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Oil Resources, Deficit Financing and Per Capita GDP Growth in Selected Oil-Rich African Nations: A Dynamic Heterogeneous Panel Approach

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Oil Resources, Deficit Financing and Per Capita GDP Growth in Selected Oil-Rich African Nations: A Dynamic Heterogeneous Panel Approach

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Abstract

This study examines the effect of oil resource abundance and deficit finance on per capita GDP growth in selected oil-rich African countries between 1980 and 2017. We analyse panel data from Algeria, Angola, Egypt, Libya, and Nigeria using the dynamic heterogeneous panel approach. Results show that oil production positively enhances GDP growth in the panel, Algeria, Angola, Egypt, and Libya, except in Nigeria. Oil rents adversely affect growth in Algeria, Angola, Egypt, and Libya, while net oil export negatively affects GDP growth in the short- and long-run in Africa, Angola, Egypt, Libya, and Algeria, but positive in Nigeria. Lastly, deficit finance is growth-enhancing in Algeria and Egypt, but growth-reducing in Libya, Nigeria, and Angola. It is therefore essential for these countries to invest their oil largesse in boosting the productive base of their economies to lower fiscal deficits during periods of crude oil price uncertainties and boost GDP growth.

Keywords: Oil Resources; Oil Rents; Deficit Finance; Growth; Africa.
JEL Classification: H6, N57, O13, Q32, Q33.

1. Introduction

The question of resources abundance being a blessing or curse has prompted several theoretical and empirical arguments over the years. This is because many resource-rich countries are performing at derogatory levels compared to resource-poor countries (Holden *et al.*, 2013). Experts alluding to this poor performance argue that such resource-rich countries engage in inefficient and unproductive spending that distorts the economy. However, the direction of research studies on this connection is imprecise, and a convincing answer is yet to be provided. Gylfason and Zoega, (2006), Hamdi and Sbia (2013), and Satti *et al.* (2014) explained that the reason for imprecision on the empirical evidence of these studies is due to the sensitivity of the results to the period chosen, the resource abundance measurement used, and the methodology. However, Robinson *et al.* (2017) alluded to the omission of a third variable as the indicative factor for variation in the studies. Also, Sachs and Warner (2001), Papyrakis and Gerlagh (2004), Snudden (2016), and Charles *et al.* (2018) provided support for the resource blessing hypothesis, which originates from the classical economist perspective. According to this argument, there can be no production without resources as inputs, and natural resources abundance become a blessing due to their ability to ease aggregate demand via consumption, investment and public budget. This invariably becomes a spur to growth.

On the other hand, resource abundance has been associated in the literature with the capacity to impact growth through five possible channels of transmission. The Dutch Disease channel where there is substitution of resources from the non-tradeable sector to the tradeable sector making the former uncompetitive and resulting in real exchange rate appreciation (Corden and Neary, 1982; Corden, 1984; Van Wijnbergen, 1984;Van Der Ploeg, 2011). The rent-seeking channel whereby resource abundance countries with weak institutional framework facilitates rent-seeking in diverting resources away from the productive sector (Auty, 2001; Usui, 1997; Gelb, 1988; Hall and Jones, 1999; Barbier, 2002; Mehlum *et al.*, 2006). The human capital channel where resource abundance serves as a disincentive for human capital development due to social spending and low taxes which invariably undermine the long-run value of human capital (Ross, 2001; Aytac *et al.* 2016). The saving-investment channel where resource abundance provides support for the disincentive to save and invest, thereby becoming a drag to growth (Haber and Menaldo, 2011). The money-inflation and financial capital channel where resource abundance

tends to crowd-out financial capital, thereby impeding on financial deepening in impacting growth.

The empirical literature on the resource abundance-growth link is mixed. For instance, Bulte *et al.* (2005), Alexeev and Conrad (2009), Cavalcanti *et al.* (2011), Boyce and Emery (2011), Yuxiang and Chen (2011), James (2015) and Ben-Salha *et al.* (2018) showed evidence of resource abundance being a spur to growth. But Gylfason (2001), Bannon and Collier (2003), Papyrakis and Garlagh (2004), Mehlum *et al.* (2006), Mehrara and Oskoui (2007), Van Der Ploeg and Venables (2009), Sala-i-Martin and Subramanian (2013), Cockx and Francken (2016), Eregha and Mesagan (2016), Robinson *et al.* (2017), Allcott and Keniston (2017), and Moradbeigi and Law (2017) showed evidence of resource abundance being a drag to growth. Also, Davis and Tilton (2005) and Badeeb et al. (2017) showed resource abundance to impact negatively on growth via commodity price volatility in affecting public revenue and finance. Again, Corden and Neary (1982), Corden (1984) and Van Wijnbergen (1984) showed resource abundance to be a growth drag as it lessened the competitiveness of the non-resources sector. Mehlum *et al.* (2006), Collier and Bannon (2003), Robinson *et al.* (2017), Aytac *et al.* (2016) and Eregha and Mesagan (2016) provided evidence of resource curse due to rent-seeking or weak institutional framework. Ross (2001) and Aytac *et al.* (2016) specifically provided evidence of resource-curse via taxation effect resulting from weakened domestic resources mobilisation effort.Lastly,Torvik (2002), and Mehlum *et al.* (2006) showed that the resource curse syndrome exists due to high public consumption compared to investment.

The empirical literature is imprecise and the channels of transmission matter in decoupling the resources abundance-growth link. One channel identified in the literature is countercyclical fiscal policy response, and less attention is given to it in the empirical literature especially in oil resource-rich African countries that treat positive oil price shock as permanent in their fiscal spending making it challenging to adjust fiscal spending in periods of adverse shocks. Hence, a study of this sort is not only understandable but is timely in decoupling the oil resource abundance-growth link via fiscal policy response channel. The rationale for this scientific inquiry cannot be overemphasised as African oil-rich countries are faced with large and persistent shocks resulting from oil price uncertainty and the adoption of countercyclical fiscal policies.

Consequently, the main thrust of the study is to analyse the effect of oil resource abundance on per capita GDP growth via deficit finance channel in Africa. Specifically, the study determines the impact of oil production on GDP growth, it examines the effect of oil rents on GDP growth, it analyses the effects of the net oil exports on GDP growth, and then controls for deficit finance in the resource-growth model to establish the role of deficit financing in the selected nations' per capita GDP growth. The study contributes to the literature in three ways. One, the study applies comprehensive measures of resource abundance on the African oil-rich countries. Two, the importance of fiscal policy channel in the transmission of resource abundance-economic growth link is analysed, and lastly, we use the recently developed dynamic heterogeneous panel regression approach, based on the Pooled Mean Group methodology, in examining both the country-specific and panel analyses of these countries in providing policy direction. The study is structured in five sections. Following this section is stylised facts on the economies of these countries, sections three and four present the methodology and empirical analysis, respectively, while section five concludes the paper.

2. Stylised Facts

The selected oil-rich African nations have certain homogenous features, which we analyse in this section. We use the Tables and Figures to explain such characteristics to provide crucial explanations to the empirical findings.

2.1. Statistical Evidence from the Selected Oil-Rich African Countries

Table 1: Oil Production, Fiscal Balance and GDP Growth

Countries	Crude Oil Production (Thousand Barrels)			Fiscal Balance (% of GDP)			GDP Growth (Annual %)		
	2011	2014	2017	2011	2014	2017	2011	2014	2017
Algeria	1642	1589	1540	-1.3	-7.9	-4.7	2.9	3.8	1.7
Angola	1670	1668	1674	10.2	-5.6	-4.9	3.9	4.7	0.7
Egypt	714	714	660	-9.7	-13.1	-9.5	1.8	2.9	4.2
Libya	479	498	865	-15.6	-43.7	-43.0	-62.1	-24.0	26.7
Nigeria	2463	2278	1988	-0.1	1.0	-5.1	4.9	6.3	0.8

NOTE: *Crude Oil Production, Fiscal Balance, GDP Annual Growth.*

Source: *Authors' Compilation from BPS (2018), AFDB (2019), WDI (2019).*

In Table 1, evidence shows that crude oil production has been on the decline in Algeria, Angola, Egypt and Nigeria between 2011 and 2017. Only Libya recorded an increase in its crude oil production from 479,000 barrels in 2011 to 498,000 barrels in 2014 and then to 865,000 barrels in 2017. Also, among the five countries, Nigeria maintained its leadership position as the continent's largest oil producer followed closely by Angola and Algeria, then Egypt and Libya. For fiscal balance, evidence suggests that between 2011, 2014 and 2017, all the five countries have been using deficit financing to stimulate their economies. But in 2011, Angola had a budget surplus to the tune of 10.2% of GDP, and this represents the only time that any of these oil-net exporting African countries experienced surplus in their budget. This also attests to the fact that resource-rich developing nations are associated with substantial fiscal spending and are often associated with using fiscal deficits to manage their economies. Thus, the extent to which such fiscal stance interacts with oil earnings to promote economic growth occupies the central stage of this study. Considering the growth of GDP, evidence in Table 1 shows that Libya with the least amount of crude oil production recorded negative GDP growth rates of 62.1% and 24.0% in 2011 and 2014 respectively while the significant increase in its crude oil output from 498,000 barrels in 2014 to 865,000 barrels in 2017 made the country to record a positive growth rate of 26.7% in 2017. However, even though Algeria, Angola and Nigeria recorded favourable GDP growth rates by 2011, 2014, and 2017, their growth rates declined significantly in 2016, which also reflected in 2017.This can be attributed to the massive reduction in world crude oil prices between 2014 and 2016 plunging several of them into recession in 2016. Albeit, Egypt is the only oil-wealthy African nation which did not only maintain its positive rate of growth but was also able to raise it significantly between 2011 and 2017. This can be attributed to the fact that since 2004, Egypt has become a net oil importing nation and as such, benefited immensely from the crash in the global crude oil price.

Table 2: Oil Earnings and Current Account Balance

Countries	Crude Oil Price ($ per barrel)			Oil Rent (% of GDP)			Current Account Balance (% of GDP)		
	2011	2014	2017	2011	2014	2017	2011	2014	2017
Algeria				20.3	15.7	11.3	8.8	-4.4	-16.5
Angola				44.1	27.1	13.5	12.6	-3.0	-1.7
Egypt	121.24	102.5	54.19	9.6	6.6	4.1	-2.3	-1.9	-4.0
Libya				46.8	28.3	14.8	9.2	-46.2	-9.8
Nigeria				16.6	8.5	4.3	2.6	0.2	2.8

NOTE: *Crude Oil Price, Oil Rent, Current Account Balance.*
Source: *Authors' Compilation from BPS (2018), WDI (2019), AFDB (2019).*

The crude oil price data presented in Table 2 shows that global crude oil price fell from $121.24 per barrel in 2011 to $102.5 per barrel in 2014. In 2017, the oil net-exporting nations were merely surviving as crude oil was only sold for $54.19 per barrel. The decline in the crude oil price adversely affected the oil earnings of these countries. Table 2 also shows that oil rent for the five African countries fell sharply between 2011 and 2017. The significant reduction in oil earnings occasioned by the dwindling crude oil price and their import-dependency status negatively affected their current account that transmitted into their fiscal position via revenue. Except for Egypt, which had a negative balance of payment (BOP) position to the tune of 2.3% of GDP in 2011, Nigeria, Algeria, Egypt and Angola had a positive balance of payment positions. However, apart from Nigeria, the remaining four countries recorded negative values in their current account in 2014 and 2017. Nigeria's favourable BOP situation over this period can be attributed to the considerable size of its oil earnings since it consistently exports around 2 million barrels of crude oil on the average. Moreover, linking the oil resource rents in Table 2 to fiscal balance presented in Table 1, it is evident that only Angola recorded a fiscal surplus of 10.2% in 2011 while Nigeria recorded a surplus of 1.0% in 2014. However, on the average, fiscal deficit is very prominent across the five nations. This means that oil-wealthy nations often budget deficits to manage their economies whenever oil resource earnings drop. The sharp decline in oil rents is also transmitted to GDP growth, which dropped significantly for all countries, except Libya, between 2014 and 2017.

Table 3: Government Effectiveness, Human Development and Foreign Reserves

Countries	Government Effectiveness			Human Development Index			Foreign Reserves (% of Foreign Debt)		
	2011	2014	2017	2011	2014	2017	2011	2014	2017
Algeria	-0.6	-0.5	-0.6	0.736	0.747	0.754	3155.5	3375.1	1804.7
Angola	-1.2	-1.1	-1.0	0.535	0.564	0.581	149.2	97.3	56.3
Egypt	-0.6	-0.8	-0.6	0.668	0.683	0.696	52.9	35.7	36.8
Libya	-1.3	-1.7	-1.8	0.707	0.695	0.706	17.3	14.8	22.5
Nigeria	-1.1	-1.2	-1.0	0.494	0.524	0.532	205.3	151.5	89.6

NOTE: *Government Effectiveness, Human Development Index, Foreign Reserves.*
Source: *Authors' Compilation from WGI (2019), UNDP (2019), WDI (2019).*

The ensuing argument in natural resource literature is the governance effectiveness of resource-rich nations to translate resource-wealth into economic growth. Thus, by considering government effectiveness in the selected African countries, Table 3 shows that government effectiveness is weak in the oil-rich nations. Specifically, Angola, Libya and Nigeria are the lowest in terms of government effectiveness while both Algeria and Egypt have relatively better government effectiveness score in 2011, 2014 and 2017. In Table 3, evidence shows that human development in Algeria is the best followed by Libya and then Egypt. However, the two largest oil-producing African nations did not fare well in terms of human development index. Angola comes next to Egypt, while Nigeria had the least human development. Although these nations may not be doing great regarding human development, they only recorded mild improvements between 2011, 2014 and 2017. Regarding the foreign reserves' situation, Table 3 suggests that the countries recorded reductions in foreign reserves between 2011 and 2017. Except for Libya and Egypt, which both improved their reserves between 2014 and 2017 slightly, the situation is worst in Nigeria, Algeria and Angola. This is expected because whenever oil earnings decline, foreign exchange earning into the reserves declines and invariably a narrowing down of current account balance ensues. Therefore, the fact that oil-rich African countries consistently deplete their foreign reserves to finance imports and also meet debt obligations in the foreign exchange market explains the decline in foreign reserves between 2011 and 2017. During a period of rising oil price, African oil-rich countries treat this as a permanent shock, instead of a temporary shock, resulting in higher fiscal spending without proper discipline. Hence, when there is an

unprecedented decline in oil price, it is challenging for these countries to reduce their expenditure and this reflects in rising debt profile that transmits into weak GDP growth due to low domestic resources mobilization. Hence, the focus of this study on the continent in analyzing the resources-growth channel from the fiscal transmission position.

2.2 Trend Analysis of Crude Oil Abundance in the Selected African Nations

Fig. 1: Oil Exports

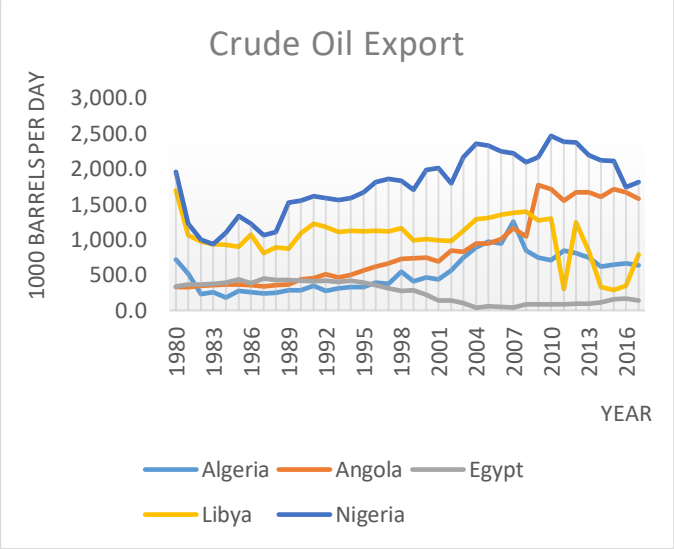
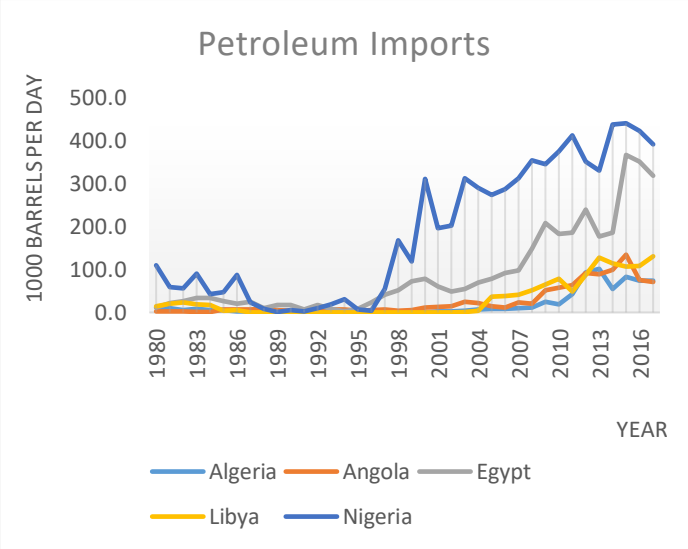


Fig. 2: Oil Imports



Source: *Authors' Computation from the 2018 OPEC Statistical Bulletin*

Figure 1 shows that Nigeria is Africa's largest crude oil exporting country. Between 1980 and 2017, Nigeria maintained its dominant force in terms of crude oil export. Nigeria is followed by Libya until 2009 when it was overtaken by Angola, which replaced Libya as the second largest oil exporting African country till date. Algeria followed in that order while Egypt exports the least barrels of crude oil among the selected oil-rich African nations. Specifically, Nigeria's crude oil export in 1980, which stood at 1.96 million barrels per day rose to an all-time high amount of 2.46 million barrels in 2010 before stabilizing at about 2 million barrels up to 2015. The instability and crises in the oil-producing Niger Delta region of the country plunged oil export to 1.73 million in 2016 before slightly improving to 1.8 million barrels in 2017. That of Libya, which was 1.69 million barrels in 1980, fell slightly in the early 1980s before stabilising at about 1 million barrels up till the year 2000. From the early 2000s, it maintained an upward trend to 1.3 million barrels in 2010. However, the Arab Spring uprisings of late 2010 plunged oil exports to an all-time low amount of 299,000 barrels in 2011 when it was overtaken by Angola.

Albeit, a little improvement in 2012, oil exports in Libya remained 350,000 barrels in 2016 before increasing to 792,000 barrels per day in 2017. For Angola, since starting from 332,000 barrels in 1980, crude oil exports continue to climb. This upward trend continues to the present period to about 1.58 million barrels in 2017 just slightly below that of Nigeria at 1.8 million. The Angolan civil war between 1975 and 2002 restricted its crude oil exports at the early periods until recently. Algeria also enjoys a consistent trend in oil export from 715,000 barrels in 1980 to about 632,000 in 2017. Regarding the importation of petroleum products, Figure 2 shows that Nigeria is the largest importer of refined petroleum products, followed by Egypt, then Libya, Angola, and Algeria. Evidence from Figures 1 and 2 have implications for the crude oil net exporting situation in Africa and consequently determines how each country responds to the global crude oil price situation.

Fig. 3: Crude Oil Net Exports

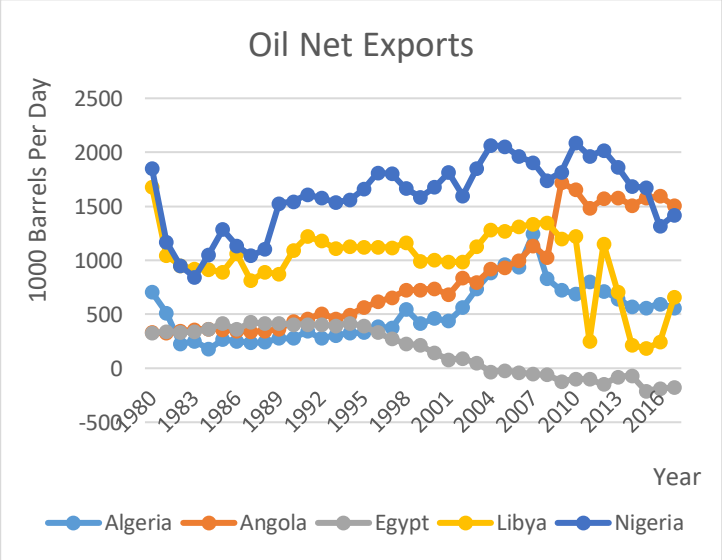
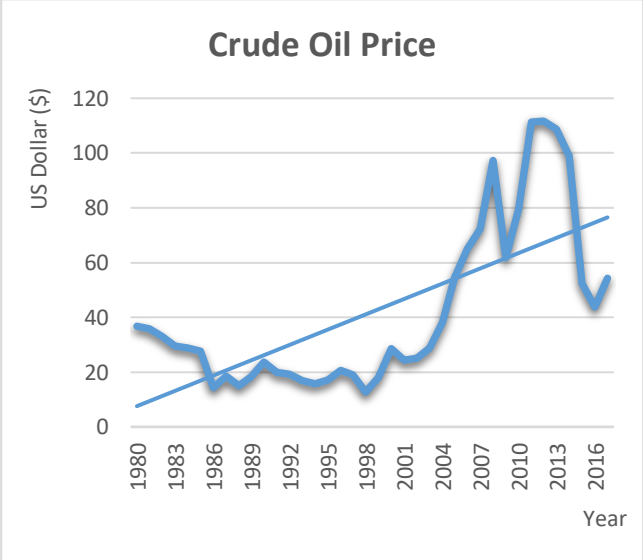


Fig. 4: Global Crude Oil Price



Source: *Authors' Computation from the 2018 OPEC Statistical Bulletin*

As shown in Figure 3, Nigeria, Angola, Libya, and Algeria are oil net exporting nations in Africa while Egypt is an oil net importing country since 2004. This explains why Egypt did not experience the last economic recession that hit almost all the oil net exporting African nations between 2016 and 2017. The slump of oil net exporting nations' GDP during this period was attributed to the crash in the international crude oil price to a 12-year low amount of US$43.7 in 2016 (see Figure 4), thereby, transmitting through their revenue to widening fiscal deficit

financed through increased borrowing. According to the World Bank, Nigeria was in recession for five consecutive quarters between the first quarter of 2016 to the second quarter of 2017. The country recorded a negative growth rate of 1.6% in 2016 before crawling out of recession in 2017 with a growth rate of 0.8%. Angola recorded negative GDP growth of 0.8% in 2016 before crawling out of recession with 0.7% in 2017 (WDI, 2019). Moreover, Libya had a negative growth rate of 2.8% in 2016 before recording 26% in 2017. However, apart from Egypt, only Algeria recorded favourable economic growth rates of 3.3% and 1.7% respectively in 2016 and 2017 while Egypt consistently maintained growth rates of 4.3% and 4.2% respectively in 2016 and 2017. The challenges facing the oil-rich African nations stem from their inability to effectively manage their resource wealth by "saving for the rainy day". The drag to growth and fragility experienced in these African oil-rich countries is not unconnected with the fact that fiscal spending is closely tied to oil rent and any exogenous shock is transmitted through the fiscal position to the macroeconomy vis-à-vis; inflation rate, exchange rate and GDP growth. This is because they face a paradoxical position where the non-oil sector contributes massively to their GDP, but they are overdependent on the oil sector for foreign exchange earnings and revenue. Consequently, their fiscal positions are grossly affected and thus, economic activities hampered.

3. The Model

Following Hamdi and Sbia (2013) and recently by Ben-Salha *et al.* (2018), we specify the econometric model between Growth and oil resources abundance measures accounting for the deficit financing as a countercyclical fiscal response. Our choice of fiscal deficit channel on the resources-growth nexus is born out of the fact that these African oil-rich countries treat oil price boom as permanent shock and significantly increase their spending thereby making them run at a deficit most of the time. So, when a negative price shock hits them, they find it difficult to adjust their spending to ensure fiscal sustainability. Hence, rising debt ensued in crowing-out private investment leading to declining economic activities. The empirical model basically as espoused from these studies, provides a dynamic relationship among real GDP per capita growth, deficit financing and oil resource abundance. Consequently, a dynamic heterogeneous panel regression represented as a panel-ARDL (p,q) based on Pesaran *et al.* (1999) is employed. Accordingly, the panel-ARDL model based on the Mean Group (MG), Dynamic Fixed Effect (DF) and Pooled

Mean Group (PMG) estimators developed recently for dynamic heterogeneous panel analysis are suitable for panel data analysis with large time (T) and cross-section (N) dimensions unlike the GMM approach with small T and large N is employed (Pesaran and Smith, 1995; Pesaran *et al.* 1999).

Given the panel-ARDL representation thus:

$$a_i(L)y_{it} = b_i(L)x_{it} + d_i z_{it} + e_{it} \quad (1)$$

For country$i$, where$i = 1, .., N$ then the long-run parameter for country i is thus:

$\theta_i = \frac{b_i(1)}{d_i(1)}$ and the MG estimator for the panel is $\theta = N^{-1}\sum_{i=1}^{N}\hat{\theta}_i$. In the PMG estimation, only the long-run coefficients are constrained to be the same across countries while the short-run coefficients vary across countries.

Consequently, the unrestricted panel-ARDL specification for $t = 1,2, \ldots T$ periods and $i = 1,2, \ldots N$ countries for the dependant variable y is thus:

$$y_{it} = \sum_{j=1}^{q}\omega_{ij}\, y_{i,t-j} + \sum_{j=0}^{p}\gamma_{ij}'\, x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (2)$$

Where, $x_{ij} = kx1$ vector of explanatory variables for group $i\ and\ \mu_i = fixed\ effects$

The model can be represented as a VECM system in a re-parameterized process as follows:

$$\Delta y_{it} = \theta_i\left(y_{i,t-1} - \varphi_i' x_{i,t-1}\right) + \sum_{j=1}^{q-1}\omega_{ij}\,\Delta y_{i,t-j} + \sum_{j=0}^{p-1}\gamma_{ij}'\, x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (3)$$

where, $\varphi_i's$ are the long-run parameters and $\theta_i's$ are the error correction parameters.

For instance, the MG allows for short-run and long-run slope coefficients to be different across groups, the PMG allows short-run coefficients, the speed of adjustment and intercepts to differ across groups but the long-run coefficient to be homogeneous across groups while the DFE restricts both long and short-run coefficients to be equal across all (Pesaran and Smith, 1995; Pesaran *et al.* 1999).The study also adopts the familiar Hausman-type test as suggested by Pesaran *et al.* (1999) for selection between MG and DFE and between MG and PMG. For pre-estimation diagnosis, the homogenous and heterogeneous panel unit root tests are employed and the Pesaran & Chudik (2014), Breusch-Pagan LM, Frees and Friedman cross-sectional dependence tests are also used to ascertain the appropriateness of the first-generation panel unit root tests.The variables used for the study based on Hamdi and Sbia (2013) and Ben-Salha *et al.* (2018) are the growth of real GDP per capita (GDPG) as the dependent variable, and explanatory variables include; Deficit financing as a ratio of GDP (DFIN), and the oil resource abundance measures.The gross fixed capital formation as ratio of GDP is used to capture investment (INV),

labour force(LF) to proxy human capital, current account balance (CAB), the net foreign direct investment (FDI), crude oil price (OPR), and the foreign exchange reserves (RES) are used as control variables to reduce the omitted variable bias in the study. Our models use three measures of oil resource abundance, and they include (i) oil production per capita (OPPC) (ii) oil rentsper GDP (OILR) and (iii) oil net export per capita (NOILPC). The selected top oil-rich African countries are Algeria, Angola, Egypt, Libya and Nigeria for the period 1980-2017. Data for the study are extracted from the World Development Indicators of the World Bank (WDI, 2019) and the BP Statistical Review of World Energy (BPS, 2018).

4. Empirical Analysis

4.1. Homogeneous and Heterogeneous Panel Data unit root test result

Table 4 presents the result of the panel data unit test result using the homogenous tests of Breitung (2001) and Levin *et al.*(2002), and the heterogeneous tests of the ADF Fisher and Im *et al.* (2003). Results from the table suggest that jointly using homogeneous unit root criteria, only deficit finance is stationary at levels while all the other covariate variables are not stationary. Also, for the joint consideration of the heterogeneous unit root test criteria, oil price, current account balance, investment, non-oil export per capita, foreign reserves and labour force are not stationary at levels. However, all the variables are stationary at first difference for all criteria used in both the homogeneous and heterogeneous panel unit root tests. Therefore, testing at 1% and 5% levels of significance at first difference, we reject the null hypothesis of the existence of unit root and confirm that all the variables are stationary.

Table 4. Homogeneous and Heterogeneous Panel data unit root

Regressors	Homogeneous unit root process				Heterogeneous unit root process			
	Level		1st difference		Level		1st difference	
	Levin et al.(2002)	Breitung (2001)	Levin *et al.*(2002)	Breitung (2000)	Im *et al.* (2003)	ADF–Fisher	Im *et al.* (2003)	ADF–Fisher
OPR	-5.4361	0.4053	-10.339***	-5.4887***	-2.0152	5.2232	-5.3537***	100.190***
CAB	-5.7495	-0.4425	-13.101***	-4.5689***	-2.2533**	10.937	-5.8201***	123.212***
GDPG	-5.7196**	-1.5953	-12.247***	-7.1667***	-5.1771***	87.122***	-9.1855***	232.614***
INV	-7.0501***	-0.3179	-11.859***	-2.5043***	-2.2323**	8.1114	-5.4510***	111.059***
OILR	-5.5902***	-1.4082	-13.338***	-6.8031***	-2.8946***	20.204**	-6.9749***	180.227***
FDI	-6.2294**	-3.1470	-11.612***	-7.5274***	-2.9333***	20.770**	-7.0314***	187.463***
DFIN	-6.6851***	-2.2297**	-12.009***	–5.7183***	-3.1208***	30.118***	-6.5362***	159.829***
NOILPC	-6.0514	-0.9609	-12.616***	-3.4748***	-3.9493***	54.904	-7.1774***	191.026***
OPPC	-4.8728	0.2146	-9.4464***	-3.0448***	-2.9565***	33.565***	-6.5192***	159.072***
RES	-4.1745	2.6948	-8.5064***	-4.3866***	-1.7715	12.766	-3.7946***	57.6568***
LF	-4.2516	4.0889	-6.5423***	-5.3950***	-2.1118	30.275***	-5.2689***	106.416***

Note. ***and ** indicate 1% and 5% level of significance

4.2. Panel Data cointegration Test result

Table 5presents the Kao residual based panel cointegration results to confirm the long-run relationship among the regressors. In Table 5, the upper part displays the cointegration test without deficit finance, while the lower part shows the cointegration test with the inclusion of deficit finance.

Table 5: Kao Residual Cointegration Test

Null Hypothesis: No cointegration	**Without Deficit Finance**	
	t-Statistic	**Probability**
ADF	-3.727747	0.0001***
Residual Variance	24.59573	
HAC Variance	12.76446	
Null Hypothesis: No cointegration	**With Deficit Finance**	
ADF	-3.258897	0.0006***
Residual Variance	24.18188	
HAC Variance	12.34671	

Note. *** indicates 1% level of significance.

The results show the Kao tests to be significant at 1% levels of significance for both the with and without deficit finance. This means that we can reject the null hypothesis of no cointegration and therefore conclude that long-run relationship exists between oil resource abundance, deficit finance, GDP growth per capita, and all the other covariate variables in the study.

4.3. Correlation Matrix of Regressors

In Table 6, we present the bivariate correlation matrix of all the panel regressors to determine the strength of the relationship and the possibility of multicollinearity among the covariate variables. It is evident from the result that there is a weak correlation among all the covariate regressors. An interesting result in the correlation matrix is the correlation coefficient between foreign reserves and crude oil price.

Table 6: Bivariate Correlation Matrix of Variables

	CAB	***FDI***	***GDPG***	***INV***	***LF***	***NOILPC***	***OILR***	***OPPC***	***OPR***	***RES***	***DFIN***
CAB	1.000										
FDI	-0.021	1.000									
GDPG	0.236	0.043	1.000								
INV	-0.135	0.011	0.012	1.000							
LF	0.013	0.106	0.161	-0.097	1.000						
NOILPC	0.174	-0.146	-0.128	-0.183	-0.475	1.000					
OILR	0.314	0.222	0.094	-0.133	-0.379	0.346	1.000				
OPPC	0.183	-0.193	-0.116	-0.048	-0.011	0.097	0.287	1.000			
OPR	0.332	-0.129	0.126	0.098	0.191	-0.070	0.160	-0.074	1.000		
RES	0.367	-0.237	0.073	0.085	0.090	0.174	0.031	0.200	0.544	1.000	
DFIN	0.297	0.011	0.052	-0.228	-0.095	0.250	0.020	0.227	-0.203	-0.115	1.000

Source: Authors' Compilation

In Table 6, the correlation coefficient between *OPR* and *RES* is 0.544, which means that there is a positive relationship between both and they have a relatively strong level of correlation. Therefore, having confirmed a low level of correlation among the regressors, we then proceed to estimate the empirical model, which is free from the multicollinearity problem.

4.4. Empirical Findings of the Panel Estimates

We present the results of the empirical models in Tables 7 and 8. In Table 7, the panel estimation results for both the long-run and short-run are presented, while Table 8 presents the cross-sectional short-run coefficients for each of the five countries. As explained in the methodology section, we estimate the panel PMG, panel MG, and the panel DFE results and then used the Hausman test to select the most appropriate. In Tables 7 and 8, the model I is estimated without accounting for deficit finance while deficit finance is included in model II. This stepwise regression makes it possible to determine how significant is fiscal deficits in the transmission between resource rent and growth in the selected resource-rich African nationsat both the short-run and long-run.

Evidence from Table 7 shows that the Hausman test values of 10.20 and 2.03, and their corresponding probabilities of 0.0698 and 0.8452 for both models confirm that they are insignificant. Hence, we reject the null hypotheses that the difference in coefficients is not systematic and confirm that the difference is systematic, thereby approving the appropriateness of the PMG over the MG at 5%. Again, we test between the PMG and the DFE and the Hausman test values of 0.53 and 0.65, and their respective probabilities of 1.000 mean that they are insignificant. We also reject the null hypotheses that the difference in coefficients is not systematic and confirm that the difference is systematic, thereby confirming that the PMG is more appropriate over the DFE. Therefore, since both tests are insignificant at 5% level, we confirm that the short-run coefficients, the speed of adjustments, and intercepts are different across groups, but the long-run coefficients are homogenous across groups. We, therefore, proceed to interpret the pooled mean group results.

Table 7: Oil Resources, Deficit Finance and GDP Growth (Panel Analysis)

Regressors	**Dependent Variable:ΔGDPG**			**Model 1: ARDL (1,1,1,1,1,1,1,1,1,1) Model 2: ARDL (1,1,1,1,1,1,1,1,1,1,1)**		
	Panel PMG		**Panel MG**		**Panel DFE**	
	I	II	I	II	I	II
A. Long-run Estimates						
OPPC	129.325***	120.937***	331.440	244.696	67.120	60.786
	(40.397)	(43.558)	(549.95)	(401.43)	(55.152)	(53.693)
OILR	0.2118***	0.1963***	0.1042	0.0684	0.1719**	0.1718***
	(0.0618)	(0.0619)	(0.1077)	(0.0949)	(0.0670)	(0.0652)
NOILPC	-78.788*	-103.952**	-253.55	-222.105	-23.142	-23.766
	(46.386)	(52.021)	(265.22)	(184.03)	(61.929)	(63.524)
DFIN	-	0.0886	-	0.1120**	-	0.0067
		(0.0670)		(0.0529)		(0.0557)
CAB	-0.0412	-0.0322	0.1189	0.0517	0.0899	0.0802
	(0.0532)	(0.0566)	(0.1885)	(0.1136)	(0.0888)	(0.0895)
FDI	-0.0746	-0.1208	-0.9024	-0.3828	0.00003	0.0014
	(0.0859)	(0.0900)	(1.1773)	(0.7209)	(0.1748)	(0.1700)
LF	9.3538	14.855**	-17.455	-13.216	4.9558	6.2502
	(6.3211)	(6.7397)	(25.671)	(25.903)	(10.776)	(10.625)
INV	0.2569***	0.3195***	-0.2425	-0.3894	0.0948	0.0850
	(0.0683)	(0.0703)	(0.2983)	(0.4998)	(0.1257)	(0.1221)
OPR	-0.0211	-0.0228	0.0237	0.1814	0.0344	0.0219
	(0.0149)	(0.0150)	(0.0812)	(0.2308)	(0.0333)	(0.0335)
RES	1.6235*	0.9849	9.1939	4.5153*	0.7219	0.7953
	(0.8338)	(0.8723)	(6.3477)	(2.5374)	(2.2396)	(2.1976)
B. Short-run Estimates						
ECT	-0.9182***	-0.9026***	-1.1552***	-1.1240***	-1.1428***	-1.1729***
	(0.0901)	(0.1060)	(0.1212)	(0.1111)	(0.0560)	(0.0582)
Δ*OPPC*	558.793**	617.529*	308.89	566.164*	454.07***	434.171***
	(230.14)	(325.67)	(447.18)	(301.41)	(83.587)	(84.382)
Δ*OILR*	-0.1136*	-0.1686***	0.0521	0.0770	-0.0944	-0.1118
	(0.0658)	(0.0642)	(0.1289)	(0.1069)	(0.1078)	(0.1079)
Δ*NOILPC*	-52.085	-56.476	208.55	104.324	-187.11**	-176.454**
	(425.96)	(535.20)	(372.84)	(358.80)	(87.052)	(87.084)
Δ*DFIN*	-	-0.0287	-	0.0624	-	-0.0982
		(0.0872)		(0.1174)		(0.0651)
Δ*CAB*	0.0229	0.0658	-0.0461	-0.0817	0.0081	0.0224
	(0.0159)	(0.0599)	(0.0945)	(0.0958)	(0.1372)	(0.1401)
Δ*FDI*	-0.7158	-0.7162	0.1616	-0.2304	-0.0605	-0.0510
	(0.4485)	(0.5249)	(0.6469)	(0.2961)	(0.1788)	(0.1782)
Δ*LF*	-183.302	-176.296	69.045	351.290	-54.492	-59.196
	(141.32)	(143.40)	(348.56)	(636.39)	(85.577)	(85.480)
Δ*INV*	-0.1547	-0.1916	0.0284	0.1221	-0.4594**	-0.4511**
	(0.2078)	(-0.2149)	(0.2080)	(0.2811)	(0.2035)	(0.2027)
Δ*OPR*	0.0753**	0.0463	0.0172	-0.0372	-0.0435	-0.0397
	(0.0328)	(0.0303)	(0.0714)	(0.1029)	(0.0691)	(0.0724)
Δ*RES*	-6.2602	-4.6436	-0.0572	-12.674	0.7611	0.8928
	(9.1472)	(8.4524)	(12.294)	(15.551)	(3.0465)	(3.0480)
Constant	-73.670***	-102.95***	148.105	118.356	-50.953	-61.707
	(9.6443)	(12.321)	(171.24)	(168.28)	(78.963)	(80.109)
Hausman test	-	-	10.20	2.03	0.53	0.65
[prob.]			[0.0698]	[0.8452]	[1.000]	[1.000]

Note:*PMG, Pooled Mean Group; MG, Mean Group; DFE, Dynamic Fixed Effect(), standard error; [], probability; *Indicates 10% level of significance. **Indicates 5% level of significance.***Indicates 1% level of significance*
Source: *Authors' Computation from Stata*

As observed in the PMG result in the model without fiscal deficits, in the long-run, both oil production per capita (*OPPC*) and oil rents (*OILR*) positively and significantly enhance GDP growth, while net oil export per capita (*NOILPC*) negatively and significantly impacts GDP growth in the selected panel. Both oil production and oil rents are significant at 1% while net oil export is significant at 10%. In model II when deficit finance is accounted for, the signs of these indicators remain the same. Albeit, net oil export becomes significant at 5% level. This means that treating positive oil price shock as a permanent shock is detrimental to growth via these countries' fiscal positionas oil exports take more than 80% of export earnings and around 70% to total revenue. The long-run results of both oil production and oil rents suggest that oil resource abundance, via output and crude oil earnings, helps to boost output growth in the panel of selected African nations thereby rejecting the proposition of the resource curse in Africa. However, when we consider the net oil exports, the reverse is the case as GDP growth reduces with increases in the net oil export, thereby alluding to the resource curse syndrome in the long-run via fiscal position. The net oil export situation is not surprising because treating positive oil price shock as permanent one makes it difficult for them to have fiscal discipline even in periods of negative oil price shock thereby escalating their debt profile in crowding-out private investment which later hampers economic activities. The long-run resultimplies that in spite of their huge oil earnings and foreign exchange, the inability of these countries to diversify their export sector away from the oil sector exposes them to unexpected exogenous shocks. These shocks are often transmitted through their current account to lower budget revenue leading to growth fragility.

Regarding the short-run estimates, Table 7 shows that in both models I and II, only oil production per person positively and significantly enhances GDP growth in Africa, whereas, both oil rents and net oil exports have adverse effects on the growth rate of GDP. Like the long-run results, oil production and oil rent significantly affect the GDP growth at various critical levels while net oil export is insignificant at both 1% and 5% levels in the short-run. This result implies that in the short-run, the amount of crude oil produced contributes significantly to output growth rates in the selected African nations. However, the Petro-dollars earned and net oil export did not translate into developing the non-oil sector production base to be globally competitive to cross these countries border in fetching them foreign exchange earnings to diversify the export

sector and as well the revenue sources to ensure fiscal sustainability preventing exposure to exogenous shocks. It means that in the short-run when we use oil rents and net oil export as proxies of resource wealth, there is evidence of resource curse in the selected panel of countries unlike the situation with oil production per capita. The short-run result for oil rents is indicative of the volatility proposition in oil-rich nations that higher oil-earning returns are often volatile and are therefore not favourable for planning economic growth. Moreover, considering the inclusion of deficit financing in the model, Table 7 shows that *DFIN* harms GDP growth in the short-run but improves it in the long-run. Also, deficit financing is insignificant at 1%, 5%, and 10% levels in both short-run and long-run. This has far-reaching implications for the selected oil-rich African countries as it suggests that countercyclical policy response in these economies is not only growth-reducing but also inadequate in the short-run. Evidence in Table 7 indicates that the error correction terms are negative and are significant at 1% levels for all models. This means that the PMG models are well specified, and the speed of adjustment from the short-run to the long-run steady state is 92% and 90% respectively for models I and II. Also, the results are robust as informed by the sign of *OILR*, *OPPC*, and *NOILPC* in models I and II for both short-run and long-run.

4.5. Results of the country-specific short-run estimates

In Table 8, we present the short-run coefficients for each of the five countries. Results from the table show that for all the five countries, oil production per capita positively impacts GDP growth in model I,meanwhile, with the introduction of deficit finance in model II, oil production has a negative effect in Nigeria but remains positive inAlgeria, Angola, Egypt, and Libya. Interestingly, oil rent reduces GDP growth in Algeria, Angola, Egypt, and Libya, while it improves growth in Nigeria. It gives credence to the volatility of oil revenue hypothesis and indicates that oil-earning volatility in Algeria, Angola, Egypt, and Libyahinders favourable planning for economic growth, except in Nigeria.

Table 8: Oil Resources, Deficit Finance and GDP Growth (Country-Specific Result)

Regressors	**Dependent Variable:ΔGDPG**		**Model 1: ARDL (1,1,1,1,1,1,1,1,1,1) Model 2: ARDL (1,1,1,1,1,1,1,1,1,1,1)**	
	Panel PMG		**Panel MG**	
	I	II	I	II
		ALGERIA		
ECT	-0.6632***	-0.5717***	-0.9970***	-0.9821***
	(0.1829)	(0.1763)	(0.2177)	(0.2437)
Δ*OPPC*	87.653	59.567	322.53*	331.760*
	(121.23)	(121.71)	(167.18)	(183.62)
Δ*OILR*	-0.0434 (0.1856)	-0.1756	0.3571	0.4209
		(0.2079)	(0.3654)	(0.4899)
Δ*NOILPC*	12.555(46.895)	-21.819	2.7296	0.9358**
		(50.401)	(77.039)	(83.657)
Δ*DFIN*	-	0.0650	-	-0.0176
		(0.0697)		(0.1684)
Δ*CAB*	0.0526	0.0679	-0.0394	-0.0452
	(0.0905)	(0.0925)	(0.1486)	(0.1618)
Δ*FDI*	-0.5655	-0.4705	-1.1473	-1.2305
	(0.6735)	(0.7010)	(0.9326)	(1.0669)
Δ*LF*	-18.146	-35.321	26.363	29.897
	(26.904)	(28.032)	(31.385)	(38.364)
Δ*INV*	0.1112	0.0737	0.3316	0.3402
	(0.1987)	(0.2075)	(0.2266)	(0.2604)
Δ*OPR*	0.0277	0.0412	0.0018	-0.0074
	(0.0619)	(0.0610)	(0.1429)	(0.1584)
Δ*RES*	-0.9387	-0.1471	-4.1012	-4.0854
	(0.8897)	(0.9108)	(2.8281)	(3.3035)
Constant	-57.167*	-69.341**	407.81***	421.48**
	(32.585)	(32.888)	(128.59)	(209.09)
		ANGOLA		
ECT	-0.8922***	-0.8780***	-0.8251***	-0.8163***
	(0.1008)	(0.0987)	(0.1570)	(0.2115)
Δ*OPPC*	1199.4***	1060.2***	1838.6***	1576.8**
	(261.85)	(267.76)	(539.63)	(624.91)
Δ*OILR*	-0.3496*** (0.0895)	-0.3211***	-0.3149**	-0.2472
		(0.0846)	(0.1522)	(0.1945)
Δ*NOILPC*	6.6863(219.31)	69.823	178.78	326.37
		(221.69)	(629.00)	(665.83)
Δ*DFIN*	-	-0.1635	-	-0.2486
		(0.1227)		(0.2517)
Δ*CAB*	-0.0252	-0.0544	-0.2600	-0.3050
	(0.1837)	(0.1755)	(0.5795)	(0.5991)
Δ*FDI*	0.0577	0.0843	0.3280**	0.2693
	(0.0907)	(0.0863)	(0.1482)	(0.1792)
Δ*LF*	-608.69***	-594.25***	-651.89*	-699.34*
	(185.44)	(179.16)	(390.51)	(411.67)
Δ*INV*	-0.7483***	-0.7890***	-0.7469***	-0.7108***
	(0.1439)	(0.1385)	(0.2164)	(0.2306)
Δ*OPR*	0.1592**	0.1492**	0.2955*	0.2972
	(0.0782)	(0.0753)	(0.1684)	(0.1860)
Δ*RES*	9.3279*	11.363**	13.051*	13.509
	(4.9077)	(4.9096)	(7.5714)	(9.0457)
Constant	-62.224*	-92.005**	-394.62*	-414.21*
	(37.037)	(38.673)	(208.87)	(217.09)
		EGYPT		
ECT	-1.0183***	-1.0157***	-1.5449***	-1.4767***
	(0.1595)	(0.1474)	(0.2184)	(0.2173)
Δ*OPPC*	984.07	1654.4**	-319.23	609.39
	(639.93)	(646.48)	(1003.2)	(1134.6)
Δ*OILR*	-0.1522 (0.1523)	-0.2942*	0.2614	0.0281

		(0.1574)	(0.2222)	(0.2739)
Δ*NOILPC*	-1398.1**(635.77)	-1771.9***	-565.85	-894.18
		(601.22)	(797.95)	(805.09)
Δ*DFIN*	-	0.2733**	-	0.2647
		(0.1131)		(0.1764)
Δ*CAB*	-0.0035	-0.0162	0.2522	0.1709
	(0.1072)	(0.0999)	(0.1571)	(0.1715)
Δ*FDI*	0.1493	0.2471	-0.3696	-0.1484
	(0.1788)	(0.1721)	(0.2754)	(0.2977)
Δ*LF*	86.915*	-116.75***	-66.228	-116.70
	(46.628)	(44.662)	(56.633)	(64.450)
Δ*INV*	0.1546	0.0857	-0.0143	-0.1021
	(0.1089)	(0.1026)	(0.1593)	(0.1642)
Δ*OPR*	0.0413	0.0656*	-0.0701	-0.0217
	(0.0376)	(0.0366)	(0.0561)	(0.0632)
Δ*RES*	0.3180	0.3714	-3.5602	-2.6944
	(2.3368)	(2.1553)	(2.8278)	(2.9088)
Constant	-78.452	-116.50**	487.18**	-309.97
	(46.708)	(49.669)	(188.69)	(207.95)
		LIBYA		
ECT	-1.1961***	-1.2140***	-1.2453***	-1.1338***
	(0.1190)	(0.1184)	(0.1339)	(0.1238)
Δ*OPPC*	447.44***	395.73**	498.20**	605.35***
	(158.71)	(159.57)	(204.20)	(184.47)
Δ*OILR*	-0.0542 (0.4228)	-0.0628	-0.1796	0.0563
		(0.4135)	(0.6389)	(0.5289)
Δ*NOILPC*	-168.44 (153.41)	-162.45	-188.45	-207.62
		(150.12)	(216.95)	(177.28)
Δ*DFIN*	-	-0.1559	-	0.3953**
		(0.1071)		(0.1999)
Δ*CAB*	0.0368	0.2895	-0.2325	-0.2969
	(0.5162)	(0.5214)	(0.6435)	(0.8828)
Δ*FDI*	-2.3362	-2.6858	2.5710	0.4314
	(2.8825)	(2.8333)	(5.1630)	(5.0880)
Δ*LF*	188.86	240.26	1380.5*	2849.4***
	(521.01)	(525.52)	(774.50)	(769.78)
Δ*INV*	-0.5604	-0.6214	0.4227	1.0087
	(1.1582)	(1.1388)	(1.5288)	(1.2500)
Δ*OPR*	0.1484	-0.0288	-0.0447	-0.3430
	(0.2312)	(0.2522)	(0.3013)	(0.3793)
Δ*RES*	-42.152	-37.424	-56.556	-73.628**
	(29.885)	(30.688)	(41.568)	(35.611)
Constant	-109.40**	-142.14	352.35	337.15
	(47.757)	(51.017)	(555.12)	(515.39)
		NIGERIA		
ECT	-0.8211***	-0.8334***	-1.1638***	-1.2113***
	(0.1444)	(0.1449)	(0.2595)	(0.3139)
Δ*OPPC*	75.377	-82.238	-799.66	-292.47
	(1357.5)	(1370.7)	(2718.1)	(3309.4)
Δ*OILR*	0.0315 (0.1528)	0.0108	0.1364	0.1270
		(0.1520)	(0.2611)	(0.2790)
Δ*NOILPC*	1287.9 (1356.4)	1604.1	1615.5	1296.1
		(1411.9)	(2555.6)	(3104.1)
Δ*DFIN*	-	-0.1622	-	-0.0819
		(0.1923)		(0.5418)
Δ*CAB*	0.0539	0.0424	0.0493	0.0678
	(0.1528)	(0.1519)	(0.2968)	(0.3234)
Δ*FDI*	-0.8842	-0.7561	-0.5752	-0.4736
	(0.4614)	(0.4647)	(0.8404)	(0.9458)
Δ*LF*	-391.62**	-375.40**	-343.47	-306.84
	(184.75)	(182.66)	(370.11)	(415.83)
Δ*INV*	0.2695	0.2930	0.1491	0.0744

	(0.3710)	(0.3705)	(0.9776)	(1.0738)
ΔOPR	-0.0001	0.0044	-0.0967	-0.1110
	(0.0844)	(0.0831)	(0.1375)	(0.1530)
ΔRES	2.1438	2.6186	5.8804	3.5289
	(5.6795)	(5.6373)	(11.180)	(14.473)
Constant	-61.113	-94.781**	-112.19	-143.61
	(40.508)	(45.746)	(408.03)	(444.21)

Note: *PMG, Pooled Mean Group; MG, Mean Group; DFE, Dynamic Fixed Effect (), standard error; [], probability; *Indicates 10% level of significance. **Indicates 5% level of significance. *** Indicates 1% level of significance*

Source: *Authors' Computation from Stata*

Regarding net oil exports, it exerts a negative impact on growth in Angola, Egypt, and Libya, with or without controlling for deficit financing. Meanwhile, in Nigeria, net crude oil export has a positive impact on GDP per capita growth rate for both models while it also has a positive effect in Algeria without deficit finance. With the inclusion of *DFIN* in Algeria, net oil export reduces the GDP growth. Interestingly, while the net oil export in Nigeria, Algeria, Libya, and Angola is insignificant at 1%, 5%, and 10% levels, that of Egypt is significant at 5% and 1% levels respectively in both models. Considering the inclusion of deficit finance in the country-specific models, *DFIN* positively contributes to growth in Algeria and Egypt, while it lowers growth in Libya, Nigeria, and Angola. Interestingly, the inclusion of deficit finance reverses the positive impact of net oil exports on GDP growth in Algeria and that of oil production on growth in Nigeria. It, however, did not alter the sign of any of the oil resource abundance proxies in Libya, Egypt, and Angola. The intuition is that while countries like Algeria and Nigeria are reaping the positive benefits of deficit finance on their GDP growth, the management of such fiscal deficits sterilises certain part of their resource wealth thereby causing it to lower the growth rate of the GDP. Another notable result is that deficit finance is only significant in Egypt at 5% level, it is insignificant at 1%, 5%, and 10% in Algeria, Nigeria, Libya, and Angola.

4.6 Discussion of Findings

The fact that oil production positively impacts GDP growth in Algeria, Angola, Egypt, and Libya except in Nigeria intuitively means that the resource curse syndrome is only found in Nigeria but absent in the remaining four countries. The interpretation is that in Algeria, Angola, Egypt, and Libya, their per capita GDP growth is mainly driven by crude oil export and not overall economic output of manufacturing and agriculture. Therefore, as crude oil exports increase and they earn more foreign exchange, their GDP rises too. Also, it means that in Nigeria, the productive sectors are becoming essential in driving overall output compared to those in Algeria,

Angola, Egypt, and Libya. Therefore, the oil production result in Algeria, Angola, Egypt, and Libyais at variance with Sachs and Warner (2001), Sala-i-Martin and Subramanian (2013), Polterovich *et al.* (2008), Haber and Menaldo (2011),Satti*et al.* (2014), Eregha and Mesagan (2016), Robinson*et al.* (2017), Mesagan *et al.* (2019), which found the existence of the resource curse syndrome in natural resource-rich countries. This situation also permeates through the panel result as oil production per capita in the selected panel positively affects GDP growth, both in the short- and long-run. This is indicative of the fact that output growth among the selected African nations is primary product dependent. This probably explains why any adverse shocks to the global crude oil price always adversely affect these countries, thereby resulting in budget deficits as their expenditure often outweighs revenue. This is in tune with the findings of Usui (1997) as well as Mehrara and Oskoui (2007) for Indonesia.

Furthermore, the adverse cross-sectional effect of oil rents on growth in Algeria, Angola, Egypt, Libya, and short-run of the panel resultsupports the volatility of oil earnings hypothesis in resource-rich nations. It plausibly indicates that oil-earning volatility inthe four countries and the short-run of the selected panel encumbers favourable growth planning for economic growth, except in Nigeria. This is in tune with the findings of Aladejare (2018) for a group of selected oil-exporting nations. Moreover, the negative effect of net oil export on GDP growth in the short- and long-run in the selected panel, Angola, Egypt, Libya, and Algeria while controlling for deficit finance corroborates the earlier adverse effects of oil rents on growth in the four nations and the panel. It thus means that the oil-revenue volatility in Angola, Egypt, Libya, Algeria, and the panel also works through the channel of the net oil export to negatively impacts the GDP per capita growth. Only Nigeria escapes this oil-revenue volatility trap as both oil rents, and net oil exports positively affect growth. More so, this result is not surprising because Nigeria is the 6th largest oil producing nation globally and dominates the other African countries in terms of the amount of Petro-dollars earned over the study period. It also implies that GDP growth in Nigeria is tied to the oil sector than the other countries. Also, since the turn of the year 2004, Egypt has become a net oil importing nation considering the negative trend of its oil net export presented in Fig. 3. This scenario explains why net oil export has an insignificant effect in Nigeria, Algeria, Libya, and Angola but significant in Egypt.Again, the significant reduction power of net oil

export on growth in Africa in the long-run indicates an uncertain future if oil-rich African nations do not invest part of their oil-wealth in boosting the productive base of their economies.

Moreover, the fact that deficit finance positively impacts GDP growth in Algeria and Egypt, while it is negative in Libya, Nigeria, and Angola means that both Egypt and Algeria have been able to transform fiscal deficits into enhancing GDP growth while Libya, Nigeria and Angola have not. This is indicative of the fact that the composition of debts might have limited the capacity of Libya, Nigeria and Angola to translate fiscal deficits into output growth. Theoretically, when local borrowings occupy a significant chunk of fiscal financing, a crowding-out of private investment that retards GDP growth is imminent. For instance, in Nigeria's 2018 budget, 48% of the deficits will be financed from the domestic debt market, and this is very large vis-à-vis the critical situation prevailing in the domestic economy. The reason is that 48% of ₦1.954 trillion borrowing from local sources placed a massive burden on the local front and significantly affects the amount of fund that private investors can have access to as such spending results in raising interest rate. Thus, the result for Algeria and Egypt is in line with those of Mehrara and Oskoui (2007), Usui (1997), and Cologni and Manera (2013) thatfiscal expansion stimulates growth in resource-wealthy countries. It is also indicative of the fact that Algeria and Egypt have sufficiently used fiscal deficits to boost GDP growth while its effectiveness in Libya, Nigeria and Angola remains a mirage. The result for Algeria and Egyptis also in sync with Usui (1997), which found that fiscal actions regarding the efficient use of budget deficits were responsible for growth in Indonesia. The fact that deficit finance has a negative short-run effect on growth in the panel but positive impact in the long-run means that it is an essential channel for improving long-run growth in oil-rich Africa due to low domestic resource mobilization if properly channel to productive infrastructure.Also, the insignificant impact of deficit finance on growth in Algeria, Angola, Libya, Nigeria, and the panel, in both the short- and long-run, except in Egypt means that deficit financing as a countercyclical response in the largest oil-rich African nations is still fragile. This is in tune with Bulte *et al.* (2005), Gylfason and Zoega (2006), Aslanli (2015),and Doro and Kufakurinani (2018), which attributed the growth drag in resource-rich nations to their inability to establish effective fiscal policy rule. Our findings also corroborate the results of Bova *et al.* (2018) that procyclical fiscal policy

biases necessitated the weak contribution of fiscal deficits to growth in non-renewable commodity-exporting African nations.

4.7 Cross-sectional Dependence Tests

In Table 9, we present the result of the cross-sectional dependence tests. These tests are crucial since the literature on cross-country studies affirm that panel data can exhibit a certain level of cross-sectional dependence owing to several unexplained elements that are fused into the residual terms and the presence of common shocks. As explained in the methodology section, the Pesaran and Chudik (2014) cross-sectional dependence test is specifically used to ascertain the appropriateness of the first-generation panel unit root tests.To this end, we present four different cross-sectional tests in Table 6; they include the Breusch-Pagan Langrage Multiplier (LM) test, the Pesaran Cross-sectional Dependence (CD) test, the Frees normality test, and the Friedman chi-square test.

Table 9: Cross-Sectional Dependence Test Results

Null Hypothesis: There is Cross-Sectional Independence				
Test	**Without Deficit Finance**		**With Deficit Finance**	
	Statistic	**Probability**	**Statistic**	**Probability**
Breusch-Pagan LM test	4.558	0.9187	4.620	0.9151
Pesaran CD test	0.704	0.4812	0.719	0.4721
Frees test	-0.055	1.7079	-0.058	1.7343
Friedman test	42.023	0.0000***	42.542	0.0000***

**** Indicates 1% level of significance*

Available evidence in Table 6 suggests that we can reject the null hypothesis of cross-sectional dependence using the Breusch-Pagan LM test, the Pesaran CD test, and the Frees test since they are all insignificant with statistic values of 4.558, 0.704, and -0.055 respectively in the with and without deficit finance models. Only the Friedman test accepts the null hypothesis of cross-sectional dependence at 1% level of significance. Therefore, this possibly means that there is no strong cross-sectional dependence among the selected oil-rich nations since most of the criteria reject the null hypothesis. However, with the Friedman result, it means that a certain level of dependence may exist due to the role that Organisation of Petroleum Exporting Countries (OPEC) plays in enforcing specific oil production quotas and policies among its members.

However, such is not strong enough to necessitate a strong cross-sectional dependence. This also makes the use of the first-generation unit root tests very appropriate in this study.

5. Conclusions and Policy Implications

From 1980 to 2017, this study examined the effect of oil resource abundance and deficit finance on per capita GDP growth in selected oil-rich African countries. The five largest oil-rich African nations comprising Algeria, Angola, Libya, Egypt, and Nigeria are used in the study. The GDP growth per capita is employed as the dependent variable, while oil production per capita, oil rents, and net oil export are used as oil resource abundance measures. The oil resources-growth nexus is considered through the transmission of deficit financing in these countries as positive oil price shock is mostly treated as permanent which shows in these countries rising spending pattern in a way that it becomes tough to adjust during the period of negative oil price shock. To provide a dynamic relationship among per capita GDP growth, deficit financing and oil resource link, we employed the recently developed dynamic heterogeneous panel-ARDL regression based on the Pooled Mean Group, Mean Group and Dynamic Fixed Effect estimators. The PMG was interpreted based on the Hausman test criteria, which rejected both the MG and the DFE. For the specific objectives, the PMG result confirmed that oil production positively enhanced GDP growth in Algeria, Angola, Egypt, and Libya, except in Nigeria. Oil production also undoubtedly increased growth in the selected panel in the short- and long-run. Hence, the result for Algeria, Angola, Egypt, Libya, and the panel, is similar to those of Bulte *et al.* (2005), Alexeev & Conrad (2009), Cavalcanti *et al.* (2011), Boyce & Emery (2011), Yuxiang & Chen (2011), James (2015), Ben-Salha *et al.* (2018), and Mesagan, Yusuf & Ogbuji (2019), which found that resource abundance is growth enhancing. Meanwhile, the Nigerian result is similar to those from Gylfason (2001), Bannon & Collier (2003), Papyrakis & Garlagh (2004), Mehlum *et al.* (2006), Mehrara & Oskoui (2007), Van Der Ploeg & Venables (2009), Sala-i-Martin & Subramanian (2013), Cockx & Francken (2016), Eregha & Mesagan (2016), Robinson *et al.* (2017), Allcott and Keniston (2017), as well as, Moradbeigi & Law (2017), which found evidence of resource abundance being a drag to growth. More so, oil rents have an adverse effect on growth in Algeria, Angola, Egypt, Libya, and in the selected panel in the short-run, but exert a positive impact on the oil-rich African nations in the long-run. Thirdly, results showed that net oil export has a negative effect on GDP growth in the short- and long-run in Africa, Angola, Egypt, Libya,

and Algeria, but positive in Nigeria. Lastly, deficit finance positively enhanced GDP growth in Algeria and Egypt, while it had negative effects in Libya, Nigeria, and Angola. It also exerted a negative short-run impact on growth in Africa but had a positive effect on growth in the long-run.

Consequent on this result, we conclude that oil production enhanced per capita GDP growth in Algeria, Angola, Egypt, Libya, and Africa, except in Nigeria. Also, we conclude thatoil rents and net oil exports negatively affected per capita GDP growth in Algeria, Angola, Egypt, and Libya, apart from Nigeria. Similarly, oil rents adversely affected oil-rich Africa in the short-run but positive in the long-run, while net oil export negatively impacted African oil-rich nations both in the short- and long-run. Lastly, we conclude that deficit finance positively enhanced GDP growth in Algeria and Egypt, while it negatively affected growth in Libya, Nigeria, and Angola. Also, it exerted a negative short-run effect on growth in Africa but had a long-run positive impact on growth too. With this result, it is pertinent for Egypt and Algeria to utilise their positive fiscal actions to augment the harmful effects of oil rents and net oil exports to boost output growth. In countries like Angola, Libya, and Nigeria with a weak fiscal position, as informed by the negative effect of deficit finance on growth, they can improve their countercyclical fiscal policy response by ensuring that sustainability of their rising debt is guaranteed and proper utilisation of deficit finance to productive infrastructure that has the tendency to reduce production cost. Moreover, it will be necessary for all the five oil-rich African nations to reshape the structure and composition of government budget deficits to enable them to translate the short-run adverse effect of deficit finance on growth into a positive one in the long-run. Furthermore, oil-rich African nations can learn from the Indonesian experience to use part of their oil largesse in boosting the productive base of their economies. This will not only help to enhance GDP growth but will also propel government revenue beyond expenditure and lower fiscal deficits during the periods of adverse crude oil price shocks. It also behoves on these countries not to treat any positive oil price shock as permanent in their spending pattern.

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