EXPLORING THE RELATIONSHIP BETWEEN GOVERNMENT SPENDING, INTEREST RATE AND GDP USING ANOVA: A CASE STUDY OF NIGERIA

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A PROJECT WORK SUBMITTED TO THE DEPARTMENT OF TATISTICS, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF SCIENCE DEGREE IN ATISTICS, FACULTY OF PHYSICAL SCIENCES, UNIVERSITY OF BENIN, BENIN CITY, NIGERIA.

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UNDERTAKING

This project work was carried out by me DAVID OYELEKE BAMIGBOYE with matriculation number PSC2008398. I have not copied the work of other author(s) all texts used have been duly cited and acknowledged.

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DAVID O. BAMIGBOYE **DATE**

CERTIFICATION

This is to certify that the project work was carried out by DAVID OYELEKE BAMIGBOYE with Matriculation number PSC2008398 in the Department of Statistics, Faculty of Physical Sciences, University of Benin in partial fulfilment for the requirement for the award of the Bachelor of sciences (Base) Degree in Department of Statistics

_____ _____

PROF. A. IDUSERI Date
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(Head of Department)

DEDICATION

I dedicate this study to God Almighty, the all-teacher. I also dedicate this project to my parents, Mr. and Mrs. Bamigboye.

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My deepest gratitude goes to God Almighty for wisdom, understanding and strength he endowed me with all through this period

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TABLE OF CONTENTS

ABSTRACT

This study investigates the relationships between economic growth, government expenditure, and interest rates in Nigeria, employing various statistical methods. The research aims to provide actionable insights into the interactions between these crucial macroeconomic variables and their implications for policymaking.

The theoretical foundation draws from Wagner's Law and the Keynesian Framework, which offer contrasting perspectives on whether government expenditure is a cause or effect of economic growth. Using data from the Central Bank of Nigeria and the World Bank, the study employs the Augmented Dickey-Fuller (ADF) unit root test to assess stationarity, the Granger causality test to examine causal relationships, and Ordinary Least Squares (OLS) regression to analyze the effects of interest rates and government expenditure on Gross Domestic Product (GDP).

The findings confirm the applicability of Wagner's Law in the Nigerian context, indicating that economic growth granger-causes government spending. Furthermore, the analysis reveals a positive relationship between interest rates, government expenditure, and GDP, although the results are not statistically significant. The study highlights the importance of interest rates as a policy instrument for influencing economic performance and attracting foreign investment.

To enhance the statistical robustness of the analysis, the study incorporates the Analysis of Variance (ANOVA) table, demonstrating its effectiveness in

evaluating and improving the performance of regression models. The research culminates in actionable recommendations for policymakers, emphasizing the need for strategic fiscal policies, careful interest rate management, and targeted investments in sectors that foster economic growth.

Overall, this study contributes to the understanding of the intricate dynamics between economic growth, government expenditure, and interest rates in Nigeria, providing valuable insights for policymakers and researchers alike.

CHAPTER ONE
INTRODUCTION

1.0 INTRODUCTION

The interest rate, government spending, and GDP are the three sets of variables that have perhaps garnered the most attention in econometrics analysis. The main cause of this phenomena is the broad impact that these variables' measures have on monetary policy, macroeconomics, governance, and even household budgets. Every government in history and even now devotes a significant portion of its resources to regulating and modifying these factors through the implementation of monetary policies in order to influence the level of living and overall quality of life for its people. These maneuvers frequently have the unintended consequence of offending someone, as is the case with Nigeria. This observation inspired the study's substance.

1.1 BACKGROUND OF STUDY

The majority of emerging nations struggled with severe budgetary imbalances throughout the 1970s and 1980s. This disparity was evident in the skyrocketing governmental expenditure that outpaced GDP. For instance, in 1970, the whole amount of money collected by the federal government in Nigeria was N634 million, while the total amount of money spent by the government was N904 million (CBN data bulletin, 2009). Two methods immediately spring to mind to make up for the gap. To start, strategies to raise revenue might be employed to reduce the deficit.

However, this concept is problematic since it is hard to boost tax earnings quickly and investing returns take time to materialize, thus the second option is more appropriate. The second option was to cut costs; several emerging countries, including Nigeria, made extensive use of this strategy. While "cost-cutting" is important, there comes a point at which diminishing marginality kicks in, making further spending cuts unacceptably costly on both a social and economic level. This is because the government will eventually pay more for less utility, driving up overall spending. A further reason for the spending spree is the absence of a strong private sector. Under such circumstances, the government must start providing services, which raises capital costs and government spending. This typically results in debt being taken on by the government to increase "revenue," which increases finances for debt payment.

Because of this series of events, government expenditure aims only at keeping the economy from completely collapsing, rather than at boosting economic production. Due to the decline in production, this raises inflation, which in turn raises interest rates. According to macroeconomic models, government spending raises nominal interest rates in normal times (i.e., when the economy is not on the verge of a recession), which may discourage investment and reduce future economic production. It's easy to understand the logic: excessive government expenditure results in resource demand. Interest rates must rise in order to cause enterprises to postpone investment or households to delay spending in order for markets to clear.

We can see from the preceding paragraphs that there is a connection between interest rates, government spending, and GDP (economic production). The crux of this work is in using efficient statistical models to investigate these links.
The monetary interest rate would be employed in this investigation.

1.2 AIM and OBJECTIVES

Using Nigeria as a case study, the purpose of this research is to investigate the connections between government spending, interest rates, and GDP growth and to offer practical guidance. The goals are as follows:

1. To investigate the link (using Wagner's law or a Keynesian framework) between government spending and economic growth.

2. To investigate the connection between interest rates and economic expansion (maintaining, raising, or lowering current interest rates).

3. To investigate how government spending and interest rates combine to influence economic development.

4. To offer doable suggestions to enhance the direction of economic growth.

1.4 DEFINITION OF BASIC TERMS

1. Interest rate: the amount that a lender charges a borrower for the usage of borrowed funds; it is stated as a percentage of the principal. It is a percentage of the capital borrowed for a year, or for any other duration, such as a month, week, or day, as decided upon by the parties at the loan contract signing. It may also be thought of as the rent payment for the borrower's usage of credit or the lender's return of credit that was previously granted (CBN, research department, 2016).

2. Government spending: Also known as public expenditure, this term refers to the entire amount of money spent, invested, and transferred by a nation's government.

3. Economic growth: Over time, this is the rise in the quantity of goods and services per person in a population.

4. Gross Domestic Product (GDP): The entire amount of money, or market value, that is created, over a certain period of time, inside the borders of a nation. In this study, economic growth was measured using GDP.

CHAPTER TWO
LITERATURE REVIEW

2.1 INTRODUCTION

Using the findings of earlier research on the interplay of these factors, we will examine the link between government spending, interest rates, and economic growth in this chapter.

2.2 LITERATURE REVIEW

Two schools of thought must be taken into account in order to understand the relationship between government spending and economic growth: Wagner's law, which views government spending as an endogenous issue (an outcome), and the Keynesian framework, which views government spending as an exogenous issue (a cause of economic growth) (Adewinle et al., 2021).

2.2.1 WAGNER'S LAW

Wagner's law has been thoroughly investigated, beginning in the years following World War II. According to the law, public spending rises in tandem with real wages and a nation's per capita income when financial progress takes place (Wagner, 1883). Wagner basically said that over time, government expenditure would increase in proportion to the growth of the economy. This phenomena is mostly seen in countries that are going through an industrial revolution. This is mostly due to the fact that government involvement would be necessary to supply funds for large-scale initiatives that would meet the country's technical demands.

In conclusion, Wagner's law suggests that government spending should be seen as an effect rather than a source of economic growth (Awode & Akpa, 2018).

Wagner's law was assessed by Chlestos and Kollias (1997) for its applicability in Greece between 1958 and 1993. According to their findings, Wagner's rule might provide an explanation for the rise in defense spending, which is a subset of overall government spending.

Wagner's idea was validated by a research done in 2008 by Mohammadi et al. utilizing yearly data for Turkey from 1950 to 2005. The hypothesis is well supported by the empirical data obtained from the co-integration tests with the ARDL limits. Furthermore, the outcomes held up well under six different Wagner's hypothesis specifications and four different lag length selection criteria.

Nworji et al. (2012) looked at how public spending affected Nigeria's economic development from 1970 to 2009. The results of the OLS multiple regression model showed that, throughout the reviewed period, capital and ongoing spending on economic services had a negligible negative influence on the economy. Additionally, the growth effect of capital expenditure on transfers was only marginally favorable; nevertheless, capital and ongoing spending on social and community services, as well as ongoing spending on transfers, had a major and beneficial impact on Nigeria's economic growth.

Onuorah and Akujuobi (2012) looked at the pattern and empirical study of public spending and how it affected Nigeria's economic expansion. The growth rates had been gradually increasing over time, as shown by the figures, and the explanatory factors only partially described differences in real gross domestic product, accounting for 4% of the variation. A long-term correlation between public spending and economic growth at 5% was found via the vector error correction result. The relationship between public expenditure factors and the expansion of the Nigerian economy, however, was not statistically significant.

According to Awode & Akpa (2018), there is empirical support for the intriguing short- and long-term link between government spending in Nigeria and GDP per capita (economic growth). However, there is no statistically meaningful link. In Nigeria, their research did not support Wagner's theory in the short or long run.

2.2.2 KEYNESIAN FRAMEWORK

The conceptual framework established by John Maynard Keynes during the 1930s, known as the Keynesian Framework, emerged as a response to comprehending the complexities of the Great Depression. Diverging from Wagner's law, this framework posits that governmental expenditure, orchestrated through monetary policies, wields the capacity to influence economic expansion.

In a study conducted by Ighodaro and Oriakhi (2010), employing disaggregated government expenditure data spanning from 1961 to 2007, an exploration was undertaken to ascertain the specific government spending categories that may

significantly impact economic growth within Nigeria. Findings from the investigation reveal a disconfirmation of Wagner's hypothesis across all estimations, with the validation of the Keynesian proposition consistently evident. Elasticity assessments and Granger causality analyses yielded congruent results.

Omoke (2009) examined the causal relationship between government expenditure and national income in Nigeria, utilizing annual data spanning from 1970 to 2005. The absence of cointegration was noted, alongside the inference that causality predominantly flows from government expenditure towards economic growth, thereby affirming the Keynesian hypothesis while negating Wagner's assertions.

2.3 RELATIONSHIP BETWEEN INTEREST RATE AND GDP

Numerous economists have extensively scrutinized the determination of interest rates within the economy. Among the most prominent theories are Irving Fisher's classical perspective, which evolved into the loanable funds theory, and John M. Keynes's liquidity preference theory. Interest rate, defined as the remuneration paid by a borrower to a lender for the utilization of resources over a specified period, lacks a singular metric in the economic landscape. However, the yield to maturity on an asset stands widely accepted as a prevailing gauge of interest rate.

According to Fisher, individual economic agents may opt to either consume or save their incomes. Saving occurs when individuals prioritize future consumption

over present consumption, thereby curtailing immediate expenditure to augment future consumption. Various factors influence saving decisions, with income serving as a primary determinant. While higher income levels typically correlate with increased saving propensity, such decisions hinge not only on income levels but also on expectations regarding future income, marginal propensities to consume and save, and preferences regarding temporal allocation of consumption and saving.

In contrast, Keynes's Liquidity Preference Model offers an alternative paradigm for interest rate determination, emphasizing the role of money supply and demand fluctuations rather than variations in the supply and demand for savings. Within this model, individuals navigate between holding money for transactions and holding interest-bearing bonds. Consequently, the interest rate represents the opportunity cost of holding money, with individuals weighing the benefits of holding cash against the returns from investing in bonds. Lower bond interest rates diminish opportunity costs, encouraging greater cash holdings, while higher rates elevate opportunity costs, prompting a preference for bonds over cash.

Interest rates wield significant influence over resource allocation efficiency, thereby facilitating economic growth and development. Moreover, they serve as pivotal tools for demand management, fostering both internal and external equilibrium, with particular emphasis on deposit mobilization and credit creation to bolster economic advancement (Ebirigan, 2012). Jelilov suggests that while

interest rates exhibit a modest impact on growth, lowering rates can potentially spur investment and subsequently enhance economic expansion (Jelilov, 2016).

2.4 SUMMARY

The link between government spending and GDP growth has been examined in this chapter. It is evident that there are two schools of thinking on government spending: endogenous (Wagner's law) or exogenous (Keynesian framework). As a monetary tool, interest rates have an impact on GDP, or economic growth. Government spending can be endogenous (Wagner's law) or exogenous (Keynesian framework). As a monetary tool, interest rates have an impact on economic expansion.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter provides a thorough overview of the methodologies employed to investigate the connection between interest rates, government spending, and economic growth. The unit root test, the causality test, and the Ordinary Least Squares method (OLS) are the techniques employed. The significance of Analysis of Variance (ANOVA) is also covered in this chapter.

3.2 VARIABLES

Economic development is theoretically influenced by a sizable number of macroeconomic factors. On the other hand, adding these variables to the specification reduces the degrees of freedom while simultaneously improving the model's fit (Aliyu, 2009). Because of this, the model can only include government spending (represented as GEX), interest rates (represented as IR), and GDP (in US dollars). As a result, a measure of economic growth is regressed on the variables listed above.

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3.3 NATURE AND SOURCES OF DATA

The World Bank Database and the CBN Statistics Bulletin (2022 edition) are the sources of secondary data used in this study. The Monetary Policy Rate found in the CBN Statistical Bulletin (2022 edition) was the source of the interest rate. The World Bank Database was used to get the GDP, while the CBN Statistical Bulletin was used to determine government spending.

3.4 STATISTICAL METHODS USED IN THE STUDY

3.4.1 UNIT ROOT TEST

The Augmented Dicker-Fuller (ADF) unit root test, which is covered in detail in Dickey and Fuller's 1979 paper, is the unit root test used in this investigation. The stationarity of the data series in this study is examined using this test. It involves regressing the series' initial difference against lagged terms, lagged difference terms, and, if desired, a constant and a temporal trend. This can be stated as:

$$\Delta Y_t = \beta_t + \beta Y_{t-1} + + \mu_t \ , t=1,\ldots,T \qquad (3.1)$$

where Y_t is the endogenous variable; Δ is a difference operator, β_t is a deterministic term which may consist of the constant or drift and the trend, β and α_i are coefficients of Y_{t-1} and ΔY_{t-i} respectively, p is the number of lags and the difference terms, ΔY_{t-i} is added to eliminate serial correlation in the residual term μ_t.

The ADF test is carried out on all the variables in the models with the following hypothesis. Null hypothesis H_o: $\beta = 0$ against Alternative hypothesis H_1: $\beta \leq 0$. The test is based on the t-statistic of the coefficient β, hence

$$ADF_t = t\,\beta = 0 = \frac{\beta}{SE(\beta)} \qquad (3.2)$$

where β and SE(β) are the estimated value of β and its standard error estimate respectively. The decision rule is that we reject H_o if the tβ is less than asymptotic critical values. Rejection of H_o implies that the series is stationary.

3.4.2 ORDINARY LEAST SQUARE

To facilitate the estimation of the time series data generated for this study, the ordinary least squares (OLS) method for multiple regressions will be utilized. This analytical approach is favored due to its unbiased nature, relative simplicity, and minimal data requirements. Despite advancements in computational resources and statistical methodologies, OLS remains a widely employed technique in economic analysis, offering satisfactory results across a broad spectrum of economic relationships (Koutsoyiannis, 1977). It serves as a foundational tool in econometric modeling, integral to many other sophisticated techniques.

Multiple regression analysis aims to elucidate the relationship between several independent variables and a dependent or criterion variable. OLS regression, as a form of generalized linear modeling, is adept at modeling a single response

variable recorded on at least an interval scale. It accommodates both single and multiple explanatory variables, including categorical variables suitably encoded for analysis.

3.4.2.1 ASSUMPTIONS OF OLS METHOD

For the OLS technique to work, a number of presumptions must hold. The list of fundamental presumptions is as follows:

1. Linearity: The dependent variable and the independent variables must have a linear relationship.
2. Independence: Each observation must stand alone from the others.
3. Homoscedasticity: At every level of the independent variables, the residuals' variance ought to be constant.
4. Normality: A normally distributed residual or set of errors is desired.
5. Lack of multicollinearity: There should be little to no significant correlation between the independent variables.

3.4.2.2 MINIMIZING THE SUM OF SQUARES RESIDUALS IN OLS METHOD

The following represents the calculus method for minimizing the sum of squares residuals to find the unknown parameters for the model

$$Y = mx + b \tag{3.3}$$

If we take the partial derivative of the cost function, sum of squared residuals, $\sum(y_i - \hat{y}_i)^2$ with respect to m; we have

$$\partial/\partial m\ (SSE) = \sum -2Xi\ (y_i - \hat{y}_i) \quad (3.4)$$

Take the partial derivative of the cost function, $\sum (y_i - \hat{y}_i)^2$ with respect to b:

$$\partial/\partial b\ (SSE) = \sum -2(y_i - \hat{y}_i) \quad (3.5)$$

Set the partial derivatives of equations (3.4) and (3.5) equal to zero and solve for m and b; that is:

$$\sum -2Xi\ (y_i - \hat{y}_i) = 0 \quad (3.6)$$

$$\sum -(y_i - \hat{y}_i) = 0 \quad (3.7)$$

This results in the following two equations:

$$\sum y_i * x_i = m\sum x_i * x_i + b * \sum x_i \quad (3.8)$$

$$\sum y_i = m\sum x_i + b * n \quad (3.9)$$

Where n is the number of data points.

3.4.3 GRANGER CAUSALITY TEST

Many models make various assumptions to explain the link between the variables, but they are unable to confirm the cause-and-effect relationship between the variables. Granger (1969) employed the twin components of VAR to determine the causal link between the variables, but he was the first to identify lead and lag associations based on the importance of predictability. A technique for determining if one time series can accurately predict another is the Granger causality test (Granger, 1969). If historical X changes may be used to forecast future Y changes, then X Granger-causes Y. Unidirectional causation occurs when X Granger-causes Y but not the other way around. In the event that X Granger causes Y and Y Granger causes X, then there is bi-directional causation between.

3.4.4 ANALYSIS OF VARIANCE

ANOVA is a statistical technique that divides a variable's overall variability into components that may be attributed to several sources. It is employed to ascertain how well the independent variable or variables are able to explain variations in the dependent variable (Arun, 2021).

3.4.5 ANOVA FOR REGRESSION

The computations used in Analysis of Variance (ANOVA) give insights into the degree of variability in a regression model and serve as a foundation for significance tests. This is a rewrite of the fundamental regression line principle, which is DATA = FIT + RESIDUAL:

$(y_i - y) = (\hat{y}_i - y) + (y_i - \hat{y}_i)$. (3.10)

The total variation in response y is the first term, the mean response variation is the second term, and the residual value is the third term. The equation is obtained by squaring each of these terms and adding the total number of observations,

$\sum (y_i - \bar{y})^2 = \sum (\hat{y}_i - \bar{y})^2 + \sum (y_i - \hat{y}_i)^2$ (3.11)

This equation may also be written as:

SST = SSM + SSE (3.12)

where SS is notation for sum of squares and T, M, and E are notation for total, model, and error, respectively.

The square of the sample correlation is equal to the ratio of the model sum of squares to the total sum of squares: $r^2 = SSM/SST$.

This formalizes the interpretation of r^2 as explaining the fraction of variability in the data explained by the regression model.

The sample variance sy^2 is equal to $\sum(y_i - \bar{y})^2/ (n - 1) = SST/DFT$, the total sum of squares divided by the total degrees of freedom (DFT).

For simple linear regression, the MSM (mean square model) = $\sum (\hat{y}_i - \bar{y})^2/ (1) =$ SSM/DFM, since the simple linear regression model has one explanatory variable x.

The corresponding MSE (mean square error) = $\sum (y_i - \hat{y}_i)^2/(n - 2)$ = SSE/DFE, the estimate of the variance about the population regression line (^{2}).

ANOVA calculations are displayed in an analysis of variance table, which has the following format for simple linear regression:

Source	Degrees of Freedom	Sum of squares	Mean Square	F
Model	1	$\sum (\hat{y}_i - \bar{y})^2$	SSM/DFM	MSM/MSE
Error	n – 2	$\sum (y_i - \hat{y}_i)^2$	SSE/DFE	
Total	n - 1	$\sum (y_i - \bar{y})^2$	SST/DFT	

The "F" column provides a statistic for testing the hypothesis that $\beta_1 \neq 0$ against the null hypothesis that $\beta_1 = 0$

The test statistic is the ratio MSM/MSE, the mean square model term divided by the mean square error term. When the MSM term is large relative to the MSE term, then the ratio is large and there is evidence against the null hypothesis.

For simple linear regression, the statistic MSM/MSE has an F distribution with degrees of freedom (DFM, DFE) = (1, n - 2). (Yale education, 1998)

CHAPTER FOUR

`DATA ANALYSIS AND DISCUSSION

4.1 INTRODUCTION

In this chapter, the examination of data from reliable sources—the World Bank Database for Nigeria's GDP and the Central Bank of Nigeria for government spending and interest rates—is clearly reported. STATA 17 software was used for all calculations and statistical analysis. This chapter provides a comprehensive discussion of the findings and their potential ramifications.

4.2 DATA PRESENTATION

TABLE 4.1

YEAR	IR (%)	GEX (₦)	GDP (US$)
2012	12.0	4605.3	463.97
2013	12.0	5185.3	520.12
2014	13.0	4587.4	574.18
2015	11.0	4988.9	493.03
2016	14.0	5858.6	404.65
2017	14.0	6456.7	375.75
2018	14.0	7813.7	421.74
2019	13.5	9714.6	474.52
2020	11.5	10231.7	432.20
2021	11.5	12164.1	440.83
2022	16.5	17320.0	477.39

4.3 DESCRIPTIVE STATISTICS

TABLE 4.2

Stats	IR	GEX	GDP
Mean	13	8084.209	461.6709
Min	11	4587.4	375.75
Max	16.5	17320	574.18
Variance	2.6	1.59e+07	3100.66

The tabulated data provides a synthesis of the dataset under consideration. The average Gross Domestic Product (GDP) over the ten-year span amounted to 461.6709, exhibiting a variance of 3100.66. Notably, the highest GDP value recorded occurred in 2014, reaching 574.18, while the lowest value manifested in 2017 at 375.75. Regarding government expenditure, the mean expenditure amounted to 8084.209, accompanied by a variance of 1.59e+07. The pinnacle of government spending within the studied decade transpired in 2022, registering at 17320, whereas the nadir occurred in 4587.4.

A cursory examination of the variance in government expenditure across the temporal sequence hints at significant fluctuations. Furthermore, the interest rate exhibited an average value of 13, with a variance of 2.6. Notably, the lowest recorded interest rate stood at 11, juxtaposed against the highest rate of 16.5. Such fluctuations in interest rates potentially reflect decisive governmental interventions

aimed at mitigating challenging economic circumstances throughout the observed period..

4.4 DATA ANALYSIS

The procedure taken to analyze the data is outlined as follows;

1. Stationarity test (The Augmented -Dicker- Fuller test)
2. Casuality test (Granger causality Wald statistics)
3. Ordinary Least Squares (linear regression)
4. Interpretation of the Analysis of Variance table

4.4.1 STATIONARITY TEST

To determine if there is a unit root in the data being viewed, a stationarity test is run. The existence of a unit root suggests that the data are non-stationary and may include cycles, trends, and other patterns that might provide false regression, or findings that are statistically significant but not logical. The data is transformed (log, exponential, etc.) and/or differenced in order to solve the stationarity problem. Thus, the theories are;

H_0: The data is non-stationary

H_1: The data is Stationary

Testing the variables for stationarity yielded the following results:

TABLE 4.3

Variables	Test Statistics	Critical value at 5% sig.	Critical value at 10% sig.

GDP	-1.567	-3.000	-2.630
GEX	3.484	-3.000	-2.630
IR	-2.324	-3.000	-2.630

This demonstrated that the data were stationar. In order to deal with stationarity, we differentiate the data until we are able to reject the hypothesis of non-stationarity and draw that conclusion. Following a third-degree differentiation, the following outcome was attained;

TABLE 4.4

Variables	Test Statistics	Critical value at 5% sig.	Critical value at 10% sig.
GDP	-3.569	-3.000	-2.630
GEX	-2.684	-3.000	-2.630
IR	-5.806	-3.000	-2.630

Since the test statistics is less than the critical value at the level of significance, we reject H_o and conclude that the data is now Stationary and can be applied for further analysis.

4.4.2 CASUALITY TEST

The Casualtiy test is applied to determine the direction of causation between variables. The hypotheses are given as follows;

H_0: Variable A does not granger-cause variable B

H_1: Variable A does granger-cause Variable B

TABLE 4.5

Equation	Excluded	chi2	df	Prob > chi2
GDP	IR	155.13	2	0.000
GDP	GEX	88.166	2	0.000
GDP	ALL	162.24	4	0.000
IR	GDP	10.809	2	0.004
IR	GEX	5.3477	2	0.069
IR	ALL	22.685	4	0.000
GEX	GDP	1.9514	2	0.377
GEX	IR	2.4971	2	0.287
GEX	ALL	3.4747	4	0.482

The data presented in the table indicates the presence of Granger-causality between Gross Domestic Product (GDP) and government expenditure. Additionally, the relationship between interest rate and GDP appears to be bi-directional. This observation aligns with the role of interest rates as a tool utilized by the government to influence economic activity. For instance, during periods of excessive economic expansion, the government may opt to increase interest rates to mitigate inflationary pressures by curbing excessive spending. Conversely, during economic downturns, lowering interest rates can stimulate spending and bolster economic activity.

Moreover, interest rates are observed to Granger-cause government expenditure, as fluctuations in interest rates impact the government's borrowing and lending activities, as well as the returns on investments within the economy. However, there is no evidence to suggest that government expenditure Granger-causes either interest rates or GDP.

This analysis lends support to Wagner's law within the context of Nigeria's economy, which posits that government spending tends to increase as a proportion of GDP over time, particularly as the economy develops.

4.4.3 ORDINARY LEAST SQUARES

The Ordinary Least Squares, computed using STATA produced the following results:

TABLE 4.6

dgdp	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
dgex	.003591	.0255544	0.14	0.894	-.0620986	.0692806
dir	9.17596	8.473713	1.08	0.328	-12.60641	30.95833
_cons	-2.811158	41.13175	-0.07	0.948	-108.5437	102.9214

The output of an OLS with GDP as the dependent variable and interest rates and government spending as the independent variables is shown in this table. It is evident that the interest rate (dir) has a 9.17596 coefficient. This suggests that interest rates have a favorable impact on GDP. As interest rates are a gauge of

investment return and a means of luring in foreign capital, this shows that setting favorable interest rates aids in economic growth. The GDP and government spending (GEX) showed a positive correlation, but not as strong as the interest rate. The statistical significance of the results is not supported by the significant values of these coefficients, indicating that the data do not

4.4.4 ANOVA TABLE

The ANOVA table presented from the regression above is displayed below:

TABLE 4.7

Source	SS	df	MS	Number of obs	=	8
				F(2, 5)	=	0.65
Model	15586.3788	2	7793.18942	Prob > F	=	0.5612
Residual	59968.1459	5	11993.6292	R-squared	=	0.2063
				Adj R-squared	=	-0.1112
Total	75554.5247	7	10793.5035	Root MSE	=	109.52

The result's insignificant level is supported by the ANOVA table. This demonstrates how crucial an ANOVA table is for determining a result's statistical significance. More effective factors can be added to the model's independent variables to increase the precision of the outcome. The rate of inflation is another indicator that influences GDP. The following is the outcome of adding the inflation rate to the independent variables:

TABLE 4.8

Source	SS	df	MS	Number of obs	=	7
				F(3, 3)	=	11.52
Model	68766.3603	3	22922.1201	Prob > F	=	0.0374
Residual	5969.00832	3	1989.66944	R-squared	=	0.9201
				Adj R-squared	=	0.8403
Total	74735.3686	6	12455.8948	Root MSE	=	44.606

The R-squared, a metric used to gauge how much variability the regression model explains, shows progress.

This illustrates how well ANOVA measures and enhances statistical analysis.

4.8 SUMMARY

The link between GDP, government spending, and interest rates has been examined in this chapter. Additionally, it was shown that ANOVA may be applied to improve statistical findings.

CHAPTER FIVE

SUMMARY AND CONCLUSION

5.0 INTRODUCTION

The study's result and suggestions are appropriately presented, as the link between GDP, interest rates, and government spending was investigated using ANOVA, a statistical technique for determining a model's significance.

5.1 SUMMARY

The study determined how interest rates and government spending affected GDP. In the instance of Nigeria's economy, a Granger-casuality test was conducted and Wagner's law was developed. The impact of interest rates has been studied both theoretically and quantitatively, and their significance in the design of the economic system is evident. Interest rates are used as a tool by the government to influence the economy and as a gauge of economic success. It was shown that ANOVA was applicable in assessing a regression model's performance and providing researchers with more alternatives when estimating a model.

5.2 RECOMMENDATION

Since government spending in industrially mature nations is largely determined by GDP, the government should invest more in the manufacturing sector of the economy.

1 The CBN office, on behalf of the government, should carefully establish interest rates as they have a significant impact on and signal the health of the economy.
2 Budgeting for government spending should be done carefully to prevent deficits since excessive government spending has little effect on GDP growth.
3 The ANOVA table should be carefully taken into account when performing regression analysis since it may offer suggestions for ways to make the model better.

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5.3 CONCLUSION

The link between GDP, government spending, and interest rates has been examined in this study. The theoretical backdrop was discussed, outlining the many schools of thought about how government spending and economic growth interact. A thorough theoretical explanation of the statistical methods used was provided, and the analysis was done in compliance with the relevant principles. As government expenditure was proven to be granger-caused by economic growth, Wagner's Law was validated. It has been determined that interest rates, as an indication of the economy, are a crucial statistic that the government may utilize to influence economic growth. A regression model was employed to evaluate the impacts of interest rates and government spending on GDP since the data were stationary at the third differencing.

REFERENCES

Adewinle, F.; Abdullahi, M. & Tukuv, S. (2021). "Wagner's Law in Nigeria: A n Investigation Using Nigeria's Time Series Data

Aliyu. U.R. (2009): "Impact of Oil Price Shock and Exchange rate Volatility on Economic Growth in Nigeria: An Empirical Investigation".

Arun. N (2021): "ANOVA and Standard Error of an Estimate in Simple linear Regression".

Awode. S & Akpa. E (2018): "Testing Wagner's Law in Nigeria in the Short and Long run; NISER, Olabisi Onabanjo University, Nigeria.

Central Bank of Nigeria; Education in Economics Series, 2018.

Central Bank of Nigeria, Statistical Bulletin, 2009 Edition.

Chlestos, M. & Koliias, C. (1997). "Testing Wagner's Law Using Disaggregated Public Expenditure Data in the Case of Greece: 1958-93", Applied Economics, 29(3). Pp. 371-373.

Dicker, D.A & Fuller, W.A(1979). "Distribution of the Estimates for Autoregression Time Series with a Unit Root".

Fabozzi, F.J, Modigliani, F. & Ferri, M.J (1998). "Foundations of Financial Markets and Institutions".

Granger, C.W.J. (1969). "Investigating Casual Relationships by Econometric Models and Cross-spectral Methods".

Ighodaro, A. U & Oriakhi, D.E (2010). “Does the Relationship Between government Expenditure and Economic Growth follow the Wagner’s Law in Nigeria?” Annals of the University of Petrosani, Economics, 10(2), pp 129-18

Jelilov, G. (2016): “The Ipact of Interest Rate on Economic Growth: Example of Nigeria.

Koutsoyiannis, A. (1977). “Theory of Econometrics”.

Mohammed, H.; Cak, M. & Cak, D. (2008). “Wagner’s Hypothesis. Journal of Economic Studies, 35(1), pp 94-106.

Mishkin, F. S. (2019). “The Transmission Mechanisms and the role of Asset Prices in Monetary Policies”.

Nworji, I. A; Okwu, A. T; Obiwuru, T. C & Nowrji, L. O. (2012). “Effects of Public Expenditure on Economic Growth in Nigeria: A Disintegrated Time Series Analysis”, International of Journal of Management Science and Business research, 1(7), PP 1-3.

Omoke, P. (2009). “Government Spending and National Income: A Casuality test for Nigeria”, European Journal of Economic and Political Studies, 2(2), pp 1-11.

Onuorah, A. C. & Akujobi, L. E (2012). “Empirical Analysis of Public Expenditure and Economic Growth in Nigeria”, Arabian Journal of Business and Management Review, 1(11), pp 46-59.

Wagner, A. (1883). “Three Extracts on Public Finance. In: Musgrave, R. A and A.T Peacock, (eds)1988, classics on the theory of Public Finance, Macmillan, London.

Yale education(1998).”http://www.stat.yale.edu/Courses/1997-98/101/anovareg.htm”