

Testing Wagner's Law: The Impact of Sectoral Economic Growth on Government Expenditure in Nigeria (1981–2019).

Oyetola Bukunmi Oyelakun^{1*}, Aderemi Adetunji Abdul-Azeez², Elizabeth Adeola Julius³,
Abegunde Joseph Kayode⁴ and Segun Zacchaeus Onifade⁴

Abstract: *Empirical studies on the growth-expenditure nexus are inconclusive, and research has produced opposing findings on the Wagner Law. Testing frameworks that reverse causality have further complicated interpretation and have created conceptual ambiguities and empirical gaps in the conceptualisation of this relationship in the Nigerian context. This paper explores the validity of the Law of Wagner in Nigeria by analysing the correlation between sectoral economic growth (agriculture, industry, and services) and the country's recurrent expenditure between the years 1981 and 2019. The analysis, based on time-series data of the Central Bank of Nigeria and utilising the Vector Error Correction Model (VECM) and Granger causality tests, confirms that the data are cointegrated but provides no support that sectoral growth is the cause of recurrent expenditure. The agricultural GDP has a strong negative long-run correlation with recurrent spending, whereas industry and services have positive correlations without short-run causality. These findings reject the Law of recurrent expenditure in Nigeria by Wagner, which implies that fiscal growth is more of an autonomous and institutionally driven affair than growth impelled. The research suggests a shift in fiscal policy to capital investment and the infrastructure sector to boost productivity and realign government expenditure with sustainable economic development. This study is original in providing fresh information on the Nigerian macroeconomic literature, as well as providing a policy-relevant approach to fiscal efficiency by combining sectoral disaggregation with a strong causality test.*

Keywords: Wagner's Law; Government Expenditure; Sectoral Growth; Nigerian Economy; VECM.

JEL classification: H50, O40, C22

¹Department of Accounting and Finance, Faculty of Management and Social Sciences, Thomas Adewumi University, Oke, Kwara State, Nigeria.

²Department of Accounting, Faculty of Management Sciences, Osun State University, Osogbo, Osun State, Nigeria.

³Department of Accounting and Finance, Landmark University, Omu-Aran, Kwara State, Nigeria

⁴Department of Economics, Faculty of Management and Social Sciences, Thomas Adewumi University, Oke, Kwara State, Nigeria

* Correspondence E-mail: oyelakunoyetola@gmail.com

1.0 Introduction

1.1 Background to the Study

The term government expenditure represents the monetary expenses incurred by the government to provide goods and services, as well as administrative operations in an economy (Madueke & Emeneka, 2024). It includes recurrent expenditure, which includes wages and salaries and operational expenses, and capital expenditure, which goes to infrastructure and development (Razzolini & Shughart, 2017). Recurrent expenditure is the main component of fiscal activities in Nigeria, which indicates long-term investments in institutional upkeep and the delivery of social services (CBN, 2022).

Government expenditure (also known as public spending) is a very important tool in attaining macroeconomic stability, socio-economic development, and improvement of welfare. It promotes the development of human capital and productivity by making allocations to education, healthcare, and infrastructure (Razzolini & Shughart, 2017). In addition, it eases redistribution and governance of income and provides efficient allocation of resources, besides reducing social inequalities and enhancing inclusive development.

The connection between government spending and economic growth is still central to the discussion on macroeconomics. According to the Wagner Law, economic growth is endogenous to drive an increase in public spending due to the increased demand of people in society to access the services provided by the government (Mushtaq, Hafeez, & Ahmad, 2023). Keynesian theory, on the other hand, proposes that government spending is an exogenous growth stimulus through aggregate demand increase (Keynes, 1936).

Economic growth, commonly symbolised by real GDP, is a sustained growth in output in the long run (Madueke & Emeneka, 2024). This study breaks down growth into agriculture, industry, and services, which are structural elements of the Nigerian economy. The growth of the sector increases the need for public goods, regulation, and infrastructural facilities, which require a greater involvement of the government (Olayiwola, Bakare-Aremu, & Abiodun, 2021). This is consistent with the fact that fiscal expansion is an endogenous reaction to the changing economic situations proposed by Wagner (Wagner, 1883).

1.2 Problem Statement

Although Nigeria has been experiencing steady growth in government spending, there has been minimal economic growth and productivity gains in the sector (CBN, 2022). An example is that the recurrent expenditure increased by 4.9 billion in 1981 to more than 4.8 trillion in 2019, but the GDP growth of Nigeria was only 2.3% on average, with agriculture, industry, and services performing unevenly. There was a slight increase in agricultural production, stagnation in industrial production, and a rise in services without equivalent productivity. The intrinsic systemic issues, such as fiscal inefficiency, sectoral misallocation, institutional weaknesses, and structural transformation failure, which severely constrain the real economy, are largely highlighted by the deeply entrenched gap between upward-moving spending and low sector-specific productivity. Empirical studies on the growth-expenditure nexus are inconclusive, and research has produced opposing findings on the Wagner Law (Awode & Akpa, 2018). Testing frameworks that reverse causality have further complicated interpretation and have created conceptual ambiguities and empirical gaps in the conceptualisation of this relationship in the Nigerian context due to methodological inconsistencies (Ighodaro & Oriakhi, 2010). This discrepancy between increasing spending and low productivity highlights the necessity of a strict re-analysis of

the Wagner Law in Nigeria. Therefore, it is crucial to note that a focus on individual sectoral output (GDP components) rather than sectoral spending as the primary driver of fiscal expansion is the foundation of the true empirical novelty of this research, as it aims at directly testing whether changes in real production endogenously compel growing state administrative capacity.

1.3 Rationale to carry out the Study

The reason behind this study is that the Law of Wagner has not been examined in such a rigorous and sectorally disaggregated manner within the Nigerian context. Although past studies have heavily depended on aggregate indicators of government expenditure and GDP, these methods fail to capture the individual dynamics between agriculture, industry, and services. This research provides a more detailed insight into the interaction of various elements in the economy with government expenditure by emphasising sectoral development. In addition, the study also fills the gaps related to the methodology of other studies, especially the inadequate coverage of the causality issue, as well as the insufficient use of the powerful econometric models. The use of the Vector Error Correction Model (VECM) enables both the short-run dynamics and long-run equilibrium to be analysed, and hence a more global structure of testing the Wagner Law.

The originality of this research is that it combines sectoral disaggregation and the test of causality, which has been mostly missing in the Nigerian literature. This will not only add to the scholarly discourse, but it will also produce policy-relevant knowledge on fiscal efficiency. Through the emphasised sector-specific linkages, the study educates strategies of matching government spending with productive investments, thus facilitating sustainable economic growth and fiscal stability in the long-term.

1.4 Rationale for Focusing Specifically on Recurrent Expenditure

The study intentionally looks at recurrent expenditure instead of total expenditure or capital expenditure, because of the peculiar structural and conceptual position of the recurrent expenditure in the Nigerian fiscal framework. Recurrent expenditure is the biggest, most inflexible segment of public expenditure in Nigeria and is dominated by wages of government employees, subsidies and administrative costs. Theoretically, the isolation of recurrent expenditure offers a powerful test of Wagner's Law, the original statement of which was that economic development is always accompanied by a "natural increase of public administration, of regulation and of maintenance of institutions, as the society becomes more complex. While capital investment is usually sporadic, recurrent expenditure is the ongoing expenditure on the operations of the machinery of the state. This conceptually important question of whether these administrative costs grow endogenously in line with growth in real sectoral output (Wagnerian approach) or remain an exogenous baseline as a function of autonomous political and institutional demands (Keynesian or structuralist approach) is missing from the domestic public finance literature.

1.5 Study Objectives

The aims of the study are to:

1. Test the long-run equilibrium between the economic growth of sectors (agriculture, industry, and services) and government spending in Nigeria.
2. Examine the short-run dynamics and adjustment processes between sectoral output and government expenditure.
3. Establish causality and direction of the relationship between government spending and sectoral economic growth.
4. Test the empirical validity of the Wagner Law in the Nigerian context.
5. Produce policy-relevant information on how to increase fiscal efficiency and support sustainable economic development.

2.0 Literature Review

2.1. Theoretical Foundation

This paper is based on the Law of Wagner or the Theory of Growing State Action, which was first developed by Adolph Wagner in 1883. The theory states that the expenditure of the government increases both in absolute and relative terms with the development of an economy, especially in the process of industrialisation. According to Wagner, economic growth creates an increasing need for administrative, protective, and regulatory services, which in turn prompts the constant increase in the amount of public expenditure as society becomes more complex (Olayiwola, Bakare-Aremu, & Abiodun, 2021).

Wagner further divides up the growth of public expenditure into three functional units: (i) administrative and protective functions like defense, law enforcement, and justice; (ii) welfare and equity functions like pensions, subsidies, and merit goods such as education and healthcare; and (iii) provision of public goods and services like infrastructure and sanitation, which are poorly supplied by the market (Chinedu, Daniel, & Ezekwe, 2018).

One key implication of the Wagner Law is that the growth in spending by the government is disproportionate to the growth in national income, and hence it is an income-elastic measure. Observations of developed economies like Britain, Germany, France, and the United States have shown that government expenditure is continually growing with per capita income (Wagner, 1917).

Nevertheless, there are limitations to the Law of Wagner. Critics say that the theory presupposes that there is a homogeneous relationship between economic growth and expenditure, ignoring structural variations across economies. In developing nations, fiscal expansion can be primarily motivated by politics, external shocks, or resource dependency rather than by income growth. In addition, inefficiencies in government expenditure, corruption, or ineffective institutional capacity, which tend to typify developing economies such as Nigeria, are not properly considered by the law. Keynesian views also dispute the argument of Wagner by indicating the possibility of government spending as an exogenous growth factor, as opposed to a reaction to income growth.

In the context of the present research, the Law by Wagner will give a theoretical foundation to the investigation of the correlation between sectoral economic development and government spending in Nigeria. This means that agricultural, industrial, and service growth should result in a similar increment in government expenditure to finance infrastructure, regulation, and service provision. However, due to fiscal and structural

imbalances and limitations to governance in Nigeria, the Law of Wagner might not be applicable, and therefore, the necessity for empirical testing.

2.2 Empirical Literature

The empirical research on the Law of Wagner has led to mixed and context-determined results. As an example, Granger causality and cointegration were used by Olayiwola, Bakare-Aremu, and Abiodun (2021) to investigate the relationship between economic growth and public health expenditure in Nigeria. Their findings indicated a relationship in the long run but no causal interdependence, implying that they are interconnected without growth-induced spending. This demonstrates the need for a direct test of causality, which the current study focuses on.

On the same note, Okonkwo et al. (2023) employed an Autoregressive Distributed Lag (ARDL) model to evaluate disaggregated capital expenditure in Nigeria. They discovered considerable positive impacts of administrative and economic services expenditure, and concluded that specific capital expenditure could enhance growth. This highlights the topicality of the sectoral disaggregation that is core to this work.

Chandana, Adamu, and Musa (2020) used ARDL and structural break methods to analyse capital and recurrent expenditure. Their results indicate that capital expenditure is positively related to growth as opposed to recurrent expenditure, which is not significantly related to growth. This justifies the necessity to differentiate types of expenditures, which this study fills by concentrating on recurrent expenditure.

Günay and Aygun (2022) report a wider Sub-Saharan African context in which the negative impact of public expenditure on economic growth also lends some support to Keynesian views. This differs from the Law by Wagner and highlights the value of country-specific analysis, which justifies the need to carry out research on Nigeria.

The study of Brazilian states by de Holanda, Júnior, and de Freitas (2023) did not identify much empirical evidence to support the Law of Wagner, and the authors linked the growth of income-driven expenditures with the increase in public debt. Their results emphasise the issue of fiscal sustainability, which applies to the fiscal issues faced by Nigeria.

There are also mixed results in evidence in Pakistan. Mushtaq, Hafeez, and Ahmad (2023) investigated six different forms of the Wagner Law and have only partially supported it; most of the results leaned toward Keynesian causality. Correspondingly, Mushtaq, Ahmad, and Khan (2023) found no long-run cointegration, weak bidirectional causality, and concluded that welfare-oriented recurrent expenditure is more important. These conclusions illustrate the significance of context, which this paper addresses by concentrating on the dynamics of the sector in Nigeria.

In Nigeria, Awode and Akpa (2018) have detected the negative but insignificant correlation between expenditure on the public and economic growth, as it disproves the Wagner Law. They focus on oil revenue, and that is why they have to be diversified, and this study indirectly focuses on this by discussing agriculture, industry, and services.

Sector-specific analyses give additional insights. According to Okoye (2021), recurrent expenditure has a positive impact on growth in the construction sector, whereas capital expenditure has a negative impact. Madueke and Emeneka (2024) indicated that growth is greatly boosted by agriculture and health spending, but not by education spending. According to a study by Chinedu, Daniel, and Ezekwe (2018), the growth in the long-term is positively affected by expenditure on agriculture and defence, which confirms the Wagner Law. These studies show the heterogeneity of the results in different sectors, which supports the significance of the sectoral approach used in this case.

Overall, the literature suggests that Wagner's Law may hold under specific sectoral or structural conditions, but broader fiscal outcomes are often shaped by Keynesian dynamics. This underscores the importance of disaggregated analysis and prudent fiscal management in understanding the expenditure–growth nexus.

3.0 Methodology

This paper evaluates the Wagner Law by exploring the relationship between the economic growth of the sector and the spending in Nigeria between 1981 and 2019. It implements an ex post facto research design, which is based on historical data and no manipulation of variables. It focuses on three main sectors, the agriculture sector, the industry sector, and the services sector, over a period of 39 years. The Central Bank of Nigeria (CBN) Statistical Bulletin (2023), in particular the Real Sector and Public Finance sections, was used as the source of secondary, quantitative, time-series data. The proxy of public spending is government recurrent expenditure (RECEXP), and the sectoral real GDP indicators represent the economic growth dynamics. All the variables were converted to forms of natural logarithms in order to make sure that they are linear, stabilise the variance, and can be interpreted using elasticity. The estimation horizon was limited to 1981–2019, with 39 observations according to the consistency and completeness of the data. With regard to the time frame of the data used, although further observations from 2020 to 2024 are included in the more recent editions of the CBN statistical bulletin, this study deliberately stops at 2019 since the data used during the period 2020–2024 are only provisional rather than fully audited and revised. The use of provisional macroeconomic indicators imposes significant risk of measurement error, which may result in false econometric estimates, false structural parameters and false policy conclusions.

The Vector Error Correction Model (VECM) was employed for the estimation of long-run and short-run relationships. The selection of these statistical methods stems essentially from the econometric characteristics of the macro variables studied. Time-series indicators are often non-stationary, so if not properly pre-tested, standard linear regressions can lead to spurious relationships.

The Phillips-Perron (PP) unit root test was carried out to test stationarity before estimation. The fact that the PP test has a high capacity to control data structural breaks and residual heteroskedasticity without the need to specify a rigorous lag structure makes it the choice of the unit root test in this study. Findings affirmed that all the variables are of order one, $I(1)$, which is why Johansen cointegration and VECM are used. Handling multiple cointegrating vectors in a multivariate system is the unique capacity of the Johansen framework and the reason for its adoption, while the resulting VECM is adopted

because it is effective in capturing short-run dynamic adjustments that are immediate alongside long-run equilibrium properties, preventing the chance of losing vital structural information that is historical. Information criteria were used to determine the lag length. The Schwarz Criterion (SC) suggested a parsimonious specification, but this excluded lagged differenced terms necessary for short-run dynamics. The Akaike Information Criterion (AIC) showed an optimal lag structure of $(p-1) = 1$, which was used to provide sufficient dynamic adjustments. EViews software was used to do all the estimations. The sufficiency and reliability of the model were verified by testing, that is, diagnostic and post-estimation tests such as the Johansen cointegration test, the Granger causality test, the Breusch-Godfrey LM test of serial correlation, and the stability tests.

Table 1: Definition and Measurement of Variables

Variable	Type	Code	Description
Recurrent Expenditure	Dependent	RECEXP	It represents the total amount spent by the government on regularly recurring activities such as wages, salaries, and administrative costs. The non-capital expenditure associated with the provision of public services and general administration is all included in the recurrent expenditure.
Agriculture Real GDP	Independent	AGR GDP	This represents the sum of all goods produced by the agricultural sector, measured at constant prices. The performance of the agricultural sector and its contribution to the overall economic growth are reflected in this variable.
Industry Real GDP	Independent	IDR GDP	The total value of goods produced by the industrial sector, measured at constant prices. It represents industrial sector growth and its contribution to national output.
Services Real GDP	Independent	SVR GDP	The total value of services produced within the economy, measured at constant prices. It captures the performance and expansion of the services sector.

Results were analysed using coefficient significance, direction, and adjustment dynamics, and conclusions were reached using the joint evidence of VECM estimates and diagnostic results.

3.1 Model Specification

To empirically examine the relationship between sectoral economic growth and government expenditure in Nigeria, this study adopts a multivariate Vector Error Correction Model (VECM). The VECM is appropriate given that all variables are integrated of order one, I (1), and cointegrated.

The long-run relationship is specified as:

$$\ln(RECEXP_t) = \beta_0 + \beta_1 \ln(AGR GDP_t) + \beta_2 \ln(IDR GDP_t) + \beta_3 \ln(SVR GDP_t) + \varepsilon_t$$

Where:

- $RECEXP_t$ = Government recurrent expenditure
- $AGR GDP_t$ = Agricultural sector output
- $IDR GDP_t$ = Industrial sector output
- $SVR GDP_t$ = Services sector output
- $\ln$ = Natural logarithm
- ε_t = Error term

3.1.1 Vector Error Correction Representation

The short-run dynamics and long-run adjustment are captured using the VECM specified as:

$$\Delta \mathbf{Y}_t = \alpha + \sum_{i=1}^{p-1} \Gamma_i \Delta \mathbf{Y}_{t-i} + \Pi \mathbf{Y}_{t-1} + \varepsilon_t$$

Where:

- $\mathbf{Y}_t = [\ln RECEXP_t, \ln AGR GDP_t, \ln IDR GDP_t, \ln SVR GDP_t]'$
- Δ = First difference operator
- α = Vector of intercepts
- Γ_i = Short-run dynamic coefficients
- Π = Long-run coefficient matrix
- ε_t = White noise error term
- The matrix Π can be decomposed as: $\Pi = \alpha \beta'$

Where:

- $\beta' \mathbf{Y}_{t-1}$ represents the cointegrating equation (long-run equilibrium relationship)
- α represents the speed of adjustment coefficients, indicating how quickly variables return to equilibrium after a shock.

3.1.2 Error Correction Model (Single Equation Form)

For the government expenditure equation, the VECM can be expressed as:

$$\Delta \ln RECEXP_t = \alpha_0 + \sum_{i=1}^{p-1} \gamma_i \Delta \mathbf{X}_{t-i} + \lambda ECT_{t-1} + \mu_t$$

Where:

- ECT_{t-1} = Error correction term derived from the long-run equation

- λ = Speed of adjustment parameter
- $\mathbf{X}$ = Vector of explanatory variables
- μ_t = Error term

3.1.3 A Priori Expectations

Based on Wagner's Law, the expected signs are:

$\beta_1 > 0, \beta_2 > 0, \beta_3 > 0$, indicating that increases in sectoral output should lead to higher government expenditure.

3.1.4 Lag Length Selection

The standard information criteria, such as the Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Final Prediction Error (FPE), were used to estimate the appropriate lag length of the Vector Error Correction Model (VECM). The SC proposed a parsimonious specification of an effective lag structure $(p-1) = 0$. This specification, however, does not work with VECM estimation because it lacks lagged differenced terms required to model short-run dynamics. Conversely, the AIC showed an optimum lag structure of $(p-1) = 1$, which guarantees enough dynamic adjustments in the model. Since the econometric condition that a VECM should have at least one lag of differenced variables exists, the lag length that was chosen by AIC was considered more suitable. Based on this, the VECM was estimated by the lag structure $(p-1=1)$ that strikes a balance between model parsimony and the desire to have strong short-run dynamics.

4.0 Results and Discussion

4.1 Results and Interpretation

Table 2: Dataset Descriptive Statistics

STATISTICS	LOGRECEXP	LOGAGRGDP	LOGIDRGDP	LOGSVRGDP
Mean	5.628597	8.746134	9.378350	9.427002
Median	6.134699	8.484870	9.356947	9.144811
Maximum	8.852922	9.795823	9.725685	10.53335
Minimum	1.568616	7.742189	9.018666	8.585330
Std. Dev.	2.401493	0.705674	0.207181	0.706975
Skewness	-0.365158	0.138661	-0.026821	0.412240
Kurtosis	1.743150	1.468729	1.917734	1.599453
Jarque-Bera	3.433679	3.935260	1.908036	4.292109
Probability	0.179633	0.139788	0.385190	0.116945
Sum	219.5153	341.0992	365.7556	367.6531
Sum Sq. Dev.	219.1524	18.92308	1.631116	18.99292
Observations	39	39	39	39

The descriptive statistics in Table 2 indicate significant distributional and structural differences among the variables. The standard deviation of the LOGRECEXP is the largest (2.401493), and the difference between the minimum (1.568616) and maximum (8.852922) values is large, which means that the recurrent expenditure varies significantly over time. Conversely, the most stable series is the LOGIDRGDP, whose standard deviation (0.207181) is the lowest, and the range is minimal, indicating a steady growth in industrial output. The variability in LOGAGRGDP and LOGSVRGDP is moderate, which indicates rather stable but uneven performance of sectors. The mean-median comparison shows a small skewness: LOGRECEXP is negatively skewed (-0.365158), indicating rare values at the lower end, whereas LOGSVRGDP is positively skewed (0.412240), indicating occasional high values.

Table 3: Phillips-Perron Unit Root Test

Variable	Adj. t-Stat	Prob.	Decision at 5%	Order of Integration
D(LOGAGRGDP)	-5.906340	0.0000	Reject H_0 (0.0000 < 0.05)	I (1)
D(LOGIDRGDP)	-5.282447	0.0001	Reject H_0 (0.0001 < 0.05)	I (1)
D(LOGSVRGDP)	-2.944161	0.0499	Reject H_0 (0.0499 < 0.05)	I (1)
D(LOGRECEXP)	-8.221595	0.0000	Reject H_0 (0.0000 < 0.05)	I (1)

The entire values of kurtosis are less than 3, which proves the platykurtic distributions with thinner tails than normal. Notably, Jarque-Bera probabilities are greater than 0.05 in all variables, which proves that the data is normally distributed and the additional parametric econometric estimates and hypothesis testing methods are reliable.

The information in Table 3 provides clear evidence that all variables become stationary at their first differences, which additionally confirms that each series is integrated of order one, I (1). Therefore, the prerequisite for checking the existence of a long-run relationship between them through Johansen cointegration testing is satisfied.

Table 4: Johansen Cointegration Test

Number of Hypothesised CE(s)	Eigenvalue	Trace Statistic	Eigen Max-Statistic	Critical Value at 5%	Prob
None *	0.633772	63.72236	37.16652	47.85613	0.0008
At most 1	0.379666	26.55584	17.66739	29.79707	0.1129
At most 2	0.142281	8.888457	5.678718	15.49471	0.3758
At most 3	0.083093	3.209738	3.209738	3.841465	0.0732
1 cointegrating equation (CE) is indicated by Trace & Max-eigen at the 0.05 level					

The Johansen cointegration results in Table 4 indicate the existence of one cointegrating equation at the 5% level. The test results confirm that a long-run equilibrium relationship

exists between sectoral economic growth (agriculture, industry, and services) and government expenditure in Nigeria, despite short-run deviations. The results also justify the use of the VECM framework.

Table 5: Lag Order Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	8.910980	NA	9.01e-06	-0.265458	-0.091305	-0.204061
1	184.7505	304.1549	1.60e-09	-8.905434	-8.034668*	-8.598448
2	206.9764	33.63916*	1.18e-09*	-9.241968*	-7.674589	-8.689393*
* Indicates lag order selected by the criterion LR: sequential modified LR test statistic (each test at 5% level) FPE: Final prediction error AIC: Akaike information criterion SC: Schwarz information criterion HQ: Hannan-Quinn information criterion						

In Table 5, the standard information criteria, specifically the AIC and SC, were used to determine the optimal lag length for the Vector Autoregression (VAR) system. According to the SC, an optimal lag length of 1 is desirable, while according to the AIC, an optimal lag length of 2 is proposed based on the minimum information criterion value. The Vector Error Correction Model (VECM) incorporates $(p-1)$ lags in first differences because it was derived from a VAR framework of order p . Therefore, selecting an optimal lag length of 1 would eliminate the short-run dynamic structure of the VECM, rendering it inappropriate. Consequently, the lag length of 2, as suggested by the AIC, was adopted, ensuring the inclusion of one lag in differenced terms. This choice balances model parsimony with the need to adequately capture short-run dynamics and adjustment processes within the system.

Table 6: Vector Error Correction Model (VECM) Estimates

A. Cointegrating Equation (Long-Run Relationship)

Variable	Coefficient	Std. Error	t-Statistic
LOGRECEXP(-1)	1.000000	—	—
LOGAGRGDP(-1)	-106.8190	14.2975	-7.47117
LOGIDRGDP(-1)	68.91145	19.8418	3.47304
LOGSVRGDP(-1)	80.70078	13.2722	6.08042
Constant (C)	-477.5016	—	—

B. Error Correction Model (Short-Run Dynamics)

Dependent Variable: D(LOGRECEXP)

Variable	Coefficient	t-Statistic
CointEq1	-0.005389	-1.12986
D(LOGRECEXP(-1))	-0.355709	-2.15794
D(LOGAGRGDP(-1))	-0.054993	-0.07923
D(LOGIDRGDP(-1))	0.572118	0.91716
D(LOGSVRGDP(-1))	-1.150101	-1.07955
Constant (C)	0.319304	3.83218

Dependent Variable: D(LOGAGRGDP)

Variable	Coefficient	t-Statistic
CointEq1	0.000457	0.31725
D(LOGRECEXP(-1))	0.017172	0.34466
D(LOGAGRGDP(-1))	-0.025018	-0.11926
D(LOGIDRGDP(-1))	0.319029	1.69210
D(LOGSVRGDP(-1))	0.184352	0.57252
Constant (C)	0.040253	1.59836

Dependent Variable: D(LOGIDRGDP)

Variable	Coefficient	t-Statistic
CointEq1	-0.002812	-2.42785
D(LOGRECEXP(-1))	0.014938	0.37322
D(LOGAGRGDP(-1))	-0.043505	-0.25815
D(LOGIDRGDP(-1))	0.143198	0.94542
D(LOGSVRGDP(-1))	-0.261028	-1.00906
Constant (C)	0.023905	1.18155

Dependent Variable: D(LOGSVRGDP)

Variable	Coefficient	t-Statistic
CointEq1	-0.002590	-5.22936
D(LOGRECEXP(-1))	-0.011308	-0.66052
D(LOGAGRGDP(-1))	-0.291132	-4.03890
D(LOGIDRGDP(-1))	0.211990	3.27224
D(LOGSVRGDP(-1))	0.367422	3.32077
Constant (C)	0.048765	5.63531

C. Model Diagnostics

Statistic	D(LOGRECEXP)	D(LOGAGRGDP)	D(LOGIDRGDP)	D(LOGSVRGDP)
R-squared	0.1775	0.1109	0.2267	0.7233
Adj. R-squared	0.0448	-0.0325	0.1020	0.6786
Sum sq. resids	1.9352	0.1768	0.1141	0.0209
S.E. equation	0.2499	0.0755	0.0607	0.0259
F-statistic	1.3380	0.7731	1.8180	16.2053
Log likelihood	2.0870	46.3577	54.4589	85.8828
Akaike AIC	0.2115	-2.1815	-2.6194	-4.3180
Schwarz SC	0.4727	-1.9203	-2.3582	-4.0568

D. System Statistics

Statistic	Value
Determinant of Residual Covariance	6.77E-10
Log Likelihood	193.6985
Akaike Information Criterion (AIC)	-8.9567
Schwarz Information Criterion (SIC)	-7.7376
Number of Coefficients	28

Table 6 shows the estimates of the Vector Error Correction Model (VECM) that looks at the long-run relationship as well as short-run dynamics between recurrent government expenditure and sectoral GDP components. The cointegrating equation proves that there is cointegration between the variables and thus, there is a long-run equilibrium relationship. The long-run coefficient estimates indicate that agriculture has a negative association with recurrent expenditure, and the association between the industrial and services industries is positive in the long run. In particular, the coefficient of agricultural GDP (-106.8190) seems to be large in absolute value, but it is actually more representative of long-run equilibrium adjustments than of the more traditional short-run elasticities, within a normalised VECM cointegrating vector. The result may be due to the structural divergence of agricultural expansion and recurrent government spending in Nigeria, where effective growth in agricultural output has been accompanied by the endeavour to cut down administrative overheads, subsidies and other recurrent fiscal commitments of government. This implies that higher productivity in agriculture can reduce dependence on recurrent expenditure, which can lead to a significant negative long-run relationship.

Importantly, this coefficient has not been manipulated, transformed or altered by the authors, but was directly extracted from the EViews-normalized cointegrating vector, showing the real equilibrium relationship that is present in the data. The error correction terms imply that the equations of the industrial and services sectors possess statistically significant adjustment mechanisms toward the long-run equilibrium. However, the sizes of the coefficients of $D(\text{LOGIDRGDP})$ (-0.002812 ; $t = -2.42785$) and $D(\text{LOGSVRGDP})$ (-0.002590 ; $t = -5.22936$) are very small, suggesting that adjustment's speed takes an extremely slow motion. The interpretation of this result is that although there is a gradual correction of the deviations from the long-run equilibrium over time, the process of convergence is weak and occurs at a modest pace rather than through rapid adjustment. Conversely, recurrent expenditure lacks a statistically significant adjustment coefficient, which means that there is weak feedback from disequilibrium conditions. Most lagged variables are statistically insignificant in the short-run dynamics, which implies that not many short-run interactions exist among the variables. On the whole, the findings indicate insignificant evidence of systematic reaction of government recurrent expenditure on the sectoral economic growth, meaning that the Law of Wagner could not find much support in the Nigerian context.

4.2 Stability Diagnostic Test

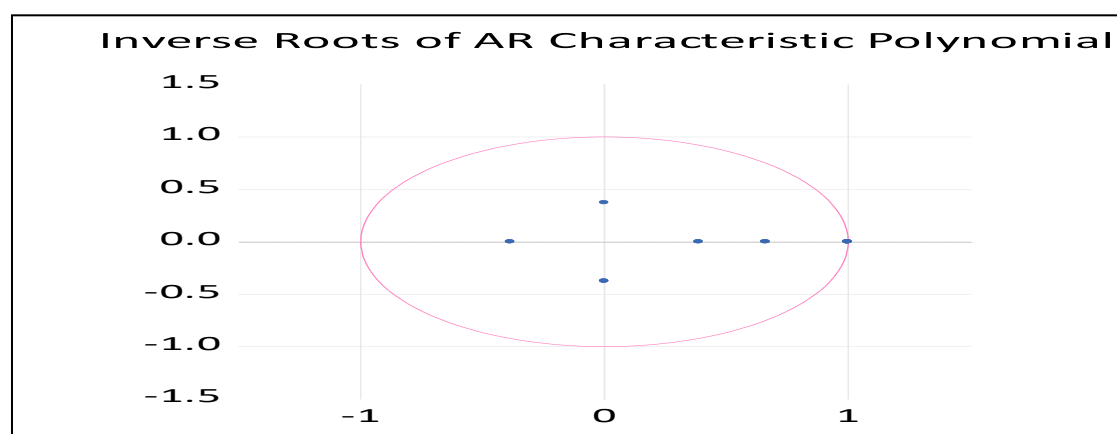


Figure 1: Graph of Inverse Roots

The inverse roots of the AR characteristic polynomial obtained using the VECM are shown in Figure 1. The circular boundary is an approximation to the unit circle (with radius one), and the plotted points are the inverse roots (i.e., the eigenvalues of the companion matrix). To be dynamically stable, the VECM requires all the inverse roots to be in the unit circle. The inverse roots of all the roots in this work lie within the limits of the unit circle, meaning that the model meets the stability criterion. This validates the dynamical stability of the VECM, and the approximations of the results, both long-run relationships and adjustment coefficients, can be used to interpret and make predictions.

Table 7: VECM Residual Serial Correlation LM Test

Lag	LRE* Statistic	Df	Prob.	Rao F-Statistic	Df	Prob.
1	13.02122	16	0.6712	0.806587	(16, 74)	0.6738
Null hypothesis (H_0): Absence of autocorrelation						
Number of observations: 37						

The presence of autocorrelation in the model residuals is tested with the help of the VECM residual serial correlation LM test. The null hypothesis states that there is no serial correlation at the specified lag. The likelihood of the LRE* value (0.6712) and the Rao F-statistic value (0.6738) are above the 5% level of significance (please refer to Table 7). Thus, the null hypothesis is not rejected, which means that there is no serial correlation in the residuals at lag 1. This implies that the model is specified and the residuals are independent, and therefore, the accuracy of the estimated results is justified.

Table 8: VECM Residual Heteroskedasticity Test (Levels and Squares)

Statistic	Value
Chi-square	104.3277
Degrees of Freedom	100
Probability (p-value)	0.3637
Null hypothesis (H_0): Absence of heteroskedasticity in the residuals	
Number of observations: 37	

Table 8 shows the VECM residual heteroskedasticity test of levels and squares that assesses whether the level of variance of the residuals is the same. The Chi-square statistic (0.3637) has a probability value that is greater than the 5% significance value; hence, the null hypothesis of homoskedasticity is not rejected. This means that the heteroskedasticity of the residuals is not evident. Therefore, the model meets the constant variance assumption, implying that the estimated coefficients are efficient and the statistical inferences made based on the model are valid.

Table 9 of the Granger causality test shows that there is no causality between sectoral GDP constituents and recurrent expenditure. In particular, the Granger-cause of recurrent expenditure is not notable in agriculture, industry, and services, and recurrent expenditure does not have any significant effect on any of the sectoral outputs. Nonetheless, the unidirectional causality in the agricultural and industrial production towards the service sector is well established. Agricultural GDP ($p = 0.0001$) and industrial GDP ($p = 0.0011$) both significantly Granger-cause services GDP. Moreover, the joint test assures that all sectoral outputs have a strong impact on the services sector collectively. In general, the results are not in favour of the Law of Wagner in the case of recurrent expenditure because the economic growth does not seem to be a driver of government expenditure in the short run. It is, however, important to note that Wagner's Law does not require it to be a short-run

Granger causal relationship, as it essentially asserts a long-run income-elastic structural relationship. The results of the Johansen cointegration test (Table 4) validated a stable long-run relationship between the industrial and services sectors, while the long-run estimates (Table 6) indicate positive cointegration coefficients for both sectors ($\beta = 68.91145$ and 80.70078 , respectively).

Table 9: Granger Causality Test

Dependent Variable	Excluded Variable	Chi-sq	Df	Prob.	Decision (5%)	Implication
D(LOGRECEXP)	D(LOGAGRGDP)	0.006278	1	0.9368	Fail to reject H_0	No Granger causality
	D(LOGIDRGDP)	0.841182	1	0.3591	Fail to reject H_0	No Granger causality
	D(LOGSVRGDP)	1.165420	1	0.2803	Fail to reject H_0	No Granger causality
	All	1.781595	3	0.6189	Fail to reject H_0	No joint Granger causality
D(LOGAGRGDP)	D(LOGRECEXP)	0.118790	1	0.7304	Fail to reject H_0	No Granger causality
	D(LOGIDRGDP)	2.863188	1	0.0906	Fail to reject H_0	No Granger causality
	D(LOGSVRGDP)	0.327777	1	0.5670	Fail to reject H_0	No Granger causality
	All	3.844339	3	0.2788	Fail to reject H_0	No joint Granger causality
D(LOGIDRGDP)	D(LOGRECEXP)	0.139295	1	0.7090	Fail to reject H_0	No Granger causality
	D(LOGAGRGDP)	0.066642	1	0.7963	Fail to reject H_0	No Granger causality
	D(LOGSVRGDP)	1.018203	1	0.3129	Fail to reject H_0	No Granger causality
	All	1.334363	3	0.7210	Fail to reject H_0	No joint Granger causality
D(LOGSVRGDP)	D(LOGRECEXP)	0.436282	1	0.5089	Fail to reject H_0	No Granger causality
	D(LOGAGRGDP)	16.31274	1	0.0001	Reject H_0	D(LOGAGRGDP) Granger-causes D(LOGSVRGDP)
	D(LOGIDRGDP)	10.70753	1	0.0011	Reject H_0	D(LOGIDRGDP) Granger-causes D(LOGSVRGDP)
	All	26.91292	3	0.0000	Reject H_0	All sectoral GDPs jointly Granger-cause D(LOGSVRGDP)
Null Hypothesis (H_0): No Causality Number of observations: 37						

These results can be interpreted as partial support for the Wagner hypothesis over an extended time horizon, even though there may be no short-run causal feedback loops. Rather, the short-run findings point to the predominant role of agriculture and industry in stimulating growth in the services sector.

4.3 Discussion of Results

The VECM analysis results affirm that there is a long-run equilibrium relationship between recurrent expenditure and sectoral GDP components. The direction of such relationships, however, questions the validity of the Wagner Law in Nigeria. GDP in agriculture has a strong negative long-run correlation with recurrent spending ($t = -7.47$), which suggests that agricultural growth does not cause a fiscal boost, but instead it coincides with a fall in recurrent expenditure. In contrast, industrial and services GDPs exhibit positive long-run coefficients, but there is no significant change in recurrent expenditure responding to the disequilibrium conditions, which implies that fiscal policy is not very responsive to sectoral growth.

Most lagged variables are statistically insignificant in the short-run, which supports the conclusion that recurrent expenditure is largely independent of sectoral output. This observation implies that the recurrent spending in Nigeria is institutionally motivated and does not vary in response to growth, but is based on wages, subsidies, and administrative expenditures, and thus refutes the idea of endogenous fiscal expansion suggested by Wagner.

4.4 Comparison with Literature

The findings are in line with other researchers like Awode and Akpa (2018) and Olayiwola et al. (2021), who reject the application of Wagner Law in the Nigerian context as well due to the weak or non-causal relationships between expenditure and growth. They, however, differ from sector-specific results like Chinedu et al. (2018) and Okoye (2021), which report positive expenditure growth relationships in agriculture and construction. It is this heterogeneity that explains the significance of disaggregation: though there may be Wagnerian dynamics in some sectors, this is not the case with aggregate recurrent expenditure.

This divergence is also supported by international evidence. As an example, Günay and Aygun (2022) discovered that in Sub-Saharan Africa, the negative impact of government spending on growth is in line with the Keynesian views. Likewise, Mushtaq et al. (2023) found that the Law of Wagner was not supported in Pakistan and that welfare-oriented recurrent expenditure is of greater significance for growth. The case of Nigeria thus indicates some wider trends in developing economies whereby fiscal growth is influenced more by institutional obligations and political influences than by growth in sectoral outputs.

4.5 Policy Implications

The rejection of Wagner's Law on recurrent expenditure in Nigeria has significant policy implications. First, its ability to promote the productivity of the sector is constrained by the fact that recurrent spending is predominant and is mainly associated with salaries, subsidies, and administrative expenses. The fiscal policy must then be shifted towards capital investments and sector-specific infrastructure, especially in agriculture and industry, which have fewer linkages to growth.

Second, there is a need to have increased alignment of fiscal policy and sectoral performance. Government spending can raise sector competitiveness, lessen structural discrepancies, and achieve sustainable growth by balancing expenditure and productive investments. Lastly, cutting autonomous recurrent expenditure in favour of specific capital expenditure would not only enhance fiscal efficiency but would also enhance the long-term development trend of Nigeria.

5.0 Conclusion and Recommendations

5.1 Conclusion

This paper aimed to verify the Law of Wagner in Nigeria by analysing the connection between the economic growth of the sector and the government's recurrent expenditure in the period between 1981 and 2019. The findings affirm that there is a long-run equilibrium association but indicate that recurrent expenditure is not a systematic reaction to sectoral output. There is a negative relationship between recurrent spending and agricultural growth, with positive long-run relationships between industry and services, without a significant short-run causality. These results disprove the Law of Wagner in the Nigerian situation, which implies that fiscal expansion is mostly independent, institutionally mandated, as opposed to growth-related.

The larger implication is that the recurrent expenditure in Nigeria is heavily wage-based, and subsidies, as well as administrative costs, which consume the recurrent expenditure, do not add value in terms of sectoral productivity. The fiscal policy should then be realigned to capital investments and infrastructure specific to sectors that directly benefit agriculture, industry, and services. Aligning spending with sector performance would improve fiscal efficiency, lessen structural imbalances, and facilitate sustainable economic growth.

This paper enhances the literature on the subject by combining sectoral disaggregation with solid causality testing, thus showing the boundaries of the Wagner Law in developing economies as well as providing policy-relevant implications to the fiscal management of Nigeria. Subsequent studies can build on this discussion and examine capital expenditure and investigate industry-specific policy frameworks that can be more effective in balancing government expenditure with longer-term growth goals.

5.2 Recommendations

1. **Adopt Performance-Based Budgeting:** Performance-based budgeting should be adopted in the government so that the growth rates of the agricultural and industrial sectors can be commensurate with the increments of recurrent spending, so that the government is responsive to the fiscal aspect. This transition directly addresses

the statistically insignificant feedback loop (CointEq1 = -0.005389) observed in the recurrent expenditure equation, shifting public outlays from an autonomous baseline to an empirically responsive fiscal structure.

2. **Redirect Outlays to Capital Investment:** Since there is no causal relationship between recurrent expenditure and sectoral growth, according to the Granger causality test (Table 9), the authorities should place more emphasis on capital expenditure, which prior studies, such as Okonkwo et al. (2023), found to be more efficient in development. The short-run empirical findings, which show that real-sector production is not stimulated by expanding recurrent administrative overheads, are the bedrock of this pivot.
3. **Strengthen Primary Sector Support:** In response to the identified strong negative long-run elasticity ($\beta = -106.8190$) agriculture and recurrent expenditure (Table 6), this negative long-run relationship in agriculture should be mitigated through fiscal policy by providing administrative/regulatory support on a targeted scale within the sector to ensure that structural administrative overheads are reduced by systematically expanding primary production
4. **Increase Service Sector Integration:** Based on analysis results showing highly significant short-run causal pathways where services GDP (Table 9) is Granger-caused by agricultural GDP ($p = 0.0001$) and industrial GDP ($p = 0.0011$), the policymakers should use this proven causal force of industry and agriculture on the services sector to develop a more integrated and diversified economy.

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