

# ASSESSMENT OF THE IMPACTS OF OIL PRICES ON NIGERIA ECONOMY USING COBB-DOUGLAS PRODUCTION FUNCTION

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## ABSTRACT

*Fluctuations in oil prices have been a global issue over the years. Although many studies have been carried out the majority of those studies relating to oil prices focused more on its effects on oil-consuming nations than oil-producing ones. This study, however, examines the vulnerability of the economy of the oil-producing country to oil price changes using Nigeria being an OPEC member as a case study. The Cobb-Douglas production function was used to formulate the appropriate model that relates oil prices with the economy of Nigeria. However, the close to close (standard deviation) volatility method was used to measure the amount of variability in oil prices. Nevertheless, the perpetual inventory method was used to estimate the accumulated physical capital of Nigeria and the problems of multicollinearity inherent in the data were attenuated using ridge regression techniques as capital cannot be left out while dealing with production.*

**Keywords:** *Accumulated Capital, Nigerian Economy, OPEC Oil Prices, Perpetual Inventory Method, Price Variability, Ridge Regression*

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## 1. Introduction

Crude oil has been the major source of Nigeria income after its discovery in 1956, which led to less concentration on agricultural products that used to be contributing about 70% to the growth of Nigeria gross domestic product (GDP) in the early 1950s (Alley *et al.*, 2014 and NBS, 2018). Though Nigeria has achieved tremendous growth due to the high production of oil which has led to higher revenue for the country when the oil price was moving to its peak, and that contributed about 8.4% to the growth of GDP in 2009 (World Bank, 2018). Nevertheless, it is quite unfortunate to see Nigeria as one of the richest countries in Africa, and still among the country battling extreme poverty and economic mess. Without a doubt, Nigeria is a country currently in dire need of high and sustainable economic growth that is capable of engendering rapid economic development and reducing poverty but, its mono-product (crude oil) economic practice has allowed its growth to be highly vulnerable to the movements in oil prices over time. (Nwoba *et al.*, 2017).

Hence, there is a need for the Nigerian government to diversify the economy. In 2015, the Federal Government of Nigeria came up to diversify the economy of the country to the agricultural sector. After about four years of flagging off the diversification policy, it is pertinent to examine the responsiveness of the economy concerning international oil price

changes. This study, therefore, attempts to verify the vulnerability of Nigeria's economy to oil price through production function, putting into consideration, some economic indicators such as Real GDP, Gross National Income (GNI), Physical Capital (Capital Stock), and Working Age Population (Labour).

Traditionally, there are specific approaches used in analysing the effect of oil price changes which include non-structural models which solely depend on the theory of exhaustible resources as the root for understanding the oil market. Structural supply/demand framework that uses behavioural equations and factors that link oil demand and supply to its various determinants and the informal approach that can be studied by analysing oil price movements within specific contexts and episodes of oil market history (Bassam, 2007).

Most studies on oil prices literature have been using structural methods with the use of Augmented Dickey-Fuller, Cointegration, and Granger Causality and high numbers of them have used Gross fixed capital formation as a proxy for capital accumulation (stock). For example, Taofik (2018), Birouke *et al.* (2012), Aljebrin (2013), Kathleen *et al.* (2012), Maku *et al.* (2018), and Alley *et al.* (2014) Likewise, the informal approach which only describes some economic indicators during the volatility period has been used by a set of economic organizations among which include International Monetary Fund (IMF, 2000) and US Energy Information Administration (EIA, 2018). While few studies have used the non-structural approach, for example, Bassam (2007), in his article "the drivers of oil prices: the usefulness and limitations of non-structural models" describe oil price based on historical, projected prices, and future speculations.

Therefore, this paper adopted structural methods and has a paired distinct contribution to Nigeria's government, stakeholders, and citizens in general to have a view of the recent performance of the economy. This will allow the government to know their stands whether they are getting it right or there is a need to re-strategize. On the other hand, the paper makes a great contribution to research methods on oil price, production function with the usage of estimated capital stock, and addressed the collinearity issues while dealing with time series.

## 2. Methodology

Given the Cobb-Douglas production function

$$Y_t = F(L, K) = A K_t^\alpha L_t^\beta \quad (1)$$

where,  $Y_t$  = Total production (GDP) of Nigeria for year t.  $K_t$  = Physical capital of Nigeria for year t,  $L_t$  = Total labour employed in year t, t = Time (Year), A = Efficiency of the function,  $\alpha$  = Elasticity of output relative to the physical capital,  $\beta$  = Elasticity of output about workers. Hence,  $\alpha + \beta = 1$ , would suggest that an increase in production would be by the increasing rate of inputs.  $\alpha + \beta > 1$ , would suggest that an increase in production would supersede proportional inputs increase.  $\alpha + \beta < 1$ , would mean that an increase in production would fall-off to inputs increasing rate. Assuming,  $P$  = Oil Price where P is not directly related to GDP. Because neoclassical production theory only described the general production function as  $Y = F(K, L)$  meaning that the output is the function of capital and labour.

Due to scarcity of data on physical capital “ $K_t$ ”, is estimated using investment capital “ $I_t$ ” of the country by Perpetual Inventory Method used by Berlemann (2014). And from (1), if  $A = P_t$ , then by linearizing (1) it gives

$$\ln Y_t = a_1 + a_2 \ln P_t + \alpha \ln K_t + \beta \ln L_t + \varepsilon_t \quad (2)$$

where  $P_t$  is Oil Price in year t, likewise  $a_1$  and  $a_2$  are constants and coefficients of parameter P in equation (2) respectively. Although from the literature, at the beginning of desired period t, the net capital stock  $K_t$ , can be written as a function of the net capital stock at the beginning of the previous period  $t-1$ ,  $K_{t-1}$ , gross investment capital in the current period,  $I_t$ , and consumption of fixed capital,  $D_{t-1}$  such that

$$K_t = K_{t-1} + I_t - D_{t-1} \quad (3)$$

If the geometric depreciation of fixed capital D at a constant rate is denoted by  $\delta$ , then equation (3) becomes

$$K_t = K_{t-1} (1-\delta) + I_t \quad (4)$$

where  $K_t$  = Physical capital of year t,  $K_{t-1}$  = Physical capital of previous year  $t-1$ ,  $\delta$  = Capital depreciation rate, and  $I_t$  is the investment (gross fixed capital formation) of year t.

But  $K_{t-1}$  in equation (4) can be estimated such that

$$K_{t-1} = \frac{I_t}{gGDP + \delta} \quad (5)$$

$I_t$  is the investment (gross fixed capital formation) of year t and  $gGDP$  is the growth rate of GDP. Because neoclassical growth theory assumed that; if the economy under consideration is in its steady-state, the gross domestic product will be rising at the same rate as the capital stock and the growth rate of the capital stock can be approximated by the growth rate of investments. Therefore, looking at the trend of Nigeria’s growth rate which has been somehow like a wave around equilibrium over decades World Bank (2019), the  $K_{t-1}$  was estimated by gross fixed capital formation growth rate (investment growth rate) with the assumption that the economy is not in steady-state. Such that

$$K_{t-1} = \frac{I_t}{gI_t + \delta} \quad (6)$$

## 2.1 Volatility

Volatility has been the word used to describe the fluctuations in the price of commodities over time and it is usually in form of a comparison of historical changes in the price of such commodity and current price. It should be noted that high variability does not connote high price but rather give the yearly amount of variability in oil price. Hence, the close-to-close volatility method is considered the simplest and most used for the test.

It can be estimated by multiplying standard deviation by the square root of working days or number sample. That is:

$$Volatility = \sqrt{\sum_i^n \frac{(x_i - \bar{x})^2}{n-1}} \times \sqrt{n} \quad (7)$$

where ‘n’ is the number of trading days in a year and  $X_i$  is the log return of OPEC daily oil price ( $P_i$ ), which is calculated by:  $X = \ln\left(\frac{P_t}{P_{t-1}}\right)$  or  $\left(\frac{P_t - P_{t-1}}{P_{t-1}}\right)$ , for  $P_{t-1}$  = oil price of the previous day.

## 2.2 Cursed Economy

An economy is said to be cursed if the growth of per capita income is negatively correlated with the share of labour in the primary sector (Thirlwall, 2011). The scattered plot is used to determine the situation of this and as well determine the accountability of the share of labour in agriculture to the growth of Gross National Income (GNI) by testing through SPSS at a 5% significant level.

## 2.3 Effects of Oil Price on Nigeria Economy

In many cases, time-series data always have some problems such as multicollinearity, non-stationary, autocorrelation among others which is contrary to the assumptions of ordinary least square (OLS) regression. Due to this fact, performing (OLS) regression may lead to the superiority of the model and make some important variables insignificant. Therefore, Ridged regression shall be used as a substitute for the OLS during the analysis. Note: overall regression being significant and insignificant of almost the entire individual test will signify the existence of multicollinearity. Likewise, the high correlation between the independent variables may also be a signal of multicollinearity. For more about the condition of multicollinearity see Gujarati (2004).

### 2.3.1 Ridge regression

Ridge regression is like the OLS method because it assumes three out of the BLUE assumptions of the OLS except for an unbiased estimator, as it introduces a small amount of bias to the model. Theoretically, Hoerl *et al.* (1970), define ridge regression as a regression technique used to solve the problems of multicollinearity in the data set under study. The advantage of this technique is it is capable of producing a result with a minimum standard error by standardizing all of the variables included in the model, Normalize the data towards zero which will automatically take care of non-stationary problems, and as well accounting for the effect of outliers in the data sets (NCSS, 2018). In general, we can say that ridge regression is the best substitute for OLS when the variables are suffering from multicollinearity (Hoerl *et al.* 1970). Mathematically, OLS regression coefficients are usually estimated using

$$\hat{\beta} = (X'X)^{-1}X'Y \quad (8)$$

Here,  $\hat{\beta}$  is a  $p \times 1$  coefficient matrix of the least-squares,  $X'X$  is  $p \times p$  matrix of the square of independent variables and  $X'Y$  is a  $p \times 1$  matrix resulting from the multiplication of dependent and independent variables. The ridge regression coefficients estimation is a little

bit different due to standardized variables used to perform the regression and it added a very small value say  $\lambda$  to the correlation matrix of the independent variables in equation (8) such that if  $X'X = R$ , where R denotes design matrix of independent variables, then the estimate of the coefficient for ridged regression is given by

$$\hat{\beta}^R = (R + \lambda I)^{-1}X'Y \quad (9)$$

Where are the coefficients of ridge regression,  $R$  is the design matrix of the independent variables,  $I$  is  $p \times p$  identity matrix and  $X'Y$  is  $p \times p$  matrix of the square of independent variables likewise,  $\lambda$  is a positive quantity usually ranges between 0 and 1 but, the lower the value of  $\lambda$ , the smaller the introduction of bias to the model. Although, there are several ways of determining the value of  $\lambda$  which can be used to conduct the ridge regression to have better results. One of the popular ways is to plot the Ridge Trace and choose the value of  $\lambda$  which the coefficient line settled. It is done by plotting the coefficients of ridge regression against each value of  $\lambda$  assumed. But in this study, since we have prior knowledge of coefficients of the model, we will select the best minimum value of  $\lambda$  that produces the accurate results based on the theory and with the technological improvement in the field of machine learning and statistical computing, STATA shall be used to run the regression for this study with (*ridgereg*) function and the results are interpreted by OLS method.

## 2.4 Nigerian Economic Data

Between 1988 and 1999 as shown in Figure 1, the oil price has been floating around \$14.24 per barrel to \$22.26 per barrel, which seems unfavourable to the economy of Nigeria. However, since 2003 Nigeria's economy continues to grow steadily until 2013 when the oil price has again been fallen till it dropped to \$40.68 per barrel in 2016.

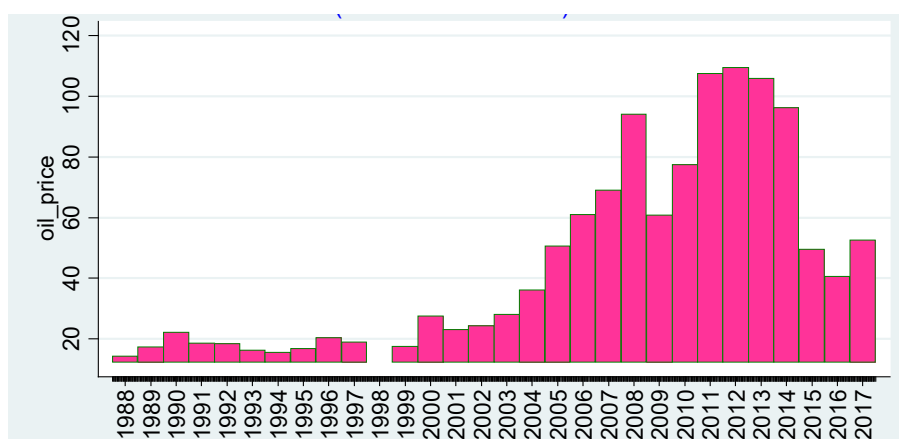


Figure 1. OPEC Oil Price between 1988-2017 (USD Per Barrel).  
Source: Plotted by Authors based on data collected from OPEC (2019)

Since 2017, Nigeria has also been experiencing economic growth as the oil price rose to USD 52.51 per barrel. In summary, Nigeria’s economy (GDP) virtually moves together with the oil price. Hence, it is very imperative to check if Nigeria’s economy is among the cursed economy in the world. (See Figures 1 & 2).

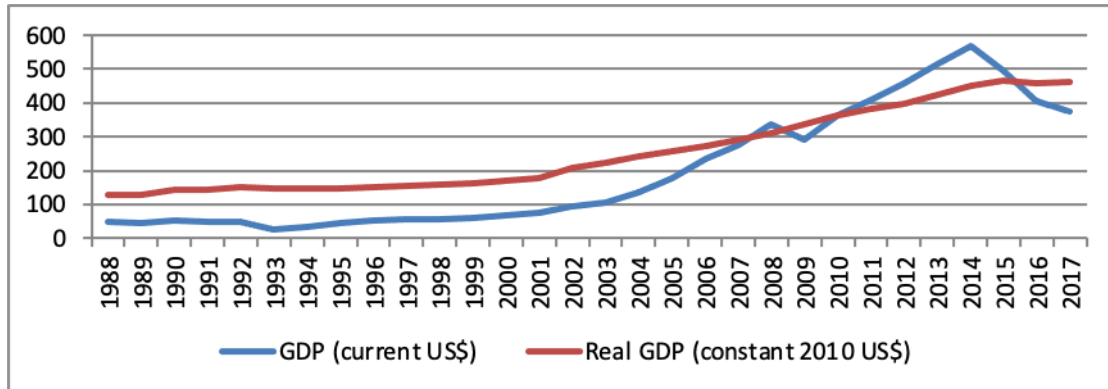


Figure 2. GDP of Nigeria between 1988-2017 (constant 2010) in Billion USD. Source: Plotted by Authors based on data collected from World Bank (2019)

In terms of employment, Nigeria’s employment has mostly been from the agricultural and services sector over time and her unemployment rate has reached 23.1% National Bureau of Statistics (NBS, 2018). Meanwhile, an industry which oil sector fell into has not been creating employment opportunities for the population under the labour force even though much attention of government is in this sector since the late 1980s and based on a survey conducted by the national bureau of statistics in 2013 on job creation, it was reported that oil sector only accounts for about 0.01% of total employment in Nigeria. As depicted from Figure 3, since the late 1980s agricultural sector take close to 60%, the service sector covers over 30% and the industrial sector accounted for less than 10% of the total employment in Nigeria. Due to the oil prices boom that started in 2001 (as shown in Figure 1), many Nigerians who are in the agricultural sector begin to lose their jobs because of government negligence of the agricultural sector and that reduced the percentage of employment in the agriculture sector meanwhile the sector is currently accounting for less than 40% of the total employment in Nigeria.

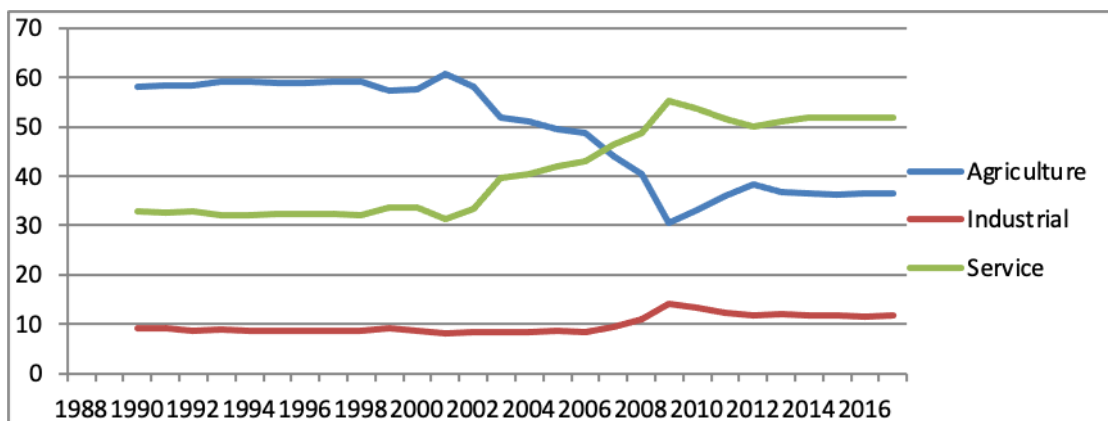


Figure 3. Nigeria Employment by Sector (% of total employment). Source: Plotted by Authors based on data collected from World Bank (2019)

## 2.5 Nigeria Physical Capital

Nigeria’s capital stock has been increasing over time. It was estimated to be 66.92 trillion Naira in 1988 and 170.70 trillion in 2017 if assumed that Nigeria’s capital depreciation rate is 4%. For the uniqueness of the results, the analysis was tested with different depreciation rates which are 7%, 8%, 10%, 20%, 25%, and 30% respectively. Here the higher the depreciation rate of the country, the lower the amount of physical capital and vice versa. These results are presented in Table 1.

Table 1. Estimated Physical Capital through gross fixed capital formation (constant 2010).

Year	K(4%)	K(7%)	K(8%)	K(10%)	K(20%)	K(25%)	K(30%)
1988	66.92	50.2	46.35	40.2	24.23	20.25	17.4
1989	70.69	53.13	49.09	42.62	25.83	21.63	18.63
1990	75.19	56.74	52.49	45.69	27.99	23.55	20.37
1991	79.42	60.01	55.53	48.36	29.63	24.9	21.5
1992	83.52	63.09	58.37	50.8	30.99	25.96	22.33
1993	88.01	66.5	61.52	53.55	32.61	27.29	23.45
1994	92.12	69.48	64.23	55.83	33.72	28.1	24.05
1995	95.56	71.74	66.22	57.37	34.11	28.2	23.96
1996	99.35	74.33	68.53	59.24	34.89	28.76	24.38
1997	103.43	77.18	71.11	61.37	35.97	29.63	25.12
1998	107.46	79.94	73.59	63.4	36.94	30.39	25.75
1999	111.55	82.73	76.08	65.45	37.94	31.18	26.41
2000	116.08	85.94	78.99	67.9	39.35	32.38	27.49
2001	118.3	86.78	79.54	67.97	38.34	31.15	26.1
2002	121.13	88.27	80.73	68.73	38.23	30.92	25.83
2003	125.46	91.27	83.45	71.04	39.76	32.37	27.26
2004	127.79	92.23	84.12	71.28	39.16	31.62	26.43
2005	130.2	93.29	84.91	71.68	38.85	31.24	26.02
2006	135.55	97.32	88.68	75.07	41.64	33.99	28.77
2007	138.37	98.75	89.83	75.81	41.56	33.74	28.39
2008	140.87	99.87	90.68	76.26	41.28	33.33	27.9
2009	144.07	101.71	92.25	77.46	41.85	33.83	28.36
2010	147.49	103.77	94.05	78.9	42.66	34.55	29.04
2011	150.01	104.94	94.96	79.43	42.56	34.34	28.75
2012	152.65	106.23	96.00	80.13	42.69	34.4	28.77
2013	155.87	108.11	97.64	81.44	43.47	35.12	29.46
2014	160.2	111.12	100.4	83.87	45.35	36.91	31.19
2015	164.43	113.98	103	86.12	46.91	38.32	32.47
2016	167.78	115.93	104.69	87.43	47.46	38.67	32.66
2017	170.7	117.44	105.95	88.32	47.6	38.63	32.49

Source: Computed by author

### 3. Results and Discussion

Based on the analysis, it was discovered that Nigeria’s economy is not cursed and the share of labour in agriculture does account for GNI growth in Nigeria. This is due to the insignificant negative correlation that exists between GNI growth and the share of labour in agriculture (evident from Figure 4). On the other hand, Nigeria economy is highly vulnerable to oil price changes especially in the years 2008, 2009, 2015, and 2016 where oil price was highly varied with the amount of 41%, 34%, 35%, and 42% respectively, except in 2013 where the number of oil prices changes was only 12%.

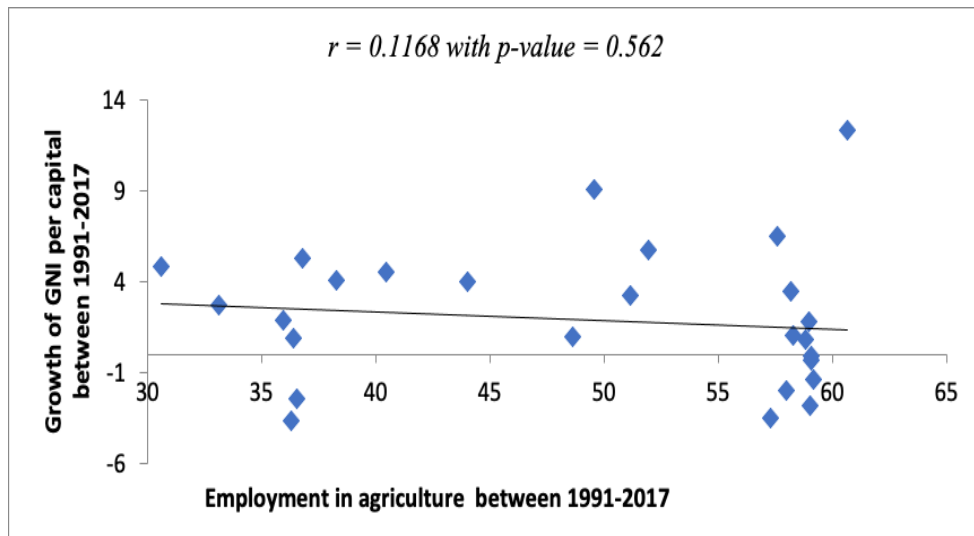


Figure 4. Scattered Plot Showing the Correlation between Gross National Income and Percentage of Employment in Agricultural sector of Nigeria.

The values of variance inflation factors of the collinearity diagnosis are all less than 5 and the respective  $R^2$  for different models conducted has been minimized. Thus, the models are no more biased, and the collinearity has been eliminated and we can say that the independent variables (factors of productions) account for about 61% on average to changes in Nigeria economy.



Also, going by the assumption made by Berlemann *et al.* (2014), with a hundred-year interval of depreciation rate for physical capital, if we assume 4% as the depreciation rate of Nigeria capital, then the resulting equation of the Nigeria production function as shown in Table 2 is given by

$$\ln \hat{Y}_t = 1.975 + 0.2162 \ln P_t + 0.5879 \ln K_t + 0.5238 \ln L_t \quad (10)$$

Table 2. Test with capital depreciation rate ( $\delta = 4\%$ ) and  $\lambda=0.5$ .

Ln (RGDP)	Coefficients	Std. Error	t-statistic	Prob.	VIF	R <sup>2</sup>
Ln(K)	0.5879	0.2008	2.93	0.007	3.8430	
Ln(L)	0.5238	0.2225	2.35	0.026	1.7973	0.6278
Ln(P)	0.2162	0.0679	3.18	0.004	2.9871	
(Constant)	1.9751	5.6148	0.35	0.728		

Note: The Labour & Price remain unchanged

Meaning that the elasticity of output relative to capital ( $\alpha$ ) is 0.5879 and the elasticity of output relative to labour employed ( $\beta$ ) is 0.5238. Therefore, since  $\alpha+\beta = 0.5879 + 0.5238= 1.1117 > 1$ , then we conclude that the rate of increase in production (Nigeria economy) will be more than the rate of increase in the input of both capital and labour. That is, a 10% increase in both capital and labour will increase Nigeria’s real GDP by 111%.

Similarly, both capital and oil prices are highly significant to the economy of Nigeria at a 1% significance level, but the labour is significant at 5%. This means that Nigeria is a capital-intensive country and is largely driven by the oil price. However, Nigeria has not been able to utilize its labour to its fullest like most developed countries.

Table 3 has a variability of oil prices in Nigeria between 2003 and 2008. It was observed that the lowest variability was 12% and occurred in 2013 while the highest variability was 42% and occurred in 2016.

Table 3. Oil Price Variability between 2003 and 2018.

Year	Oil Price (USD)	Variability in Percentage (%)
2003	28.1	28
2004	36.05	27
2005	50.59	24
2006	61.00	22
2007	69.04	20
2008	94.1	41
2009	60.86	34
2010	77.38	21
2011	107.46	23
2012	109.45	17
2013	105.87	12
2014	96.29	16
2015	49.49	35
2016	40.68	42
2017	52.51	19
2018	58.74	22

#### 4. Conclusion

Based on the results obtained from the analysis, it can be deduced that the contribution of oil to the growth of Nigeria's economy has not anyway been limited, and is still largely driven by oil price and capital. Therefore, it is highly recommended for the government to put more effort towards economic diversification and make sure oil revenue is reinvested into the economy by the building of refineries, sustainable infrastructures, and the development of other sectors of the economy. Because in the long run, if the developed oil buyers (countries) eventually implement the use of solar power, electric cars, and automobile, the economy of Nigeria will be in trouble and worse-off even more than its current situation. Also, with the low rate of the manufacturing industry in Nigeria which has not been providing employment opportunities to many citizens under the working-age population, the government of Nigeria should use the opportunity of belt and road initiatives of the People's Republic of China to improve the employability of Nigerians, as China has emerged as the most frequent country Nigeria is trading with.

Although, there has been a lot of conspiracy on to whether the belt and road initiatives of China is a symptom of colonialism, nevertheless, it is economically recommended for the government of Nigeria not to only look at the financial aspect of these initiatives but also, find a way of attracting productive industries for it to maximally utilize its working-age population to improve the productive capacity of the country. And that will not only increase the employability of Nigerians but also increase its revenue generation from other sectors of the economy. Furthermore, Nigeria needs to focus on real productive industries which can make use of the raw materials produced from the agricultural sector after the diversification has been effective. This is the way to achieve a balance within the industrial and agricultural sectors as there will be an increase in return not only to labour but also to the industry. Lastly, based on economic theory, many scholars agreed that for the economy to move away from stagnating, there is a need for having the right institution to set up political and economic policy and as well as to install the restriction to the political power and controlling the behaviour of the citizens. Therefore, it is greatly recommended to emulate fast-growing economy countries such as China in terms of restructuring of policies and constitutions, as much of the Nigeria capital has sunk into the pocket of political leaders over time.

#### References

- Acemoglu, K. D. (2008). *Introduction to modern economic growth*. Department of Economics, Massachusetts Institute of Technology, Turkey.
- Adeniran, A. O. (2018). *Effects of fuel subsidy on transport costs and transport rates in Nigeria*. Federal University of Technology, Akure, Nigeria.
- Adnan, S.E. (2005). *Oil and Development: The Role of OPEC: A Historical Perspective and Outlook to the future*. Vienna, Austria, OPEC press room. Retrieved from [https://www.opec.org/opec\\_web/en/press\\_room/400.htm](https://www.opec.org/opec_web/en/press_room/400.htm) on 28<sup>th</sup> January 2019.
- Afandiyev, E. (2013). Causes of dutch disease and ways to deal with it: Literature overview, (Book 2), IPFW student research and creative endeavor symposium, India. Retrieved from [http://opus.ipfw.edu/stu\\_symp2013/2](http://opus.ipfw.edu/stu_symp2013/2) in January, 2019.
- Aliyu, A. (2014). Modeling petroleum product demand in Nigeria using structural time series model (STSM) approach. *International Journal of Energy Economics and Policy*, US.

- Aljebrin, M. (2013). A production function explanation of Saudi Economic Growth 1984-2011. *International Journal of Economics and Finance*, 5(5). Canadian Center of Science and Education, Canada.
- Alley, I., Asekomeh A., Mobolaji H., & Adeniran Y. (2014). Oil price shocks and Nigerian economic growth. *European Scientific Journal*, 10(19).
- Antony, K., Charles, N., & Kevin, W. (2018). Effect of crude oil prices on GDP growth and selected macroeconomic variables in Kenya. *The Asian Institute of Research Journal of Economics and Business*, 1(3), 282-298.
- Aparna, A. (2014). Impact of oil prices on the Indian economy. *NMIMS Management Review Double Issue*, XXIII(October-November 2013).
- Bassam F. (2007). *The drivers of oil prices: the usefulness and limitations of the non-structural model, the demand-supply framework, and informal approaches*. Oxford Institute for Energy Studies. England.
- Berlemann, M., & Wesselhöft, J. (2014). Estimating aggregate capital stocks using the perpetual inventory method. *Review of Economics*, 65, 1–34. Lucius & Lucius Verlagsgesellschaft mbH, Stuttgart. [http://www.ifw-kiel.de/academy/databases/netcap\\_e/database-on-capital-stocks-inoecd-countries/view?set\\_language=en](http://www.ifw-kiel.de/academy/databases/netcap_e/database-on-capital-stocks-inoecd-countries/view?set_language=en).
- Bert, B., & Harry, G. (1996). Volatility, fundamentals, and economic policy. *BIS Conference Papers No. 1* page 169.
- Birouke, T., Frehiwot F., & Zewdu, A. (2012). *Implications of Oil Price Shocks and Subsidizing Oil Prices to the Ethiopian Economy*. (A CGE Analysis 008), working paper of Ethiopian Development Research Institute, Addis Ababa, Ethiopia.
- Carmine, D. (2014). Oil: economic growth and strategic petroleum stocks. U.S. Department of Energy, *Journal of Energy Strategy*, US. [www.sciencedirect.com/journal/energy-strategy-reviews](http://www.sciencedirect.com/journal/energy-strategy-reviews) in January 2019.
- Christiane, B., & Lutz K. (2016). Forty years of oil price fluctuations: Why the price of oil may still surprise us? *Journal of Economic Perspectives*, 30(1), 139–160.
- Christopher, R. T., & Charles S. M. (2014). *Managerial economics: the foundation of business analysis and strategy (11th Edition)*. ISBN 0-07-802171-5.
- Colin, B., & Miguel A. G. (2012). *Equity derivatives strategy measuring historical volatility*. Santander Global Banking and Markets.
- Cooper, M. (1998). Oil production in the 21st century”, *CQ Researcher*, 8, 673-696. Retrieved From <http://library.cqpress.com/> in January, 2019.
- Elena, P., Irina, D., Sokolova, A., Doronkina, I., & Konovalova, K. (2017), Dependence of the Russian economy on oil prices in the context of volatility of the global oil market: articulation of issue. *International Journal of Energy Economics and Policy*, 2146-4553.
- Energy Information Administration (EIA) (2018). Independent Statistics and Analysis. Retrieved from [www.eia.gov/tools/faqs/faq.php?id=41&t=6](http://www.eia.gov/tools/faqs/faq.php?id=41&t=6) in January, 2019.
- Georgy I., Kazakova, M., & Polbin A. (2015). A theoretical interpretation of the oil prices impacts on economic growth in contemporary Russia. *Russian Journal of Economics*, 1, 257–272.

- Gujarati D. N. (2004). *Basic econometrics. (4th edition)*. The McGraw-Hill Company, New York.
- Gummi, U. M., Buhari, A. I., & Muhammad, A. (2017). Oil price fluctuations and economic growth in Nigeria: Evidence from Granger causality test. *Australasian. Journal of Social Science*, 3, 1-16.
- Hall, J., Sobel, R., & George C. (2010). Institutions, Capital, and Growth. *Southern Economic Journal*, 77(2), 385-405.
- Hall, R. (2005). The ERP'S analysis of the adverse macroeconomic effects of oil price increases. *Journal of Economic Literature*, 43(3), 809-812. Published by: American Economic Association Stable.
- Hamilton, J. (2000). What is an oil shock? NBER working paper series. Retrieved from <http://www.nber.org/papers/w7755> in January, 2019.
- Hoerl, A., & Kennard R., (1970). Ridge regression: biased estimation for nonorthogonal problems. *Technometrics*, 12(1), 55-67. Retrieved from <https://doi.org/10.1080/00401706.1970.10488634>.
- International Energy Agency (2004). Analysis of the impact of high oil prices on the global economy. Retrieved from <https://allafrica.com/download/resource/main/main/idatcs/00010270:2043de08f3df04dc11065547c17b3e71.pdf>.
- International Monetary Fund (2000). The Impact of Higher Oil Prices on the Global Economy. Washington DC, USA. Retrieved from <https://www.imf.org/external/pubs/ft/oil/2000/oilrep.PDF>. Assessed on 22<sup>nd</sup> January, 2019.
- Kale Y., & Doguwa, S. (2015). Compilation of labor force statistics for Nigeria. *CBN Journal of Applied Statistics*, 6 (1). Central Bank of Nigeria.
- Kathleen K., Deng A., & Metz, D., (2012). An econometric analysis of oil price movements: the role of political events and economic news, financial trading, and market fundamentals. Bate White Economic consulting. Retrieved from <https://www.bateswhite.com/assets/htmldocuments/media.768.pdf> January, 2019.
- Maku, E., Adetayo, A., & Oyelade A. (2018). Impact of the petroleum product price on human welfare in Nigeria. Extracted from DOI: <http://dx.doi.org/10.23856/2903>.
- National Bureau of Statistics (NBS) (2018). Labour Force Statistics: Unemployment and Underemployment Report. Retrieved from <https://nigerianstat.gov.ng/download/856>. Assessed on 28<sup>th</sup> January, 2019.
- Nazir, S., & Qayyum, A. (2014). Impact of oil price and shocks on the economic growth of Pakistan: Multivariate analysis. Pakistan Institute of Development Economics (PIDE), Islamabad, MPRA Paper No. 55929. Retrieved from <http://mpra.ub.uni-muenchen.de/55929/>.
- NCSS (2018) Statistical Software Manual chapter 355. Retrieved from [https://ncss-wpengine.netdna-ssl.com/wp-content/themes/ncss/pdf/Procedures/NCSS/Ridge\\_Regression.pdf](https://ncss-wpengine.netdna-ssl.com/wp-content/themes/ncss/pdf/Procedures/NCSS/Ridge_Regression.pdf), 28<sup>th</sup> January, 2019.

- Nkomo, J. C. (2006). The impact of higher oil prices on southern African countries. *Energy Research Centre, University of Cape Town and Journal of Energy in Southern Africa*, 17(1), 10–17. DOI: <http://dx.doi.org/10.17159/2413-3051/2006/v17i1a3373>.
- Nigerian National Petroleum Corporation (NNPC) Business Upstream Report on Oil Production (2018), Retrieved from [www.nnpcgroup.com/nnpcbusiness/upstreamventures/oilproduction.aspx](http://www.nnpcgroup.com/nnpcbusiness/upstreamventures/oilproduction.aspx), January, 2019.
- Nigerian National Petroleum Corporation (NNPC) Statistical Bulletin, (2017). NNPC, Nigeria. Retrieved from <http://www.nnpcgroup.com>, January, 2019.
- Nwoba E., Nwonu C., & Agbaeze E. (2017). Impact of fallen oil prices on the Nigerian economy. *Journal of Poverty, Investment and Development. International Peer-reviewed Journal*, 33.
- Okonjo-Iweala, N., & Osafo, K. (2007). Nigeria's economic reforms progress and challenges. Global Economy and Development Program, The Brookings Institution, Washington, Retrieved from [http://www.brookings.edu/wp-content/uploads/2016/06/20070323okonjo\\_iweala.pdf](http://www.brookings.edu/wp-content/uploads/2016/06/20070323okonjo_iweala.pdf).
- Olimb, M. (2010). Understanding the factors behind crude oil price changes: a time-varying model approach. Master's thesis presented to Faculty of Social Sciences and Technology Management, Department of Industrial Economics and Technology Management, Norwegian University of Science and Technology, Norway. Retrieved from [https://www.iot.ntnu.no/users/fleten/students/tidligere\\_veiledning/OlimbOdegard\\_V10.pdf](https://www.iot.ntnu.no/users/fleten/students/tidligere_veiledning/OlimbOdegard_V10.pdf). Assessed in January, 2019.
- Organization of the Petroleum Exporting Countries (2019). OPEC Basket Price [Data set]. Retrieved from <https://www.opec.org/basket/basketDayArchives.xml>, 22<sup>nd</sup> January, 2019.
- Petrol Price in Nigeria (2019). Extracted from [Nigerianprice.Com/Petrol-Price-In-Nigeria](http://Nigerianprice.Com/Petrol-Price-In-Nigeria).
- Rentschler, J. (2013). *Oil price volatility, economic growth and the hedging role of renewable energies*. Policy Research Working Paper 6603, World Bank, Washington, DC.
- Robinson, D., Bayoumi, T., Kumar, M. S., Isard, P., MacFarlan, M., Edison, H., Rourke, B., Hunt, B., & Cheetham, X. (2000). *The impact of higher oil prices on the global economy*. *International Monetary Fund*. US.
- Ronald, R. and Vespignani, J. (2014). OPEC and Non-OPEC oil production. *Journal of Energy Economics*, 50, 364–378. Retrieved from <http://www.sciencedirect.com/journal/energy-economics>.
- Smith, J. L. (2009). World oil: Market or mayhem. *The Journal of Economic Perspectives*, 23(3), 145-164. Retrieved from <https://www.jstor.org/stable/27740545>.
- Stéphane, D., Gasteuil, A., Kaufmann, R. K., & Mann, M. (2008). Assessing the factors behind oil price changes. The working paper of European Central bank, Germany. Retrieved from <http://www.ecb.europa.eu/> or [http://ssrn.com/abstract\\_id=1080247](http://ssrn.com/abstract_id=1080247), January, 2019.
- Taofik, I. (2018). *Oil price fluctuation and aggregate output performance in Nigeria*. Department of Economics, Ahmadu Bello University, Zaria, Kaduna State, Nigeria. Munich Personal RePEc Archive (MPRA) Paper No. 88636, posted 27 August 2018 10:47 UTC. Assessed in January, 2019.

Thirlwall, A. (2011). *Economics of development: theory and evidence*. Palgrave Macmillan, Ninth Edition 2011, Tenth Edition 2017.

Venus, L. K. (2004). Which lag length selection criteria should we employ? *Universiti Putra Economics Bulletin*, 3(33). 1–9. Malaysia.

World Bank (2019). Nigeria Economic Indicators [Data set]. Retrieved from <https://data.worldbank.org/indicator/ny.gdp.mktc.cd?locations=ng>, 22<sup>nd</sup> January, 2019.

World Bank Report on Commodity Markets Outlook (April, 2018). Oil exporters: policies and challenges. Retrieved from

<http://pubdocs.worldbank.org/en/734451528311174935/CMO-April-2018-Special-Focus-Oil-Exporters.pdf>, January, 2019.

Zhang Q. (2011). *The impact of international oil price fluctuation on China's economy*. School of Economics and Management, Wuhan University, Wuhan 430072, China.