Effects of Oil Wealth on Capital Accumulation in Nigeria: A Non-linear ARDL Approach.

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Abstract

This study investigated the effect of oil wealth on capital accumulation in Nigeria over the period 1981 to 2017. In addition, the study assessed the nonlinear effect of oil wealth on capital accumulation in Nigeria. These were with a view to examining the uncertainties in the relationships between oil wealth and capital accumulation in Nigeria. Annual data on oil wealth, capital accumulation, economic growth, and real effective exchange rate were sourced from the World Development Indicators (WDI) of the World Bank Data 2017 and 2018 editions. Globalisation index and oil price were sourced from the Swiss Economic Institute Statistical Bulletin, KOF, 2017 edition and the British Petroleum Statistical Bulletin (BP, 2017). Data collected were analysed using Autoregressive Distributed Lag (ARDL) and the Non-Linear Autoregressive Distributed Lag (N-ARDL) econometric techniques. Linear ARDL result indicated that oil wealth had a negative and insignificant relationship with capital accumulation ($t= -1.11$; $p>0.10$). Non-linear ARDL results show that both positive ($t = -6.69$; $p<0.01$)and negative ($t = -5.59$; $p<0.01$) changes in oil wealth significantly affect capital accumulation negatively while only the positive long run sum of capital accumulation affect oil wealth negatively ($t = -2.76$; $p<0.05$). Finally, real effective exchange rate had effects on capital accumulation ($t = -6.66$; $p<0.01$) and oil wealth ($t = -4.66$; $p<0.01$) both in the short run and long run. Globalisation had positive long run and short run effects on capital accumulation ($t = 5.56$; $p<0.01$ and $t = 4.38$; $p<0.01$) and short run positive effect on oil wealth ($t = 2.56$; $p<0.01$). The study therefore, concluded that oil wealth have a negative relationship with capital accumulation which aligns with the resource curse argument for Nigeria.

Key words: Oil wealth, capital accumulation, globalisation, and N-ARDL.

1. Introduction

Before the discovery of oil in 1956 at Oloibiri in Niger Delta, Nigerian economy depended largely on agriculture which accounted for about 75% of her Gross Domestic Product (GDP). Oil became the mainstay and the major source of energy for Nigeria towards the end of the Nigerian civil war of 1967 to 1970 (Odularu, 2008). Available data show that petroleum reserves in Nigeria hover around 40 billion barrels of crude oil with more new discoveries, while, the capacity for oil production in Nigeria varies between 2.5 to 3 million barrels a day (mbpd). It could sometimes be less due to production cuts caused by Organisation of Petroleum Exporting Countries (OPEC) and pipeline vandalism. The price of the Nigerian Forcados, for instance, fluctuates and declined on the average, from an all-time high of $114.21 in 2012 to $101.35, $43.7 and below $30 in 2014, 2016 and 2017 respectively (BP statistical reviews, 2017). Also, the level of annual growth rate of physical capital accumulation averaged 2.95 percent from 1981 to 2017 with maximum and minimum records of 59.39 and -34.42 percent in 2006 and 1983 respectively. The resultant high volatility in the revenues from crude oil export with changes in the level of accumulated capital that does not commensurate with changes in economic growth, especially during oil price accretion, further necessitated the need to create a Sovereign Wealth Fund (SWF) in Nigeria in May 2011.

The establishment of SWF in Nigeria was to proffer solutions to the problems associated with Excess Crude Account (ECA) created in 2004. SWF is expected to keep some savings for future generations, invest the extra income from natural resource that results from its exploitation into the development of infrastructure and meet budget shortfalls in the future. Establishing this fund was projected to serve as shield in the case of financial crisis and to insulate Nigerian economy from external shocks (Central Bank of Nigeria, 2012). Thus, the workability of SWF, in terms of investment scope and structure, is dependent on the existing institutions of every nation and the purposes for which the fund is set to achieve (Ndanusa, 2018). This raises serious issues of transparency and accountability as justification for resource curse and the Dutch disease syndrome that result from corruption and maladministration of Nigeria's oil wealth.

Oil wealth has been a blessing to countries with large deposit of crude oil since its discovery as a source of energy. However, energy sources are ever changing: from fossil fuels like coal to oil, oil to natural gas, and now moving towards new sources of energy with minimal level of carbon emission in the future. Nigeria is yet to be classified as a country with requisite technological advancement to currently catch up with the low carbon emission policy of the advanced countries.

In addition, the Nigerian economy is basically an open economy that depends largely on oil revenues and savings for international transactions (Abayomi, Adam and Alumbugu, 2015). However, the determination of oil prices, price differential between different grades of crude oil, and market spread as well as factors affecting future markets are caused by such external factors as world oil demand and supply, exploration of US shale oil and OPEC (BP Statistical Review, 2017). The sudden increase in crude oil prices led the ECA to also rise to almost fourfold of its value, from $5.1 billion to over $20 billion in 2005 and 2008 respectively. This sudden development in crude oil price during that period increased Nigeria's external reserve by more than a-third. The excesses in ECA had dropped drastically in June 2010 to a little below $4 billion owing to a steep drop in crude oil price and budget deficit in Nigeria that consequently led to the establishment of SWF by the Nigerian Sovereign Investment Authority (NSIA) in 2011 (CBN, 2012). The fund was established to mobilise savings in order to buffer the economy during any other financial crisis that may affect the country in the future, and to store extra funds to cushion liquidity shortages that may endanger future generations. Even though the fund helped to enhance the growth in external reserves and boosting the confidence of international investors during the period of its establishment, it still could not sustain the Nigerian economy. Thus, SWF could not serve as a buffer for the Nigerian economy against external shocks that result from drastic drop in oil price between 2012 and 2017. Consequently, there was need for Nigeria to seek for loans externally to finance her budget shortfalls during the period of the crisis.

Considering this background, Nigeria's decisions on oil production and the decisions on economic fundamentals required for developmental purposes should be seen mainly in the context of savings (SWF) and management of the nation's assets as suggested by economic theory (Razavi, Aitzhanova, Iskaliyeva, Krishnaswamy, Makauskas, Sartip and Urazaliyeva, 2015). It is pertinent, therefore, to ensure that policy issues surrounding oil wealth and SWF, capital accumulation and infrastructural development be properly investigated and addressed to ensure that Nigeria sets a pace for Africa

From the foregoing, this study will make contributions in the following two areas: (1) assessment of the extent to which oil wealth affects capital accumulation in the Nigerian economy; (2) formulation of the nonlinear relationship to adequately capture asymmetries that may exist between oil wealth and capital accumulation especially during the recent business cycle fluctuations.

The rest of this paper is set out as follows; Section 2 discusses related literature and empirical justification from the literature on oil wealth and capital accumulation nexus. Section 3 presents the theoretical motivation, data description and methodology. In this section, a preliminary analysis of data is also provided. Section 4 presents the results and discuss the empirical findings. Section 5 contains the conclusion and policy implications.

2. Literature Reviews

2.1 Discussions on Related Literature

Despite the long run relationship established in the literature that oil rent contribute immensely to the basic revenue source and remain the main channel through which oil-rich exporting countries finance their spending (Odularu, 2007; Akinleye and Ekpo, 2013; Hamdi and Sbia, 2013; Akinlo and Apanisile, 2014; Ahmouda, 2014; Attamah, 2015; Matallah & Matallah, 2015; Obi, Awujola and Ogwuche, 2016), many studies indicate that resource curse does exist in some of these oil-rich exporting economies (Sachs and Warner,1997; Auty, 1998; Hamilton *et al.*, 2006; Olomola and Adejumo, 2006; Olomola, 2007; Akinlo, 2012; Emani and Adibpour, 2012; Matallah & Matallah, 2016). A few other studies indicate the contrary (Bjørnland 1996; 1998; Arin and Braunfels, 2016). Most of the studies that investigate economic growth-resource curse and economic growth-capital accumulation nexus in Nigeria focus attention on transmission channels such as democracy, or Dutch disease and institutions without putting much attention on capital accumulation as one of the major channels through which oil wealth transcends to growth.

The Dutch Disease Syndrome argument have often been advanced to have been caused by weak institutions in Nigeria – a phenomenon expression that Nigeria, though endowed with natural resources, still suffer from low per capita income. This event of low per capita income is usually preceded by resource movement effect that often leads to indirect deindustrialization and spending effect that results from the unguided spending culture and abuse of public funds (Olomola, 2007; Baghebo and Atima, 2013; Matallah & Matallah, 2016) that disrupt the basic economic fundamentals required for development (Ndanusa, 2018).

Oil price changes and hence oil revenue changes have been established to have significant influence on economic activity of oil importing and exporting economies either negatively or positively depending on whether there is sharp oil price increase or decrease (Hamilton, 1983; 2003; 2009; Olayeni, 2011; Emami and Adibpour, 2012; Hamdi and Sbia, 2013; Akinleye and Ekpo, 2013; Akinlo and Apanisile, 2014; Fuinhas *et al.*, 2015). Olomola and Adejumo (2006) note that oil price shock has no effect on growth in Nigeria. However, positive and negative oil revenue shocks affect output growth significantly with asymmetric effects (Emami and Adibpour, 2012; Obi *et al.*, 2016).

Similarly, some group of authors opine that the rise in oil rent, in real term and as a proportion of the GDP, was not followed by an expansion of capital accumulation both in physical and human capital (Kornblihtt, 2015; Blanco and Grier, 2011). Although, some authors argued that oil wealth is associated with higher physical capital in developed oil-rich countries and lower human capital in developing oil-rich countries (Blanco and Grier, 2011), human capital remains the major channel of transmission to growth in both categories of countries (Adebiyi and Olomola, 2013).

Many researchers have established that a strong correlation exists between oil wealth and capital accumulation in the Nigeria economy using linear model. Studies are yet to compare the correlation between oil wealth and capital accumulation using non-linear model. A key point is that, linear models have a symmetry feature which are restrictive and cannot adequately capture the asymmetric features that may occur in business cycle fluctuations in the data. For instance, linear models suggest that shocks taking place during recession periods are as repetitive and continuous as the counterpart shocks in the expansionary phases (Koop, Pesaran & Potter, 1996); meanwhile, such may not be the case with the use of non-linear model.

2.2 Empirical Justification from the Literature

Results from Stijns (2006) indicate that mineral wealth affects positively accumulation of human capital. Stijns examines the rents from abundance of natural resource and the indicators of human capital accumulation in 102 countries running from 1970 to 1999 using a Panel VAR. His observable results from cross-country analysis does not reveals that they are both driven by overall economic development; both subsoil wealth and that political stability really seem to have effect on accumulation of human capital, though not enough to overturn his earlier findings; a shock of $1 to resource rent produces an extra five cents expenditure per year for education. His findings are in line with the conclusions of Hirschman that "economies have weaker production leakages but stronger government revenue linkages than other activities".

Hamilton, Ruta and Tajibaeva (2006) explore data on rents on exhaustible resource extraction and investment from 70 countries in order to make submission on question of "how rich would resource-abundant countries be if they had actually followed the Hartwick Rule" (i.e. invest rents from resource into other productive assets)? They employs Perpetual Inventory Model (PIM), Hartwick Rule and Constant Genuine Investment Rule. Findings reveal that the individual wealth of Venezuela, Trinidad and Tobago, and Gabon would be as that of South Korea, while Nigeria would be better off five times as she is currently if the paths of Hartwick Rule were pursued. For simplicity, they presume all resource rents be used to finance the production of reproducible capital, although suggestions from the theory later allowed resource rents to be used up in various of assets, especially in accumulating human capital.

Following the same steps, Jojarth (2007) applies two separate models namely Feasible Generalized Least Square (FGLS) and Ordinary Least Square (OLS) to investigate how to find the right metrics in estimating oil wealth in 25 oil rich countries. Their study cover two separate periods from 1987 to 2006. Findings show that oil rents give a different picture about a country's oil wealth than production volume alone in these countries. Equally, Blanco and Grier (2011) posit that total dependence of resource is significantly unrelated to physical and human capital. By applying GMM approach to investigate 17 Latin American countries, they disaggregated variables of natural resource into subgroups. Their findings reveal that dependence on petroleum export has connection with lower human capital and higher physical capital, while dependence on agricultural export mostly can be linked with lower levels of physical capital.

Auty (1998) adopts Staple Trap Model and Sequenced Industrialisation Model to study resource-rich countries from 1920 to 1992. His results show that since 1960s resource-abundance had been associated with disappointing economic development and affects the structural change and the rate of accumulation of produced and human capital. Even if natural capital assets contribute considerably less to the generation of economic growth than human capital, natural capital still exerts a significant role in directing the development trajectory and in explaining how produced and human capital are better organised efficiently.

Bond, *et al.* (2007) submit from their findings that an expansion in investment as a share of GDP envisages greater rate of growth in per worker output, not only in the meantime, but in the longer term also. They employ Autoregressive Distributed Lag (ARDL) model to investigate link between per worker output growth and physical capital investment in pooled annual data of 94 countries from 1960 to 2000. They also allow over-lapping five-year periods with slope parameters as well as intercept parameters varying across countries. In addition, countries with oil production as the dominant industries were included following Mankiw *et al.* (1992). Their findings show that the impact of investment on growth rates is a long term one which agrees with the main suggestion of some endogenous growth models such as Romer (1986) AK-type models, and Schumpeterian-type models whereby capital serves as an input in the creation of innovations.

Adebiyi and Olomola (2013) investigate Norway and Nigeria between 1970 and 2007 using VAR model. Findings indicates that oil wealth improves human capital in Norway, but negatively influence human capital in Nigeria. Submissions from their results, though not conforming to expectations, suggest that the major channel of transmission to growth still remain human capital in the two countries. Also, for the two countries, human capital, oil wealth and economic growth have a long run relationship.

The fundamental step required for measuring oil rent and its distribution over time inspired Kornblihtt (2015) to graphically analyse the Venezuela economy from 1980 to 2008. His discoveries are that: the rise in oil rent in Venezuela's history absolutely and relative to GDP—was not followed by an expansion of capital accumulation; and the increasing importance of oil rent in the Venezuelan economy is as a result of the stagnant accumulation of capital that have not grown in the private sector.

Osundina and Osundina (2014) investigate the problems associated with low savings and capital accumulation in connection with economic growth in Nigeria between 1980 and 2012. Results from the applications of Savings Models, Investment Models and Growth Models show that investment and GDP have a positive and significant effect on savings in Nigeria; savings significantly has positive effect on the Nigerian investment; and the effect of investment on economic growth is insignificantly positive, while savings positively has significant effect on the Nigerian economic growth.

Regarding the relationship between oil export and capital formation, Udude *et al.* (2017) adopt VECM method to investigate the effect of oil exportation on capital formation in Nigeria from 1980 to 2015. Their investigation indicated that: oil exports significantly affect gross capital formation negatively; the influence of real GDP on capital formation in Nigeria only occur in the long run; causal relationship does exist between gross fixed capital formation and Economic growth in Nigeria. Conclusion from their findings show that oil export does not improve gross capital formation growth in Nigeria.

3. Data Description, theoretical motivation and Methodology

3.1 Data Description

This paper investigates the linear and the non-linear effects of oil wealth on capital accumulation in Nigeria. Building on other studies, five macroeconomic variables are used in the analysis and these are: economic growth (Hamilton, 1983; 2003; 2009; Auty 1998; Olomola and Adejumo, 2006), oil rent (Olomola, 2007), capital accumulation (Stern, 1993; Auty, 1998; Stijns, 2006; Adebiyi and Olomola, 2013; and Udude *et al.*, 2017), real effective exchange rate (Arnold, 2004; Hinkle and Montiel, 1999; Odedokun, 1997; Aliyu, 2011), and institutions (North and Thomas, 1973; Acemoglu, 2007; Olomola, 2007). Olomola (2007) interacted institution with oil rent to examine their joint effect on economic growth. For the purpose of this study, globalisation was used in place of institution since oil price (hence oil revenue) is determined majorly by external factors. Additionally, the composite index measuring globalisation for every country in the world (Dreher, 2006; Dreher *et al.*, 2008; Haelg, 2018) is along economic, political and social dimensions. This index suggest that globalisation is broader in scope and all-encompassing than institution when it comes to the aspect of oil wealth. The study make use of annual secondary data from 1981-2017 This period spans through recent major oil booms and recessions during which Nigeria experienced some levels of growth as well as diminution in economic activities. The data was sourced from the Nigeria Bureau of Statistical Bulletin (NBS, 2010; 2017; 2018:Q1) World Development Indicator (WDI, 2017); Swiss Economic Institute Statistical Bulletin (KOF, 2017); and British Petroleum Statistical Bulletin (BP, 2017).

3.2 Theoretical motivation

The theoretical framework for this study has its underpinning theory from Hartwick's rule (1977; 1978) and endogenous growth theory (an extension of the Solow growth model of 1956 and 1974). Hartwick's rule (1977, and 1978) focused on intergenerational equity and points out that rents from exhaustible resources should be invested into reproducible capital (machines, buildings, etc.). Only then will per capita consumption remain constant along dynamically efficient paths.

The endogenous growth theory posits that economic growth is determined endogenously by factors such as a broader definition of capital goods which include growth in human capital (knowledge and innovation). Resources here consists of physical capital, human capital and knowledge capital (innovations). The term innovation also refers to the adaptation of technologies which in turn depend upon the institutional arrangements.

Following the work of Solow (1956; 1974), Mankiw, Romer and Weil (1992) augmented the Cobb-Douglas production function with shift variables.

$$Y_t = A_t K_t^{\alpha} L_t^{\beta}, \qquad (0 < \alpha < 1,\ 0 < \beta < 1,\ 0 < \alpha + \beta < 1) \qquad (3.1)$$

where Y_t is output; L is labour; A_t Labour Augmenting factor, indicating the technology and efficiency level in the country and it grows at exogenous constant rate of $\hbar$; K is the physical capital stock in the country t is time period; while, α and β are the shares for capital and labour respectively that must sum to 1.

Remodelling equation (3.1), we have:

$$y_t = A_t k_t^{\alpha} \qquad (3.2)$$

where $y_t = \mathrm{Y_t} / L_t$ is the output per worker, and $k_t = \mathrm{K_t} / L_t$ is the capital per worker representing the level capital accumulation. Capital formation is used as capital accumulation in this study.

The presumption of technology by Solow as evolving is expressed as $A_t = A_0 e^{\hbar t}$ where A_0 = stock of initial knowledge and $\hbar t$ = rate of growth in knowledge at time t

However, for there to be spending, government must generate revenue mainly through Oil wealth and other non-oil taxes. Thus revenue from oil resource is considered a major component in the endogenous growth equation. For this study, we adopt oil rent (*OilR*) to measure oil wealth. Therefore:

$$A_t = f(OilR_t) \tag{3.3}$$

where $OilR_t$ is oil rent at time t.

Equation (3.3) can be rewritten such that oil rent can be captured in the model:

$$A_t = A_0 e^{\hbar t} OilR_t^{\tau} \tag{3.4}$$

where $e^{\hbar t}$ accommodates other factors regarded as catch-all. Substituting equation (3.4) into equation (3.2), the production function becomes:

$$y_t = \left(A_0 e^{\hbar t} OilR_t^{\tau} \right) k_t^{\alpha} \tag{3.5}$$

3.3 Methodology

The objective of this empirical investigation is in two folds. First is to look at the linear relationship between oil wealth and capital accumulation, while the second is to investigate the non-linear relationship between these variables. In order to establish the stability of the data series, the paper first investigates the stationarity property through the use of unit root tests as suggested by Dickey and Fuller (1976; 1979; 1981) and Phillips-Perron (1988). The study subject the variables to the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root test to verify whether unit root is present in the series or not and to ascertain the integrating order of the variables. Having verified that the data series are of mixed order, we then move further to examine the long-run relationship between the variables by conducting the cointegration tests using Autoregressive Distributed Lag (ARDL) Bounds testing procedure. This is to examine how the time series data of the variables, which though may be individually non-stationary and drift extensively away from equilibrium, can be paired such that the workings of equilibrium forces will ensure they do not drift too far apart. Thus, our estimating model is:

$$\Delta gfcf_t = \hbar + \beta oilr_t + \theta gdpp_t + \phi reer_t + \omega glob_t + \varepsilon_t \qquad (3.6)$$

Where: β , θ, ϕ , and ω are the coefficients of oil rent ($oilr_t$), gross domestic product growth rate per capita ($gdpp_t$), real effective exchange rate (*reer)* and globalisation index (*glob*). $gfcf_t$ represents the accumulation of physical capital as a percentage of GDP, while $\hbar$ and ε_t represents constant parameter and the error term respectively.

The cointegration process pertaining to oil wealth and capital accumulation starts with the re-modification of equation (3.6) above into ARDL framework:

$$\Delta gfcf_t = \hbar + \sum_{i=0}^{p} a_{1i}\Delta gfcf_{t-i} + \sum_{i=0}^{q} a_{2i}\Delta oilr_{t-i} + \sum_{i=1}^{r} a_{3i}\Delta gdpp_{t-i} + \sum_{i=0}^{s} a_{4i}\Delta reer_{t-i}$$
$$+ \sum_{i=0}^{t} a_{5i}\Delta glob_{t-i} + \vartheta gfcf_t + \tau oilr_t + \alpha gdpp_t + \lambda reer_t + \sigma glob_t + \varepsilon_t \qquad (3.7a)$$

where: Δ = difference operator, $a_{1i} - a_{5i}$ represent the short run parameters, $\vartheta, \tau, \alpha, \lambda, \sigma$ are the long run parameters. The region with the summation sign (∑) in equation (3.7a) represent the short run estimates while, the portion without the summation sign denote the long run estimates

The cointegration test requires setting up the null hypothesis of no cointegration $(H_0 : \vartheta = \tau = \alpha = \lambda = \sigma = 0)$ against the alternative hypothesis of cointegration $(H_0 : \vartheta \neq \tau \neq \alpha \neq \lambda \neq \sigma \neq 0)$. Long run relationship exists if F-statistic is greater than the upper critical bound value for which the null hypothesis that signifies no cointegration is rejected. If the calculated F-statistics is below the lower bound critical value, the null hypothesis of no cointegration in equations is accepted. However, no inferential conclusion is made if it F-statistic lies within the lower and upper bounds.

The next step is to estimate the long-run model, having established that cointegration does exist between the variables. Therefore:

$$gfcf_t = \hbar + \alpha gfcf_t + \tau oilr_t + \vartheta gdpp_t + \lambda reer_t + \sigma glob_t + \varepsilon_t \qquad (3.7b)$$

The selection of the lag orders for the variables are carefully decided using Akaike Information Criteria (AIC) or Schwarz Bayesian Criteria (SBC) to determine the optimal structure for the ARDL specification. After estimating and calculating the ARDL ($p, q, r, s, t.$) model and the associated long-run multipliers, the following error correction model is formulated in order to estimate the short-run dynamics:

$$\Delta gfcf_t = \hbar + \sum_{i=0}^{p} a_{1i}\Delta gfcf_{t-i} + \sum_{i=0}^{q} a_{2i}\Delta oilr_{t-i} + \sum_{i=1}^{r} a_{3i}\Delta gdpp_{t-i} + \sum_{i=0}^{s} a_{4i}\Delta reer_{t-i} + \sum_{i=0}^{t} a_{5i}\Delta glob_{t-i} + \Omega ECM_{t-1} + \varepsilon_t \qquad (3.7c)$$

Ω represents the parameter for speed of adjustment expected to be in negative form.

The ECM is the lagged error correction term obtained from the estimated cointegration model of equations (3.7b). To establish the stability of the long-run and short-run coefficients, the CUSUM and CUSUMSQ tests to the residuals of the equation was applied to examine if the two statistics stay within the 5 % significant level.

3.3.1. Nonlinear ARDL Bounds Test Approach

Application of N-ARDL provides us with information that capture short run and long run asymmetries in the oil wealth –capital formation relation. The criticism for the linearity of the classical cointegration models as put forward by Engle and Granger (1987) lead us to attempting at the modelling of non-linear cointegration relation. Therefore, significant inputs from econometric modellers (such as: Granger and Lee, 1989; Granger and Hallman, 1991; Granger and Swanson, 1996; Enders and Granger, 1998; Escribano and Pfann, 1998; Park and Phillips, 2001) changed the approaches and the understanding of the idea of cointegration and error correction modelling (Bayramoglu and Yildirim (2017). Owing to this, they argued the restrictive nature of linear models. For instance, they recommend that "linear models have a symmetry feature which implies that shocks occurring in a recession phase are just as persistent as shocks taking place in an expansion phase of business cycle fluctuations. Hence, linear models cannot adequately capture asymmetries that may exist in business cycles" (Koop, Pesaran and Potter 1996). Since oil revenue and capital accumulation fluctuate, linear models may be too restrictive and cannot adequately capture asymmetries that may exist especially during the recent business cycle fluctuations.

Hence, this study adopts the Nonlinear Autoregressive Distributed Lag (N-ARDL) approach (based on the linear ARDL model of Pesaran and Shin, 1999; and Pesaran, Shin and Smith, 2001) to investigate the nonlinear relationship between oil wealth and capital accumulation in Nigeria. This is expressed in compact form as:

$$\Phi(L)y_t = \alpha_0 + \alpha_1 w_1 + \beta^{'}(L)x_{it} + \varepsilon_t \qquad (3.8)$$

Where: $\Phi(L) = 1 - \sum_{i=1}^{\infty}\Phi_i L^i$ and $\beta(L) = \sum_{j=1}^{\infty}\beta_i L^i$ with L, y_t, x_{it}, w_t and ε_t being the lag operator of dependent variable, vector of independent variables, vector of deterministic variables with fixed lags and the error term respectively. As a result of the oscillatory behaviour of oil price and revenue, emphasis should be based on non-linear framework in line with Hamilton (2000, 2003). The non-linear framework, the long run relationship is given below:

$$gfcf_t = \hbar_0 + \tau_1 oilr_t^{+} + \tau_2 oilr_t^{-} + \vartheta_1 gdpp_t + \varepsilon_t \qquad \tau oilr_t = \tau_1^{+} oilr_t^{+} + \tau_1^{-} oilr_t^{-} \quad (3.9)$$

Where, $\hbar_0, \vartheta_1, \tau_1$ *and* τ_2 are the long-run coefficients. The asymmetric impact of oil wealth is accounted for by including the positive changes $oilr_t^{+}$ and negative changes $oilr_t^{-}$.

Where $oilr_t^{+}$ and $oilr_t^{-}$ are partial sums of the positive and negative changes in $oilr_t$ respectively:

$$oilr_t^{+} = \sum_{i=1}^{t}\Delta oilr_t^{+} = \sum_{i=1}^{t}\max(\Delta oilr_i, 0) \text{ and } \quad oilr_t^{-} = \sum_{i=1}^{t}\Delta oilr_t^{-} = \sum_{i=1}^{t}\min(\Delta oilr_i, 0) \quad (3.10)$$

By relating equation (3.9) and (3.10), the non-linear form of the ARDL model is derived as:

$$\Delta gfcf_t = \hbar_0 + \tau_1^{+} oilr_{t-1}^{+} + \tau_1^{-} oilr_{t-1}^{-} + \vartheta_1 gdpp_{t-1} + \alpha_1 gfcf_{t-1} + \sum_{i=0}^{n}(\eta_1^{+}\Delta oilr_{t-i}^{+} + \eta_1^{-}\Delta oilr_{t-i}^{-}) + \sum_{i=0}^{m}\lambda_i \Delta gdpp_{t-i} + \sum_{i=1}^{l}\rho_i \Delta gfcf_{t-i} + \varepsilon_t \quad (3.11)$$

Where: $oilr_t$ = oil wealth with $oilr_{t-i}^{+}$ and $oilr_{t-i}^{-}$ represent decomposed partial sum of positive and negative oil revenue shocks with long run restriction.

$\sum_{i=0}^{q}(\eta_{1,i}^{+}\Delta oilr_{t-i}^{+} + \eta_{1,i}^{-}\Delta oilr_{t-i}^{-})$ is the sum of short run partial sum of positive and negative oil wealth shocks with short parameters $(\eta^{+}_{(1,i)} and\, \eta^{-}_{(1,i)})$. $\alpha_1 gfcf_{t-1}$ and $\sum_{i=1}^{l}\rho_i \Delta gfcf_{t-i}$ are long run and short run components of capital accumulation respectively, $\vartheta_1 gdpp_{t-1}$ and $\sum_{i=0}^{m}\lambda_i \Delta gdpp_{t-i}$ are long run and short run components of real growth rate of GDP per capita respectively. *l*, *m* and *n* represent the lag operators.

The implementation of equation (3.11) follows from examination of long run and short run symmetry and derivation of asymmetric cumulative dynamic multiplier effect of asymmetric changes in $oilr_t$ on $gfcf_t$ expressed as $m_h^{+} = \sum_{j=0}^{h} \frac{\partial gfcf_{t+j}}{\partial oilr_t^{+}}$ and $m_h^{-} = \sum_{j=0}^{h} \frac{\partial gfcf_{t+j}}{\partial oilr_t^{-}}$

4 Empirical Findings

The unit root tests adopted include Augmented Dickey-Fuller (ADF) and Philip-Perron (PP). The test was carried out with the options of intercept without trend and intercept with trend. Results of the unit root test obtained from Table 1 for both ADF and PP are similar which show that the variables in the series are mix of two integrated orders zero I(0) and one I(1). Specifically, Gross Domestic Product Per Capita Growth (GDPP) and Gross Fixed Capital Formation (GFCF) are I(0) at 1% level of significance for intercept without trend. While, in the case of intercept with trend, GFCF is I(0) at 5% significance level. Oil Rent (OILR), Globalisation Index (GLOB) and Real Effective Exchange Rate (REER) are integrated of order one I(1) at 1% significance level both at intercept without trend and intercept with trend. The ADF unit root test for intercept and trend suggest that REER is significant at 5% level. These careful inferences and assertions were made from the traditional rule of thumb that the t-statistic values are more than the t-critical values at 5% significance level.

4.1. Nonlinear Effect of Oil Wealth on Capital Accumulation in Nigeria

This section discusses the possible effects of asymmetric connection that may exist between oil wealth and capital accumulation in Nigeria. Previous studies have made significant contribution to the body of knowledge in the linear relation linking oil wealth and capital accumulation. Their assumptions, notwithstanding, may fail to adequately identify the true dynamic correlation between them. To achieve this, we first regress the linear relationships between the two variables and then generate the shock series from the two variables that will enable us to illustrate and provide evidence of cointegration in the non-linear ARDL framework based on the changes in the variables.

Table 1:	**Unit Root Test Results**					
	ADF			**PP**		
Variables	**Level**	**First**	**Status**	**Level**	**First**	**Status**
Intercept without Trend						
GDPP	-4.90404	-8.901687	I(0)	-4.89832	-19.0673	I(0)
	[0.0003]***	[0]		[0.0003]***	[0.0001]	
OILR	-0.579555	-7.676355	I(1)	-2.15991	-7.23274	I(1)
	[0.8623]	[0]***		[0.2238]	[0]***	
GFCF	-4.750928	-4.728053	I(0)	-4.75093	-3.46672	I(0)
	[0.0005]***	[0.0006]		[0.0005]***	[0.0151]	
GLOB	-1.058128	-6.448205	I(1)	-1.05813	-6.4439	I(1)
	[0.7215]	[0]***		[0.7215]	[0]***	
REER	-1.986891	-4.100833	I(1)	-1.87663	-4.05780	I(1)
	[0.2910]	[0.003]***		[0.3391]	[0.0033]***	
Test critical values						
1% level	-3.626784	-3.6329		-3.62678	-3.6329	
5% level	-2.945842	-2.948404		-2.94584	-2.9484	
10% level	-2.611531	-2.612874		-2.61153	-2.61287	
Intercept with Trend						
GDPP	-5.030706	-8.822954	I(0)	-5.033103	-25.50461	I(0)
	[0.0013]***	[0]		[0.0013]***	[0]	
OILR	-1.993779	-8.193174	I(1)	-2.821154	-14.85663	I(1)
	[0.5831]	[0]***		[0.1994]	[0]***	
GFCF	-3.867614	-5.752297	I(0)	-4.016878	-3.883428	I(0)
	[0.0241]**	[0.0002]		[0.0170]**	[0.0235]	
GLOB	-1.698113	-6.446046	I(1)	-1.812829	-6.446587	I(1)
	[0.7314]	[0]***		[0.6676]	[0]***	
REER	-1.961876	-4.075781	I(1)	-1.963702	-4.708972	I(1)
	[0.6017]	[0.0150]**		[0.6007]	[0.0031]***	
Test critical values						
1% level	-4.234972	-4.243644		-4.234972	-4.243644	
5% level	-3.540328	-3.544284		-3.540328	-3.544284	
10% level	-3.202445	-3.204699		-3.202445	-3.204699	

Source*: Author's Computation (2018).*

*Note: *** = 1%, ** = 5% and * = 10% levels of significance.*
ADF = Augmented Dickey-Fuller test and PP = Philip-Perron test.
The values in the square bracket "[ ]" indicate the p-values.

To clearly understand the asymmetries between oil wealth and capital formation, we present the analysis in two folds such that the two variables are made dependent variable. We achieve the objective of assessing the nonlinear effect of oil wealth on capital accumulation in this section.

Analysis of the linear effect (Panel A of Table 2) of oil wealth on capital accumulation shows that the previous two-year value of GFCF was found to have a negative effect on its current value at 1% significance level (t=-3.58; p=0.00). This implies that a 1% change in the previous two-year value of GFCF will decrease its current value by 53%. REER has a negative short-run relationship with GFCF at 5% level (t=-2.68; p=0.01). Oil wealth was found to be negatively related to capital accumulation and statistically insignificant in the long run (t=-1.12; p=0.27). The estimated coefficient of ECM_{t-1} (-0.16) for Capital accumulation provide new evidence for slower speed of adjustment (t=-1.56; p=0.13). This shows that it will take only about 16% speed for capital accumulation to adjust back to equilibrium.

The Panel B of Table 2 shows the linear effect of capital accumulation on oil wealth. Results from the long run period indicated that there is positive and insignificant relationship between capital accumulation and oil wealth (t=0.58; p=0.57). GDP per capita growth was found to be positively and insignificantly related to oil wealth (t=1.64; p=0.12). Globalisation was seen have negative connection with oil wealth and significant at 5% level (t=-2.20; p=0.04).

Results from the short run period show that capital accumulation and real effective exchange rate have negative relationship and significant at 5% level (t=-2.53; p=0.02) while, previous two years value of globalisation affect oil wealth at 1% level of significance (t=2.85; p=0.01). The constant value is positive and statistically significant at 5% level (t=2.71; p=0.013). ECM_{t-1} also has statistical significance of 5% level with the reverting speed of adjustment of about 41% to equilibrium (t=-2.48; p=0.02).

From the non-linear relationship in Panel A of Table 4.7.2, evidence confirms that changes in the previous value of capital accumulation negatively have a causal effect on changes in its current value at 1% significance level (t=-6.53; p=0.00). A shocking new evidence show that positive changes in the current value of oil wealth have a strong negative causal effect on capital accumulation at 1% level of significance (t=-7.67; p=0.00). Also, positive changes in the lag one value of oil wealth accumulates capital (t=3.35; p=0.00) at 1% significant level. It therefore imply that positive changes in oil wealth have an oscillating causal relationship with capital accumulation. At 1% significance level, evidence of causal relationship does show negative relationship between negative changes in oil wealth and changes in capital accumulation (t=-5.66; p=0.00). Considering the long run period, both positive and negative changes in oil wealth affect capital accumulation negatively at 1% level of significance (t=-6.69; p=0.00 and t=-5.59; p=0.00). Major conclusion from the findings are that, for Nigeria, current positive changes in oil wealth does not expand capital accumulation both in the short run and long run. This is in line with Blanco and Grier (2011), Kanu and Ozurumba (2014), Kornblihtt (2015), and Udude *et al.* (2017) that the rise in oil rent in absolute term and as a proportion of the GDP –was not followed by an expansion of capital accumulation both physical and human capital.

Furthermore, short run changes in GDP per capita growth cause reduction to the changes in capital accumulation at 10% level of significance (t=-2.70; p=0.02). Findings from this result show that the level of growth per capita in Nigeria has yet transform the level of capital, but rather overstretching the existing level of accumulated capital. The result corroborates the findings of Auty (1998) that resource-rich countries had been associated with disappointing economic development that affects the structural change and the rate of accumulation of produced and human capital since 1960. This result also support the views of Auty and Mikesell (2000) that in spite the huge earnings from oil wealth, Nigeria GDP per capita is far below United Nations projection that could have transform capital. The result does not support the views of Boskin and Lau (1990) and Kim and Lau (1994) that technical progress can be represented as capital augmenting in all countries.

Evidence of negative causal relationship exist between changes in lag two value of real effective exchange rate and changes in capital accumulation (t=5.19; p=0.00). Similarly, long run changes in real effective exchange rate have significant but declining relationship with capital accumulation (t=-6.66; p=0.00). This signifies that exchange rate movements in both short run and long run reduce accumulation capital. This is in line with Antinolfi and Huybens (1998), Benczur and Konya (2007) that indeed, exchange rate matters for capital accumulation as a transmission mechanism. Additionally, changes in the values of globalisation have causal effects in increasing the values of capital accumulation at 1% level (t=4.37; p=0.00). The long run changes in globalisation also indicate positive relationship with capital accumulation at 5% level –(t=5.56;

p=0.00). The basic conclusion here is that changes in globalization is significant and have positive asymmetric effects on level of capital that Nigeria accumulates. This is in consonant with Saibu, (2014) that trade openness (globalization) is more intense on capital flows than exchange rate. Consequently, the asymmetric ECM_{t-1} provide new evidence of transmission with about 55% speed for capital accumulation to adjustment to equilibrium in the longer run period (p=0.00)

Looking at the meantime feedback effect in the non-linear framework as presented in Panel B of Table 4.7.2, both positive and negative changes in capital accumulation have causal effects on changes in oil wealth with positive sum having positive relationship and negative sum having negative relationship (t=-2.16; p=0.06 and t=0.57; p=0.58). In the long run, changes in capital accumulation is negative significant at 5% for the positive sum (t=-2.76; p=0.02). This falls within the purview of the opinions of Auty (1998), and Auty and Mikesell (2000) that even if natural capital assets contribute considerably less to economic growth, it helps in guiding the development trajectory and in enhancing efficiency. The findings portray, though not in entirety, the views of Boskin and Lau (1990) and Kim and Lau (1994) that technical progress can be represented as purely capital-augmenting in all countries.

Result also show that the lag two value of the short-run changes in GDP per capital growth cause changes in oil wealth positively (t=2.5; p=0.03), while the long run effect is negative (t=-2.05; p=0.07). This finding appreciates Fuinhas *et al.* (2015) that oil and growth are related positively only in the short-run and negatively depressed in the run. Result also corroborate the findings of Olomola (2006), Olomola and Adejumo (2006), Olomola (2007) and Auty (2007) that oil and growth have inverse relationship. Real effective exchange rate have short run effect on oil wealth with strong negative effect in the long run. This goes with the views of Ogundipe, Ojeaga, & Ogundipe, (2014) that exchange rate is sensitive to fluctuation in the price of oil.

Additionally, changes in globalisation cause changes oil wealth positively at 5% level (t=2.56; p=0.0). This conforms with the view of Stijns (2001) that political stability, a subset of globalization index, does seem to affect subsoil wealth and capital accumulation, but not sufficient to invalidate conclusions. However, new evidence from the error correction mechanism show that there is an explosion in oil wealth and cannot asymmetrically revert to equilibrium. New discoveries of new barrels of oil may have been responsible for this phenomenon.

Table: 2 LINEAR RELATIONSHIP (ARDL)

Panel A			**Panel B**		
Dependent Variable: GFCF			Dependent Variable: OILR		
Variable	Coefficient	Prob.	Variable	Coefficient	Prob.
Short Run Form					
$\Delta GFCF_{t-1}$	0.067680	0.6800	$\Delta OILR_{t-1}$	-0.117131	0.4806
$\Delta GFCF_{t-2}$	-0.527276***	0.0015	$\Delta OILR_{t-2}$	-0.572745***	0.0010
$\Delta OILR_{t}$	-0.049163	0.2060	$\Delta GFCF_{t}$	-1.246900*	0.0765
$\Delta GDPP_{t}$	-0.014947	0.7550	$\Delta GFCF_{t-1}$	0.670533	0.4280
$\Delta REER_{t}$	-0.013735**	0.0131	$\Delta GFCF_{t-2}$	-1.477492**	0.0312
$\Delta GLOB_{t}$	0.281021	0.1990	$\Delta GDPP_{t}$	0.183549	0.2872
$\Delta GLOB_{t-1}$	-0.277042	0.1802	$\Delta REER_{t}$	-0.049010**	0.0202
			$\Delta GLOB_{t}$	0.668382	0.3827
			$\Delta GLOB_{t-1}$	-1.358847	0.1506
			$\Delta GLOB_{t-2}$	2.156117**	0.0103
Long Run Form					
ECM(-1)	-0.158495	0.1279	ECM(-1)	-0.407020**	0.0225
$OILR_{t}$	-0.310188	0.2747	$GFCF_{t}$	0.681082	0.5709
$GDPP_{t}$	-0.094307	0.7520	$GDPP_{t}$	1.259723	0.1183
$REER_{t}$	-0.086657	0.2462	$REER_{t}$	-0.120411	0.1231
$GLOB_{t}$	0.427658	0.5151	$GLOB_{t}$	-1.360811**	0.0406
C	5.666561	0.8532	C	90.18174**	0.0137

***Source**: Authors compilation (2018).*

*Note: ***, ** and * indicate the statistical level of significance at 1%, 5% and 10% respectively*

4.2 Dynamic Multiplier Effects of Non-Linear ARDL

This section investigates and presents the asymmetric properties of the dynamic multiplier effects of the shocks from oil wealth to capital accumulation. This is done in a bid to trace the evolution of capital accumulation at given level following shocks from oil wealth and vice versa. The difference between the effects of the positive and negative shocks in the independent variable are usually the basis for decision rule. The selected variable is said to be symmetrical if the line denoting the difference line between the positive and negative shocks lies perfectly on the zero line. In the same vain, if the difference line lies anywhere else but not the zero line, then the selected independent variable is said to be asymmetrical to the changes in the dependent variable.

Thus, the dynamic multipliers indicating the short run to long run response of capital accumulation to changes in oil wealth and the feedback response are depicted in Panel A and B of Figure 4.3 respectively. Panel A indicates that the positive changes in oil wealth have declining multiplier effect on capital accumulation and settles at the negative long run region.

Table: 3 NON-LINEAR RELATIONSHIP (N-ARDL)

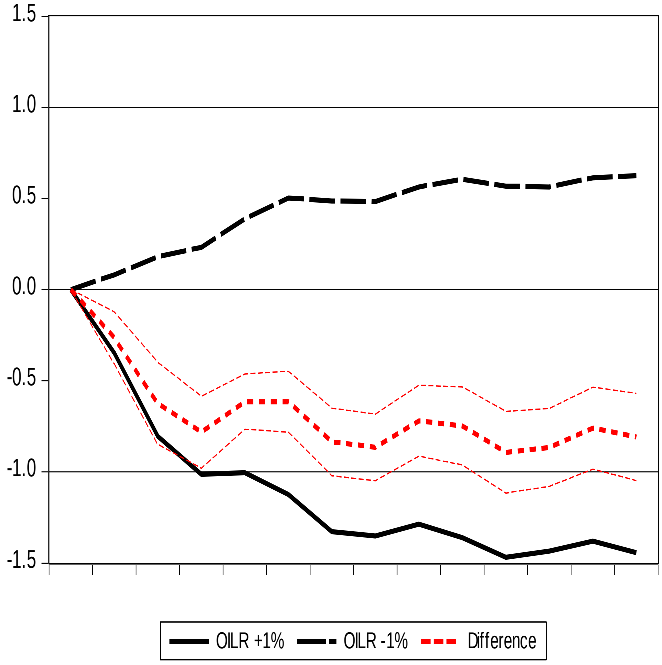
Panel A			**Panel B**		
Dependent Variable: GFCF			Dependent Variable: OILR		
Variable	Coefficient	Prob.	Variable	Coefficient	Prob.
Short Run Estimates					
$\Delta GFCF_{t-1}$	0.142881	0.1774	$\Delta OILR_{t-1}$	0.204773	0.3023
$\Delta GFCF_{t-2}$	-0.615662***	0.0002	$\Delta OILR_{t-2}$	-0.199009	0.2270
$\Delta OILR_{t}^{+}$	-0.346013***	0.0001	$\Delta GFCF_{t}^{+}$	-1.144424	0.2168
$\Delta OILR_{t-1}^{+}$	0.203203***	0.0065	$\Delta GFCF_{t-1}^{+}$	2.463533**	0.0357
$\Delta OILR_{t}^{-}$	-0.079744	0.2527	$\Delta GFCF_{t}^{-}$	-0.611003	0.6528
$\Delta OILR_{t-1}^{-}$	0.056646	0.5071	$\Delta GFCF_{t-1}^{-}$	1.334556	0.4140
$\Delta OILR_{t-2}^{-}$	0.150244*	0.0601	$\Delta GFCF_{t-2}^{-}$	-3.707600***	0.0050
$\Delta GDPP_{t}$	-0.089652**	0.0207	$\Delta GDPP_{t}$	-0.213072	0.2999
$\Delta GDPP_{t-1}$	-0.051072	0.2188	$\Delta GDPP_{t-1}$	0.210049	0.3050
$\Delta REER_{t}$	-0.009485	0.1193	$\Delta GDPP_{t-2}$	0.560455**	0.0309
$\Delta REER_{t-1}$	-0.007425	0.2543	$\Delta REER_{t}$	-0.058882*	0.0713
$\Delta REER_{t-2}$	0.023247***	0.0003	$\Delta REER_{t-1}$	0.004809	0.8597
$\Delta GLOB_{t}$	0.811975***	0.0011	$\Delta REER_{t-2}$	0.039220*	0.0820
$\Delta GLOB_{t-1}$	-0.701726***	0.0010	$\Delta GLOB_{t}$	2.961975**	0.0284
$\Delta GLOB_{t-2}$	-0.523384**	0.0124	$\Delta GLOB_{t-1}$	-0.446754	0.6070
			$\Delta GLOB_{t-2}$	2.060182**	0.0115
ECM(-1)	-0.554977***	0.000	ECM(-1)	-1.297310***	0.0017
Long Run Parameter					
$OILR^{+}$	-1.447631***	0.0000	$GFCF^{+}$	-0.757154**	0.0202
$OILR^{-}$	-0.611906***	0.0002	$GFCF^{-}$	0.421567	0.5683
GDPP	-0.034706	0.8072	GDPP	-0.809373*	0.0672
REER	-0.093347***	0.0000	REER	-0.117980***	0.0009
GLOB	3.352346***	0.0002	GLOB	0.633682	0.3386
C	-73.18281***	0.0028	C	23.097848	0.1682

***Source**: Authors compilation (2018).*

Note: Subscript "+" and "−" indicate positive and negative partial sums respectively
****, ** and * denote the statistical levels of significance at 1%, 5% and 10% respectively*

Consequently, the negative changes in oil wealth accumulate capital and settle at the positive long run multiplier effect region. The difference line falls within the negative region and not on zero line indicating long run asymmetric response of capital accumulation to changes in oil wealth. Additionally, Panel B reveals that both positive and negative changes in capital accumulation are responsible for the swings and criss-crossing on the positive and negative sums of oil wealth along the zero line path. Both changes settle in the negative multiplier effect region with negative change dominating the positive. The difference line does not fall perfectly on the zero line showing that there is a long run asymmetric relationship between changes in capital accumulation and oil wealth.

Panel A



Note: Panel A depicts dynamic Multiplier Effects of + and – oil wealth to capital accumulation

PANEL B

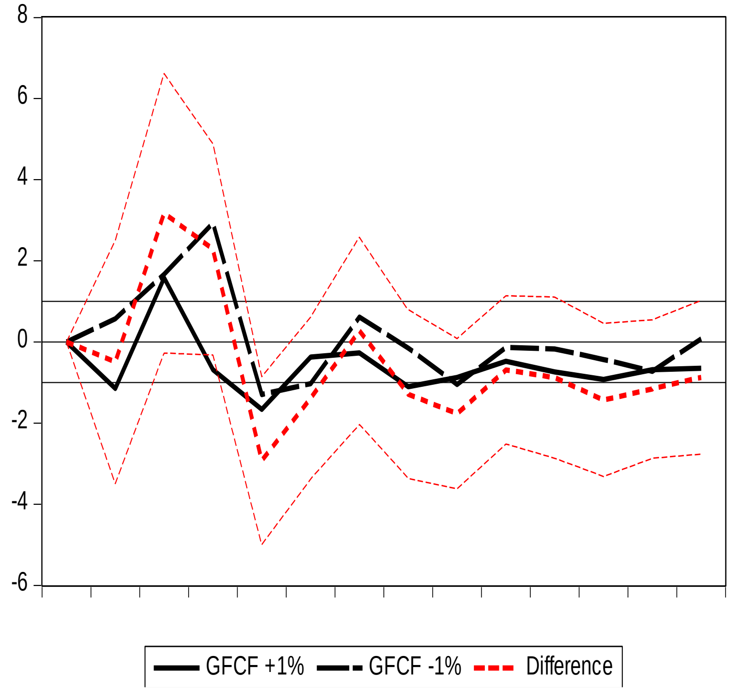


Figure 4.3: N-ARDL Dynamic Multiplier Effects

Panel B depicts dynamic Multiplier Effects of + and – capital accumulation to oil wealth.

4.3 N-ARDL Sensitivity and Stability Tests

The result from the sensitivity test presented in Table 4.8 clearly indicated that there is a robust and normal model for GFCF. The serial correlation test suggests that there is no evidence of autocorrelation in the residuals of the model as the P-value (0.48) of the F-Statistic is insignificant. The Heteroskedasticity test of the Breusch-Pagan-Godfrey indicated no variation in the variance of the model. The adjusted R-Square of 0.93 suggests that there is high explanatory power in the explanatory variables. In addition, the stability test of the cumulative sum (CUSUM and CUSUMSQ) graph of the model coefficients as presented in panels A and B of Figure 4.4 fall within the 5% bounds.

In the same plight, the model for OILR is normal based on the sensitivity test presented in the second segment of Table 4.8. The serial correlation test indicated nonexistence of autocorrelation in the model residuals as the null hypothesis of serial correlation has to be declined since the P-value (0.36) of the F-Statistic is insignificant. The Heteroskedasticity test of the Breusch-Pagan-Godfrey revealed no variation in the variance of the model. The adjusted R-Square of 0.88 suggests high explanatory power in the explanatory variables. , the stability test of the model coefficients in the recursive CUSUM and CUSUMSQ graphs as shown in panels C and D of Figure 4.5 fall within the limit bounds at 5% level.

Table 4.8 N-ARDL Sensitivity and Stability Test Result			
Variable	**Test Statistic.**	**F-Stat**	**P-Value**
GFCF	Serial Correlation	0.901850	0.4815
	Heteroscedasticity	1.706764	0.1808
	R_*^2	0.931644	
OILR	Serial Correlation	1.246621	0.3631
	Heteroscedasticity	0.302515	0.9907
	R_*^2	0.883265	

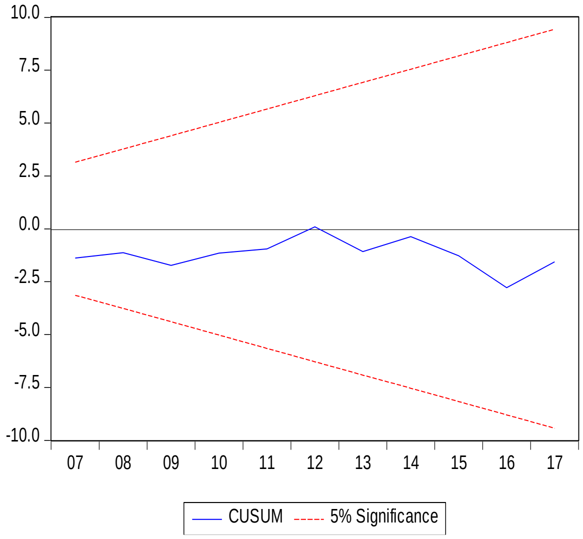
***Source**: Authors computation (2018).*

Note: 1.) The serial correlation test is that of Breusch-Godfrey Serial Correlation LM Test.

2.) Heteroskedasticity test is that of Breusch-Pagan-Godfrey Test

3.) R_*^2 is the adjusted R^2

PANEL A



PANEL B

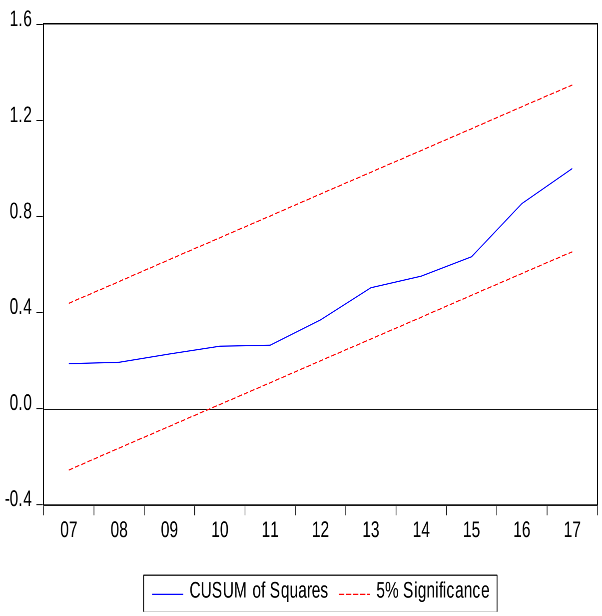
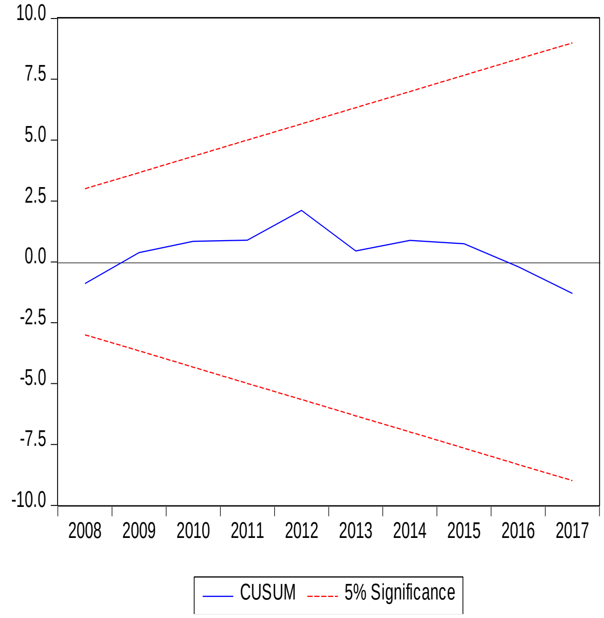


Figure 4.4: N-ARDL Cumulative Sums Test for GFCF

PANEL C



PANEL D

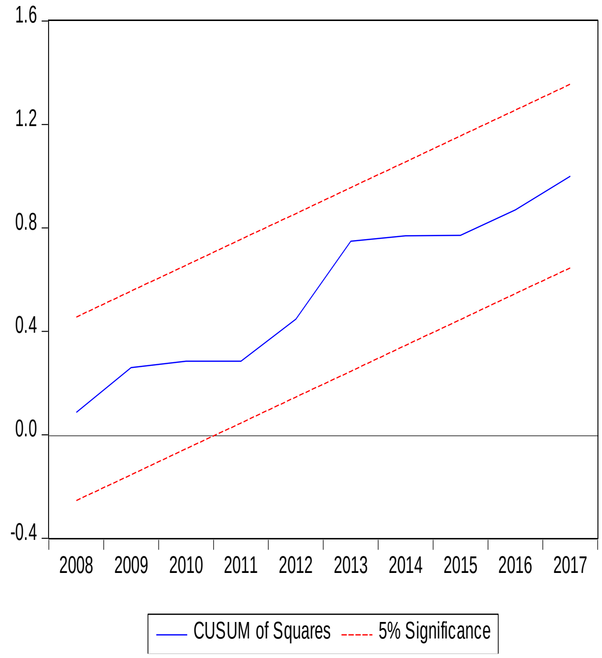


Figure 4.5: N-ARDL Cumulative Sums Test for OILR

Source: Authors computation, 2018

5 Conclusion and Policy Implications

5.1 Conclusion

Based on the investigation of the effect of oil wealth on capital accumulation, the study concludes that, for Nigeria, there is strong evidence of resource curse phenomenon. The study also concludes that an inverse relationship exists between oil wealth and capital accumulation in Nigeria. Additionally, positive changes in oil wealth is caused by negative changes in the capital accumulation. Having, analyse the non-linear effect of oil wealth on capital accumulation, the study concludes that there exist negative asymmetric connection between oil wealth and capital accumulation. Furtherance to making conclusion, the study discovered that real effective exchange rate and globalisation individually affect capital accumulation and oil wealth both in the short run and long run respectively, though positive effect of globalisation in the long run, is insignificant.

5.2 Policy Implications

Government could address the controversies surrounding the ECA and SWF in Nigeria. Given the importance of oil resource wealth in the world's energy demand and production, Nigeria could develop her capacity in the area of oil refining-production chain. Since changes in capital accumulation are affected by changes in oil wealth, more efforts could be placed on Stabilization Fund (SF) and Nigeria Infrastructure Fund (NIF) to cushion the effects of cyclical external shocks from oil price. There is also the need for diversification into areas of agriculture, education and auto-technology.

REFERENCES

Abayomi, A., Adam, O. S. and Alumbugu, A. I. (2015). Oil Exportation and Economic Growth in Nigeria. *Developing Country Studies. Vol.5,* No.15, 2015

Acemoglu, D., Johnson S. and Robinson J. A. (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *American Economic Review*, 91**:**1369–401.

Adebiyi O. O. and Olomola P. A. (2013). Oil wealth; Meat in Norway, Poison in Nigeria: An analysis of Human Capital as a Transmission Channel of Resource Curse. *Journal of World Economic Research.* 2(3): 39-44

Ahmouda, M. (2014). The Impact of oil Exports on Economic Growth – The Case of Libya. *Czech University of Life Sciences Prague Faculty of Economics and Management, Department of Economics*. Doctoral Thesis.

Akinleye, S. O. and Ekpo S. (2013). Oil Price Shocks and Macroeconomic Performance in Nigeria. *Economía Mexicana Nueva Época, vol. Cierre de Época* (II) pp. 565-624.

Akinlo A. E. (2012). How important is Oil in Nigeria's Economic Growth? *Journal of Sustainable Development*, Vol. 5, No. 4. http://dx.doi.org/10.5539/jsd.v5n4p165

Akinlo, A. E., and Apanisile (2014). The Impact of Volatility of Oil Price on the Economic Growth in Sub-Saharan Africa. *British Journal of Economics, Management & Trade 5(3):* 338-349,

Aliyu, S. U. R. (2011). Real Exchange Rate Misalignment: An Application of Behavioural Equilibrium Exchange Rate to Nigeria. *Central Bank of Nigeria Occasional paper*, No. 41

Antinolfi, G. and Huybens, E. (1998). Capital Accumulation and Real Exchange Rate Behaviour in a Small Open Economy with Credit Market Frictions. *Economic Theory*, Vol. 12(3).

Arin, P. K. and Braunfels, E. (2016). Oil Wealth and Economic Growth Revisited: A Bayesian Model Averaging Approach. *Zayed University*, *Working Paper No. ZU-WP 2017-04-10.*

Attamah, N. (2015). The Impact of Oil Wealth on Economic Growth of a Mono-cultural Economy-Nigeria. *International Journal of Economics, Commerce and Management.* Vol. III, Issue 5, Page 838. United Kingdom.

Auty, R. and Miksell, R. F. (2000). *Sustainable Development in Mineral Economies.* Oxford: Oxford University Press.

Auty, R. M. (1998). Resource Abundance and Economic Development: Improving the Performance of Resource-Rich countries. *UNU World Institute for Development Economics Research (WIDER): Research for Action 44*. Finland.

Baghebo, M. and Atima, T. O. (2013). The Impact of Petroleum on Economic Growth in Nigeria. *Global Business and Economics Research Journal*, 2(5): 102-115

Bayramoglu, A. T. and Yildirim, E. (2017). The Relationship between Energy Consumption and Economic Growth in the USA: A Non-Linear ARDL Bounds Test Approach. Energy and Power Engineering. Vol. 9(3).

Benczur, P. and Konya, I. (2007). Convergence, Capital Accumulation and the Nominal Exchange rate. *Journal of International Money and Finance, Elsevier*. Vol. 37(C)

Bjørnland, H. C. (1996). Sources of Business Cycles in Energy Producing Economies-The Case of Norway and United Kingdom. *Statistic Norway Research Department, Discussion Papers*, 179. Norway.

Bjørnland, H. C. (1998). The Economic Effects of North Sea Oil on the- Manufacturing Sector, Scottish. *Journal of Political Economy*, vol45, No 5.pp.553-585.

Blanco, L., and Grier, R. (2011). The (non) Effect of Natural Resource Dependence on Capital Accumulation in Latin America. *Pepperdine University, School of Public Policy Working Papers*. 26.

Bond, S., Leblebicioglu, A. and Schiantarelli, F. (2007). Capital Accumulation and Growth: A New Look at the Empirical Evidence. *IZA*, 7(30)

Boskin, M. J., and Lau, L. J. (1990). Post-War Economic Growth of the Group-of-Five Countries: A New Analysis, *Technical Paper 217, Centre for Economic policy Research, Stanford University*. Stanford, CA.

British Petroleum. (2017). British Petroleum Statistical Review of World Energy 2017.

Central Bank of Nigeria. (2012). Understanding Monetary Policy Series: The Sovereign Wealth Fund. *CBN;* No 18.

Dickey, D. and Fuller, W. (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root, *Journal of the American Statistical Association*, 74, 427-431.

Dickey, D. and Fuller, W. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root, *Econometrica*, 49, 1057-1072.

Dreher, A. (2006). Does Globalization affect Growth? Evidence from a New Index of Globalization. Thurgauer Wirtschaftintitut. Research Paper Series.

Dreher, A., Gaston, N., Martens, P., and Boxem, L. V. (2008). Measuring Globalization – Opening the Black Box. A Critical Analysis of Globalization Indices. Globalistics and Globalization Studies 129-147

Emani, K. and Adibpour, M. (2012). Oil income shocks and economic growth in Iran. *Department of Management and Economics, Science and Research Branch, Islamic Azad University*, Tehran, Iran

Enders, W. and Granger, C. W. J. (1998). Unit Root Test and Asymmetric Adjustment with an Example Using the Term Structure of Interest Rates. *Journal of Business and Economic Statistics.* Vol. 16 (304-311).

Engle, R. and Granger, C. W. J. (1987). Cointegration and Error Correction: Representation, Estimation, and Testing, *Econometrica*, 55, pp. 251-276.

Escribano, A. and Pfann, G. A. (1998). Non-linear Error Correction, Asymmetric Adjustment and Cointegration. *Economic Modelling, Elsevier.* Vol. 15(2).

Fuinhas, J. A., Marques, A. C. and Couto, A. P. (2015). Oil rents and Economic Growth in oil Producing Countries: Evidence from a Macro Panel. *Springer Science and Business Media*. New York.

Granger, C. W. J. and Hallman, J. (1991). Long Memory Series with Attractors. *Oxford Bulletin of Economics and Statistics.* Vol. 53 (11-26)

Granger, C. W. J. and Lee, T. H. (1989). Investigation of Production, Sales and Inventory Relationships Using Multicointegration and Non-Symmetric Error Correction Models. *Journal of Applied Econometrics.* Vol. 4

Granger, C. W. J. and Swanson, N. R. (1996). An Introduction to Stochastic Unit Root Processes. Journal of Econometrics, Vol. 80 (35-62).

Hamdi, H. and Sbia, R. (2013) Dynamic relationships between oil revenues, government spending and economic growth in an oil-dependent economy. Elsevier: *Economic Modelling 35* 118–125.

Hamilton, J. D. (1983). Oil and the Macroeconomy since World War II. Journal of Political Economy 91, pp. 228-248.

Halmilton, J. D. (2003). What is an Oil Shock? Journal of Econometrics.113:363-398.

Hamilton, J. D. (2009) .Causes and Consequences of the Oil Shock of 2007-08. *NBER Working Paper No. 15002 2009*. “Understanding Crude Oil Prices.” *Energy Journal*.

Hamilton, K., Ruta, G. and Tajibaeva, L. (2006). Capital Accumulation and Resource Depletion: A Hartwick Rule Counterfactual. Environmental & Resource Economics. *Springer 34*: 517–533

Hartwick, J. M. (1977a). Intergenerational equity and the investing of rents from exhaustible resources, American Economic Review, Dec.

Hartwick, J. M. (1977b), Population growth, technical progress, intergenerational equity and the investment of resource rents. *Queen’s University Discussion Paper 280*.

Hartwick, J. M. (1978) Intergenerational equity and substitution among exhaustible resources, The Review of Economic Studies, June.

Hinkle, L. E. & Montiel, P. J. (1999). *Exchange rate misalignment: concepts and measurement for developing countries.* New York: Oxford University Press: A World Bank research publication.

Hotelling, H. (1931). The Economics of Exhaustible Resources. *The Journal of Political Economy* 39(2), 137-175.

Kanu, S. I and Ozurumba, B. A. (2014). Capital Formation and Economic Growth in Nigeria. *Global Journal of Human-social Science: Economics*. Vol. 14(4)

Koop, G., Pesaran, M. H., and Potter S. M. (1996). Impulse Response Analysis in Nonlinear Multivariate Models. *Journal of Econometircs; 74*: 119-147.

Kornblinhtt, J. (2015). Oil Rent Appropriation, Capital Accumulation, and Social Expenditure in Venezuela during Chavism. *Pluto Journals: World Economic Reviews Vol. 6, No. 1*, 58-74.

Kim, J. and Lau, L. J. (1994). The Sources of Economic Growth of the East Asian Newly Industrialised Countries. *Journal of the Japanese and International Economies*. Vol. 8(3)

Lucas, R. E., Jr. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, 22, 3–42.

Maniw, N. G., Romer, D., and Weil, D. N. (1992). A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics.* Vol. 107, No. 2.

Matallah, S. and Matallah A. (2016). Oil rents and economic growth in oil-abundant MENA countries: Governance is the trump card to escape the resource trap. *Topics in Middle Eastern and African Economies:* Vol. 18, Issue No. 2.

Ndanusa, S. (2018). Nigeria's Sovereign Wealth Fund: Prospects and Tips for getting it right. www.gamji.com/article9000/NEWS9229.htm

Obi, B., Awujola A. and Ogwuche D. (2016). Oil Price Shock and Macroeconomic Performance in Nigeria. Journal of Economics and Sustainable Development: Vol.7, No.24, 2016. www.iiste.org

Odedokun, M. (1997). An Empirical Analysis on the Determinants of the Real Exchange Rate in Afrcan Countries. *The Journal of International Trade & Economic Development, Vol. 6, Issue 1*, pp. 63-82.

Odularu G. O. (2008). Crude Oil and the Nigerian Economic Performance. Oil and Gas Business. *http://www.ogbus.ru/eng*

Ogundipe, O., Ojeaga, P. & Ogundipe, A. (2014). Oil Price and Exchange Rate Volatility in Nigeria. *IOSR Journal of Economics and Finance (IOSR-JEF),* Vol. 5. 2321-5925.

Olayeni R. O. (2011). Effects of Oil Price Shocks on Nigerian Economy: 1970-2008. *A PhD. Thesis Submitted to the Department of Economics, Obafemi Awolowo University. Ile-Ife.*

Olomola P.A. (2007). Oil Wealth and Economic Growth in Oil Exporting African Countries. African Economic Research Consortium, AERC Research Paper 170. Nairobi.

Olomola, P. A. and Adejumo A.V. (2006). Oil Price Shock and Macroeconomic Activity in Nigeria. *International Research Journal of Finance and Economics.*

Osundina K. C., Osundina J.A. (2014). Capital Accumulation, Savings and Economic Growth of a Nation –Evidence from Nigeria. *Global Journal of Intersciplinary Social Sciences G.J.I.S.S., Vol.3 (3):* 151-155

Park, J. and Phillips, P. (2001). Nonlinear Regressions with Integrated Time Series. *Econometrica*. Vol, 69 (1)

Pesaran, M. H. and Shin, Y. (1999). An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis. In: Strom, S., Holly, A., Diamond, P. (Eds.), *Centennial Volume of Rangar Frisch*, Cambridge University Press. Cambridge.

Pesaran, M. H., Shin, Y. and Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Levels Relationship. Journal of Applied Econometrics. John Wiley and Sons Ltd., Vol. 16(3)

Pesaran, M. H., Smith, R. J. and Shin, Y. (1996b). Testing for the Existence of a long run Relationship, *DAE Working Paper No.9622*. Department of Applied Economics, University of Cambridge.

Phillips P. C. B., Perron P. (1988). Testing for a Unit Root in Time Series Regression. *Biometrica* 75: 335-346.

Razavi, H., Aitzhanova, A., Iskaliyeva, A., Krishnaswamy, V., Makauskas, D., Sartip, A. R., and Urazaliyeva, A. (2015). A Practical Approach to Oil Wealth Management: Application to the case of Kazakhstan. *Energy Economics*, 47, 178–188: National Analytical Centre, Kazakhstan.

Rebelo, S. (1991). Long-Run Policy Analysis and Long-Run Growth. *Journal of Political Economy*, 99: 500–521.

Romer, P. (1986). Increasing Returns and Long-Run Growth. *Journal of Political Economy*, 94, 1002–1037.

Sachs, I. and Warner, A. (1997). Sources of Slow Growth in African Economies. Journal of African Economies 6 (3), 335-376.

Saibu, O. (2014). Capital Inflow and Economic Growth Nexus in Nigeria: The Role of Trade Openness. *Acta Univesitatis Danubius, Vol. 10. 98-113.*

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, *70(1*), p.65.

Solow, R. M. (1974). Intergenerational equity and exhaustible resources, *The Review of Economic Studies, Symposium*, 29-46.

Stern, D. I. (1993). Energy use and economic growth in the USA, A multivariate approach. *Energy Economics* 15: 137-150.

Stijns, J. P. (2001) Natural Resource Abundance and Human Capital Accumulation. *University of California at Berkeley JEL*: O13, Q33, I22

Stijns, J. P. (2006). Natural resource abundance and human capital accumulation. *World Development* 34 (6), 1060-1083.

Udude, C. C., Odo, S. I., Ituma, S. O., and Elom-Oded, O. F. (2017). Investigating the Impact of Oil Export on Gross Capital Formation in Nigeria. *Asian Research Journal of Arts & Social Sciences*: Vol 2(4): 1-12.

World Bank. (2017). World Development Indicators. *www.data.worldbank.org/data-catalogue/commodity-price-data*.