Oil Price Shocks And Macroeconomic Variables In Nigeria

Stella Madueme

&

Onyenkwere Christian Nwosu

Abstract

Since the 1970s, and at least until recently, macroeconomists have viewed changes in the price of oil as an important source of economic Fluctuations, as well as a paradigm of a global shock, likely to affect many economies simultaneously. Such a perception is largely due to the two episodes of low growth, high unemployment, and high inflation that characterized most industrialized economies in the mid and late1970s.The events of the past decade, however, seem to call into question the relevance of oil price changes as a significant source of economic fluctuations. The reason: Since the late 1990s, the global economy has experienced two oil shocks of sign and magnitude comparable to those of the 1970s but, in contrast with the latter episodes, GDP growth and inflation have remained relatively stable in much of the industrialized world. This work looked at how the shocks have affected Nigeria recommendations were given.

Theoretical Issues

Aliyu (2009) stated that an oil price increase, all things being equal, should be considered positive in oil exporting countries and negative in oil importing countries, while the reverse should be expected when the oil price decreases. The challenge, however, of the combined effect of hikes in oil prices and exchange rate instabilities on macroeconomic economic stability and economic growth for oil producing nations like Nigeria is really enormous. Akpan (2009) stated that there has been a steep upward trend in the price of crude oil in recent years, reaching a record nominal high in mid-2008. This have led to increasing concern about its macroeconomic implications, both abroad and in Nigeria given that the Nigerian economy is highly vulnerable to oil price fluctuations. He analysed the dynamic relationship between oil price shocks and major macroeconomic variables in Nigeria by applying a VAR approach. The study pointed out the asymmetric effects of oil price shocks; for instance, positive as well as negative oil price shocks significantly increase inflation and also directly increases real national income through higher export earnings, though part of this gain is seen to be offset by losses from lower demand for exports generally due to the economic recession suffered by trading partners. His findings showed a strong positive relationship between positive oil price changes and real government expenditures. Unexpectedly, the result identified a marginal impact of oil price fluctuations on industrial

output growth. Furthermore, the "Dutch Disease" syndrome is observed through significant real effective exchange rate appreciation.

Aliyu (2009) assessed the impact of oil price shock and real exchange rate volatility on real economic growth in Nigeria on the basis of quarterly data from 1986Q1 to 2007Q4. The empirical analysis started by analyzing the time series properties of the data which is followed by examining the nature of causality among the variables. Furthermore, the Johansen VAR-based cointegration technique was applied to examine the sensitivity of real economic growth to changes in oil prices and real exchange rate volatility in the long-run while the short run dynamics was checked using a vector error correction model. Results from ADF and PP tests show evidence of unit root in the data and Granger pairwise causality test revealed unidirectional causality from oil prices to real GDP and bidirectional causality from real exchange rate to real GDP and vice versa. His findings showed that oil price shock and appreciation in the level of exchange rate made positive impact on real economic growth in Nigeria. He recommended greater diversification of the economy through investment in key productive sectors of the economy to guard against the vicissitude of oil price shock and exchange rate volatility.

Farzanegan and Markwardt (2009) stated that due to the high dependence on oil revenues, oil price fluctuations had a special impact on the Iranian economy. By applying a VAR approach, they analyzed the dynamic relationship between asymmetric oil price shocks and major macroeconomic variables in Iran. Contrary to previous empirical findings for oil net importing developed countries, oil price increases (decreases) have a significant positive (negative) impact on industrial output. Unexpectedly, the authors noted that they can not identify a significant impact of oil price fluctuation on real government expenditures. The response of real imports and the real effective exchange rate to asymmetric oil price shocks are significant. Furthermore, the response of inflation to any kind of oil price shocks is significant and positive.

Olusegun (2008) investigated the impacts of oil price shocks on the macroeconomic performance in Nigeria using Vector Autoregression (VAR) approach. Forecast error variance decomposition is estimated using 7 key Nigerian macroeconomic variables, which are; real gross domestic product, consumer price index, real oil revenue, real money supply, real government recurrent expenditure, real government capital expenditure and real oil price. An annual data between the periods 1970-2005 were employed. The Johansen cointegration test identified at least four cointegrating vectors among the variables. The forecast error variance decomposition estimated from the VAR model shows that oil price shocks significantly contribute to the variability of oil revenue and output. On the other hand, the result reveals that oil price shock does not have substantial effects on money supply, price level and government expenditure in Nigeria over the period covered by the study. This is evident, as its contributions to the variability of these variables are very minimal. The study again reveals that the variability in the price level, apart from its own shock, is explained substantially by output and money supply shocks. Also, apart from its own shock, the variability in money supply is also explained by price level and output. This finding confirms, therefore, that oil price shock may not be necessarily inflationary especially, in the case of an open developing economy like Nigeria. The policy implication of this is that fiscal policy can be used more effectively to stabilise the domestic economy after an oil shock

Kilian (2008) used a newly developed measure of global real economic activity, he proposes structural decomposition of the real price of crude oil in four components: oil supply shocks

driven by political events in OPEC countries; other oil supply shocks; aggregate shocks to the demand for industrial commodities; and demand shocks that are specific to the crude oil market. The latter shock is designed to capture shifts in the price of oil driven by higher precautionary demand associated with concerns about the availability of future oil supplies. He quantifies the magnitude and timing of these shocks, their dynamic effects on the real price of oil and their relative importance in determining the real price of oil during 1975-2005. The analysis also sheds light on the origins of the major oil price shocks since 1979. Distinguishing between the sources of higher oil prices is shown to be crucial for assessing the effect of higher oil prices on U.S. real GDP and CPI inflation. It is shown that policies aimed at dealing with higher oil prices must take careful account of the origins of higher oil prices. He also quantifies the extent to which the macroeconomic performance of the U.S. since the mid-1970s has been determined by the external economic shocks driving the real price of oil as opposed to domestic economic factors and policies.

Olomola and Adejumo (2006) examine the effect of oil price shock on output, inflation, the real exchange rate and the money supply in Nigeria using quarterly data from 1970 to 2003. The VAR method was employed to analyze the data. Their findings were contrary to previous empirical findings in other countries; oil price shock does not affect output and inflation in Nigeria. However, oil price shocks did significantly influence the real exchange rates. The implication was that a high real oil price gave rise to wealth effect that appreciated the real exchange rate. This squeezed the tradable sector, giving rise to the "Dutch Disease".

Ayadi(2005) states that the single most important issue confronting a growing number of world economies today is the price of oil and its attendant consequences on economic output. He notes that several studies have taken the approach of Hamilton (1983) in investigating the effect of oil price shocks on levels of gross domestic product. The focus of his paper is primarily on the relationship between oil price changes and economic development via industrial production. A vector auto regression model is employed on some macroeconomic variables from 1980 through 2004. The results indicate that oil price changes affect real exchange rates, which, in turn, affect industrial production. However, this indirect effect of oil prices on industrial production is not statistically significant. Therefore, the implication of the results presented in this paper is that an increase in oil prices does not lead to an increase in industrial production in Nigeria.

1.2 STATEMENT OF THE PROBLEM

The increasing spate of variations in oil prices remains a source of challenge to policy makers the world over. Since the major oil shock of 1973, there have been marked fluctuations in the world price of oil. The $17 per barrel price of oil in the earlier part of the year 2002 increased by about 50% to around $26 by the end of the year and later climbed to $53 in late 2004. Earlier studies focusing on the United States have suggested that on the one hand, rising oil prices led to reduction in output and higher inflation in the 1970s and early 1980s and that oil price declines on the other had an exactly opposite effect (Adeniyi, 2009).

Oil plays a significant role in the Nigerian economy as the largest contributor in terms of total government revenue but also as the overall contributor in her exports composition. It accounted for about 82.1% of total government revenue during the oil boom in 1974 before reducing to a share of 64.3% by 1986 which was a consequence of the rapid decline in world market price of crude oil. The share of oil revenue in total government revenue still remains substantial as evidenced by the attainment of 85.6% and 86.1% in 2004 and 2005

respectively(Akpan,2009). Thus persistent oil shocks could have severe macroeconomic implications like fluctuation in the GDP which may induce challenges with respect to policy making. Nigeria's membership of Organization of Petroleum Exporting Countries (OPEC) implies some degree of influence on the international oil market but the level of vulnerability to oil market events is more substantial than the former. In this situation any shock to global oil markets can have a tremendous effect on the structure of the economy (Cashin et al 2000). The revenue from oil is the pivot for government budgets and subsidization of domestic petroleum product prices(especially gasoline which is the most demanded for transportation and other uses).In spite of higher oil prices and revenues in recent times, the attempts by government to continue subsidizing energy is still a source of challenge in terms of budget deficit. Hence it appears that oil price changes significantly influence the welfare programs of the state.

Oil price changes impact on real economic activities via both the demand and the supply side. The demand side effects operate through consumption and investment decisions. While consumption is indirectly affected because of its positive association with disposable income (for instance a rise in oil prices may lead to an increase in the general price level which then reduces consumers purchasing power), investment could also be affected where the shock to oil prices creates an incentive for producers to substitute less energy intensive capital for more energy intensive capital. On the supply side, the fact that crude oil is an input into the production process is vital with an increase in the price of oil leading to a rise in the cost of production which firms respond to by cutting down on output. The country has been facing a continued decline in industrial capacity utilization coupled with a gradual but consistent increase in the general price level most particularly food prices. The foregoing problems make raising the following conceptual and policy questions a necessary exercise: What are the effects of oil price shocks on the real sector of the Nigerian economy? What are the channels through which the oil shocks are transmitted within the economy? The link between the problem statement and the literature review is that an increase in oil price reduces production and hence brings about shocks in the output.

1.3 OBJECTIVES OF THE STUDY

Broadly, the objective of this study is to investigate the effects of oil price shocks on the Nigerian macroeconomic performance. To achieve this, the following specific objectives are stated:

(i) To investigate the effect of oil price shocks on the real sector of Nigeria economy.

(ii) To examine the effects of oil price shocks on some macroeconomic variables like inflation and exchange rate.

(iii) To identify the channels through which the impact of oil price shocks is transmitted in the Nigerian economy.

1.4 RESEARCH HYPOTHESIS

The research hypothesis that will guide this study is stated as follows:

That oil price shock does not impact on output in Nigeria.

1.5 JUSTIFICATION FOR THE RESEARCH

The Nigerian economy is largely oil-dependent as it (oil) accounts for a significant proportion of the Gross Domestic Product. Also the structure of exports in Nigeria shows the acute dominance of this natural resource. This dominance is further revealed especially with regards to revenue generation by the government. Budgetary allocations are many a time made based on projections about the expected path of oil prices thus making the economy

susceptible to volatility emanating from the international oil market. The sustained increases in oil price since the early twenty-first century has provided Nigeria with huge financial resources which could be channeled into productive use for boosting growth and development. The claim (by the authorities) in terms of improvement in macroeconomic performance needs to be scrutinized in order to ascertain whether the "good news" is as result of sound management of the economy through effective domestic policies(fiscal, exchange rate, monetary, price controls) or just the inevitable result of the influence of external factors, the oil price increase in particular. This study therefore would contribute immensely to knowledge and total understanding of the workings of the economy in Nigeria, as it relates to the natural resource (crude oil). Through the macroeconomic variables that we are going to consider in this work, it will help the government and the general public to know the trend of oil price shocks and policy instruments required to stabilize the oil price changes and hence economic growth in Nigeria.

METHODOLOGY OF THE RESEARCH

The econometric model to consider in this study takes crude oil price, external reserve and crude oil export as the explanatory variable and gross domestic product as dependant variable respectively. These variables are used at constant prices. This is used to obtain a reliable parameter estimates in the time series regression.

This study therefore estimates the impact of oil price shock on macroeconomic variables in Nigeria in order to ascertain the shock impact on key variables. Therefore, developing a model for the econometrics analysis of exchange rate fluctuation in Nigeria from 1970 – 2008 could be stated mathematically as follows:

GDP = F (COP, CAP, CRUDE, EXCHR, CEX, INF) …… (1)

where

COP= crude oil prices

CAP = government capital expenditure

CRUDE = total sale of crude oil

EXCHR = exchange rate

CEX = crude export

INF = inflation

In order to estimate the equation empirically, equation (1) would be transformed into an econometric equation stated as follows:

$GDP = \alpha_0 + \alpha_{1COP} + \alpha_{2\ CAP} + \alpha_{3CRUDE} + \alpha_{4EXCHR} + \alpha_{5CEX} + \alpha_{6INF} + \mu \ldots (2)$

α_0 = the constant term

α's = the parameters to be estimated

μ = stochastic error

The data for this study would be generated from the Central Bank of Nigeria (CBN) statistical bulletin from 1970-2008 covering the period of 39years. Other relevant statistics and data will be obtained from the National Bureau of Statistics (NBS) of Nigeria as these are the major databanks in Nigeria

The Generalized autoregressive conditional heteroskesticity (GARCH) model of estimation is used to conduct the econometric test. This is because the GARCH method is used to test for volatility of financial time series. The variable of interest being crude oil prices which is considered volatile, its imperative to use the GARCH method.

In line with Gujarati (1999), regression models involving time series data sometimes give results that are spurious, or of dubious value, in the sense that superficially the results look good but on further investigation they look suspect. This implies that the series might be nonstationary or contain unit root; a highly persistent time series process where the current value equals last period's value, plus a weakly dependent disturbance (Wooldridge 2006). Noting Greene (2003), the Augmented Dickey Fuller (ADF) test is employed to test for unit root based on an equation of the forms:

$$pyt = \mu + \gamma\, yt\text{-}1 + \Sigma_{j=1}\, \gamma j \Delta yt\text{-}j + ut \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

$$pyt = \mu + \beta t + \gamma\, yt\text{-}1 + \Sigma_{j=1}\, \gamma j \Delta yt\text{-}j + ut \quad \ldots\ldots\ldots\ldots (4)$$

where equations (3) and (4) indicate ADF tests without trend and with trend, respectively. Thus, the ADF unit root test posits a null hypothesis $\gamma = 0$ versus an alternative hypothesis $\gamma < 0$. As a result, implying that if the series have unit root, one can conclude that cointegration is necessary.

Since the cointegration test procedures of Johansen and Juselius (1990) can distinguish between the existence of one or more cointegrating vectors and also generate test statistics with exact distributions (Van den Berg and Jayanetti 1993); it is hereby appropriate to utilize. Thus, assuming a vector autoregressive (VAR) model:

$$\Delta xt = \Sigma \Gamma i \Delta xt\text{-}i + \Omega xt\text{-}1 + \mu + \varepsilon t \quad \ldots\ldots\ldots\ldots\ldots (5)$$

Where xt is a vector of nonstationary variables p x 1 and (i = 1,……..,k).

In essence, the JJ (Johansen and Juselius) method tests whether the coefficient matrix Ω reflects the fundamentals of long run equilibrium among the non-stationary variables. As a result, if $0 < \text{rank}\ \Omega = r < p$, then there are matrices α and β of dimension p x r where $\Omega = \alpha\beta'$ and r cointegrating relations among elements of xt; where α and β are cointegration vectors and error correction parameters, respectively.

The error-correction mechanism was employed to look at the short-run and long-run behaviour of the independent variable in relation to its explanatory variables. This equation incorporates the short-run adjustment mechanism into the model. In the previous section, it was evident that there is at least one cointegrating relationship between the variables. Nevertheless, in the short run, there may be disequilibrium. Therefore, the error term equation is employed to eliminate deviation from the long-run equilibrium. Thus, the error correction model would be stated as follows:

$$\Delta y_t = \square_0 + \gamma_0 \Delta x_t + \square\, (y_{t\text{-}1} - \beta x_{t-1}) + u_t \quad \ldots\ldots\ldots\ldots\ldots (6)$$

where $\square < 0$ If $y_{t\text{-}1} > \beta x_{t-1}$, then y in the previous period has overshot the equilibrium; because $\square < 0$, the error correction term works to push y back towards the equilibrium. Similarly, if $y_{t\text{-}1} < \beta x_{t-1}$, the error correction term induces a positive change in y back towards the equilibrium. An error correction model allows us to study the short-run dynamics in the relationship between y and x. For simplicity, consider the model without lags of Δy_t and Δx_t

Goodness of Fit test (R2). Coefficient of determination known as R2 was used to measure the goodness of fit of the model. Thus the higher the R2 the more the model is able to explain and hence the better the fit. Adequacy of regression equation (F –test). The regression equation is adequate if the computed F-statistic is higher than the tabulated F-statistic. There

was also a correlation test, which measured the degree of relationship between the variables under consideration. There was a normality test, which helped to determine if the error term of the variables under consideration are normally distributed. This was done using the hypothesis, which states that if the Chi-Square calculated is less than the Chi- Square tabulated, then it shows that the variables are normally distributed.

ANALYSIS OF THE RESULT FINDINGS

The data result was analyzed based on the following economic and statistics criteria.

The economic criterion is conducted with a view that the apriori expectations of the economic theory would hold both in sign and sizes. The impact of Oil Price Shock on macroeconomic performance was analyzed based on the functional relationships of the variables under-consideration. From the regression result the Gross Domestic Product (GDP) is the dependent variables, while the variables CAP, CRUDE, EXCHR, INF and COP are the independent variables.

From the regression result the variable CAP, EXCHR and COP showed positive sign. This shows that during the period under review, the capital expenditure of the Federal Government, exchange rate and crude oil prices, contributed positively to the growth of the Nigeria economy.

The graph showed that crude oil prices have been volatile.

The variables CRUDE which represents crude oil sales and INF (inflation) showed negative signs, indicating that during the period under review, had negative impact on GDP.

Statistically, the probability of EXCHR and COP variables are below 0.05 hence the statistically significant, while the rest are not.

The F – Statistics is interpreted with the hypothesis stated as follows:

H_O: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6$

H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6$

$V_1 = K - 1$

$V_2 = N - K$

where

K = number of parameters

N = number of observations

The decision rule that guides the test is stated as follows: If the F- calculated is greater than the F- tabulated, we reject H_O and accept H_1 with a conclusion that the overall estimate of the regression is statistically adequate, otherwise it is not. From the regression result, the F-values obtained are as follows: F (6, 39) = 18.81 while tabulated value is given as follows F (6,39) = 1.93

Decision: Since the F –calculated is greater than the F- tabulated, we reject H_O and conclude that the overall estimate of the regression is adequate statistically.

The R^2 of the regression is conducted to measure the overall goodness of fit of the regression. The test result indicates the following value: $R^2 = 0.833781 = 83\%$. It shows that the independent variables explain the dependent variable to the tune of 97%. The Durbin – Watson statistics DW = 0.789347.

Under the econometrics criterion, the following tests were conducted: Normality, Unit Root, Stationary. In the event of the variables not stationary of the same order, a cointegration test would be conducted. The Error correction test would equally be conducted to correct for the short run disequilibrium of the variables under consideration.

The Normality test procedure is conducted to ascertain the level of normality of the variables under estimation. The test is conducted following the assumption stated as follows: If the Chi-square calculated is less than the Chi-square tabulated, we conclude that the error term of the variables under consideration is normally distributed otherwise it is not. From the regression result, the Jarque-Bera (JB) test statistics shows the following values JB =52.3 the tabulated result shows the following value: 5.99147.

Decision: Since the Chi-Square calculated is greater than the Chi-Square tabulated we conclude that the error terms of the variables under consideration are not normally distributed.

The test was conducted to ascertain the level of stationarity existing between the variables under consideration. The test is conducted following the decision rule stated as follows: if the absolute value of the Augmented Dickey Fuller (ADF) test is greater than the critical value, either at 1%, 5% or 109, level of significant at the order zero, one or two, we conclude that the variables under consideration are significant otherwise, they are not.
For the variables under consideration the following values were obtained:

The Critical value is at 5% level of significant and the value given is as followings: 5% Critical value = -2.9446.
From the result obtained, it shows that all the variables GDP and CAP were stationary at order two. CRUDE, EXCHR and INF were stationary at order one while COP was stationary at other three. This therefore leads us to conduct a cointegration test.

The cointegration test procedure is conducted to establish a long run relationship between the variables under consideration. Using Engle Granger (EG) and Augmented Engle –Granger (AEG) test. Two variables will be co integrated if they have a long-term or equilibrium relationship between them. According to Granger (1986) "A test for cointegration can be thought of as a pre-test to avoid spurious regression situations.
In finding that the time series are cointegrated, one could obtain the residuals from the cointegrating regression. The residual of the long-run relationship is tested for the existence of a unit root, therefore. If the residuals are found to be I(0), then a cointegrating relationship will be established
There is the presence of cointegration at the fifth iteration.

CONCLUSION AND RECOMMENDATIONS
In conclusion, the analysis of the result findings shows that the variables (CAP) Capital expenditure and COP (Crude oil prices) showed a positive sign indicating that crude oil prices during the period under review contributed positively to the Nigerian economic growth. It also shows that oil price irrespective of its shocks and volatility during the period under review continued to become the main stay of the nation's economy.

On the whole, the picture paints an unstable future for the Nigerian economy following oil price shocks. There is a strong need for policy makers to focus on policies that will strengthen/stabilize the macroeconomic structure of the Nigerian economy with specific focus on; alternative sources of government revenue (reduction of dependence on oil proceeds), reduction in monetization of crude oil receipts (fiscal discipline), aggressive saving of proceeds from oil booms in future in order to withstand vicissitudes of oil shocks in future.

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