861_t^{*2} + 2.2127i_t + 1.0350c_t + 0.7434p_t$ (from 12)

Since $\phi_2 = 10.6738$ and $\phi_3 = 0.4861$

$$g_t = \frac{10.6738}{2(0.4861)} = 10.98$$

The procedure that equalizes the values of the first partial differentiation to zerocalculates the optimal government size ($\hat{g}$) with regard to the first regression as 19.81%. This result, therefore,suggests that the curve peaks where government spending is approximately equalto 20% of GDP, when the growth of real GDP with government component was used to capture growth in economy's productivity and the optimum of about 13% of GDP when we applied real GDP growth without government component. More so, from model (3) where we employed a variant of government size, defined as recurrent government expenditure share of GDP, the optimal government spending is approximately 11% of GDP.

The average government share of GDP in Nigeria was in the neighborhood 23% up to early 1990s, thereafter the country started to witness a downward trend in theshare of government spending to an average of 12.08%of GDP between 2010 and 2012. This result indicatesthat Nigeria had excessive government expenditure in the past,however the countries is reaching an ideal amount of government expenditure from the standpoint ofgrowth optimisation.

8. SUMARRY AND CONCLUSION

Using an annual Nigeria country-level data for the period 1970 to 2012, this study attempted to answer two research questions related to government expenditure and economic growth in the context of Nigeria: (a) whether government expenditure increases or decreases economic growth, and (b) whether it is possible to empirically verify the existence of the BARS curve – an hump-shaped curve that demonstrate that government spending is growth-enhancing at low levels but growth-retarding at high levels, with the optimal size occurring somewhere in between. This study employed three estimation equations. First, for the size of government, two measures are considered as follows: (i) share of total expenditures to gross domestic product, (ii) share of recurrent expenditures to gross domestic product. Second, the study adopted real GDP (without government expenditure component), as a variant measure of economic growth other than the real total GDP, in estimating the optimal level of government expenditure.

In answering the first question as to whether government expenditure increases or decreases economic growth, estimated coefficient of government spending in the three equations showed that government expenditure and economic growth are positively correlated, that is as government expenditure increases, the economic growth also witnesses upward trend. However, our findings showed that the impact coefficient of government expenditure when growth of real GDP (without government component) was used as proxy for economic growth was not significant at 5 percent level. The results are generally consistent with the previous findings such as Akpan (2011), Ogbonna (2012), Oriakhi and Arodoye (2013) and Muse, Olorunleke and Alimi (2013).

The estimation results of the regression analyses is then used, in the latter part of the study to answer the second question as to whether it is possible to empirically verify the existence of the Armey curve for Nigeria. The signs of the coefficients of the government share of GDP and its square term confirm the possibility of constructing the inverted U-shaped Armey curve for Nigeria. The estimated optimum share was found to be 19.81% of GDP when the growth of real GDP with government component was used to capture growth in economy's productivity and the optimum of about 13% of GDP when we applied real GDP growth without government component. The study also found that with a variant of government size, defined as recurrent government expenditure share of GDP, the optimal government spending is approximately 11% of GDP. Moreover, out of the four control variable we used, the study showed that investment (i) and population size (p) promote economic growth in all the estimated equations.

When comparing thesefindings to the actual government expenditurepercentage in recent years, our analysis shows that the actual share of government spending on average (2000 - 2012) is about 13.4%.This result indicates that Nigeria had excessive government expenditure in the past, however the countries is reaching an ideal amount of government expenditure from the standpoint of growth optimization.

This study adds to the literature confirming that the optimal government size exists not only for developed economies, but also for developing economy like Nigeria. Thus a public intervention threshold level that fosters economic growth is a reality; beyond this point economic growth should be left in the hands of the private sector. This finding has a significant implication for the appraisal of government spending and budgetary policy design. Our empirical findings clearly indicate that Nigeria government should reduce its expenditures by a good percentage to have an optimal or growth maximizing size. If the government finds cutting its spending difficult or politically unattractive, it should try to at least enhance its efficiency.

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