

# Government Size and Economic Growth in Nigeria: A Test of Wagner's Hypothesis

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## Abstract

*This paper attempted an empirical validation of Wagner's law in Nigeria using quarterly data for the period 1982 to 2012. The hypothesis that real income does not Granger-cause government expenditure was rejected. Adopting the Fully Modified Ordinary Least Square (FMOLS) regression techniques, the study found support for the Wagner's hypothesis in Nigeria. The analysis provided empirical evidence to support the existence of a long-run equilibrium relationship between economic activity and government expenditure in Nigeria. Overall, the results corroborated the Goffman's version of the Wagner's law in Nigeria. Thus, government needs to create fiscal space to enable deployment of more resources in growth-enhancing activities, while at the same time putting in place policies aimed at raising revenues concomitantly.*

**Keywords:** Wagner's law, Government expenditure, Granger causality, Cointegration, long run, Economic growth, FMOLS, ECM, Nigeria

## I. Introduction

Public finance is one of the most extensively debated facets in economics. Government expenditure, in particular, has been so well studied theoretically and empirically that further attempts to revisit it often seems to be a rehearsal of same old arguments. Nevertheless, many of the issues have remained inconclusive both at the level of theory and empiricism. What drives public expenditures, or the relationship between income and public spending, is one of such contentious issues. The Wagner Law (WL) is iconic among the early attempts to explain this relationship<sup>1</sup>. Wagner (1890) had posited that government activities or expenditure tended to increase with economic expansion, particularly, as a nation tries to industrialise. That is, the share of public expenditure in aggregate economic activity increases with the size of the economy. Though

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<sup>1</sup>Other explanations of the tendency of government expenditure to expand rather rapidly include: social disturbances Peacock and Wiseman, (1961); fiscal decentralization and Urbanization, Pryor (1968); Samuelson (1969); Kee (1977); and Ubogu (1982); public choice (Buchanan 1963, 1975; Tullock 1976, Mueller 1976, 1987); level of bureaucracy and international budgeting Wildavsky (1974), Meltzer and Richard (1981) and Niskanen (1971); fiscal illusion, economic and socio-political forces as well as government borrowing (Buchanan and Wagner (1977), Gupta 1967, Kwanashie (1981) and Ndekwu (1984); increasing government revenue shares, Hinrichs (1965), Marlour and Neela (1987), Anderson et al. (1986) and International demonstration effects and openness of the economy, Cameroun (1978)

old, this subject has remained pertinent in public finance debates. The markets have not been able to effectively displace or confine governments to providing only an enabling environment as is often envisioned by free market advocates. Recent events like the fiscal crisis in Greece and the protracted budget concern in the U.S. attest to the prime place of government expenditure in the economy.

In many oil-exporting developing economies, including Nigeria<sup>2</sup>, Morgan (1979) observed that, Government expenditure has remained the major lubricant driving economic activities such that whenever there is a decline in oil revenues, economic growth suffers. The implication for these economies is that, even when alternatives to oil revenues are found, the discourse about the relationship between government expenditure and economic activity still continues to subsist.

The Wagner's law offers a good theoretical premise for analysing the relationship between Federal Government expenditures and national income growth not just in Nigeria but in other economies. The empirical evidence of Wagner's law on developing countries is growing albeit with conflicting results. Whereas, some studies including Dada and Oguntegbe, (2013); and Ogbonna (2012) reported evidence of the Wagner's Law in Nigeria, others reported non-existence of the law based on equally robust analysis (Babatunde, 2011 and Olayemi, 2009). Consequently, further investigations are required in this direction.

The rationale behind the use of quarterly data is that more data points would be employed in the econometric estimations and this should add to the robustness of results relative to the lower frequency data used by most studies. Generally, quarterly data reveals short-term dynamics and other details that may be otherwise hidden.

The objectives of the study, therefore, are to:

- contribute to the literature on the empirical verification of Wagner's Law using quarterly data on Nigeria, as compared with annual data used in previous studies.
- describe the trends in federal government expenditure and national income growth in Nigeria in order to determine which version of Wagner's law holds true for Nigeria,
- establish the direction of causality between the federal government and national income growth in Nigeria and,

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<sup>2</sup>Where fiscal policy, especially the monetisation of oil receipts, has become a major determinant of liquidity and growth in recent times.

- determine whether Wagner's Law holds in Nigeria, and what policy implications that would elicit.

Following the introduction, Section II reviewed the literature and the gap to be filled by the study. Section III presented a descriptive analysis while Section IV specified the model. Section V presented and discussed the results. Section VI concluded the study with some policy recommendations.

## **I. Literature Review**

### **II.1 Theoretical Literature**

Of the numerous attempts to explain the growth in government expenditure, Wagner (1890), was perhaps the first systematic theoretical construct to put forward an explanation for the increasing scale of state or government activity in countries. Though Wagner's theory had been interpreted in diverse ways, Rocktenwald (1978:103), however, stated that "...from the political economy standpoint, this law means absolute and even relative growth" and that "...an ever increasing and increasingly important proportion of aggregate demand of an advancing civilised people is met by the state instead of by others...".

According to Wagner, for government to discharge its various duties to the society, it had to incur expenditure for different purposes. He went on to argue that as the scale of government increased, the amount of expenditure it incurred for various developmental projects also increased. Thus, the expansion of the public sector or economic growth and public expenditure moved in the same direction. In other words, as the economy developed, government tended to spend more in the quest for industrialisation and social development as asserted by Bhatia (1985), Rocktenwald (1978) and Ghandi (1971). This was indeed, the nexus of the Wagner's law. Thus, expenditure was posited to be positively correlated to the level of economic growth and development.

As observed earlier, the Wagner's law remained unchallenged until 1961, when Peacock and Wiseman (1961) came with an alternative hypothesis that government expenditure grew because of the presence of social disturbances. They found from the results that in the UK, government expenditure moved in a rather spasmodic and step-like manner, as the growth in government expenditure was discovered to have been concentrated within the disturbance period and occurred with displacement effect. The displacement effect was produced because people appeared to accept the higher level of taxes associated with every disturbance and that even after the disturbance, government expenditures did not return to original levels.

Since the works by Wagner in 1890 and those of Peacock and Wiseman (1961), several other studies had been carried out to determine the nature of changes in government expenditure across countries. These results varied from the school of thought that government expenditure actually grew with the level of economic activity (Beck, 1976 and 1979; and Pluta, 1981 and 1979). The decline in government expenditure was found to have occurred in both developed and developing countries, but that it was more apparent in developing countries.

## II.2 Empirical Literature

It is germane to note that while most of the theories were posited based on results of data analysed for the developed countries, few had utilised data from developing countries without considering the peculiarities of these economies<sup>3</sup>. The empirical literature presented two fundamental strands of the Wagner's law. In the first perspective, growth in public sector spending was attributed to the increasing power of interest groups, while the second perspective attributed expansion in government spending to high income elasticity of demand for public goods<sup>4</sup>.

The interest group perspective was developed by Mancur Olson's Logic of Collective Action (1971) which posited that there existed a strong relationship between the growth of public sector expenditure and the political power of interest groups. The second version of the Law stated that a high income elasticity of demand for public goods explained the rise in government expenditure. A plethora of empirical studies both in advanced and developing economies had found evidence in support of the Wagner's law. For example, Szarowska (2012)<sup>5</sup> investigated the Wagner's law in 8 European countries (The Czech Republic, Bulgaria, Latvia, Slovenia, Hungary, Romania, Slovakia, and Estonia) from 1995 to 2009. The results showed that the Law was valid in all the countries, both in the short and long-run. Similarly, Kumar et al., (2012)<sup>6</sup> used New Zealand data to test for the validity of the Wagner's law for the period 1960 to 2007 using both GNP and GDP as proxies for economic activity. Their results supported the Wagner's law. In another study, Mahdavi (2011) examined the validity of the Wagner's law in the United States using data on states and local government expenditures from 1957 to 2006. The study adopted both the Pesaran Bounds Johansen cointegration test and the Toda-Yamamoto causality approaches. The results confirmed validity of the

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<sup>3</sup>This was partly so because majority of those developing countries, including Nigeria, were under colonial rule making some authors to equate the interest of these countries to those of their colonial governments.

<sup>4</sup>Both have formed the premise for a number of empirical works including Friedman and Kuznets (1954)

<sup>5</sup>The author used the Johansen cointegration test and the error correction model.

<sup>6</sup>They carried out the following tests: Autoregressive distributed lag bounds test, Engle and Granger, Phillip Hansen's Fully Modified Ordinary Least Squares and Johansen's time series techniques

Wagner's law for the US states and local governments during the sample period.

Using a sample of 115 countries between 1950 and 1980, Rati (1987) employed the Granger causality to establish the link between government expenditure and national income. He found that 60.0 per cent of the countries in the sample had income elasticity of demand for public goods greater than 1, thus supporting the Wagner's law. He also found that the pattern of causality was different across countries, due to vast differences in each country's socio-economic and political features.

Sidelis (2008) used cointegration and Granger causality techniques to determine whether or not long-run changes in income accounted for growth in government expenditure in Greece during the period 1833 to 1938. The study found that the growth in government expenditure was as a result of the income elastic demand for public goods. In another study, Rati (1986) and Lamartina and Zaghini (2011) reported an inverse relationship between economic growth and public sector expenditure in a sample of 23 OECD countries. The study further noted the existence of a strong correlation between income growth and government expenditure in countries with low levels of initial levels of GDP per capita. Neck and Getzner (2007) tested for the Wagner's law by investigating increase in the level of public sector spending in Austria from the period 1870 to 2002. The authors were of the view that most of the increases in government expenditure were attributed to upward changes in the price levels.

Other studies reported mixed results and outright rejection of the Wagner's law. Karagianni et al., (2002)<sup>7</sup> found results that invalidated the Wagner's law. According to the cointegration results, the Law was valid for 3 (Finland, Netherlands and Italy) out of the 15 EU member countries. In addition, the causality test revealed that the Law was valid for Finland and Italy while partially valid for all other countries except Greece. The Johansen test, however, showed that the Law was invalid for France. The authors opined that the validity of the Wagner's law was sensitive to the methodology adopted.

Other studies with mixed results included Loizides and Vamvoukas (2005)<sup>8</sup>. They found that the Wagner's law was valid for Greece and the UK but not Ireland, while Chang et al (2004)<sup>9</sup> established validity of the Law for South Korea, Taiwan, Japan,

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<sup>7</sup>They employed a series of econometric tests such as Engel and Granger cointegration test, Johansen and Juselius test and Granger causality test for 1949 to 1998.

<sup>8</sup>The authors use cointegration analysis, ECM strategy and Granger causality tests for 1948 to 1995

<sup>9</sup>They employed the Johansen and Juselius cointegration test as well as the Granger causality tests for various periods ranging from 1951 to 1996.

the UK and the USA but not for Australia, Canada, New Zealand, South Africa, and Thailand. Loizides and Vamvoukas (2005) asserted that the validity of the Wagner's law could be strengthened with the inclusion of inflation variable in the model. Studies that did not find validity for the Wagner's law included Ekimova and Balatsky (2012)<sup>10</sup> for the US, Great Britain, Sweden and Russia; Durevall and Henrekson (2011)<sup>11</sup> for the UK and Sweden; Zheng et al (2010)<sup>12</sup> for China; Neck and Getzner (2007)<sup>13</sup> for Austria; Huang (2006)<sup>14</sup> for China and Taiwan; and Afxentiou and Serletis (1996) for 17 European Union countries.

An interesting finding on the Wagner's law was reported by Kuckuck (2012)<sup>15</sup> who indicated that the Law had strong validity at the early stages of economic development but tended to weaken as the country developed. This could imply that the Wagner's law may be stronger in developing than developed countries.

Studies on developing countries also reported mixed results on the validity of the Wagner's law. Bojanic (2013) applied disaggregated data on Bolivia using error correction models and cointegration analysis to test the assumption of a long-run relationship between various kinds of government expenditure and national income. The results showed that there was bi-directional causality between income and government expenditure, thus, establishing validity for the Wagner's law in Bolivia. Sahni and Singh (1984) found no bi-directional relationship between public expenditure and national income in Canada, India and the US. Enweze (1973) in a study of 15 developing countries found that the mean elasticities of public expenditures on administration, defense and education were relatively higher than other expenditure items, suggesting factors other than income, were responsible for the changes in government spending.

Afxentiou and Serletis (1991) employed Granger and Sims causality test on annual data from the European Union and their results rejected the validity of the Wagner's law. At the sub-national level, Narayan et al., (2012) found that 9 out of the 15 Indian States covered in their study indicated strong evidence of the Wagner's law but with the relationship driven more by consumer rather than

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<sup>10</sup>They tested with OLS regression for the period 1930 to 2010.

<sup>11</sup>It used Engle-Granger cointegration and Gregory Hansen tests for structural break for the period 1800 to 2006.

<sup>12</sup>They tested using linear regression, Granger causality test for 1952 to 2007.

<sup>13</sup>Their methodology included descriptive analysis, Johansen-Juselius Procedure and OLS regression for the period of 1954 to 2002.

<sup>14</sup>Author made use of Bounds Test with respect to the Unrestricted Error Correction Model (UECM) estimation and Toda-Yamamoto Granger non-causality approach for the period 1979 to 2002.

<sup>15</sup>They tested the Wagner's law in UK, Sweden, Finland, Italy and Denmark from 1850 to 2010 using the Johansen cointegration technique and vector error correction analysis.

capital expenditure. Again, this is another area that would require further empirical investigation for Nigeria.

In a study that tested for the validity of the Wagner's law in the Fiji Islands during the period 1970 to 2002, Narayan et al., (2008) applied the Johansen cointegration technique and found a long-run relationship between economic growth and government expenditures. On the nature of causality, the authors reported a unidirectional causality running from national output to government expenditure. The authors, however, cautioned that "while the results were a validation of the Wagner's law in the Fiji Islands, the high 69.0 per cent debt to GDP ratio could mean that, in future, the bulk of government expenditures would be expended on debt servicing rather than growing national income. For South Africa, Ogbonna (2009) established support for the Wagner's law in the South African economy during the period 1950 to 2008. Similarly, Ziramba (2009) also found validity for Wagner's law in South Africa for the period 1960 to 2006.

In Nigeria, the outcome of studies on the validity of the Wagner's law were also mixed, with some supporting the Law and others disputing it, but with most of the differences coming mainly from the direction of causality. Danmola, Olateju and, Abba (2013) investigated the linkages between the different components of government expenditure and real gross domestic product for Nigeria. Using Granger causality, error correction model and cointegration techniques, the results were rather mixed. While total capital expenditure and real gross domestic product support the Wagner's law through the Granger causality test showing a unidirectional causality, total recurrent expenditure and real gross domestic product exhibited bi-directional causality. Also Matthew and Adewale (2013) used VECM and confirmed the unidirectional causality running from expenditure to revenue.

Oyinlola et al., (2013) also used Nigerian data for the period 1970 to 2006, to investigate the long-run relationship between government expenditure and economic activity using the VECM. Their findings indicated that increases in federal government expenditures were positively related to economic growth in Nigeria. Usenobong (2011) examined the validity of the Wagner's Law for Nigeria for the period 1970 to 2008 using the (ARDL) bounds testing approach, vector error-correction method (VECM) and the standard Granger causality test. The study found strong support for the Wagner's long-run postulate of causal relationship from national income to public expenditure. However, a short-run causal relationship running from public expenditure to national income in Nigeria was also observed.



Other studies on Nigeria included Aregbeyen (2006) who applied the Johansen cointegration technique and found, amongst others, the presence of a bi-directional causality between non-transfer federal government expenditures and national income. Based on the analysis of the variance decomposition, a stronger causality was established running from national income to non-transfer expenditure when compared with the reverse causality. Also, Akpan (2005) found that government expenditure was positively related with economic growth in Nigeria. Olomola (2004) used the VECM to test data for the period 1970 to 2001 and indicated evidence of the Wagner's law in both the short and long-run. The causality results suggested that economic growth Granger caused government expenditures in Nigeria, which meant that the direction of causality ran from national output to government expenditure.

However, Babatunde (2011) used data for the period 1970 to 2009 and found no evidence of the Wagner's Law in Nigeria. Similarly, Clement and Dickson (2010) used disaggregated data of federal government functional expenditures for the period 1961 to 2007 to test the Wagner's law. They could not establish any evidence of the Wagner's law even when other fiscal policy variables were included in the model. Also, Omoke (2009) could not establish any evidence of long-run relationship between government expenditure and national income in Nigeria during the period 1970 to 2005. Clement et al., (2010), using disaggregated data from 1961 to 2007 to validate the Wagner's hypothesis, observed that the Law did not hold in all the estimations, instead the Keynesian hypothesis was validated.

Applying a cointegration and Granger causality to establish the existence of long run relationship between various items of agricultural capital expenditure and their contribution to GDP, Otu and Nsikan (2013) established empirical evidence for Nigeria on Musgrave's (1969) version of Wagner's law<sup>16</sup>. Equally, Akinlo (2013) investigated the connection between government spending and national income in Nigeria over the period 1961 to 2009. He incorporated population size as one of the variables and the results showed that there was a long run relationship between government spending GDP and population size.

In summary, it could be concluded that the Wagner's law had a strong validity at early stages of development, implying a weakening of the Law as the country developed. This meant that the Wagner's law had more policy relevance to developing than advanced economies; GDP might not always be the best proxy for economic activity. The inclusion of inflation and population size improved the functional specification of the relationship between government expenditure and

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<sup>16</sup>which expresses government size as a function of per capita economic activity



economic activity and the quality of the results was influenced by the econometric technique employed in the analysis. Also, most of the studies concentrated on testing the Wagner's law at the national or federal level, with very few attempts on sub-national governments in America and India. None of the studies tested the Wagner's law at the state or local government levels. This is an important area for further research. More importantly, all the studies used annual time series or cross section data in validating the Wagner's law, with none using quarterly data. The contribution of this study was the use of quarterly data from 1982 to 2012 to investigate the validity of the Wagner's law in Nigeria and its implications for policy within the context of declining oil revenues and the challenge for national development.

### III. Federal Government Expenditure and Economic Activity

In this section, a preliminary descriptive examination of the two variables of interest, federal government spending and economic activity, was presented.

**Figure 1: Government Expenditure and Nominal GDP, 1982-2012**

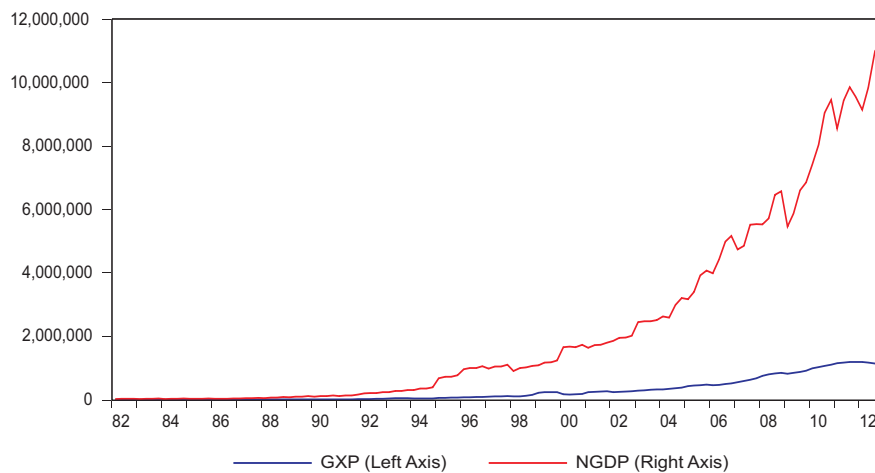
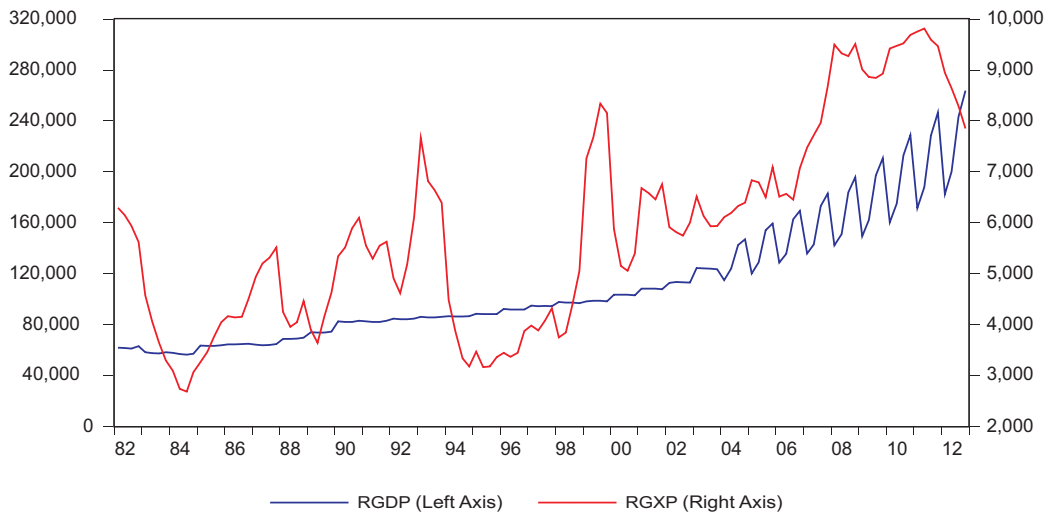


Figure 1 shows both government expenditure and nominal gross domestic product trending upwards between 1982 and 2012, suggesting some relationship. The same pattern appeared evident from the graph of real government expenditure and real GDP in figure 2. Both charts offer some indication of some kind of Wagner relationship, particularly of the absolute type.

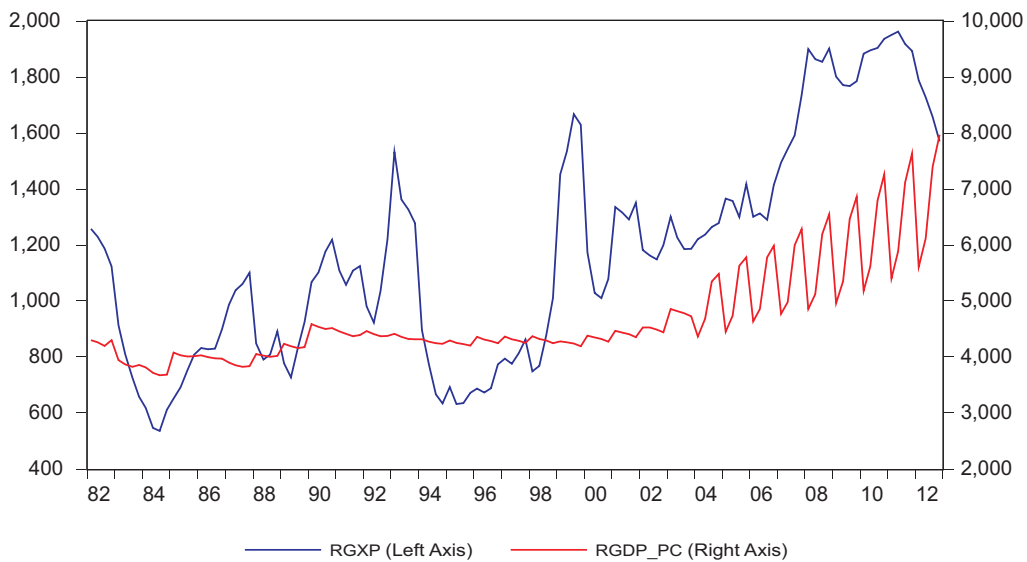
The pattern in figures 1 and 2 are also visible in the per capita variants of the government spending and income in figures 3 and 4. Again, this reinforces the suspicion that a Wagner-type mechanism could be at work with government

spending being driven by expansion in economic activity. There is also the possibility of a feedback from government to income.

**Figure 2: Real Government Expenditure and Real GDP, 1982-2012**

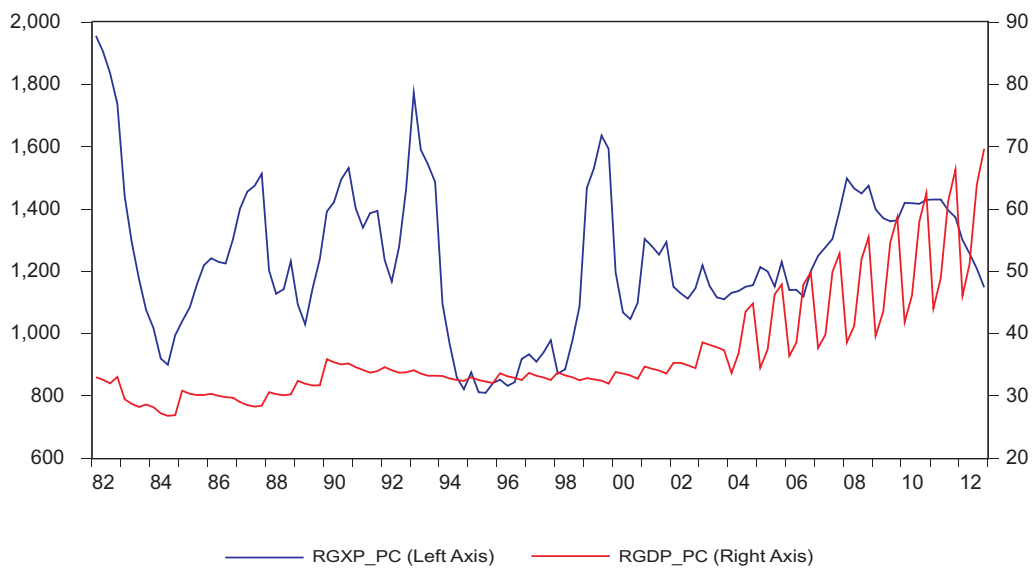


**Figure 3: Real Government Expenditure and per capita Real GDP, 1982-2012**



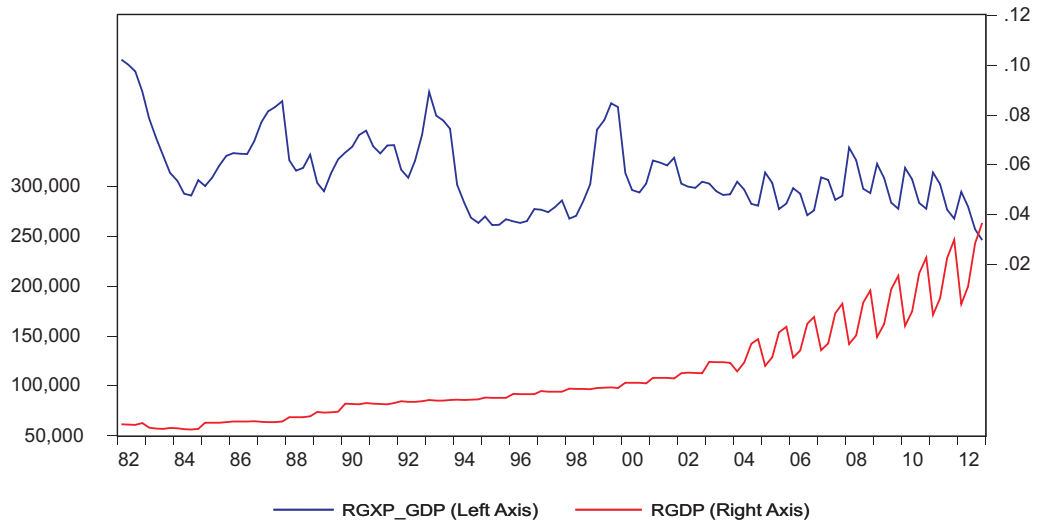
However, when relative expenditure was considered, the picture changed. Federal government expenditure as a ratio of GDP is presented alongside real GDP in figure 5. The series appear to diverge in their trends, which cast some doubts on the presence of the relative interpretation of Wagner's hypothesis by Musgrave (1969) and Mann (1980). Figure 6 reinforces this suspicion as government expenditure as a share of GDP and real GDP per capita appear to be moving in opposite directions during much of the period 1982 to 2012. However, when relative expenditure was considered, the picture changed. Federal government

**Figure 4: Real Government Expenditure and Real GDP per capita, 1982-2012**

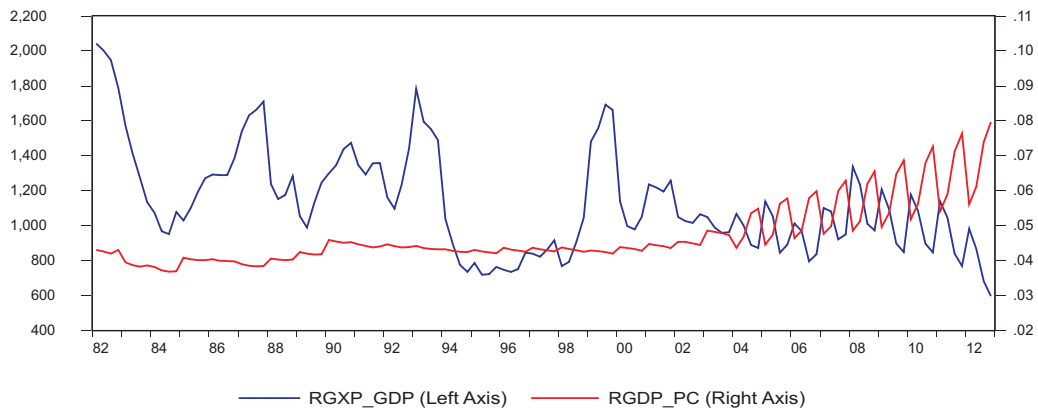


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**Figure 5: Real Government Expenditure/GDP Ratio and Real GDP, 1982-2012**



**Figure 6: Real Government Expenditure/GDP Ratio and Per capita Real GDP, 1982-2012**



The foregoing preliminary indications would inform the choice of which interpretations of the Wagner's hypothesis are focused in the rest of the analysis. Specifically, the relative versions, Peacock and Wiseman (1967), Goffman (1968) and Gupta (1967), are the candidate ones given the pattern gleaned from figure 1-6.

## IV. Methodology

### IV.1 Data Type and Sources

This paper employed Nigeria's quarterly data from 1982 to 2012 on two main time series, real aggregate expenditure of the Federal government of Nigeria to proxy government size<sup>17</sup> and real gross national income of the country to proxy economic development. Other data employed were either subsets of the former, for example, non-oil income or relative measures of government spending per head and per capita GDP. All the data were obtained from publications of the National Bureau of Statistics (NBS) and Central Bank of Nigeria (CBN). All the series were transformed to log to enable us obtain elasticities directly upon estimation.

### IV.2 Model Specification

In this paper, three approaches relating to three different versions of the Wagner's law were employed to investigate the Wagner's law in Nigeria. These included: Peacock - Wiseman (1961); Goffman (1968) and Gupta (1967). In the literature, the three are referred to as the absolute interpretations of the Law. Real gross domestic product (RGDP) and real gross domestic product per capita (RGDP\_PC) were used as proxy for economic activity/growth. Non-oil real gross domestic product (NON\_OIL RGDP) and non-oil real GDP per capita (NON\_OIL RGDP\_PC) were alternative measures of economic development. The study used real government expenditure (RGXP) and real government expenditure per capita (RGXP\_PC) to proxy government size.

The Peacock-Wiseman version stated that public expenditure growth was a function of revenue collection, and over time, economic development would lead to substantial increase in public sector size. In regression form, it is expressed as:

$$\text{LRGXP}_t = \alpha_0 + \alpha_1 \text{LRGDP}_t + \varepsilon_t \quad (1)$$

Where,

$\text{RGXP}_t$  = Real government expenditure at time t;

$\alpha_0$  = Constant term; and

$\alpha_1$  = is the elasticity of government expenditure with respect to economic development<sup>18</sup>

$\text{RGDP}_t$  = Real gross domestic product at time t and;

$\varepsilon_t$  = Stochastic Error term

<sup>17</sup>Government size envisaged by the Wagner's law is total, i.e., includes central government, states or provincial, local government and even public corporations. The study is however constrained by the dearth of reliable data on fiscal activities of government at the lower levels as well as of public corporations. The nearest reliable aggregate is Federal government spending, which is what has been used.

<sup>18</sup>The value of this elasticity is interpreted in the literature in the context of 'loose' and 'strict' Wagner's relationship, if less than one and if greater than one respectively. (Lamartina and Zaghini (2011)

The Goffman (1968) version expresses government size as a function of per capital economic activity.

$$\text{LRGXP}_t = \beta_0 + \beta_1 \text{LRGDP\_PC}_t + \varepsilon_t \quad (2)$$

Where,

|                     |   |   |
|---------------------|---|---|
| $\text{RGXP}_t$     | = | Real government size at time t;                       |
| $\beta_0$           | = | Constant term;  |
| $\text{RGDP\_PC}_t$ | = | Real gross domestic product per capita at time t and; |
| $\varepsilon_t$     | = | Stochastic error term                                 |

All the variables were transformed to their logarithmic form, which expressed the slope coefficients in the models as elasticities. The Wagner's law would be valid in Nigeria if the coefficients  $\alpha_1$  and  $\beta_1$  are greater than zero. The paper applied some standard analytical tools in examining the relationship between government expenditure and economic activity. The tests conducted included unit root, causality, cointegration and estimation of cointegrating equations using the Fully Modified Ordinary Least squares (FMOLS).

## V. Data Analysis

### V.1 Unit Root Tests<sup>19</sup>

The result showed that all the variables were stationary at first difference at 5.0 per cent level of significance as shown in Table 1 below.

**Table 1: Results of Stationarity Tests**

| Variable          | ADF (Prop. Value) |                       | Order of Integration |
|-------------------|-------------------|-----------------------|----------------------|
|                   | Level             | 1 <sup>st</sup> Diff. |                      |
| LRGXP             | 0.1856            | 0.0000                | I(1)                 |
| LRGXP_PC          | 0.4559            | 0.000                 | I(1)                 |
| LRGDP             | 0.9998            | 0.0000                | I(1)                 |
| LRGDP_PC          | 0.9994            | 0.0000                | I(1)                 |
| *LNON_OIL_RGDP    | 0.9804            | 0.000                 | I(1)                 |
| *LNON_OIL_RGDP_PC | 0.9844            | 0.000                 | I(1)                 |

\*Non-oil real GDP

<sup>19</sup>The use of time series economic data in a regression requires a good analysis of the properties of such data to avoid spurious results. The efficacy of times series econometric methodology in establishing relationships among variables hinges on the assumption that the data is stationary (Sevitenyi, 2012). The unit root test is used to examine the status of time series data in terms of stationarity. The Augmented Dickey Fuller (ADF) test was conducted for the presence or otherwise of unit roots in the data. In its general form, it can be written as follows:

$$\Delta Y_t = \alpha + \beta_t + \gamma Y_{t-1} + \delta_1 \Delta Y_{t-1} + \dots + \delta_{p-1} \Delta Y_{t-p+1} + \varepsilon_t \dots \dots \dots (3)$$

Where,  $Y_t$  is the series,  $\alpha$  is the intercept,  $\beta$  is the coefficient on a trend,  $p$  is the order of lag of the autoregression process and  $\varepsilon_t$  is the error term. The ADF test is used to determine the level of integration as well as the possibility of cointegration among variables (Dickey and Fuller, 1981; Ogbonna, 2012). using the past values of both  $X_t$  and  $Y_t$  than it can using the past values of  $Y_t$  alone (Awe, 2012).

**V.2 Causality Tests<sup>20</sup>**

Granger causality was used to gain preliminary insights about the nature of the relationship between measures of government size and economic activity. The results are presented in Tables 2, 3 and 4.

**Table 2: LR GDP and LR GXP (Peacock – Wiseman version, 1961)**

| Pairwise Granger Causality Tests     |     |             |        |
|--------------------------------------|-----|-------------|--------|
| Null Hypothesis:                     | Obs | F-Statistic | Prob.  |
| LR GDP does not Granger Cause LR GXP | 119 | 2.43138     | 0.0395 |
| LR GXP does not Granger Cause LR GDP |     | 0.73291     | 0.6003 |

The result showed that LR GDP Granger-caused LR GXP while LR GXP does not Granger-cause LR GDP. Therefore, a unidirectional causality ran from LR GDP to LR GXP. Similarly, a bi-directional causality was established between LR GDP\_PC and LR GXP.

**Table 3: LR GDP\_PC and LR GXP (Goffman, 1968)**

| Pairwise Granger Causality Tests        |             |        |
|---|-------------|--------|
| Null Hypothesis:                        | F-Statistic | Prob.  |
| LR GDP_PC does not Granger Cause LR GXP | 4.64087     | 0.0115 |
| LR GXP does not Granger Cause LR GDP_PC | 6.58970     | 0.0019 |

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<sup>20</sup>The essence of this study is to find out if there exists a long run tendency for federal government expenditures in Nigeria to grow along with the growth in economic activity. This implies that causality must run from economic activity to government expenditure. The Granger Causality test is employed to establish the direction of causality among variables. In mathematical form it is expressed as follows:  

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \dots + \alpha_j Y_{t-j} + \epsilon_t \dots \dots \dots (1)$$
 In equation 1,  $Y_t$  is expressed as a function of its past values;  

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \dots + \alpha_j Y_{t-j} + \beta_1 X_{t-1} + \dots + \beta_m X_{t-m} + \epsilon_t \dots \dots \dots (2)$$
 However, in equation 2,  $Y_t$  is written as a function of its past values as well as the past values of another times series variable  $X_t$ . The basic idea is that  $X_t$  can be said to Granger cause  $Y_t$  if it can better predict  $Y_t$



**Table 4: LRGDP\_PC and LRGXP\_PC (Gupta, 1967)**

| <b>Pairwise Granger Causality Tests</b>  |                    |              |
|--|--------------------|--------------|
| <b>Null Hypothesis:</b>                  | <b>F-Statistic</b> | <b>Prob.</b> |
| LRGDP_PC does not Granger Cause LRGXP_PC | 0.55652            | 0.6947       |
| LRGXP_PC does not Granger Cause LRGDP_PC | 3.00879            | 0.0212       |

A similar result was found when Goffman Approach was employed.

The causality results from the first two approaches provided useful insight into the application of the Wagner's law to Nigeria. Further investigations and evidence were presented in Section V.3.

### V.3 Cointegration Analysis<sup>21</sup>

Two methods, Engle and Granger (1987) and Phillips Ouliaris (1990), were used to explore cointegration. The results are presented in Table 5 and Table 6.

**Table 5: Cointegration Results based on Engle & Granger (1987)**

| <b>Dependent</b> | <b>tau-statistic</b> | <b>Prob.*</b> | <b>z-statistic</b> | <b>Prob.*</b> |
|------------------|----------------------|---------------|--------------------|---------------|
| LRGXP            | -3.746653            | 0.0200        | -58.26262          | 0.0000        |
| LRGDP            | -2.47165             | 0.2978        | -19.76325          | 0.0480        |

**Table 6: Cointegration Results based on Phillips-Ouliaris (1990)**

| <b>Dependent</b> | <b>tau-statistic</b> | <b>Prob.*</b> | <b>z-statistic</b> | <b>Prob.*</b> |
|------------------|----------------------|---------------|--------------------|---------------|
| LRGXP            | -3.65934             | 0.0250        | -23.88             | 0.0188        |
| LRGDP            | -2.89052             | 0.1462        | -16.22             | 0.1047        |

<sup>21</sup>Cointegration exists between two series if both series are integrated of order one (for instance) and the residuals or errors of the cointegrating equation are integrated at a lower order i.e. I(0). The variables may have long run relationship. The Engle and Granger (1987) test and Phillips Ouliaris (1990) procedures are used to determine if a long-run equilibrium relationship exists between government spending and economic development in this study. For Wagner's law to hold, cointegration is a necessary condition but not sufficient as the direction of causality also matters.

The cointegration results in Tables 5 and 6 showed that government size proxied by government expenditure (LRGXP) and economic activity represented in the model by log of real gross domestic product (LRGDP) are cointegrated. The tau-statistics obtained from tests (Engle and Granger and Phillips-Ouliaris) indicate clearly that this is only valid unilateral causality running from LRGDP to LRGXP. In other words, cointegration was not supported in a reverse relationship in which economic activity was explained by public size instead. This finding from Nigerian data supports the Wagner's hypothesis of increasing state activity.

Cointegration was similarly established between LRGXP and LRGDP\_PC (Goffman's model) and between LRGXP\_PC and LRGDP\_PC (Gupta's model) over the same sample period, 1982 to 2012 (Appendix)

**Wiseman-Peacock Model**

In estimating equation 1 which was the adapted Wiseman Peacock model, the study employed the fully modified ordinary least squares (FMOLS) having established cointegration between real government expenditure (LRGXP) and real gross domestic product (LRGDP).

The results obtained showed that government size tends to grow with economic expansion but by less than unity in the long-run with an estimated coefficient of 0.71 (Table 7).

The result supported the loose interpretation of the Wagner's hypothesis. A strict

**Table 7: Cointegrating Regression Result**

| Dependent Variable: LRGXP                    |             |                    |             |          |
|--|-------------|--------------------|-------------|----------|
| Method: Fully Modified Least Squares (FMOLS) |             |                    |             |          |
| Variable                                     | Coefficient | Std. Error         | t-Statistic | Prob.    |
| LRGDP  | 0.715097    | 0.092602           | 7.722236    | 0.0000   |
| C  | 0.382253    | 1.068130           | 0.357871    | 0.7211   |
| R-squared                                    | 0.596913    | Mean dependent var |             | 8.617114 |
| Adjusted R squared                           | 0.593582    | S.D. dependent var |             | 0.345595 |

Wagner's relationship might only be inferred if the elasticity of government spending was significantly different from unity.

### Goffman's Model

In order to strengthen the evidence, the paper used another version of the Law, following Goffman (1968). Rather than aggregate GDP, Goffman used per capita income, which was viewed as a more appropriate indicator of economic development. This study similarly used real per capita income (LRGDP\_PC) to proxy state activity rather than real income (LRGDP) and log of real government expenditure to proxy for government size<sup>22</sup>. Having established the order of integration of both variables to be one, a non-stationary regression using the fully modified OLS (FMOLS) proposed by Phillips and Hansen (1990)<sup>23</sup> was conducted. The results are presented in Table 8.

**Table 8: Cointegrating Regression (FMOLS)**

| Dependent Variable: LRGXP                    |             |                    |             |        |
|--|-------------|--------------------|-------------|--------|
| Method: Fully Modified Least Squares (FMOLS) |             |                    |             |        |
| Variable                                     | Coefficient | Std. Error         | t-Statistic | Prob.  |
| LRGDP_PC                                     | 1.739636    | 0.221143           | 7.866555    | 0.     |
| C  | -3.25944    | 1.510724           | -2.157534   | 0.0329 |
| R-squared                                    | 0.532248    | Mean dependent var |             | 8.6171 |
| Adjusted R-squared                           | 0.528382    | S.D. dependent var |             | 1      |
|  |             |                    |             | 0.3456 |

The results on Table 8 show that real government expenditure was positively related to economic activity, measured as per capita income (LRGDP\_PC) with a coefficient of 1.73. This supported the 'strict' version of the Wagner's law given that the elasticity of government spending was greater than unity<sup>24</sup>. In line with standard procedure, the residuals from the equation reported in table 8 were examined for the presence of unit roots. The absence of unit roots as suggested by

<sup>22</sup> Log transformation enables us to obtain elasticities directly

<sup>23</sup> Note that cointegration was first established between the variables (Appendix 2)

<sup>24</sup> Elasticity value of less than one is referred to in the literature as supporting loose Wagner hypothesis

the results in Table 9 implied a robust evidence of cointegration, which meant that the two series might diverge in the short-run, but converge around a long-run equilibrium.

**Table 9: Residual Unit Root Test Result**

| Null Hypothesis: RESIDUAL GOFFMAN has a unit root |           |             |        |
|---|-----------|-------------|--------|
|   |           | t-Statistic | Prob.* |
| <b>Augmented Dickey-Fuller test statistic</b>     |           | -3.681751   | 0.0056 |
| <b>Test critical values:</b>                      | 1% level  | -3.488585   |        |
|   | 5% level  | -2.886959   |        |
|   | 10% level | -2.580402   |        |

\*MacKinnon (1996) one-sided p-values

### Gupta's Model

The paper also investigated the Wagner's hypothesis following Gupta (1967) which used government spending per head as a measure of the relative size of government. Since both variables are integrated of order one, cointegration was explored and found to exist between the two (Appendix). The non-stationary regression results in Table 10 showed that per capita government expenditure (LRGXP\_PC) was positively related to economic activity. This result supported the 'strict' version of the Wagner's law given that the elasticity of government spending was greater than unity<sup>25</sup>.

**Table 10: Cointegrating Regression (FMOLS)**

| Dependent Variable: LRGXP_PC                 |             |                    |             |          |
|--|-------------|--------------------|-------------|----------|
| Method: Fully Modified Least Squares (FMOLS) |             |                    |             |          |
| Variable                                     | Coefficient | Std. Error         | t-Statistic | Prob.    |
| LRGDP_PC                                     | 1.096699    | 0.375112           | 2.923658    | 0.0041   |
| C  | -3.346591   | 2.472664           | -1.353435   | 0.1785   |
| Trend  | -0.003605   | 0.001773           | -2.033556   | 0.0442   |
| R-squared                                    | 0.065095    | Mean dependent var |             | 3.918555 |
| Adjusted R-squared                           | 0.049513    | S.D. dependent var |             | 0.227629 |

<sup>25</sup>Elasticity value of less than one is referred to in the literature as supporting loose Wagner hypothesis

The residual series from the equation, RESIDUAL GUPTA, was tested for unit roots and found to be stationary (Table 11).

**Table 11: Residual Unit Root Test Result**

| <b>Null Hypothesis: RESIDUAL GUPTA has a unit root</b> |                  |                  |        |
|--|------------------|------------------|--------|
|  |                  | t-Statistic      | Prob.* |
| Augmented Dickey-Fuller test statistic                 |                  | -3.802397        | 0.0199 |
| Test critical values:                                  | 1% level         | -4.040532        |        |
|  | 5% level         | -3.449716        |        |
|  | <b>10% level</b> | <b>-3.150127</b> |        |

\*MacKinnon (1996) one-sided p-values

Overall, the analysis of data spanning 1982 to 2012 provided some evidence in support of the Wagner's Law in Nigeria. All the tests, Granger Causality, single equation cointegration tests (Engle-Granger and Phillips-Ouliaris) and FMOLS estimates suggested the relevance of the Wagner's hypothesis in explaining government expenditure in Nigeria between 1982 and 2012. It was also interesting to note that, the results did not remarkably differ from other studies using aggregate series. Table 12 presented a summary of elasticities of government expenditure with respect to economic activity.

**Table 12: Estimates of Cointegrating Equations using Real Non-Oil GDP**

| <b>Model</b>           | <b>Dependent Variable</b> | <b>Independent Variable*</b> | <b>Elasticity</b> | <b>t-statistics</b> |
|------------------------|---------------------------|------------------------------|-------------------|---------------------|
| <b>Wiseman/Peacock</b> | LRGXP                     | LNON_OIL_RGDP                | 0.84              | 2.95                |
| <b>Goffman</b>         | LRGXP                     | LNON_OIL_RGDP_PC             | 1.3               | 7.86                |
| <b>Gupta</b>           | LRGXP_PC                  | LNON_OIL_RGDP_PC             | 0.85              | 2.99                |

\* LNON\_OIL\_RGDP is log of real non-oil gross domestic product while LNON\_OIL\_RGDP\_PC is log of real non-oil gross domestic product, per capita

The results in Table 12 simply validated the earlier ones. While the elasticity of government spending increased in the Wiseman-Peacock model, those obtained from both the Goffman and Gupta models declined when non-oil GDP was used as proxy for economic development.

## **V. Conclusion**

Recent developments in the field of econometrics had generally ensured that more rigorous and empirical evaluations of the Wagner's law could be carried out using long-run simulation on time-series data. Nevertheless, empirical works on both developed and developing countries had reported different results. The major findings of this paper was that Federal government expenditures in Nigeria is not 'completely exogenous' as implied by Keynes in the *General Theory*. The results also did not rule out the possibility of reverse causality. For Nigeria, judging by the results of this and many other studies, it was safe to say that Federal government expenditures were, in part, driven by economic development, as measured by aggregate output or per capita income. Overall, the data on Nigeria provided a strong evidence of the Goffman's version of the Wagner's law.

Given that government fiscal position was positively influenced by economic activity, a symbiotic relationship might be exploited by policy makers to accelerate growth. For planning, the results are very crucial. This is because, as economy expands, public sector financial commitment increases, which may be sustainable if the revenue side is concomitantly strengthened. It is, therefore, possible to plan and implement improvement in taxation as the economy grows to avoid fiscal indiscipline.

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### Appendix: E-Views Outputs of Cointegration Results

| Dependent | tau-<br>statistic | Prob.* | z-statistic | Prob.* |
|-----------|-------------------|--------|-------------|--------|
| LRGXP     | -3.720369         | 0.0215 | -293.3343   | 0.0000 |
| LRGDP_PC  | -1.825713         | 0.6187 | -21.11690   | 0.0351 |

\*MacKinnon (1996) p-values.

| Dependent | tau-<br>statistic | Prob.* | z-statistic | Prob.* |
|-----------|-------------------|--------|-------------|--------|
| LRGDP_PC  | -4.425279         | 0.0025 | -39.27814   | 0.0004 |
| LRGXP     | -4.098319         | 0.0072 | -31.38778   | 0.0029 |

| Dependent | tau-<br>statistic | Prob.* | z-statistic | Prob.* |
|-----------|-------------------|--------|-------------|--------|
| LRGXP     | -3.720369         | 0.0215 | -293.3343   | 0.0000 |
| LRGDP_PC  | -1.825713         | 0.6187 | -21.11690   | 0.0351 |

\*MacKinnon (1996) p-values.

| Dependent            | tau-<br>statistic | Prob.* | z-statistic | Prob.* |
|----------------------|-------------------|--------|-------------|--------|
| LRGXP                | -4.150720         | 0.0061 | -31.75488   | 0.0027 |
| LNON_OIL_RG<br>DP_PC | -4.329004         | 0.0035 | -37.28503   | 0.0006 |

\*MacKinnon (1996) p-values.

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| Dependent | tau-<br>statistic | Prob.* | z-statistic | Prob.* |
|-----------|-------------------|--------|-------------|--------|
| LRGXP     | -3.720369         | 0.0215 | -293.3343   | 0.0000 |
| LRGDP_PC  | -1.825713         | 0.6187 | -21.11690   | 0.0351 |

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\*MacKinnon (1996) p-values.

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| Dependent | tau-<br>statistic | Prob.* | z-statistic | Prob.* |
|-----------|-------------------|--------|-------------|--------|
| LRGXP_PC  | -4.233217         | 0.0047 | -32.20790   | 0.0024 |
| LRGDP_PC  | 0.570510          | 0.9973 | 1.226266    | 0.9974 |

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\*MacKinnon (1996) p-values.

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| Dependent   | tau-<br>statistic | Prob.* | z-statistic | Prob.* |
|-------------|-------------------|--------|-------------|--------|
| LRGXP_PC    | -4.212844         | 0.0050 | -31.96471   | 0.0025 |
| LNON_OIL_RG |                   |        |             |        |
| DP_PC       | 0.783832          | 0.9985 | 1.798596    | 0.9988 |

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\*MacKinnon (1996) p-values.

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| Dependent | tau-<br>statistic | Prob.* | z-statistic | Prob.* |
|-----------|-------------------|--------|-------------|--------|
| LRGXP     | -3.720369         | 0.0215 | -293.3343   | 0.0000 |
| LRGDP_PC  | -1.825713         | 0.6187 | -21.11690   | 0.0351 |

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\*MacKinnon (1996) p-values