Oil Price Shocks and the Nigeria Economy: A Variance Autoregressive (VAR) Model

GUNU UMAR (Ph. D)

Department of Business Administration, University of Ilorin, Ilorin, Nigeria

Tel: 234-805-5912-617 E-mail: gunu_umar_2002@yahoo.com

KILISHI, A. ABDULHAKEEM

Department of Economics, University of Ilorin, Ilorin, Nigeria

Tel: 234-805-0221-980 E-mail: meetkilishi@yahoo.com

Abstract

Oil prices have been highly volatile since the end of World War II. The volatility becomes even more serious in recent time. This has implications for the economies of oil exporting countries, particularly oil dependent countries like Nigeria. The paper examined the impact of these fluctuations on macroeconomic of Nigeria.

Using VAR, the impact of crude oil price changes on four key macroeconomic variables was examined. The results show that oil prices have significant impact on real GDP, money supply and unemployment. It impact on the fourth variable, consumer price index is not significant. This implies that three key macroeconomic variables in Nigeria are significantly explained by exogenous and the highly volatile variable. Hence, the economy is vulnerable to external shocks. Consequently, the macroeconomic performance will be volatile and macroeconomic management will become difficult. Diversification of the economy is necessary in order to minimize the consequences of external shocks.

Keywords: Oil prices, Vector autoregressive, Macroeconomic variables, Diversification

1. Introduction

Since oil was discover in commercial quantity in Nigeria, oil has dominated the economy of the country. In Nigeria, oil accounts for more than 90 percent of its exports, 25 percent of its Gross Domestic Product (GDP), and 80 percent of its government total revenues. Thus, a small oil price changes can have a large impact on the economy. For instance a US$1 increase in the oil price in the early 1990s increased Nigeria's foreign exchange earnings by about US$650 million (2 percent of GDP) and its public revenues by US$320 million a year. Nigeria's reliance on oil production for income generation clearly has serious implications for its economy.

Secondly, oil is an important commodity in the economy of any country in the world because it is a major source of energy for domestic and industrial use. Oil therefore serves as intermediate product and as well as consumer commodity. There are different end products of oil; these include kerosene, diesel, gasoline, and others. Changes in the prices of either the crude oil or any of the end products are expected to have impact on users and the nation at large.

Oil prices traditionally have been more volatile than many other commodity or asset prices since World War II. The trend of demand and supply in the global economy coupled with activities of OPEC consistently affects the price of oil. The recent changes in oil prices in the global economy are so rapid and unprecedented. This is partly due to increased demand of oil by China and India. However, the current global economy melt down suddenly counteracted the skyrocketing oil price. At the beginning of the crisis oil price crashed below $40/b in the world market which had serious consequences on Nigeria fiscal budget which led to the downward review of the budget oil bench mark price. Today oil price is oscillating between $60/b and $75/b. This rapid change has become a great concern to everybody including academics and policy makers; therefore a study of this kind is timely.

The objective of this paper is to examine the impact of oil price fluctuation in the Nigeria economy using some key macroeconomic variables. A vector auto regression (VAR) model is developed and variance decomposition test is carried out. The paper is divided in to six sections, following this introduction is section two which presents the trend of oil prices. Section three focuses on empirical evidences of the relationship between oil price and economic performance. Section four is the methodology and analysis of VAR, while section five presented the results and discussed the variance decomposition and section six concludes the paper.

2. Trend of Oil Prices

Crude prices have been very volatile since 1999. Spikes from March 1999 are because of the following factors: (i) OPEC restricted crude oil production and there is greater cooperation among its members; (ii) Asian growing oil demand signifying recovery from crisis; and (iii) shrinking non-OPEC production. The world market responded accordingly with sharp increase in prices, with crude oil prices increasing and exceeding US$30/b towards the end of 2000. OPEC then tried to maintain prices at a range between US$22/b and US$28/b by increasing or reducing production, and with increases in output by non-OPEC producers, particularly Russia. The September 11 2001 incident sent crude oil prices plummeting, despite earlier production increases by non-OPEC producers and reduction of quotas by OPEC member countries. Soon afterwards, prices moved to the US$25/b range. In 2004, prices moved above this range, with the Brent crude hovering above US$40/b per barrel during the year. Factors contributing to the increase can be isolated as follows: the continued fall in the US dollar and following political tension in the Middle East, the high demand for crude oil by China and uncertainty about the future of Yukos, the Russian oil producer. The falling of the US dollar against other major currencies contributed to increasing fuel prices.

The banking crisis that erupted in September 2008, following more than a year of less acute financial turmoil, has substantially reinforced the cyclical downturn that was already under way. Following the insolvency of a large number of banks and financial institutions in the United States, Europe, and the developing world, financial conditions have become much tighter. The consequent global economic meltdown resulted to crash in oil prices. Figure 1 shows the trend of oil price from 1970 to 2009 (see appendix 1).

To capture the volatility of oil price it is important to consider recent fluctuations in the market, thus figure two shows the monthly oil prices of three years, 2007, 2008 and 2009 as shown in appendix 1.

Both figures one and two show the volatility of oil prices. At the beginning of 2008 the net price of oil was less US$100/b, mid of the year it was above US$140/b and by the end it stood below US$40/b. The changes were almost weekly, this is obvious from figure 2. The presence of high volatility commonly associated with claims that markets often overshoot relative to underlying fundamentals. It would appear obvious to most observers that the price swings of the past year represent prime examples of overshooting. However, this conclusion may not be as valid as it may appear at first glance. After all, changes in underlying economic fundamentals themselves can lead to complicated price dynamics.

Sometimes the changes in the crude oil prices does not translate to changes in domestic end user prices of oil products, because of the dynamics of domestic demand and supply, domestic policies such as subsidy and price regulations. Hence, fluctuations in crude oil prices may not have much impact in the domestic economy through the domestic end user prices. Therefore, it might be interesting to examine the price movement of end user prices of kerosene, gasoline (known as petroleum in Nigeria) and diesel.

Monthly average world gasoline prices increased from US$0.26 a liter in January 2004 to US$0.37 in January 2007 and to US$0.73 by August 2008. Diesel prices were US$0.25 a liter in January 2004, US$0.42 in January 2007, and US$0.84 in August 2008. During this period, some developing countries experienced a large currency appreciation which partially helped offset oil price increases. Other countries experienced currency depreciation, exacerbating the impact of steep oil price rises.

Retail fuel prices of gasoline and diesel in August 2008 were, on average, about 50 percent higher in industrialised countries than in developing countries. Gasoline, diesel, and household kerosene prices in oil-importing developing countries were twice as high as those in oil-exporting countries. By region, Sub-Saharan Africa had the highest gasoline and diesel prices in the developing world, a consequence of the landlocked nature of some of its countries, inadequate economies of scale in small markets, inadequate infrastructure for transporting fuels, rising demand for diesel to offset power shortages, and relatively high rates of taxation. Retail prices in Asia and Latin America were comparable. Retail prices of liquefied petroleum gas, used in household cooking, were low in relation to world prices, reflecting the tendency of governments to subsidize this fuel. However, a number of countries—including Bangladesh, China, Egypt, Ethiopia, India, Indonesia, the Islamic Republic of Iran, Malaysia, Nepal, Nigeria, Sri Lanka, the Syrian Arab Republic, Venezuela, and the Republic of Yemen—set fuel prices in an ad hoc manner, and most have seen growing price subsidies in recent years.

In Nigeria the domestic retail prices are regulated and subsidize by government, however, the prices are adjusted (upward or downward) from time to time. Figure three shows retail prices of major petroleum products as shown in appendix 1.

3. Oil Price and the Economy: Empirical Evidence

The oil price shock of 1973 and the subsequent recession gave rise to a plethora of studies analyzing the effects of oil price increases on the economy. The early studies included Pierce and Enzler (1974), Rasche and Tatom (1977), Mork and Hall (1980), and Darby (1982), all of which documented and explained the inverse relationship between oil price increases and aggregate economic activity. Later empirical studies—such as, Gisser and Goodwin (1986) and the study on Energy Modeling Forum as documented in Hickman et al. (1987)—confirmed the inverse relationship between oil prices and aggregate economic activity. Darby (1982), Burbidge and Harrison (1984), and Bruno and Sachs (1982, 1985) documented similar oil-price-economy relationships in cross country analysis. Hamilton (1983) made a definitive contribution by extending the analysis to show that all but one of the post-World-War-II recessions were preceded by rising oil prices and those other business cycle variables could not account for the recessions. This is also evident in the current economic meltdown.

In an extensive survey of the empirical literature, Jones and Leiby (1996) found that the estimated oil price elasticity of GNP in the early studies ranged from -0.02 to -0.08, with the estimates consistently clustered around -0.05. Tobin (1980) thought the estimated effects seemed too high to be consistent with a classic supply shock, but Jones and Leiby (1996) argued that values around -0.05 are in the ballpark for output elasticities that are roughly equal to factor shares. After the 1973 oil-price shock, oil's share in GNP was around 4-6 percent.

Several different channels have been proposed to account for the inverse relationship between oil price movements and aggregate economic activity. The most basic is the classic supply-side effect in which rising oil prices are indicative of the reduced availability of a basic input to production. Other explanations include income transfers from the oil-importing nations to the oil-exporting nations, a real balance effect and monetary policy. Of these explanations, the classic supply-side effect best explains why rising oil prices slows GDP growth and stimulates inflation.

Rising oil prices can be indicative of a classic supply-side shock that reduces potential output, as in Rasche and Tatom (1977 and 1981), Barro (1984) and Brown and Yücel (1999). Rising oil prices signal the increased scarcity of energy which is a basic input to production. Consequently, the growth of output and productivity are slowed. The decline in productivity growth lessens real wage growth and increases the unemployment rate at which inflation accelerates. If consumers expect the rise in oil prices to be temporary, or if they expect the near term effects on output to be greater than the long-term effects, they will attempt to smooth out their consumption by saving less or borrowing more which boosts the equilibrium real interest rate. With slowing output growth and an increase in the real interest rate, the demand for real cash balances falls, and for a given rate of growth in the monetary aggregate, the rate of inflation increases. Therefore, rising oil prices reduce GDP growth and boost real interest rates and the measured rate of inflation.

If wages are nominally sticky downward, the reduction in GDP growth will lead to increased unemployment and a further reduction in GDP growth—unless unexpected inflation increases as much as GDP growth falls. The initial reduction in GDP growth is accompanied by a reduction in labor productivity. Unless real wages fall by as much as the reduction in labor productivity, firms will lay off workers, which will generate increased unemployment and further GDP losses. If wages are nominally sticky downward, the only mechanism through which the necessary wage reduction can occur is through unexpected inflation that is at least as great as the reduction in GDP growth.

However, studies in Nigeria such as Olusegun (2008), Christopher and Benedikt (2006) and Philip and Akintoye (2006) did not find any significant impact of oil price shock on variables like: money supply, price level, and output and government expenditure.

4. Methodology and Model Specification

4.1 Features of VAR

The paper makes use of Variance Autoregressive (VAR) Model. Generally a VAR model is specified as:

$$y_t = m + A_1 y_{t-1} + A_2 y_{t-2} + \ldots + A_p y_{1-p} + \epsilon_t \text{ ----------------------(1)}$$

Equation (1) specifies VAR (P) process, where A_i ($_i$= 1,2,…,p) are K x K matrices of coefficients, m is a K x 1 vector of constants and ϵ_t is a vector of white noise process.

The easiest way to appreciate the feature of VAR is to specify a simple VAR. Consider a simple VAR where K= 2 and p=1. This gives:

$$\begin{pmatrix} y_{1t} \\ y_{2t} \end{pmatrix} = \begin{pmatrix} m_1 \\ m_2 \end{pmatrix} + \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \begin{pmatrix} y_{1,t-1} \\ y_{2,t-1} \end{pmatrix} + \begin{pmatrix} \epsilon_{1t} \\ \epsilon_{2t} \end{pmatrix}$$

$y_t = m + Ay_{t-1} + \epsilon_t$ ……………………..(2)

more explicitly, this can be written as:

$y_{1t} = m_1 + a_{11}y_{1,t-1} + a_{12}y_{2,t-1} + \epsilon_{1t}$

$y_{2t} = m_2 + a_{21}y_{1,t-1} + a_{22}y_{2,t-1} + \epsilon_{2t}$

Thus, each variable in VAR is expressed as a linear combination of lagged values of itself and lagged values of all other variables in the group. The behavior of the y depend on the properties of the A matrix. If the Eigen values and Eigen vectors of the A matrix are:

$$\Lambda = \begin{pmatrix} \lambda_1 & 0 \\ 0 & \lambda_2 \end{pmatrix} \qquad C = \begin{pmatrix} \vdots & \vdots \\ C_1 & C_2 \\ \vdots & \vdots \end{pmatrix}$$

Provided the Eigen values are distinct, the eigenvectors will be linearly independent and C will be nonsingular. It then follows that

$C^{-1}AC = \Lambda$ and $A = C\Lambda C^{-1}$ ----------------- (3)

Defining a new vector Z_t as:

$Z_t = C^{-1}y_t$ or $y_t = CZ_t$ -----------------(4)

The process of pre-multiplying (2) by C^{-1} and simplifying gives:

$Z_t = m^* + \Lambda Z_{t-1} + \eta_t$ -------------------------(5)

Where $m^* = C^{-1}m$ and $\eta_t = C^{-1}\epsilon_t$

Thus: $Z_{1t} = m^*_1 + \lambda_1 Z_{1,t-1} + \eta_{1t}$

$Z_{2t} = m^*_2 + \lambda_2 Z_{2,t-1} + \eta_{2t}$

Each Z variable follows a separate AR(1) process and is stationary I(0), if the Eigen value has modulus less than 1; is a random walk with drift I(1), if the Eigen value is 1; and is explosive, if the eigen value exceeds 1 in numerical value. Finally, it is important to look for the cointegrating relation. Using equation (4) such relation can readily be found. The second bottom row in equation (4) gives:

$Z_{2t} = c^{(2)}y_t$ -------------------------(6)

Where $c^{(2)}$ is the bottom row in C^{-1}. Thus, z_2 is the linear combination of I(1)variables but is itself a stationary I(0) variable. The cointegrating vector annihilates the I(1) component in y_t.

a. Model Specification

The model for this study is specified as:

$$\Delta GDP_t = \sum_{i=1}^{L} \alpha^i{}_{11}\Delta GDP_{t-i} + \alpha^0{}_{12}\Delta UNE_t + \sum_{i=1}^{L} \alpha^i{}_{12}\Delta UNE_{t-i} + \alpha^0{}_{13}\Delta CPI_t + \sum_{i=1}^{L} \alpha^i{}_{13}\Delta CPI_{t-i} + \alpha^0{}_{14}\Delta M1_t + \sum_{i=1}^{L} \alpha^i{}_{14}\Delta M1_{t-i} + \alpha^0{}_{15}\Delta COP_t + \sum_{i=1}^{L} \alpha^i{}_{15}\Delta COP_{t-i} + \varepsilon_{1t}$$

$$\Delta UNE_t = \sum_{i=1}^{L} \alpha^i{}_{21}\Delta UNE_{t-i} + \alpha^0{}_{22}\Delta GDP_t + \sum_{i=1}^{L} \alpha^i{}_{22}\Delta GDP_{t-i} + \alpha^0{}_{23}\Delta CPI_t + \sum_{i=1}^{L} \alpha^i{}_{23}\Delta CPI_{t-i} + \alpha^0{}_{24}\Delta M1_t + \sum_{i=1}^{L} \alpha^i{}_{24}\Delta M1_{t-i} + \alpha^0{}_{25}\Delta COP_t + \sum_{i=1}^{L} \alpha^i{}_{25}\Delta COP_{t-i} + \varepsilon_{2t}$$

$$\Delta CPI_t = \sum_{i=1}^{L} \alpha^i{}_{31} \Delta CPI_{t-i} + \alpha^0{}_{32} \Delta GDP_t + \sum_{i=1}^{L} \alpha^i{}_{32} \Delta GDP_{t-i} + \alpha^0{}_{33} \Delta UNE_t + \sum_{i=1}^{L} \alpha^i{}_{33} \Delta UNE_{t-i} + \alpha^0{}_{34} \Delta M1_t + \sum_{i=1}^{L} \alpha^i{}_{34} \Delta M1_{t-i} + \alpha^0{}_{35} \Delta COP_t + \sum_{i=1}^{L} \alpha^i{}_{35} \Delta COP_{t-i} + \varepsilon_{3t}$$

$$\Delta M1_t = \sum_{i=1}^{L} \alpha^i{}_{41} \Delta M1_{t-i} + \alpha^0{}_{42} \Delta GDP_t + \sum_{i=1}^{L} \alpha^i{}_{42} \Delta GDP_{t-i} + \alpha^0{}_{43} \Delta UNE_t + \sum_{i=1}^{L} \alpha^i{}_{43} \Delta UNE_{t-i}$$

$$+\alpha^0{}_{44} \Delta CPI_t + \sum_{i=1}^{L} \alpha^i{}_{44} \Delta CPI_{t-i} + \ + \alpha^0{}_{45} \Delta COP_t + \sum_{i=1}^{L} \alpha^i{}_{45} \Delta COP_{t-i} + \varepsilon_{4t}$$

$$\Delta COP_t = \sum_{i=1}^{L} \alpha^i{}_{51} \Delta COP_{t-i} + \alpha^0{}_{52} \Delta GDP_t + \sum_{i=1}^{L} \alpha^i{}_{52} \Delta GDP_{t-i} + \alpha^0{}_{53} \Delta UNE_t + \sum_{i=1}^{L} \alpha^i{}_{53} \Delta UNE_{t-i} + \alpha^0{}_{54} \Delta CPI_t + \sum_{i=1}^{L} \alpha^i{}_{54} \Delta CPI_{t-i} + \alpha^0{}_{55} \Delta M1_t + \sum_{i=1}^{L} \alpha^0{}_{55} \Delta M1_{t-i} + \varepsilon_{5t}$$

Where:

GPD is Real Gross Domestic Product; UNE is unemployment; CPI is Consumer Price Index; M1 is money supply and COP is crude oil prices. M1 is included to represent the financial sector. L is the lag length; t is time and ε is vector of innovations. The variables are time series variables and the data is sourced from CBN bulletin and OPEC bulletin respectively.

The VAR model is adopted for this study because of the forecasting power relative to large structural models. Again one of the common virtue of VAR is that it obviates a decision as to what contemporaneous variables are exogenous, all variables are endogenous.

5. Results and Discussion

The estimation and analysis of the model involves multi-stage procedure. The study first considered the correlogram for crude oil prices (COP). As shown in figure 4, in appendix 1, COP displays the classical pattern for AR (1) series, with the autocorrelations dying out and only the first partial correlation coefficient being significant.

As with most macroeconomic variables, all the five variables of the model are nonstationary at levels. Both Augmented Dickey- Fuller (ADF) and Phillips – Perron unit root tests are conducted. The two tests show similar results, except for M1 which is not stationary at 5% even at the second difference. However, Phillips- Perron test shows that COP, GDP and UNE are stationary at I(1), while CPI and M1 are stationary at I(2). Tables 1 and 2 showed results of the tests as indicated in appendix 1.

As a matter of necessity, the study tested for cointegration using the Johansen approach which is suitable for VAR model. The result shows that (at 5%) there is at least one cointegrating relation in each of the models (see figure 5 in appendix 1). This naturally allowed us to proceed to the estimation of VAR. Meanwhile, before estimating VAR, Pairwise Granger Causality tests were conducted. The results are presented in table 3 (see appendix 1). At 5% significance level there are evidences that CPI granger caused COP, M1 granger caused COP, CPI granger caused M1, UNE granger caused GDP and M1 granger caused UNE. Other granger causalities are not statistically significant.

The results of the VAR estimates are shown in table 4 in appendix 1. The result of GDP equation showed significant positive relationship between GDP and first and second lag of COP, and first lag of CPI. There is also significant but negative relation between GDP and second lag of CPI. The entire remaining variables have insignificant coefficients. The coefficients of the error correction terms in the GDP equation are significant but positive. The R^2 shows the model of this equation explains about 63% variations in GDP. In CPI equation the coefficients of first and second lag of GDP, M1 and UNE are significant and positive. Coefficients of lags of COP and CPI are not significant. However, first lag of COP is positive and the second lag is negative. In M1 equation, the coefficient of the lags of COP, and CPI are significant, while all others are not. The first lag of COP has positive coefficient while the second lag has negative coefficient. In UNE equation only the coefficients of lags of COP and CPI are significant while others are not. Both the first and second lags of COP are negative to UNE. M1 equation has the highest R^2 with about 92%, while UNE equation has the lowest with about 27%.

Discussion of Results

The GDP in Nigeria increases as crude oil prices rise, this is evident from the result of the study. The implication is that the economic growth of the country is driven by external forces, since crude oil prices are determine by exogenous factors. This means that, if crude oil prices decline the GDP of the country will equally fall. This may result to Dutch disease. The impulse response function presented in the Appendix 2 confirms this argument. Impulse functions show that COP and GDP exhibited volatile response to innovations. CPI and UNE responses to innovations indicate gradual increase over time. Though, UNE shows little volatility. The results also show that money supply in Nigeria is inversely related to crude oil prices. As crude oil prices increases money supply falls, and if crude oil prices falls, money supply increases. Another important relationship shown in the result is inverse relationship between unemployment and crude oil prices. As crude oil prices rise, unemployment reduces in the country. The insignificant relation between crude oil prices and CPI implies that crude oil prices have no significant influence on consumer price index in Nigeria. This is not surprising because the computation of CPI in Nigeria does not include crude oil prices.

6. Concluding Remarks

The study concluded from the findings that crude oil prices have significant influence on three key macroeconomic variables in Nigeria- GDP; money supply and unemployment. This constitutes serious implication for macroeconomic management of the country because; money supply is a major macroeconomic policy instrument, while GDP and unemployment are key macroeconomic policy targets. If these key macroeconomic variables are influenced by a volatile, almost unpredictable exogenous variable like crude oil prices, then the economy becomes highly vulnerable to unpredictable external shocks. The way to minimize this is to diversify the economy so as to make it less oil dependent.

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Appendix 1

Table 1. Augmented Dickey –Fuller Unit Root Test

Variable	ADF Statistics	Critical Value (5%)	Oder of Integration
COP	-4.17324	-2.94343	I(1)
CPI	-5,87616	-2.95402	I(2)
GDP	-5.99807	-2.94343	I(1)
M1	2.81673	-2.63875*	I(2)
UNE	-6.48980	-2.94342	I(1)

Source: computed by the authors (* significant at 10%)

Table 2. Phillips – Perron Unit Root Test

Variable	Phillips-Perron Stat.	Critical Value (5%)	Oder of Integration
COP	-4.34184	-2.94343	I(1)
CPI	-785286	-2.94584	I(2)
GDP	-5.99921	-2.94343	I(1)
M1	-4.19616	-2.94584	I(2)
UNE	-6.48980	-2.94343	I(1)

Source: computed by authors

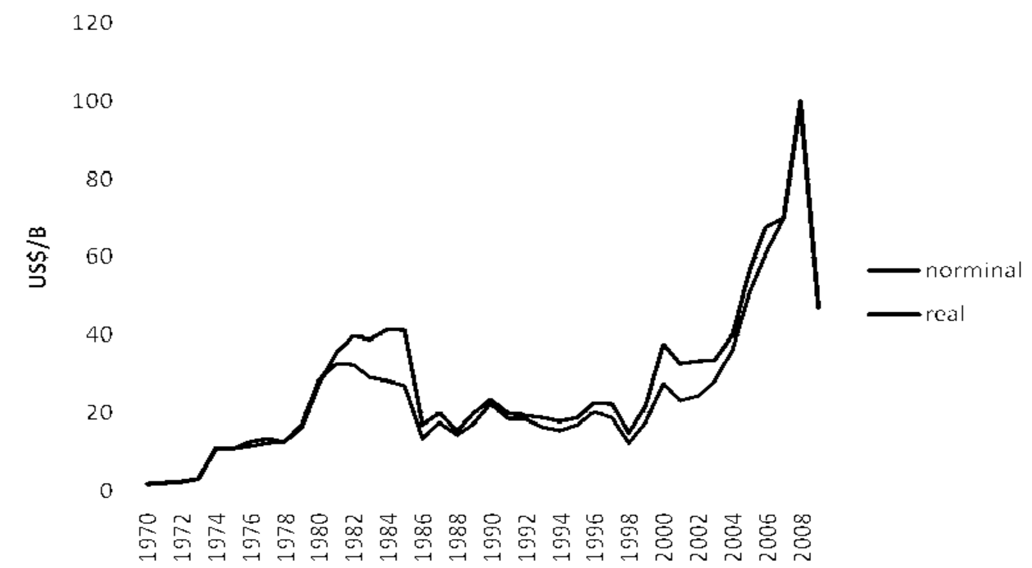
Table 3. Pairwise Granger Causality Tests

Sample: 1970 2008
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
CPI does not Granger Cause COP	37	6.35773	0.00473
COP does not Granger Cause CPI		0.06326	0.93882
GDP does not Granger Cause COP	37	1.00187	0.37842
COP does not Granger Cause GDP		2.69075	0.08316
M1 does not Granger Cause COP	37	10.2495	0.00036
COP does not Granger Cause M1		0.12098	0.88645
UNE does not Granger Cause COP	37	8.12785	0.00140
COP does not Granger Cause UNE		0.18924	0.82851
GDP does not Granger Cause CPI	37	1.17294	0.32241
CPI does not Granger Cause GDP		1.69039	0.20050
M1 does not Granger Cause CPI	37	1.01676	0.37316
CPI does not Granger Cause M1		11.3590	0.00019
UNE does not Granger Cause CPI	37	0.11812	0.88898
CPI does not Granger Cause UNE		5.65061	0.00791
M1 does not Granger Cause GDP	37	1.15381	0.32821
GDP does not Granger Cause M1		1.61174	0.21532
UNE does not Granger Cause GDP	37	6.89783	0.00323
GDP does not Granger Cause UNE		2.39115	0.10769
UNE does not Granger Cause M1	37	0.35227	0.70578
M1 does not Granger Cause UNE		7.00399	0.00300

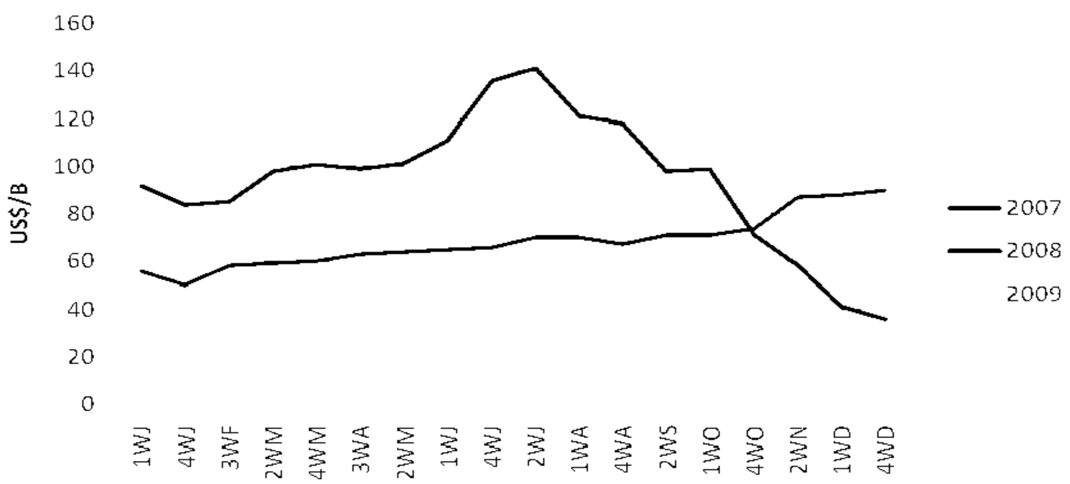
Table 4. VAR Results

Error Correction:	D(COP)	D(CPI)	D(GDP)	D(M1)	D(UNE)
CointEq1	-0.170788	0.031095	32.06896	-3109.517	43.71220
	(0.06227)	(0.03638)	(215.378)	(894.223)	(587.524)
	[-2.74273]	[0.85471]	[0.14890]	[-3.47734]	[0.07440]
D(COP(-1))	0.060987	0.051986	1500.944	485.6375	-1199.158
	(0.22633)	(0.13223)	(782.837)	(3250.24)	(2135.48)
	[0.26946]	[0.39314]	[1.91731]	[0.14942]	[-0.56154]
D(COP(-2))	0.015255	-0.288226	4.181522	-2310.186	-1460.555
	(0.22551)	(0.13175)	(780.012)	(3238.51)	(2127.77)
	[0.06765]	[-2.18760]	[0.00536]	[-0.71335]	[-0.68643]
D(CPI(-1))	0.457360	0.417973	2730.620	-4014.702	1015.324
	(0.48036)	(0.28064)	(1661.47)	(6898.20)	(4532.27)
	[0.95213]	[1.48933]	[1.64350]	[-0.58199]	[0.22402]
D(CPI(-2))	-0.437814	-0.000488	-2602.110	-6705.939	2739.039
	(0.49922)	(0.29167)	(1726.71)	(7169.09)	(4710.25)
	[-0.87700]	[-0.00167]	[-1.50697]	[-0.93540]	[0.58151]
D(GDP(-1))	-7.27E-05	2.61E-05	-0.039034	-1.168950	0.065883
	(5.2E-05)	(3.0E-05)	(0.17885)	(0.74257)	(0.48788)
	[-1.40670]	[0.86285]	[-0.21825]	[-1.57420]	[0.13504]
D(GDP(-2))	-1.67E-05	1.29E-05	0.146145	-0.758316	0.184308
	(4.3E-05)	(2.5E-05)	(0.14992)	(0.62247)	(0.40897)
	[-0.38530]	[0.50979]	[0.97479]	[-1.21824]	[0.45066]
D(M1(-1))	-0.000133	1.74E-05	-0.217783	-1.261802	0.287748
	(5.5E-05)	(3.2E-05)	(0.19137)	(0.79456)	(0.52204)
	[-2.39701]	[0.53864]	[-1.13800]	[-1.58805]	[0.55120]
D(M1(-2))	-4.30E-05	5.60E-05	0.332727	-0.013571	-0.166160
	(4.1E-05)	(2.4E-05)	(0.14079)	(0.58453)	(0.38405)
	[-1.05610]	[2.35432]	[2.36334]	[-0.02322]	[-0.43265]
D(UNE(-1))	-7.94E-05	1.18E-05	-0.090428	-1.779809	-0.204289
	(4.4E-05)	(2.6E-05)	(0.15333)	(0.63662)	(0.41828)
	[-1.79018]	[0.45490]	[-0.58975]	[-2.79570]	[-0.48841]
D(UNE(-2))	-6.25E-05	2.64E-05	0.369424	-1.329277	-0.134792
	(4.2E-05)	(2.5E-05)	(0.14529)	(0.60324)	(0.39634)
	[-1.48805]	[1.07668]	[2.54262]	[-2.20358]	[-0.34009]
C	19.19558	-2.277716	5322.514	354951.5	-6138.716
	(7.06545)	(4.12794)	(24438.1)	(101464.)	(66664.0)
	[2.71683]	[-0.55178]	[0.21780]	[3.49830]	[-0.09208]
R-squared	0.514105	0.756066	0.630772	0.919780	0.266384
Adj. R-squared	0.291403	0.644263	0.461542	0.883013	-0.069857
F-statistic	2.308487	6.762478	3.727316	25.01628	0.792241
Log likelihood	-113.9784	-94.63065	-407.3311	-458.5792	-443.4578
Source :	Computed	By	Authors		



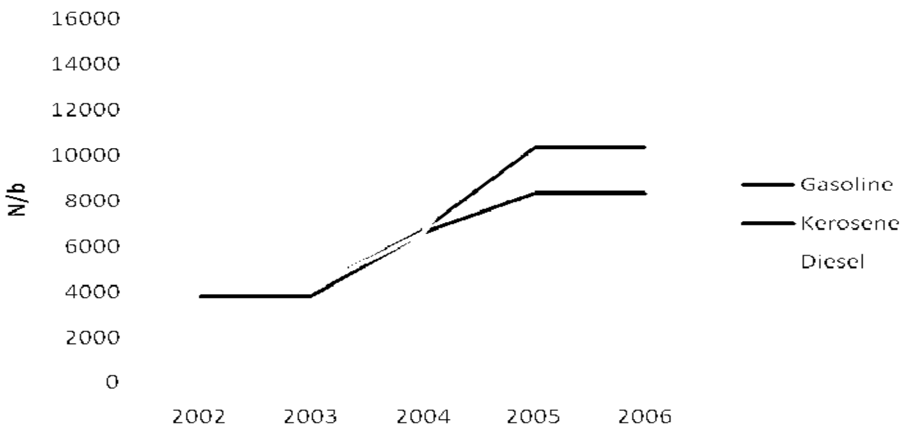
Source: OPEC Bulletin

Figure 1.



Source: OPEC Monthly Survey

Figure 2. Monthly Price of Oil



Source: OPEC Bulletin

Figure 3. Trend of Prices of Major Petroleum Products in Nigeria

Sample: 1970 2008

Included observations: 39

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat
. |****** |	. |****** |	1	0.719	0.719	21.741
. |**** |	. |*. |	2	0.552	0.074	34.929
. |*** |	. *| . |	3	0.372	-0.101	41.081
. |** |	. *| . |	4	0.211	-0.093	43.121
. |*. |	. | . |	5	0.133	0.050	43.951
. |*. |	. | . |	6	0.072	0.002	44.200
. | . |	. *| . |	7	0.009	-0.066	44.204
. | . |	. | . |	8	-0.042	-0.052	44.293
. *| . |	. *| . |	9	-0.148	-0.165	45.459
. *| . |	. | . |	10	-0.185	0.005	47.347
. *| . |	. |*. |	11	-0.164	0.089	48.889
. *| . |	. | . |	12	-0.163	-0.044	50.469
. *| . |	. *| . |	13	-0.156	-0.075	51.969
. *| . |	. | . |	14	-0.126	0.027	52.978
. | . |	. |*. |	15	-0.054	0.138	53.169
. | . |	. | . |	16	-0.001	0.021	53.169

Figure 4. Correlogram for COP

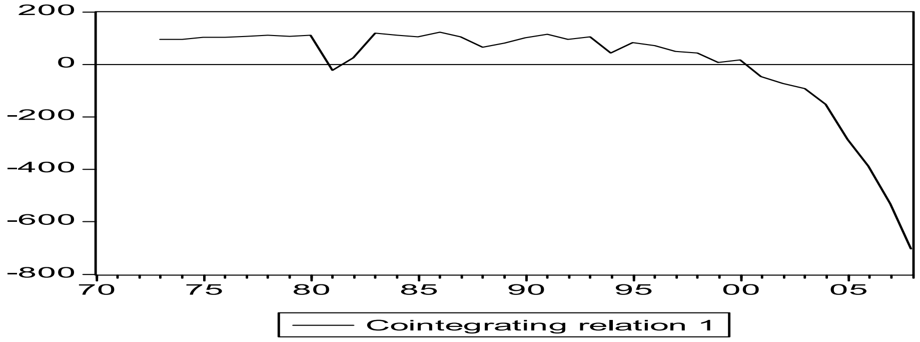
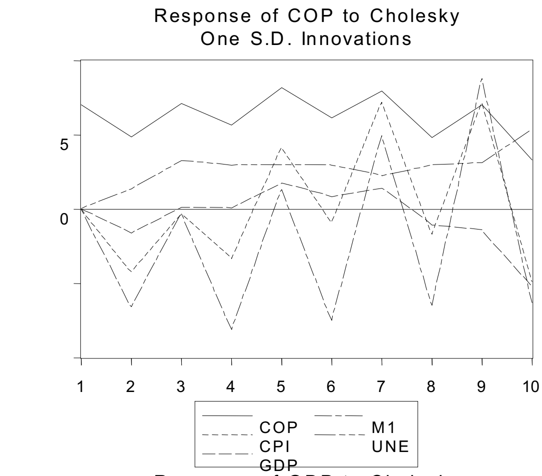
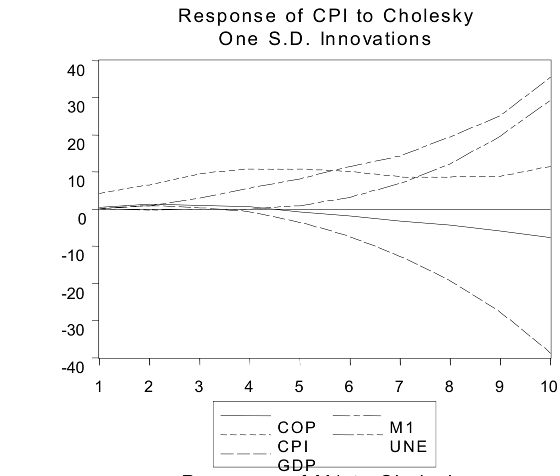
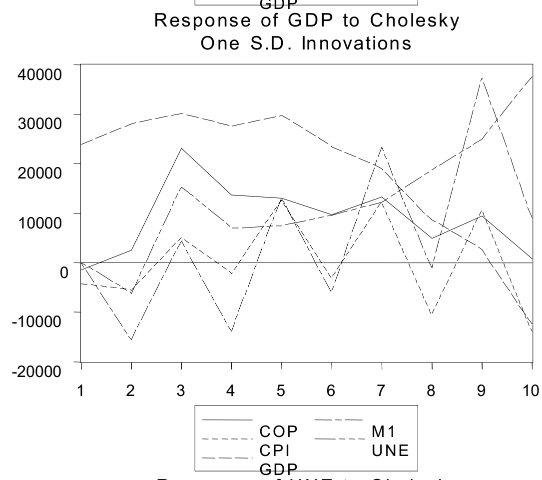


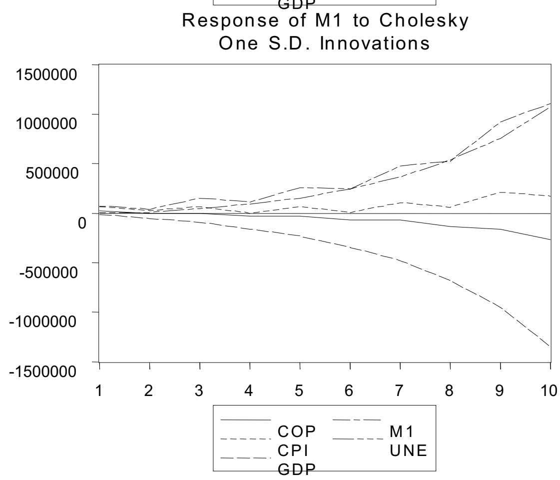
Figure 5. Cointegration relation

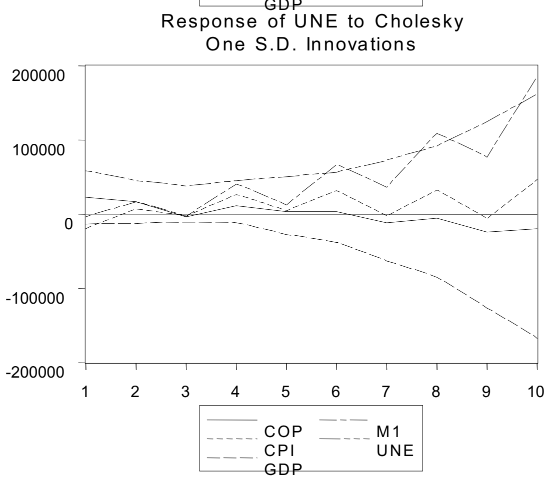
Appendix 2


Response of COP to Cholesky
One S.D. Innovations
5
0
1 2 3 4 5 6 7 8 9 10
COP
CPI
GDP
M1
UNE


Response of CPI to Cholesky
One S.D. Innovations
40
30
20
10
0
-10
-20
-30
-40
1 2 3 4 5 6 7 8 9 10
COP
CPI
GDP
M1
UNE


Response of GDP to Cholesky
One S.D. Innovations
40000
30000
20000
10000
0
-10000
-20000
1 2 3 4 5 6 7 8 9 10
COP
CPI
GDP
M1
UNE


Response of M1 to Cholesky
One S.D. Innovations
1500000
1000000
500000
0
-500000
-1000000
-1500000
1 2 3 4 5 6 7 8 9 10
COP
CPI
GDP
M1
UNE


Response of UNE to Cholesky
One S.D. Innovations
200000
100000
0
-100000
-200000
1 2 3 4 5 6 7 8 9 10
COP
CPI
GDP
M1
UNE