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OIL PRODUCTION - GDP NEXUS: EMPIRICAL INSIGHTS FROM THE NIGERIAN ECONOMY

Bernhard O. ISHIORO, Ph.D[1]

[1]Department of Economics,
Delta State University,
Abraka, Nigeria.

*Corresponding Author:Bernhard O. ISHIORO
Corresponding Author Email: ben_ishioro@yahoo.co.uk

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ABSTRACT

Several studies abound that concentrated on oil production and the environment, oil exploration and socio-economic conditions, contributions of crude oil consumption to the growth of the Nigerian state, etc. But there are no recent studies investigating the oil production- GDP nexus. Hence, the main goal of this study is to explore the contribution of oil production to the national GDP from an oil-dependent economy nexus. Annual time series data on oil production and its growth rate represented the oil production side of the nexus while GDP and its growth rate represented the GDP side of the nexus. We applied the three different econometric techniques: unit root test, cointegration test, vector error correction and the Granger causality estimation techniques. Our results largely suggest that there exists a long-run joint and simultaneous (bilateral performance) between GDPg and OILPRODg , and between GDP and OILPRODg; growth rate of GDP (GDPg) has negative coefficients in relation to its contribution to the growth of oil production (OILPRODg); and negative but statistically insignificant impact of the dependence of the growth rate of current OILPRODg on GDP. Furthermore, OILPRODg

Granger caused GDPg as well as GDP, and GDP does not Granger cause OILPROD. We recommend that oil production should be controlled and directed towards effective management of GDP and economic growth outcomes in Nigeria

JEL Classification Code: O47, O55,Q32,Q43

INTRODUCTION

The advent of oil (CO) and its production (OILPROD) has placed Nigeria and productive growth-enhancing economic activities of the real sector at a vintage position to either export, consume and / or generate revenue from its consumption and export-related activities. Essentially, OILPROD has myriads of both economic, political and social implications for an emerging economy like Nigeria. From the perspective of microeconomic analysis, economic agents such as individuals, households, firms and industries are seen as both oil production and consumption decision making units. From this premise, OILPROD is akin to the production of an intermediate good that is needed by the economic agents (the individuals, households, firms, institutions and industries) for the purpose of further production of similar or other goods and services (Ishioro, 2020a; 2019; and 2018). This seems to suggest that OILPROD is an indispensable stimulant and determinant of productive and growth-enhancing economic activities and capacity utilization.

However, as important and significant as OILPROD is, its nexus to sustainable growth is not properly and adequately studied and documented in the context of the economy of Nigeria. Sub-optimal OILPROD could act and serve as a recipe for widening socio-economic crises. Hence, the empirical investigation of the nexus of OILPROD-economic growth is not only a right step in the right direction but also a timely attempt.

Moreso, most productive sectoral economic activities are either directly or indirectly linked to OILPROD (Ishioro, 2018). The volume of a country's oil-derived export depends on its OILPROD capacity. Also, availability and access to CO for domestic consumption in an economy is determined partly by the degree of its OILPROD. This is why most countries' energy crises are traceable to either under-production or non-production of CO.

The current population of Nigeria is large, out of which about 108.57 million people live on or less than US$1.25 per day with a high proportion and segment of the population described as permanently or always poor (CIA, 2022). The production and export of CO since the 1950s have not proffered solution to the widening poverty crises in Nigeria. With the huge proceeds from OILPROD and oil export since the 1950s, one of the welfare indicators adopted in the assessment of the quality of life of Nigerians (especially quantitative measure - the per capita GDP) is still very low and piteous **(**CIA, 2022).

Hence, our major and principal focus is to answer the following questions: what is the significant impact and effect of OILPROD on the expansion of output and growth of the productive and growth-enhancing economic activities in Nigeria? Has the Nigerian state benefitted from the domestic consumption of CO? What contribution has oil made to the sustainable expansion and growth of the economic activities in Nigeria? Following the introduction, the rest parts of the paper is structured as: Section Two presents the trends of OILPROD, export and domestic consumption of CO. Furthermore, section two appraises the related literature on the

contributions and significance of CO to sustainable growth in Nigeria. Section three explicates issues relating to the method / estimation technique while section four focuses on empirical findings of the study. Section five concludes the study with policy implications of the major findings.

TREND IN OIL PRODUCTION IN NIGERIA

Eras of Oil Production in Nigeria

CBN(2010) observed that, although Nigeria for several decades has been one of the major oil consuming, exporting and producing nation, the petroleum industry and sector of Nigeria that ought to have been a trail-blazing sector and the prime mover of the economy has suffered numerous developmental setbacks in terms of its significance since the 1970s due to the dramatic fluctuations and prolonged instability in oil prices and sudden phenomenal downturns in oil reserves accumulation and production (see Anyanwu, Oyefusi, Oaikhenan and Dimowo,1997; Orji, Nwagu, Ogbuabor, Nwosu and Anthony-Orji, 2019). According to Anyanwu *et al* (1997), OILPROD reached about 1,876,000 Barrels in 1958 and rose to about 395,843,000 barrels per day (Bpd) in 1970. In Nigeria, this consistently monumental increase in OILPROD was sustained until it rose to about 660,404,000 bpd, and remained at 753,404, 000 bpd in 1980 (Ishioro,2020a).

Four major periods of OILPROD and exports are recognized in the literature (CBN 2010). These include: 1960-1969 oil export/production era;1970-1979 oil export/production era; 1980-1998 oil export/production era; and 1999-to date oil export/production era.

The **1960-1969 era** was characterized by the followings: Government was only a regulator and not a participator in OILPROD and oil export. Consequently, major regulatory policy framework concerning the management and control of the industry producing oil was provided by the government. Also, the ownership of the production facilities (i.e. equipment and infrastructure) was entirely the prerogative and responsibility of the companies producing oil. The oil companies paid the requisite taxes and royalties to government; they determined the quantum of OILPROD, control CO prices and formulate pricing policies. During this era, the total CO produced was exported until 1965 when local refining of CO started mainly because of the establishment of the first Port Harcourt refinery (Anyanwu *et al* , 1997).

The **1970-1979 era** is very significant in the history of CO export and production in Nigeria. During this era, Nigeria became a member of the Organization of Petroleum Exporting Countries (OPEC). Oil proceeds accruing to Nigeria increased significantly due to the Middle East crises as well as the oil sanctions on both Europe and the United State of America (USA). This era also witnessed the establishment of the Warri Refinery (in 1978) and the allocation of 200,000 barrels per day for daily consumption in the economy of the Nigerian state (Anyanwu *et al* ,1997; CBN, 2010).

In order to increase the level of OILPROD and accumulate more oil reserves during **the 1980-1998 period**, the government signed a Memorandum of Understanding (MOU) with the oil companies. The primary objective of the MOU was to curtail dwindling OILPROD and to improve the accumulation of oil reserves. To this end, two MOUs were signed. In 1986, precisely January, a five-year (1986-1990) MOU was signed with the following provisions: guaranteed profit (with a margin) of US $2.00 per barrel of CO for company equity crude.

In 1991, the second MOU was signed. This MOU covered the period 1991-1995 with the guaranteed profit margin slightly raised to US $2.30 per barrel. The upward review of the profit margin was designed to accommodate the sinister effects of inflation. Within this period, a US $0.20 per barrel enhancement in the national margin incentive for oil companies was introduced.

The **period 1999-til date** :This era witnessed the attempt made by the federal government to deregulate the oil sector-to encourage optimal private sector participation(especially in the downstream sector). Prior to the deregulation of the downstream sector, government had taken several steps aimed at revamping, repositioning and resuscitating the sector. These include: importation of petroleum product to augment the inefficient and epileptic domestic production of CO; periodic maintenance and refurbishing of the near non-functional refineries, occasional review of the prices of petroleum products(directed at the removal of subsidy on petroleum products). In 2004, the Nigerian Extractive Industry Transparency Initiative was actuated. The initiative was configured to stifle the rent-seeking behavior that was predominant and widespread in the sector. Also, between 2012 and 2013, the Petroleum Industry Bill(PIB) was brought before the national legislators for consideration and enactment .

It is remarkable to note that the period, from 1970 to 1980 constituted four *quinquennia* of oil boom in terms of OILPROD, oil-derived exports and oil revenue. The oil boom of the 1970s coincided with OPEC power and embargoes of 1973 – 1975 and drastic (somewhat unprecedented) upsurge of oil revenues to ₦13.86 billion before 1980 (see Orubu, 2003). The revenues from oil exports peaked at US$25 billion in 1980 but dropped to less than US$10 billion in 1983 and US$7 billion in 1986.

Though oil prices fell during the 1980s due to the Global recession and the associated glut, CO still accounted for about 90 percent of foreign earnings and 80 percent of government revenue. CO remains the hope of the economy of Nigeria. The crash in the OPEC price mechanism contributed to the steep decline in Nigerian OILPROD for most part of the 1980s. Due to the unprecedented/ abysmal crash in the production of oil in Nigeria; by 1983, OILPROD stood at 450,961,000 barrels per day. OILPROD increased sluggishly in the 1980s and 1990s until 1998 and 1999 when it recorded 776,010,000 and 778,900,000 barrels respectively.

During the 2000s, the production of oil was encouraging as it increased to about 900,600,000 barrels per day in 2004 but decreased at a decreasing rate in 2006 to 813,850,000 barrels per day. In 2010, OILPROD stood at a total of 896,043,406 barrels with an average of 2.45 *mmb/pd*. Total OILPROD for 2012 was 852,776,652 barrels with daily production at about 2.27 *mmb/pd* (NNPC, 2012).Total CO and condensate production for the year 2013 was about 800,488,102 barrels (i.e. a daily production of 2.19 *mmb/pd*).

Crude Oil Production: Oil Wells and Oil Rigs in Nigeria.

There are five major types of oil wells in the petroleum economics literature: exploratory wells, appraisal wells, development wells, re-entered wells, and work-over/completion wells. The first oil well which was 12,008 feet deep was found at *Oloibiri* in the then Eastern region on the 12th day of June,1956. Due to state creation and the attendant boundary adjustment, *Oloibiri* was relocated to Rivers state in 1967 and currently in Bayelsa state since 1996. In 1997, a total of about One hundred and fifty-five (155) oil wells (12 were exploratory, 14 were appraisal,101

were development and 28 either work-over or completed oil wells) were found in Nigeria. These wells were either spudded or re-entered (NNPC,1997; 2012).

In 2000, there was a total of One hundred and forty-eight (148) oil wells in Nigeria representing about four (4) percent reduction in the number of oil wells. However, in 2005, the number of oil wells rose marginally to about One hundred and seventy-nine (179). In 2012, a total of One hundred and thirty-eight (138) oil wells were drilled. But in 2013, there were about One hundred and eighty-one (181) oil wells in Nigeria. Oil wells have been discovered in Edo and Benue states; and about 25 oil wells are located in the Chad Basin.

There are about 606 oil fields in Nigeria (specifically in the Niger Delta area). 355 oil fields are on-shore while about 251 are off shore . Of the 606 oil fields, 193 are operational while about 24 have been abandoned due poor production performance or uneconomic prospectivity.

Basic Characteristics of the Nigerian Crude Oil

Table 1

Essential Features of the Nigerian Oil

Crude	API Gravity	Sulfur Content	Volume 1,000 b/d	Primary Loading Port
Bonny Light	35.4	0.14	422	Bonny
Brass River	41.5	0.09	185	Brass River Terminal
Escravos	34.2	0.15	450	Escravos
Forcados	30	0.28	450	Forcados
Oso Condensate	47.4	0.05	140	Qua Iboe
Pennington	35	0.08	75	Pennington Terminal
Qua Iboe	36.4	0.12	460	Qua Iboe

Source: Wikipedia

The API gravity (the units of API are in degrees) is also known as the density of CO. It shows the degree of lightness or heaviness of the oil. The API gravity varies inversely with the density of the oil. For instance, the heavier the oil, the lower its API gravity or density. Lighter oil has higher or more proportion of small molecules that can be easily processed into gasoline, jet fuel, diesel while heavier oil has higher proportion of very large molecules that can be processed into smaller molecules and further processed, or used as asphalt and other products (OPEC, 2022; Reynolds, 2014; ICCT, 2011; Parkash, 2003; Maple, 2000; Al-Jarri and Startzaman,1997).

Sulfur has one of the most important effects on oil refining process. The sulfur content of CO is usually in weight percent (denoted as wt %) or in parts per million by weight (ppmw). Based on the sulfur content, CO can be referred to as low sulfur (sweet with the sulfur level at a threshold of 0.5 wt % or 5,000 ppmw), or high sulfur (soar).The sulfur concentration increases with the increase in carbon number (ICCT, 2011).

Krane (2017) evaluated critical issues relating to OILPROD in Saudi Arabia. The study focused on the implications of increasing OILPROD of Saudi Arabia and these include growing population and allied oil products; peak production and turning point of domestic demand; the likely demand plateau for essential oil products, etc. The study also viewed adjustment timelines for the depleting of oil as a result of heightening oil production. Furthermore, the study summed up the complementary consequences of oil production on gas production, wastage and consumption; and observed that expansion in oil production would result into positive returns inversion (in case of global over production).

Dagoumas, Perifanis and Polemis (2018) studied Saudi Arabia's oil production strategy using selected macroeconomic and market fundamentals as indicators for the period 1980-2017.The main objective of the study was to clearly identify the principal determinants of oil production in Saudi Arabia. In the light of the above, the study specified and estimated 3 models of OILPROD, crude oil prices and world CO demand. The results certified that Saudi's oil production is inelastic to world oil production/ demand; and exhibits characteristic nature of the trade-off theory (Hallack, Szklo, and Junior, 2017).

MATERIALS AND METHODS

Source and Description of Variables.

Times series data on OILPROD and growth variables were used in this study. The data on the OILPROD variables: Crude Oil Production (OILPROD) and growth rate of crude oil production(OILPRODg) were extracted from the OPEC Statistical Bulletin (for various years) while the data on growth rate of GDP (GDPg) and GDP were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin (for various years). The study covered the period from 1980 to 2021.The variables used in this study are defined and described below:

Table 2

Sources, Nature and Description of Data

S/No	Variables	Symbol	Source of Data
1	Growth rate of Gross Domestic Product	GDPg	Central Bank of Nigeria (CBN),2022
2	Gross Domestic Product	GDP	Central Bank of Nigeria (CBN),2022
3	Crude Oil Production	OILPROD	OPEC, 2022
4	Growth Rate of Crude Oil Production	OILPRODg	OPEC, 2022

Source: Author's Compilation

Growth rate of GDP (GDPg): This is defined as sustainable growth measured by the growth rate of GDP. It is a welfare indicator that measures the standard of living of the citizenry in the era of the production of crude oil. This is a non-oil indicator.

GDP is the quantum of the goods and services produced in the economy over a period of time (usually one year) expressed in monetary value regardless of the nationality of those involved in the production process.

Crude Oil Production (OILPROD): This is defined as the total annual CO produced in the entire economy of Nigeria by the various firms involved in both the Joint venture with NNPC, production sharing companies, service contract firms, independent/sole risk companies and oil exploratory production from marginal fields. OILPRODP is usually measured in barrels per day (bpd) (ICCT, 2011).This is a crude oil variable.

Estimation Technique

This section provides a highlight of the estimation techniques, starting with the unit root tests, bivariate cointegration test, vector error correction mechanism, and Granger causality test akin to Ishioro (2022b) and Adams and Bello (2022).

Order of integration Test: Augmented Dickey Fuller (ADF)

The general form of the Augmented Dickey Fuller (ADF) test can be specified both at levels and in first difference forms as follows after Ishioro (2015a and 2015b, 2017, 2020a and 2020b):

$$\Delta x_t = \alpha x_{t-1} + \sum_{i=1}^{k} \beta \Delta x_{t-1} + \phi + y_t + \varepsilon_t \qquad (1)$$

The Augmented Dickey Fuller (ADF) test is the most widely applied technique for determining the unit root of a series in the econometric literature (Ishioro, 2015c and 2022b). This test is used to determine the stationarity of the time series in this study. A series is said to be stationary if its probability distribution is unchanged as time proceeds and the data generation process remains constant (Kingsley-Akpara,2014; Ishioro, 2016).

Order of integration Test: Phillips-Perron (PP)

The PP test is non-parametric test (the model does not emphasize the specification of the serial correlation equation of the Δy_t under the non-alternative hypothesis and an advancement over the Dickey and Fuller, and the Augmented Dickey Fuller (ADF) test as stated in Perron (1989, 1997), Ishioro (2017, 2020a, 2022a).This is stated as:

$$\Delta y_t = \Pi y_{t-1} + \sigma_i D_{t-i} + \varepsilon_t \quad (2)$$

In equation (2), D_{t-i} represents a deterministic trend of the unit root regression model while our hypothesis is tested using $\Pi = 0$.

Order of Integration Test: Kwiatkowski, Phillips, Schmidt and Shin (KPSS)

The main innovation and deviation of the KPSS test is in the correction of the bias of the other tests towards accepting the null hypothesis when they shouldn't (Kwiatkowski, Phillips, Schmidt, & Shin, 1992). In the context of the KPSS, the null hypothesis is assumed to be stationary, and the alternative hypothesis is conversely assumed to be non-stationary (Ishioro, 2022b, and 2022c). The model is stated as follows:

$$y_t = x_t + \varepsilon_t \quad (3)$$

But *x* is defined as:

$$x_t = x_{t-1} + \varepsilon_t \quad (4)$$

ε_t represents the pedestatal for testing the null hypothesis; and one of the basis for deriving the Lagrange Multiplier (LM) tests (Ishioro, 2017).

Functional Forms of the Vector Autoregressive Model

Two functional forms (equation (5) and (6)) were adopted in this study. The first functional form in which $OILPROD_g$ depends on the lagged values of GDP ($GDP_{t-1,\ldots,}GDP_{t-n}$) and OILPROD($OILPROD_{t-1,\ldots,}OILPROD_{t-n}$) implies that $OILPROD_g$ is determined by past values ($GDP_{t-1,\ldots,}GDP_{t-n}$) of GDP and own values ($OILPROD_{t-1,\ldots,}OILPROD_{t-n}$).

$$OILPRODg = f(GDP_{t-1}, GDP_{t-2}, GDP_{t-3}, \ldots, GDP_{t-n}, OILPROD_{t-1}, OILPROD_{t-2}, \ldots, OILPROD_{t-n}) \quad (5)$$

$$GDP = f(GDP_{t-1}, GDP_{t-2}, GDP_{t-3}, \ldots, GDP_{t-n}, OILPROD_{t-1}, OILPROD_{t-2}, \ldots, OILPROD_{t-n}) \quad (6)$$

The second functional form hypothesizes that GDP is a function of own past values ($GDP_{t-1,\ldots,}GDP_{t-n}$) and past values ($OILPROD_{t-1,\ldots,}OILPROD_{t-n}$) of OILPROD.

From the functional form, we specify our vector error correction as:

$$\Delta GDP_t = \theta_0 + \sum_{i=1}^{o} \kappa_i \Delta GDP_{t-i} + \sum_{i=1}^{p} \Phi_i \Delta OILPROD_{t-i} + \lambda_1 GDP_{t-1} + \lambda_2 OILPROD_{t-1} + \varepsilon_t \quad (7)$$

The null hypothesis of our model is : $\lambda_1 = \lambda_2 = 0$ which connotes the absence of long-run relationship in our model.

Granger Causality Tests

The implementation of the causality test (especially the Granger causality test) is based on the premise that either GDP and oil production or GDP and oil production (g) are cointegrated. This means that the causality model can be specified as in Tamba (2017).

$$\Delta GDP_t = \sum_{i=1}^{l} \omega_i \Delta GDP_{t-i} + \sum_{i=1}^{m} \beta_j \Delta OILPROD_{t-j} + u_{1t} \quad (8a)$$

$$\Delta OILPROD_t = \sum_{i=1}^{n} \varsigma_i \Delta OILPROD_{t-i} + \sum_{i=1}^{h} \Omega_j \Delta GDP_{t-j} + u_{2t} \quad (8b)$$

The bivariate equations expressed as equation (8a) and (8b) imply that the current values of the change in GDP(OILPROD) is related to the past values of own performance and the past values of the change in OILPROD (GDP).The null hypothesis is: ΔGDP does not Granger cause $\Delta OILPROD$.

DISCUSSION OF EMPIRICAL RESULTS

Table 3

Results of Unit Root Tests

	ADF Test		PP Test		KPSS Test	
Variable	**Level**	**1st Difference**	**Level**	**1st Difference**	**Level**	**1st Difference**
GDP_g	-6.395	-10.231	-6.346	-12.792	0.132	0.135
GDP	-0.999	-3.633	-0.339	-3.532	0.219	0.491
$OILPROD_g$	-7.841	-7.922	-8.923	-9.225	0.120	0.130

Source: Author's Computation

The three tests of unit root applied in this study provided insight into the unique characteristics of our series in terms of stationarity (and non-stationarity).

First, ADF at level shows that GDPg, GDP and OILPRODg are not stationary; that is, they possess unit roots at level. However, they became stationary at first difference.

Second, outcomes of the unit root regression of the PP indicated that the series GDPg, GDP and OILPRODg were not stationary at level but were at first difference akin to the ADF test. Conversely, using the KPSS as the unit root test, shows that the series were stationary at level.

Table 4

Results of VAR Selection Criteria [GDPg, OILPRODg]

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-90.855	NA*	0.233*	4.220*	4.301*	4.250*
1	-87.038	7.113	0.235	4.229	4.472	4.319
2	-85.316	3.053	0.261	4.332	4.738	4.482
3	-80.447	8.187	0.252	4.293	4.860	4.503
4	-79.184	2.009	0.287	4.417	5.147	4.688

Source: Author's Computation.

NOTE:*Lag are the various optimal lag lengths;LR is the modified sequential test statistic;FPE is the Final Prediction Error;AIC is the Akaike Information Criterion; SC represents Schwartz Information Criterion; and HQ is the Hannan-Quinn Information Criterion.*

The lag selection was based on the FPE, AIC, SC and the HQ criteria.Using FPE with a value of 0.233 against 0.235, 0.261, 0.252 and 0.287, the zero (0) lag was selected because it is the lag value that minimises the lag selection error.Using AIC selection criteria, it is 4.220 that minimises the lag selection error (against 4.229, 4.332,4.293,4.417) hence, the zero (0) lag was selected.

Table 5

Johansen Co-integration Test

Cointegration Rank Test (Trace) [GDPg , OILPRODg]				
Hypothesized No. of CE(s)	**Eigen-value**	**Trace Statistics**	**0.05 Critical value**	**Prob.**
None*	0.491	40.733	15.494	0.000
At most 1	0.188	3.841	9.591	0.200
Cointegration Rank Test (Maximal Eigen value) [GDPg , OILPRODg]				
Hypothesized No. of CE(s)	**Eigen-value**	**Trace Statistics**	**0.05 Critical value**	**Prob.**
None*	0.491	31.142	14.264	0.0001
At most 1	0.188	3.841	9.591	0.200
Cointegration Rank Test (Trace) [GDP , OILPRODg]				
Hypothesized No. of CE(s)	**Eigen-value**	**Trace Statistics**	**0.05 Critical value**	**Prob.**
None*	0.437	25.897	15.494	0.001
At most 1	1.64E-05	0.0007	3.841	0.979
Cointegration Rank Test (Maximal Eigen value) [GDP , OILPRODg]				
Hypothesized No. of CE(s)	**Eigen-value**	**Trace Statistics**	**0.05 Critical value**	**Prob.**
None*	0.437	25.896	14.264	0.000
At most 1	1.64E-05	0.0007	3.841	0.979

Source: Author's Computation

The results of the Johansen cointegration test (using both trace and maximal Eigen value statistics) presented in table (5) show that there exists a long-run relationship between GDPg and OILPRODg , and between GDP and OILPRODg as both staistics indicated one cointegrating equation.The existence of one cointegrating equation suggests that there must be at least a unidirectional causality between the variables (that is, either GDP (OILPRODg) *Granger causes* OILPRODg (GDP) or OILPRODg (GDPg) *Granger causes* GDPg (OILPRODg).The policy implication is that, formulating OILPRODg (GDPg) without considering GDP or GDPg (OILPRODg) will produce long-run sinister consequences for the causality-destination-recipient variable(s).

Result of Vector Autoregression Model [Estimates]

The results of the estimates of the vector autoregressive model displayed in table 6 is in three panels (panel one, two and three respectively).

Table 6

Result of Vector Autoregression Model [Estimates]

PANEL ONE			**PANEL TWO**			**PANEL THREE**		
Lags	**GDPg**	**$OILPROD_g$**	**Lags**	**GDPg**	**$OILPROD_g$**	**Lags**	**GDP**	**$OILPROD_g$**
GDPg(-1)	0.519	0.004	**OILPRODg(-**	5.952	-0.135	**GDP(-1)**	1.591	3.93E-07
	(0.191)	(0.004)	**1)**	(8.816)	(0.202)		(0.190)	(1.1E-06)
	[2.709]	[1.133]		[0.675]	[-0.668]		[8.348	[0.372]
GDPg(-2)	-0.025	-0.002	**OILPRODg(-**	5.952	-0.135	**GDP(-2)**	-0.504	-5.78E-07
	(0.196)	(0.004)	**2)**	(8.816)	(0.202)		(0.370)	(2.0E-06)
	[-0.127]	[-0.597]		[0.675]	[-0.668]		[-1.362]	[-0.281]

GDPg(-3)	0.359 (0.187) [1.918]	0.008 (0.004) [2.003]	**OILPRODg(-3)**	0.322 (7.535) [0.042]	-0.099 (0.173) [-0.573]	**GDP(-3)**	0.293 (0.384) [0.762]	2.21E-06 (2.1E-06) [-1.054]
GDPg(-4)	-0.182 (0.191) [-0.952]	0.002 (0.004) [0.482]	**OILPRODg(-4)**	-5.539 (7.587) [-0.730]	-0.380 (0.174) [-2.182]	**GDP(-4)**	-0.252 (0.388) [-0.651]	-2.26E-06 (1.4E-06) [-0.017]
GDPg(-5)	0.119 (0.193) [0.618]	-0.002 (0.004) [-0.476]	**OILPRODg(-5)**	-2.077 (7.509) [-0.276]	0.119 (0.172) [0.693]	**GDP(-5)**	-0.174 (0.260) [-0.669]	-2.48E-08 (1.4E-06) [-0.017]
GDPg(-6)	0.018 (0.188) [0.098]	-0.007 (0.004) [-1.829]	**OILPRODg(-6)**	1.651 (7.405) [0.222]	0.089 (0.170) [0.524]			
GDPg(-7)	-0.164 (0.193) [-0.849]	-0.006 (0.004) [-1.429]	**OILPRODg(-7)**	-5.061 (6.186) [-0.818]	0.120 (0.142) [0.084]			
Constant	1.585 (1.111) [1.426]	0.021 (0.025) [0.854]	**Constant**	1.585 (1.111) [1.426]	0.021 (0.025) [0.854]	**Constant**	15818.96 (8506.73) [1.859]	0.079 (0.047) [1.678]
R-Squared	0.545	0.435	**R-Squared**	0.545	0.435	**R-Squared**	0.996	0.246
Adj. R-Squared	0.300	0.131	**Adj. R-Squared**	0.300	0.131	**Adj. R-Squared**	0.995	0.210

Source: Author's Computation

NOTE:*Values presented in ( ) are standard errors while values presented in [ ] are t-statistic*

Panel one and two contain the results of the estimates with GDPg and OILPRODg as dependent variables while panel three used GDP and OILPRODg as dependent variables. The second, fourth and seventh previous periods growth rates of GDP has negative coefficients in relation to its contribution to the growth of OILPRODg.This implies that, two previous periods growth rates of GDP exerted negative impacts on current growth rate of OILPRODg in Nigeria: an exhibition of the existence of a negative retrospective impact.The negative but statistically insignificant impact implies a non-sustainable influence.However, it implies that the accumulation and sustainance of the growth achieved by GDP for the purpose of increasing the OILPROD in Nigeria is insignificantly detrimental and / or consequentially insignificant.

Furthermore, the results show a negative but statistically insignificant impact of the dependence of the growth rate of current OILPRODg- a validation of the " drill and drain " or "extract and export phenomenon". This further suggests that the growth of OILPRODg in the economy in the previous periods was sufficiently negative and insignificant.Also, it means that previous growth of oil production could become harmful for current growth of OILPRODg (behaviour of non-renewable resource).

Results of the Long-run Granger Causality Test

Table 7

Results of the Long-run Granger Causality Test

Null Hypothesis	Chi-sq.	d.f	Probability	Inference
GDPg does not Granger Cause OILPRODg	0.605	7	0.542	
OILPRODg does not Granger Cause GDPg	12.735	7	0.078***	Uni-Directional
GDP does not Granger Cause OILPRODg	0.319	7	0.737	
OILPRODg does not Granger Cause GDP	8.401	7	0.0014*	Uni-Directional

Source: Author's Computation.

The null hypothesis adopted for Granger causality test states that' GDPg (or GDP) does not Granger cause OILPRODg'. The results shown in table 7 indicated that using either GDP or GDPg as the dependent variable in the Granger causality test regression , GDPg (or GDP) does not Granger cause OILPRODg. Therefore we do not reject the null hypothesis. This means that, in the long-run GDPg (or GDP) does not Granger cause OILPRODg, suggesting that in the long-run, the growth rate of the GDPg (or GDP) does not increase the performance of the rate at which OILPRODg grows. Our results suggest that the Nigerian economy can grow without depending on oil production and its growth rates (GDPg, or GDP, does not determine oil production in Nigeria). Furthermore, the results suggest that the expansion of GDPg or GDP has no significant consequences for OILPRODg; implying that the two phenomena are mutually exclusive and independent of each other. This validates the fact that the impacts of the GDPg or GDP has not been experienced in the oil sector in general (in consonance with Ishioro, 2020a), and does not affect OILPRODg (implying that the long- run GDPg has not significantly reflected in the current performance of OILPRODg).

However, OILPRODg *Granger caused* GDPg as well as GDP, suggesting that as OILPRODg increases and/or expands in the long-run, and the multiplier effects of its impact significantly flows into the economy thereby increasing GDPg and the GDP (national output).This seems to confirm the fact that both GDPg and GDP in Nigeria are OILPRODg-dependent. The economy of Nigeria has been adjudged as oil production-dependent economy, this further suggests that distortions in OILPRODg would 'ripple' such distortions to both GDPg and GDP. Furthermore, the results point to the fact that OILPRODg is a determinant of the performance (negative or positive) of both GDPg and GDP. This affirms the impact of the increase in oil production and its attendant windfalls on the performance of the economy. Nigeria has experienced oil booms from OPEC's increased production quota that have translated into growth-enhancing performance over the years. Finally, a reduction in OILPRODg without adopting suitable policy measures could have negative impacts on Nigeria's economic growth in the long run.

Discussion of Results

The findings confirmed that previous periods' output (GDP) has a negative impact on OILPRODg, implying that OILPROD in Nigeria is negatively and GDP-driven. Furthermore, it means that GDP of previous periods do not encourage continuous growth of oil production. It also means that GDP is oil-exhausting, that is, as GDP expands OILPRODg reduces overtime. This suggests ' a drill and drain OILPRODg-GDP relationship'. The GDP in Nigeria is mainly oil-dependent and oil-depleting as a major percentage of GDP is contributed by oil. Therefore, our results indicate that the expansion of GDP is a drag on oil production. In the long run, integrating oil production into GDP management and GDP performance in oil production will be a correct strategic economic and resource management step, that is, improve policy integration frameworks to redirect oil production and its expansion for economic growth and integrate oil production into economy-wide and sector-specific development plans, thereby encouraging the use of local oil resources.

CONCLUSION

The study examined the contributions of oil production and its growth to the dynamics of the GDP and its growth in Nigeria. Three (3) very important variables were introduced into the

econometric model and procedure and analyzed: GDP, GDPg, and OILPRODg. The study covered the period from 1980 to 2021, using the economy of Nigeria and the oil sector as the focal point. Multiple estimation techniques were adopted and applied in the modelling process. Our findings show that, in Nigeria, GDP expands at the expense of oil production, as it imposes a drag on it with prolonged retrospective and oil-depleting effects. There is also confirmation of the existence of a long-term co-variation, co-change, and co-movement between the two. We recommend the delinking of OILPROD from GDP and a redirection of OILPROD and OILPRODg for economy-wide sustainable gain.

References

Adams, S.O., & Bello, J.O. (2022). Modelling the effects of crude oil production and other factors on Nigeria's economy: an autoregressive distributed lag approach. *Science Archives*, *3*(1), 72-79.

Al-Jarri, A.S., & Startzman, R.A. (1997). Analysis of world crude oil production trends. In: Presented at the SPE Hydrocarbon Economics and Evaluation Symposium, 16–18 March, Dallas, Texas. Society of Petroleum Engineers. SPE 37962. http://dx.doi.org/10.2118/37962-MS.

Anyanwu, J.C., Oyefusi, A., Oaikhenan, H., & Dimowo, F.A. (1997).*The Structure of the Nigerian Economy (1960-1997).*Onitsha, Joanee Educational Publishers

CBN[Central Bank of Nigeria](2010).*Changing Structure of the Nigerian Economy*. A Publication of the CBN.

CBN [Central Bank of Nigeria](2022). Statistical Bulletin (Online Version).

CIA (2022) CIA 2022 World Fact Book.

Dagoumas, A., Perifanis, T., & Polemis, M.(2018). An Econometric Analysis of the Saudi Arabia's Crude Oil Strategy. *Resources Policy*, *58*, 265-273. https://doi.org/10.1016/j.resourplo.2018.013

Hallack, L.N., Szklo, A.S., & Junior, A.O. (2017) Curve-fitting Variants to Model Brazil's Crude Oil Offshore Post-Salt Production. *Journal of Petroleum Science and Engineering*, *159*, 230-243

ICCT[International Council on Clean Transportation](2011). An introduction to petroleum refining and the production of ultra low sulfur gasoline and diesel fuel. *A Publication of Energy Economics Applied Optimization.*

Ishioro, B. O. (2022a) Dynamic Effects of Health Expenditure Shocks on HIV Prevalence in sub-Saharan Africa. *Journal of Academic Research in Economics***,** *14*(3), 23.November.

Ishioro, B. O. (2022b). Deposit Money Bank-based Financial Inclusion and Economic Growth in Nigeria: The Role of a Dual Folded Proxy. *Gusau International Journal of Management and Social Sciences*,*5*(3), 1-23.

Ishioro, B. O. (2022c). Unit root and stationarity tests in expenditure on health and economic growth series: maximizing the power of breakpoints. *Himalayan Journal of Community Medicine and Public Health, 3*(6), 14-21.

Ishioro, B. O. (2020a). Crude oil and economic growth in nigeria: a simplified pair-wise causality test. *Journal of Academic Research in Economics***,** *12*(2), 224-246.

Ishioro, B. O. (2020b).Financial market inclusion, shadow economy and economic growth paradigm: a less developed country perspective. *Scientific Papers of the University of Pardubice, Series D,* Vol. XXVIII: No.1/ 2020, 67-78

Ishioro, B. O. (2019). Energy consumption and economic growth in nigeria: an augmented neoclassical growth model perspective. *Journal of Environmental Management and Tourism, X*(39), 1637-1657:Winter

Ishioro, B.O. (2018). Energy consumption and performance of sectoral outputs: evidence from an energy-impoverished economy, *Journal of Environmental Management and Tourism, IX, Winter, 7*(31), 1539-1558.

Ishioro, B.O. (2017) Banking sector reforms and economic growth: recent evidence from a reform-bound economy. *Binus Business Review, 8*(1), 46-60

Ishioro, B.O. (2016). HIV/AIDS and macroeconomic performance :empirical evidence from Kenya. *Scientific Papers of the University of Pardubice, Series D,XXIII*(36), 102-117.

Ishioro, B.O. (2015a). Intertemporal optimization of the consumption of petroleum stock: empirical evidence from Nigeria. *Journal of Academic Research in Economics, 7*(2), 232-255.

Ishioro, B.O. (2015b). The long-run relationship between foreign reserves inflows and domestic credit: evidence from a small open economy, *Oeconomica, 11*(2), 18-41.

Ishioro, B.O. (2015c) Causal Relationship among Economic Growth, Finance, Exchange Rate and Investment in Nigeria. *Journal of Arts and Social Sciences, 3*(2), 1-21.

Kingsley-Akpara, C. (2014). Modelling crude oil production outlook:a case study of the oil and gas industry in Nigeria, *Selected Papers for the Society of Petroleum Engineers (SPE),*Annual International Conference and Exhibition held in Lagos, Nigeria (SPE-172381-MS)

Krane, J. (2017).Beyond 12.5:the implications of an increase in Saudi crude oil production. *Energy Policy, 110*, 542-547

Kwiatkowski, D., Phillips, P.C.B., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root: how sure are we that economic time series have a unit root? *Journal of Econometrics, 54*, 159-178.

Maples, R.E. (2000) *Petroleum Refinery Process Economics* (2nd Edition), Pennwell Corp.

NNPC (1997). Statistical Bulletin (Published by the Nigerian National Petroleum Corporation)

NNPC (2012). Statistical Bulletin (Published by the Nigerian National Petroleum Corporation)

OPEC (2022). Annual Statistical Bulletin(Published by the Organization for Petroleum Exporting Countries)

Orji, A., Nwagu, G.U.,Ogbuabor, J.E., Nwosu, E.,& Anthony-Orji, O.I.(2019) Empirical analysis of the nexus between crude oil price volatility and selected economic sectors in Nigeria. *Institutions and Economies, 11*(4), 135-156.

Orubu,C.O.(2003).The development and contributions of the petroleum industry to the Nigerian Economy in Iyoha, M.A. and Itsede, C.O.(eds) *Nigerian Economy: Structure, Growth and Development*.

Parkash, S. (2003).*Refining Processes Handbook*. Gulf Professional Publishing.

Perron, P. (1989).The great Crash, the oil price shock, and the Unit root hypothesis. *Econometrica, 57*, 1361-1401.

Perron, P. (1997). Further evidence of breaking trend functions in Macroeconomic variables. *Journal of Econometrics, 80*, 355-385.

Reynolds, D.B. (2014).World oil production trend: comparing Hubbert multi-cycle curves. *Ecological Economics*, 62–71. http://dx.doi.org/10.1016/j.ecolecon.2013.12.016

Tamba, J.G. (2017).Crude Oil Production and Economic Growth: Evidence from Cameroon. *Energy Sources. Part B Economics, Planning and Policy*,*12*(3), 1-7.