Evaluating the effect of oil prices volatility on the capital expenditure of the Federal Government in Nigeria

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ABSTRACT

This study examines the effect of oil price volatility on federal government capital expenditure in Nigeria over the time frame from 1993 to 2022. The analysis was conducted using secondary data obtained from relevant government agencies. The study focuses on analysing the impact of volatility in the prices of Brent UK crude oil, OPEC spot rate crude oil, and West Texas intermediate crude oil prices on capital expenditure. It takes into account the potential disruptions caused by oil subsidies, corruption, and inflation. The study employed an ex-post facto research design via the autoregressive distributed lagged (ARDL) regression. The empirical findings of the model indicate that the volatility of Brent UK crude oil price, OPEC spot rate crude oil, and West Texas intermediate crude oil price volatility do not have a statistically significant effect on the federal government's capital expenditure. This indicates that oil price volatility is a short-run phenomenon that will fade out in a short period, thus explaining the high speed of adjustment of the error correction term. There is a need to monitor the federal government's capital expenditure pattern and the income of key revenue-generating agencies. The federal government should continue to prioritise fiscal reforms in order to create space for capital and infrastructural development.

1. Literature review

Many world economies are characterised by low capital accumulation and a lack of resources to meet rising government spending (Saheed *et al.*, 2018). Most governments are forced to resort to domestic and international borrowing to plug budget deficits and growth as public spending continues to increase and budget deficits widen. In the modern world, external borrowing has become indispensable (Soludo, 2018) because it complements domestic savings and helps countries conduct productive activities. The determinants of government expenditure are important factors that are relevant for managing fiscal imbalances in developing countries, including Nigeria (Raza *et al.,* 2019). This becomes more pungent when development challenges such as poor infrastructure, a high level of unemployment, and insecurity

about life and properties are blooming. These developmental challenges persist in Nigeria, despite the huge government expenditures that are budgeted annually to solve them. Based on this, diverse fiscal policy measures are being adopted by the Nigerian government with the aim of managing national capital budget expenditures (Orji, 2019). Ramadhan (2019) opined that driving road infrastructure and education infrastructure had a significant impact on GDP per capita and concluded that it is necessary to strengthen capital budget planning for the development of public infrastructure to improve economic welfare. A notable characteristic of public finance in these countries is the strong pro-cyclicality of government expenditures and the non-oil operational balance in relation to oil price fluctuations (El Anshasy & Bradley, 2020; Villafuerte & Lopez-Murphy, 2019). Government spending usually acts as a key transmission mechanism for oil price shocks to the macroeconomy (Husain *et al.*, 2018; Sturm *et al.*, 2019).

In Nigeria, oil revenue is the dominant source of government revenue, accounting for 80% of total government revenue. Brent crude oil price is the leading global price benchmark for Atlantic basin crude oils for European sales. It is used to set the price of two-thirds of the world's internationally traded crude oil supplies. It is one of the two main benchmark prices for purchases of oil worldwide, the others being West Texas Intermediate (WTI) for American crude sales and OPEC spot prices for Asia and African sales. Oil revenue and oil prices stimulate all kinds of activities in the economy. Nigeria is spending about 118% of its revenue on debt servicing, meaning it is also borrowing to service debt at an interest rate. Foreign debt servicing is denominated in foreign exchange rates in dollars and pound sterling from the Paris Club and London Club (Olayungbo, 2021).

It has also been suggested that uncertainty about future oil revenues and the variability of such revenues arising from changes in oil prices can influence the level of public expenditure in oil-dependent countries as governments reassess their expected income streams (Abdel-Latif *et al.*, 2018; Mourad & Hadadah, 2019). In fact, most times, revenues have fallen short due to low oil prices. The Nigerian government was compelled to adjust its expenditure downward, the same way high oil prices have led to an upward adjustment in public expenditure (Orhewere & Ogbeide-Osaretin, 2020). Public expenditure tends to fluctuate in response to changes in oil prices (Adedokun, 2018). Available statistics from the Organisation of Petroleum Exporting Countries (OPEC) illustrate that oil prices fluctuated during 1996-2019 (Orhewere & Ogbeide-Osaretin, 2020). Evidence from the world and Nigeria shows that the nexus between government expenditure and oil price fluctuation is documented and has mixed result, as shown in the literature. This study examines the nexus among these major determinants of capital expenditure, with certain innovative contributions.

Nigeria's federal government budget has been on the rise over the last thirty years, and the performance of the capital budget has been a subject of hot debate (Dikeogu, 2018). Developmental challenges persist in Nigeria, despite the huge government capital expenditures that are budgeted annually to solve them. Dikeogu (2018) noted that the level of capital expenditure is insufficient and inadequate to foster and achieve the desired sustainable development goals in Nigeria. From a budget size of about ₦200 billion in 1990 to ₦3.93 trillion in 2010 and ₦10 trillion in 2020, available statistics suggest that the annual capital budget has not been able to improve the lives of Nigerians over the past several years because of the observed low level of capital budget performance, which is insufficient to foster rapid economic development and reduce poverty (Olaoye & Akinola, 2019). Davies *et al.* (2019) identify barriers causing the poor implementation of the Sustainable Development Goals in Nigeria, namely inadequate allocation to capital expenditure, poverty, poor accountability, inadequate domestic water supply, poor energy supply, poor human capital development initiatives, poor transportation and telecommunication networks, illiteracy level, and environmental degradation. This becomes more pungent when development challenges such as poor infrastructure, a high level of unemployment, and insecurity about life and properties are blooming. Despite consistent improvement in government budgetary allocation on health, education, transport, road construction, and defence sectors in Nigeria. The country is still bedevilled with problems of poor health infrastructure, low educational facilities in areas of primary education, research, and development, bad

roads with attendant accidents, inaccessibility to farm settlements, and incessant insecurity (Richardson & Chigozie, 2019). The implications of the problem of government capital expenditure are infrastructural deficits and the loss of many lives and properties due to road accidents caused by bad roads. If the budget is well implemented and the roads are fixed, it would prevent accidents. Relocations of many companies from Nigeria to other countries are non-implementation of the electricity budget. The relocation of those companies has created unemployment for their workers, and their contributions to GDP are gone (Adah & Akogu, A., 2019; Raza *et al.,* 2019).

The national capital budget is always at risk and is not exempt from exposures like accounting exposure, forecasting exposure, transaction exposure, and macroeconomic exposure. Oil forecasts and taxes, and other uncertainties in budget projections are major practical and academic issues in public sector accounting (Effiom & Edet, 2019; Gurdal *et al.*, 2021). Since the 1990s, oil price cycles have been highly unpredictable. Fiscal policy in oil-exporting economies plays a significant role in managing the highly volatile and uncertain oil revenues (Adewale, 2021; Olayungbo, 2021). Though, in the quest to reduce the effect of this shock, the authorities were forced to lower their oil revenue projection to ₦820 billion from oil exports in 2016 based on a benchmark price of $38 per barrel from projected oil earnings of ₦3.9 trillion predicated on a price assumption of $53/b in 2015 (Ebi & Aladejare, 2022).

In light of the above, the primary aim of this study is to investigate the effect of oil price volatility on the capital expenditure of the Federal government of Nigeria. The specific objectives include investigating the effect of oil prices (Brent oil price, OPEC oil price, and West Taxes intermediate oil price volatility) on the capital expenditure of the federal government in Nigeria.

2.   Literature review

2.1 Capital expenditure

Capital expenditure is the government's capital spending on capital projects, the provision of infrastructure, as well as major repairs, restructuring, and overhauling of the existing ones to match the present needs of the citizens (Pantamee *et al.*, 2020). According to Gitonga et al. (2022), capital budget expenditure involves spending on infrastructural projects such as highways, ports, fibre optics, standard gauge railways, agriculture mechanisation, improving public health infrastructure, massive investment in road management and maintenance, and defence and education development spending. In all developing nations, public investment serves a very important purpose and is paramount for sustainable economic development. Governments spend on capital projects like road construction, airports, the building of new schools, health care centres, electricity generation, telecommunications, and the buying of new software and specialist hospitals to be able to adequately develop an economy (Olaoye & Akinola, 2019). These categories of expenditures are referred to as capital investments and are made on capital projects that help to maintain or improve government properties, usually called infrastructure (Ogbonna & Appah, 2018).

The capital budget is therefore the aspect of the overall national budget that determines the allocation of funds to finance capital projects and critical infrastructure, such as the construction of roads, bridges, hospitals, schools, prisons, public administrative buildings, highways, dams, and irrigation systems; the purchase of machinery and equipment; and the supply of water, electricity, transport, health, and educational facilities (Orisanaiye *et al.,* 2020). The capital budget, unlike the recurrent budget, is intended to provide funds to finance capital expenditures, such as the construction of durable assets. Capital expenditures may be on short- or long-term capital projects. For instance, in Portland, a capital project has to satisfy certain conditions, such as that it must be a new construction, expansion, renovation, or replacement project for an existing facility or facilities before it could be classified as capital expenditure (Gurdal *et al.*, 2021). They have a productive life of several decades and help to provide a more efficient economy (Delavallade, 2019).

2.2   Oil price volatility

Oil production is centralized by the world organisation OPEC, whose members control about 73% of oil. Ramyar and Kainfar (2019) speak about the necessity and importance of oil and mention entities for which information about oil prices is particularly important, important-especially enterprises, governments, and policymakers. According to Aamir *et al.* (2018), future oil prices are highly dependent on historical prices. The authors also state that, in recent years, future oil prices have been considered very uncertain. For this reason, great attention is currently paid to their prediction, including the methods of measurement, especially from the side of investors, economists, academics, government agencies, etc.

Crude oil prices always seem to be fluctuating over time, showing different degrees of ups and downs. The degree of responsiveness of different countries to the volatility of oil prices typically varies according to economic conditions worldwide. However, for both oil-importing and oil-exporting nations, oil continues to play a key role because it is a critical energy source and one of the most exchanged products. In the case of oil-consuming countries, the rise in oil prices is bad news as it affects production, investment decisions, and economic growth. A rise in oil prices will cause an increase in the cost of producing domestic products, and this will affect production and output negatively (Alekhina & Yoshino, 2018; Charfeddine & Barkat, 2020).

2.2.1   Brent crude oil price volatility

The price of crude oil depends heavily on its different classifications, and these classifications depend on several factors. The most important of which are its origin (Brent, West Texas) and its density (light, medium density, heavy), as well as its sulphur content (Alvarez-Diaz, 2020). Brent crude derives its name from a Shell oil exploration title on an oil field it has verified in the North Sea region on behalf of Exxon Mobile and Royal Dots Shell. Shell has named all the oil fields by the names of birds. In this case, the area was named after "goose Brent". The Brent blend is an oil ore used as a benchmark to price two-thirds of global oil production, especially in European and African markets. Brent consists of an oil mix of 15 different fields in the Brent and Tienen regions (some in the United Kingdom and others in Norway), which produce about 500,000 barrels per day (Uzo-Peters *et al.*, 2018).

2.2.2   West Texas Intermediate (WTI) crude oil price volatility

The West Texas Intermediate (WTI) crude oil is a sweet and light oil, has a specific weight of 396 degrees, and contains only 0.24% sulfur,, which makes it superior to OPEC oil and Brent crude (Caporin *et al.*, 2019). On average, WTI is sold for about $2 more than the OPEC basket, is about $1 higher than Brent because of its quality, and is the main source of gasoline in the United States (Klein, 2018). As his name implies, most of it is produced in West Texas. It is one of the global measurement materials used in pricing other materials, especially in North America. The city of Cushing, Oklahoma, is the world's largest oil market and the pricing point as the centre of intersection of a wide range of oil pipelines that enable the transfer of oil to various parts of the United States, including US ports, and then anywhere in the world (Caporin *et al.*, 2019). Crude oil is an essential commodity and dominates many aspects of global economics and politics. There are two major benchmarks for world oil prices: West Texas Intermediate (WTI) crude oil and Brent crude oil, which are both light and sweet. WTI refers to oil extracted from wells in the US and sent via pipeline to Cushing, Oklahoma (Caro *et al.*, 2020). The supplies are landlocked, and it is relatively expensive to ship to certain parts of the globe. Brent refers to oil from fields in the North Sea. Because the supply is water-borne, it is easier to transport to distant locations.

2.2.3   OPEC reference basket price

Nigeria, being among the members of the Organisation of the Petroleum Exporting Countries (OPEC), does not abide by the benchmark prices of crude oil set by OPEC for all the oil-producing countries in four classifications according to their grades: (i) West Texas Intermediate (WTI)–Texas Light Sweet, with the grade of crude oil used as a benchmark in oil pricing. It was also described as light because of its relatively low density and because of its low sulphur content. (ii) Market Average (MA) price of crude oil in U.S. dollars per barrel based on average in the market. (iii) Bonny Light (BL), a high-grade crude oil with high API gravity (low specific gravity). (iv) Brent (BP), a trading classification of sweet light crude oil that serves as a major benchmark price for purchases of oil worldwide (Ayoola & Olanrewaju, 2018).

According to OPEC (2022), ORB is currently made up of the following types of crude oils: Saharan Blend, Girassol, Djeno, Zafiro, Rabi Light, Iran Heavy, Basra Medium, Kuwait Export, Es Sider, Boony Light, Arab Light, Murban, and Merey. The OPEC oil market is highly volatile, with a pronounced cyclicality. Oil has been transformed into a financial asset because trading in financial derivatives (futures) greatly exceeds physical oil's global production and consumption. The Islamic Republic of Iran, Venezuela, Kuwait, Saudi Arabia and Iraq founded the Organization of the Petroleum Exporting Countries (OPEC) in 1960 (OPEC, 2020). Later, Qatar, Indonesia, Libya, the United Arab Emirates, Algeria, Nigeria, Gabon, Angola, Equatorial Guinea, and Congo joined the cartel (OPEC, 2020). OPEC produces approximately 44% of the total crude oil production. OPEC tries to control the oil price by manipulating the supply and demand of the oil.

2.3   Control variables

Oil subsidies, corruption, and inflation are employed as control variables in the study. The control variables will enhance the internal validity of the study by limiting the influence of confounding and extraneous variables, namely distortions of huge oil subsidy payments, hydra-headed corruption, and hydra inflationary trends, on capital expenditure. The three control variables will be held constant in the study models, which will help to validly establish whether there is a correlational or causal relationship between the variables of interest in this study and avoid research bias.

Namovsky (2018) defined subsidy as any government intervention, in cash or kind, to private sector producers or consumers for which the government receives no equivalent compensation in return. Fuel subsidy has been a growing liability to Nigeria's budgets in a systematic fashion for almost four decades, hence creating vested interest. The exponential growth of the cost of fuel subsidy is due to the rising cost of crude oil in the international market, exchange rate volatility, and the population growth of Nigeria, which resulted in increased petroleum consumption. The combination of these three variables therefore made the cost of fuel subsidy unsustainable. Understanding the magnitude of current fuel subsidies is critical for advancing reform because it underscores the potential socio-economic benefits to be realised (Kyle, 2018). In addition to the burden that fuel subsidies are placing on the national budget, keeping petroleum below the market value has discouraged additional investment in Nigeria's oil sector because the visibility of recovering the investment under the artificially low price structure is uncertain. With 5.1 trillion cubic metres of proven natural gas reserves and 26.8 billion cubic metres of exports in 2014, Nigeria is not only Africa's biggest natural gas country but also the world's third-largest producer. It is also the 4th biggest crude oil exporting nation, having produced 2.1 million barrels per day in 2014, and the 8th in proven crude oil reserves (Namovsky, 2018).

There is not generally accepted and precise definition of the word corruption. One short version is 'the abuse of public power for private benefit, which focuses particularly on the public sector (Delavallade, 2019). Transparency International uses the broader definition 'abuse of entrusted power for private gain'. The latter also includes various forms of corruption that take place in the private sector and elsewhere. The

current state of corruption in Nigeria has been categorized as endemic; corruption has been identified as one major obstacle to economic growth and development of the Nigerian economy (Okafor *et al.*, 2020). Several incomes generated from the oil industry in Nigeria are diverted to the pockets of some individuals, whose responsibility it is to manage the resources on behalf of the nation. Donwa *et al*. (2019) viewed corruption as diverting the resources that should have been used for the developmental purposes of society to private or personal use. Ngwakwe (2019) defined corruption as the illicit activities done with the purpose of making prosperity unlawfully, either alone or collectively, thereby disrespecting standing laws put in place and the business actions of the government. Salisu (2020) defined corruption as the misapplication of public resources to private ends. For instance, government actors ask for inducement for carrying out their official duties. The Corruption Perceptions Index (CPI) by Transparency International (TI) ranks 180 countries and territories around the world by their perceived levels of public sector corruption. The results are given on a scale of 0 (highly corrupt) to 100 (very clean). The CPI aggregates data from a number of different sources that provide perceptions among businesspeople and country experts of the level of corruption in the public sector.

Almahdi and Faroug (2018) describe inflation as a persistent tendency for price and money wages to increase. Inflation is measured by the proportional changes over time in some appropriate price index, commonly a consumer price index or a GDP deflator. The consumer price index, a measure of inflation, shows the yearly percentage change in the cost to the average consumer of purchasing a basket of goods and services that may be fixed or changed at particular intervals, such as annually. For instance, petroleum oil price explosions in the world market and excess crude oil can trigger inflation in the economy if the increased income is not properly managed. Mukhtarov *et al.* (2019) further stated that demand-pull inflation can be caused by too much aggregate demand. According to Almahdi and Faroug (2018), the neo-classical economists defined inflation as a galloping rise in prices as a result of the excessive increase in the quantity of money. The Nigerian economy has been struggling to tackle inflationary pressure for decades. In the 1980s and 1990s, the annual consumer price index inflation rate stood at an average of about 22.1% and 30.63%, respectively (World Development Indicator WDI, 2020). There was an easing in inflationary pressure in the 2000s, with the annual consumer price index inflation rate falling to about 11.53% on average between the year 2000 and the last quarter of the year 2015 (WDI, 2018). However, more recent statistics have shown that the nation is yet to achieve the desired success in stemming inflation to a sustainable single-digit rate, as 2018 and 2019 statistics show annual inflation rates of 15.67% and 16.52%, respectively (WDI, 2020).

2.4 Theoretical review

2.4.1 Peacock and Wiseman Theory of public expenditure

Allan Peacock and Jack Wisemen theory, otherwise known as PWT, was based on the political theory of public expenditure determination, which states that government likes to spend more money, that citizens do not like to pay more taxes, and that government needs to pay some attention to the aspirations and wishes of their people. PWT attempted to explain the circular trend or time pattern of change in government expenditure in response to development in the political economy while the electorate acts as a constraint. Their theory is known as the displacement hypothesis and is based on the experience of Great Britain. The displacement hypothesis states that government expenditure grows in step-wise fashion (Peacock & Scott, 2000). Peacock and Wiseman (1979), in a study of public expenditure from 1891 to 1955 in the U.K., asserted that Wagner's Law is valid as they made the following conclusions: that an increase in government spending depends on income generated by the government as economic development brings in considerable proceeds to the government, which makes it possible to increase her spending; there is a difference between the hope of the people about public expenditure and the tolerance level of taxation in the economy.

2.5 Empirical review

2.5.1 *Effect* of oil price volatility on capital expenditure

Raouf (2021) employed the vector autoregressive model (VAR), impulse response function, and variance decomposition to study the impact of oil price shocks on components of government spending in both oil-exporting and oil-importing countries over the period from 1980 to 2018. While the vast majority of previous studies focused on the impact of oil price shocks on government spending, this study emphasised the impact of these shocks on current and capital government expenditure. It was found that oil price shocks affect government current expenditure positively in the two groups of countries. While it affects government capital expenditure positively in oil-exporting countries and negatively in oil-importing countries, Raouf (2021) asserts that oil revenue has played an important role in the annual government budgets of many countries around the globe. There is no doubt that government decisions to spend on consumption or investment are highly affected by changes in oil prices. The results indicate that in oil-exporting countries, revenues generated from increasing oil prices help to increase countries' growth rates and enhance current and capital expenditure, or, in other words, the government will use this revenue to spend and invest more. In the case of oil-importing countries, the increase in oil prices will affect the growth rate in two different ways: it will affect the funds available to import the materials needed for the production process and, at the same time, restrict the funds necessary to invest.

Qwader (2018) studied the effect of fluctuations in oil prices on a number of factors of the Jordanian budget using ordinary least squares using annual data over the period from 1992 to 2015. The main results indicate that oil price shocks have a statistically significant positive impact on government and tax receipts, foreign grants, and government spending. With respect to the effect on budget deficits, oil price shocks have a statistically significant negative impact. Koh (2017) examined the macroeconomic implications of the downward oil price shock in 40 crude-exporting countries under various exchange rate systems and fiscal policy structures over the period from 1973 to 2010 using VAR techniques. The findings indicate that government output and demand declined because of the fall in oil prices. Nevertheless, in countries with flexible currency regimes, the production reaction is considerably smaller and simpler due to a larger, instant reduction in real exchange rates. Contractionary fiscal policy is also less required, as the depreciation of the currency plays an effective damping function. Upstream oil price variation is omitted. Only West Texas Intermediate (WTI) oil price volatility is used, and the proposed study will use WTI, the OPEC spot rate, and Brent crude oil price volatility. Johansen Co-integration is used for the pre-test, while the Vector Error Correction Model (VECM) is not employed as an estimation technique.

Erdogan et al. (2020) examined the relationship between volatility in oil prices and military expenditures in GCC countries (United Arab Emirates, Bahrain, Qatar, Kuwait, Saudi Arabia, and Oman) using the ARDL model. According to the bound test results, there is a cointegration relationship between the variables in all countries. Besides, the long-term results showed that the volatility in oil prices in all countries, except for Bahrain, positively affects military expenditures. The error correction model indicated that there is a reverse relationship between oil price volatility and military expenditure. These findings indicated that despite the volatility in oil prices, military expenditures in GCC countries are not reduced. Only military expenditure is captured as against total government expenditure on budget implementation. Also, the OPEC spot price is the only oil price variant used in the study. Adedokun (2018) investigated the effects of oil shocks (price) on the dynamic relationship between government revenues and government expenditure in Nigeria using structural VAR (SVAR) on data from 1981–2014. The results of SVAR show that oil price shocks could not predict the variation in government expenditure in the short run, while the predictive power of oil revenue is very strong both in the short run and in the long run on government expenditure. The structural VAR (SVAR) deployed in this study did not indicate the direction of the causation and effect among the variables. This makes the estimation result incomplete. Hence, the proposed study will use ECM and VECM analysis in addition to cointegration tests.

From the analysis of previous research, the causal relationship between oil price volatility and capital expenditure is inconsistent; mixed results are evident, with some results indicating that oil price volatility has a positive influence on government capital expenditure (Abu *et al.*, 2022; Erdogan *et al.*, 2020; Jibir & Aluthge, 2019); others find that oil price volatility has no significant influence on capital expenditure (Adedokun, 2018; Anis, 2020; Mohammed & Sani, 2020). But oil price volatility had a negative effect on capital expenditure (Betour, 2020; Ebi & Aladejare, 2022; Orhewere & Ogbeide-Osaretin, 2020). None of the accessible previous studies examined the effect of volatility of Brent crude oil price, West Texas Intermediate oil price, and OPEC spot crude oil price on capital expenditure, which this study seeks to evaluate. A number of studies have link a rise or fall in capital expenditure of the federal government to several factors including oil price volatility (Abdel-Latif *et al.*, 2018; Abu *et al.*, 2022; Adedokun, 2018; Ebi & Aladejare, 2022; Erdogan *et al.*, 2020; Mohammed & Sani, 2020; Qwader, 2018; Raouf, 2021), corruption (Anfofum & Olure-Bank, 2018; Donwa *et al.*, 2019; Delavallade, 2019; Özşahin & Üçler, 2017), oil subsidy (Namovsky, 2018), inflation rate uncertainty (Almahdi &Faroug, 2018; Dikeogu, 2018; Mukhtarov *et al.*, 2019), amongst others. Whether these or any other factors could rightly be held responsible for the long-term increase or decrease in capital budget expenditure remains an unresolved empirical question. These mixed results and inconclusive arguments are a result of differences in their study periods, test statistics used, sources of their data, and study jurisdictions, among others, which necessitated this study to close these gaps by providing further empirical evidence on the impacts of revenue and budget risk factors on capital expenditure in Nigeria.

3. Methodology

The research design for the study is ex post facto research analysis on annual multivariate time series data. The study examined the data of capital expenditure and oil price volatility in Nigeria. Annual time series data for Nigeria will be used from 1993 to 2022. The time series data from 1993 to 2022 are obtained from the statistical bulletins of the Office of the Accountant General of the Federation (OAGF), the Budget Office of the Federation, the OPEC and Energy International Agency (EIA).

3.1 *Description and measurement of variables*

The description and measurements of variables of the study are shown in Table 3.1.

Table 1. Description and measurement of variables

Variable	Proxy/Symbol	Measurement	Sources
Capital Expenditure (Dependent Variable)	Federal Government Capital Expenditure (FGCE)	Summation of all federal government expenditure in a fiscal year	Zakaria & Shamsuddin (2017); Yinusa et al. (2017);
Oil Price Volatility (Budget Risk factor) Independent variable	OPEC spot rate Crude Oil Price (OP); Brent Crude Oil Price (BP): West Texas Intermediate (WTI)	Average OPEC spot rate Crude Oil Price (OP) per fiscal year; Average Brent Crude Oil Price (BP) per fiscal year; Average West Texas Intermediate (WTI) per fiscal year	Erdogan et al. (2020); Zakaria & Shamsuddin (2017); Adedokun (2018)
Oil Subsidy (Control Variable)	Oil Subsidy payment to major petroleum marketers (OS)	Total Petroleum Products subsidy payments to Downstream Marketers in a fiscal year	Deh & Edeh (2020)
Corruption (Control Variable)	Corruption Perceptions Index (CPI).	Average scale of Corruption Perceptions Index (CPI) per fiscal year.	Salisu (2020); Ben et al. (2018)
Inflation Rate (Control Variable)	Consumer Price Index	Average Changes in general price level per fiscal year (an average of the consumer price level (cpi)	Özşahin & Üçler (2017)

3.2   Model specification

The following multiple linear regression analysis model is adapted from work of Erdogan et al. (2020).

$$FGCE = f(BP, OP, WTI, OS, CPI, IRV) \qquad (1)$$
$$FGCE = \beta_0 + \beta_1 BP + \beta_2 OP + \beta_3 WTI + \beta_4 OS + \beta_5 CPI + \beta_6 IRV + \varepsilon \qquad (2)$$

Where: FGCE represents Federal Government Capital Expenditure (Proxy for Capital Expenditure) (Dependent variable); BP represents Brent Oil Price Volatility (Independent variable); OP represents OPEC Oil Price Volatility (Independent variable); WTI represents West Texas Intermediate Oil Price Volatility (Independent variable); OS represents Oil Subsidy (Control variable); CPI represent Corruption Perceptions Index (Control variable); IRV represent Inflation Rate Variation (Control variable); $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ and β_6 are regression coefficients to be estimated and ε is Error term.

4.   Data analysis and interpretation of results

4.1   Descriptive statistics

Table 4 reports on the descriptive statistics.

Table 4. Descriptive statistics

Variable	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Prob	Obs
BP	54.191	53.285	111.63	12.8	32.431	0.403	1.898	2.332	0.311	30
CPI	20.6	24	28	7	6.677	-0.83	2.448	3.827	0.147	30
FGCE	808.586	697.06	3079.87	54.5	682.239	1.549	5.512	19.894	0	30
IRV	12.483	12.37	21.95	5.42	4.426	0.377	2.355	1.23	0.54	30
OP	52.139	48.99	109.08	12.3	32.006	0.413	1.876	2.433	0.296	30
OS	453.322	133.01	3400	5.46	706.1	2.783	11.421	127.382	0	30
WTI	52.238	49.77	99.06	14.39	28.672	0.303	1.746	2.424	0.297	30

4.2   The effect of oil price volatility on capital expenditure of the federal government in Nigeria

4.2.1   Correlation analysis

The correlation matrix shows the pairwise correlations between the variables used in the study. There is no evidence of highly correlation among the variables.

Table 4. Correlation analysis

	FGCE	BP	OP	WTI	OS	CPI	IRV
FGCE	1						
BP	0.59545	1					
	0.0005	-----					
OP	0.61817	0.49872	1				

	0.0003	0.0000	-----				
WTI	0.58656	0.49232	0.48975	1			
	0.0007	0.0000	0.0000	-----			
OS	0.80103	0.45598	0.47022	0.44086	1		
	0.0000	0.0001	0.0001	0.0001	-----		
CPI	0.60673	0.44747	0.45497	0.44651	0.3954	1	
	0.0004	0.0000	0.0000	0.0000	0.0306	-----	
IRV	0.34378	-0.0182	-0.0133	-0.0119	0.34332	0.01034	1
	0.0629	0.924	0.9442	0.9501	0.0633	0.9568	-----

The ARDL technique is applicable regardless of the stationarity of the independent variable, which can be either stationary at I(0) or I(1). Moreover, the ARDL technique is regarded as more accurate in calculating the optimal number of lags. Furthermore, the ARDL approach considers both short-term dynamics and long-term equilibrium. The autoregressive distributed lag (ARDL) technique is appropriate for analysing data sets with small sample sizes. The first step entails procedure doing the Augmented Dickey-Fuller (ADF) test to examine the presence of a unit root. The study evaluated the cointegration between variables by utilising the Bound test. After confirming the presence of a cointegration, the next step is to determine the optimal lag order.

4.2.2   ARDL model interpretation

The study aims to analyse the model's estimation of the impact of oil price volatility on the federal government's capital expenditure in Nigeria. The result in Table 5 indicate that in the short run, most variables are significant at the 5% level of significant, except variables lagged-two FGCE, lagged BP, lagged OP, WTI and lagged WTI is 0.5678. This implies that a current or immediate change in the Brent oil price does not lead to an immediate change in capital expenditure in the country. The result shows that the rise in the previous Brent UK crude oil price will bring about a fall in the capital expenditure of the country. The result implies that in the short run, the country's capital expenditure increases as the price of crude oil volatility increases.

The variable WTI shows that in the short run, the coefficient of WTI reported a value of 27.02967, the t-value of 3.989530, and the p-value of 0.0104. The coefficient suggests that a one-unit change in West Texas Intermediate Crude Oil Price Volatility has a significant positive effect on FGCE. The result shows that the error correction term is statistically significant and negatively signed, which implies that the model will converge to equilibrium in the long run. The coefficient shows that about 63.4% of the errors will be corrected annually. More so, the long-run estimate of the model report shows that Brent UK crude oil price volatility (BP), OPEC spot rate crude oil volatility (OP), and West Texas intermediate crude oil price volatility (WTI) failed to report significant effects on federal government capital expenditure in Nigeria. This shows that volatility is a short-run phenomenon that will fade out in a short period of time, hence the high speed of adjustment of the error correction term. The R-squared value is 0.961915, indicating that the independent variables explain approximately 96.19% of the variance in FGCE in the long run. The adjusted R-squared value is 0.917482, which takes into account the degrees of freedom.

Table 5. ARDL Model estimate of effect of oil price volatility on Federal Government capital expenditure in Nigeria

	Short Run Estimate		
	Coefficient	t-value	p-value
D(FGCE(-1))	-0.011575	-0.1253	0.9052
D(FGCE(-2))	0.677445	6.2701	0.0015
D(BP)	-8.970828	-0.6112	0.5678
D(BP(-1))	-96.55132	-5.2220	0.0034
D(OP)	-20.27386	-1.2003	0.2838
D(OP(-1))	72.38945	4.3148	0.0076
D(WTI)	27.02967	3.9895	0.0104
D(WTI(-1))	36.2032	5.6584	0.0024
D(OS)	0.149582	1.9205	0.1129
D(OS(-1))	0.804435	8.8391	0.0003
D(CPI)	35.24096	4.3513	0.0073
D(CPI(-1))	-21.49602	-2.6462	0.0456
D(IRV)	20.91952	4.0571	0.0098
D(IRV(-1))	28.48946	6.0993	0.0017
CointEq(-1)*	-0.634741	-9.54	0.0002
	Long Run Estimate		
	Coefficient	t-value	p-value
BP	157.1117	1.1511	0.3017
OP	-126.3603	-1.2929	0.2526
WTI	-57.4113	-1.0043	0.3613
OS	0.5061	0.5766	0.5892
CPI	139.9466	2.2768	0.0718
IRV	8.1298	0.2092	0.8425
C	-1481.006	-1.7026	0.1494
R-squared	0.9619		
Adjusted R-squared	0.9174		

The empirical analysis reveals that the estimated coefficients of Brent UK crude oil price, OPEC spot rate crude oil, and West Texas Intermediate crude oil price do not demonstrate a statistically significant impact on the federal government capital expenditure in Nigeria. The result shows that the oil price is a short run phenomenon that will fade out within a short period, thus explaining the speed at which the error correction term adjusts. The F-test is statistically significant at the 1% level. The results of the study contradicted those of previous studies conducted by Abu et al., 2022; Erdogan et al., 2020; Jibir & Aluthge, 2019. Conversely, some other studies such as Adedokun, 2018; Anis, 2020; Mohammed & Sani, 2020, concluded that oil prices volatility does not have a major impact on capital spending. However, fluctuation in oil prices have an adverse impact on capital expenditure (Betour, 2020; Ebi & Aladejare, 2022; Orhewere & Ogbeide-Osaretin, 2020). The result of the study shows evidence that the federal government capital expenditure in Nigeria responds largely to fiscal synchronisation theory. Hence, a comprehensive

understanding of the Federal government's capital expenditure in Nigeria cannot be fully understood from the conventional framework of the Wagner's theory and Peacock-Wiseman theories. It is important to closely monitor the capital expenditure patterns and revenues of key revenue-generating institutions under the federal government.

5.   Conclusion

The study investigates the impact of oil price fluctuations (Brent oil price, OPEC oil price, and West Texas intermediate price) on the federal government capital expenditure in Nigeria. The long-run estimate of the model report shows that Brent UK crude oil price volatility, OPEC spot rate crude oil volatility, and West Texas Intermediate crude oil price volatility failed to report significant effects on federal government capital expenditure in Nigeria. This shows that the oil price volatility is a short-run phenomenon that will fade out in a short period, hence the high speed of adjustment of the error correction term. The key research findings on the effects of oil price volatility on the capital expenditure of the federal government, considering the three major global crude oil prices (the Brent UK oil price, the West Texas Intermediate (WTI), and the OPEC spot oil price), suggest that the crude oil price fluctuation has little or no influence on federal government capital expenditure in Nigeria. The outcome of the study revealed that non-oil revenue and oil revenue were statistically significant and had positive effects on federal government capital expenditure at the 5% level of significance. This study made the following recommendations: the Federal Government should reconsider and renegotiate its relationship with OPEC to avoid being capped to a limit when and if the output exceeds the production quota, given the country's urgent need for upstream oil revenues for capital expenditure on infrastructural development. In line with the findings on the effect of oil price volatility on the capital expenditure of the Federal Government in Nigeria, there is a need to diversify income resources to minimise dependency on oil price volatility and hedge the budget deficit from the volatility of oil price volatility. The appropriate policies towards shifting from an oil economy to a non-oil economy are the shield to face and save the economy from the negative impact of the oil price volatility in Nigeria. In view of the findings, the study recommends that the government should save more when the price of oil rises above its benchmark. This study contributed to knowledge by adding to the available literature on the subject of oil price volatility and capital expenditure. Oil subsidy, corruption perception index, and inflation rate are used as control variables. The study segregated all independent variables as follows: oil price volatility (OPEC spot price, Brent oil price, West Texas Intermediate price), which is very rare in any literature in Nigeria. It is suggested that further study should factor in the transmission effect or pass-through of crude oil shocks at different stages on capital expenditure in Nigeria. The degree of oil price pass-through to the entire budgetary expenditure framework should be explored. Comprehensive analysis and management of budget risks can help ensure sound fiscal and public finances and budgetary stability. The federal government needs a more complete understanding of these potential threats to their fiscal position.

Conflict of interest statement

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

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Authors' contributions

This work was carried out by the authors. The three authors read and approved the final manuscript.