
Bigben Chukwuma Ogonbna
Department of Economics, Ebonyi State University, Abakaliki, Nigeria
E-mail: bigbenogbonna@yahoo.com +234-803-7467-628

Abstract
Wagner’s Law suggests that as the economic activity of a country increases, so does its government expenditure. This paper examines the validity of Wagner’s law in Nigeria for the time period 1950-2008. For investigating the existence of a long run and causal relationship between government expenditure and national income, three of the most advanced econometric methods, the Johansen maximum likelihood cointegration method, error correction modeling and the Granger causality test have been applied to Musgrave (1969) version of the functional interpretations of the law. All the results of the empirical estimations point to the fact that Wagner’s Law is supported for Nigerian economy during the period under review. Policy wise, this contribution suggests that Government of Nigeria cut back on public capital spending because of lack of transparency in the procurement of capital projects which has left such expenditures unproductive. Government should see the urgent need to provide environment conducive for private sector active participation in economic activities and implement with all sincerity the on-going Public Private Partnership Programme (PPPP). These will ensure increased efficiency in the allocation of resources and tend to reduction in government size. The results further imply that development plans of Nigeria must incorporate such fiscal policy measures that would guarantee commensurate growth in government revenue to accommodate the expected growth in government size.

Keywords: Wagner’s law; causality; government size; growth.

Introduction
Wagner’s law has been the subject of intensive and extensive investigations, in particular during the post second world war era, when public consumption declined in favor of the private activities development. The above law is of the notion that there is a long-run tendency for government activities to grow relative to economic activity (Wagner, 1890). More specifically, the law states that, during the process of economic development, as the real income per capita of a nation increases, the share of public expenditures in total economic activities increases. Thus, higher levels of economic growth require higher levels of public expenditure. Wagner stated that during the industrialization process, as real income per capita of a nation increases, the share of public expenditures in total gross domestic product increases. According by him, three main reasons support this hypothesis: (1) during industrialization, the administrative and regulatory functions of the state would substitute public for private activity; (2) economic growth would result in increased need for cultural and welfare services, which are assumed to be income elastic; (3) state participation would be inevitable to provide the capital funds to finance large-scale projects made to satisfy the technological needs of an industrialized society, where private sector lacks the capacity. In other words, Wagner’s law states that government grows because there is an increasing demand for public goods and for the control of externalities. In effect, the law also suggests that causality runs from national income to public consumption, indicating that public expenditure is considered as endogenous to the growth of national income.

Wagner’s law is predicated on a simple positive correlation between a nation’s gross domestic product (GDP) and government size (G). This has generated different interpretations leading to introduction and empirical examination of several versions of the law since the 1960s (Ferda, 2003). Several commentators on Wagner's Law (see e.g. Musgrave, 1969) have claimed that it is unclear whether the law of expanding scale relates to the share of government in national income or just to the absolute level of government. To Timm (1961), this alleged ambiguity is unjustified as thorough assessment of Wagner's writings, convincingly demonstrates that Wagner had the relative growth
in mind. In effect, there seems to be a reasonable consensus in the literature that Wagner’s Law should be interpreted as predicting an increasing relative share for the public sector in the total economy as per capita real income grows. If $G/GDP$ increases as $GDP/N$ increases, the elasticity value for the relationship exceeds zero. Wagner’s law in functional forms, however, seems to be more controversial. See Peacock–Wiseman (1961), Musgrave (1969), Goffman and Mahar (1971), Pryor (1968), Mann (1980), Goffman (1968), Gupta (1967) and Michas (1975). The final functional form is a Musgrave (1969) version, which expresses the share of government expenditure in gross domestic product (GE/GDP) as a function of income per capita (GDP/N) as follows:

\[
GE/GDP = f \left(\frac{GDP}{N}\right)
\]

Musgrave (1969) version which was also adopted by Ram (1986), Murthy (1993), Henrekson (1993) and Hsieh and Lai (1994), appears to represent what Wagner had in mind in his proposition and has more or less gained universal acceptance and application. Thus, this paper will follow the same path to investigate the validity of Wagner’s Law for the South African economy. The remainder of this paper is structured as follows: Section 2, brief literature review; section 3, empirical methodology; section 4, presents the empirical evidence and Section 5, the concluding remarks.

**Literature synopsis**

One of the frequently quoted stylized facts of public sector economics is that of “Wagner’s Law,” about the long-run tendency for public expenditure to grow relative to some national income aggregate such as GDP. This implies that public expenditure can be treated as an outcome, or an endogenous factor, rather than a cause of growth in national income. On the other hand, Keynesian propositions treat public expenditure as an exogenous factor, which could be utilized as a policy instrument. In the former approach, the causality runs from national income to public expenditure whereas in the latter proposition, causality runs from public expenditure via domestic demand to national income (Afonso and Furceri, 2008). Evidence concerning this topic is not conclusive. Moreover, Barro (1990) mentions the importance of government expenditure in public infrastructure for economic growth and Romer (1990) stresses the relevance of research and development expenditure. Therefore, composition of public spending is also a relevant issue, and if the aim is to promote growth, the focus should be put on the more productive items of the budget, even if the balance between the various functional items of the budget can vary in accordance with country specifics. The basic thrust of Wagner’s law is that the relative size of the public sector in the economy (G/DGP) has an inherent tendency to grow as per capita income (GDP/POP) increases. It is fair to say on balance that most of the time series studies have found the ratio-income-elasticity coefficients to be positive and statistically significant, by using

\[
G/GDP + \alpha + \beta \left(\frac{GDP}{POP}\right) + \epsilon
\]

Thus, Wagner’s law has been validated, particularly for countries in the process of transition from Rural-Agricultural to an Urban-Industrial one (Nagarajan and Spear, 1977) Wagner’s law has been tested empirically in time-series and cross-sectional frameworks and, with few exceptions, the law has received strong support. In empirical analyses, country-specific studies are frequently used: for example, Henrekson (1993) for Sweden, Ashworth (1995) for the UK, Hondroyiannis and Papapetrou (1995) for Greece, Nomura (1995) for Japan and Park (1996) for South Korea. Cross-country studies have also become quite popular, thus, Ram (1987) includes 115 countries, Bohl (1996) investigates the G-7 countries and Anwar et al. (1996) analyze 88 countries. In addition to aggregate analyses, disaggregating of data is also noted in empirical studies of Wagner’s law. See, Bairam (1995), Asseery et al. (1999) and Burney (2002). There have been also some empirical studies relating to Wagner's Law for Turkey. Krzyzaniak (1974) conducted a study of Turkey for the period from 1950 to 1969. After regressing public expenditure on GNP he found statistically significant estimates of the income elasticity of public expenditure with regard to GNP which appear to support Wagner’s Law. Önder (1974) conducted a study of public expenditure growth in Turkey for the period 1947-1967. Using aggregate variables (in total and in per
capita terms), he found the income elasticity of public expenditure with regard to GNP (or GNP per capita) to be smaller than unity. These results appear to undermine Wagner’s Law (with aggregate data) for the study period. In a recent study, Yalçin (1987) also found that using aggregate data, her findings did not support the validity of Wagner’s Law. Sideris (2007) empirically investigated the long-run tendency for government expenditure to grow relative to national income, Wagner’s law, using Greek data for the period 1833 – 1938. The results provide support for the validity of the law, and are in line with other studies examining the relationship between government spending and national income in other economies during the 19th century. Granger causality tests indicate causality running from the variables approximating income to the government expenditure variable. In effect, the results of the study support the validity of Wagner’s Law for Greece.

However, Babatunde (2008) tests Wagner’s Law for Nigeria using annual time series data between 1970 and 2006. It adopts the Bounds Test approach proposed by Pesaran et al. (2001) based on Unrestricted Error Correction Model and Toda and Yamamoto’s (1995) Granger non-causality tests. Empirical results from the Bounds Test indicate that there exists no long-run relationship between government expenditure and output in Nigeria. In addition, the Toda and Yamamoto’s (1995) causality test results show that Wagner’s Law does not hold for over the period being tested. Rather 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.

Furthermore, Olayeni (2009) examines the productivity of government expenditure. It adopts a Barro-type production function to chart out a growth model that accounts for the productivity of government spending and also adopts Wagner’s hypothesis to account for endogeneity resulting from fiscal expansion. The model is estimated via the Bayesian technique using the data on Nigeria. The result shows that government expenditure was unproductive in Nigeria and that this conclusion is independent of the macroeconomic environment. Neither is it dependent on the external circumstances. The paper concludes that there is need for urgent budgetary evaluation and close monitoring of the government budget in Nigeria.

Aregbeyen (2006) examines the validity of Wagner’s Law against the contending Keynesian proposition using Nigeria’s data over the period 1970-2003. Two variants of the models for investigating Wagner’s Law were tested. The first relates total public expenditure to national income, while the second relates non-transfer public expenditure to national income. Using recent econometric advances of cointegration and causality techniques, the results suggest a unidirectional causality from national income to total public expenditure in support for Wagner’s Law. There is bi-directional causality between non-transfer public expenditure and national income. But, the causality from national income to non-transfer public expenditure was found to be stronger than the reverse direction following variance decomposition analysis. This therefore confirms the validity of Wagner’s Law for Nigeria.

Although there are some studies of public expenditure growth in the Nigerian public finance literature, as mentioned above, in the present contribution, we intend to employ data spanning through 1950 – 2008 and econometric methodologies that has gained considerable currency to test for the presence of Wagner’s Law in Nigerian economy both for the purpose of providing further empirical literature for Nigeria and enquiry into existing results in this direction. Moreso, a study of the relationship between Government expenditure and national income is worthwhile and receive increasing attention from researchers both in public finance literature and in the literature dealing with macroeconomic modeling (Cheong, 2001). A testable thesis in the present contribution is whether economic development promotes Government size in Nigeria.

Empirical methodology

Data and variable definition

The data we have employed for Nigeria are annual figures covering the period 1950–2008. Following Musgrave (1969) version of Wagner’s law formulation, the variables are measured as follows: real Gross Domestic Product (RGDP) is proxied by
Perron (PP) unit root tests are applied to the latter series econometrics methodology requires an estimation procedure for annual instead of quarterly data sets that according to Tao and Zestos, 1999 "... causality is a timely phenomenon, and the interaction of economic variables cannot work in short periods of a few quarters’”

Model specification and estimation procedure

To investigate the relationship between government expenditure and economic activity, this paper adopts Musgrave (1969) final version of functional form of Wagner’s law which examines the relationship between government size in GDP and real per capita income. This can be written in linear natural logarithmic regression of the form:

\[ \text{LGCYR}_t = a_0 + a_1 \text{LYPCAP}_t + \sum_{i=1}^{\infty} \sum_{j=1}^{p} \beta_{ij} \Delta \text{Y}_{t-i} \Delta \text{Y}_{t-j} + \epsilon_t \]  

where \( \epsilon_t \) is the stochastic error term and \( P \) is the lag length. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests are employed to test the integration level and the possible co-integration among the variables. (Dickey and Fuller, 1981; Phillips and Perron, 1988).

(ii) Next, we employ co-integration test to determine if the variables in the system are co-integrated. The Johansen (1988, 1991) maximum likelihood procedure of testing for cointegration is preferred to the Engle-Granger method as the latter may not yield a definitive conclusion with regard to cointegration between two variables. It is often the case that while cointegration is suggested to exist between two variables in a regression of one variable on the other, a reverse regression between them would yield an opposite conclusion. This problem does not arise with the maximum likelihood procedure. It permits simultaneous estimation of systems involving two or more variables, regards all variables in a model as endogenous within a vector auto regression (VAR) framework (Tan, n.d) and provides more accurate estimate for the parameters of the long run relationship (Hallam and Zanoli, 1993). Generally, it allows estimation and testing for the presence of one or more co integrating vectors in a multivariate system.

(iii) If the series are found to be co integrated, then an error correction-term, \( EC_{t-1} \), obtained from one lagged period of \( \epsilon_t \) in (3) should be included into the standard Granger causality procedure as in model (5), which more formally refers to the error-correction model (ECM), and estimate the same.

\[ \Delta \text{LGYR}_t = a_0 + \sum_{i=1}^{\infty} \Delta \text{LGYR}_{t-i} + \sum_{j=1}^{P} \Delta \text{LYPCAP}_{t-j} + a_3 \text{EC}_{t-1} + \epsilon_t \]  

(i) Unlike traditional econometric methodology, time-series econometrics methodology requires an analysis of the time-series properties of the economic variables in a regression equation before any estimation for fear of spurious regression. To stem the problem of spurious regression, it is important that the time series properties of the data set employed in estimation of equation 3 is verified. It might seem reasonable to test for the presence of a unit root in the series using the most general of the models as:

\[ \Delta \text{Y}_t = \gamma_{t} + \eta_t + \sum_{j=1}^{\rho} \beta_{j} \Delta \text{Y}_{t-j} + \epsilon_t \]  

The estimation procedure adopted in this study is in three sequences.

The GDP as deflated with the consumer price index, real government expenditure (RG) is proxied by total annual public consumption deflected with consumer price index to adjust for inflation. Real Government size is refers to real government expenditure normalized by real gross domestic product (RGYR) and real per capita income, defined as gross economic activities of Nigeria divided by the population size (RYPCAP) to remove the effect of population growth. Data are sourced from IMF-International financial statistics (IFS) O-line (2009). In this study, our preference for annual instead of quarterly data sets that according to Tao and Zestos, 1999 “... causality is a timely phenomenon, and the interaction of economic variables cannot work in short periods of a few quarters’”

The estimation procedure adopted in this study is in three sequences.

(i) Unlike traditional econometric methodology, time-series econometrics methodology requires an analysis of the time-series properties of the economic variables in a regression equation before any estimation for fear of spurious regression. To
(iv) Finally we employ Granger Causality test to determine the cause and effect direction between the variables.

**Empirical evidence.**

In this section, empirical evidence to verify whether or not Wagner’s Law, the proposition that there is a long-run tendency for the public sector to grow relative to national income, holds for Nigerian economy employing the estimation procedures below.

**Summary statistics**

Data on all the employed variables for 1950-2008 periods are presented in table 1 with their means, standard deviation (SD) and coefficient of variation (CV).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Coef. of Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRGCYR</td>
<td>0.07112</td>
<td>0.02675</td>
<td>0.37612</td>
</tr>
<tr>
<td>LRYPACP</td>
<td>0.71240</td>
<td>0.27490</td>
<td>0.9874</td>
</tr>
</tbody>
</table>

Note: The test was performed using Eviews version 6.0 econometric package.

**Unit root tests**

It is pertinent that we establish the time series properties of the employed variables for the period 1950 – 2008. If the first difference of a non-stationary variable is stationary, that variable is said to be integrated of order one, I (1). If second differences are required to achieve stationarity, then the variable is integrated of order two, I (2), and so on. Testing explicitly for the manifestations of non-stationary is of great essence in econometric analysis associated with time series data. In one way, it serves the first step in exploring the status of the data and in the other, because the presence of such non-stationary at times has important econometric implication. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test procedures are employed in testing the integration level and the possible co integration among the variables (Dickey and Fuller, 1981, Phillips and Perron, 1988). With respect to the ADF test statistics, it is interesting to note that both the Akaike Information and the Schwarz Bayesian criteria for optimal lag length selection yield consistent results about the order of integration of the variables. The Phillips-Perron tests procedures which compute a residual variance that is robust to auto-correlation are employed as an alternative to the ADF. According to the unit root test results, table 2 in the appendix, all the time-series variables appear to be stationary in their first differences, i.e., they are both I(1) at 1 percent significant level. This by implication suggests that all the employed data series are non-stationary and thus quiet suitable for purpose intended.

**Co integration test**

Now, we proceed to test for co integration between the data series. We present this using the Johansen (1991) and Johansen and Juselius (1994) maximum likelihood approaches to test for co integration employing Trace Test and Maximal Eigenvalue. The tests are based on the comparison of H0 ($r=0$) against the alternative H1 ($r \neq 0$), where “r” represents the number of co integrating vectors. Table 3 in the appendix reports the results from the co integration tests. Evidence from the results suggest that the null hypothesis of $r = 0$ between the variables be rejected. These results show that there is long-run relationship between Government size and per capita income in Nigeria as evidenced by one cointegrating vector. Evidence of cointegration is sufficient to establish a long-run relationship between government expenditure and income; however, support for Wagner's law would require unidirectional causality running from income to government expenditure. In effect, cointegration should be seen as a necessary condition for Wagner's law, but not sufficient. The results further reveal that Wagner’s law is supported for Nigeria, since the normalized coefficient of real per capital income is positive (Ferda, 2003).

**Estimation of an error-correction model (ECM).**

The results of the co integration confirm the existence of an underlying long-run stationary steady-state relationship between the explained and the explanatory variables in logarithm. In this instance, the error correction model (ECM) is considered the best option and constructed as in equation 5 and estimated to determine the dynamic behavior of the employed variables. This is because
of ECM’s ability to restrict the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics. The estimated coefficient of the error correction term lagged one period, EC(-1) is appropriately negatively signed and statistically significant even at 0.1 percent level. This supports the validity of a long-run equilibrium relationship between the dependent and the explanatory variables. The estimated value of the coefficient of EC(-1) of -0.3799 suggests that the system corrects its previous period disequilibrium by about 38 percent a year, which indicates a high speed of adjustment. The result further indicates that the validity of Wagner’s law is verified for Nigeria.

**Granger causality test**

Evidence from the results of cointegration test suggest that the null hypothesis of \( r = 0 \) between the variables be rejected. Cointegration constitutes a sufficient condition for the existence of Granger causality between the employed variables though it does not indicate the direction of the causality. Therefore, to establish the direction of the causality, the Johansen Maximum Likelihood procedure for cointegration test is used to verify the causality direction. In the tests, causality is hypothesized to run from per capita income to Government size. This by implication suggests that the hypothesis that GDP causes Public expenditure requires that Public Expenditure does not cause GDP. The tests are carried out using the first differences of each series (i.e. the stationary values). The null hypothesis of no causality is tested using F-statistics. The results of F-tests as presented in Table 4 indicate that there is a strong evidence of support for Wagner’s Law in Nigeria at 0.5 percent level of significance. Analysis of the causality further confirms the results of both the ECM technique and the cointegration approach that Wagner’s Law holds for Nigeria.

\[ \text{RYPCAP} \rightarrow \text{RGYR} \text{ at 0.5 percent significant level.} \]

**Concluding remarks**

The purpose of this paper is to establish econometrically whether the Nigerian government expenditure behavior has been consistent with Wagner's law. In the present contribution, the long-run tendency for government expenditure to grow relative to national income is investigated empirically using Nigerian data for the period 1950 – 2008. Utilizing annual data, this paper examines the validity of Wagner’s Law based on co-integration analysis, error correction modeling and Granger Causality test. The hypothesis of a long-run relationship between real income per capita (RYPCAP) and the share of real public expenditure in real gross domestic product (RGYR) is investigated using Johansen Maximum Likelihood (JML) approach to co-integration test and found to be true. The results further reveal that Wagner’s law is supported for Nigeria since the normalized coefficient of real per capita income (rypcap) is positive. We use the Granger non-causality test procedure developed by Toda and Yamamoto, which uses a vector auto regression model to test for the causal link between two variables to investigate the direction of the established causal relationship. Results of the short-run causality tests find unidirectional causality stemming from real GDP per capita to Government Size. On the basis of empirical results in this paper, one may tentatively conclude that Wagner’s law finds support in Nigeria. All the results of the empirical estimations point to the fact that Wagner’s Law is supported for Nigerian economy during the period under review. This finding is inconsistent with the contribution of Sideris, 2007 for Greece, Babatunde, 2008 for Nigeria but in agreement with the finding of Demirbas, 1999 for Turkey.

These results indicate that the privatization efforts of the Federal Government appear to be yielding insignificant results yet, supporting the non functional status of most of the privatized establishments such as Transcorp and Nitel amongst others. Policy wise, this contribution suggests that Government of Nigeria should cut back public capital spending because of lack of transparency in the procurement of capital projects which has left such expenditures unproductive (Olayeni, 2009). Government should see the urgent need to provide environment conducive for private
sector active participation in economic activities and implement with all sincerity the on-going Public Private Partnership Programme (PPPP). These will ensure increased efficiency in the allocation of resources and trend to reduction in government size. The results further imply that development plans of Nigeria must incorporate such fiscal policy measures that would guarantee commensurate growth in government revenue to accommodate the expected growth in government size.

References


APPENDIX

Table 2: Results of ADF and PP Unit Root Tests

<table>
<thead>
<tr>
<th>Variables</th>
<th>ADF</th>
<th>Phillips Perron</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRG</td>
<td>2.587</td>
<td>-2.556 1(0)</td>
</tr>
<tr>
<td>YR</td>
<td>9.134</td>
<td>-9.073 1(1)*</td>
</tr>
<tr>
<td>YR</td>
<td>9.134</td>
<td>-9.073 1(1)*</td>
</tr>
<tr>
<td>YR</td>
<td>9.134</td>
<td>-9.073 1(1)*</td>
</tr>
<tr>
<td>LRY</td>
<td>2.172</td>
<td>2.447 1(0)</td>
</tr>
<tr>
<td>PCA</td>
<td>2.172</td>
<td>2.447 1(0)</td>
</tr>
<tr>
<td>PCA</td>
<td>2.172</td>
<td>2.447 1(0)</td>
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</tr>
<tr>
<td>PCA</td>
<td>2.172</td>
<td>2.447 1(0)</td>
</tr>
<tr>
<td>YPR</td>
<td>9.176</td>
<td>9.134 1(1)*</td>
</tr>
<tr>
<td>YPR</td>
<td>9.176</td>
<td>9.134 1(1)*</td>
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</tr>
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<td>9.176</td>
<td>9.134 1(1)*</td>
</tr>
</tbody>
</table>

Notes: *, represents 1 percent level of significance. The test was conducted using E-view version 6.0 econometric package

Table 3: Results of Co integration Test.

<table>
<thead>
<tr>
<th>Trace</th>
<th>0.05</th>
<th>Prob*</th>
</tr>
</thead>
<tbody>
<tr>
<td>None*</td>
<td>20.107</td>
<td>0.009</td>
</tr>
<tr>
<td>At most 1</td>
<td>1.472</td>
<td>0.225</td>
</tr>
<tr>
<td>Maximum Eigenvalue</td>
<td>18.635</td>
<td>0.009</td>
</tr>
</tbody>
</table>
Notes: 1. Both Trace and Max-Eigen Tests indicate 1 co integration at the 0.05 level
2. The test was conducted using E-view version 6.0 econometric package
* denotes rejection of the hypothesis at the 0.05 level.

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Of</th>
<th>Pr</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRYCAP does not Granger Cause LRGCYR</td>
<td>5</td>
<td>5.79</td>
</tr>
<tr>
<td>LRGCYR does not Granger Cause LRYCAP</td>
<td>7</td>
<td>1.68</td>
</tr>
</tbody>
</table>

Note: The test was performed using Eviews version 6.0 econometric package.