

OIL PRODUCTION AND THE NIGERIAN ECONOMY: AN ANALYSIS OF THE CONTRACTUAL ARRANGEMENTS

Gabriel Efe Otolorin¹, Nsudoh Samuel Nsudo², Christopher N Ekong³ and
Ettah Bassey Essien⁴

¹Gabriel Efe Otolorin is a Ph.D Student, Department of Economics, University of Uyo

²Nsudoh Samuel Nsudo is a Ph.D Student, Department of Economics, University of Uyo

³Christopher N Ekong is a Professor of Economics, Department of Economics, University of Uyo, Uyo, Nigeria

⁴Ettah Bassey Essien is an Associate Professor of Economics, Department of Economics,
University of Uyo, Uyo, Nigeria. E-mail: gabrielotolorin@yaboo.com

Article History

Received : 23 April 2022

Revised : 11 May 2022

Accepted : 25 May 2022

Published : 19 June 2022

To cite this article

Gabriel Efe Otolorin, Nsudoh Samuel Nsudo, Christopher N Ekong and Ettah Bassey Essien (2022). Oil Production and the Nigerian Economy: An Analysis of the Contractual

Arrangements. *Journal of Applied Financial Econometrics*, Vol. 3, No. 1, pp. 79-96. <https://DOI: 10.47509/JAFE.2022.v03i01.05>

Abstract: This paper is an assessment of the crude oil contractual arrangement in Nigeria. Following the ambiguity and secrecy surrounding the contractual arrangement in Nigeria as well as the call by researchers to shift away from joint venture agreement to production sharing contract, the study employed monthly time series data for the period 2017 – 2020 to search if there is a need to move away as well as possibility of seasonality in crude oil production by contractual arrangement and to determine the relationship between oil price, oil revenue and the contractual arrangement based on crude oil production. The empirical results clearly show a uni-causal relationship between exchange rate and JV as well as oil price and JV. The study also showed evidence of causality between PSC and exchange rate, as well as PSC and Oil Price. Which signifies changes in exchange rate and oil price granger causes changes in crude oil production by PSC and JV. The study also revealed that there is seasonality in production in the month of July and August which may have resulted to higher gross oil revenue noticeable in the third quarter. The study also discovers the likelihood for production and revenue to be lower in the first half of the year and higher in the second half of the year cumulatively. The study recommends that rather than shifting away from JV to PSC, the federal government should continue with all the contractual arrangement since they have their individual peculiarities but concerted effort should be made to encourage indigenous contract arrangement as already springboard through the marginal field. Also, the government should pay close attention going forward on the seasonal patterns as such information can be used for planning as there is the likelihood of FAAC to be higher or lower within the period identified in the study.

Keywords: Contractual agreement, service contract, Marginal Field

JEL: Classification: C22, J48, K12, Q43

INTRODUCTION

Petroleum exploration in developing countries has been controlled by international oil companies (IIOCs) rather than the developing host countries themselves since the dawn of the modern petroleum industry, because the latter lacked the capital and expertise required for resource extraction. As noted by Aigboduwa and. Oisamoje, (2013), this situation has remained largely unchanged. This is due to an inadequate legal and regulatory framework for effectively regulating and monitoring the oil and gas industry, local banks' inability to finance long-term capital-intensive projects, a difficult operating environment, a lack of technological expertise, financial institutions' perception of IIOCs as posing a high risk, insufficient information about the petroleum sector, and a lack of credible institutions. All of these factors among others work against local participation, investment, and profit repatriation in Nigeria's oil and gas sector.

Following the challenge bedeviling local participation especially in the area of technology Nigeria, just like other developing nations in order to maximally explore and produce the oil and gas she is rich in has entered into contracts with different international oil companies. According to National Petroleum Investment and Management Services [NAPIMS] (2022), there are four basic types of petroleum arrangements in the Nigerian oil and gas industry. Joint Operating Agreement (JOA), Production Sharing Contract (PSC), Service Contract (SC), and Memorandum of Understanding (MOU) are all part of the Petroleum Arrangement. This agreement protects the contractual framework within which the Nigerian National Petroleum Corporation, acting on behalf of the Nigerian government, and multinational oil firms conduct petroleum operations in the country.

The Nigerian government has recently made a concentrated effort to stimulate indigenous participation, which is closely observed in a number of initiatives, including the licensing of marginal fields to Nigerians, the enactment of the Nigerian Oil and Gas Industry Local Content Development Act in 2010, the leasing of oil blocks to IIOCs, and the passage of the Petroleum Industry Bill (PIB) into law. However, these initiatives have not yielded the predicted significant results. Indigenous participation has improved to some level, although financing IIOCs remains a challenge. This is partly due to the inability of Nigerians to understand the rules that govern petroleum developments due to contract secrecy. Nigerian government officials have negotiated a complex web of agreements that only a few individuals comprehend, exposing the country to situations where inefficiency and corruption lead to major leakages from government coffers (NEITI, 2014).

The rules that regulate petroleum projects in Nigeria are found in a variety of official documents such as the constitution, legislation, regulations, and contracts. However, while the constitution and laws are open to the public, petroleum contracts and certain rules are not. Relevant stakeholders cannot decide whether the government or a firm is behaving in accordance with their obligations without access to the rules

contained in these documents. Many government employees and legislators, for example, are unable to access contracts, which may make it difficult for them to comprehend rules that are important to their tasks.

According to the Nigerian Tribune (2017), public disclosure of contracts may reveal fiscal irregularities, such as undercharged royalty rates for deep offshore oil and gas production in Nigeria. Due to the non-implementation of the 1993 Production Sharing Contract (PSC) provisions that allow royalty payments under the Deep Offshore Act, the country lost an estimated USD 60 billion in royalty payments and about USD 2 billion in additional government revenue.

Lack of clarity in the contractual arrangement and observed loss in revenue due to negligence have resulted to many scholars currently x-raying the oil and gas sector with the intension to better understand the operationality. Ogunleye (2005), Aniche (2014), Sani , Hamidu and Abubakar (2014) are among the selected few who have carried out scholarly work in trying to examine Production Sharing Contract Arrangements in the Nigerian Petroleum Industry and Optimum Petroleum Contractual Arrangement for the Exploitation of Nigeria Oil and Gas.

More so, there have been calls in recent time for Nigeria to shift towards PSC, forgetting that a shift from one contractual arrangement or total shift to a new contractual arrangement to another may affect the oil revenue accruing to the country and the investment of the foreign oil companies. It is on this premise that the researcher is poised to determine the direction and strength of relationship between oil revenue and crude oil production by contractual arrangement with a view of ascertaining the optimal arrangement, the causal relationship between oil price and the contractual arrangement as well as the relationship between exchange rate and crude oil production by contractual arrangement and finally explore the possibility of seasonal patterns in crude oil production and invariably revenue in Nigeria. This work is significant because apart from understanding the contractual arrangement in the petroleum sector, it also look at the optimal contractual arrangement and check for the possibility of monthly seasonality in the production. This is the focus of this paper. The paper has five sections. Following the introduction is section 2, focuses on reviews of previous literature. Section 3 highlight the methodology. In section 4, we analyse the data, interpret the results and discuss the findings. Conclusions and policy options are in section 5.

LITERATURE REVIEW

Production Sharing Contract (PSC)

According to Oyedele (2019), a Production Sharing Contract (PSC) is a contractual arrangement for the exploration and production of petroleum resources in which the contractor assumes all financial, technical, and operational risks associated with the

petroleum operation in exchange for a share of the profit oil after royalty, cost, and tax oil have been paid.

The system was implemented during the 1991 licensing round, and the PSC Act went into force on January 1, 1993. At the time, the price of a barrel of oil was roughly US\$13. Certain incentives were thought to be important to attract deep offshore activities, which involve major expenditure and technology. The unique incentive program comprises the following:

- i) longer duration of oil prospecting licenses
- ii) reduction in the petroleum profit tax rate
- iii) investment tax credit or investment tax allowance
- iv) lower royalty regime

Section 16 of the PSC Act provides for the incentives to be reviewed where the price of oil exceeds US\$20 per barrel or in any event after 15 years from inception and every 5 years thereafter. Therefore, the new amendment now introduces the following key changes:

- i) Field based royalty rates of 10% for deep offshore (>200m water depth) and 7.5% for frontier/inland basin operation
- ii) Introduction of incremental royalty rate based on the price of oil
- iii) Periodic review of the PSC arrangement every 8 years
- iv) Significant penalty for offences including imprisonment

Joint Venture Contractual Arrangement

Joint Venture is a contractual arrangement in which the host Government enters into a partnership with the International Oil companies to explore and exploit Oil and Gas together and share the cost and benefits together at agreed terms. According to Garrick (2013), Joint operating arrangement was first executed in Nigeria in 1971. In Nigeria, the interest of the Government is represented by the NNPC which usually owns 60% interest of the joint Venture.

The Joint Venture Contract comes in as a common mode of doing international oil business. The Joint Venture Contract (JVC) has an additional combination structure that makes the partnership more effective and creates a more balanced atmosphere between the parties; which we will approach as balance of interests between the parties and its mechanism specifically in this academic work in later chapters. Moreover, it has been claimed that in comparison with a concession contract and production sharing contract, the Joint Venture Contract provides the host state greater control over the petroleum projects (Cotula, 2010). Although the financial and technical aspects are necessities in a petroleum project, spreading and minimizing the various risks (geological, technical, development, environmental, and political risk) attached to a petroleum operation are also reasonable motives to adopt Joint Venture Contracts (Taverne, 2008).

Under this type of contract the host state or (its National Oil Company) and the international oil company share the equity and instalments in joint operations to explore, develop and produce petroleum resources (Nations, *Alternative Arrangements for Petroleum Development: A Guide Government Policy-makers and Negotiators*, 1982). The parties are sharing the risks, costs, production and profits, in pursuant to the terms specified in the Joint venture contract (Nations, *Alternative Arrangements for Petroleum Development: A Guide Government Policy-makers and Negotiators*, 1982). A Joint Venture Contract creates a partnership arrangement, in which both parties interests somehow are balanced by jointly bearing the rights and obligations in the petroleum operations. The host country must be able to participate in the petroleum operations and bear the costs and risks, in case the commercial discovery fails the host state becomes subject to losses, which is not the case under the Concession and Production Sharing Contracts (Cotula, 2010).

Marginal Field

Marginal Fields is a financing arrangement in the oil industry. Its development is an offshoot of Federal Government policy to kick start indigenous participation in the upstream sector of the petroleum industry. The government sought to achieve this objective by ensuring the farm out of marginal fields within the concessions of the major multinational Oil operators to the indigenous operators. Despite this laudable policy of the Federal Government, the success of the indigenous players' incursion into the upstream sector could be said to be very 'marginal' as not many have made appreciable progress with their farmed-out concessions. This may be because the financial demands of oil exploration and production are extremely high and the funding capacity of the indigenous marginal field owner is very low. A marginal field is an oil field that may be unattractive for development due to technical, economic or strategic reasons. Huge reservoir of marginal oil fields exists in Nigeria conservatively estimated to contain over 2.3 billion barrels of Stock Tank Oil Initially in Place (STOIIP) spread over 183 fields (Otombosoba, 2018).

These fields are discoveries located in the acreages operated by International Oil Companies (IOCs) and had remained undeveloped due to better investment options. In 2001, the government launched marginal fields programme and invited bids from indigenous companies for the 24 out of the 116 identified fields. Twenty-four (24) of the identified 116 marginal fields were awarded to 30 indigenous companies in an openly contested bid round in 2003. After the deal was finally formalized with the oil majors in 2004, it is disheartening to know that the status of the majority of these fields has not changed from the undeveloped state. To date only twelve oil fields have come on stream or are under development and anticipated production have not been realized, leading to loss in revenue for the government (Otombosoba, 2018). For current operators, the biggest barriers to success are a lack of local finance or inadequate technical expertise.

These limitations being faced by marginal operators mostly arise because of improper planning for field development. An important aspect of any field development planning exercise is inherent in adequately quantifying risks and uncertainty, particularly when information availability is limited. For marginal fields, accurate evaluation of the project downside becomes even more crucial, as different development options carry a substantial probability of negative net-present-value and project economic viability relies on oil field risk minimization.

Service Contract

Where a state lacks technological capabilities to exploit its crude oil, it may contract IOC to provide highly technical E&P services in return for payment of a pre-determined fee. This arrangement is referred to as Service Contracts. Here, the IOC undertakes to explore for petro carbons at its own risk and expense on behalf of the NOC and by which it is reimbursed and remunerated in cash depending on the success of the exploration (Guirauden, 2004). Oil and Gas Service Contracts have three subsets as well, the first type of contracts are the Pure service contracts and the others are Risk Service Contracts and Technical Assistance Contracts.

Pure Service Contracts: Pure service contracts or Oilfield Service contracts are agreements or contracts for the facility of specific oilfield services, for instance, the most common types of pure service agreements are seismic contracts, drilling contracts, well services contracts, master services agreements, design and construction contracts, and procurement contracts. Under this arrangement, the host Government provides capital for exploration and production of resources and the contractor merely performs its predetermined agreed services and in return, is paid a flat fee for the services performed, whether or not there is discovery. These types of contracts prove to be very beneficial for the oil-producing countries having high petroleum deposits.

Risk Service Contracts: Risk service contracts include a more comprehensive scope of services than the pure service contracts and these contracts actually represent the evolution of the service contracts from concession and PSA models. Herein, a host nation contracts with an oil company to explore and further develop its resources. The Company in this service contracts model, undertakes all managerial and technical tasks and bears all the financial and operational risks, in consideration for a prescribed fee rather than the share of profits earned or any interests or stake in the resources developed or services performed. Also, risk service contracts do not provide any guarantee regarding payment of fees for those situations where oil is not discovered or produced, unlike it was in the case of Pure service contracts. Rather, if the exploration results in no discovery, then without any doubt, the contractor or oil company will not be paid at all.

Technical Assistance Contracts: Technical Assistance Contracts are often described as the modern upgraded form of Pure service contracts. Here, the contractor or the

Oil company, not only provides exploration and production services but also transfers the requisite technology, technical services and also provides their own staff for running the project to the host nation. The host country is entirely responsible for the financing of the project. This type of contract appears closest to an international public-private partnership, in which the host Government has the maximum negotiating power (Swara and Baviskar, 2021).

Theoretical Framework: Resource Curse Theory

Evidence of Dutch disease has been identified in almost all countries where petroleum exports play a major economic role (Corden, 1982; Corden and Neary, 1982). However, it cannot explain why there is no tendency towards changing policies, even when these policies led to a drastic decline in production and employment. These surprisingly unsuccessful outcomes cannot be fully understood separate from institutional development. Many empirical studies have approved this idea that combined economic and political factors cause natural resource wealth to become a curse (Karl, 1997; Auty, 2001 and 2004; Humphreys et al., 2007).

In 1993 Richard Auty created the term “Resource Curse” and argued that Dutch Disease is not the only reason for poor performance of oil rich countries. Weak institutions, corruption, rent seeking, and wrong policy making of government have more negative effects than Dutch Disease in these countries (Bulte and Wick, 2006). Dependence on oil shapes social classes, regime types, institutions, the framework for decision-making, and the decision calculus of policymakers (Karl, 1997). The experiences of the past four decades show that oil wealth negatively affects the quality of institutions, and institutional quality is in turn an important determinant of economic growth. Various oil exporters such as Venezuela, Iran, Nigeria, Algeria and Indonesia demonstrate striking similarities in macroeconomic performance. Auty (2001) argues that resource-rich countries, especially oil exporters, tend to be dominated by factional and predatory oligarchic politics and suffer from policies that postpone the transition to competitive industrialization and diversification of the economy. Political fragmentation, recurring conflicts, and authoritarian rule hamper the development of democratic institutions and remain major obstacles to economic reform. Ross (2001) states that growth failures are the outcome of strong associations between resource wealth and the likelihood of weak democratic development. In most oil exporting countries political parties are often weak and formed around charismatic leaders while military intervention in politics are common and political support derives from systems of patronage. Mehlum et al. (2006) found that oil revenues hinder growth in countries with weak legal and political institutions. For a given increase in resource rents, this negative effect is more likely to offset the positive effect of the resource boom.

Empirical Literature

AUTHORS	TOPIC	METHODOLOGY	FINDINGS / RECOMMENDATIONS
Ogunleye (2005)	Legal Analysis of Production Sharing Contract Arrangements in the Nigerian Petroleum Industry.	Content review.	Production sharing formula had taken prominence in the Nigerian Oil sector which has taken more than 30% of the total contract model in Nigeria. The researcher concluded that Production Sharing Contract arrangement is a better option for development of the offshore oil reserves as it relieved the Government incurring any financial burden that is associated with joint venture arrangement.
Aniche (2014)	Oil Joint Venture partnerships and Nigerian economy".	Content review.	Oil joint venture partnerships which Nigerian government entered into with the international oil companies represented by the NNPC have been hampered by shortfalls and delays in meeting cash call obligations by government which lead to cuts in the oil operations and substantial reductions in oil production and shortfalls in projections which in turn result in significant reductions in oil revenue and shortfalls in oil revenue projections.
Sani , Hamidu and Abubakar (2014)	Production Sharing or Joint Venturing: What Is the Optimum Petroleum Contractual Arrangement for the Exploitation of Nigeria Oil and Gas	Contractual elements, pattern-matching and content analysis were used as the main techniques for data analysis.	The results of the study have proved Joint Venture to be optimal in terms of economic rent, while PSC was found optimal in terms of accountability and transparency. On the overall, the results proved Joint Venture as optimal for the stakeholders in the Nigerian oil and gas industry.
Daria, Goran and Vladislav (2017)	The Mining-Geology-Petroleum Engineering	Content Review.	They posited that any choice of contractual arrangement must minimize the risk for the both parties involved and maximize the state's share during the exploitation phase. For the companies, it has to be attractive enough to balance risks during the exploration phase with profits gained during the exploitation phase.
Madaki (2006)	A shift from joint operating agreements to production sharing contracts in the Nigerian oil industry	Content review	He concluded that the shift in contractual structure from JVAs to PSCs has the potential of opening up the industry to new players and creating the necessary environment for existing players to expand their operations without the hindrance hitherto posed by the JVA arrangements. This should also witness a huge inflow of Foreign Direct Investments into the Nigerian economy. He recommended that the Nigerian government and the foreign oil companies must maintain the long-term view of their relationship and create win-win situations, which eschew mutual suspicion.
Okwanduand and Agundu (2005)	Multinational Companies and Joint Venture Investment Management Strategy	Survey research design was used. Data analysis mainly involved in the application of chi-square (x2) statistical technique,	They asserted that JVA option was considered the best alternative strategy for optimizing Nigeria's oil returns and indigent capacity buildings, since April 1971. Their study, however, indicated that the JVA has made marginal contributions towards indigent executive/operative capacity building.

Agbede (2018)	Oil Revenue and Output Growth in Nigeria	Using Beghebo and Atima model with little modification, the study employed the fully modified ordinary least squared method (FMOLS) to examine the relationship.	Oil revenue does not have short run impact on the economic activities of Nigeria. However, the long run impact of this policy gave a sterling story, as it was revealed that the persistence rise in oil revenue will ultimately lead to future economic growth of the country. He, however recommended that the government should effectively and efficiently utilize the oil fund into strategic developmental projects so as reduce the rate of poverty and facilitate output growth.
Onyi-Ogelle (2016)	Contractual Arrangements in the Nigeria's Oil Industry	Content review.	It discovers the problems with the application of the contracts considering the political background of the developed nations vis-à-vis Nigeria's yet to be developed background, and made recommendations on the way forward. This paper concludes that with the application of the contractual arrangements as amended and the recommendations hereto, Nigeria's richness in oil and gas will be evidenced in their control of the oil industry with resultant increase in revenue and foreign earnings.
Ogbonna, and Ebimobowei, (2012)	"Impact of Petroleum Revenue and the Economy of Nigeria"	The data collected were analysed using Pearson product correlation coefficient, Ordinary Least Square Regression and descriptive statistics.	The results of the analysis suggests that petroleum revenue affects the gross domestic product and per capital income of Nigeria positively. However, the relationship between petroleum revenue and inflation rate was negative. Therefore, the research conclude that the revenue generated from petroleum exploration in Nigeria contributes to the gross domestic product and per capita income, hence proper management and utilization to achieve long run growth and development of the country..

Gap in the Literature

From the foregoing, we infer that much have not being done in the area of contractual arrangement. The work of Ogunleye (2005) was on Legal Analysis of Production Sharing Contract Arrangements in the Nigerian Petroleum Industry while that of Aniche (2014) on Oil Joint Venture partnerships and Nigerian economy both used content analysis. Also, Sani , Hamidu and Abubakar (2014) in determining the Optimum Petroleum Contractual Arrangement for the Exploitation of Nigeria Oil also employed content analysis. A departure is seen in the work of Okwandu and and Agundu (2005) who applied chi-square (χ^2) on his Survey data in his study of Multinational Companies and Joint Venture Investment Management Strategy.

However, very few study have employed timeseries analysis in their study of the contractual arrangement. This study therefore employs timeseries data in determining the direction and strength of relationship between oil revenue and crude oil production by contractual arrangement with a view of ascertaining the optimal arrangement, as well as the causal relationship between oil price and production by contractual arrangement and finally explore the possibility of seasonal patterns in crude oil production and invariably revenue in Nigeria.

METHODOLOGY

In the literature, it is clear that the oil revenue is very key to the Nigeria economy and that the magnitude of oil revenue in a given month is closely tied to the crude oil production. Earlier works have been done to determine which among joint venture and production sharing contract is optimal for exploitation, while few study have been done on legal analysis of production sharing contract arrangements in the Petroleum Industry but the possibility of seasonality affecting oil production, and relationship among oil price, oil revenue and the contractual arrangement crude oil production have been left unexploited. This study adopts the ex-post facto research design and inductive approach also known in induction reasoning, Inductive approach starts from collecting data to explore a phenomenon and generate or build theory (Saunders, Lewis and Thornhill, 2016). The step of inductive approach is “involves the search for pattern from observation and the development of explanations – theories – for those patterns through series of hypotheses” (Bryman and Bell, 2011).

The ex-post facto research design is also adopted given the fact that the study is aimed at using previously collected (secondary) data to measure the relationship that subsist between variables. Hence, the study employs the Pairwise Granger Causality Tests, cross correlational analysis and other descriptive means to achieve the set objective.

The causal relationship between oil price and the contractual arrangement as well as the relationship between exchange rate and crude oil production by contractual arrangement was examined. Here, we seek to know if exchange rate and oil price granger causes crude oil production by contractual arrangement and determines the direction of causality. The Granger causality method to determine this relational direction is specified according to Granger (1988).

$$\Delta OILPRICE_t = a_i + \sum_{i=1}^n \beta_{\Delta} PSC_{t-1} + \sum_{i=j}^n \beta_{\Delta} OILPRICE_{t-i} + \mu_{1t} \quad (3.1)$$

$$\Delta PSC_t = a_i + \sum_{i=1}^n \varphi_{\Delta} OILPRICE_{t-1} + \sum_{i=j}^n \varphi_{\Delta} PSC_{t-i} + \mu_{2t} \quad (3.2)$$

$$\Delta OILPRICE_t = b_i + \sum_{i=1}^n \omega_{\Delta} MARFIELD_{t-1} + \sum_{i=j}^n \omega_{\Delta} OILPRICE_{t-i} + \mu_{3t} \quad (3.3)$$

$$\Delta MARFIELD_t = b_i + \sum_{i=1}^n \infty_{\Delta} OILPRICE_{t-1} + \sum_{i=j}^n \infty_{\Delta} MARFIELD_{t-i} + \mu_{4t} \quad (3.4)$$

$$\Delta \text{OILPRICE}_t = c_i + \sum_{i=1}^n \pi_{\Delta} SC_{t-1} + \sum_{i=j}^n \tau_{\Delta} \text{OILPRICE}_{t-i} + \mu_{5t} \quad (3.5)$$

$$\Delta SC_t = c_i + \sum_{i=1}^n v_{\Delta} \text{OILPRICE}_{t-1} + \sum_{i=j}^n v_{\Delta} SC_{t-i} + \mu_{6t} \quad (3.6)$$

$$\Delta \text{OILPRICE}_t = d_i + \sum_{i=1}^n \phi_{\Delta} JV_{1t-j} + \sum_{i=j}^n \phi_{\Delta} \text{OILPRICE}_{t-i} + \mu_{7t} \quad (3.7)$$

$$\Delta JV_t = d_i + \sum_{i=1}^n \phi_{\Delta} \text{OILPRICE}_{t-1} + \sum_{i=j}^n \alpha_{\Delta} JV_{t-i} + \mu_{8t} \quad (3.8)$$

The causal relationship between exchange rate and crude oil production by contractual arrangement was also examined using similar equations as stated in equation 3.1 to 3.8.

Where,

- JV_t = Joint venture Agreement (Crude oil production [barrels])
- PSC_t = Production Sharing Contract. (Crude oil production [barrels])
- SC_t = Service Contract (SC) (Crude oil production [barrels])
- MARFIELD = Marginal Field (Crude oil production [barrels])
- OILPRICE = Oil Price
- EXCHR = Exchange rate
- Δ = first difference operator
- α_p, b_p, c_p, d_i = constants
- $\beta, \phi, \theta, \alpha, \omega, \theta$ = the coefficients,
- μ_{1t} to μ_{8t} = the eight uncorrelated white noise error terms
- n = maximum number of lags

Consequently, according to Gujarati (2009) there are three possible outcomes in any granger causality test:

- i) Unidirectional Causality: This occurs when the relation of cause and effect runs from one direction alone. From either the dependent to independent variable or vice versa but not both ways.
- ii) Bi-Causality: This applies when the relation of cause and effect runs both ways. It means that the dependent and the independent variables are statistically significant and the cause-and-effect relationship is both ways.

- iii) Independent Causality: This situation arises when the lead variable and the explanatory variables are not statistically significant in the regressions. It means that neither the dependent variable nor explanatory variables “Granger cause” the other

Description of Data and Sources

In order to check the causal relationship between exchange rate and crude oil production by contractual arrangement as well as oil price and crude oil production by contractual arrangement, with focus on the Nigerian economy, monthly gross oil revenue (oilrev), average monthly oil price (oilprice), average monthly exchange rate (EXCHR), inflation rate (INFLATION) were extracted from Quarterly CBN Bulletin (2021), while Joint venture Agreement (Crude oil production [barrels]) (JV), Production Sharing Contract. (Crude oil production [barrels]) (PSC), Service Contract (Crude oil production [barrels]) (SC), Marginal Field (Crude oil production [barrels]) (MARFIELD) were extracted from NNPC Annual Statistical Bulletin (ASB, 2021).

Analytical Technique

In order to make statistical meaning from the data and achieve the objectives of the study, the study shall employ Pairwise Granger Causality Tests to In order to check the causal relationship between exchange rate and crude oil production by contractual arrangement as well as oil price and crude oil production by contractual arrangement, Pearson correlation analysis to determine the direction and strength of relationship between oil revenue and crude oil production by contractual arrangement while descriptive means was used to explore the possibility of seasonal patterns in crude oil production and revenue.

4. DATA ANALYSIS AND RESULTS

This section presents the analysis as well as the interpretation. The procedure for estimation involves the Pairwise Panel Causality Tests and Pearson correlation.

The Pairwise Panel Causality Tests was carried out to ascertain the causal relationship between oil price and the contractual arrangement as well as the relationship between exchange rate and crude oil production by contractual arrangement. The result in (Table 1), shows evidence of causality between PSC and exchange rate, as well as PSC and Oil Price. The result also shows causality between JV and exchange rate, as well as JV and Oil Price

The results imply that a change in exchange rate granger causes changes in crude oil production by PSC and not the other way round, thus implying a unidirectional causality. change in oil price also was found to granger causes changes in crude oil production by PSC.

A uni-causal relationship was also found between exchange rate and JV as well as oil price and JV. The results implies that change in exchange rate and oil prices granger causes changes in crude oil production by JV but not the other way round. This clearly shows that exchange rate and oil price are key determinant in crude oil production in Nigeria. This is because the IOCs operating under this arrangement put into consideration the prevailing oil price and exchange rate in carrying out production

Table 1 : Pairwise Granger Causality

<i>Null Hypothesis:</i>	<i>Obs</i>	<i>F-Statistic</i>	<i>Prob</i>
OILPRICE does not Granger Cause EXCHR	47	4.53414	0.0389
EXCHR does not Granger Cause OILPRICE		0.18744	0.6672
MARFIELD does not Granger Cause EXCHR	47	2.32057	0.1348
EXCHR does not Granger Cause MARFIELD		2.13224	0.1513
PSC does not Granger Cause EXCHR	47	0.19071	0.6645
EXCHR does not Granger Cause PSC		9.34514	0.0038
SC does not Granger Cause EXCHR	47	5.55050	0.0230
EXCHR does not Granger Cause SC		2.40546	0.1281
JV does not Granger Cause EXCHR	47	3.73850	0.0596
EXCHR does not Granger Cause JV		11.9722	0.0012
MARFIELD does not Granger Cause OILPRICE	47	2.22013	0.1434
OILPRICE does not Granger Cause MARFIELD		0.13857	0.7115
PSC does not Granger Cause OILPRICE	47	0.79449	0.3776
OILPRICE does not Granger Cause PSC		5.45855	0.0241
SC does not Granger Cause OILPRICE	47	2.61183	0.1132
OILPRICE does not Granger Cause SC		2.20883	0.1444
JV does not Granger Cause OILPRICE	47	0.40785	0.5264
OILPRICE does not Granger Cause JV		5.86378	0.0196
PSC does not Granger Cause MARFIELD	47	0.07728	0.7823
MARFIELD does not Granger Cause PSC		0.24755	0.6213
SC does not Granger Cause MARFIELD	47	0.01363	0.9076
MARFIELD does not Granger Cause SC		1.76812	0.1905
JV does not Granger Cause MARFIELD	47	0.13010	0.7201
MARFIELD does not Granger Cause JV		1.21827	0.2757
SC does not Granger Cause PSC	47	0.70585	0.4054
PSC does not Granger Cause SC		0.22470	0.6378
JV does not Granger Cause PSC	47	1.05277	0.3105
PSC does not Granger Cause JV		2.54459	0.1178
JV does not Granger Cause SC	47	0.87428	0.3549
SC does not Granger Cause JV		0.07615	0.7839

Source: Authors computation from Eviews 10.

Pearson correlation was employed to determine the direction and strength of relationship between oil revenue and crude oil production by contractual arrangement.. The correlation matrix reveals that there exists a weak correlation between PSC and Oil revenue. Marginal field, SC and JV had high correlation with oil revenue. PSC has a coefficient of 0.06%, whereas Marginal Field, SC and JV had 30.2%, 31.1% and 37.09% respectively. This thus contradicts the finding of Madaki (2006) whose finding postulated the need for a shift in contractual structure from JVAs to PSCs but inline with that of Okwanduand and Agundu (2005) who suggested that JVA option was considered the best alternative strategy for optimizing Nigeria's oil returns and indigent capacity buildings.

**Table 2: Cross Correlation Between Oil Revenue And Crude Production
By Contractual Arrangement**

<i>Variables</i>	<i>OILREV</i>	<i>OILPRICE</i>	<i>EXCHR</i>	<i>INFLATION</i>	<i>MARFIELD</i>	<i>PSC</i>	<i>SC</i>	<i>JV</i>
OILREV	1							
OILPRICE	0.380607	1						
EXCHR	-0.17541	-0.67479	1					
INFLATION	-0.65807	-0.36932	0.051804	1				
MARFIELD	0.302416	0.232664	-0.34025	-0.14243	1			
PSC	0.064898	0.289661	-0.71455	0.039982	0.28739	1		
SC	0.311342	0.636704	-0.53148	-0.39967	0.502841	0.23385	1	
JV	0.370976	0.254572	-0.5085	-0.35706	0.333327	0.49015	0.418305	1

Table 3 depicts the possibility of seasonality. Seasonal patterns in oil revenue are noticeable in the in the month of January 2017, 2018, March 2017 and 2018 and May 2017, 2018 and 2020 as well as June 2019 and 2020. This period highlighted in red signify the lowest revenues generated. A possible explanation might be attributed to the fact that there is low demand for crude oil in the first and second quarter of the year which invariably translates to poor revenue. The gross oil revenue is higher in the third quarter of the year and this can be seen in the seasonal pattern of July 2017, 2018 and September 2017, 2018 and 2019 highlighted in green which signal the highest revenue derived within the period under review.

Table 4 depicts the possibility of seasonality in crude oil production. Just like in Table 3, seasonal patterns in crude oil production are noticeable more in the first half of the year. Except for November which also shows significant possibility of seasonal pattern as shown in 2018, 2019 and 2020. Signifying that crude oil production is low in November, February and March respectively which may have resulted signify the low revenues generated within that time period. The table also revealed that there is

Table 3: Gross Oil Revenue Seasonality Chart

<i>Month/ Year</i>	<i>2017</i>	<i>2018</i>	<i>2019</i>	<i>2020</i>
Jan	388,336.00	641,581.41	711,318.00	848,550.00
Feb	481,482.00	667,646.31	727,810.00	718,995.00
Mar	453,791.00	664,166.00	706,434.07	631,144.00
Apr	478,785.00	664,543.66	656,081.50	787,020.00
May	419,169.00	719,582.56	630,978.00	487,291.00
Jun	491,607.00	762,663.80	681,176.00	534,874.00
Jul	782,930.00	893,054.95	766,545.00	697,676.00
Aug	634,986.20	705,221.61	817,371.00	690,515.00
Sep	805,669.02	767,454.00	790,725.00	691,939.00
Oct	626,382.00	657,547.00	800,880.00	514,016.00
Nov	628,682.00	866,548.86	770,634.00	558,288.00
Dec	684,118.00	761,137.00	684,731.00	663,708.13

Source: CBN (2021)

*NB: RED (3 LOWEST) and GREEN (3 HIGHEST)

seasonality in production in the month of July and August which may have resulted to higher gross oil revenue noticeable in the third quarter in Table 3. this can be seen in the seasonal pattern of July 2017, 2018 and September 2017, 2018 and 2019 highlighted in green which signal the highest revenue derived within the period under review.

Table 3: Total Terminal Crude Production Seasonality Chart (Barrels)

<i>Month/ Year</i>	<i>2017</i>	<i>2018</i>	<i>2019</i>	<i>2020</i>
Jan	58,195,934	61,187,946	59,225,478	63,652,914
Feb	52,155,179	56,026,418	55,431,803	59,804,990
Mar	50,957,628	59,744,507	62,665,023	63,491,236
Apr	54,986,851	58,557,861	60,025,576	60,926,894
May	59,404,310	55,347,327	59,848,914	53,716,354
Jun	61,791,920	54,076,596	63,526,377	49,957,532
Jul	65,806,854	58,316,838	65,583,704	51,146,373
Aug	65,621,178	63,048,154	64,611,984	51,221,054
Sep	61,024,741	59,762,368	61,898,612	47,742,795
Oct	63,587,753	61,204,036	63,374,338	50,095,409
Nov	62,050,718	54,826,657	58,249,489	48,154,743
Dec	64,109,747	59,200,985	60,802,783	44,452,091

Source: NNPC ASB (2021)

*NB: RED (3 LOWEST) and GREEN (3 HIGHEST)

Conclusion and Policy Options

This paper sought to assess the contractual arrangement in the petroleum industry in Nigeria. From the review of literature, it has been found there are four basic types of petroleum arrangements in the Nigerian oil and gas industry. Joint Operating Agreement (JOA), Production Sharing Contract (PSC), Service Contract (SC), and Memorandum of Understanding (MOU) are all part of the Petroleum Arrangement. Majority of oil exploration and agreement have been found to be done with IOCs rather than with the local but to change the narrative the Nigerian government has recently made a concentrated effort to stimulate indigenous participation, which is closely observed in a number of initiatives, including the licensing of marginal fields to Nigerians, the enactment of the Nigerian Oil and Gas Industry Local Content Development Act in 2010, the leasing of oil blocks to IIOCs, and the passage of the Petroleum Industry Bill (PIB) into law.

Apart from ambiguity and secrecy surrounding the contractual arrangement in Nigeria, the study observed that research around the study area is quite limited and focused on optimal arrangement, leaving gaps for the study on the possibility of seasonality affecting crude oil production by contractual arrangement, as well as the relationship oil price, oil revenue and the contractual arrangement crude oil production. The study employed monthly time series data for the period 2017 – 2020 to research on the unexploited areas.

A uni-causal relationship was also found between exchange rate and JV as well as oil price and JV. The study also showed evidence of causality between PSC and exchange rate, as well as PSC and Oil Price. Which signifies changes in exchange rate and oil price granger causes changes in crude oil production by PSC and JV. Meaning that oil price and exchange rate are key determinant considered in production especially as it patterns JV and PSC. Another major finding from the correlation matrix, is that there exists a weak correlation between PSC and Oil revenue. Marginal field, SC and JV had high correlation with oil revenue. PSC has a coefficient of 0.06%, whereas Marginal Field, SC and JV had 30.2%, 31.1% and 37.09% respectively

Finally, as regard seasonal patterns, Table 3 revealed that there is seasonality in production in the month of July and August which may have resulted to higher gross oil revenue noticeable in the third quarter in Table 3. The study also discovers the likelihood for production and revenue to be lower in the first half of the year and higher in the second half of the year cumulatively.

Based on this finding, the following policy options are suggested:

Rather than shifting away from JV to PSC, the federal government should continue with all the contractual arrangement since they have their individual peculiarities but

concerted effort should be made to encourage indigenous contract arrangement as already springboard through the marginal field.

Since increase in oil production invariably signifies higher revenue holding price constant. Subnational government and even federal government should pay close attention going forward on the seasonal patterns as such information can be used for planning as there is the likelihood of FAAC to be higher or lower within the period identified in the study.

References

- Agbiede, M. O. (2018). Oil Revenue and Output Growth in Nigeria. *ILARD International Journal of Economics and Business Management*. www.iiardpub.org. (Retrieved on 15th January 2022).
- Aigbodua, J. E. and. Oisamoje, M. D. (2013). Promoting Small and Medium Enterprises in the Nigerian Oil and Gas Industry. *European Scientific Journal* 9(1).1-13.
- Annual Statistical Bulletin (2020). Annual Statistical Bulletin. <https://www.nnpcgroup.com/NNPCDocuments/Annual%20Statistics%20Bulletin%20E2%80%8B/2020%20Annual%20Statistical%20Bulletin%20ASB.pdf>. (Retrieved on 12th January 2022)
- Aniche, E.T. (2014). Oil Joint Venture Partnerships and Nigerian Economy. *University of Nigeria Journal of Political Economy*, 7(2): 1-24).
- Auty, R. M. (2001). The political economy of resource-driven growth. *European Economic Review*, 45(4-6), 839–846.
- Baviskar, P. and Swara, D. (2021). Various service contracts in the oil and gas industry. <https://blogipleaders.in/various-service-contracts-in-the-oil-and-gas-industry/> (Retrieved on 12th January 2022).
- Corden, W. M. (1982). Exchange Rate Policy and the Resources Boom. *Economic Record*, 58(160), 18-31.
- Corden, W. M., and Neary, J. P. (1982). Booming sector and de-industrialisation in a small open economy. *Economic Journal*, 92(1): 825-848.
- Daria, K.; Goran, B., Vladislav, B. (2017). The Mining-Geology-Petroleum Engineering Bulletin UDC: 622.1:622.2:553.9 DOI: 10.17794/rgn.2017.1.6 Review scientific paper)
- Humphreys, M., Sachs, J. D., and Stiglitz, J. E. (2007). *Escaping the Resource Curse* (Ed.). New York: Columbia University Press.
- Karl, T. L. (1997). *The Paradox of Plenty, Oil Booms and Petro–States*. London: University of Carolina Press.
- Madaki, O. A. (2006). The shift from joint operating agreements to production sharing contracts in the Nigerian oil industry: any benefits for the players?" <http://www.sciepub.com/reference/60743>. (Retrieved on 15th January 2022)
- Mehlum, H., Moene, K., and Torvik, R. (2006). Institutions and The Resource Curse. *The Economic Journal* 116, 1-20.
- Nigeria Extractive Industries Transparency Initiative (NEITI), 2014 Oil & Gas Industry Audit Report 2016), 113–121, <https://eiti.org/sites/default/files/documents/neiti-oil-gas-report-2014-fullreport-301216.pdf>. (Retrieved on 12th January 2022)

- Nigerian Tribune (2017, December). "The unclaimed \$60bn oil royalty," 19 December 2017, <http://www.tribuneonline.ng.com/the-unclaimed-60bn-oil-royalty>. (Retrieved on 12th January 2022)
- Ogbonna, G.N. and Ebimobowei, A. (2012) Impact of Petroleum Revenue and the Economy of Nigeria *Current Research Journal of Economic Theory*, 4 (2): 11-17.
- Onyi-Ogelle, H. O. (2016). Contractual Arrangements in the Nigeria's Oil Industry. *International Journal of Arts and Humanities (IJAH)* Bahir Dar- Ethiopia. 5(3):136-149.
- Oyedeke, T. (2019). Nigeria: A Bill To Amend The Production Sharing Contract Act In The Petroleum Industry Has Been Signed Into Law. <https://www.mondaq.com/nigeria/tax-authorities/863698/a-bill-to-amend-the-production-sharing-contract-act-in-the-petroleum-industry-has-been-signed-into-law>.(Retrieved on 12th January 2022).