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WAGNER'S LAW REVİSİTED: THE CASE OF NIGERIAN AGRICULTURAL SECTOR (1961 – 2012)

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Abstract

This study examines whether government spending in the Nigerian Agricultural sector has been consistent with Wagner' Law. To test the validity of Wagner's law, six alternative functional forms were adopted, using annual data from the Nigerian agricultural sector over the time period 1961 - 2012. Data was analyzed using cointegration and granger causality test. The result of the Johansen and Juselius cointegration test showed the existence of a long run relationship between various items of agricultural capital expenditure as well as agricultural contribution to Gross Domestic Product. The granger causality test result confirmed that Wagner's law holds in the Nigerian agricultural sector. However, there was no clear evidence of government spending causing national income. Hence, the Keynesian proposition of government spending as a policy instrument that encourage and lead growth in the sector is not supported by the data used.

Keywords: *Public spending, economic growth, Wagner's Law, cointegration, causality*

1. Introduction

Wagner's Law is one of the first and most widely used model for the determination of public spending. The relationship between government spending and national output is important for many policy-related issues. For instance, recessionary (expansionary) periods impede (enhance) central authorities' abilities to stimulate their economy via fiscal measures unless the share of government spending to GNP increases (reduces).

On the theoretical front, however, there are two main strands of theories that are prevailing in economic literature regarding the relationship between public expenditure and economic growth. These are: Wagner's hypothesis or Wagner's Law, and the Keynesian hypothesis.

Wagner's Law (Wagner, 1883, 1912) suggests that during the process of economic development, the share of public spending in national income tends to expand. This implied that there is a long-run tendency for government activities to grow relative to economic activity. Specifically, the law states that, during the process of economic development, the share of public expenditures in total economic activities increases as the real income per capita of a nation increases, Thus, a higher level of economic growth requires higher levels of public expenditure. According to Wagner, 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 expenditure, indicating that public expenditure is considered endogenous to the growth of national income.

In contrast, Keynesian hypothesis emphasizes that economic growth occurs as a result of rising public expenditure and is considered as an independent exogenous variable to influence the economic growth. The direction of causality runs from public expenditure to national income (Keynes, 1963).

Therefore, the Keynesian and the Wagnerian approaches represent two alternative points of view towards the causality between government expenditure and aggregate income. The former approach views public spending as a behavioral variable, since it is considered as an exogenous policy instrument for aggregate demand management in the Keynesian approach.

Several studies (Akitoby *et al.,* 2006; Zaman *et al.,* 2011; Magazzino, 2012a, 2012b; Kesavarajah, 2012) have been conducted to investigate the existence of Wagner's law in different countries including Nigeria using time series data. Based on the methodology used, diverse results have been gotten. While studies such as Ogbonna (2012), Dada and Adewale (2013) posited that Wagner's law holds in Nigeria others like Babatunde (2008), Igahodaro and Oriakhi (2010), Ele *et al* (2014) stated that Wagner's law does not hold in Nigeria. However, all these studies made use of aggregate economic data for their analysis. None of them investigated Wagner's law using disaggregated or sectoral economic data as is the case in this study. Hence, this study verifies the validity of Wagner's Law in the Nigerian Agricultural sector using time series econometric techniques over the time period 1961-2012.

The remaining portion of the Paper is structured as follows: section 2 briefly reviews the theoretical and empirical literature on Wagner's Law. Section 3 presents the sources of data and methodology employed in this paper to test the existence of Wagner's law in the Nigeria agricultural sector. Section 4 presents the econometric results and discusses the findings. Section 5 summarizes the major findings of the study and drew conclusion based on the findings of the study.

2. Literature Review or Wagner's Model and the Economic Literature

2.1 Theoretical Framework

Different versions of Wagner's Law have been empirically estimated in functional forms since the 1960s. In this paper (as shown in Table 1), five alternative functional forms of the law are being examined, plus the "Augmented" version of Wagner's Law. The variables used were: public expenditure proxied as Agricultural capital expenditure (ACEX), Agricultural contribution to Gross Domestic Product (AGDP) proxied for economic growth; and Agricultural Population (APOP) is the variable used to represent population. However, because of scarcity of data on budget deficit for the agricultural sector from 1961 – 2012 data on the overall budget deficit for the entire economy was use as a proxy for Agricultural Budget Deficit (ABDF).

Table 1. Six versions of Wagner's Law

Equation	Functional Forms	Version
I	$Log(ACEX_t) = a_1 + b_1 Log(AGDP_t) + u_{1t}$	Peacock and Wiseman (1961)
II	$Log(ACEX_t/APOP_t)= a_2 + b_2 Log(AGDP_t/APOP_t) + u_{2t}$	Gupta (1976)
III	$Log(ACEX_t) = a_3 + b_3 Log(AGDP_t/APOP_t) + u_{3t}$	Goffman (1968)
IV	$Log(ACEX_t/AGDP_t)=a_4 + b_4 Log(AGDP_t/APOP_t) + u_{4t}$	Musgrave (1969)
V	$Log(ACEX_t) = a_5 + b_5 Log(AGDP_t) + u_{5t}$	Modified version of P-W suggested by Mann (1980)
VI	$Log(ACEX_t/AGDP_t)=a_6 + b_6 Log(AGDP_t/APOP_t) + b_7(ABDF_t/AGDP_t) + u_{6t}$	Murthy (1994)

Source: Our elaborations

Equation I was adopted by Peacock and Wiseman (1961). According to them, growth in agricultural expenditure (ACEX) is dependent upon the growth in agricultural Gross Domestic Product (AGDP). Gupta (1967) used a different model to test the validity of Wagner's law by accounting for the increase in population (APOP). He affirmed that growth in per capita agricultural expenditure (ACEX/APOP) is dependent upon the growth in agricultural Gross Domestic Product per capita (AGDP/APOP). This is shown in equation II. Goffman (1968) used another mathematical form known as the absolute version of the law, where he expressed the law in the following way: "during the development process, the GDP per capita increase should be lower than the rate of public sector activities increase". He emphasized that agricultural expenditure (ACEX) is dependent upon the growth in agricultural Gross Domestic Product per capita (AGDP/APOP). This is shown in equation III. According to Musgrave (1969), shown in equation IV, "the public sector share to GDP is increases as the GDP per capita increases, during the development process". He explained that growth in ACEX in AGDP depends upon AGDP per capita. Equation V represents a modified version of Peacock-Wiseman (1961) adopted by Mann (1980). In his own expression of the law, public expenditure (ACEX) share to GDP (AGDP) is a function of GDP (AGDP). Finally, we consider the last equation (VI) of Wagner's law suggested by economic literature and then renamed "Augmented Version". Of all the versions of Wagner's law, equation VI is often used and is considered the most appropriate one (Halicioglu, 2003). The inclusion of the last explanatory variable into equation VI is justified because it does not contradict the spirit of the law. It is normally expected that as economic development progresses, the budget deficit ratio would increase in the case of developing countries since government revenue increase less in proportion to expenditure. This problem would be further alleviated if developing countries were adopting financial and economic libration policies (Murthy, 1994). Murthy (1994) suggested a broad interpretation of the law to allow for more explanatory variables related to economic development and government spending, such as the degree of urbanization, budget deficits, etc. into Wagner's functional forms, which would also reduce the omitted variable bias and mis-specification in econometric estimations.

Direction of causality

The directions of the causality relationship between public spending and aggregate income could be categorized into four types, each of which has important implications for economic policy (Peacock & Scott, 2000). In fact, we can have:

• *Neutrality hypothesis:* if no causality exists between GDP and public spending. It implies that the two economic variables are not correlated. The absence of Granger-causality supports the neutrality hypothesis, as documented by Sinha (2007), Chimobi (2009), and Afzal and Abbas (2010).

• *Wagnerian hypothesis:* the unidirectional causality running from GDP to public spending. This hypothesis had empirical supports in Sideris (2007), Kalam and Aziz (2009), and Abdullah and Maamor (2010).

•*Keynesian hypothesis:* the unidirectional causality running from public spending to GDP. This hypothesis is in line with empirical findings in Dogan and Tang (2006), Babatunde (2007), and Govindaraju *et al.* (2010).

•*Feedback hypothesis:* if there exists a bi-directional causality flows between GDP and public spending. The feedback hypothesis is documented by Narayan, Nielsen, and Smyth (2008), Ziramba (2009), Ghorbani and Zarea (2009), and Yay and Tastan (2009).

2.2 Empirical Framework

Wagner's law has received wide attention from economists, and many empirical investigations of its validity in both developed and developing economies have yielded mixed results. Kesavarajah (2012) use time series annual data over the period 1960 – 2010 to examine whether there is empirical evidence in support of Wagner's law in Sri Lankan economy. Using cointegration and error correction modeling (ECM), the result shows that, while there exist a short-run relationship between public expenditure and economic growth, the long-run results showed no strong evidence in support of the validity of the Wagner's law for Sri Lankan economy. Kumar, Webber and Fargher (n.d) empirically investigated the Validity of Wagner's Law for New Zealand over the period 1960-2007.The results suggested that output measures Granger-cause the share of government expenditure in the long run, thereby providing support for Wagner's law. Akitoby *et al* (2006) examined the short and long term behaviour of government spending with respect to output in 51 developing countries using an error-correction model. The results revealed that output and government spending are cointegrated for at least one of the spending aggregates in 70% of countries, implying a long term relationship between government spending and output consistent with Wagner's law. Zaman *et al* (2011) examine the relationship between growth, employment, exports and their impact on Gross National Expenditure (as a percentage of agriculture GDP), in Pakistan's agricultural sector by using the Bound Testing approach. His findings revealed that, in the long-run, Wagner's Law does not hold in Pakistan's agriculture sector, as agriculture growth is negatively correlated with the share of agriculture expenditure; while, in the short-run, Wagner's law does hold, as it supports the hypothesis.

Magazzino (2012a) investigated the empirical evidence of Wagner's hypothesis in EU-27, for the period 1970 – 2009. Using seven versions of Wagner's law; including the augmented version and dividing the EU-27 into two different groups, namely "Rich" for older members and "poor" for new comers. The empirical evidence is in favour of Wagnerian hypothesis, according to which the law is appropriate for developing countries, since public expenditure should be determined by aggregate income in an initial step of the development process. Magazzino (2012b) assessed the empirical evidence of Wagner's law in Italy for the period 1960 – 2008 at disaggregated level, using time series approach. The author investigated the causality and relationship between several items of public spending (interests, final consumption, labour dependent income, grants on production and public investment) on real GDP in Italy. The results of Granger causality test showed evidence in favour of Wagner's law (Y→G) long-run, and only in the case of passive interests spending in the log-run, and of spending for dependent labour income in the short-run. On contrary, causality flow is in line with Keynesian hypothesis (G→Y) in the case of spending for passive interests, for grant on production and for public investments in the long-run, and for grants on production in the short run. Based on the empirical result, the author concluded that Wagner's law finds a very weak support in Italy. The Granger causality tests results showed that the relationship between several items of government spending and national income is more Keynesian than Wagnerian. The author further emphasized that there is no clear evidence of government spending causing national income. In other words, the Keynesian proposition of government spending as a policy instrument to encourage and lead growth in the economy is not completely supported by the data of Italy.

Igahodaro and Oriakhi (2010) investigated if the relationship between government expenditure and economic growth follow Wagner's law in Nigeria. Their findings showed that Wagner's hypothesis does not hold in all the estimations rather Keynesian hypothesis was validated in all the estimation. Babatunde (2008) using a Bound Testing analysis found out that Wagner's law did not hold in Nigeria over the period studied (1970 - 2006), rather; he found a weak empirical support in Keynes's preposition. Ogbonna (2012) investigated if Wagner's law holds in Nigeria from 1950 -2008. He investigated the existence of a long run and causal relationship between government expenditure and national income using Musgrave (1969) version of the functional interpretations of the law. The empirical results pointed to the fact that Wagner's law is supported for the Nigerian economy during the period under review. Dada and Adewale (2013) investigated if Wagner's Law is a myth or a reality in Nigeria from the period 1961 - 2011. The study attempted to examine the long-run relationship and direction of causality between economic growth and government spending with consideration for exchange rate, consumer prices and monetary policy rate. The study concludes that Wagner's law is supported in the long-run, hence Wagner's law is never a short-run but a long-run phenomenon and is said to be a reality and not a myth in Nigeria during the period under investigation.

Ele *et al*. (2014) investigated the impact of agricultural public capital expenditure on agricultural economic growth in Nigeria over the period 1961 to 2010. The data was analyzed using Augmented Dickey-Fuller test, Johansen maximum likelihood test and Granger causality test. The result showed that, there exist a long-run relationship between agricultural public capital expenditure and agricultural economic growth. Also, granger causality test showed a unidirectional relationship between agricultural capital expenditure and agricultural economic growth. This means that agricultural economic growth does not cause expansion of agricultural public capital expenditure rather; it indicates that agricultural public capital expenditure raises the nation's agricultural economic growth.

3. Data and Methodology

For the purpose of this paper, all variables analyzed have been expressed in logarithmic form except agricultural budget deficit. The annual data employed in this study covered the time period 1961 – 2012. These variables: ACEX, AGDP, and ABDF were gotten from Central Bank of Nigeria (2000, 2006, 2010, and 2012) statistical bulletin while APOP was taken from FAOstat. The variables used and their description are shown in Table 2.

To establish the validity of Wagner's law, a three step procedure is applied in this study. First, to avoid any spurious relationship between various items of agricultural capital expenditure and agricultural economic growth we used the Augmented Dickey Fuller test (Dickey & Fuller, 1979), and Phillips and Perron (1988) to test for the unit root properties of the series. Second, we tested for possible cointegration relationship among equation I to VI using the Johansen and Juselius procedure (Johansen, 1988; Johansen & Juselius, 1990). Finally, to establish if there is causality between the variables using the pairwise Granger causality test (Granger, 1986).

Table 2. List of Variables

Variables	Description
ACEX	Agricultural capital expenditure (Million Naira)
AGDP	Agricultural contribution to gross domestic product (Million Naira)
ABDF	Agricultural Budget Deficit (Million Naira)
APOP	Agricultural population (Millions)
ACEX/APOP	Per capita agricultural expenditure
AGDP/APOP	Agricultural gross domestic product per capita
ACEX/AGDP	Agricultural expenditure share to AGDP
ABDF/AGDP	Overall government budget deficit share of AGDP

Source: Extracted from CBN (2012) and FAOstat

To test for stationarity of the data, a general form of Augmented Dickey Fuller (ADF) (Dickey and Fuller 1979,) regression is formed below:

$$\Delta y_t = \beta y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta y_{t-i} + \emptyset + \lambda_t + \varepsilon_t \quad (7)$$

Where Δy is the first difference of the series, m is the lag length, t is a time trend, ε_t is a white noise residual. The ADF test is carried out by using the null hypothesis as H_0: $\alpha_2 = \alpha_3 = 0$. Alternatively, Phillips (1986) and Phillips and Perrron (1988) proposed a non-parametric method to correct a wide variety of serial correlation and heteroskedasticity (PP). Peron (1989, 1990) demonstrated that if a time series exhibits stationarity fluctuations around a trend or around a level containing a structural break, then unit root test will erroneously conclude that there is a unit root. PP and ADF tests have the same asymptotic distributions.

The test for cointegration follows the Johansen and Juselius procedure (Johansen, 1988; Johansen & Juselius, 1990), which is a preferable test for cointegration of more than two series and series that are integrated of different order. Moreover, Johansen and Juselius procedure is considered better than Engle and Granger (1987) even in two time series case and has better small sample properties, since it allows feedback effects among the variables under investigation, where it is assumed in the Engle and Granger procedure that there are no feedback effects between the variables. The procedure is based on likelihood ratio (LR) test to determine the number of cointegration vectors in the regression. Johansen technique enables us test for the existence of non-unique cointegration relationships. Three tests statistics are suggested to determine the number of cointegration vectors: the first is Johansen's "trace" statistic method, the second is his "maximum eigenvalue" statistic method, and the third method chooses r to minimize an information criterion. The Johansen and Juselius cointegration technique is based on the following equation:

$$\Delta X_t = \prod_0 + \prod_1 \Delta X_{t-1} + \prod_2 \Delta X_{t-2} + \ldots + \prod_{p-1} \Delta X_{t-p+1} + \pi X_{t-p} + AZ_t + \vartheta_t \quad (8)$$

Where X_t represents m x 1 vector of $I(1)$ variables, Z_t stands for s x 1 vector of $I(0)$ variables, $\prod_s$ are unknown parameters and ϑ_t is the error term. The hypothesis that π has a reduced rank $r < m$ is tested using the trace and the maximum eigenvalues test statistics.

Granger causality implies causality as a prediction (forecast) rather than in a structural sense. It starts with the premise that 'the future cannot cause the past'; if event A occurs after event B, then A cannot cause B (Granger, 1969). As clarified in Ansari *et al.* (1997), the causality in Wagner's law runs from national income to public expenditure. In other words, support for Wagner's law in this paper requires unidirectional causality from aggregate income (*AGDP and AGDP/APOP*) to public expenditure (*ACEX*, *ACEX/APOP*, *ACEX/AGDP, and ABDF/AGDP*). Therefore, in order to test whether public spending Granger-causes GDP the following bivariate equation is estimated:

$$\Delta y_t = \alpha_o \sum_{i=0}^{m} \beta_i \Delta y_{t-1} + \sum_{j=1}^{n} \lambda_i \Delta e_{t-1} + \upsilon_t \qquad (9)$$

where $e_t = \ln(E_t)$; $yt = \ln(Y_t)$; E_t is various items of agricultural capital expenditure; Y_t is various items of agricultural gross domestic product; and Δ is the first difference operator. The presence of Granger-causality depends on the significance of the Δe_{t-1} terms in Eq. (9).The short-run causality is based on a standard *F*-test statistics to test jointly the significance of the coefficients of the explanatory variable in their first differences. The long-run causality is based on a standard *t*-test.

4. Econometric Results

Table 3. Exploratory Data Analysis

Variable	Mean	Median	Standard deviation	Skewness	Kurtosis	Range
AGDP	1.72E+12	3.35E+10	3.33E+12	2.1074	3.4205	1.34E+13
ACEX	2.50E+10	8.34E+08	1.05E+11	6.5970	43.2066	7.57E+11
APOP	3.98E+07	4.09E+07	3.55E+06	-0.9393	0.9670	17232800
ABDF	-1.07E+11	-5.44E+09	2.56E+11	-3.2834	9.9504	1.19E+12
ACEX/APOP	624.32	20.19	2638.07	6.5968	43.2049	18914.9
AGDP/APOP	43148.5	804.39	84485.9	2.1502	3.6404	344107.9
ACEX/AGDP	0.015	0.0079	0.0193	2.1761	4.6982	0.0926
ABDF/AGDP	-0.0952	-0.0799	0.2950	-3.475	18.5802	2.1920

Source: Our calculation on CBN and FAOstat data

As a preliminary analysis, some descriptive statistics are shown in Table 3. Interestingly, throughout the study period, the average agricultural capital expenditure and agricultural gross domestic product were 250 billion naira and 1.72 trillion naira, respectively.

Table 4. Correlation Matrix

	AGDP	ACEX	APOP	ABDF	$\left(\frac{ACEX}{APOP}\right)$	$\left(\frac{AGDP}{APOP}\right)$	$\left(\frac{ACEX}{AGDP}\right)$	$\left(\frac{ABDF}{AGDP}\right)$
AGDP	1							
ACEX	0.4086	1						
APOP	0.0006	0.0126	1					
ABDF	-0.8247	-0.1701	-0.001	1				
$\left(\frac{ACEX}{APOP}\right)$	0.4104	1.000	0.0121	-0.1719	1			
$\left(\frac{AGDP}{APOP}\right)$	0.9999	0.4040	-0.0015	-0.8285	0.4058	1		
$\left(\frac{ACEX}{AGDP}\right)$	-0.0351	0.5519	0.3133	0.1190	0.5514	-0.0365	1	
$\left(\frac{ABDF}{AGDP}\right)$	0.0588	0.0414	-0.4510	0.0167	0.0415	0.0582	-0.2012	1

Source: Our calculation on CBN and FAOstat data

The correlation coefficients summarized in Table 4 indicates especially a strong negative correlation between agricultural gross domestic product and agricultural budget deficit. This means that higher values of agricultural contribution to Gross Domestic Product are not associated with higher values of agricultural budget deficit.

Table 5 shows the results of unit root test of our variables. First of all, we obtained log-transformation of time series variables, except agricultural budget deficit. This is because ABDF contain negative values. Then we applied time series techniques on stationarity and unit root processes, in order to check some stationarity properties. The second column present results for Augmented Dickey and Fuller (1979) test; and the third one for Phillips and Perron (1988) test. Here, the results indicate that the following series: agricultural contribution to gross domestic product, agricultural budget deficit, agricultural population, and agricultural gross domestic product per capita are I(1) process. While agricultural capital expenditure, per capita agricultural expenditure, agricultural expenditure share to AGDP and overall government budget deficit share of AGDP are I(0) process.

Table 5. Results for Stationarity Tests

Variables	Stationarity tests		
	Deterministic component	ADF	PP
$LogAGDP$	Intercept and trend	NS: -2.8323	NS: -2.6375
$\Delta logAGDP$	Intercept	DS: -4.8219	DS: -4.6388
$LogACEX$	Intercept and trend	LS: -4.604	LS: -4.5941
$ABDF$	Intercept and trend	NS: 7.542	NS: -2.0548
$\Delta ABDF$	Trend	DS: -6.4669	DS: -8.2243
$LogAPOP$	Intercept and trend	NS: -2.0719	NS: -2.0712
$\Delta LogAPOP$	Intercept and trend	DS: -6.9655	DS: -6.9655
$Log\left(\frac{ACEX}{APOP}\right)$	Intercept and trend	LS: -4.7699	LS: -4.7436
$Log\left(\frac{AGDP}{APOP}\right)$	Intercept and trend	NS: -2.8811	NS: -2.7775
$\Delta Log\left(\frac{AGDP}{APOP}\right)$	None	DS: -4.6972	DS: -4.5046
$Log\left(\frac{ACEX}{AGDP}\right)$	Intercept	LS: -3.6601	LS: -3.5183
$\left(\frac{ABDF}{AGDP}\right)$	None	LS: -5.2391	LS: -5.2134

Source: Our calculations on CBN and FAOstat data
Notes: NS, non stationary; LS, level stationary; DS, difference stationary.

Since all the variables are integrated of different order, we proceeded to find the long-run relationship between each item of agricultural capital expenditure and agricultural economic growth using Johansen and Juselius cointegration method. The result is shown in Table 6. The lag-order selection has been chosen according to Schwarz's Bayesian Information Criterion (SBIC), Hannan and Quinn Information Criterion (HQIC), and the Akaike's Information Criterion (AIC). These statistics selected a model with three lags for equation I, II, III, IV and V, while a model with two lags were selected for equation VI. From the result in Table 6, the null hypothesis - that there is no cointegration is rejected at 5% critical value for equation I, II, III, V, and VI, while it is accepted in equation IV. The Johansen and Juselius cointegration method suggest that there is at least one cointegration relationship in five equations (I, II, III, V, and VI,) and no cointegration relationship in equation IV. This implies that, there exist a long-run relationship between the dependent variables and independent variables in equation I, II, III, V, and VI. This result shows that there is a long-run relationship between various items of agricultural capital expenditure (which represent public expenditure) and agricultural contribution to Gross Domestic Product (which represent aggregate income) in the Nigerian agricultural sector. 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 (AGDP or AGDP/APOP) to government expenditure (ACEX, ACEX/APOP, ACEX/AGDP, and ABDF/AGDP). In effect, cointegration should be seen as a necessary condition for Wagner's law, but not sufficient to indicate the direction of causality.

Table 6. Results for Cointegration

Johansen and Juselius procedure				
Equation	Trace statistic	Maximum-eigenvalue statistic	SBIC, HQIC, AIC	Rank
I	3.282(3.841)	3.282(3.84)	2.7081	r =1
			2.5868	
			2.5131	
II	3.468(3.84)	3.468(3.84)	-0.7026	r =1
			-0.8238	
			-0.8975	
III	3.312(3.84)	3.312(3.84)	-0.7060	r =1
			-0.8272	
			-0.9009	
IV	0.0616(3.841)	0.062(3.84)	2.6573	r =0
			2.5360	
			2.4623	
V	8.(3.84)	8.142(3.84)	-0.6288	r =2
			-0.7283	
			-0.8020	
VI	0.0304(3.84)	0.0304(3.84)	0.1173	r = 1
			-0.0845	
			-0.2613	

Source: Our calculations on CBN and FAOstat data
Notes*:* 5% critical values in parenthesis

The result of Granger causality test is presented in Table 7. To validate Wagner's law the direction of causality must be unidirectional, running from aggregate income (AGDP and AGDP/APOP) to public spending (ACEX, ACEX/APOP, ACEX/AGDP, and ABDF/AGDP). If this occurs we called it Wagnerian hypothesis. Neutrality hypothesis occurs when there is no causal relationship between aggregate income and public expenditure; while a unidirectional causality running from public spending to aggregate income is refer to as Keynesian hypothesis. From the result in Table 7, equation I, II, and III shows a unidirectional causality flow from aggregate income to public expenditure; while equation IV, and V, shows a neutral hypothesis. However, in equation VI, causality runs from per capita agriculture expenditure (ACEX/AGDP) to overall government budget deficit share of AGDP (ABDF/AGDP) and this was significant at 1% level. These variables are all items of public spending, thus did not fall in to any of the four hypothesis category investigated in this paper. Thus, this result could be subjected to further research. The result of the F-test of equation I, II and III indicate that there is a strong evidence of support for Wagner's law in the Nigerian agricultural sector at 5% and 10% level of significance. In summary, from the empirics it is evident that as agricultural contribution to gross domestic

Table 7. Result for Granger Causality Test

Equation	F-statistic	Direction of causality	Type of hypothesis
I	3.02(0.0585)	AGDP → ACEX	Wagnerian
	0.98(0.3804)	ACEX → AGDP	-
II	2.90(0.0649)	$\left(\frac{AGDP}{APOP}\right) \rightarrow \left(\frac{ACEX}{APOP}\right)$	Wagnerian
	1.29(0.2830)	$\left(\frac{ACEX}{APOP}\right) \rightarrow \left(\frac{AGDP}{APOP}\right)$	-
III	2.39(0.1000)	$\left(\frac{AGDP}{APOP}\right) \rightarrow ACEX$	Wagnerian
	1.39(0.2584)	$ACEX \rightarrow \left(\frac{AGDP}{APOP}\right)$	-
IV	0.41(0.6622)	$\left(\frac{AGDP}{APOP}\right) \rightarrow \left(\frac{ACEX}{AGDP}\right)$	Neutrality
	1.29 (0.283)	$\left(\frac{ACEX}{AGDP}\right) \rightarrow \left(\frac{AGDP}{APOP}\right)$	
V	0.50(0.6054)	$AGDP \rightarrow \left(\frac{ACEX}{AGDP}\right)$	Neutrality
	0.98(0.3804)	$\left(\frac{ACEX}{AGDP}\right) \rightarrow AGDP$	
VI	0.41(0.6622)	$\left(\frac{AGDP}{APOP}\right) \rightarrow \left(\frac{ACEX}{AGDP}\right)$	-
	1.29(0.2830)	$\left(\frac{ACEX}{AGDP}\right) \rightarrow \left(\frac{AGDP}{APOP}\right)$	-
	0.37(0.6871)	$\left(\frac{ABDF}{AGDP}\right) \rightarrow \left(\frac{ACEX}{AGDP}\right)$	-
	4.23(0.0206)	$\left(\frac{ACEX}{AGDP}\right) \rightarrow \left(\frac{ABDF}{AGDP}\right)$	None
	1.06(0.3519)	$\left(\frac{ABDF}{AGDP}\right) \rightarrow \left(\frac{AGDP}{APOP}\right)$	-
	1.47(0.2386)	$\left(\frac{AGDP}{APOP}\right) \rightarrow \left(\frac{ABDF}{AGDP}\right)$	-

Source: Our calculations on CBN and FAOstat data
Notes*:* values in parenthesis are P-values

product (AGDP) or agricultural gross domestic product per capita (AGDP/APOP) grows rapidly during the process of economic development, the share of agricultural capital expenditure (ACEX) in total economic activities increases thus validating the existence of Wagner's law for the Nigerian agricultural sector. The results of this paper agrees with Ogbonna (2012), Magazzino (2012a), and Magazzino (2012b).

5. Conclusion

This paper has empirically tested the validity of Wagner's law in Nigerian Agricultural sector. To validate the existence of Wagner's law, we employed six alternatives functional forms, using annual data from the Nigerian agricultural sector over the time period 1961 – 2012. Thus, we studied the relationship between different items of aggregate income (agricultural contribution to gross domestic product (AGDP) and agricultural gross domestic product per capita (AGDP/APOP)) and public expenditure (agricultural capital expenditure (ACEX), per capita agricultural expenditure (ACEX/APOP), agricultural expenditure share to AGDP (ACEX/AGDP), and overall government budget deficit share of AGDP (ABDF/AGDP). The time series properties of the data were assessed using ADF and PP unit root test. Empirical results indicate that the following series: agricultural contribution to gross domestic product, agricultural budget deficit, agricultural population and agricultural gross domestic product per capita are $I(1)$ process while agricultural capital expenditure, per capita agricultural expenditure, agricultural expenditure share to AGDP and overall government budget deficit share of AGDP are *I*(0) process. The Johansen and Juselius cointegration analysis revealed that there is at least one cointegration relationship in equation I, II, III, V, and VI. This result means that there is a long run relationship between various items of agricultural capital expenditure and agricultural contribution to gross domestic product in the Nigerian agricultural sector. However, support for Wagner's law requires a unidirectional causality running from aggregate income (AGDP or AGDP/APOP) to government expenditure (ACEX, ACEX/APOP, ACEX/AGDP, and ABDF/AGDP). Result of Granger causality test shows a unidirectional causality running from AGDP to ACEX in equation I, AGDP/APOP to ACEX in equation II and AGDP/APOP to ACEX in equation III. This result confirmed that, Wagner's law which state that, the share of the public sector in the economy will rise as economic growth proceeds holds in the Nigerian agricultural sector. However, we find no clear evidence of government spending causing national income. In other words, the Keynesian proposition of government spending as a policy instrument to encourage and lead growth in the sector is not supported by the data used. Certainly, this result is subjected to the time period examined and to statistical methods used; nevertheless, it is particularly discouraging for those who see government as a major actor to encourage economic growth in the Nigerian agricultural sector.

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