International Journal of Social Science And Human Research

ISSN(print): 2644-0679, ISSN(online): 2644-0695

Volume 05 Issue 06 June 2022

DOI: 10.47191/ijsshr/v5-i6-15, Impact factor- 5.871

Page No: 2120-2136

Oil Price Uncertainty and Industrial Output in Nigeria

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ABSTRACT: Concerned by the dismal performance of Nigeria's industrial sector as evidenced by the sector's inauspicious and uneven contributions to the country's aggregate output and total government earnings, this study has been embarked upon to examine the impact of crude oil price volatility on industrial output in Nigeria. The Ordinary Least Square (OLS) technique was employed in estimating the time series data used in the study which spans from 1981–2019. The Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model was estimated to capture crude oil price fluctuations and government oil revenue fluctuations by obtaining the conditional variances from the estimated results. The study found that crude oil price fluctuation has negative impact on industrial output, while an increase in government oil revenue fluctuation results in a significant decrease in industrial output. It was also found that an increase in unearned government oil revenue leads to an insignificant decrease in industrial output, while government recurrent expenditure exerts positive but insignificant impact on industrial output. Domestic investment was found to have a positive and significant impact on industrial output while population growth has a positive and significant impact on industrial output. The study concludes that it is government's financial imprudence that allows oil price volatility to be hazardous to Nigeria's industrial output. It recommends more effective export diversification policies and a pro-development government financial structure that takes erratic oil revenue and inimical effects of high unproductive expenditures into account.

KEY WORDS: Oil price, Uncertainty, Industrial Output

Gel Classification: Q31, D8, L60

INTRODUCTION

An economy is said to be thriving when its total output experiences consistent growth rate; even better, the growth rate of total output is said to bring about visible improvement in the standard of living of the populace when it is higher than the growth rate of the population of the inhabitants of the country. Increase in aggregate output implies increase in production which also means increase in the employment of productive resources. Consequently, increase in the productive capacity of a country entails sourcing for funds to finance expansion which leads to increase in the employment of labour, the acquisition of more machines and other fixed capital assets, and growth in merchandise related activities.

The economic development of a country is said to be tied to the expansion of its industrial sector. At the earliest stage of the economic development of a country, the Gross Domestic Product (GDP) is often largely comprised of economic activities that belong to the primary sector, especially agricultural activities. The subsequent stages of development are said to involve the expansion of both the industrial and services sectors of the economy, though the level of deviation from this assertion tends to be high in recent years. The services sector has been observed to be of almost similar or even higher size than the agricultural sector in a number of countries considered to be still at their early stages of development in recent times. This hints that the performance of a particular sector partly depends on the importance of the goods it is comprised of, and if these goods are tradable or not. The industrial sector is appreciably comprised of tradable commodities which implies that they could be easily imported as needed, therefore, the level of patronage locally manufactured tradable goods enjoy depends substantially on the competitive and comparative advantage the produce firms have over their rivals in other countries. In this light, features such as product quality, prices, marketing strategy, among others are of the essence (Todaro & Smith, 2011).

The industrial sector of the Nigerian economy is bedeviled by a lot of challenges; the sector which cuts across both the formal and informal sectors faces a set of challenges that differ from the sets of challenges the sector faced in the years that preceded the country's discovery of crude oil in commercial quantity in 1967. A keen assessment of the sector shows that a sizeable proportion of the industries in the country used to be owned by foreign nationals, and the somewhat sterling performance of the sector started dwindling with the

implementation of the indigenization initiative. The indigenization policy which ensured the relinquishing of foreign-owned firms by their foreign owners to Nigerians, regardless of their capacities to manage them or not, led to the poor management and eventual demise of these firms. The huge earnings from the then relatively new and booming oil sector further worsened the woes of the industrial sector (Olokoyo et al., 2016; Focuseconomics, 2019).

Dutch disease may have contributed to the underperformance of Nigeria's industrial sector, especially in the years following the commencement of the exploitation of crude oil in the country, but there seems to be other factors that tend to be the major causes of the malaise. The envisaged deindustrialization effect of earnings from primary commodities as posited by Corden (1984) in his 'Dutch disease hypothesis,' could be surmounted by oil exporting countries if they put into place measures to forestall this occurrence. While countries like Norway, United Arab Emirates, Brazil, among others have somewhat succeeded in putting Dutch at bay through prudent government budget structures, Nigeria continues to struggle with the menace (AL-Risheq, 2016).

Unlike the manufactures, the prices of primary commodities are exposed to the vagaries that characterize the international commodity market, which makes the prices of these commodities to experience wide fluctuations due to the interaction of market forces in the market. Crude oil has one of the most extremely volatile prices among the commodities; this is because it is a highly traded commodity and the speculation that characterize its trade in the futures market is massive. The sharp increase or decrease in its price following expected decreases or increases in quantity produced respectively, are accentuated by socio-political factors within the economies of oil producing countries or at the international level (Ezenekwe et al., 2018). These occurrences affect crude oil production levels of oil producing countries, which inadvertently disrupt supply levels. Restoration of production to levels attained before disruption plunges oil price, while disruptive occurrences lead to price increases (Gylych et al., 2020; Tejvan, 2015).

Wide fluctuations in crude oil prices affect the finances of governments of countries that rely heavily on oil as a source of revenue. Governments of oil exporting countries end up with a lot more money than budgeted when crude oil prices soar high, and earn a lot less when the prices go far below estimated rates. This results in wide swings in government earnings which tend to be unhealthy for the general economic performance of a country, and the productive sector in particular.

Dutch disease has been cited by a number of scholars to be responsible for the dismal performance of the industrial sector in Nigeria over the years. This view can hardly be disputed when the shares of the country's agricultural and industrial sectors as proportion of Gross Domestic Product (GDP) in the years preceding the commencement of exploitation crude oil are juxtaposed with those recorded in the years after it. Nigeria's agriculture value added as percentage of GDP was put at 12.24%, 18.23%, 21.56%, 25.49%, 21.36%, 26.09%, 23.89%, 20.63%, and 21.20% in 1981, 1985, 1990, 1995, 2000, 2005, 2010, 2015 and 2018 respectively; while the country's manufacturing value added as percentage of GDP was put at 20.26%, 21.05%, 17.78%, 19.99%, 13.93%, 10.06%, 6.55%, 9.43%, and 9.65% respectively in similar periods. The country's official rate of exchange remained stable throughout the 1960s at an average of 0.71 kobo per US dollar; it then appreciated from 0.71 kobo in 1971 to 0.67 kobo in 1982. However, it started depreciating from 1983 till date; it was put at 0.72 kobo in 1983, 8.04 Naira in 1990, 101.70 in 2000, 150.30 in 2010 and 306.08 in 2018 (Corden, 1984; CBN, 2019; Nwogwugwu & Umeghalu, 2021).

The movements of these economic indicators tend to show the prevalence of Dutch disease in the years following the commencement of oil production in Nigeria. Nonetheless, the drastic decrease in the country's official rate of exchange subsequently, particularly from 1983, the fluctuations in government's revenue and high government consumption expenditure, all show that there are other factors that seem to affect industrial output in Nigeria aside Dutch disease. This tends to imply that the purported inimical effects of the petroleum sector on the Nigerian industrial sector and economy at large stems from government's inability to manage the situation effectively, as evidenced by its poor financial structure, and not the Dutch disease as assumed by some scholars. Government's recurrent expenditure as proportion of Gross Domestic Product (GDP) was put at 5.6%, 11.0%, 4.4%, 6.9%, 8.4%, 5.7%, 3.8%, and 3.9% in 19985, 1990, 1995, 2000, 2005, 2010, 2014, and 2018 respectively (CBN, 2019). Comparing government's capital expenditure as proportion of Gross Domestic Product (GDP) put at 4.1%, 7.3%, 4.2%, 3.6%, 3.6%, 1.6%, 0.9%, and 1.1% in the same period with that of recurrent expenditure above, shows the preponderance of recurrent expenditure over capital expenditure (World Bank, 2019).

The challenge of over reliance on oil revenue is largely tied to the volatility that characterizes the price of crude oil in the international market. With changes in the prices of crude oil amidst stagnant output (as determined by the OPEC quota), the finances of the Nigerian government is strained beyond expectations, especially when prices plummet. A fall in the price of crude oil below benchmark rates as stipulated in the budget means government will be earning lower than expected, resulting in a gaping budget deficit which is usually financed through borrowing from both domestic and foreign sources. While financing deficits, government focuses more on recurrent expenditure with the aim of forestalling the social upheaval that could ensue when salaries, wages, pensions, gratuities, and subsidies are not paid. Thus, the allocation for capital expenditure which has always received lesser share of the budget outlay when compared to recurrent expenditure ends up having even lesser allocation. This explains why government capital budgets have low implementation levels, and the resulting low patronage of locally produced goods (Oriakhi & Iyoha, 2013).

Furthermore, the domestic borrowings of government to fund deficits tend to crowd-out the private sector through increase in the rate of interest, which results from the relative scarcity of funds occasioned by massive government borrowings. Consequently, an increase in the rate of interest would make capital that ought to be used for investment purposes more expensive, and even rarely available for industrial purposes, since loans for industrial production are usually long term facilities. The banks prefer giving out loans of shorter durations when rates of interests are high, and in such circumstances, taken loans are largely used to finance trades, portfolio investments and other speculative purposes (Asogwa & Okeke, 2013).

From another dimension, oil price volatility tends to affect total output through its effect on average income level. The unpredictability of the price of crude oil in the international market tends to put the financial plans of the governments of oil exporting countries under pressure, such that, when it is not effectively managed, it tends to assume a structure where the proportion of recurrent expenditure as a percentage of total expenditure becomes unusually high. It is unusual because a government finds itself restrained in a manner that prevents it from raising the wage rates of its employees and that of the entire country's workforce at large. A stagnant income in the face of soaring inflation implies the diminishing of the domestic market, which is the most important market for locally produced goods. The persistence of these anomaly for a long time leads to the gross underperformance of the sectors that consist of tradable goods, especially the industrial sector ((Thorbecke, 2018; Nwogwugwu & Umeghalu, 2021).

The study broadly attempts to examine the impact of crude oil price volatility on industrial output in Nigeria. It specifically seeks to examine the impacts of the fluctuations in crude oil price, the fluctuations in government oil revenue, unearned government oil revenue, and government recurrent expenditure on industrial output in the country. Other related studies dwell largely on the impact of the fluctuation of crude oil revenue on economic growth. Works in this direction neglect the fact that the oil sector is also a component of the aggregate output of a country, hence, it will be difficult to determine the impact of changes in government revenue as a result of changes in oil prices on economic growth when the oil sector makes substantial contribution to the growth rate of oil exporting economies. Also, the Dutch disease is said to affect the output of the tradable sector more; the aggregate economy is comprised of both the tradable and non-tradable sectors (Gummi et al., 2017; Shaari et al., 2013; Aye et al., 2014).

This study promises to validate the applicability of the Dutch disease hypothesis in the Nigerian economy and also highlight the line where it stops been applicable. It also stands to solve the perennial problem of wide swings in government earnings and its potential impact on industrial production in the country. The study attempts to underscore the major challenges that bedevil the industrial sector in Nigeria, highlighting on the likely contribution of crude oil price volatility to this anomaly with a view to come up with workable solutions on how to resuscitate the sector.

The study examines the impact of crude oil price volatility on industrial output in Nigeria over the period 1981-2018; the specified range of years consists of the period shortly after Nigeria started earning revenue from the export of crude up to recent years. As at the time of the commencement of crude oil exploitation in Nigeria in the late 1960s, the industrial sector made more meaningful contribution to the nation's GDP than in the years following the introduction of austerity measures in the late 1980s. It is an efforts to shed light on this puzzle and to provide sufficient evidence needed to categorically state how the fluctuations in the price of crude oil in the international market affect industrial output through their effects on government finances that this study has been embarked upon.

Does the structure of the nigerian government expenditure incentivize industrialization?

Before the advent of Keynesian economics, the laissez faire economic system of the classical school of thought held sway; it stipulates minimum governmental interference in the economic affairs of private groups. Nonetheless, there were anomalous economic occurrences that market forces did not succeed in restoring them back to their initial states of equilibrium. The lacuna paved way for the emergence of the Keynesian theory. Keynesian economics typifies the macroeconomic theories that argue that total spending in an economy affects total output, employment, and inflation. The theories are anchored on the works of Keynes, who advocates for increase in government expenditures and tax reduction in efforts to stimulate demand and pull an economy out of depression. In that light, optimal economic performance could also be achieved by influencing aggregate demand through economic intervention policies by the government (Jhingan, 2003).

Interestingly, there are countries that do not perform optimally economically despite government's intervention in the economy. Available data do not clearly show that aggregate output of the Nigerian economy is affected by government's total expenditure. There are studies that their findings reveal the existence of a relationship between government expenditure and economic growth and development, however, the poor performance level of the Nigerian economy and the pitiable living condition of the inhabitants of the country suggests that government interventionist policies do not come close to yielding the desired objectives (Okonkwo & Mojekwu, 2018). How is the Nigerian government interventions in the country's economy different from those of countries with high human development?

The fundamental reason as to why the Nigerian government has not been able to optimize the economic potentials of the country stems from its ineffective financial structure, which has to do with the government's heavy reliance on oil revenue. Oil earnings account for close to 70 percent of the Nigerian government's total revenue, even when the source is very unstable due to its high price volatility. The implication is that when crude oil prices soar high, which is higher than budgeted benchmark prices, government earnings will also increase beyond budgeted amounts. Since there is rarely an effective system that plans for price falls and the attendant inimical effects, a substantial amount of the excess oil revenue is spent on unproductive ventures. The budget benchmark oil price is then reviewed upwardly to allow for increases in size of government and other newly initiated projects. Then the huge flow of oil proceeds drops abruptly with a sharp decrease in the price of crude oil (Oriakhi & Iyoha, 2013).

The Nigerian government's usual responses to decreases in government revenue due to glut in oil price is to finance budget deficits by borrowing from domestic or/ and foreign sources. Many governments around the world find themselves from time to earning less than envisaged budgeted amounts, and thereby seek means of funding the deficits. Unfortunately, the Nigerian case has reasons why one ought to be concerned; this has to do with what the borrowed funds are used for. While borrowing to finance budget deficits, the Nigerian government accords more priority to recurrent expenditure, this means that a sizeable chunk of borrowed funds is spent on salaries, wages, allowances, transfers, subsidies and other recurrent items, with little or nothing spent on productive projects. This makes repayment of debts very difficult, and is responsible for the perennial large recurrent budgetary allocation.

Table 1: Nigeria's budget deficit, recurrent and capital expenditures (% of GDP)

Year	Recurrent Expenditure as % of GDP (%)	Capital Expenditure as % of GDP (%)	Budget Deficit as % of GDP
1985	5.6	4.1	2.3
1990	11.0	7.3	6.7
1995	4.4	4.2	0.03
2000	6.9	3.6	1.6
2005	8.4	3.6	1.1
2010	5.7	1.6	2.0
2014	3.8	0.9	1.1
2018	3.9	1.1	1.6

Source: CBN Statistical Bulletin, 2019

Therefore, crude oil price volatility places the Nigerian government in a precarious position where it tends not to be fully in control of its finances; this entails incessant borrowings for unproductive projects. Aside from being a drain to the Nigerian economy since they are mostly used for non-capital investments, government borrowings also tend to crowd out the private sector. The relative scarcity of capital due to government borrowings from the domestic bond and money markets and other domestic sources lead to increase in the rate of interest, which deters private investment in the industrial sector. On the other hand, government's high recurrent expenditure creates wage rate rigidity. Government's minimum wage legislation spurs increase in average income more when compared to expected increase in wage rate due to industrialization. Nonetheless, government will only approve a higher minimum wage rate when it can afford it; high cost of governance makes it a herculean task for the government to raise average income. Investments, especially in the industrial sector share a positive correlation with income level. High income levels instigate more productive investments, while lower income levels lead to low demand and eventual poor performance of industries in a given economy (Asogwa & Okeke, 2013). Table 1 above shows Nigeria's budget deficit, recurrent and capital expenditures as proportions of GDP over time.

Nigeria's Industrial Development in the Post-Colonial Era

Creation of markets for the goods produced in the colonialists' home countries is one of the major reasons as to why colonized territories got colonized, aside exploitation of their mineral deposits and other pecuniary and international relations interests. Like other colonized countries, the early years of colonial rule in Nigeria was characterized by the importation of goods from England and other parts of Europe. Over the years, industrial productions made more emphasis on import substitution, especially in the production of commodities that Nigeria had comparative and competitive advantage in their production. The comparative advantages were largely due to the abundantly available raw materials needed for the production of these goods and the difficulty and costs of transporting certain goods due to their bulkiness. Some of the goods produced then include: soaps, detergent, vegetable oil, rubber products, beverages, textiles, snacks, food, beverages, tobacco, shoes, bags and other leather materials among others (Afolabi & Ogoh, 2017).

However, the existing industrial policy as it were which made emphasizes on import substitution was implemented in a skewed manner. Some of the manufacturing firms in the country at the time established assembling plants in lieu of manufacturing plants; this meant only marginal value additions were made to some finished goods, denying the country the employment and foreign exchange that could have accrued to it if comprehensive productions were carried out in the country. Numerically, industries of medium and large sizes in Nigeria as at 1960 were put at about 150, and rose to about 380 by 1965. The increment was attributed to the effective implementation of the import substitution initiative. Nevertheless, the industrial sector started experiencing challenges after Nigeria's discovery of crude oil in commercial quantity in 1967. The observed trend of poor performance was exacerbated by the indigenization policy, before Dutch disease dealt a final blow. With the discovery of crude oil, the Nigerian government invested huge capital into the development of the sector, giving lesser attention to the other sectors. As the petrodollar started flowing, the petroleum sector succeeded in attracting almost the full attention of government, relegating the industrial sector and other sectors to the background (Ajayi, 2011).

The little attention the industrial sector was given by the Nigerian government led to the relaxation and non-implementation of existing industrial policies. And when government noticed that the sector was beginning to perform poorly, it introduced the indigenization policy in 1972. The indigenization policy sought to transfer the ownership of foreign owned firms to new Nigerian owners. The policy was aimed at improving local content in the national economy; it also partially stemmed from the fear of domination by foreigners, who as at then owned most of the largest and best performing firms. The policy ended up worsening the state of the already ailing Nigeria's industrial sector, as many of the firms that were handed over to their new Nigerian owners became moribund shortly after the handover, due to mismanagement and the lack of the requisite capacities for making them competitive and profitable.

Dutch disease stealthily crawled in while the nation was still grappling with the aftermath effect of the indigenization policy; its prevalence was evidenced by the erosion of the competitive advantages industries in Nigeria used to enjoy (Corden, 1984). Interestingly, some studies argue that the dismal performance of the industrial sector and the worsening standard of living that ensue after the exploitation of a newly discovered natural resources are not occasioned by the Dutch disease. The huge spending of the Nigerian government on unproductive ventures when the country makes more money from the oil sector than budgeted, the impact of the huge oil earnings on balance of payments and the country's rate of exchange corroborate the view of the researchers who express reservation for the Dutch disease hypothesis (Nwogwugwu & Umeghalu, 2021).

The austerity measures dubbed Structural Adjustment Programme (SAP) in the Nigerian economy which was vehemently supported by the World Bank and International Monetary Fund (IMF) was implemented from 1986 to 1990. Though the programme was part of the conditions for obtaining loans from designated international financial institutions, it was also adopted to lessen the dominance of unproductive investment in the public sector. It also sought to improve the sector's efficiency and intensify the growth of the private sector through a radical reform of trade and exchange rate policies (Opusunji & Akyuz, 2019). Amusingly, SAP seems to jostle for the position of the worst economic policy ever implemented in Nigeria. It led to the drastic depreciation of the rate of exchange of Nigeria's currency against the US dollar and other major currencies, and with it average real income plummeted, making the standard of living of the populace worse-off.

The resulting decrease in income level as a result of the implementation of SAP led to the closure of many firms operating in Nigeria, since their viability was hanging on the balance. The Nigerian market tends to be a very important market for local manufacturing firms in the country as obtained in other countries, aside the multinational corporations operating in these climes. In that light, if the average man in a particular country ceases to be able to afford the manufactures produced locally, then it will not be a wrong decision for the firms in this country to relocate to some other countries. Interestingly, since Nigeria got into this limbo, it yet to get out of it, the continuous depreciation of the country's official exchange rate since then says it all. The country's huge and burgeoning population makes it a potentially attractive market, so it is not surprising that the industrial sector has performed fairly since the country's return to democracy in 1999. Unfortunately, the poor state of infrastructure and unstable exchange rate which seem to be as a result of the country's over reliance on a volatile revenue source tend to undermine efforts directed towards increasing industrial output.

Industrial Output and Economic Performance

The 'take-off' stage of the Rostow's stages of growth theory is characterized by rapid expansion of the industrial sector. With the sustained growth rate of industrial output a country could attain the apex stage of development, which is the stage of massive consumption. Rostow's stages of growth theory paints a close to perfect picture of development procedures of poor countries that eventually attained high human development until now. Closer observations of many developing economies show that even with sizeable industrial and services sectors, a number of these countries still have low human development. There are appreciably industrialized countries that belong to the low human development and middle human development categories of the United Nations Development Programme's (UNDP) Human Development Index (HDI) rankings. Countries like India and Pakistan among others belong to this category (UNDP, 2019; Onwuka, 2011; Todaro & Smith, 2011).

That development patterns of various developing countries are not in consonance with Rostow's position suggests that industrialization in itself does not engender economic development, especially in countries with weak institutions, poor economic structure, and compromising labour unions. Notwithstanding, the industrial sector is very important for engendering and sustaining economic development. The potential impact of industrial productions on an economy entails its impact on the welfare of the populace and its impact on government's finances. The industrial sector provides employment for the numerous unemployed and the number of employed also increases with increase in the production level of the industries. Unlike the primary sector, the producers derive optimum benefit from the financial accruals that come with the production and exportation of tradable goods of the industrial sector (Onwuka, 2011).
Government derives benefit from the industrial sector through taxes remitted by firms in the sector to government. Many of the firms in the sector are duly registered and adhere to the provisions of the law that border on the manners they conduct their business activities. With economic activities such as illegal mining and subsistence farming that involve the use of crude tools which belong to the informal sector, tax accruals are either poorly mobilized or not paid at all. The relative stability that comes with government revenue earnings tend to ensure economic stability and sustainable development. Unlike primary commodities that the quantities exported remain almost the same even with changes in price, manufactures are price and income elastic. This implies that the quantities of manufactures exported increase with decrease in their prices and vice versa, ensuring relatively stable revenue flow (Ezenekwe et al., 2018).

Table 2: Nigeria's non-oil revenue and manufacturing value added (% of GDP), GDP growth rate and interest rate

Year	GDP Growth Rate (%)	Non-oil Revenue as % of GDP (%)	Manufacturing Value added as % of GDP	Lending Interest Rate
1981	-13.13	5.0	20.26	8.92
1985	5.95	3.1	21.05	9.43
1990	11.78	8.0	17.78	25.30
1995	-0.07	4.7	19.99	20.23
2000	5.02	4.7	13.93	21.27
2005	6.44	5.4	10.06	17.95
2010	8.01	3.5	6.55	17.59
2015	2.65	3.7	9.43	16.85
2018	1.94	3.6	9.65	16.90

Source: CBN Statistical Bulletin, 2019

Thus, it becomes more glaring that the intermittent economic upheavals that bedevil the Nigerian economy tend to stem from the huge proportion of the country's government total revenue that is sourced from crude oil sales. Earnings from oil export are unstable due to the wide price and quantity fluctuations of the commodity in the international market, which tend to have inimical effects on the Nigerian economy and the industrial sector in particular. High revenue earnings resulting from sharp increases in crude oil prices cajole governments of oil exporting countries to spend more on unproductive ventures; this is common in countries without robust financial structures that will make them immune to the inimical effects of the vagaries of the international oil market like Nigeria. Conversely, a downward trend in oil prices tends to put the governments of these countries in tight financial positions that leave them with little or no choice but to borrow from various sources.
Government borrowings from domestic sources in attempts to fund budget deficits tend to crowd out private investments. The sourcing of funds by borrowing from domestic bond and money markets aside other sources by government, creates relative scarcity of loanable funds (Asogwa & Okeke, 2013). The scarcity then makes cost of borrowing funds more expensive through lending rate hikes; increases in lending rates discourage investments in start-up manufacturing firms or expansion of production output of existing manufacturing firms. The tardiness of financial institutions towards lending to manufacturing firms in countries with high rates of inflation has to do with the usual longer durations of facilities borrowed to finance industrial productions; the payback periods and duration of loans obtained by manufacturing firms are usually longer than most of the other business ventures. This is why many financial institutions in developing countries prefer to lend to businesses who borrow to finance trade and other speculative ventures. Table 2 above shows Nigeria's non-oil revenue and manufacturing value added as percentage of GDP, GDP growth rate and interest rate.

LITERATURE REVIEW

The theories in the literature highlight on the relevance of the industrial sector to the performance of an economy and how increased industrial output could be achieved. The Harrod-Domar growth theory was independently propounded by Roy F. Harrod in 1939 and

Evsey Domar in 1946. The model explains the growth rate of an economy in terms of the savings rate and the productivity of capital. The theory states that economic growth rate is positively determined by savings ratio and negatively determined by the capital-output ratio. That is, the more an economy is able to save and invest, the more the growth rate of the economy; also, the higher the capital-output ratio, the lower will be the economic growth rate (Onwuka, 2011).

The Solow growth model stipulates that there are three factors that determine aggregate output in an economy: labour, capital and technology. According to the model, changes in labour are influenced by changes in the population or fraction of the population available for work known as the participation rate. On the other hand, changes in the available productive capital is determined by net investment (gross investment minus depreciation of available capital). If the net investment is positive, capital grows and production growth follows, though the size of the investment is very relevant. It may be so minimal that the induced change in the capital is marginal and so is the effect on production. Finally, the technology combines the other inputs, labour and capital, to produce output (Todaro & Smith, 2011; Jhingan, 2003).

Rostow's stages of growth theory states that every transition from underdevelopment to development would go through a series of steps or stages which every country must pass through. The stages are the traditional society, the preconditions for take-off, the take-off, the drive to maturity and the age of high mass consumption. The decisive stage among these stages is the take-off stage. It is at this stage that developing countries are expected to transit from underdeveloped to developed states (Todaro & Smith, 2011). The Cobb-Douglas production function was developed by Paul Douglas and Charles Cobb in 1928. It is an economic production function that involves two variables (inputs) that determine the output of a firm. It is used to represent the technological relationship between the amounts of two or more inputs (particularly physical capital and labour) and the amount of output that could be produced by the inputs (Jhingan, 2003).

The literature is replete with related works, however, there are rarely related works that identify government's financial structure are being one of the major reasons why oil price volatility is potentially hazardous to industrial output. Iganiga, Anyanwu, Ikubor and Ojima (2021) examined the symmetric and asymmetric effects of oil price dynamics on the Nigerian industrial sector using ARDL and NARDL frameworks based on quarterly times series data spanning $1970Q_1$ to $2018Q_4$. The result of the short-run linear ARDL model reveals that oil price stimulates marginally the performance of the building and construction subsector as well as the aggregated industrial output, though it dampens the performance of the manufacturing subsector. The long-run non-linear ARDL shows that oil price shocks have mixed and variegated effects on the industrial sector.

Ugbaka and Nnnak (2020) investigated the impact of oil price shocks on manufacturing sector output in Nigeria over a thirty year period using ordinary Least Squares (OLS) technique. The findings of the study reveal that oil price shock exerts a significant negative impact on Nigeria's manufacturing sector, suggesting the need for policies that will mitigate the menace and enhance the prospects of manufacturing activities in the country.

Omolade, Ngalawa and Kutu (2019) examined the influence of crude oil price shocks on the macroeconomic performances of eight major net oil-producing countries: Algeria, Nigeria, Egypt, Angola, Gabon, Equatorial Guinea and the Congo Republic, from 1980 – 2016. The study used the price of oil in each quarter with the maximum values observed during the preceding four quarters to derive sharp increases and declines in oil prices to capture oil price shocks. A Panel Structural Vector Auto-Regression model was employed by the authors in the study. The findings of the study shows that the reaction of output to sharp increases and declines in oil prices differ among countries. It was also found that structural inflation was accompanied by sharp declines in oil prices more than monetary inflation, as indicated by an insignificant decline in outputs and investments.

Ezenekwe, Umeghalu and Uzodigwe (2018) examined the impact of oil export earnings instability on standard of living in Nigeria for the period 1980 - 2016. They employed the ARDL model in an attempt to obtain short and long run impacts of total oil export earnings instability due to quantity and price variations on economic development in Nigeria. The findings of the study do not support the popular view that standard of living is driven mainly by total oil export earnings instability due to price variation, rather the result indicates that in the short run, standard of living responds more to oil export earnings instability occasioned by quantity variation than to oil export earnings instability occasioned by price variation.

Gummi, Hassan and Asiya Mu'azu (2018) examined the effect of petroleum price on manufacturing performance (output) in Nigeria from $2009Q_1 – 2017Q_4$. The Autoregressive Distributive Lag (ARDL) approach was adopted by the authors. The findings of the study show that oil price has a positive and statistically significant impact on manufacturing output. They also found that exchange rate and interest rate were negatively related to manufacturing output.

Okonkwo and Mojekwu (2018) examined the effects of oil price fluctuations on Nigeria economic growth with a view of examining whether the Dutch disease theory applies in Nigeria. Ordinary Least Squares (OLS) technique was employed in the study that covers the period 1997 – 2015. The findings of the study reveal that crude oil prices have positive but insignificant effect on aggregate output.

It was also found that a negative and significant relationship exists between oil price and exchange rate, while the crude oil price was found to have positive and significant effects on government expenditure.

The relationship between oil price volatility and economic growth was studied by Gummi, Buhari and Muhammed (2017). They employed Granger causality test to assess the causal relationship between oil price and economic growth for the period 1970 – 2014. The results of the study reveal that there exists a significant unidirectional causality which runs from oil price to economic growth in the short run. There also exists a significant positive unidirectional causality running from human capital to economic growth in Nigeria. Other findings show the existence of a significant positive unidirectional causality running from oil price to total exports in Nigeria.

AL-Risheq (2016) carried out a multi country study that involves 52 developing countries in his attempt to determine the impact of oil prices on industrial production in 52 developing countries for the period 1970 – 2012, using the fixed effects. The findings of the study reveal that oil prices significantly determined industrial production in developing countries; while real exchange rate was also found to have significant impact on industrial production.

Wang and Zhang (2014) examined the impact of global oil price shocks on China's four fundamental industries – grains, metals, petrochemicals, and oil fats. They also examined the asymmetric effect of oil price shocks. The study applied both the autoregressive conditional jump intensity and 5 generalized conditional heteroscedasticities (GRACH) models on the monthly data for the period October 8, 2001, to November 30, 2011. The results of the study reveal that oil prices negatively affect industries, and asymmetric effects exist.

In his bid to examine the consequences of oil price volatility on the growth of the Nigerian economy, Oriakhi and Iyoha (2013) used VAR model to analyze the time series data the spans from 1970 – 2010. From the result of the study he found that oil price volatility has a positive impact on government expenditure, real exchange rate, and real import. On the other hand, real GDP and inflation were found to be negatively influenced by oil price volatility. These findings point out that change in oil price determines government expenditure which in turn determines the growth of the Nigerian economy.

Fascinated by the pivotal role of the oil sector in the economy of Malaysia, Shaari, Pei and Rahim (2013) tried to examine the effects of oil price shocks on the productive sectors of the Malaysian economy. They employed co-integration and Granger causality techniques in analyzing the quarterly data that spans from 2000 – 2011. The findings of the study reveal the existence of a long term impact of oil price shock on the performance of the agricultural, construction and manufacturing sectors of the South African economy. The Granger causality test result shows the existence of causal relationship between oil price instability and the sectors of the country's economy under study.

In his work, Chuku (2012) showed interest in the likely linear and asymmetric impacts of oil price shocks on the Nigerian economy over the period $1970Q_1$ - $2008Q_4$ using VAR model and Granger causality technique. From the results of the study he found that oil price shocks are not a major determinant of macroeconomic activities in Nigeria from the linear model. The Granger causality results indicate that oil price does not have causal relationship with macroeconomic performances, while the nonlinear specification result shows that the impact of oil price shocks on the Nigerian economy is asymmetric.

Scholtens and Yurtsever (2012) attempted to determine the impact of oil price shocks on the industrial output of 38 European countries using VAR and multivariate regression techniques over the period 1983 – 2007. They also tried to analyze the asymmetric response of industries in these countries to increases and decreases in oil prices. The findings of the study reveal that the effects of oil price shocks differ among industries, while the existence of asymmetric effect was detected, though these asymmetries were found not be statistically significant most of the time.

Mehrara and Sarem (2009) examined the effects of oil price shocks on industrial output in three oil exporting countries: Iran, Saudi Arabia and Indonesia. The employed the Gregory and Hansen co-integration and Granger causality techniques in analyzing the annual data that span from 1970 to 2005. The findings of the study reveal that Iranian and Saudi Arabian industrial output are strongly affected by oil price shocks. On the other hand, it was also found that the role played by oil prices in Indonesia was limited; this implies that the country is less sensitive to oil shocks.

Kumar (2009) made effort to examine the macroeconomic impact of oil price shocks in India by focusing on its effect on the country's industrial production growth. He employed a multivariate VAR and Granger causality techniques in analyzing the quarterly data used in the study from $1975Q_1$ - $2014Q_3$. The results of the study reveal the asymmetric impact of oil price shocks on industrial growth in India. The study also found out that inflation rate and short-term interest rate are positively affected by the increase in real oil prices.

METHODOLOGY

Theoretical Framework

The study is based on the Cobb-Douglas production function theory. The Cobb-Douglas production function which was developed by Paul Douglas and Charles Cobb in 1928; it models the relationship between production output and production inputs (factors), which include labour (L) and capital (K). It is used to represent the technological relationship between the amounts of two or more inputs (particularly physical capital and labour) and the amount of output that can be produced by those inputs (Jhingan, 2003). The Cobb-Douglas production function is based on the assumption of substitutability of factors and neglects the complementarity of factors. This function is based on the assumption of perfect competition in the factor market which is unrealistic. However, if this assumption is dropped, the coefficients α and β do not represent factor shares. One of the weaknesses of Cobb-Douglas function is the aggregation problem. This problem arises when this function is applied to every firm in an industry and to the entire industry. In this situation, there will be many production functions of low or high aggregation.

Model Specification

Following the work of Shaari, Pei and Rahim (2013), who specified the productive sectors of the Malaysian economy as a function of oil price shocks, with a slight deviation to allow for the arguments made in this study, industrial output in Nigeria is specified as a function of fluctuations in oil prices. The functional form of the model is specified as follows:

$INDOUT = (\text{CRUDOILPI}, GREVF, GRSHORT, REXP, GFCF, POPG)\ldots.$ (1)

The model for estimation after taking the log of the variables is:

$INDOUT = \alpha_0 + \alpha_1 ln\text{CRUDOILPI} + \alpha_2 lnGREVF + \alpha_3 lnGRSHORT + \alpha_4 REXP + \alpha_5 lnGFCF + \alpha_6 POPG + \varepsilon_1 \ldots \ldots\ldots$ (2)

Where INDOUT = industrial output; CRUDOILPI = Oil price fluctuation; GREVF = government oil revenue fluctuation; GRSHORT = unearned government oil revenue; REXP = government recurrent expenditure; GFCF = gross fixed capital formation; POPG = population growth; ε_1 = stochastic error term; $\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4 and\ \alpha_5$ are parameters to be estimated. $INDOUT$, $REXP$ and $POPG$ are not logged because the variables are already in percentages.

Data and Data Sources

Industrial output (INDOUT) is the aggregate output of all the manufacturing firms producing goods within the country. Industrial output measures the output of the industrial sector which is comprised of manufacturing, construction, processing of raw materials and all production activities. Gross fixed capital formation (GFCF) refers to the total expenditure on investment by the production units of the domestic economy. It is used as a measure of domestic investment in this study because investment is the expenditure incurred on the acquisition of capital goods that result in capital formation. Population is the number of persons in a country. Whereas population growth rate (POPG) is the rate at which population of a country (Nigeria) grows. Solow's growth model is of the position that labour force is a source of output growth. Thus, this study uses population growth rate as proxy for the growth of the labour force since a growing population is invariably also endowed with a growing labour force.

Crude oil price is the amount at which crude oil is sold per barrel in the international oil market. Crude oil price fluctuation is the substantial changes in the price of oil; it could be defined as the difference between the expected and realized oil price. It is captured as the conditional variance of oil prices. Government oil revenue is the revenue generated by the government through the sale of crude oil at the international market. Government oil revenue fluctuation is the substantial changes in government oil revenue - defined as the difference between the expected and realized government oil revenue. It is captured as the conditional variance of government oil revenue. Unearned government oil revenue is the oil revenue that was never earned by government due to the fall in crude oil price below benchmark price; it is the government revenue lost as a result of unexpected fall in the international crude oil price. It is measured by government revenue deficit. In countries such as Nigeria that depend heavily on oil revenue, fall in oil prices leads to deficit in government annual budget.

The data used for the study were sourced from the annual statistical bulletin of Nigeria's Central Bank, World Bank World Development Indicators, Nigeria's Bureau of Statistics and relevant online data websites.

Estimation Technique

The regression equations are estimated using the Ordinary Least Square (OLS) technique. The variables of the study are subjected to a unit root test, after which the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model is estimated to obtain the fluctuations in crude oil price and government oil revenue; this is done by obtaining the conditional variances from the estimated results. The Augmented Dickey-Fuller unit root test technique is used in carrying out the stationarity test of the variables. The EGARCH model was developed by Nelson (1991) to capture information asymmetries and also ensure that the conditional variance is always positive. Assuming y_t follows an autoregressive process of order k, the mean equation is specified as:

$$y_t = \beta_0 + \sum_{i=1}^{k} \beta_i y_{t-i} + \varepsilon_t \quad . \quad . \quad . \quad (3)$$

The complete model will include the following variance equation:

$$log\sigma_t^2 = \varphi + \sum_{i=1}^{q} \alpha_i log\sigma_{t-i}^2 + \sum_{i=1}^{p} \beta_i \left|\frac{\varepsilon_{t-i}}{\sigma_{t-i}}\right| + \sum_{k=1}^{r} \gamma_k \left(\frac{\varepsilon_{t-k}}{\sigma_{t-k}}\right) \quad . \quad . \quad . \quad (4)$$

The left-hand of equation 4 is the logarithm of the conditional variance. The logarithmic form of the EGARCH (p, q) model certifies the non-negativity of the conditional variance without the need to constrain the model's coefficients (Pesaran, Shin, & Smith, 2001).
If two or more variables under study are co-integrated, it means that there is a meaningful long-run relationship between them. The Johansen's co-integration technique is employed in the con-integration test of the variables of the study, with a view to determine the long-run relationship between them. The possibility of having multiple co-integration equations makes the Johansen technique the preferred technique (Pesaran & Shin, 1999).

ANALYSIS AND DISCUSSION OF RESULTS

The conditional variances for oil price and government revenue (the measures for oil price and government revenue fluctuations) were obtained by estimating the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model. Thereafter, the effect of oil price fluctuation and government revenue fluctuation, as well as other variables on industrial output were examined by estimating the regression equation specified in equation 2. Before estimating the regression equation, all the variables were tested for unit root and the lag order was selected using the Akaike information model selection criteria.

Determination of the Conditional Variance of Oil Prices, as a Measure of Crude Oil Price Fluctuation (CRUDOILPI)

The conditional variance was generated from the oil price variable. Before generating the conditional variance, we ran an OLS model that has only the constant and used it to test for ARCH effects in oil prices by using Engle's Lagrange multiplier test. The reason for this is to make sure that the use of the oil price variable in an EGARCH model to obtain the conditional variance is appropriate. The OLS result and the ARCH test result are presented in table 3 below.

Table 3: Result of the Engle Lagrange Multiplier Test for ARCH Effects in Oil Price

Result of a constant-only model by OLS used to test for ARCH effect				
CRUDOILP	Coefficient	Standard Error	t	P
Constant	57.1072	4.7066	12.13	0.000
LM test for autoregressive conditional heteroskedasticity (ARCH)				
chi2	9.617			
Prob.	0.0019			
Lags	1			
The lag length of 1 was automatically chosen by the Akaike's final Prediction Error (FPE), and Akaike's information criterions				

Source: Author's computation using STATA 16

The p-value of the Engle's LM test is 0.0019. Since it is significant at the 5 per cent level, the null hypothesis of no ARCH effects is rejected. This means that there is an ARCH effect of the oil price. Since ARCH effect is present, there is justification to estimate an Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model as specified earlier. Table 4 below shows the result of the EGARCH model estimation.

Table 4: EGARCH Estimates of Oil Price

D.CRUDOILP	Coefficient	OPG Standard Error	z-value	p-value
CRUDOILP				
Constant	-0.0015	0.0680	-0.02	0.982
ARCH				

egarch (L1)	0.3457	2.8661	0.12	0.904
arch (L1)	1.0270	4.7721	0.22	0.830
Constant	-1.6470	7.1156	-0.23	0.817
The lag length was empirically determined using the Akaike's final Prediction Error (FPE), and Akaike's information criterions				

Source: Author's computation using STATA 16

The positive arch (L1) coefficient means that there are positive innovations. That is, an unanticipated increase in price of crude oil is more profitable than an unanticipated decrease in the price of crude oil. In other words, it is better for the price of crude oil to increase unexpectedly than to decrease unexpectedly. The EGARCH asymmetry coefficient informed us the opposite of what would have been anticipated in the case a GARCH model is applied to the crude oil price. The EGARCH asymmetry coefficient has a positive value of 0.3457, this means that a decreasing oil price brings about higher next period negative shocks in crude oil prices than increasing prices by the same amount.

On the other hand, the asymmetric of oil price shocks has a negative coefficient of -0.0015 with a t-value of -0.02. The t-value of -0.02 is insignificant at the 5 per cent level; this means that there is an observed tendency of the crude oil price shock to be insignificantly lower by approximately 0.002 per cent in increasing oil prices in the crude oil market than in rising prices in the oil markets.

Determination of the Conditional Variance of Government Oil Revenue – as a Measure of Government Oil Revenue Fluctuation (GREVF)

Similarly, the conditional variance of oil revenue was generated from the oil revenue variable. Before generating the conditional variance, we ran an OLS model that has only the constant and used it to test for ARCH effects in oil revenue by using Engle's Lagrange multiplier test. This is to make sure that the use of the oil revenue variable in an EGARCH model to obtain the conditional variance is appropriate. The OLS result and the ARCH test result are presented in table 5 below.

Table 5: Result of Engle Lagrange Multiplier Test for ARCH Effects in Oil Revenue

Result of a constant-only model by OLS used to test for ARCH effect				
lnGREV	Coefficient	Standard Error	T	P
Constant	6.2193	0.3958	15.71	0.000
LM test for autoregressive conditional heteroskedasticity (ARCH)				
chi2	33.714			
Prob.	0.0000			
Lags	1			
The lag length of 1 was automatically determined using the Akaike's final Prediction Error (FPE), and Akaike's information criterions				

Source: Author's computation using STATA 16

The p-value of the Engle's LM test is 0.0000; this means that there is an ARCH effect of the oil revenue. Since ARCH effect is present, there is justification to estimate an Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model. Table 6 below shows the result of the EGARCH model estimation.

Table 6: EGARCH Estimates of Government Oil Revenue

D. lnGREV	Coefficient	OPG Standard Error	z-value	p-value
CRUDOILP				
Constant	8.4499	0.0933	90.52	0.000
ARCH				
egarch (L1)	0.9023	0.0771	11.69	0.000

arch (L1)	0.0219	0.0142	1.55	0.122
Constant	0.3048	0.0957	-3.18	0.001

The lag length was empirically determined using the Akaike's final Prediction Error (FPE), and Akaike's information criterions

Source: Author's computation using STATA 16

The positive arch (L1) coefficient means that there are positive oil revenue innovations. That is, an unanticipated increase in oil revenue due to oil price change is more profitable than an unanticipated decrease in the oil revenue. It is better for the oil revenue to increase unexpectedly than to decrease unexpectedly. The EGARCH asymmetry coefficient informs us the opposite of what would have been anticipated in the case a GARCH model is applied to the oil revenue. The EGARCH asymmetry coefficient has a positive value of 0.9023. This means that decreasing oil revenue is associated with higher next period negative shocks in oil revenue than increasing oil revenue.

On the other hand, the asymmetric of oil price shocks show a positive coefficient of 8.4499 with a t-value of 90.52. The t-value of 90.52 implies that there is an observed tendency of the oil revenue shock to be higher by approximately 8.45 per cent in increasing oil revenue than falling revenue.

Descriptive Statistics of the Variables

The descriptive statistics are observed to have an idea about the variables under study. Thus, the descriptive statistics of the variables were examined and reported in table 7 below.

Table 7: Mean, Standard Deviation Maximum Values and Minimum Values of the Variables

Variables	Obs	Mean	Standard Deviation	Minimum value	Maximum value	(Skewness)	(Kurtosis)
INDOUT	39	10781.42	3395.9	5885.927	16742.15	0.3952	0.0007
GREVF	39	-2.2307	2.4720	-6.4685	0.6414	0.1403	0.0053
CRUDOILPI	39	-0.0115	0.3105	-0.6639	0.9680	0.2761	0.0631
GRSHORT	39	-632.8654	1157.264	-4913.816	32.0494	0.0000	0.0006
GFCF	39	11.1813	1.8467	9.0824	14.7086	0.1513	0.0093
REXP	39	2.6525	2.6923	0.0317	9.8019	0.0358	0.8462
POPG	39	2.5462	0.0619	2.4581	2.6452	0.9347	0.0005

Source: Author's Computation

The standard deviation values of government oil revenue fluctuation, crude oil price fluctuation, gross fixed capital formation, government recurrent expenditure and population growth rate are close to their respective mean values. The closeness of the standard deviation values to their respective mean values means that the values of the variables are not far from their respective mean values. The rest of the variables have mean values that are far away from their respective standard deviation values, indicating that the values of the variables are far away from the respective mean values. For the skewness, unearned government revenue due to a fall in crude oil price below benchmark price and government recurrent expenditure are significant at the 5 per cent level. The insignificant skewness probability values for the rest of the variables means that the variables are normally distributed. For the Kurtosis, crude oil price fluctuation and government recurrent expenditure are not significantly different from kurtosis of a normal distribution at the 5 percent level of significance, while the rest of the variables do not have Kurtosis of normal distribution as indicated by the significant p-value.

The variables in the model were tested for unit root using the Augmented Dickey-Fuller unit root test and the result is reported in table 8 below.

Table 8: Augmented Dickey-Fuller Unit Root Test Results

Variable	ADF – Statistic		Model	Lag order	~I(d)
	Level Form	1st Difference			
INDOUT	-2.368	-3.598*	Trend	2	I(1)
lnCRUDOILPI	-3.438	-5.619*	trend	2	I(1)
lnGREVF	-0.313	-4.224*	trend	2	I(1)
lnGRSHORT	-2.291	-4.398*	trend	2	I(1)
REXP	-0.445	-1.597*	trend	2	I(1)
lnGFCF	-1.663	-3.733*	Trend	2	I(1)
POPG	-2.509	-4.546*	Trend	2	I(1)

Where * denotes significance at 5% and the rejection of the null hypothesis of the presence of unit root. The optimal lag lengths were chosen according to Akaike's final Prediction Error (FPE), and Akaike's information criteria. 5% critical value at the level form is -3.556 and the 1st difference is -3.564.

Source: Author's Computation using STATA 16

The test statistics of the variables at level were all less than the 5% critical value of -3.556. This means that all the variables have a unit root at the level form. The variables were differentiated once and the test was conducted again. At 1st difference, the test statistics of all the variables became greater than the respective 5% critical value, thus, we conclude that all the variables are stationary at 1st difference. Since all the variables are stationary at the same order, a co-integration test is conducted and presented.

A co-integration test is conducted using the Johansen co-integration test to determine if the variables have a long-run relationship. The result of the test is presented in table 9 below.

Table 9: Results of Johansen Test for Co-integration of the Variables

Maximum Rank	**Eigenvalue**	**Trace Statistics**	**5% critical value**
0	-	213.7895	109.99
1	0.85626	143.9577	82.49
2	0.80824	84.5030	59.46
3	0.57701	53.5282	39.89
4	0.47157	30.5660	24.31
5	0.37107	13.8714	12.53
6	0.30872	0.5795*	3.84
7	0.01597	-	-

Source: Author's computation using SATA 16

The result shows six significant trace statistics. This means that there are sex co-integrating equations, thus, we reject the null hypothesis of no co-integration. We therefore, say that the variables have a long-run relationship.

Effects of Crude Oil Price Fluctuation, Government Oil Revenue Fluctuation, Shortfall of Government Revenue and Government Recurrent Expenditure on Industrial Output

Equation 2 was estimated to examine the effects of crude oil price fluctuation, government oil revenue fluctuation, shortfall of government revenue and government recurrent expenditure on industrial output using the OLS technique. The result of the estimation is presented in table 10 below.

Table 10: Estimation Result

INDOUT	Coefficients	Standard Errors	t-stat	P-value
GREVF	-1.8513	0.0320	-5.78	0.000
CRUDOILPI	-28.9374	11.7632	-2.46	0.020
GRSHORT	-0.4391	0.4449	-0.99	0.331
GFCF	36.2981	9.4037	3.86	0.001
REXP	39.3656	338.7349	0.12	0.908
POPG	7.2942	2.4810	2.94	0.000
Constant	-1859.017	9205.056	-0.20	0.841
R-Squared	0.7621			
Adj. R-Squared	0.7548			
F(6, 31)	131.29 (0.0000)			
Durbin-Watson d-statistic (7, 37)	1.8703			
Breusch-Godfrey LM chi2	0.001 (0.9718)			

Source: Author's computation using STATA 16

The result shows that an increase in oil price fluctuation leads to a negative change in industrial output by 28.94 percent. This means that oil price fluctuation negatively affects industrial output. The t-value is -2.46, and since it is greater than 2 in absolute sense, the relationship between crude oil price fluctuation and industrial out is said to be significant. The coefficient of government oil revenue fluctuation of -1.8513 means that an increase in government oil revenue fluctuation leads to a 1.85 percent decrease in industrial output. The t-statistics value of -5.78 means that government oil revenue fluctuation significantly predicts industrial output. Also, the coefficient of the unearned government revenue due to a fall in crude oil price below benchmark price of -0.4391 means that a percentage increase in the unearned government revenue due to a fall in crude oil price below benchmark price leads to 0.44 percent decrease in industrial output. The t-value of -0.99 means that unearned government revenue due to a fall in crude oil price below benchmark price insignificantly affects industrial output.

On the other hand, the coefficient of gross fixed capital formation of 36.2981 indicates a direct relationship with industrial output. Specifically, it means that an increase in gross fixed capital formation (domestic investment) leads to an increase in industrial output by 36.29 per cent. The coefficient of gross fixed capital formation is also significant at the 5 per cent level. This means that domestic investment significantly increases industrial production. The coefficient of government recurrent expenditure of 39.39 shows that an increase in government recurrent expenditure leads to a positive change in industrial output by 39.37 percent. This means that government recurrent expenditure positively affects industrial output. However, the t-value of 0.12 shows that the relationship between government recurrent expenditure and industrial output is insignificant. The coefficient of population growth rate of 7.29 shows that an increase in population growth rate brings about 7.29 per cent increase in industrial output. In other words, population growth has a positive and significant effect on industrial output.

The coefficient of determination R^2 of 0.7621 means that the variables jointly determine 76.21 per cent change in industrial output. The F-statistics given as 131.29 is significant as indicated by the F-probability value of 0.0000. This also means that the variables jointly significantly affect industrial output. The Durbin-Watson d-statistic is approximately 2, indicating that the variables do not have autocorrelation. This is also supported by the insignificant Breusch-Godfrey LM chi2 value, showing the acceptance of the null hypothesis of no serial correlation.

CONCLUSION

Despite the volatility that characterize crude oil price in the international market, there is a minimum price limit oil price cannot get below it. This implies that a government with an effective financial structure that duly allows for anticipated fluctuations is most like to be immune to the economically unhealthy effects that countries that rely heavily on oil export revenue are exposed to. It is on this premise that this study has been embarked upon; it seeks to determine the impact of crude oil price volatility on industrial out, through its effect government revenue and expenditure. Ordinary Least Square technique was used to analyze the times series data set used for the study which covers the period 1981 to 2019. The fluctuations in oil price and government oil revenue over the period of the study were estimated using the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH).

The findings of the study reveal that crude oil price fluctuations negatively affect industrial output in Nigeria, while increase in government oil revenue fluctuation leads to significant decrease in industrial output. Increase in the unearned government revenue due to a fall in crude oil price below benchmark price was found to lead to an insignificant decrease in industrial output, while increase in government recurrent expenditure was found to lead to a positive and insignificant change in industrial output. Increase in gross fixed capital formation (domestic investment) was found to lead to a significant increase in industrial output, while population growth exerts a positive and significant effect on industrial output.

From the findings of the study, it could be deduced that crude oil price fluctuation affects industrial production which reduces industrial output. Fluctuations of crude oil price affects government finances such that government spends most of its earnings on unproductive ventures that are largely financed through borrowings from various sources. Government finances here entails government recurrent expenditure as a proportion of total expenditure, the growth rate government's revenue in relation to population growth, the contribution of government's productive expenditure to gross fixed capital formation, and unearned government revenue due to fall in crude oil price below benchmark price. On the other hand, the borrowings made by government from domestic sources then to crowd out local investors who then find investments in the manufacturing sector unattractive due to the high rate of interest.

The study recommends that the Nigerian government puts in place more effective economic and export diversifying policies, especially with the aim of diversifying government's revenue source, since it does not reflect the present economic structure. A government revenue structure that is in tandem with the sizes of the component sectors in the country will put government in a position where it becomes immune to fluctuations in revenue earnings from crude oil sales.

Government should streamline its financial structure such that benchmark oil prices used in preparing annual budgets are low enough not to widen the budget deficit further in the event where there is a glut in oil price. Budgetary allocations for recurrent expenses should also be trimmed down in favour of capital expenses. Huge government capital expenditure budgets entail more patronage for the private sector, including the manufacturing firms; it also makes wage rate increment easier. Increase in real income implies increase in real demand, which would spur increase in supply due to increase in production. Hence, wage rate increment which can be achieved with more ease if government's recurrent expenditure is sufficiently low, could amount to increase in industrial out.

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Appendix A

Data for the study

Year	INDOUT	CRDOILP	GREV	GRSHORT	REXP	GFCF	POPG	GREVF	CRUDOILPI
1981	7473.2054	93.57	8.5644	-3.9021	.03176497	18220.59	2.57	-6.30235	-.1412105
1982	6969.2028	80.88	7.8149	-6.1041	.03674322	17145.82	2.50	-6.393931	-.1442305
1983	5885.9268	70.24	7.253	-3.3645	.03430249	13335.33	2.50	-6.468548	-.1395365
1984	6128.6356	65.58	8.2692	-2.6604	.04229184	9149.76	2.53	-6.337426	-.0671345
1985	6731.3682	60.64	10.9237	-3.0397	.050665	8799.48	2.57	-6.059029	-.0768038
1986	6583.6875	31.17	8.1073	-8.2543	.05051126	11351.46	2.59	-6.357199	-.6639864

1987	6516.763	38.42	19.027	-5.8897	.10250441	15228.58	2.60	-5.504105	.2106346
1988	6895.2642	29.86	19.8317	-12.1609	.11969754	17562.21	2.58	-5.462682	-.2505459
1989	7539.2301	34.8	39.1305	-15.1347	.15030175	26825.51	2.55	-4.783062	.1546098
1990	8993.2251	42.97	71.8871	-22.1161	.18761156	40121.31	2.51	-4.174867	.2123972
1991	8574.5078	34.77	82.6664	-35.7552	.19919464	45190.23	2.49	-4.035151	-.2102348
1992	8669.8311	32.6	164.0781	-39.5325	.2703037	70809.16	2.47	-3.349621	-.0629303
1993	8646.5969	27.8	162.1024	-65.1577	.68610571	96915.51	2.46	-3.361735	-.1577639
1994	8457.8524	25.27	160.1924	-70.2706	.45034458	105575.49	2.46	-3.373588	-.0939058
1995	8539.9906	26.43	324.5476	-76.10324	.62707479	141920.24	2.46	-2.667531	.0463942
1996	9011.4371	31.19	408.783	32.0494	.58689094	204047.61	2.46	-2.436779	.1671103
1997	9157.6195	28.16	416.8111	-75.0213	.72771944	242899.79	2.46	-2.41733	-.1006827
1998	9145.4937	18.47	324.3112	-133.3893	.79746949	242256.26	2.47	-2.66826	-.4202425
1999	8685.2203	25.54	724.4225	-285.1047	2.0030032	231661.69	2.47	-1.864589	.3256105
2000	9487.8552	39.17	1591.675	-103.7773	1.9486429	331056.73	2.48	-1.077421	.4291776
2001	10192.298	32.68	1707.562	-221.0489	2.2926646	372135.65	2.49	-1.007141	-.1796354
2002	9947.8358	32.93	1230.851	-301.4016	2.4062676	499681.53	2.51	-1.334502	.0091332
2003	11866.077	37.09	2074.280	-202.7247	3.1041222	865876.46	2.53	-.8125939	.1204756
2004	12357.105	47.96	3354.8	-172.6	2.9488401	863072.62	2.55	-.3318157	.2585324
2005	12718.554	66.09	4762.4	-161.4	3.2653813	804400.82	2.58	.0185432	.3221627
2006	12648.211	76.5	5287.566	-101.3975	3.2258673	1546525.6	2.60	.1231499	.1477855
2007	12637.147	82.65	4462.91	-117.2371	3.7026581	1915348.8	2.62	-.0464077	.0788363
2008	12527.111	106.94	6530.6	-47.3796	4.6017089	2030510	2.63	.3342905	.2591656
2009	12971.064	68.05	3191.938	-810.00846	4.268227	2442703.5	2.64	-.3815804	-.450513
2010	13826.434	86.31	5396.091	-1105.4014	5.6935536	9183.0594	2.64	.1434669	.2392152
2011	14986.622	117.09	8878.969	-1158.5185	5.7632643	9897.1972	2.65	.6414776	.3065098
2012	15350.452	115.14	8025.970	-975.78314	5.5484105	10281.952	2.64	.5404739	-.0152818
2013	15682.465	110.42	6809.230	-1153.4902	5.8353933	11478.08	2.63	.376071	-.0403449
2014	16742.153	98.37	6793.82	-835.70843	5.1031359	13595.842	2.61	.373805	-.1140429
2015	16366.657	52.37	3830.096	-1557.834	5.5516216	14112.17	2.59	-.1993189	-.6288897
2016	14918.147	37.8	2693.9	-2673.8404	6.1240022	15104.184	2.57	-.5512185	-.3245124
2017	15238.28	99.37	4109.8	-3609.3739	6.9790047	16908.133	2.55	-.1288338	.9680534
2018	15523.428	64.9	5545.8	-3628.0967	8.1306458	16154.184	2.54	.1708326	-.4244901
2019	15882.346	56.99	5536.661	-4913.8156	9.8019366	37015.485	2.57	.1691837	-.1284596