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CRUDE OIL PRICE VOLATILITY AND GOVERNMENT EXPENDITURE IN NIGERIA: DO GOVERNANCE DYNAMICS MATTER?

ABSTRACT

This study looks at the effects of governance and crude oil price volatility on government expenditure in Nigeria. The main objective of the study is to provide information to the government on how oil price volatility and governance dynamics influences government expenditure in Nigeria by examining their trends using monthly data from 2015 to 2021. Volatility test is conducted using GARCH (1, 1). Due to mixed level integration of variables based on the result obtained from ADF approach to unit root test, ARDL model is employed in estimating the variables. Volatility test shows that oil price is persistently volatile. The estimation results reveal that government revenue positively influences government expenditure, while oil price volatility and governance indicators have a negative and significant effect on government expenditure. The data set provided evidence that crude oil price volatility and governance dynamics determine trends of government expenditure in Nigeria. This calls for pragmatic action in fighting corruption by setting up independent and functional anti-corruption agency empowered to probe corruption cases and persecute offenders. Participatory democracy whereby citizens' vote would count in selecting their leaders in electioneering process is required to ensure that the right candidates are elected.

Keywords: Accountability; Governance; Government Expenditure; Oil Price Volatility; Transparency; ARDL
JEL Classification: D72; D73; H27; H54

RIASSUNTO

Volatilità del prezzo del greggio e spesa pubblica in Nigeria: quanto sono importanti le dinamiche di governance?

Questo articolo esamina gli effetti della governance e della volatilità del prezzo del greggio sulla spesa pubblica in Nigeria. Lo scopo principale dello studio è fornire informazioni su come il prezzo del petrolio e la good public governance influenzano la spesa pubblica in Nigeria. A tal fine vengono esaminati dati mensili per il periodo 2015-2021. Il test di volatilità è condotto usando un GARCH (1, 1). Poiché in base al test ADF, alcune variabili sono integrate ed altre no, il modello applicato per la stima delle variabili è quello ARDL. Il test di volatilità mostra che il prezzo del petrolio è persistentemente volatile. Le stime indicano che la spesa pubblica è influenzata positivamente dal gettito dello stato, mentre la volatilità del prezzo del petrolio e gli indicatori di governance hanno su di essa un effetto significativamente negativo. I dati forniti evidenziano che la volatilità del prezzo del greggio e le dinamiche di governance determinano le tendenze della spesa pubblica in Nigeria. Ciò induce a esigere un'azione pragmatica nella lotta alla corruzione tramite la costituzione di un'agenzia indipendente dedicata per accertare i casi di corruzione e perseguire i corrotti. È inoltre auspicabile una forma di democrazia partecipativa attraverso la quale i cittadini possano scegliere i loro leader per eleggere candidati adeguati.

1. INTRODUCTION

Governments of crude oil producing economies have been interested in crude oil price swings and variability due to its direct effect on annual budget and attendant over bearing on macroeconomic fundamentals (Odili and Opara, 2020). Variability in crude oil prices instantaneously transmits to government expenditure in an oil producing economy (Aigheyisi, 2018). Crude oil price volatility influences government expenditure by either increasing or reducing government revenue, thereby forcing government to adjust its annual budget. Uncertainty of crude oil price negatively affects the process of budgeting, revenue distribution and capital allocation (Akinleye, 2017). Capital expenditure suffers downward adjustments as recurrent expenditure (salary and overhead) are hardly adjusted. Capital expenditure might be jeopardized by poor governance and downward trends in crude oil prices, especially in the short-run, as governments strive to ensure its deficit is maintained within the limits of fiscal responsibility Act.

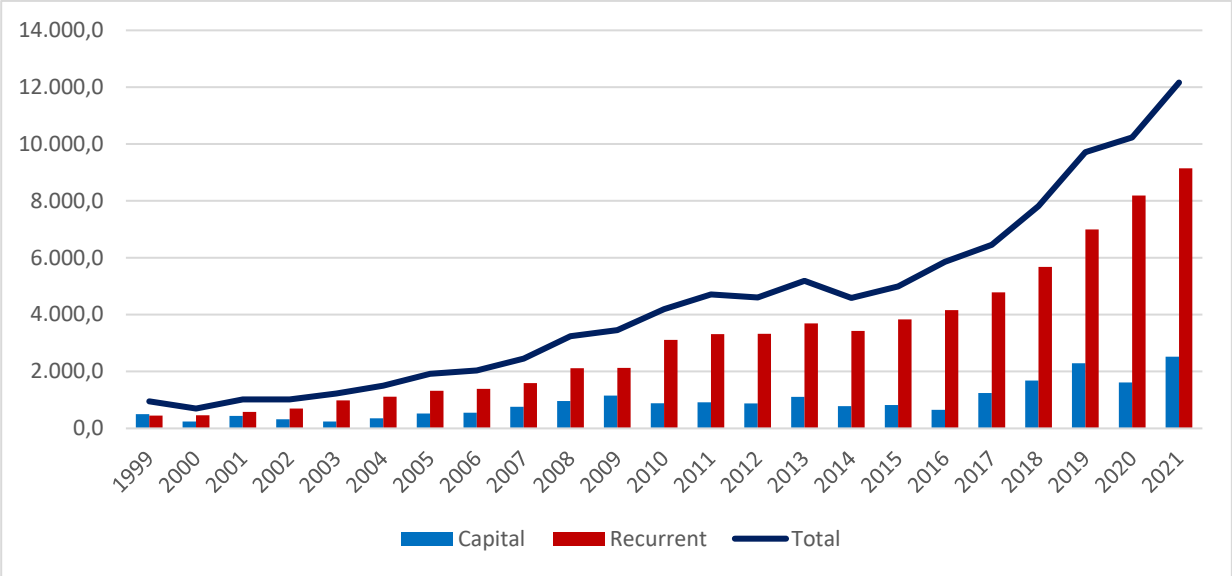
Falling in crude oil price and consequent decline in oil revenue may impose fiscal constraints on government expansionary monetary and fiscal policies which may have negative impact on economic parameters. In Nigeria, crude oil revenue is the dominant source of government revenue, accounting for about 90% of total exports, and this approximates to about 80% of total government revenue (Orhewere and Ogbeide-Osaretin, 2020).

1.1 Overview of Crude Oil Price Volatility, Governance Dynamics and Government Expenditure in Nigeria: Some Stylized Facts

In developing economies governments intervene in economic activities using fiscal and monetary policy instruments. For economic sustainability, government revenue is not expected to fall short of government expenditure, as this would leave the economy with huge deficit gap and its attendant debt burden due to debt servicing. Nigeria's economy depends on revenue from crude oil exports and has witnessed prodigious budgetary deficit due to crude-oil price variability (Aregbeyen and Fasanya, 2017). Trends in price of crude oil records $23.12, $94.1, $109.45, $40.76, $41.36, and $46.41 per barrel in 2001, 2008, 2012, 2016, 2019, and 2021 respectively (CBN, 2022). The drop in oil price from 2013 to 2021 compared to 2012 price indicates that crude oil price has been volatile and might have exerted significant influence on national income and public expenditure investments (Odili and Opara, 2020). Government efforts at ensuring economic sustainability account for budget deficits experienced in national accounts, since government has to borrow to bridge the income or revenue gap. In figure 1, government expenditure in Nigeria, especially recurrent expenditure, increased from 1999 to 2021 amidst variability in crude oil prices and dwindling crude oil revenue. The revenue-expenditure gap exposes the economy to external shocks and to cushion the effects, government has to fund infrastructural investments by borrowing to finance her fiscal deficit (Odili, 2022).

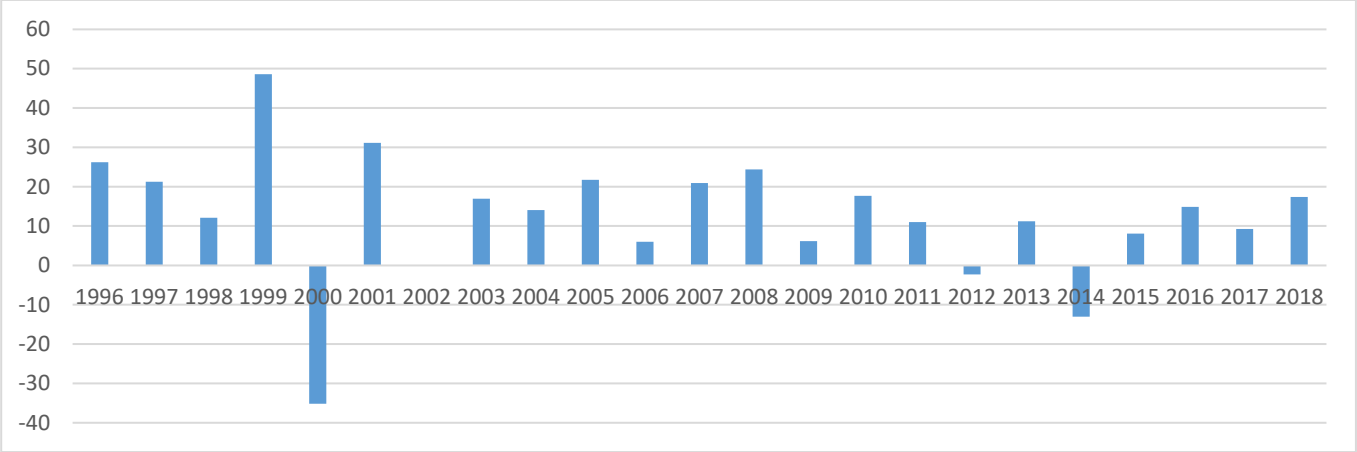
Establishing a long run relationship between government expenditure and crude oil revenue would assist in resolving fiscal imbalance in the economy (Aregbeyen and Fasanya, 2017). The percentage change in public expenditure (see figure 2) shows that in 2000 and 2014, Nigeria experienced negative change in public expenditure performance. These periods are marked by new democratic administration in 1999- 2000 and electioneering campaign in 2014.

FIGURE 1 - *Government Expenditure from 1999 to 2021*



Source: Central Bank of Nigeria (CBN) Economic Report (processed data).

FIGURE 2 - *Percentage (%) Change in Government Expenditure from 1996 to 2018*

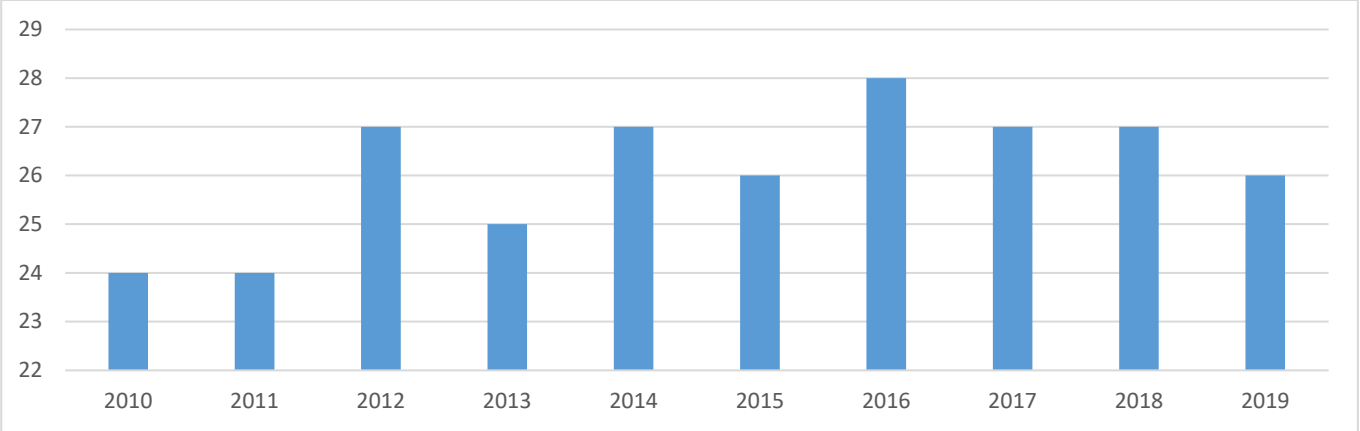


Source: Central Bank of Nigeria (CBN) Economic Report (processed data).

Government expenditure is seen to have been impacted negatively by corrupt practices of government officials through poor accountability and distortion of tax revenue collection process, which affects public expenditure (Nelson and Yebimodei, 2018).

Governance dynamics is important in revenue generation and allocation. Corrupt government personnel are likely to manipulate budgetary process to favour projects that provide negative incentives such as bribery or those that create room to overstate real cost of national projects, thereby reducing the benefits of budgetary allocation to key economic sectors and the provision of public goods (Jajkowicz and Drobiszová, 2015; Rajkumar and Swaroop, 2008). This ugly scenario has resulted to persistent increase in corruption perception index of Nigeria over the years as shown in Figure 3.

FIGURE 3 - *Corruption Perception Index (CPI)*

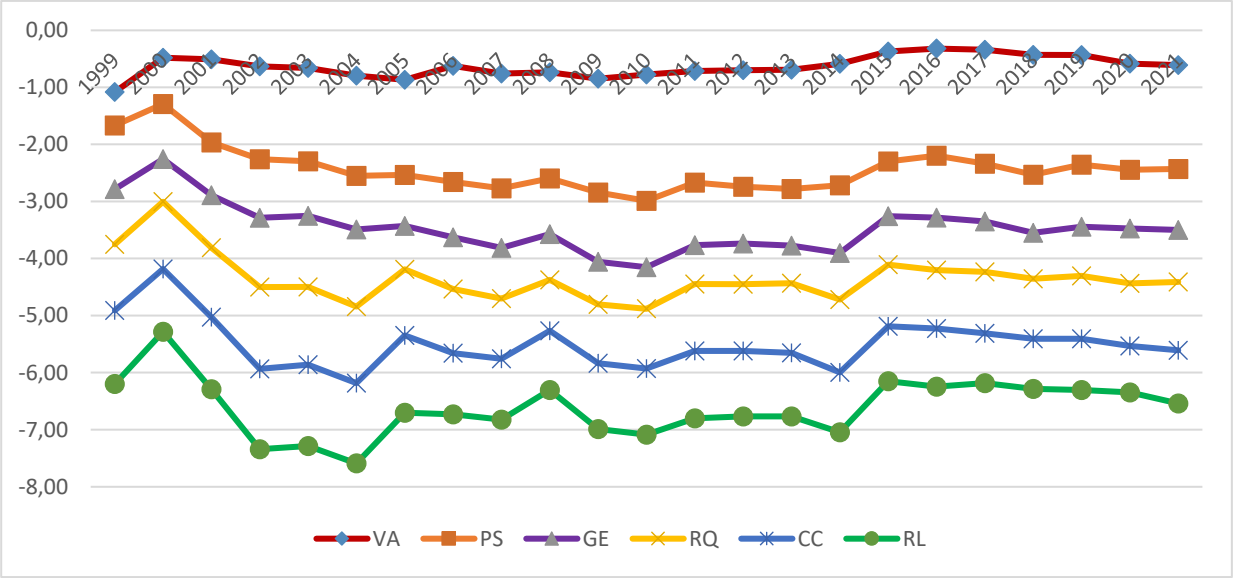


Source: World Development Indicators (WDI) database (processed data).

Figure 3 revealed that Nigeria scored 26 points over 100 in 2019 in terms of CPI as reported by Transparency International. Corruption Index was 26.10 points on average between 2010 and 2019, reaching its all-time high of 28 points in 2016. The implication is that the level of corruption in Nigeria is high and it has adverse effect on public infrastructural investments and macroeconomic fundamentals.

Trend analysis in figure 4 revealed that the values for governance parameters ranges from -0.37 to -2.21. Nigeria is exposed to governance ineffectiveness which has diminished government expenditure performance. The implication of the poor performance of governance indices is that they reduced government revenue and undermined its ability to provide public goods and fund public investments.

FIGURE 4 - *Trends in Governance Indicators (1999-2021)*



Source: World Governance Indicators (WGI) (processed data).

Few studies have been carried out on the effect of oil price volatility and/or governance on public expenditure in Nigeria. Orhewere and Ogbeide-Osaretin (2020) appraised the effect of volatility of oil prices on Nigeria's capital expenditure. Capital expenditure was discovered to respond negatively to oil price volatility and government aggregate revenue. Babalola *et al.* (2018) estimated the impact of oil price shocks on public revenue in Nigeria. The study concluded that government revenue reduced significantly due to falling oil price in the long and short run. In a similar study, Akinleye (2017) examined the extent to which oil price volatility influenced infrastructure funding in Nigeria. Findings from the study showed that oil price and government expenditure co-moved in the same direction. The impulse response function established that oil price shock was high in the short run. Aremo *et al.* (2012) analyzed the effect of crude oil price shocks on fiscal policy in Nigeria and found that oil price variability significantly influenced government revenue and government expenditure.

Similarly, related studies round the globe reported varying results. Raouf (2021) studied the impact of oil price shocks on components of government expenditure in oil-exporting and oil-importing countries of Sub-Saharan Africa and found that oil price shocks affect government current expenditure positively in the two groups of countries. Abdel-Latif *et al.* (2018) investigated how oil price fluctuations affect government expenditures on health and education

in Saudi Arabia. The study showed evidence of non-linear linkage between oil price and government spending in Saudi Arabia. Aljabri *et al.* (2021) studied the impact of oil price shocks on fiscal policy and real economy in Oman. They found that oil price shocks explained about 22% and 46% of the variation in the government revenue and real GDP, respectively. Qwader (2018) evaluated the impact of oil price changes on certain budget variables in Jordan and found significant positive correlation for oil price on government and tax revenues, external grants, and government expenditures. In Indonesia, Wardhani *et al.* (2017) studied the relationship between government spending and governance on local government performance. The result discovered that government spending has negative effect on local government performance. Good governance had positive influence on performance and reduced the inefficiency of government spending.

Conflicting and ambiguous results on related literature reviewed and non-availability of empirical studies on the effect of crude oil revenue and governance indices on public expenditure in Nigeria necessitated this study and constitute the research gap which this research is set to fill. The main objective of this study is therefore to provide information to government on how oil price volatility and governance dynamics influences government expenditure in Nigeria by examining their trends using monthly data from 2015 to 2021. This study appears to be one study in Nigeria that incorporates crude oil revenue and governance dynamics in explaining trends in government expenditures.

2. LITERATURE REVIEW

2.1 Conceptual Framework

The dynamics through which government expenditure influences infrastructural development and the pace of economic activities depend on the form and size in which public expenditure is employed in financing economic and social development projects. When public expenditure is incurred, it may be directed to particular investments or may be able to bring about re-allocation of the investible resources in the private sector. The effect is therefore on the nature and efficiency of allocation of resources to more desirable lines of investments. Resource allocation is a function of the government and therefore governance influences efficiency of government expenditures. Efficient resource allocation can only be achieved and the pace of economic activities accelerated by bridging the gap between social marginal and private marginal productivity of investments in

any given country. Inefficiency will arise when there is political instability, corruption and embezzlement of public funds by government officials, poor response to rule of law and low level of voice accountability, thus negating the tenets of good governance. The concept followed in this study is that political instability, corruption, poor response to rule of law, and low levels of voice accountability negates the tenets of good governance and has adverse effects on resource allocation.

2.2 Theoretical Construct

Two theories underpin this study. First is the Keynesian total expenditure framework which links income to expenditure. It is used in this study to link oil price volatility and government expenditure in Nigeria. Assuming an open economy, the Keynesian model is mathematically expressed in equation 1:

$$Y = C + I + G + (X\text{-}M) \quad (1)$$

Where, C = consumption; I = investment; G = government expenditure; X = export; M = import; (X – M) = net exports.

Knowing that the Nigerian economy is highly reliant on oil revenue, and consequently affected by volatility of international oil price, it is assumed that national income and total expenditure will be influenced by oil price fluctuations. Hence, C, I, G, X, M = $\acute{f}$ (volatility of oil price).

Secondly, Agency theory was used to explain the interaction between governance and government expenditure. Jensen and Meckling (1976), explains that agency relationship emanates when one or more people (principal) employ others (agent) and then delegate the decision-making authority and processes to the agent (Wardhani *et. al.,* 2017). This agency relationship may result to positive effects in the form of efficiency and might also result in an opportunistic behavior. The agency problem is seen when the government or executive tend to maximize their personal or group interests, while sacrificing the interests of the people. In the process of budgeting, the executive will secure its position by including budgetary slack for its selfish interests rather than for the people's interest. In the issue of government spending, agency problems arise when government represented by the Federal, State and Local Governments (agent) make policies that

are detrimental to the people but beneficial to the agent. This will create inefficiency in their managerial role and diminish government expenditure.

2.3 Empirical Framework

Several studies have been conducted to analyze determinants of government expenditure across the globe. Most of these studies dwelt largely on how macroeconomic factors influenced government spending over time. However, existence of literature that relates crude oil price volatility, governance and government expenditure is scanty.

Hlásny (2023) assessed the implications of inequality for corruption in Mena Region to ascertain if political connectedness and ability to get ahead through corruption are latent dimensions of multidimensional inequality. Report from the study, shows that inequality affects corruption negatively in MENA. This implies that MENA exhibits the trends similar to those seen less developed economies, which is an indication of a variety of the Dutch disease. The explanation given to this trend was that initially inequality rose as growth was spread unevenly in the economy due to successful development and building of institutions. It was recommended that should improve their laws, punish corrupt policymakers, and manage economic distribution based on social justice, and lay down procedures for healthy political and economic contestation.

Aljabri *et al.* (2021) studied the impact of oil price shocks on fiscal policy and real economy in Oman. They discovered that oil price shock explained about 26% of the variation in petroleum revenue and 90% variation in petroleum-GDP. Though petroleum and non-petroleum GDP responded positively to oil price shocks, government expenditure was not influenced by oil prices but was impacted by government revenue. The results suggested that the Omani government used its international reserve, local, and international debt to cushion the effect of oil price variability.

Dankumo *et al.* (2021) examined the influence of governance, public expenditure and trade on poverty reduction in some selected Sub-Saharan African countries, using Pool Mean Group (PMG) data which spanned 24 years (1996-2019). The results showed long-run association between governance, public expenditure, trade, and poverty reduction in SSA. Control of corruption, political stability, government expenditure, and trade reduces poverty and enhances Human Development Index (HDI) in the long run. The outcome implies that good governance is

necessary for poverty reduction as it increased performance of public expenditure and as well as promote trade in SSA.

Raouf (2021) employed VAR, impulse response function and variance decomposition, to investigate the impact of oil price shocks on components of government expenditure on oil-exporting and oil-importing countries from 1980 to 2018. The study separated government expenditure into current and capital expenditure. The result revealed that oil price shocks impacted government current expenditure positively in the two groups of countries, while its effect on government capital expenditure was positive in oil-exporting countries and negative in oil-importing countries.

Darmawan *et al.* (2021) investigated crude oil price movements and stock trading activity in Indonesia. It was measured using Jakarta composite index (JCI), stock volume transactions (VolT), stock value transactions (ValT) and stock market capitalization (MCap). The variables were estimated based on a VECM model. Results from the analysis revealed that the crude oil price movements have significant effects on the indicators. Similarly, impulse responses functions (IRF) and variance decomposition analysis shows that the indicators have significant responses and contribute to the variability of Indonesia stock trading activities respectively.

Orhewere and Ogbeide-Osaretin (2020) looked into the impact of volatility of oil prices on Nigeria's capital expenditure. Annual data spanning from 1970 to 2018 was applied to a vector error correction model when cointegration was found among the variables. Capital expenditure was found to respond negatively to oil price shocks and government aggregate revenue, while it responded positively to domestic debt and this substantially hindered the impact of capital expenditure on growth process of the country. Capital expenditure performance was discovered to be hindered by shocks in oil price volatility in the short run and total government revenue in the long run.

Mosikari *et al.* (2019) investigated the relationship between corruption and the inflows of FDI from other African countries to South Africa. Gravity model was used to estimate the panel data based on pooled, fixed and random effects model. The analysis revealed significant negative relationship between FDI inflows from other African countries to South Africa and corruption in South Africa. It was recommended that policy makers in South Africa should implement measures to curb corruption.

Abdel-Latif *et al.* (2018) investigated how oil price fluctuations determined government expenditure on health and education in Saudi Arabia. Using data spanning from 1990Q1 to 2017Q2 on quarterly basis and a non-linear autoregressive distributed lag (NARDL) model, the study showed evidence of non-linear interaction between oil price and government expenditure in Saudi Arabia, while, shocks to oil price exerted significant influence in the long run. The study recommended diversification of finance sources for education and health sectors in the long run to cancel any negative impact that oil price swings may cause to government expenditure.

Covering the years between 1983 and 2016, Babalola *et al.* (2018) estimated the impact of oil price shocks on public revenue in Nigeria. The study employed VAR model to find the short and long run influences of crude oil price movement on government revenue. The study concluded that government revenue moved in the same direction as the global oil price. Government revenue diminished significantly due to falling oil price in the long run and short run. Consequently, it was suggested that government focus on policies that would promote alternative revenue sources and less dependence on oil proceeds.

Qwader (2018) evaluated the impact of oil price fluctuations on certain budget variables in Jordan over the period 1992-2015. Time series data were analyzed using econometric techniques based on ordinary least squares (OLS). Findings from the analysis showed significant positive impact of oil price on government and tax revenues, external grants, and government expenditures, whereas, effect of oil price on budget deficits had significant negative correlation. The study recommended that government of Jordan should broaden its revenue base by investing its oil tax revenues in economic sectors, such as agriculture and manufacturing and exploit such revenue to establish alternative energy projects, such as solar, wind and bio-gas.

Aregbeyen and Fasanya (2017) investigated government's fiscal response to crude oil price volatility over the period 1970-2013. For the data analysis, VAR was applied. Findings from the VAR model revealed that oil price had influenced government expenditure and a long run interrelationship existed between the two variables. Based on the findings, the study recommended that government diversify the channels of foreign exchange inflows.

In Indonesia, Wardhani *et al.* (2017) studied the relationship between government expenditure and governance on local governments' administrative effectiveness. The study was based on 1,044 observations of local governments starting from 2009 to 2012. The study provided empirical

evidence that expenditure of local governments' in Indonesia were inefficient in increasing administrative effectiveness. On the contrary, the result showed negative effect of government spending on local government performance. Good governance had positive influence on performance and also reduced the inefficiency of government spending.

In a similar study, Akinleye (2017) examined the extent to which oil price volatility influenced infrastructure growth and development in Nigeria from 1960 to 2012. Analysis of results was based on variance decomposition and impulse response functions employed in estimating the variables. It was discovered that oil price and government expenditure co-moved in the same direction. The impulse response function established that oil price shocks were high in the short and long run which implied a persistent adverse effect of oil price volatility on infrastructure growth and development. The study suggested that government makes effort to seek alternative means of funding infrastructure as oil revenue is unpredictable due to oil price swings.

With focus on selected developing countries, Salih and Abdullah (2017) investigated the impact of governance on budget deficit. Panel data was used and Fixed Effects Model was selected. The results revealed that voice accountability, political stability and regulatory quality significantly explained trends in budget deficit, whereas, government effectiveness, rule of law and control of corruption parameters were statistically insignificant.

2.4 Gap in Literature

Several empirical studies that examined the effect of crude oil price volatility on government expenditure exist but only few studies incorporated one or two governance indicators in their analysis and they arrived at different conclusions due to the different methodologies and techniques used. This study contributes to the literature by incorporating the six fundamental indicators of governance rating alongside crude oil price volatility in determining the trend of government expenditures in Nigeria. This is the only study that provides a holistic view of the six fundamental indicators of governance.

3. METHOD

3.1 Data

Data on government expenditure (GEXP) and government revenue (GR) were sourced from Central Bank of Nigeria (CBN) Monthly Economic Report. Data on crude oil price was extracted from Energy Information Administration (EIA) database. Data on governance parameters were collected from World Development Indicators' (WDI) database. Data sample size covered 84 months (2015-2021). Where monthly data is unavailable for a variable, like in the governance indicators, yearly frequency data were converted into monthly data using E-views 10. The base year of 2015 was chosen to enable for analysis during the period in which the Nigerian economy experienced severe distress due to unstable crude oil price in the international market.

3.2 Multivariate Time Series Model

The model used for this study is a combination of models used by Aregbeyeni and Fasanya (2017), and Salih and Abdullah (2017) in their analysis on how crude oil price volatility and governance influence government funding respectively. In this study, a multivariate time series model was employed to examine the impact of crude oil price volatility and governance dynamics on government expenditure in Nigeria. The model is specified in equation 2:

$$Log(GEXP)_{it} = \beta_0 + \beta_1 logCV_{it} + \beta_2\, log(GR)_{it} + \beta_3 logVA_{it} + \beta_4 logPS_{it} + \beta_5 logGE_{it} + \beta_6 logRQ_{it} + \beta_7 logCC_{it} + \beta_8 logRL_{it} + U_{it} \quad (2)$$

where, $GEXP$ = Government expenditure; CV = Crude oil price volatility; GR = Government revenue (crude oil and non-crude oil revenue); VA = Voice accountability; PS = Political stability; CC = Index for control of corruption; RQ = Regulatory quality index; GE= Government effectiveness index; RL = Rule of law; β_0 = Constant term; β_1 - β_8 = Coefficients of the independent variables; U_{it} = Stochastic term; Log = Logged value of.

3.3 Data Estimation Techniques

Autoregressive Distributed Lag (ARDL) bounds test approach was used to establish long run and short run interaction between crude oil price volatility, governance dynamics and government expenditure in Nigeria. ARDL is a multiple time series model commonly used for data where the

underlying variables have long run stochastic trend (cointegration). If the variables are cointegrated, the long run ARDL model was estimated and also the speed of adjustment was found. In ARDL analysis, long-run and short-run coefficients are estimated simultaneously, and the model was developed and utilized for cointegration test even if all the variables were not stationary after first differencing 1(1), or at level i.e. 1(0), but none is integrated at second difference 1(2) (Pesaran *et al.,* 2001). ARDL bounds test specification is presented in equation (3):

$$\Delta Log(GEXP)_t = \delta_o + \sum_{i=1}^{p} \delta_1 \Delta Log(GEXP)_{t-i} + \sum_{i=0}^{p} \delta_2 LogCV_{t-i} + \sum_{i=0}^{p} \delta_3 Log(GR)_{t-i} + \sum_{i=0}^{p} \delta_4 LogVA_{t-i} + \sum_{i=0}^{p} \delta_5 LogPS_{t-i} + \sum_{i=0}^{p} \delta_6 LogGE_{t-i} + \sum_{i=0}^{p} \delta_7 LogRQ_{t-i} + \sum_{i=0}^{p} \delta_8 LogCC_{t-i} + \sum_{i=0}^{p} \delta_9 LogRL_{t-i} + \beta_1 logCV_{t-1} + \beta_2 log(GR)_{t-1} + \beta_3 logVA_{t-1} + \beta_4 logPS_{t-1} + \beta_5 logGE_{t-1} + \beta_6 logRQ_{t-1} + \beta_7 logCC_{t-1} + \beta_8 logRL_{t-1} + \mu_t \quad (3)$$

After cointegration is established, the estimation of the long run relationship is specified in equation 4:

$$\Delta Log(GEXP)_t = \delta_0 + \beta_1 Log(GEXP)_{t-1} + \beta_2 LogCV_{t-1} + \beta_3 Log(GR)_{t-1} + \beta_4 LogVA_{t-1} + \beta_5 LogPS_{t-1} + \beta_6 LogGE_{t-1} + \beta_7 LogRQ_{t-1} + \beta_8 LogCC_{t-1} + \beta_9 LogRL_{t-1} + \mu_t \quad (4)$$

The short run relationship is estimated using an error correction mechanism as shown in equation (5):

$$\Delta Log(GEXP)_t = \delta_o + \sum_{i=1}^{p} \delta_1 \Delta Log(GEXP)_{t-i} + \sum_{i=0}^{p} \delta_2 \Delta LogCV_{t-i} + \sum_{i=0}^{p} \delta_3 \Delta Log(GR)_{t-i} + \sum_{i=0}^{p} \delta_4 \Delta LogVA_{t-i} + \sum_{i=0}^{p} \delta_5 \Delta LogPS_{t-i} + \sum_{i=0}^{p} \delta_6 \Delta LogGE_{t-i} + \sum_{i=0}^{p} \delta_7 \Delta LogRQ_{t-i} + \sum_{i=0}^{p} \delta_8 \Delta LogCC_{t-i} + \sum_{i=0}^{p} \delta_9 \Delta LogRL_{t-i} \theta ecm_{t-i} + \mu_t \quad (5)$$

where, δ_0 = Constant; δ_1 - δ_6 = short-run elasticities (coefficients of the first-differenced explanatory variables); β_1 - β_6 = long-run elasticities (coefficients of the explanatory variables); θ = Speed of adjustment; ecm_{t-i} = Error correction term lagged for one period; Δ = First difference operator; p = Lag length.

TABLE 1 – *Description, Measurement, Unit of Measurement, Expected Signs and Sources*

Description	Identifier	Measurement and unit of measurement	*A-priori* expectation	Source
Government expenditure	GEXP	This is the total government expenditure (capital and recurrent) for a give fiscal year. Government expenditure is measured by natural logarithm of aggregate expenditures in monetary terms. The unit of measurement is naira.	Dependent variable	CBN, (2021)
Crude oil price volatility	CV	Crude oil price volatility is degree to which barrels of crude oil rise or fall over a period of time in the global oil market. Price of crude oil denominated in U.S. dollars per barrel	_	*Authors. Based on crude oil price data from* <https://www.eia.gov>
Government revenue	GR	This is the total government revenue (oil and non-oil) for a give fiscal year. The unit of measurement is naira.	+	CBN (2021)
Voice accountability	VA	It reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	-	WDI (2022)
Political stability and Absence of Violence/Terrorism	PS	Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism.	-	WDI (2022)
Government effectiveness	GE	The index of GE looks at perceptions of public service quality, independence of civil service from political pressures and interference, policy formulation and implementation qualities.	-	WDI (2022)
Regulatory quality	RQ	The RQ index measures perceptions regarding government capacity to formulate and implement effective policies and its regulatory ability.	-	WDI (2022)
Corruption control	CC	The CC index captures the extent to which public power is exercised for private benefits.	-	WDI (2022)
Rule of law	RL	The RL index captures perceptions regarding the extent agents have confidence in and abide by laws, and the quality of contract enforcement, property rights, the police, and the courts.	-	WDI (2022)

Source: Compiled by the authors.

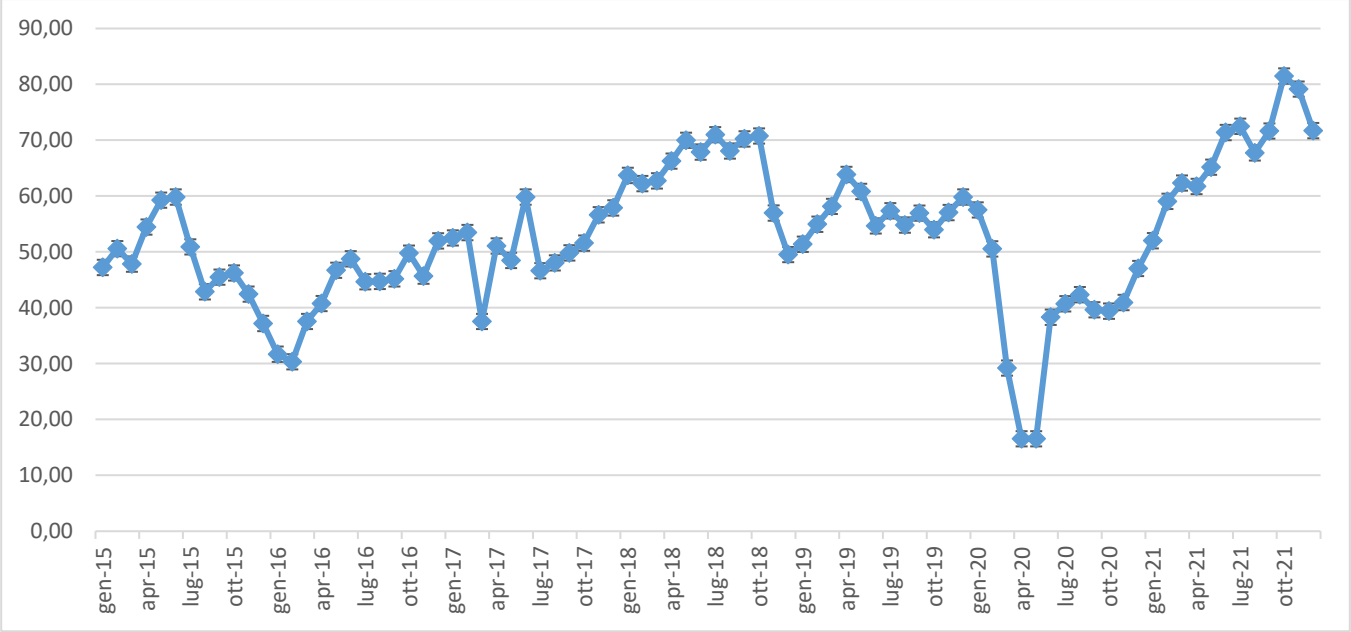
Governance measures: for all governance indicators, the standardized values lie between +2.5 and -2.5. +2.5 indicates a situation where there is no obstacle to a particular indicator (strong) and -2.5 indicates a situation where a particular governance indicator is weak.

4. Results

4.1 Volatility Testing and Trend Analysis

When crude oil price increases, government revenue will increase and public expenditure rises, and *vice versa*. Global crude oil price is presented in figure 5.

Figure 5 - *Global Crude Oil Price from Jan. 2015 to Dec. 2021*



Source: Energy Information Administration (EIA) (processed data).

Figure 5 shows that the price of crude oil decreased significantly in 2016 and 2020. The drop in oil price in 2016 and 2020 revived policy and academic interests in understanding the effect of prices of crude oil products on economies of oil-producing and oil-exporting countries especially in Sub-Saharan Africa (Odili and Opara, 2020).

Generalized Auto-Regressive Conditional Heteroskedasticity (GARCH) was used to test for latent crude oil price volatility. ARCH model of Engle and Patton (2001) provides a systematic

framework for modeling volatility process. The basic premise is that the mean value of crude oil price volatility is serially uncorrelated, but is dependent. This dependency is usually modeled as a simple quadratic function of its lagged values.

Specifically, the ARCH process imposes an autoregressive structure on the conditional variance that permits volatility shocks to persist over time. This allows for volatility clustering. The general form of the model, denoted by ARCH(q) begins with the Autoregressive Model:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_1 Y_{t-1} + \alpha_1 Y_{t-1} + \ \ldots \ \alpha_p Y_{t-p} + \varepsilon_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i Y_{t-i} + \ \varepsilon_t \qquad (6)$$

where Y_t is the dependent variable, α_i are parameters to be estimate and ε_t the error term. The lags of the dependent variable can be stacked together as X_t and the $\alpha_i's$ as φ which is rewritten thus;

$$Y_t = \ X_t\varphi + \varepsilon_t \qquad (7)$$

where the error term is assumed to be normally distributed with 0 mean and variance h_t also written as:

$$\varepsilon_t \sim N(O, h_t) \qquad (8)$$

The ARCH(q) model estimated with Maximum Likelihood Procedures is given as:

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-1}^2 + V_t \qquad (9)$$

$$V_t \sim IIN(O, h_t) \qquad (10)$$

The major problem with an ARCH model is that it needs a large number of lags to catch the nature of the volatility; this can be problematic as it is difficult to decide how many lags to include besides, and it produces a non-parsimonious model where the non-negativity constraint could fail. The GARCH model is usually much more parsimonious and often a GARCH (1, 1) model is sufficient. This is because the GARCH model incorporates much of the information that a much larger ARCH model with large numbers of lags would contain.

As a result of these deficiencies of ARCH, Bollerslev *et al.* (1992) generalized the ARCH model by allowing the conditional variance to be a linear function of p lagged conditional variances in

addition to q past squared errors. In other words, GARCH (p,q) implies the following form of the conditional variance:

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-1}^2 + \sum_{j=1}^{p} \beta_i h_{t-j} + V_t \quad (11)$$

where α_0 is the constant term, ε_{t-1}^2 is the ARCH process, h_{t-j} is the GARCH term.

Crude oil price follows an Autoregressive AR(p) process with time varying volatility, where volatility follows a mean reverting Moving Average MA(1) process. Specifically:

$$CP_t = \mathrm{p}_1 CP_{t-1} + \mathrm{p}_2 CP_{t-2} + \mathrm{p}_3 CP_{t-3} + \cdots + Pplog + e^{\sigma t} V_t = \sum_{i=1}^{P} P_i \log(CP)_t + e^{\sigma t} V_t \quad (12)$$

$$\sigma_t^2 = (1 - \delta_\sigma)\underline{\sigma} + \delta_1 \sigma_{t-1}^2 + Y_1 V_{t-1}^2 + V_{\sigma,t} \quad (13)$$

Note: $\{V_t, V_{\sigma t}\}$ ~ N(0,1) i.e. zero mean and constant variance.

CP_t is crude oil price, σ^2 is Variance, ρ, γ and δ are parameters to be estimated. σ is the unconditional mean of σ_t^2. The shock due to crude oil price volatility $V_{\sigma,t}$ is assumed to be independent of the error term V_t. A method to test for the significance of GARCH errors using the Lagrange multiplier test was proposed by Engle (1982).

The null hypothesis is that, in the absence of ARCH/GARCH components, we have:

$$H_0: \delta_1 = 0;\ Y_1 = 0 \quad (14)$$

The alternative hypothesis is:

$$H_1: \delta_1 \neq 0;\ Y_1 \neq 0 \quad (15)$$

That is, in the presence of ARCH components, the estimated coefficients δ_1 must be significant. In a sample of T residuals under the null hypothesis of no GARCH errors, the test statistic TR^2 follows χ^2 distribution with q degrees of freedom. If TR^2 is greater than the Chi-square table value, we *reject* the null hypothesis and conclude that there is a GARCH effect. If TR^2 is smaller than the Chi-square table value, we do not reject the null hypothesis. We can also test the null hypothesis using the probability value of the Lagrangian Multiplier (LM) statistics. We accept the null hypothesis if the probability falls outside the conventional levels of significance. That is, if p>0.05,

it accepts the null hypothesis that there is no GARCH effect. Where the reverse is the case, it will reject the null hypothesis.

TABLE 2 - *Estimating GARCH (1, 1)*

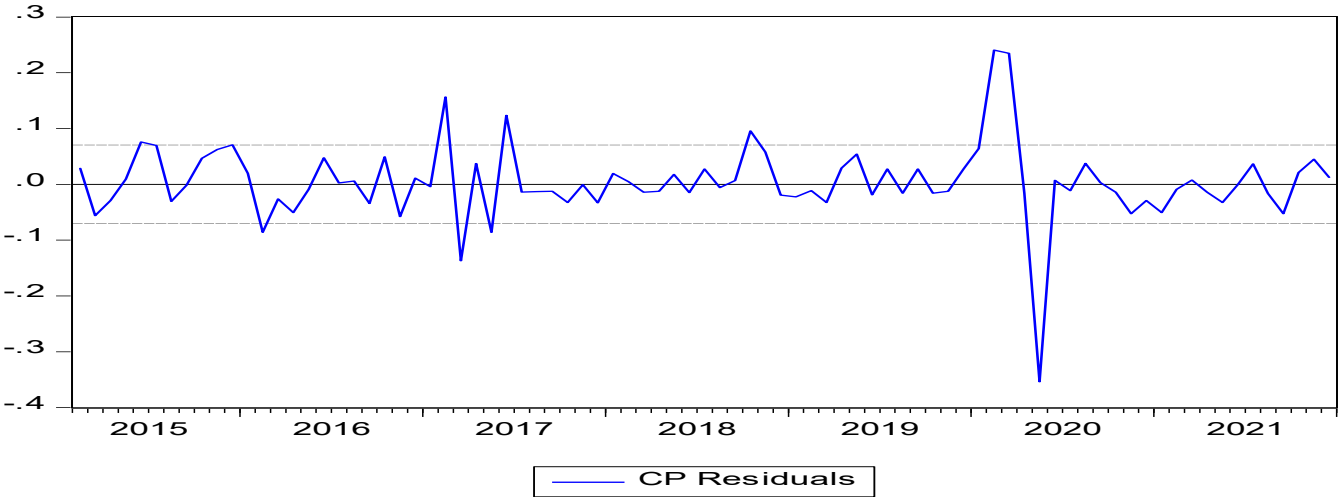
Variable	Coefficient	Std. Error	z-Statistic	Prob.
		Mean Equation		
β(-1)	-0.458433	0.100844	-4.545967	0.0000
C	0.394348	0.109563	3.599289	0.0006
		Variance Equation		
C	0.001002	0.000342	2.931693	0.0034
RESID(-1)^2	0.538657	0.179569	2.999715	0.0027
GARCH(-1)	0.331756	0.116324	2.851992	0.0043
R-squared	0.720519			
Adjusted R-squared	0.708427			
Durbin-Watson stat	1.762347			

Source: Authors' computations using E-Views 10.0 (processed data).

From Table 2, the variance equation showed the presence of GARCH effect since all the GARCH parameters are statistically significant and in the mean equation, the GARCH parameter is also significant as depicted by the probability value of 0.0043 which is lower than 0.01 (1% level of significance). This shows that volatility exists in crude oil price from 2015 to 2021.

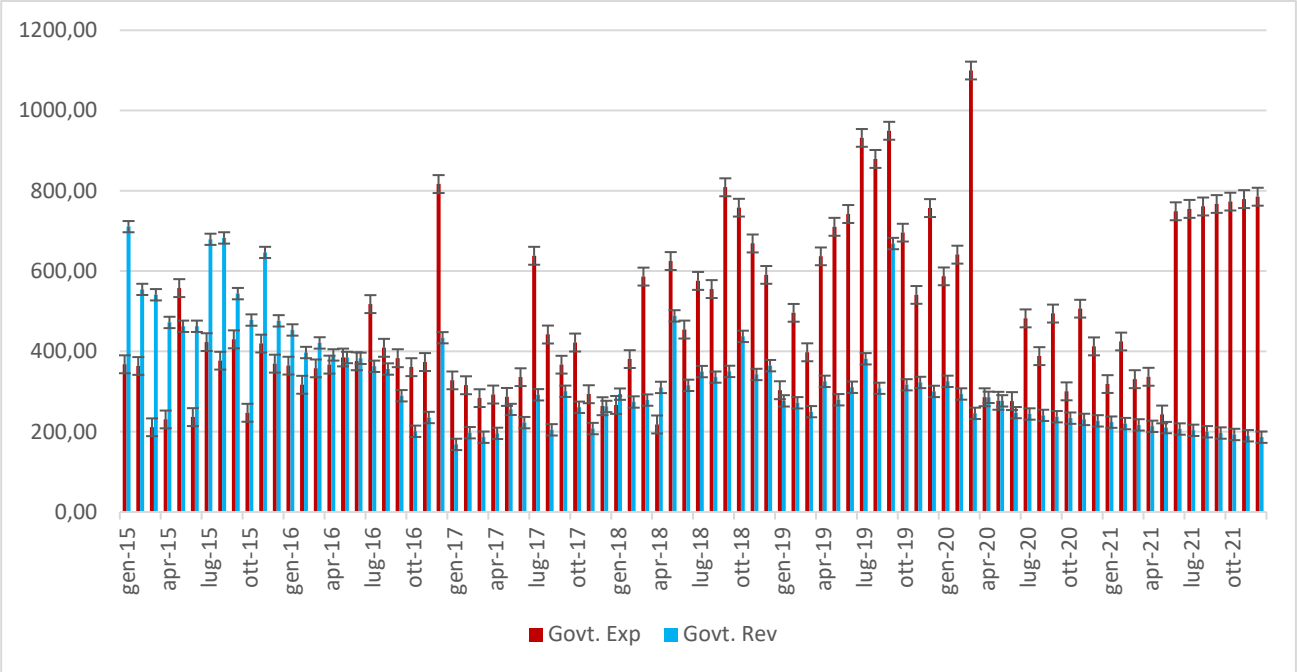
Figure 6 shows the trend of crude oil price residual volatility. The level of volatility was more severe in 2016 and 2020 probably due to economic recession induced by new political regime in 2016 and COVID-19 pandemic in 2020 (Odili and Opara, 2020). For oil dependent economies like Nigeria, fluctuations in crude oil prices caused fluctuations in government spending, hence, negatively influenced public expenditure in key economic sectors measured by natural logarithm of aggregate expenditures in monetary terms. Government revenue is a prominent determinant of government expenditure and shocks to crude oil price would cause revenue to dwindle, hence government expenditure would be reduced, denying the country necessary funds to spur investment and productivity.

FIGURE 6 - *Crude Oil Price Volatility Trend*



Source: Energy Information Administration (EIA) (processed data).

FIGURE 7 - *Government Revenue and Expenditure from Jan. 2015 to Dec. 2021*



Source: Authors' computations using E-Views 10.0 (processed data).

Figure 7 shows that government expenditure largely lies above its revenue, indicating serious revenue gap in Nigeria, an oil dependent economy. The increase in government expenditure amidst unfavourable crude oil prices and dwindled government revenue was due to government

borrowings which was used to close the revenue gap and has further left the economy in a state of debt crisis in which large proportion of revenue is now channeled to debt servicing (Odili, 2022).

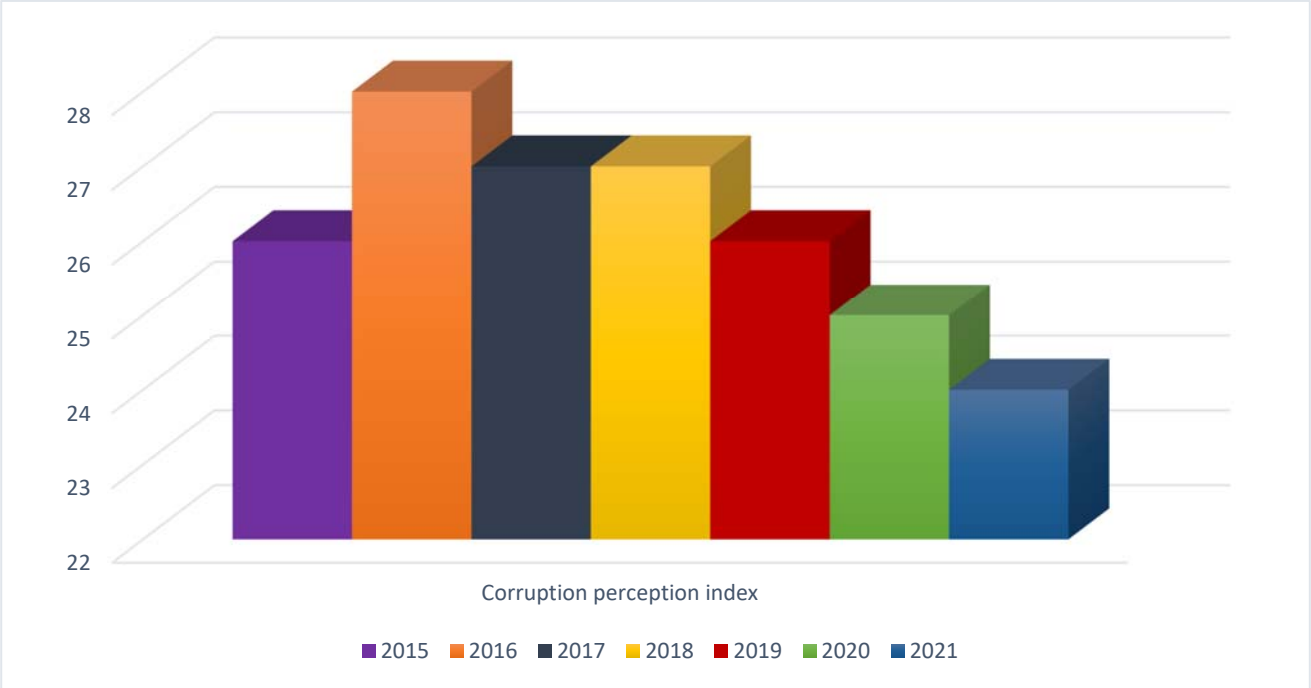
The performance of macroeconomic fundamentals in an economy is a function of many variables among which governance is prominent. In this study, governance measurement was developed based on six principles of voice accountability (VA), political stability (PS), government effectiveness (GE), regulatory quality (RQ), control of corruption (CC) and rule of law (RL). For all aforementioned governance indexes, except control of corruption, the standardized values lie between +2.5 and -2.5. The +2.5 indicates the situation where there is no obstacle to a particular indicator (strong) and -2.5 is the situation where a particular governance indicator is weak. Control of corruption is rated on percent from 0 to 100. A "0" score is perceived as "highly corrupt" and "100" score – "very clean".

Control of corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

Figure 8 presents downward trending corruption perception index from 2016 to 2021 in Nigeria. One notable aspect of corruption that has rattled the Nigerian public sector over the years is the case of oil theft, which has reduced government revenue and undermined its ability to fund public investments (Ugwu, 2022). The trend shows that corruption perception index decreased from a high score of 26% in 2016 to a low score of 23% in 2021. This implies that corruption increased in Nigeria from 2016 to 2021. Effective control of corruption in Nigeria would therefore enhance good governance and improve public sector investments.

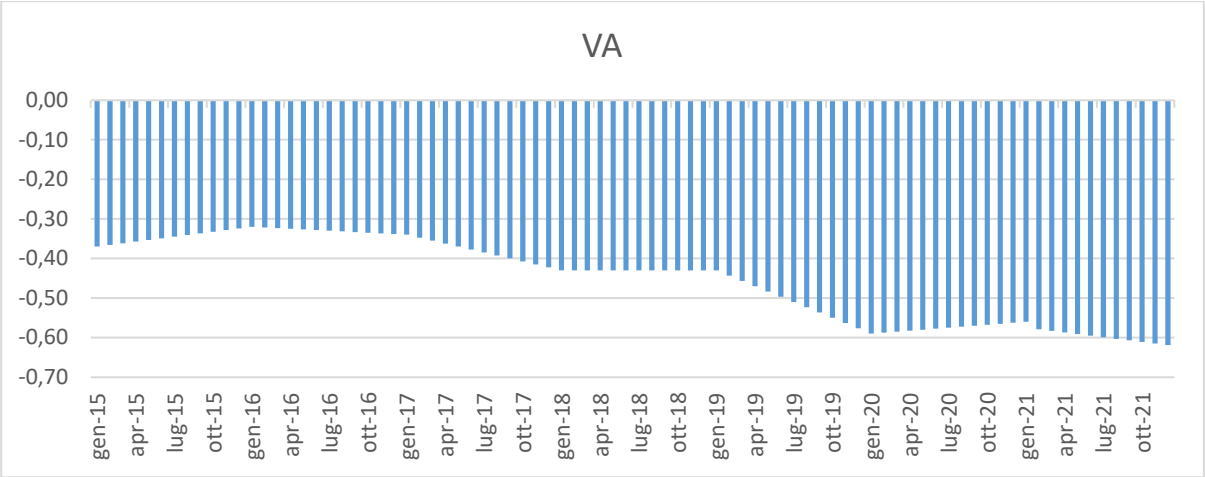
Voice accountability reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, association, and a free media.

FIGURE 8 - *Corruption Perception Index (CPI)*



Source: Transparency International.

FIGURE 9 - *Voice Accountability*

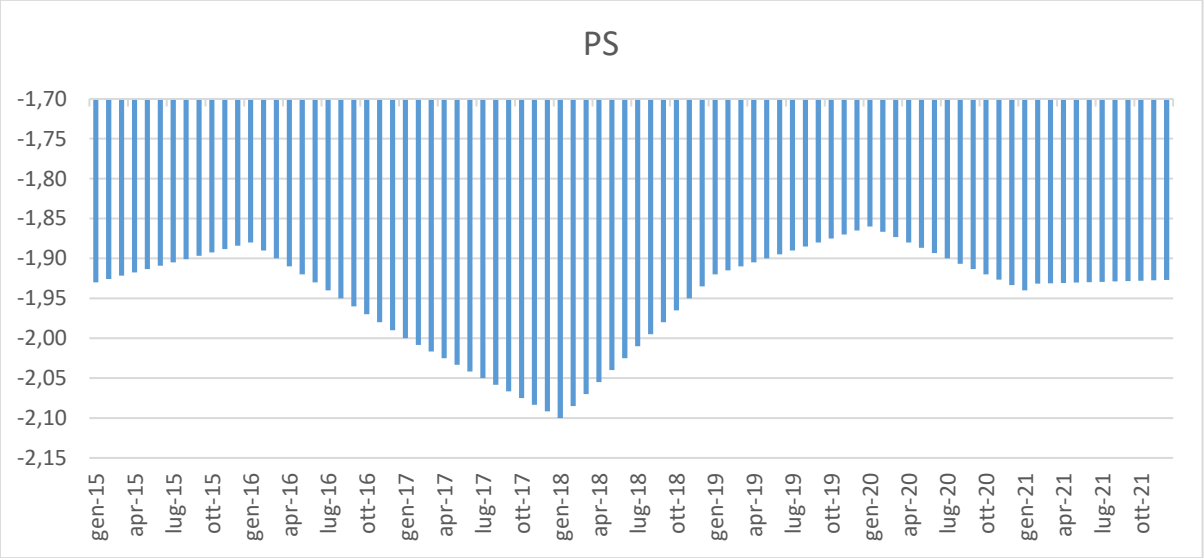


Source: Authors' computations using E-Views 10.0 (processed data).

Figure 9 revealed negative trends in voice accountability. Voice accountability was -0.37 in January 2015, -.032 in January 2017, -0.43 in January 2019 and -0.62 in December 2021. Citizens' participation in selecting their government, as well as freedom of expression, association, and a free media is weak. Electoral violence, rigging of election and other forms of electoral vices are common in Nigerian polity. The negative values of voice accountability in Nigeria are hindrances to proper allocation and utilization of government revenue and hence, impediments to national development.

Political stability and absence of violence/terrorism measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism.

FIGURE 10 - *Political Stability*

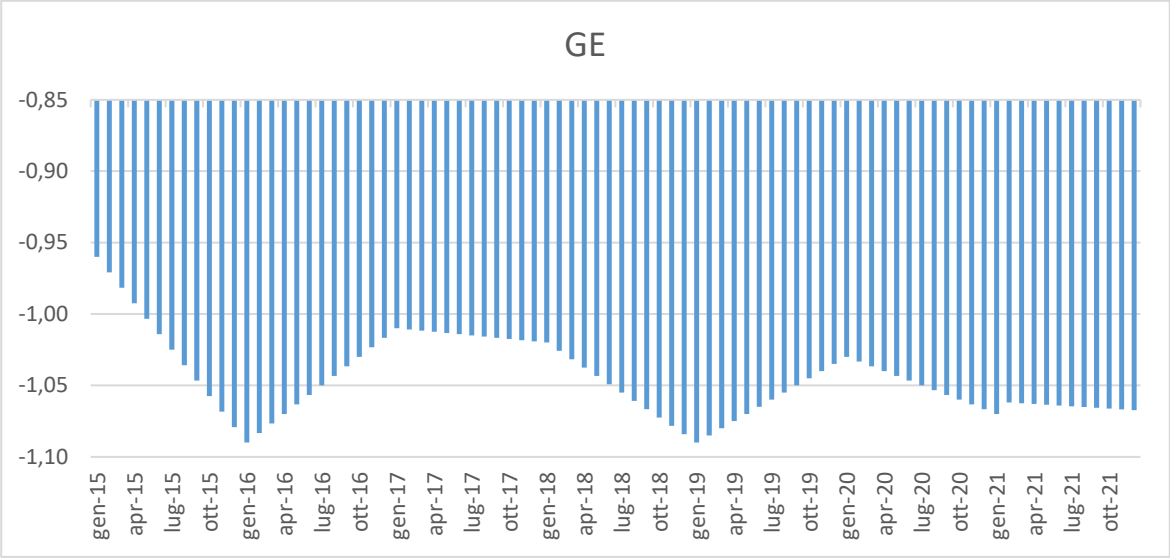


Source: Authors' computations using E-Views 10.0 (processed data).

Absence of violence/terrorism and political stability (see figure 10) was -1.93 in January 2015, -1.88 in January 2016, -2.10 in January 2018, -1.86 in January 2020, and -1.93 in December, 2021. The value of absence of violence/terrorism and political stability recorded its lowest value in January 2018 (-2.10). This means that the perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism, was highest in January 2018 in Nigeria within the study time frame. This may create tension and deprive the economy of needed foreign capital inflow and hence adversely influence government expenditure on infrastructural development.

The index of government effectiveness looks at perceptions of public service quality, independence of civil service from political pressures and interference, policy formulation and implementation qualities.

FIGURE 11 - *Government Effectiveness*



Source: Authors' computations using E-Views 10.0 (processed data).

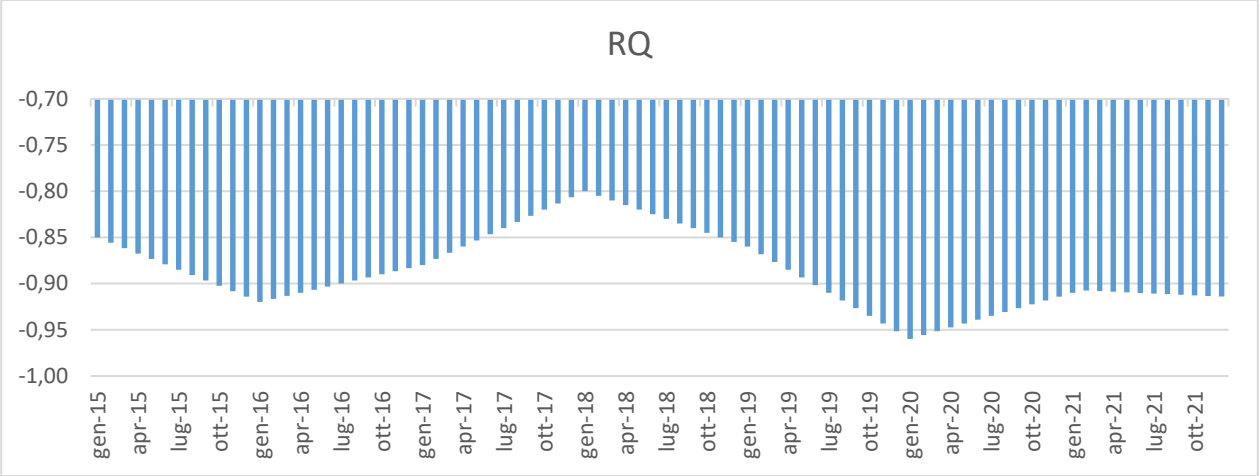
Figure 11 shows that trend in government effectiveness has negative sign (weak governance). Government effectiveness was -0.96 in January 2015, decreased further to -1.09 in January 2016, increased to-1.02 in December 2016, and in January 2018, 2019, 2020 and 2021 it was -1.02, -1.09, -1.03, and -1.07 respectively. This trend implies that public service quality, independence of civil service from political pressures and interference, policy formulation and implementation qualities are poor and was worst in January 2016 and 2019 which indicates week governance.

Regulatory quality index measures perceptions regarding government capacity to formulate and implement effective policies and its regulatory ability.

Figure 12 revealed negative trends in regulatory quality. Regulatory quality was -0.85 in January 2015, -0.92 in January 2016, -0.80 in January 2018, -0.96 in January 2020, and -0.91 in December 2021. The negative values exhibited by the trend show that Nigerian government lacks capacity to formulate and implement effective policies and its regulatory ability is weak.

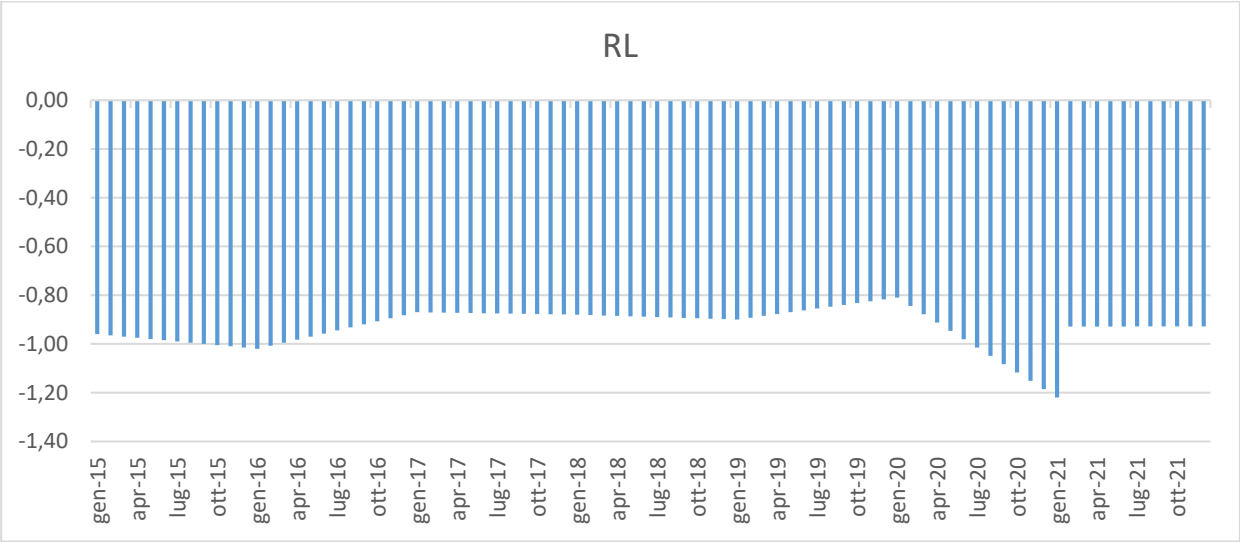
Rule of law index captures perceptions regarding the extent agents have confidence in and abide by laws, and the quality of contract enforcement, property rights, the police, and the courts.

FIGURE 12 - *Regulatory Quality*



Source: Authors' computations using E-Views 10.0 (processed data).

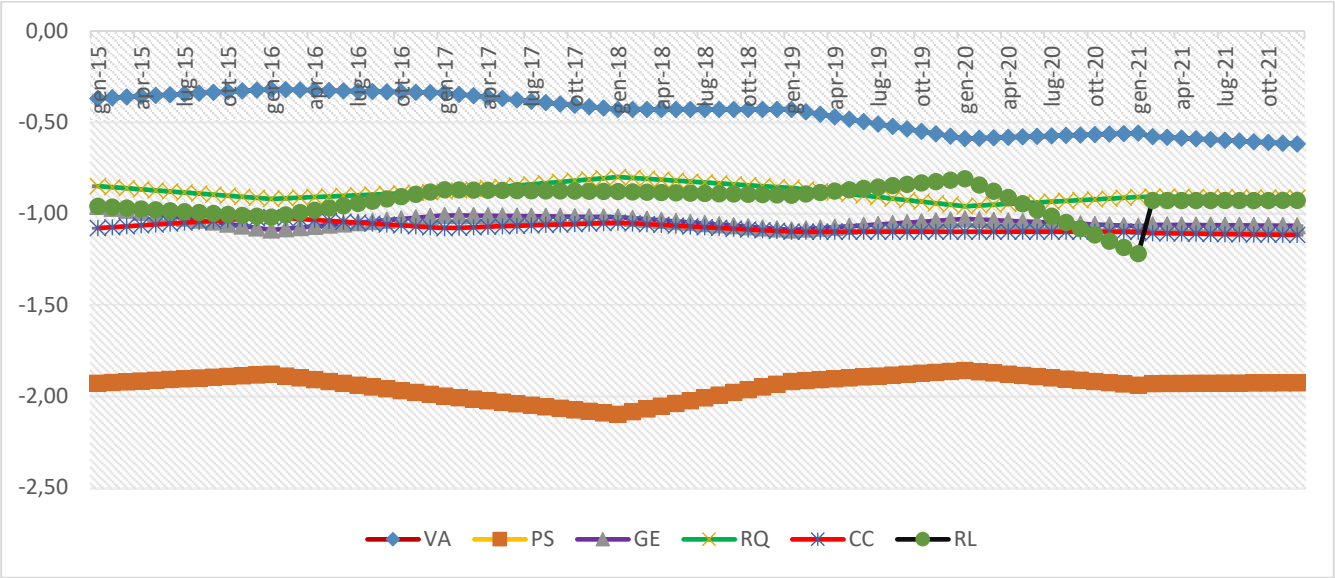
FIGURE 13 - *Rule of Law*



Source: Authors' computations using E-Views 10.0 (processed data).

Rule of law (see figure 13) was -0.96 in January 2015, -0.87 in January 2017, -0.81 in January 2020 and -1.22 in January 2021. The value of rule of law however increased to -0.93 in December 2021. The perception of the extent agents (government at various levels) has confidence in and abide by laws is therefore weak in Nigeria. This creates obstacle in governance and breeds corruption.

FIGURE 14 - *Trend of Governance Parameters*



Source: World Governance Indicators.

Figure 14 shows that trends in governance indictors lie below the horizontal axis (negative value) and revealed adverse effects on governance dynamics. Government revenue is therefore not judiciously used and this undermines its ability to fund public infrastructural investments.

4.2 *Summary Statistics*

The summary statistics presents measures of central tendency, variability, and normality. Normality indicates the pattern of distribution of the variables to identify if the variables were normally distributed or not.

TABLE 3 - *Summary Statistics*

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	JB Prob.	Obs.
GEXP	486.1121	416.0850	1099.700	211.0000	203.9905	0.801712	2.770177	0.010136	84
CV	-0.002024	-0.010000	0.250000	-0.360000	0.070314	0.446729	12.60861	0.000000	84
GR	327.1407	292.7000	710.8000	168.5000	129.5363	1.258195	4.046508	0.000002	84
VA	-0.452143	-0.430000	-0.320000	-0.620000	0.103191	0.257117	1.510668	0.012979	84
PS	-1.947381	-1.930000	-1.860000	-2.100000	0.063817	0.915338	2.699323	0.002422	84
GE	-1.045595	-1.050000	-0.960000	-1.090000	0.027870	0.735632	3.253036	0.020239	84
RQ	-0.887381	-0.900000	-0.800000	-0.960000	0.040363	0.375268	2.277799	0.149788	84
CC	-1.079643	-1.080000	-1.020000	-1.120000	0.025481	0.421452	2.112889	0.072763	84
RL	-0.931190	-0.910000	-0.810000	-1.220000	0.078240	1.448604	5.577916	0.000000	84

Source: Authors' computations using E-Views 10.0 (processed data).

The descriptive statistics indicate that all the variables have an equal number of observations of 84 each. Skewness measures the asymmetry of the series. The distribution exhibits positive skewness. Kurtosis on the other hand measures the extent to which the peak of a unimodal frequency distribution departs from the shape of normal distribution. The kurtosis value shows that the series is leptokurtic. The distribution with reference to the Jarque-Bera estimates and probability values revealed that all the variables are normally distributed at 5% level of significance, except RQ and CC that are not normally distributed. The mean, minimum and maximum values of Nigeria's governance ratings were negative, which further stressed the incidence of bad governance in Nigeria.

4.3 Unit Root Test

Test for stationarity of data was carried out on each variable with Augmented Dickey-Fuller (ADF) unit root test to avoid spurious regression (Dickey and Fuller, 1979). The general model for ADF unit root test is presented in equation 16:

$$\Delta y_t = \beta_0 + \beta_1 t + \beta\lambda y_{t-1} + \sum_{j-1}^{p} \delta_j \Delta y_{t-j} + \mu_t \quad (16)$$

Where, y_{t-1} = Lagged value of y_t at first difference; Δy_{t-j} = A change in lagged value; δ = Measure of lag length; Δy_t = First difference of y_t; μ_t = Error term.

TABLE 4 - *Unit Root Test*

Variable	Levels	Critical values		First Diff	Critical values		Integration
Log(GEXP)	-6.019157	1%	-4.072415	-	-	-	I(0)
		5%	-3.464865				
CV	-7.686511	1%	-4.075340	-	-	-	I(0)
		5%	-3.466248				
Log(GR)	-2.804886	1%	-4.073859	-5.074641	1%	-4.073859	I(1)
		5%	-3.465548		5%	-3.465548	
VA	-3.372655	1%	-4.073859	-6.232010	1%	-4.073859	I(1)
		5%	-3.465548		5%	-3.465548	
PS	-2.881755	1%	-4.073859	-4.010895	1%	-4.075340	I(1)
		5%	-3.465548		5%	-3.466248	
GE	-4.491650	1%	-4.073859	-	-	-	I(0)
		5%	-3.465548				
RQ	-2.819439	1%	-4.073859	-3.496346	1%	-4.076860	I(1)
		5%	-3.465548		5%	-3.466966	
CC	-3.760599	1%	-4.075340	-	-	-	I(0)
		5%	-3.466248				
RL	-2.075194	1%	-4.075340	-8.368064	1%	-4.075340	I(1)
		5%	-3.466248		5%	-3.466248	

Source: Authors' computations using E-Views 10.0 (processed data).

The unit root test results show that all variables are of mixed level of integration at 1% and 5% level of significance. This satisfies the requirements for using Autoregressive Distributed Lag (ARDL) as technique of data analysis (Pesaran *et al.*, 2001). The fact that there was no I(2), that is, series integrated at second difference, further justifies ARDL approach.

4.4 Optimal Lag Selection

Optimal lag for the cointegrating equation was based on the assumption of serially uncorrelated residual using Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC). The optimal lag is the lag length that minimizes the value of the AIC and SBC without any trace of autocorrelation. In this study, emphases are on trend analysis, inclusion of time trend in our equations can produce better approximated results (Pesaran *et al.,* 2001). The estimation of equation 3 was carried out with and without time trend separately from lag 1 to 4 and AICs and SBCs as well as the serially uncorrelated assumption was compared to choose the optimal lag for each equation. Estimations were limited to lag 4 because lag increase will result to the possibility of serially uncorrelated residuals; however, it was done parsimoniously to avoid over-parameterization problems (Pesaran *et al.,* 2001).

TABLE 5 - *Optimal Lag Order Selection for Equation 3 with Trend*

Lag	LogL	SBC	AIC	LM(1)	LM(4)
1	19.33420	2.28e-07	-1.102631	0.860	3.432
2	118.7304	7.79e-10	-6.825419	0.473	3.007
3	127.5955	7.97e-10	-7.122729*	0.361*	2.563*
4	128.2114	7.98e-10*	-6.918053	0.486	3.029

TABLE 6 – *Optimal Lag Order Selection for Equation 3 without Trend*

Lag	LogL	SBC	AIC	LM(1)	LM(4)
1	15.30421	3.29e-08	-2.832651	0.764	4.432
2	107.4324	8.89e-10	-7.827413	0.561	4.021
3	115.5352	9.05e-10	-8.522720*	0.469*	3.137*
4	118.0227	9.17e-10*	-7.783164	0.497	3.431

Note: *denotes significance at 10% and optimal lag chosen, SBC and AIC are Schwarz Information Criterion and Akaike Information Criterion, LM (1) and LM (4) denote Langrange Multiplier test of residual autocorrelation at order 1 and 4 respectively.

Table 5 and 6 show the AIC and SBC, and the residual autocorrelation test for first difference regression of equation 3 with trend and without trend respectively. This was done to check if change in lag affects the outcome of the test. It was found that AIC and SBC minimized their values at lag 3 and 4 with and without trend respectively. The study choose lag 3 as the optimal lag because as the lag increases from 3, SBC continuously minimizes its value while AIC increases its value. This means that SBC cannot provide minimum value until more number of lags is taken which may lead to over parameterization. This study used AIC to choose the optimal lag for equation 3 with trend and without trend. Though Pesaran *et al.* (2001) recommended SBC to be more consistent and parsimonious, Al-jammal (2010) in simulation study discovered that a model chosen by AIC is more preferred in terms of robustness.

4.5 ARDL Estimation

The results of the bound test for cointegration analysis between government expenditure, crude oil price volatility and measures of governance are presented in Table 7.

TABLE 7 - *Bounds Test*

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	5.737543	10%	1.66	2.79
K	8	5%	1.91	3.11
		1%	2.45	3.79

Source: Authors' computations using E-Views 10.0 (processed data).

The values under the I(0) and I(1) are critical values for the regressors under 1% and 5% significance levels. The I(0) are the lower bound critical values while I(1) are the upper bound critical values. The bounds test was based on the ARDL (2, 2, 3, 1, 1, 1, 1, 1, 1) for the dependent and independent variables respectively using optimal lag of 3 as determined in tables 4 and 5.

TABLE 8 – *Long Run Estimates*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CV	-0.394479	0.093968	-4.198037	0.0012
LOG(GR)	0.946668	0.222557	4.253598	0.0002
VA	-0.047555	0.992509	-0.047914	0.9619
PS	-0.318253	0.033572	-9.479715	0.0000
GE	-0.493371	0.224778	-2.194925	0.0317
RQ	-0.335314	0.103893	-3.227494	0.0036
CC	-0.448772	0.124546	-3.603263	0.0014
RL	-1.666057	0.699286	-2.382512	0.0201

Source: Authors' computations using E-Views 10.0 (processed data).

In table 7, the F-statistic (5.737543) is greater than the critical values; hence, the null hypothesis of non-cointegration is rejected. This shows that there is longrun relationship among the variables. This is in consonance with Abdel-Latif *et al.* (2018); Wardhani *et al.* (2017); Akinleye, (2017) who discovered that crude oil price volatility, governance and government expenditure co-moved in the long run.

4.6 Error Correction Mechanism (ECM)

The short run results associated with the long run estimates are estimated by the error correction model (ECM).

Adjusted R-squared (0.858411) indicates that the joint predictive strength of the independent variables was 85%. This shows that the model specified for this study significantly explained the total changes in GEXP. The coefficient value -0.695127, shows that about 70% of the disequilibrium in the previous year is corrected in the current year.

TABLE 9 – *Short Run Estimates*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(GEXP(-1))	-0.220085	0.096425	-2.282447	0.0445
D(CV)	-1.137371	0.376109	-3.024043	0.0036
D(CV(-1))	-1.041696	0.371297	-2.805557	0.0066
DLOG(GR)	0.546531	0.152565	3.582280	0.0006
DLOG(GR(-1))	0.572317	0.176686	3.239170	0.0019
D(VA)	-0.297914	0.108894	-2.735816	0.0130
D(PS)	-0.422981	0.181555	-2.329770	0.0225
D(GE)	-0.646766	0.141538	-4.569566	0.0000
D(RQ)	-0.519592	0.252130	-2.060810	0.0428
D(CC)	-0.101269	0.031570	-3.207794	0.0020
D(RL)	-0.145661	0.046323	-3.144476	0.0024
ECM(-1)	-0.695127	0.132257	-5.255883	0.0000
R-squared	0.891531	Mean dependent var	0.016225	
Adjusted R-squared	0.858411	S.D. dependent var	0.413883	
S.E. of regression	0.275034	Akaike info criterion	0.338610	
Sum squared resid	5.597624	Schwarz criterion	0.545537	
Log likelihood	-6.713688	Hannan-Quinn criter.	0.421632	
Durbin-Watson stat	2.043795			

Source: Authors' computations using E-Views 10.0 (processed data).

4.7 Diagnostic Checks

The robustness of the study outcome for policymakers, investors and other stakeholders of the economy are reinforced with diagnostic checks of the model specification using Jarque-Bera test for normality, serial correlation using Breusch-Godfrey test and heteroscedasticity. The outcome of these tests is presented in Table 10.

Serial correlation (0.159287) has probability (0.8531) greater than 0.05, implying that its residuals are serially uncorrelated. Jarque-Bera (0.201265) turned out with a probability value (0.9042 > 0.05), so residuals are normally distributed. The Autoregressive conditional heteroscedasticity

(ARCH) test shows existence of no heteroscedasticity. The probability of ARCH test is 0.2650 which is greater than 0.05, accepting the null hypothesis of non-existence of heteroscedasticity. The results of Ramsey RESET test showed that the model is correctly specified.

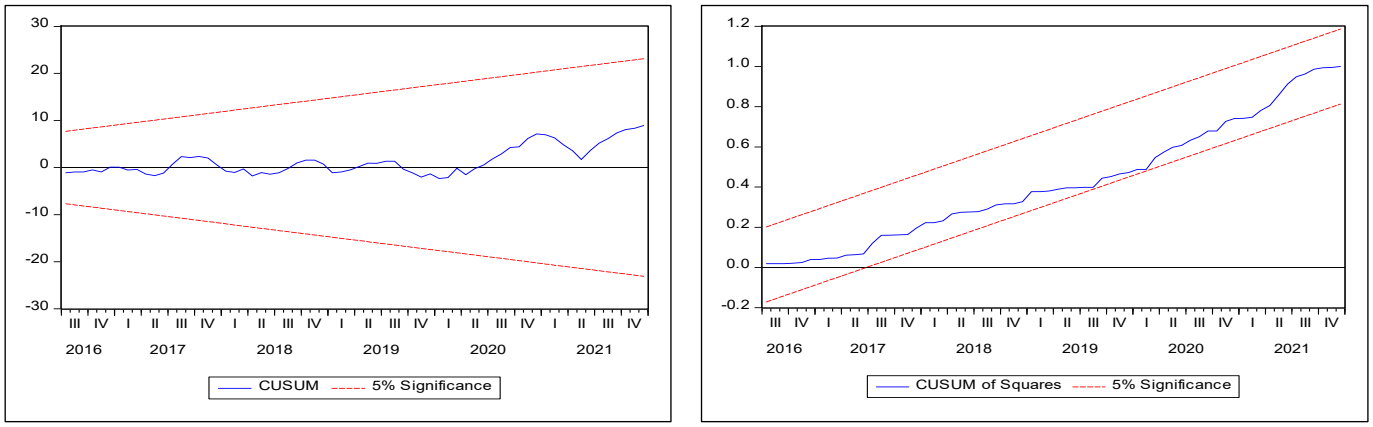
TABLE 10 - *Diagnostic Checks*

Test	t-Statistic	Prob.	Null hypothesis (Ho)	Decision
Serial correlation	0.159287	0.8531	Residuals are not serially correlated	Accept Ho
Normality	0.201265	0.9042	Residuals are normally Distributed	Accept Ho
Heteroscedasticity	0.737962	0.2650	Residuals have no ARCH effect	Accept Ho
Ramsey RESET	0.031401	0.8563	Model is stable	Accept Ho

Source: Authors' computations using E-Views 10.0 (processed data).

The ARDL model passed the diagnostic tests for serial correlation, non-normal error and functional misspecification.

FIGURE 15 - *CUSUM and CUSUM of Squares*



The CUSUM and CUSUMSQ plots are in-between the critical boundaries at 5% level of significance. This confirmed the stability of the long run and short run parameters, implying that the model is steady and well specified.

5. Discussions

The long run estimates show that, to a large extent, crude oil price volatility and governance explains the trend of government expenditure over a long period. Looking at the signs of the coefficients, it was found that CV, GE and CC negatively influenced the trend of GEXP in the long-run. The negative effects of CV, GE and CC is largely due to the overdependence on oil revenue to fund needed infrastructural development (see Aregbeyen and Fasanya, 2017; Orhewere and Ogbeide-Osaretin, 2020; and Odili, 2022) given poor government effectiveness and rising corruption especially in the area of crude oil theft and looting of public treasury by government officials (see Rajkumar and Swaroop, 2008; Jajkowicz and Drobiszová, 2015; and Nelson and Yebimodei, 2018). This finding was supported by prior studies such as Akinleye (2017); Aremo *et al.* (2012), that oil price volatility caused significant effect on government expenditure, while findings by Ibrahim (2017), failed to agree with the finding from this study probably due to difference in methodology used. Amidst changes in crude oil price volatility and governance, government revenue exerted positive and significant effect on government expenditure in Nigeria. Voice accountability had negative and insignificant effect on GEXP, while, the effects of PS, RQ and RL were significant and negative. These are in line with *a priori* expectations of this study. It implies that Nigerian government was highly ineffective and was unable to control corruption. This finding is in line with Salih and Abdullah (2017); Jajkowicz and Drobiszová (2015) that government expenditure decreased due to government's inability to control corruption in Nigeria. This is due to the increasing rate of corruption and poor regulatory framework coupled with the fact that government officials might have looted public funds for their selfish interest. The study by Salih and Abdullah (2017) lends support to this hypothesis and states that good regulatory framework and hearsome to rule of law is a forestanding factor that defines good governance which enhances government expenditure.

Short run result show that GR had significant and positive effect on government expenditure, implying that there was upward trend in government expenditure in the short run amidst decrease in oil revenue. This is possible because federal governments do borrow to finance revenue-expenditure gap (fiscal deficit) and it may have short term positive effect on the economy through output expansion. The result is in line with Odili, (2022) who states that governments borrow to finance its budgeted public expenditure in order to cover its revenue–expenditure gap. The short run coefficients of the CV and governance parameters were found to be negative and

statistically significant, except voice accountability which was positive and significant. This is in line with the *a priori* expectations of this study (also see Salih and Abdullah, 2017; Jajkowicz and Drobiszová, 2015). It implies that governance in Nigeria has been poor and has orchestrated downward trends in public expenditure performance.

6. Conclusion and suggestions

Research results indicated that the variables estimated were bound by long run relationships which lead to the conclusion that crude oil price volatility and governance dynamics determine trends of government expenditure in Nigeria. Variability in crude oil price creates uncertainty in revenue accruing from oil exports and leads to macroeconomic shocks. Except voice accountability whose effect was not significant in influencing government expenditure in the long run, the measures of governance had negative and significant effect on government expenditure in Nigeria in both short and long run. Good governance is therefore imperative for effective and efficient government revenue expenditure management to ensure infrastructural development and macroeconomic sustainability in Nigeria.

This study suggests that since oil price volatility negatively influenced government expenditure, the non-oil sector of Nigerian economy harnessed and exploited to expand the revenue base and reduce crude oil price volatility shocks. There is need to entrench participatory democracy to enhance voice accountability whereby citizens' vote counts in electioneering process. Policy measures should focus on tackling the state of political instability and violence. Nigerian government should be more pragmatic in fighting corruption by setting up independent and functional anti-corruption agency that would probe into corruption cases. Independence of anti-corruption agency should be backed by law to ensure that government do not use anti-corruption agency as a tool for checkmating its opponents. Focusing on rule of law, voice accountability and corruption control is imperative for transparency and good governance and will ensure macroeconomic sustainability in Nigeria.

7. Contribution to knowledge

This study contributed to existing knowledge by developing a conceptual framework that explains the interactions between government expenditure and governance parameters in Nigeria. This

gives an understanding of how governance influences resource allocation in Nigeria. Secondly, this study contributed to knowledge by incorporating the six fundamental indicators of governance rating alongside crude oil price volatility in determining the trend of government expenditures in Nigeria. This is the only study that provides a holistic view of the six fundamental indicators of governance. This will further give insights to policy makers that crude oil price volatility may not be a serious issue for a natural resource endowed country like Nigeria, if the processes of governance follow the right path.

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