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The Evidence of Financial Innovation and Oil Rent in Nigeria

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Abstract: This paper evaluates the connection amid oil and financial innovation in Nigeria. The study employed quantitative technique (ARDL method) for the period of 1985-2019. The results signify that long-run coefficients show no significant connection amid oil rent and financial innovation in Nigeria. Furthermore, a negative connection is established between the pair of variables. The study recommends that financial regulatory body should review and regulate the participation of financial institutions, especially the deposit money banks participating in oil and gas business.

Keywords: petroleum; financial; banking industry; oil prices

JEL Classification: G10; G15

1. Introduction

Natural resources of nation consist of Oil, minerals, and natural gas given by nature that have a substantial effect on the economic development of a country (Adams, Adams, Ullah & Ullah, 2019; Ewodo-Amougou, Sapnken, Mfetoum & Tamba, 2023). Resource extraction suppresses a significant percentage of economic activity in resource-rich economies, which vary from other economies in this regard. Natural resources, notably oil, are harmful to abundant in resources countries' permanent growth in economy, according to a number of theoretical and empirical research. Thus, oil is a profanity for these nations (Alvarado, Murshed, M, Cifuentes-Faura, Hossain & Tillaguango, 2023). The oil industry and its income, on the other hand, help these economies' long-term economic growth, which is why oil is regarded as a boon (Abdel-Latif & El-Gamal, 2019; Adekunle, Abdulmumin, Akande & Ajose, 2022; Ewodo-Amougou et al, 2023).

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The driving forces for this study are as follows. First of all, recent research has demonstrated that foreign direct investment and innovation are just a few of the development-related elements that determine how oil proceeds and rents affect sustainable expansion of the nation (Gbadebo et al., 2021; Hussain et al., 2021; Dou et al., 2022; Belaid et al., 2021; Liu & Tu, 2023).

Few earliest works have based on how financial intermediary development (FD) mitigates the effect of oil rents (OR) on sustained growth of oil-producing nations, despite a plethora of literature highlighting the crucial role of FD for economic growth. We are not aware of any such research for Nigeria nation that export oil. Second, previous works have either used the interaction technique or the interaction approach to evaluate the outcome of OR on expansion of the concerned nation through FD (sif et al., 2020; Jarrett et al., 2019; Mohammed et al., 2020; Meng, Xue & Han, 2022) or the criteria. This current adopts more sophisticated method in evaluating the connection.

Oil rent is the difference between the cost of producing a barrel of crude oil and the value of oil per barrel on the global market. A favorable oil rent is therefore anticipated to encourage financial innovation, which will advance the effective financial intermediation role of financial institutions. The success of the real estate and finance sectors in a single-economy country like Nigeria can be related to shifts in the crude-oil price on the global market. This is hinged on the fact that petroleum products in Nigeria made up almost 90% of all export revenue, and oil revenue in Nigeria accounts for 35% of the country's GDP (OPEC, 2017). High oil rent would therefore likely result in an expansion in government size, which will ensure optimal bank liquidity, credit size, and balance sheet (Khandelwal 2015). Additionally, investors' confidence is anticipated to be stimulated by positive oil price as they anticipate strong returns on the firm's equity market instruments.

The diagram revealed that, the country's oil rent dwindled consistently between 2011 and 2016 (i.e, Nigeria's oil rent depicts excess of oil production cost over oil price per barrel). The pre 2016 trend may be attributed to free fall of oil price at the international market couple with illegal oil bunkering activities and attack on oil facilities and expatriates in the South-South region of Nigeria. These invariably increased the overhead cost of oil extraction, exploration and production and by extension, it reduces the profit margin from oil. Therefore, considering the link between oil revenue and innovations in the finance sector, this paper investigated the connection amid oil rent in financial innovation in Nigeria.

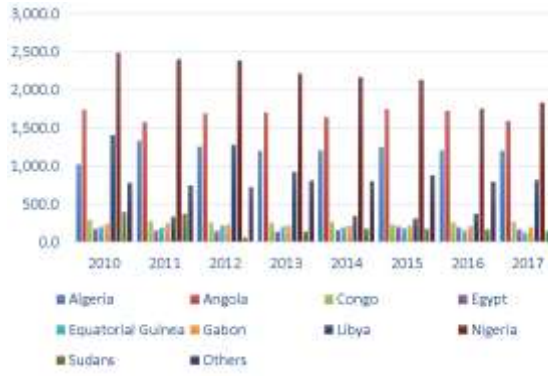

Figure 1. African exports of crude oil and petroleum products (1,000 b/d)

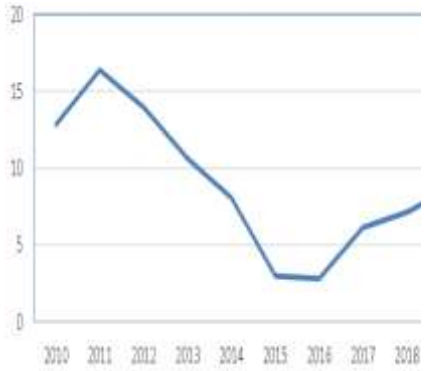

Figure 2. Nigeria's Oil Rents (% of GDP)

Source: WDI 2019

2. Literature Review

Two theories can be used to explain the connection between oil rent and financial innovation: crowding-out effect theory and financial repression theory. According to the crowding out effect, any rise in official spending that is not accompanied by a rise in the money supply would raise interest rates, which will restrict private sector investment when the money and commodities markets are both in equilibrium. Variations in the financial markets cause interest rates to rise. Beck (2011) argued that the effect of nation abundance resources on financial expansion may be described from both the demand and supply sides. On the one hand, a resource-rich economy may discourage outlay and talent in the banking industry from the supply side. The Dutch illness, on the other hand, can increase consumer credit owing to amplified request for banking services on the demand side (Alsagr & Almazor, 2020; Beck, 2011; Elhannani, Bakr & Benbouziane, 2016; Wang, Gu, Wang & Ding, 2022).

The availability of oil gain, especially may result in the expansion of the economic sector and an increase in expenditures by the government during the oil boom. According to Javadi, Motevaseli, and Farsi (2017), this results in an increase in the non-oil spending gap, an expansionary fiscal policy, and a rise in the demand in consumable items and services from the public. This increases the need for money and thus raises interest rates. Interest rates rise concurrently in alternative markets, including the black market. As a result, the fiscal policy affects the money and capital markets (financial development) and lowers private sector investment. But it becomes challenging to get company loans from banks if the government controls the interest rate and imposes limits on the banking sector. Following the evaluation, interest rates rise in alternative markets, including the non-official market. As a

result, borrowing may be more expensive. To counteract the detrimental impacts of expansionary fiscal policy in these situations, financial repression takes precedence (Zhang & Zhang, 2023).

There are various ways that the value of oil might affect stock markets. First, increasing interest rates can limit inflationary pressure, tighten corporate expenses, pressure output prices, and reduce profits when the price of a share is equal to its discounted future cash flow (Jones, Paul & Inja, 2004). Second, bond investments are more appealing than stock investments when interest rates are high (Chittedi, 2012). Significant oil trading indicates monetary system innovation, there may be an indirect correlation amid oil and financial markets that is comparable to the one between high oil prices and macroeconomic indices (Creti, Ftiti & Guesmi, 2014).

Contemporary research has centered extensively on the impact of the banking sector on the economy (Sackey & Nkrumah, 2013; Dandume, 2014) While the link between economic growth and oil reliance has also garnered a lot of focus (Betz, Partridge, Farren & Lobao, 2015; Wang & Altuntaş, 2022). According to related studies (Ashiq & Shanmugasundaram. 2017; Demirer, Jategaonkar & Khalifa, 2015; Phan, Sharma & Narayan, 2015), the price of oil has an impact on financial markets. The few research that have been done on the subject of how oil reliance affects financial development were done in advanced economies (Chami & Yousefi, 2013; Demirer, Jategaonkar & Khalifa, 2015). These studies examined the correlation between changes in oil prices and stock returns. According to the study, oil price shocks have disproportionately negative effects on economic activity and stock returns compared to positive oil shocks. On the other hand, Huang, Masulis, and Stoll (1996) discovered a strong correlation between changes in oil prices and stock returns at some US oil firms. The S&P500 and oil prices did not, however, have a correlation.

Additionally, a study conducted in 2010 by Masih, Peters, and Mello, which employed the VECM, found that the volatility of the oil price dominated real stock returns. Similar to this, time-varying dynamic correlation was employed by Creti; Ftiti and Guesmi (2014) to examine the impact of oil prices on financial markets. It was found that the effect of the worth of oil on the stock market was stronger on the markets for exporters than for importers. Kurihara (2015) also used VAR to look into how oil values affected the expansion of the global system in wealthy nations. Overall, the findings showed that increased oil prices contributed to good growth in the United States, the European Union, and Japan. Additionally, the empirical study demonstrates that economic growth is brought about by the appreciation of each national currency. But according to the VAR results, these impacts only continue for a maximum of a year.

Furthermore, Alsagr et al. (2020) examined the relationship between oil prices and stock market returns and volatility in developed economies and discovered that there is a bad correlation between oil prices and stock market returns in seven of the chosen

nations. The Singapore stock market is mostly unaffected by variations in the price of oil. Changes in oil prices significantly affect six markets' return volatility, while having little or no impact on the other markets. The oil curse and financial development were the main topics of Elhannani, Boussalem, and Benbouziane's (2016) study of Algeria. The findings of the regression study showed that while financial development boosted economic growth, it did not help lessen the detrimental effects of oil rents. From oil exporting and importing economies, Ashiq and Shanmugasundaram (2017) investigated the relationship between crude oil price, exchange rate, and stock market. The analysis demonstrated that in the chosen countries, the stock price, exchange rate, and oil price have an equilibrium relationship over the long term. among their 2017 study by Umar, Lee, Ranjanee, and Wana examined how financial development and oil prices affect economic growth among OPEC members in Africa. The four sample countries are Algeria, Angola, Libya, and Nigeria. Panel cointegration estimated results using the Pedroni cointegration process showed a long-term association and that financial development and the price of oil favorably support economic expansion. via collecting data from 70 nations between 2006 and 2014, Javadi et al. (2017) also looked into the channels via which resources were transmitted in the financial environment. The outcome revealed a negative and statistically significant correlation between OR and banking progress in underdeveloped nations, but a direct correlation exists around industrialized nations.

Using a vector error correction modeling strategy, Akinlo (2014) explored influences of the oil value on the Nigerian capital market. The findings demonstrated that the stock market's development is significantly influenced by shocks related to changes in oil prices and that the oil price has a brief beneficial impact on the stock market. Similarly, Nwannei, Iheanacho, and Okogbue (2016) used an autoregressive distributed lag approach to investigate the impact of oil prices on the growth of financial intermediation in Nigeria and discovered a direct and substantial sustainable relationship amid banking sector growth and crude oil price, while also establishing a negative short-term relationship.

3. Methodology

The study uses the following variables to examine the connection between financial innovation and oil rent in light of the theoretical framework – financial innovation index (Y), oil rent (OR), inflation rate (InR), real exchange rate (ER), real interest rate (RIR) and Gross Domestic Product Growth Rate (GDPGR).

The next step is to estimate ARDL specification that indicates how dependent variable, y_t is explicated by its own lag, y_t as well as current, x_t and past, x_{t-i} values of the independent variable. The universal form of the ARDL $(p, s_1, \dots, s_m)$ is:

$$y_t = \beta_0 + \sum_j^m \beta_j x_{j,t} + \sum_{i=1}^p \varphi_i y_{t-i} + \sum_j^m \tilde{\beta}_{j,i} x_{j,t-i} + a_t \quad (3.6.)$$

The estimations of sustainable connection amid y_t and x_t (denoted as, $\hat{\theta}_j$) from (3.6) is:

$$\hat{\theta}_j = \hat{\beta}_j / (1 - \Sigma_{i=1}^p \hat{\varphi}_i) \quad (3.7)$$

In our study the *specific ARDL* specification that analyse if the lagged of *Y* and current and past *OR*, *IR*, *ER*, *RIR* and *GDPGR* contemporaneous pointedly elucidate the independent current value of *Y* is presented:

$$Y_t = \beta_0 + \beta_1 OR_t + \beta_2 IR_t + \beta_3 ER_t + \beta_4 RIR_t + \beta_4 GDPGR_t + \sum_{i=1}^{p=4} \varphi_i Y_{t-i} + \sum_{i=1}^{m=4} \tilde{\beta}_{1,i} OR_{t-i} + \sum_{i=1}^{m=3} \tilde{\beta}_{2,i} IR_{t-i} + \sum_{i=1}^{m=2} \tilde{\beta}_{3,i} ER_{t-i} + \sum_{i=1}^{m=2} \tilde{\beta}_{4,i} RIR_{t-i} + \sum_{i=1}^{m=2} \tilde{\beta}_{4,i} GDPGR_{t-i} + a_t \quad (3.8)$$

ARDL (Cointegration) Bounds Test

The bounds test check for cointegration in (3.5, for the generic model) or (4.2, for our specific case) with the cointegration null, ($H_0: \varphi = \beta_j = 0,\ j = 1 \text{ to } m$) by estimating (a reparameterised) regression for Δy_t as:

$$\Delta y_t = \beta_0 + \varphi_i y_{t-i} + \sum_{j=1}^m \varphi_i^* \Delta y_{t-i} + \sum_{j=1}^m \beta_j x_{j,t-i} + \sum_{j=0}^m \gamma_{j,i}(B) \Delta x_{j,t-i} + a_t \quad (3.93)$$

The test null is no existence of cointegration. We estimate (3.9) with usual OLS, and the test statistic (F_k) is computed and compare with the critical value bound (C.V.B.). Pesaran et al. (2001) propose two sets of C.V.B. consistent to the polar cases of all variables being purely $I(0)$ or purely $I(d)$, where *d* is order of integration. If F_k > Upper C.V.B., the null is rejected (cointegration exists) and vice versa.

Cointegrating and Long-run Equations

The fifth and the last step is to estimate the short run model. Hence, once cointegration exist we next estimate the cointegrating equation and long run. Engle and Granger (1987) states the Granger representation theorem that the cointegration of nonstationary variables is equivalent to an error-correction mechanism, *ECM*. As suggested (Greene, 2017; Mills, 2019), to obtain the cointegrating regression the *ARDL* is transformed to include the error correction *(EC)* term.

$$\Delta y_t = \beta_0 + \sum_{j=1}^m \varphi_i^* \Delta y_{t-i} + \sum_{j=1}^m \beta_j x_{j,t-i} + \sum_{j=0}^m \gamma_{j,i} \Delta x_{j,t-i} - \mu ECM_{t-1} + \varepsilon_t \quad (3.10)$$

The cointegrating regression (3.10) gives estimates for short- and long run dynamics. The model expresses the current change in the endogenous variable, Δy_t as a linear

function of the current change in the exogenous variable Δx_t and a proportion of the previous error from the long-run "equilibrium", ECM_{t-1}.

4. Results

Basic Statistics

This section provides a description of the nature of selected variables. This is essential as variables are of different magnitudes as shown in table 1 below. The positive mean value of financial innovation index (1.89) signifies existence of Y in the country's financial system. However, the figure depicts a relatively low innovations in the finance sector. Not only that, the average oil rent of Nigeria from 1986 to 2019 stood at approximately $13US. It is also evident that, all variables are positively skewed except real interest rate. In terms of distribution peak, only oil rent is platykurtic as its kurtosis value falls below 2. Exchange rate is mesokurtic because, its value is closer to 3.

Conversely, Y, IR, RIR and GDPGR are leptokurtic as their kurtosis values are above 3. Thus, the nature of their outliers is similar to normal distribution. It is evident that, some of the variables seldom satisfy normal distribution condition. As such, selected variables are tested for stationarity through unit root testing.

The outcome of unit toot test revealed that, financial innovation (Logged) and exchange rate are order of integration one. However, oil rent, IR, RIR and GDPGR are order of integration zero. This implies that financial innovation and ER values attained stationarity status at first difference while, oil rent, IR, RIR and GDPGR attained stationarity at level.

Table 1. Statistics

Mean	1.67071	10.62155	12.42514	104.9414	2.401499	4.445796
Median	1.56012	11.64651	14.21541	118.2097	5.68558	4.631193
Std. Dev.	0.36160	3.402456	10.42441	89.57499	10.38823	3.919613
Skewness	0.68093	0.227124	1.897676	0.714256	-1.12216	0.447568
Kurtosis	4.64241	1.442233	7.076233	2.943747	4.75293	3.312141

Source: Author's Compilation, 2023

Table 2. ADF Unit Toot Test

Variables	ADF (level)	Critical Value	ADF (Diff.)	Critical Value	Remarks
LFII	-0.780921	1%: -3.646342 5%: -2.954021	-5.306013**	1%: -3.653730 5%: -2.957110	I(1)

OR	-3.269113**	1%: -3.646342 5%: -2.615817			I(0)
IR	-3.074321**	1%:-3.646342 5%: -2.954021			I(0)
ER	-0.453357	1%: -3.646342 5%:-2.954021	-4.626912*	1%:-3.653730 5%: -2.957110	I(1)
RIR	-3.427098**	1%: -3.653730 5%: -2.957110			I(0)
GDPGR	-4.274229**	1%: -3.842281 5%; -3.653730			I(0)

Source: Author's Compilation, 2023

The combination of variables with integration one and zero further confirm the applicability of ARDL as recommended by Pesaran, et al (2001). Having the stationarity level of the variables has been established in Table 2 above, the study conducted ARDL bound test. The ARDL bound test as revealed in table 3 examines the existence of a long-run connection amid the variables chosen. The outcomes of the bound test demonstrate the cointegration of the relevant variables. This is demonstrated by a higher F-statistics value (4.8) in comparison to the table's estimated 3.8 upper bound value at 5%. As a result, the study disproves the null hypothesis that there is no long-term link between the variables. The results are in line with those of Ilo, Elumah, and Umar (2017), whose research indicates a long-term connection between oil rent and Nigeria's financial development. As a result, ARDL cointegration in long run form was used in the study.

The information on table 4 shows the outcome of ARDL in cointegrating and long run form. The ARDL cointegrating form represents the short run relationship. As revealed by table 4, in the short run, oil rent significantly impacts financial innovation negatively in the current and second period. However, in the first period, there is positive and significant relationship. The result revealed that, an increase in oil rent reduces financial innovation by approximately 3% in the current and second period. However, in the first period, increase in oil rent increases financial innovation by approximately 2%. This implies that, increase in oil rent reduces intermediary efficiency of the financial market in the first period. This could be the outcome of huge investment of the finance sector in the oil industry. As such, they tend to neglect innovativeness in their intermediary role at the early stage of increase in oil rent. The outcome of the second period is a reflection of persistence oil rent accumulation. As such, the finance sector possesses sufficient capital base to effectively execute financial intermediary innovations. Lastly, the outcome of the last period can be explained by Dutch disease peculiar with the Nigerian economy (i.e, complete shift from financial intermediation to oil dealings).

Table 3. ARDL Bound Test

Test Statistic	Value	k
F-statistic	5.027	5
Critical-Value-Bounds		
Significance	I0 Bound	I1 Bound
10%	2.10	3.08
5%	3.51	4.12
2.5%	2.69	3.86
1%	2.69	3.56

Source: Author's Compilation, 2023

Table 4. ARDL Cointegration and Long Run Form

Cointegrating Form:				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFII(-1))	-0.601714	0.216417	-2.780342	0.0239
D(LFII(-2))	-0.425251	0.238325	-1.784332	0.1122
D(OR01)	-0.031450	0.009535	-3.298305	0.0109
D(OR01(-1))	0.017401	0.008072	2.155687	0.0632
D(OR01(-2))	-0.026813	0.006613	-4.054592	0.0037
D(ER)	-0.002829	0.001188	-2.382590	0.0444
D(ER(-1))	-0.002197	0.000685	-3.205008	0.0125
D(IR)	-0.004758	0.004224	-1.126387	0.2927
D(IR(-1))	0.005817	0.003731	1.558874	0.1576
D(IR(-2))	0.006565	0.001970	3.332617	0.0103
D(RIR)	-0.012707	0.006891	-1.843837	0.1024
D(RIR(-1))	0.009712	0.005667	1.713637	0.1249
D(GDPGR)	0.014448	0.006542	2.208524	0.0582
D(GDPGR(-1))	0.015290	0.005447	2.806882	0.0230
D(GDPGR(-2))	-0.016186	0.006902	-2.345006	0.0470
CointEq(-1)	-0.390961	0.143095	-2.732190	0.0258
Long Run Coefficients:				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
OR01	-0.041251	0.029044	-1.420285	0.1933
ER	-0.003388	0.002028	-1.670465	0.1334
IR	-0.081408	0.036410	-2.235875	0.0558
RIR	-0.091188	0.050169	-1.817601	0.1066
GDPGR	0.009679	0.021839	0.443207	0.6694
C	3.324711	1.184381	2.807130	0.0229

Source: Author's Compilation, 2023

In terms of adjustment to equilibrium, the table shows that, the speed of adjustment to long run equilibrium stood at approximately 39%. In the short run, despite the differences in sign, oil rent significantly influences financial innovation across the selected lags. In the current period, for every 1% increase in oil rent, financial innovation decreases by 3%. In the first period, 1% increase in oil rent increases

financial innovation by approximately 3%. Lastly, in the second period, 1% increase in oil rent will reduce financial innovation by approximately 3%. This implies that, at the initial stage of marginal increase in oil rent, financial institution neglect innovations and act as speculators. They innovate when marginal increase in oil rent is sustained over a period of time. Lastly, the cycle of non-innovativeness relapse if the sustained marginal increase in oil rent persists. This is a typical problem of Dutch disease which is common to countries endowed with natural resources.

The long run coefficients show no significant relationship between oil rent and financial innovation. Not only that, a negative relationship was established between the pair of variables. This affirms the Dutch disease syndrome established in the short run. However, among all the selected explanatory variables, only inflation rate depicts negative and significant relationship with financial innovation. This is consistent with the study's *A priori expectations* as inflation reduces the real value of money vis a vis real returns on money and capital market instruments.

The outcome of serial correlation test shows that, the variables are not suffering from serial correlation. This is because, the prob value (0.2731) is far above 5%. As such, the coefficients of the short run and long run are acceptable. The information on Table 6 shows that, in Nigeria, the relationship between oil rent and financial innovation is neither unidirectional nor bi-directional. This was based on non-significant p values in Table 6. Thus, we accept the null hypothesis and conclude that, at 5% significant level, no causality flow from oil rent to financial innovation in Nigeria.

Table 5. Breusch-Godfrey Serial Correlation LM Test

F-statistic	1.624156	Prob. F(2,6)	0.2731
Obs*R-squared	10.53699	Prob. Chi-Square(2)	0.0052

Table 6. Granger causality test

Null Hypothesis:	Obs.	F-Statistic	Prob.
OR01 does not Granger Cause LFII	32	0.22295	0.8016
LFII does not Granger Cause OR01		2.10381	0.1415

4. Conclusions

The study examined the relationship between oil rent and financial innovation in Nigeria. The conclusion from the empirical investigation is that, in Nigeria, oil rent significantly influences financial innovation only in the short run. Based on the lag specification outcome, at the early stage of increase in oil rent, the finance sector in Nigeria is less innovative. The sector only innovates when the increase in oil rent is persistent. However, due to the peculiarity of Dutch disease syndrome in Nigeria,

financial sector becomes less innovative when inflow from oil is sustained over a long period of time.

To this end, the study therefore recommends that the financial regulatory body should review and regulate the participation of financial institutions, especially the commercial banks in the oil and gas business. This is to identify the depth of deviation from their fundamental intermediation function. Also, considering the attractiveness of the oil and gas business, we expect the Central Bank of Nigeria to review its selective credit control policy as commercial bank's credit will always favour the industry at the expense of others. Lastly, following the sustained fall in oil rent as obtained in fig 2, government should diversify the economy to accommodate exploration of other natural endowment resources in the country. This will provide multiple income sources for the federation. Also, diversification will make the country less vulnerable to external shocks.

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