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Original Article

Investigating the Nexus Between Nigerian Rig Rates and Crude Oil Prices

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Abstract *- This study set out to investigate how Nigerian oil rig rates respond to oil price fluctuations and the lag between them aimed at developing models for forecasting land, swamp, and offshore rigs rates in Nigeria.*

The research methodology involves the application of Ordinary Least Squares regression to develop models that can predict land, swamp, and offshore rig rates, which can be used in the Nigerian market. Firstly, Brent crude oil prices are exogenous to Nigeria, whilst land, swamp, or offshore rig rates are endogenous. Furthermore, these exogenous variables are regressed with and without lag to test the response time between the cause and its effect.

A striking relationship is observed between these independent variables, similar to global trends. Like other countries, the Nigeria oilrigs count trends along with Brent crude oil price. However, a 3-4 months lag exists between Nigerian rig rates and oil prices. Furthermore, the model estimation using one-year lag seems to show more accuracy in matching the historical rig rates, and the more expensive the rig, the wider the margin caused by oil price changes. This confirms the possibility to predict Nigeria rig rates and perhaps, well costs from oil price forecast.

Keywords *- Oil price, rig rates, rig count, Nigeria, regression analysis.*

I. INTRODUCTION

The cyclical nature of the global crude oil market has negatively affected several aspects of the oil and gas business. Petroleum remains the major source of global energy supply today, and the major source of income for several developing nations, accounting for 60 to 90 percent of per capita income in these nations (Inikori, Kunju, &Iledare, 2001). The investment pattern in the petroleum industry is equally cyclical, and consequently, the cost of well delivery is observed to be closely linked to the fluctuation of crude oil prices.

A structural change in oil price, if sustained, can lead to a twist in exploration and production activity, which can consequently increase the demand for oil rigs. But in reality, rigs supply never responds as fast as demand when oil price increases. This mismatch between rigs supply and demand in a high oil price regime creates scarcity in the marketplace. The rig owners tend to exploit this scarcity to add premiums to their rig rates. Conversely, in a low oil price regime, the supply of oil rigs tends to exceed the demand, thereby compelling rig owners to apply appropriate discounts to sustain their activity levels. Therefore, the contract rates are routinely adjusted to reflect the prevailing oil price at the time the contract terms were agreed, but this takes a considerable time to happen.

Oil and gas companies would traditionally reduce their activities and headcounts following every sustained downward in crude oil prices. This automatically diverts investment capital to other sectors and, consequently, limits their capacity to fabricate new oil rigs. On the other hand, OPEC data on rig count data shows that UAE and Saudi Arabia take advantage of these lower rig rates to ramp up their exploration and development drilling activities (Iyua, Okongwu, Vaughan, &Orimoloye, 2016). In that regard, it is also intended that this paper would investigate which of these behaviors Nigeria would display during periods of low oil prices.

Apart from the oil price, another important barometer that dictates the tune of oil & gas activities is the drilling activity. The rig count is an important metric that portrays how the industry responds to fluctuating crude oil prices. Many studies and correlation charts are available online showing that the world rig counts trends with crude oil prices. Several regression-based studies have also shown that a time lag exists between rig count and crude oil prices (Khalifa, Caporin, &Hammoudeh, 2017); (Dollens& Williams, 1984).

Although the rig count is such an important metric, attention should also be given to associated rig rates. Iyua et al. (2016) rightly identified rig rates as the major cost driver for SEPLAT drilling activity, and by extension, the well cost. This paper, therefore, intends to investigate the nexus between crude oil prices and rig rates for land, swamp, and offshore rigs operations in Nigeria using a simple linear regression analysis method. The data collected for this investigation is discrete and spans from 2012 and 2018. Rig rates differ from country to county, and sometimes this historical information is not readily available. Therefore, finding any studies on the relationship between oil prices and rig rates is almost impossible in public literature.

II. LITERATURE REVIEW

A. Drilling Activity in the Nigerian Petroleum Industry

Since the oil supply glut of 2014,which crashed crude oil prices down below $40 per barrel, Exploration, and Production companies have been seen to becomer1111111111111111111isk-averse in making further oil & gas investments, the lower oil prices led to a sharp decrease in exploration and development funding available to the operating companies, thereby interrupting the longest investment up-time since the end of the 1999 oil glut when oil prices declined to almost $10 per barrel.

Oil rig countremains acrucial metric for evaluating how oil and gas companies will respond to changing crude oil prices, and some studies have shown the importance of time lags when comparing a cause and the effect.Drilling contracts are known to be driven by capital budgets of oil and gas operators,and their budgets are usually reliant upon their oil prices forecast, their profitability, and availability of free cash (Goodridge, 2016). Abraham (2000) showed that oil companies tend to boost their drilling activities whenever the crude oil prices remain high for 6 months at least;For drilling activities;Kellogg (2014) suggested that the major impact of oil price changes occurs after 3 months; and, Ringlund et al. (2008) showed that this relationshipdepends on the industry structure and the strength of the relationship to be region dependent.

Fig 1 and 2 show how the Nigeria oil rig count trends with the crude oil price. A visual inspection of both graphs shows that the rig count moves in sync with oil price better in figure 2 than in figure 1. The correlation coefficient between the Nigeria rig count and crude oil price is higher with a 3- or 4-month lag with oil price than without; thus, validating Kellogg's (2014) hypothesis. This paper will pay considerable attention to the lag relationship between drilling activity and oil price.

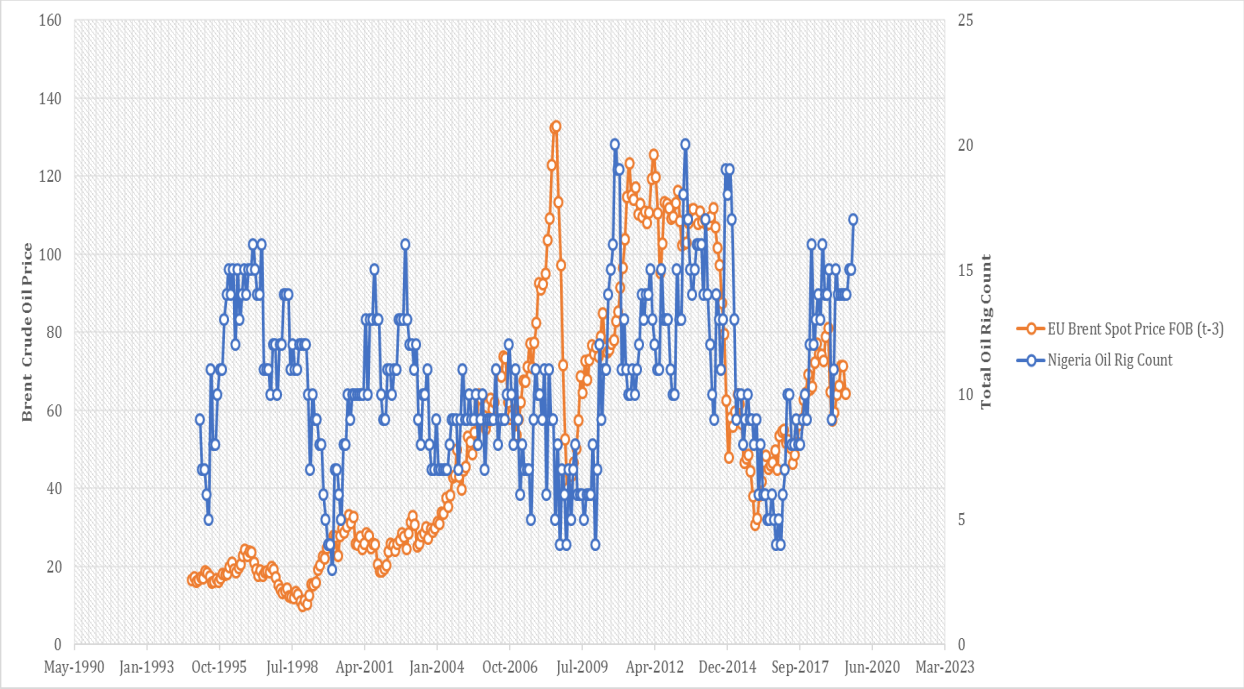

Fig.1 Oil Price and Total Nigeria Oil Rig Count

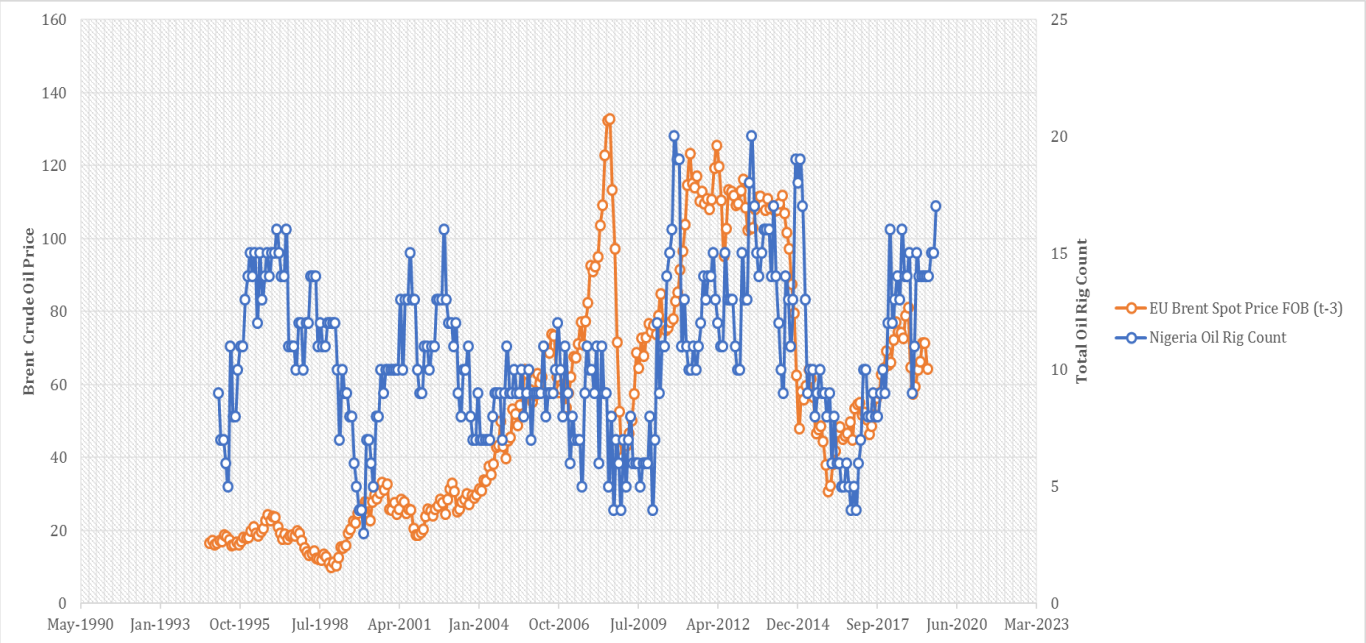

Fig. 2 Oil Price and Rig Count [with 3 months lag]

The traditional response of oil and gas companiesto a low oil price regime is to cut capital budgets and shelve drilling operations. Therefore, there is a reduction in the number of rigs in operation during lower prices. Therefore, there was a drastic butcorresponding change seen in crude oil prices globally between 2014 and 2017, and the Nigerian oil industry was not excluded in this response. During a low oil price regime, profitability and free cash arediminished, but the cost of drilling can also be significantly reduced. Many companies fail to take advantage of these reductions inthe cost of drilling by investing in future oil production. This point is buttressed by the argument made by Ringland et al. that the response of drilling activity due to oil price depends on the industry structure. The structure of the petroleum industry in Nigeria, UAE, and Saudi Arabia are quite different. The petroleum industry operations in UAE and Saudi Arabia are dominated by government-owned companies and service contracts, while the major players in Nigeria are Multinational Oil Companies (MNCs), for whom their nature of contracts is majorly Joint Ventures (JVs) and Production Sharing Contracts (PSCs). The structure of the UAE and Saudi Arabia petroleum industry, thus, allows their governments to take advantage of the low oil price episodes by ramping up drilling activity to enhance their future productions when the oil price might bounce back.

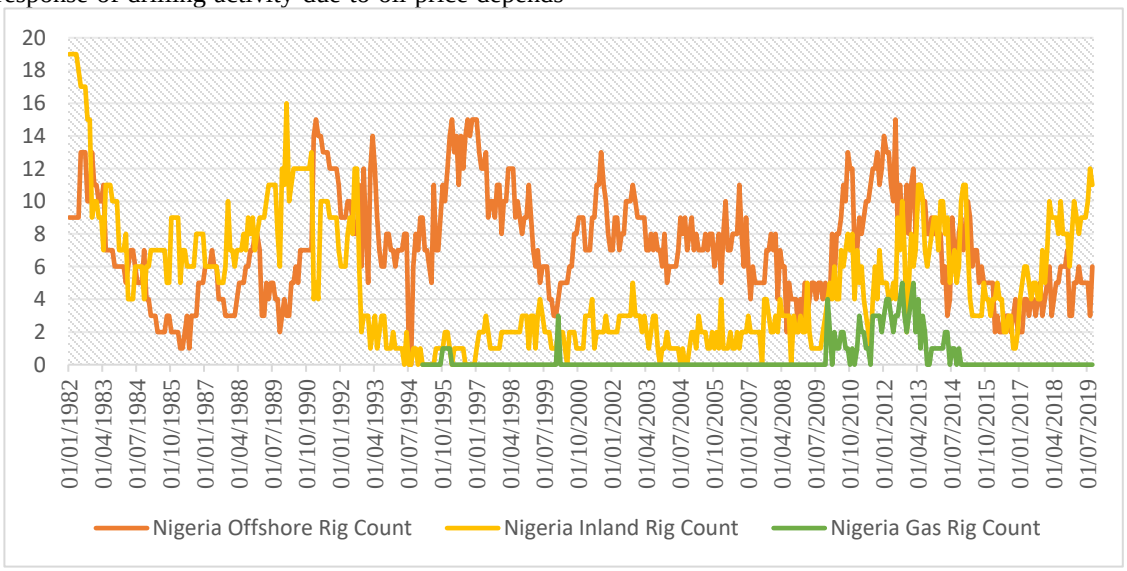

Fig. 3 Offshore, Inland and Gas Rig Count for Nigeria

B. Rig Rates

Historically, Nigeria's oil and gas exploration and production activities occur mostly on land, swamp,and offshore locations, with the exception of recent Deepwater activities that just started to contribute significantly to the nation's production. Before oil and gas activities began offshore Nigeria, the inland basins and, thus, land and swamp rigs dominated the Nigeria petroleum industry. However, offshore activities are very seemingly expensive driving activities more to the inland areas during the period of low oil prices.Figure 3 shows that the number of offshore rigs had declined since 2014, while the number of inland rigs had risen.Until recently, in thissector, Nigerian gas was mostly produced as associated gas; therefore, the low number of gas rigsis not a surprise.Offshore rigs are the most expensive, followed by swamp rigs and land rigs.

Drilling is a highly capital-intensive industry, and the price of a rig can range from 10sto to 100s of millions of dollars, depending on the type, size, and functionalities of the rig. Due to the capital-intensive nature of drilling rigs, their demand tends to exceed supplywhenever there is an upward movement in oil price. On the other hand, rig rates tend to obey the law of demand and supply, such that as demand exceedsthe supply, the rig rates go up. This heightens the pressure for rig operators as rig owners begin to revise their rig rates to vary their existing contracts (Okwa, Azoom, & Omini, 2005). Lawrence and Gabrielsen (1989) argued that because rigs are highly mobile, rational rig operators will automatically tend to move their equipment and personnel to the clients offering higher rig rates than not.

Eyitayo, Eyitayo, and Lawanson (2018) posited that the rig rate is the main cost driver for drilling and completion activities, accounting for 60 to 70% of development costs. Furthermore, Iyua et al. (2016) investigated the land and swamp spread costs for SEPLAT's drilling activities, and they came to the conclusion that the rig day rates definitely standout as cost drivers. This paper will use the rig dayrates as a proxy to measure drilling activities since the rig dayrates havebeen identified as a major cost driver for oilfield activities. In the same token, the author will present some regression models to help predict Nigerian rig rates from Brent crude oil prices as an exogenous variable.

III. DATA AND METHODOLOGY

The relevant data for this research are the average yearly Brent crude oil price obtained from the U.S Energy Information Administration website, and average yearly offshore, swamp, and land rig rates obtained from Depthwize Nigeria Limited between 2012 and 2018 are shown in Table 1.

Simple regression analysis is used to model the relationship between the different rig rates and oil prices. A test of the regressing using change in oil price vs. rig rates did not show a good correlation, and hence, oil price vs. rig rate is preferred. The rig rates for different rig types are the dependent (endogenous) variables, while the Brent crude oil price becomes the independent (exogenous) variable.

Table 1. Nigerian Rig Rates 2012 -2018

Year	Oil Price	Swamp Rig Rate	Land Rig Rate	Offshore Rig Rate
2012	111.63	111,000	37098.17	160000
2013	108.56	108,000	33388.35	163000
2014	99.03	100,000	29678.53	166000
2015	52.35	86000	28194.61	137000
2016	43.55	77000	26710.68	76000
2017	54.25	62000	25226.75	88000
2018	71.06	80000	23742.83	69000

The regression model for dependent and independent variables at a time, t, is shown below:

$$Rig\ rates_t = a + b * Oil\ price_t + e_{rr} \quad \ldots Eq.1$$

It has been established from the literature that rig rates lag oil prices. The regression model with one-year lag is shown below:

$$Rig\ rates_t = a + b * Oil\ price_{t-1} + e_{rr} \quad \ldots Eq.2$$

The R^2 of models in *Eq. 1* and *Eq. 2*are the main criteria for selecting the most appropriate model, since a high R^2 gives a smaller prediction error.

Table 2. Descriptive Statistics of Data

	Oil Price	Land Rig Rate	Offshore Rig Rate	Swamp Rig Rate
Mean	77.20428571	29148.55952	122714.2857	89142.85714
Standard Error	10.866800219	1778.902444	16448.64198	6776.811202
Median	71.06	28194.60667	13700	86000
Standard Deviation	28.750855614	4706.533462	43519.0161	17929.75712
Sample variance	826.6117286	22151457.23	1893904762	321476190.5
Kurtosis	-2.298242772	-0.222868667	-0.276072582	-0.168226721
Skewness	0.15931789	0.772369161	-0.276072582	-1.154605228
Range	68.08	13355.34	97000	49000
Minimum	43.55	23742.82667	69000	62000
Maximum	111.63	37098.16667	166000	111000
Sum	540.43	204039.9167	859000	624000
Cout	7	7	7	7

The descriptive statistics confirms that the offshore rates are the most expensive and land rates are the cheapest. The offshore rig rate has the highest range and could swing the most, and the data is symmetrical because of the skewness between -0.5 and +0.5. The dataset has a low kurtosis, meaning it has very few outliers.

IV. RESULTS

The regression Eq. 3 to Eq. 5 show the relationships between rig rates and oil price when there are no lags, while Eq. 6 to Eq. 8 show the relationships when rig rates lag oil price by oneyear.

$$Offshore\ rates_t = 31877 + 1177 * Oil\ price_t \pm 29991 \quad R^2 = 0.604 \quad \dots Eq.3$$

$$Land\ rates_t = 19074 + 130 * Oil\ price_t \pm 3113 \quad R^2 = 0.562 \quad \dots Eq.4$$

$$Swamp\ rates_t = 46387 + 554 * Oil\ price_t \pm 9030 \quad R^2 = 0.788 \quad \dots Eq.5$$

Generally, the R-squared values for regression equations with a lag are higher than those without a lag. Furthermore, the error values are significantly smaller for regression equations with a lag.

$$Offshore\ rates_t = 10886 + 1348 * Oil\ price_{t-1} \pm 12074 \quad R^2 = 0.936 \quad \dots Eq.6$$

$$Land\ rates_t = 18811 + 125 * Oil\ price_{t-1} \pm 2900 \quad R^2 = 0.684 \quad \dots Eq.7$$

$$Swamp\ rates_t = 45329 + 528 * Oil\ price_{t-1} \pm 7700 \quad R^2 = 0.846 \quad \dots Eq.8$$

The R-squared indicates that regression models with lag are more representative of the data supplied, and these models would more accurately predict rig rates from oil prices. The smaller errors for the models with lags mean that the forecast would occur within a narrower band ($\pm$ 12074 versus $\pm$ 29991), posing a lower risk of over-or-underestimating the forecasted rates when compared with the actual. The slopes of the regression equations show the rate of change of rig rates with a unit change in oil price. The slopes of Eq. 6 to Eq. 8 forecast that a $1 change in oil price will result in a $1348, $125, and $528 change in offshore, land, and swamp rig rates, respectively.

V. CONCLUSION

The Nigeria oil and gas industry responds in the same way as the global oil and gas industry to changes in oil price, where oil price determines the nature of future investment in the oil and gas industry. For the Nigerian petroleum industry, the rig rates lag the oil price by about 3-to-4 months. This fact is especially true because the major players in the Nigerian petroleum industry are the MNCs that are profit-driven and tend to shelve projects when oil prices decline. Furthermore, regression relationships between rig rates and oil prices forecast more accurately for the one-year lag case, and the most expensive rigs tend to swing with a wider margin when oil price changes.

REFERENCES

[1] Abraham, S. (2000). A revised global drilling outlook for 2000 and update on Iraq. J. Energy Dev. 25(2000) 203-215.

[2] Dollens, K. B., & Williams, J. L., Regional Models of Drilling Activity: Forecasting Rig Count in the Permian Basin. SPE 12602., (1984).

[3] Eyitayo, M., Eyitayo, S., & Lawanson, S.,Using a Land Rig in an Offshore Location: Some Lessons from a Niger-Delta Experience. SPE-193493-MS., (2018).

[4] Goodridge, S., Offshore Drilling Unveiled: Your Quintessential Investor's Primer. Market Realist., (2016).

[5] Inikori, S. O., Kunju, M. K., & Iledare, O. O., The Responsiveness of Global E&P Industry to Changes in Petroleum Prices: Evidence from 1960 - 2000. SPE 68587., (2001).

[6] Iyua, D., Okongwu, O., Vaughan, B., & Orimoloye, S., Cost Reduction Initiatives in a Low Oil Price Regime and Beyond: SEPLAT's Experience. SPE-184265-MS., (2016)

[7] Kellogg, R., The effect of uncertainty on investment: evidence from Texas oil drilling. Am. Econ. Rev. 104(6) (2014) 1698 - 1734.

[8] Khalifa, A., Caporin, M., & Hammoudeh, S., The relationship between oil prices and rig counts The importance of lags. Energy Economics, 63 (2017) 213 - 220.

[9] Lawrence, S. D., & Gabrielsen, G. (1989). Forecast and Review: Offshore Rig Activity. SPE/IADC 18644., (1989).

[10] Okwa, H., Azoom, I., & Omini, E., Application of a Light Rig in Deep Exploration Drilling Operations in Nigeria. SPE/IADC 97449., (2005).

[11] Ringlund, B., Rosendahl, E., & Skjerpen, T., Does oil rig activity react to oil price changes? An empirical investigation. Energy Econ., 30(2) (2008) 371 - 396.