Oil Price Shocks, Exchange Rate and Stock Market Behaviour: Empirical Evidence from Nigeria

by

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Abstract

This study estimates the effects of oil price shocks and exchange rate on the real stock returns in Nigeria over 1985:1-2008:4 using a multivariate VAR analysis. Variables ranging from real oil prices, real stock returns, and index of industrial production to three types of oil specifications are employed. Also, the study further classifies oil price shocks into sub-samples: for a first sub-sample (1985-1999), for a second sub-sample (2000-2004) and for a third sub-sample (2005-2008).

Empirical results show an immediate and significant negative real stock returns to oil price shock in Nigeria. The Granger causality test indicates that causation run from oil price shocks to stock returns, implying that variation in stock market is explained by oil price volatility. It is also interesting to know that causation runs from stock returns to real exchange rate, which indicates that the authorities can focus on domestic economic policies to stabilize the stock market. Comparing the impacts of oil price shocks and interest rate shocks on the stock market, strong evidence is found that the impact of interest rate shocks on the stock market is greater than oil price shocks and thus monetary policy responds systemically to oil price shocks by raising the interest rates, leading to a decline in real stock returns.

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Introduction

In the literature, a considerable attention has been paid to the investigation of the relationship between stock returns across international markets. The empirical outcomes of the investigation reveal the existence of significant cross-market interactions (Eun and Shim, 1989; Bekaert and Harvey, 1996). These empirical findings are of interest for some reasons. One, if countries' stock returns are positively related, it is possible to use the information in one market to predict the movement in the other. Two, establishing the relationship between stock prices and exchange rates can be of importance for multinational corporations. This is because the link between these two markets may be used to predict the path of the exchange rate, which can have implications for the ability of multinational corporations to manage their exposure to foreign contracts and the exchange rate they face.

The traditional models of the open economy have established the existence of a relationship between the stock market performance and the exchange rate behavior. The models show that changes in exchange rates affect the competitiveness of firms as variations in exchange rate affect the value of the earnings as well as the cost of its funds because many companies borrow in foreign currencies to finance their operations and hence its stock price (Dornbusch and Fischer, 1980). An appreciation of the local currency, for example, makes exporting goods unattractive and leads to a decrease in foreign demand and hence revenue for the firm and its value would fall. This would also lead to a fall in the stock prices (Gavin, 1989).

Alternative approach to the study of the relationship between exchange rates and stock prices is provided by the portfolio balance models where the role of capital account transactions is stressed. For instance, a vibrant stock market would attract capital inflows from foreign investors, which increase the demand for its currency. The opposite would be the case with falling stock prices where the investors try to sell their stocks to avoid further losses and convert their money into foreign currency to move out of the country. Consequently, the local currency will depreciate. In the same vein, foreign investment in domestic equities could increase over time arising from the benefits of international diversification accruing to foreign investors. Thus, movements in stock prices may affect exchange rates and money demand because investors' wealth and liquidity demand could be a function of the performance of the stock market (Mishra, 2004).

Although the existing literature investigates the relationship between exchange rates and stock prices based on a two-variable framework, a number of studies have shown that such a system can be misleading due to the omission of oil price as an important variable (Abdelaziz et. al., 2008). Oil prices can act as a channel through which the real exchange rate affects the stock market. Thus, inferences about the long-run relationship of variables and the causality structure may not reflect the thorough impact of exchange rate on stock price without an inclusion of oil price as an explanatory variable. It has been shown in literature, therefore, that the omitted variable in the extended system is the only determining factor for the sensitivity of causality inference between the variables of the incomplete system (Lutkepohl, 1982; Caporale and Pittis, 1997).

The impact of falling oil prices on stock market and exchange rates will differ from country to country depending on whether the country is an oil-exporter or oil-importer. In an oil-exporting countries, a rise in world oil prices improves the trade balance, leading to a higher current account surplus and an improving net foreign asset position. At the same time, increase in oil prices tends to increase private disposable income in oil-exporting countries. This increases corporate profitability, raises domestic demand and stock prices thereby causing exchange rate to appreciate. In oil-importing countries, the process works broadly in reverse: trade deficit are offset by weaker growth and, over time, real exchange rate depreciates and stock prices decrease (Abdelaziz *et. al.*, 2008).

In the last one year, the global financial markets have been engulfed in systemic crisis giving policy makers and financial experts serious concern. Indeed, since August 2007, the world has witnessed an extraordinary collapse of financial institutions, loss in asset value/share price particularly of mortgage-related securities, stock market declines, speculative bubbles and currency crisis, among others. For example, Nigeria has witnessed a sudden decline in oil prices from the peak of US$147 per barrel in July 2008 to US$40 per barrel in February 2009. Also, the economy has experienced depreciation of currency from ₦118 to ₦145 per US dollar (official rate) in the same period. The stock prices have also witnessed significant bearish trends due to this crisis in the last quarter of 2008.

The questions arise: what is the causal links between oil prices and stock prices in Nigeria? Do oil price shocks significantly explain both stock returns and exchange rate movement in Nigeria? Do oil price shocks contribute significantly more to changes in real stock return than monetary shocks in Nigeria? What is the causal relationship between exchange rate and stock returns? All these questions are germane to this paper.

The rest of the paper is organized as follows. Section 2 provides the literature review and the theoretical underpinnings. Section 3 describes methodology, covering the sources of data, model specification, and techniques of analysis. Empirical results are discussed in section 4, while the summary and conclusion are contained in section 5. Limitation and areas for further study are contained in the last section.

Literature Review

The mechanisms through which oil price shocks affect the macroeconomy have been demonstrated in the literature from the perspective of the supply-and demand-side effects. Oil is considered as an input to production and, thus, an increase in oil price give rise to increased production costs which causes productivity to decline. Oil price increases reduces the purchasing power of consumers and motivate producers to substitute less energy intensive capital for more energy intensive capital. It is predicted in the literature that the enormity of this effect depends on whether the shock is temporary or permanent in nature. As a result, the different authors have allotted weights to the supply and demand channels (Rasche and Tatom, 1977; Kim and Loungani, 1992 and Rotemberg and Woodford, 1996). Other channels, which have been identified in the literature, include the real balance effect (Mork, 1989), and the transfer of income effect. This transfer of wealth from oil importing countries to oil exporting countries leads to a decrease in global demand in the oil-importing countries which outweighs the increase in the oil-exporting countries because of the assumed low propensity to consume in the latter.

Three measures of oil price have been identified in the literature. The linear measure of oil price; asymmetric oil price and the net oil price increase. The linear or symmetric measure of oil price assumes that effects of oil price movements (increases or decreases) are equal such that a rise in oil price is expected to have a negative impact on the level of economic activity and oil price declines have a positive impact (Afshar *et al*, 2008). Perhaps, this is not unconnected with the impact of higher oil prices on the cost of production of modernizing economies whose oil share of total imports increase in tandem with their industrial objectives. Net oil price increase has been defined as the quantity by which oil prices exceed its maximum value over the previous periods. Thus, if by example, the current price of oil is higher than the maximum oil price of previous periods, then the percentage change between the two is computed. This measure of oil price assumes that when oil price is merely increasing to attain its maximum level in the previous period, it would have no impact. However, when the current price of oil is increase to a level above its maximum value in the previous periods, it is expected to have an impact (Hamilton, 1996). Asymmetric oil price shocks refer to an oil price measure that differentiates between the positive and negative oil price volatility. In other words, a variable represents a positive percentage changes in oil price and another variable represents the negative percentage change (Mork, 1989; Lee *et al*., 1995).

Economies are interwoven by way of increasing globalization of markets worldwide. Thus, establishing the linkages between oil price, exchange rate and stock markets is important for quite a number of reasons. For the multinationals, they can assess their exposure to foreign contracts. For the investor, it enables him assess his investment portfolio. For oil importers, fluctuations in oil price affect their trade balance and net foreign assets position. For the citenzry, it could reduce their disposable income and corporate profitability. Paramount among the reasons is that such knowledge can aid in the prevention of an economic crisis. Since the oil crisis of the 1970s, literature has been replete with how oil prices explain macroeconomic activities, irrespective of whether they are oil resource economies or not. Basher and Sadorsky (2006) see oil as lifeblood of modern economics given that the demand for oil increases as economies undergo industrial development. In other words, oil affects the terms of trade of most modern economies as long as oil is traded upon. The effects of oil price shocks can be adverse and asymmetric via various transmission channels.

In Turkey (with no oil resource, but rich in industrial base), a study conducted by Ozturk *et al* (2008) using monthly data from 1982 to 2006 found that changes in the international price (real) of crude oil Granger causes fluctuations in the real exchange rate. According to Golub (1983), rise in oil prices is a form of wealth transfer from oil importing economies to oil exporting economies. Thus, the impact of oil price shocks on the exchange rate would depend on the distribution of oil imports across oil importing economies.

Korhonen and Juurikkala (2009), using pooled data from 1975-2005, showed that high oil price leads to appreciation of the real exchange rate with the elasticity of exchange rate to oil price between 0.4 and 0.5. Examining the Algerian economy for the period 1970 to 2003, Koranchelian (2005) adopted a VECM approach and concluded that movements in the real exchange rate were time varying and were accounted for by fluctuations in productivity and real oil prices with deviations from real exchange rate adjusting itself within nine months. In specific terms, he found that a one percent rise in oil price led to an appreciation of the real exchange rate by 0.2 percent.

Parvar *et al* (2008) tested testing the Dutch disease hypothesis[2] by examining the relationship between oil prices and real exchange rate in a sample of 14 oil-exporting economies using monthly data and autoregressive distributed lag approach. They concluded that there was a long-run stable relationship between the two variables in all countries studied. In their analysis of the short-run dynamics, they also showed the existence of unidirectional causality from oil prices to exchange rates in four countries (Angola, Colombia, Norway, and Venezuela) from exchange rates to oil prices in two countries (Bolivia and Russia), bidirectional causality in four other countries (Gabon, Indonesia, Nigeria and Saudi Arabia), and no causality in the remaining four countries (Algeria, Bahrain, Kuwait and Mexico.).

Examining the effects of oil price shock to real exchange rate, output, inflation and money supply in Nigeria between 1970:1 and 2003:4, Olomola and Adejumo (2006) concluded that shocks in oil price impacted substantially on the real exchange rate and money supply in the long run, with fewer effects on output and inflation. In Ghana, a study by Jumah and Pastuszyn (2007) was conducted to examine the relationship between the world oil price and aggregate demand, via the interest rate channel and concluded that fluctuations (rises) in oil price impacted the price level positively but negatively impacts on real output.

[2] *The hypothesis states that the inflow of oil windfalls into an oil exporting country could lead to an appreciation of the real exchange rate, reduce the country's competitiveness in the non-oil exporting sector, and limit its ability to build a diversified exports base.*

Ayadi, Chatterjee and Obi (2000) study the effects of oil production shocks for Nigeria. A standard Vector Auto-Regression (VAR) process is estimated over the 1975-1992 period. The variables included in the estimation are oil production, oil exports, the real exchange rate, money supply, net foreign assets, interest rate, inflation, and output. Empirically, the response of the real exchange rate is generally positive after a positive oil production shock, indicating a real depreciation of the Naira. The impact response of the real exchange rate is negligible relative to that of oil production, but the response of the real exchange rate after a year is about two times larger than that of oil production

Ayadi (2005) uses a standard VAR process to analyze directly the effects of oil-price shocks for Nigeria over the 1980-2004 periods. Using VAR process similar to Ayadi, Chatterjee and Obi (2000), he concludes that the responses of the macroeconomic variables- output, inflation, and the real exchange rate- to oil-price shocks are small. More precisely, the contributions of the oil-price shock to the variance of output, inflation and real exchange rate are 1, 1 and 0 percent at impact, respectively, and about 7, 1 and 5 percent after a year. In comparison, the contributions of the oil price shock to the variance of oil prices are 100 percent at impact and about 97 percent after a year.

The literature on the effects of oil prices on stock market developments in developing economies are not as abundant as for developed and emerging market economies. Perhaps, this is as a result of the rigors in getting time series data associated with the stock market. The effects of oil price on stock market of developed and emerging economies have been well documented. In a research work conducted by Park and Ratti (2007) using multivariate vector autoregressive approach for a sample period of 1986:1-2005:12 in Norway (an oil exporting economy like Nigeria), their findings revealed that oil price fluctuations accounted for a six percent volatility in real stock returns. However, for most European economies understudied, it had been shown that increased volatility of oil prices significantly depressed real stock returns. For the United States, the study revealed that oil price shocks, rather than interest rates, explained more of the fluctuations in real stock market returns. This also conforms to the study of Sadorsky (1999) which stated that oil prices explained a larger fraction of the forecast error variance in real stock returns than interest rates after 1986. Cong *at al*. (2008) also reached the same conclusion in a similar study on the indices of manufacturing and oil companies quoted on the China stock market.

In a work conducted by Bjørnland (2008) for Norway, in which stock returns were incorporated in a structural VAR model, it was observed that a 10 percent rise in oil prices, increase stock returns by 2.5 percent with robust results for linear and non-linear measures of oil prices. The author concluded that the Norwegian economy responds to higher oil prices by increasing aggregate wealth and demand, while emphasizing the role of monetary policy shocks, in particular, as driving forces behind stock price variability in the short run.

Eryiğit (2009) analyzed the impacts of oil price changes on the sectoral indices of the Turkish stock exchange using daily data. Adopting the ordinary least square technique, he estimated an extended market model which included market return, oil prices (in Turkish Lira), oil price in dollars and exchange rate (USD/TL) to determine the effects of the oil price (USD) changes on market indexes in Istanbul Stock Exchange (ISE) for the period of 2000 - 2008. He found that changes in oil price (TL) had statistically significant effects on electricity, wholesale and retail trade, insurance, holding, investment, wood, paper, printing, basic metal, metal and non-metal products, machinery and mineral products indices at the 5 percent significance level. In addition, changes in oil price (USD) had a significant positive effect on wood, paper printing, insurance and electricity sub-sector indices.

Cong *et al* (2008) found out, using a multivariate vector-auto-regression, that oil price shocks depress the stock prices of some Chinese oil companies. They observed that oil price shocks do have statistically significant effects only on manufacturing index and some oil companies. The oil price volatility increased the stock returns of manufacturing, mining and petrochemical companies as a result of speculative activities arising from volatility in the oil prices, with less impact on the real stock returns of the Chinese stock market indices. Henriques and Sadorsky (2008) used a vector auto-regression model to estimate the relationship between alternative energy stock prices of some companies, technological stock prices, oil prices and interest rates. They found that technology stock price and oil prices Granger causes alternative energy companies' stock prices.

Using a similar methodology as well as the Granger causality approach for the United States for the period 1990:1 to 2007:2, Afshar *et al* (2008) examined three specifications of oil prices on stock returns. They found out that oil price declines had a significant impact on stock returns, but not oil price increases. Further analysis by these authors suggested that oil price shocks and the USD currency were important sources of stock return variability.

According to Basher and Sadorsky (2006), oil price increases act as inflation tax, which will lead consumers to source for alternative energies, increase risk and uncertainty which adversely affect stock prices and reduce wealth. They adopted an international multi-factor model that allowed for both conditional and unconditional risk factors to explore the link between oil price risk and emerging stock market returns. They found strong evidence that oil price risk impacts stock price returns in emerging markets.

Cheung and Ng (1998) employed the Johanson co-integration technique and established the existence of long run co-movement between five national stock market indexes and real oil price, real consumption, real money and real output. They found that oil prices were negatively correlated with stock prices.

Miller and Ratti (2009) examined the long-run relationship between the world crude oil price and international stock markets for the sample period 1971:1–2008:3 using a co-integrated VECM. They concluded that international stock market indices respond negatively to increases in the oil price in the long run. They also established the existence of long-run co-movement between crude oil price and stock market during 1971:1–1980.5 and 1988:2–1999.9 with evidence of break down in the relationship after this period. They concluded that it was suggestive of the possibility that the relationship between real oil price and real stock prices have changed in recent time period compared to the earlier period.

Papapetrou (2001) attempted to investigate the linkages among oil prices, real stock prices, interest rates, real economic activity and employment for Greece using a multivariate vector-autoregression (VAR) approach. The empirical results from the paper suggested that while oil prices were important in explaining stock price movements, stock market returns did not lead to changes in real activity and employment. They however, observed that changes in the oil price affected real economic activity and employment.

Driesprong *et al* (2003) findings suggests that oil price changes significantly predict negative excess returns and that financial investors seem to under-react to information in the oil price. They observed a strong linkage between monthly stock returns and lagged monthly changes in oil price.

Aleisa and Dibooğlu (2002) decomposed the shocks (real and nominal) affecting real exchange rate fluctuations in oil resource based in Saudi Arabia by employing the VAR technique. Their findings showed that real shocks (oil production) had a stronger influence in explaining real exchange rate movements in Saudi Arabia, while nominal shocks (real oil price) were more important at explaining price level movement.

An extensive study by Abdelazi *et al* (2008) for four Middle East oil economies (Kuwait, Saudi Arabia, Egypt, Oman) did not find any long-run co-integration between oil prices, stock prices and real exchange rate. However, upon splitting the sample period to account for regime shift (accounting for major oil price shocks), they discover a long-run equilibrium relationship among the stock prices, the real exchange rates and oil prices for Egypt, Saudi Arabia and Oman. In Kuwait, results suggest the existence of a long-run equilibrium relationship between stock and oil prices. An interesting aspect of their work is the introduction of oil price and global market index proxied by the US stock market as a transmission channel through which exchange rate and stock prices were linked in all the four oil-rich countries. They conclude that re-adjustment towards the long-run equilibrium in each country stock market occurs via changes in the oil price with shocks in Egypt and Saudi Arabia correcting itself in17 and 14 months, respectively, while it takes 22 and 24 months in Oman and Kuwait.

Overall, one can decipher from literature that changes in oil prices and real exchange rate predict stock market returns and affect domestic macroeconomic outcomes, albeit with varying results for different economies depending on their exposure to the international market.

3.0 METHODOLOGY

3.1 Vector Autoregression (VAR)

The paper employs vector autoregression (VAR) methodology to study the magnitude of effect and the response to impulse function of oil price with respect to stock prices[3]. Given a VAR of order *p*, where the order *p* represents the number of lags, that includes *k* variables, VAR model can be expressed as:

$$x = T_0 + \sum_{i=1}^{p} T_i \theta_i x_{t-i} + u_i \quad \text{...}(1)$$

Where x*t* = [x*1t* ... x*kt*]' is a column vector of observation on the current values of all variables in the model, T_i is $k \times k$ matrix of unknown coefficients, T_0 is a column vector of deterministic constant terms, u_i is a column vector of errors with the properties of

$E(u_i) = 0$ for all t, $E(u_s u_t) = \Omega$ if s=t and $E(u_s u_t) = 0$ if $s \neq t$

where Ω is the variance-covariance matrix. u_t's are not serially correlated but may be contemporaneously correlated. Thus, Ω is assumed to have non-zero off-diagonal elements.

3.1.1 Impulse Response Function

In a VAR system, the examination of the estimated coefficients on successive lags has no sufficient information on the dynamic relationships among the variables in the system. Rather, it is useful to trace out the system's response to typical random shocks that represent positive residuals of one standard deviation unit in each equation in the system. Therefore, Sims (1980) proposes the use of impulse response and variance decomposition to assist in achieving this logical interpretation of the VAR system.

Assuming a 2-variables VAR (1) model specified as

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[3] *Vector autoregression (VAR) is an econometric model used to capture the evolution and the interdependencies between multiple time series, generalizing the univariate AR models. All the variables in a VAR are treated symmetrically by including for each variable an equation explaining its evolution based on its own lags and the lags of all the other variables in the model. Based on this feature, Christopher Sims advocates the use of VAR models as a theory-free method to estimate economic relationships, thus being an alternative to the "incredible identification restrictions" in structural Vector models (Christopher A. Sims, 1980, "Macroeconomics and Reality").*

$$\begin{bmatrix} x_{1t} \\ x_{2t} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x_{1t-1} \\ x_{2t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

A disturbance in ε_{1t} has an instant and direct effect on x_{1t} . In period t+1, that disturbance in x_{1t} affects x_{1t-1} through the first equation and also affects x_{2t-1} through the second equation. These effects work through to period t+2, and so on. Thus, a random shock in one innovation in the VAR sets up a chain reaction over time in all variables in the VAR. Impulse response functions calculates these chain reactions.

Impulse response functions is confronted with one limitation; that is a disturbance in one innovation is not contemporaneously isolated from the other innovations in the system, although it ultimately leads to a chain reaction over time in all variables in the system. It is doubtful from the above bivariate model to hypothesize that one innovation receives a disturbance while the other does not. A solution to this problem is achieved by transforming the innovations to produce a new set of orthogonal innovations, which are pairwise uncorrelated and have unit variance.

3.1.2 Variance Decomposition

VAR system is characterized by its ability to conditionally forecast, especially short-term forecasts, future movement of the variables in the system by capturing the individual patterns of movement in the system. Therefore, the multi-period forecast error variance decompositions show that how much a random shock to one innovation is responsible for predicting subsequent fluctuation of the other innovation that is not already accounted for by its own prior fluctuation.

Variance decomposition can be computed as follows:

Assuming a VAR (1) model with a coefficient matrix A.

$$x_t = Tx_{t-1} + \varepsilon_t$$

where Ω is a variance-covariance matrix. T and Ω are predetermined.

Then,

$$x_{t+1} = Tx_t + \varepsilon_{t+1}$$

The optimal forecast of x_{t+1} is the conditional expectation of x_{t+1} , formed at time t.

That is,

$$\hat{x}_{t+1} = E(x_{t+1} / x_t, ..., x_1) = Tx_t$$

where $\hat{x}_{t+1}$ stands for a forecast vector.

In general,

$$x_{t+s} = T^s y_t + T^{s-1}\varepsilon_{t=1} + T^{s-2}\varepsilon_{t+2} + ... + T\varepsilon_{t+s-1} + \varepsilon_{t+s}$$

So, the best forecast x_{t+s} becomes

$$\hat{x}_{t+s} = E(x_{t+s} / x_t, ..., x_1) = T^s x_t$$

Therefore, the vector of forecast errors in the forecast for *s* periods ahead is

$$e_s = x_{t+s} - \hat{x}_{t+s} = \varepsilon_{t+s} + T\varepsilon_{t+s-1} + ... + T^{s-1}\varepsilon_{t+1}$$

Thus, the variance-covariance matrix for the forecast errors, *s* periods ahead, is

$$Var(e_s) = \sum(s) = \Omega + T\Omega T' + T^2\Omega(T')^2 + ... + T^{s-1}\Omega(T')^{s-1}$$

Assume two variables x_{1t} and x_{2t} in the system, the forecast error variance matrix Ω can be rephrased in terms of the variances of the orthogonal innovations as follows,

$$\Omega = p^{-1}\,\mathrm{var}(u)(p^{-1})' = \begin{bmatrix} k_{11} & k_{12} \\ k_{21} & k_{22} \end{bmatrix} \begin{bmatrix} \partial_1 & 0 \\ 0 & \partial_2 \end{bmatrix} \begin{bmatrix} k_{11} & k_{12} \\ k_{21} & k_{22} \end{bmatrix} \quad ....(1)$$

where the k's denote elements of p^{-1} and $\partial_1 = \text{var}(u_i) =$ for i = 1,2.

Since each u has a unit variance, ∂_1 and ∂_2 equal 1.

Multiplying out *Eq*.(1) gives

$$Var(\hat{x}_{11}) = k_{11}^2 + k_{12}^2 \; and \; Var(\hat{x}_{21}) = k_{21}^2 + k_{22}^2$$

where the second subscript 1 of $\hat{x}$'s denotes the one period ahead forecast. Since p^{-1} is a lower triangular matrix by construction, and so is p^{-1}, which implies c_{12} =0. Thus, all the variance of $\hat{x}_{11}$ is attributed to the first orthogonal innovation and is equal to k_{11}^2. The variance of $\hat{x}_{21}$ is decomposed into two parts. A part $k_{21}^2/(k_{21}^2 + k_{22}^2)$ is ascribed to the first orthogonal innovation and the second orthogonal innovation adds to the remaining proportion, $k_{22}^2/(k_{21}^2 + k_{22}^2)$ to give the decomposition of the forecast error variance.

3.2 Choice of Variables for the VAR

The study examines the impact of oil price shocks on the stock market using quarterly data from 1985: to 2008:4. The data series and notation used in this study are as follows. Nominal oil price is the price index in US dollars of Bonny Light crude oil. National real oil prices are obtained using the exchange rate in Nigeria and deflated by the Nigerian consumer price index (CPI).

For oil price shocks, three kinds of oil price specifications are specified- log-difference of nominal oil price (Hamilton, 1983), oil price increase distinguished from oil price decrease (Mork, 1989) and oil price volatilities (Lee, Ni, and Ratti, 1995).

Thus, quarterly changes of real oil prices, defined as the first log difference transformation of real oil price (dlrPo) variables (linear specification) is specified as:

$$dlrPo_t = \mathrm{dlnlrPo_t} - \mathrm{dlnlrPo_{t-1}} = \mathrm{lrPo_t} - \mathrm{lrPo_{t-1}}$$

where $\mathrm{rPo_t}$ is real oil price in period *t* in US$ or in local currency, *d* is the first difference and *l* is the log transformation.

Secondly, the paper specifies variables that consider oil price increases and oil price decreases. The rationale for this specification lies on the observed asymmetry in the way macroeconomic variables react to oil price changes:

Therefore, positive oil price changes are specified as:

dlrPop = max(0, dlrPo)

where dlrPop is the log difference of real oil price increase

Real oil price decrease is specified as:

dlrPon = max(0, dlrPo)

where dlrPon is the log difference of real oil price decrease

Lastly, oil price volatilities or scaled oil price (SOP) are specified based on the assumption that oil price shocks are more likely to have a significant impact in an environment where oil prices have been stable than in an environment where oil price movements have been frequent and erratic.

For this specification, a GARCH (1, 1) model is estimated

$$dlrPov_t = \alpha + \sum_{i=0}^{p} \alpha_i dlrPo_{t-1} + \sum_{i=0}^{q} \beta_i z_{t-i} + \varepsilon_t, \varepsilon / I_{t-1} \approx N(0, h_t)$$

$$h_t = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 h_{t-1}$$

$$SOP_t : \frac{\hat{\varepsilon}_t}{\sqrt{\hat{h}_t}}$$

Where ε is the estimated error term and Pov is the proxy for oil price volatilities.

$SOPI_t$: scaled oil price increase, max (0, SOP_t)

$SOPD_t$: scaled oil price decrease, min (0, SOP_t)

{Z_{t-1}: i ≥ 1) denotes an appropriately chosen vector contained in information set I_{1-t}

4.0 Empirical Analysis

4.1 Unit Root Test

The paper conducts unit root tests of the variables with Phillips Perron (PP) and Augmented Dickey Fuller (ADF). Outcomes of the tests are presented in Table 4.1. According to the PP test, all variables in log level except dLPo, dLPOP and POV cannot reject at the 5 per cent level the null hypothesis that each variable contains a unit root with a constant and a trend. However, the first log difference rejects the null hypothesis at the 5 per cent level. Only dLPo, dLPOP and POV in level reject the null hypothesis. In the ADF test, all variables except dLPo, dLPOP and POV reject at the 5 per cent level the null hypothesis that they are level and trend stationary, while the first log difference cannot reject the null. In the cases of dLPo, dLPOP and POV they cannot reject the null hypothesis of level and trend stationary. In conclusion, there is evidence that all variables except dLPo, dLPOP and POV appear to be *I*(1) processes.

Table 4.1: Unit Root Test Using Augmented Dickey Fuller (ADF) and Phillips-Peron (PP) Tests: 1985:1- 2008:4.

Variable		ADF test stat	Critical Values			Order of integration	PP test stat	Critical Values			Order of integration
			1%	5%	10%			1%	5%	10%	
ASI	Levels	-1.77	-4.06	-3.45	-3.15	I(1)	-1.31	-4.05	-3.45	3.15	I(1)
	First diff	-4.81*	-4.06	-3.45	-3.15	I(0)	-6.49*	-4.05	-3.45	3.15	I(0)
IIP	Levels	-2.72	-4.06	-3.45	-3.15	I(1)	-2.45	-4.05	-3.45	3.15	I(1)
	First diff	-10.29*	-4.06	-3.45	-3.15	I(0)	13.08*	-4.05	-3.45	3.15	I(0)
TBR	Levels	-2.56	-4.06	-3.45	-3.15	I(1)	-2.56	-4.05	-3.45	3.15	I(1)
	First diff	-8.70*	-4.06	-3.45	-3.15	I(0)	-8.65*	-4.05	-3.45	3.15	I(0)
dLRPO	Levels	-6.70*	-4.06	-3.45	-3.15	I(0)	-5.71*	-4.05	-3.45	3.15	I(0)
	First diff	-10.73*	-4.06	-3.45	-3.15	I(0)	-10.93*	-4.05	-3.45	3.15	I(0)
dLRPOp	Levels	-7.82*	-4.06	-3.45	-3.15	I(0)	-7.78*	-4.05	-3.45	3.15	I(0)

	First diff	-10.92*	-4.06	-3.45	- 3.15	I(0)	- 31.29 *	-4.05	-3.45	3.15	I(0)
POV	Levels	-3.31**	-4.06	-3.45	- 3.15	I(0)	- 3.24* *	-4.05	-3.45	3.15	I(0)
	First diff	-8.16*	-4.06	-3.45	- 3.15	I(0)	-8.00*	-4.05	-3.45	3.15	I(0)
RER	Levels	-2.35	-4.06	-3.45	- 3.15	I(1)	-2.57	-4.05	-3.45	3.15	I(1)
	First Diff	-8.45*	-4.06	-3.45	- 3.15	I(0)	-8.45*	-4.05	-3.45	3.15	I(0)

Note: ASI is the all share price index, IIP is the index of industrial production, RER represents the real exchange rate; TBR is the treasury bill rate, dLRPo stands for the log-difference of real oil price, dLRPop is the log difference of real oil price increase, and POV is the proxy for oil price volatilities. One/two asterisks denote significance at the 1%/10% level.

95% Critical Level for ADF

4.2 Cointegration Tests

Since interest rate, oil price, stock price and industrial production contain unit root, the paper conducts a cointegration[4] test suggested by Johansen to see whether these variables have a common stochastic trend. The results of cointegration tests (Table 4.2) show that no cointegration is found among the interest rate, oil price, stock price and industrial production. That is the null hypothesis of no cointegration is accepted at the 5% level of significance.

[4] *If two or more series are themselves non-stationary, but a linear combination of them is stationary, then the series are said to be cointegrated.*

Table 4.2: Johansen Cointegration Tests

Sample (adjusted): 1986Q2 2008Q3

Included observations: 90 after adjustments

Trend assumption: Linear deterministic trend

Series: dlrPo LASI TBR IIP

Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.148728	29.25993	47.85613	0.7559
At most 1	0.087719	14.76784	29.79707	0.7949
At most 2	0.069501	6.505207	15.49471	0.6358
At most 3	0.000246	0.022164	3.841466	0.8816

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.148728	14.49209	27.58434	0.7872
At most 1	0.087719	8.262630	21.13162	0.8869
At most 2	0.069501	6.483043	14.26460	0.5520
At most 3	0.000246	0.022164	3.841466	0.8816

Trace and Max-eigenvalue tests indicate no cointegration at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

4.3. Stability of the Oil Price-Macroeconomy Relationship

To test whether the nature of the oil price-macroeconomy relationship changed for the Nigerian case, we estimate a linear specification for oil prices by following the methodology developed by Hamilton (1983). We perform the Chow Breakpoint Test on the following equation:

$$rGDP_t = \alpha_t + \beta_1 rGDP_{t-1} + \beta_2 po_t + \beta_3 po_{t-1} + \mu_t$$

where rGDP is the log of real GDP and po is the log of nominal oil price, which is the price index in US dollars of Bonny light crude oil. Final Prediction Error, Schwarz information criterion, Akaike information Criterion and Hannan-Quinn information criterion tests accept the choice of one lag.

Several possible breakpoints could be tested. Hooker (1996) supports the existence of a breakpoint in 1973 and Rotemberg and Woodford (1996) found a breakpoint in 1980, both for the American economy. Since our study falls outside the 1970s, we have chosen not to test for breakpoints in these periods. Also, there was a collapse of oil prices in 1985-1986 (Saudi Arabia drastically reduced oil prices around this period) and several authors point to the mid-1980s as the rupture point in the way economic agents react to oil prices. However, we cannot test for breakpoint in 1986 due to the risk of obtaining results with little robustness, given that the first observation in our sample is 1985.

Thus, we test for breakpoints in 1999 and 2004. The 1999 test is justified on ground of regime shift (changing from military to civilian administration), while the 2004 test explains the intensity of Niger Delta crisis. The Chow breakpoint test provides evidence for the existence of a structural break in these points at the 1 per cent significance level[5].

This conclusion has two implications for the outstanding work. First, we found it more appropriate and insightful to estimate models for different time periods: for the entire sample (1985-2008), for a first sub-sample (1985-1999), for a second sub-sample (2000-2004) and for a third sub-sample (2005-2008). Second, we chose to carry out the estimation with the alternative specifications of oil price shocks presented above. This will allow us to perform a comparative analysis and conclude if the nature of the relationship has indeed changed.

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[5] *In fact, 1999 and 2004 tests produced a value of 3.55 and 4.73, respectively, which for the F-distribution with 85 and 4 degrees of freedom corresponds to a p-value of 0.00.*

4.4 Magnitude and Significance of Oil Price Shocks Effects

Working with quarterly data, it is expected that four lags of the endogenous variables should be enough to conduct the VAR estimation without problems. However, the usual lag length criteria refuted this choice. Thus, we estimated VAR Models of order 1[6].

To analyze the effects of the different specifications of oil price changes, we first studied the coefficients obtained in the VAR estimation (even though not reported here) and then we performed the Granger Causality Tests. For the whole sample, the effect of treasury bill rate, index of industrial production and all share price index are not significant. We further examine this effect by classifying oil price shocks into sub-samples: for a first sub-sample (1985-1999), for a second sub-sample (2000-2004) and for a third sub-sample (2005-2008). The same conclusion holds as one moves from log-difference of nominal oil price to oil price increase and from oil price increase to oil price volatilities.

To analyse the statistical causality link between oil price shocks and the other variables, we will perform bivariate Granger Causality Tests. The Granger (1969) approach assesses whether past information on one variable helps in the prediction of the outcome of some other variable, given past information on the latter. It is important to note that the statement "x Granger causes y" does not imply that y is the effect or the result of x. Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term.

Appendix 1, indicates the null hypothesis that oil price shocks does not Granger cause stock return is rejected at the 5 per cent level of significance, implying that there is a one-way causality going from oil price shocks to stock returns. However, the null hypothesis that oil price shocks does not Granger cause exchange rate is upheld at the 5 per cent level of significance. It is also observed from the table that between 1985 and 2008, causality runs from RER to TBR, ASI to RER and IIP to RER. From the third sub-sample, causality runs from oil IIP to DLPO, ASI to DLPOP and from RER, IIP and ASI to POV. It is also interesting to know that causation runs from ASI to RER, which implies that the authorities can focus on domestic economic policies to stabilize the stock market

[6] *Final Prediction Error , Schwarz information criterion, Akaike information Criterion and Hannan-Quinn information criterion*

4.5 Impulse Response Functions

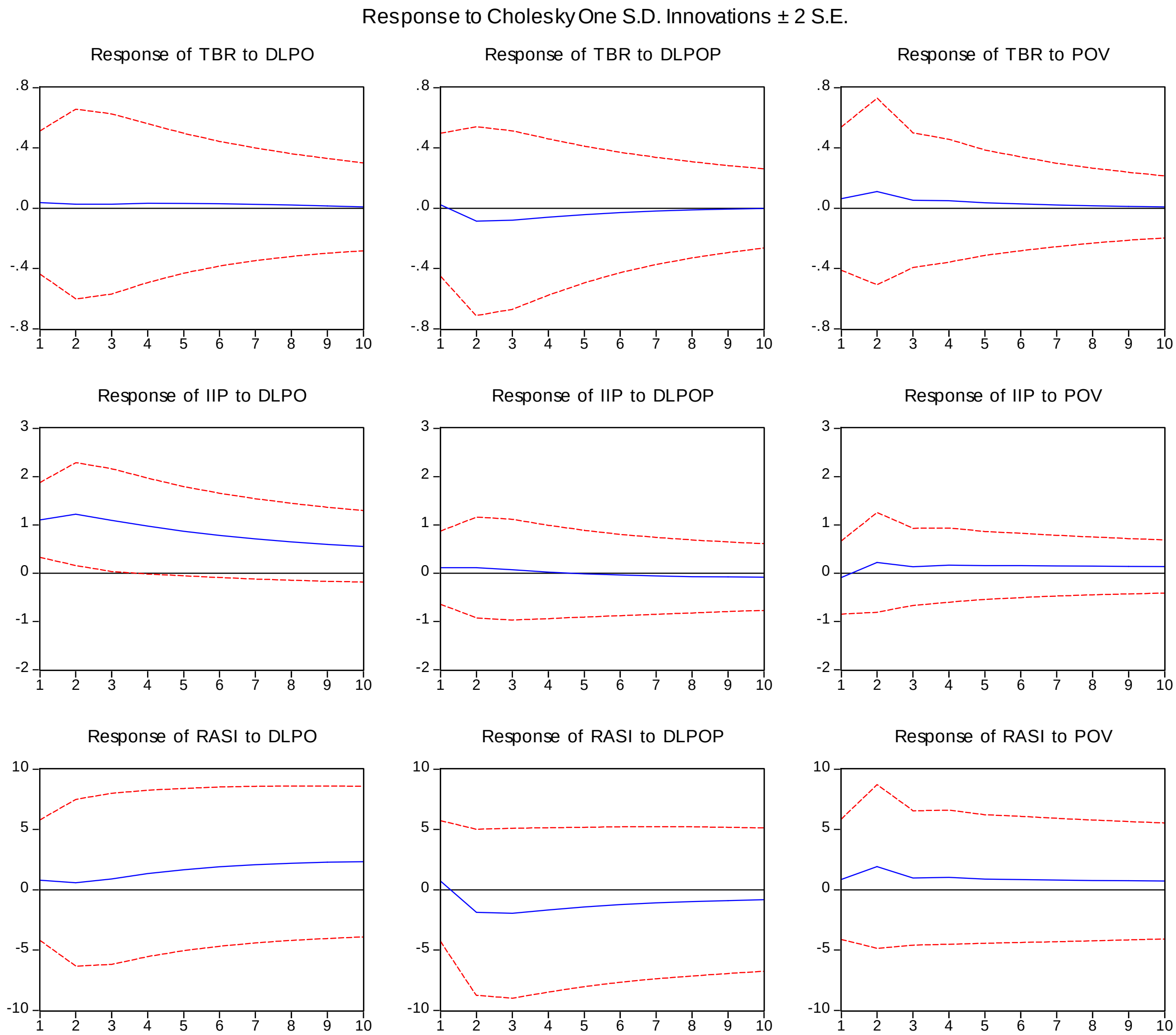
4.5.1 Impact of Oil Price Shock on Stock Market

In this section, the impact of oil price shocks on real stock returns, among others is assessed. Since according to Sims, most estimated coefficients from a VAR model are not statistically significant. Therefore, the impulse response functions and variance decompositions are further examined. Impulse response functions are dynamic simulations showing the response of an endogenous variable over time to a given shock, while variance decompositions show us the contributions of each source of shocks to the variance of the future forecast error for each endogenous variable.

Thus, attempt is made to examine the effect of oil price shocks on real stock returns using impulse response functions with different oil price specifications in a basic VAR model, coupled with different regime shifts. Figures 4.1 to 4.3 show the impulse response of real stock returns, interest rate and index of industrial production from a one standard deviation shock of oil price.

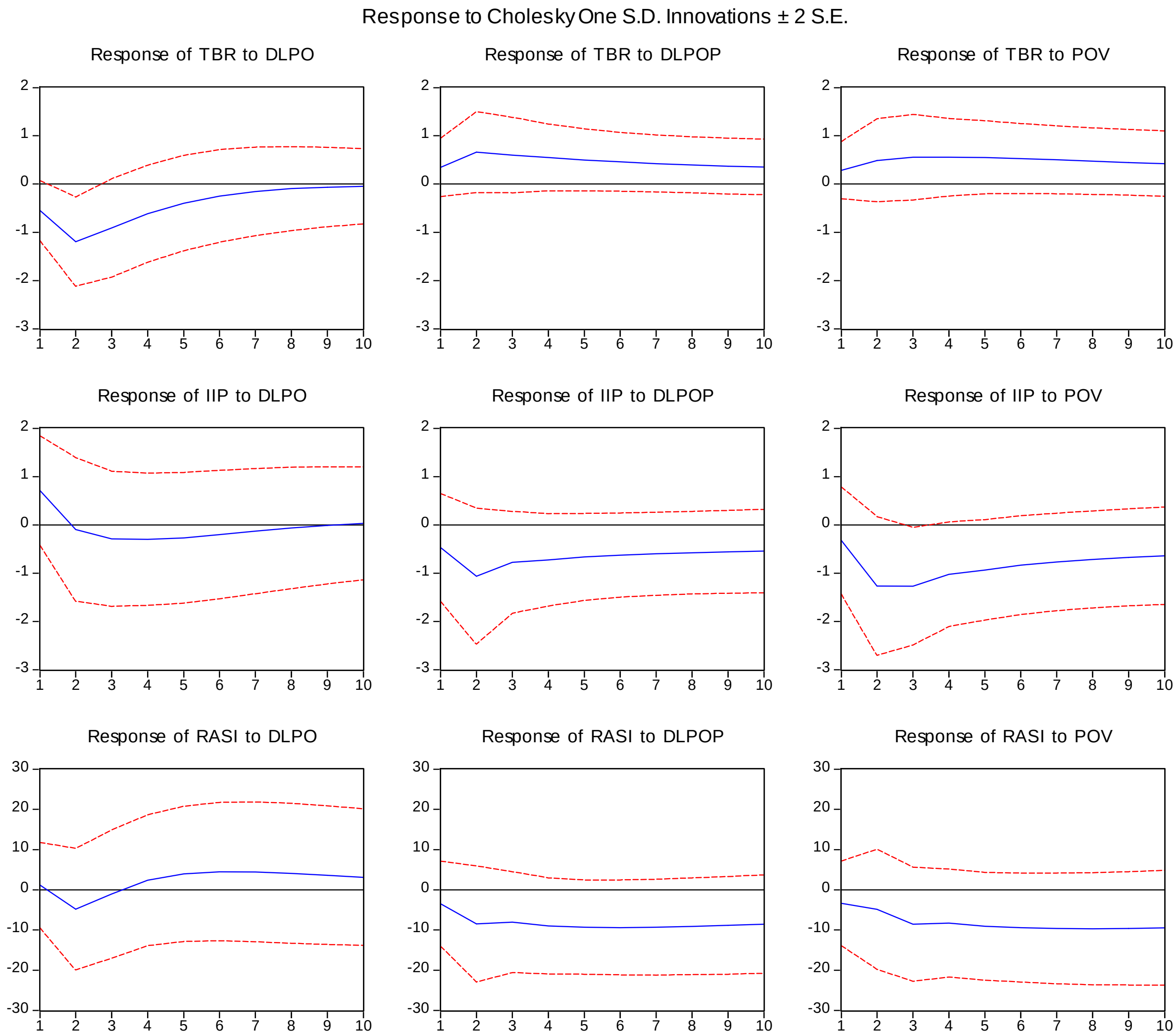
These figures show that in all the sub-samples (1985-2008; 1999-2008 and 2004-2008), an oil price shock has a negative and statistically significant impact on real stock returns at the 5 per cent level instantaneously or in two quarters. Outcomes are a little different depending on what kind of oil price specification (log-difference of nominal oil price, oil price increase distinguished from oil price decrease and oil price volatilities) is used. In all the different oil specifications, oil price shocks have negative and significant impact on real stock returns under different regime shifts. Using the entire sample (1985 - 2008), only oil price volatilities have positive and significant impact on real stock returns. For the sub-samples 1999-2008 and 2004-2008, the responses of real stock returns become more significant than the entire sample.

Figure 4.1: Impulse Response Functions 1985-2008



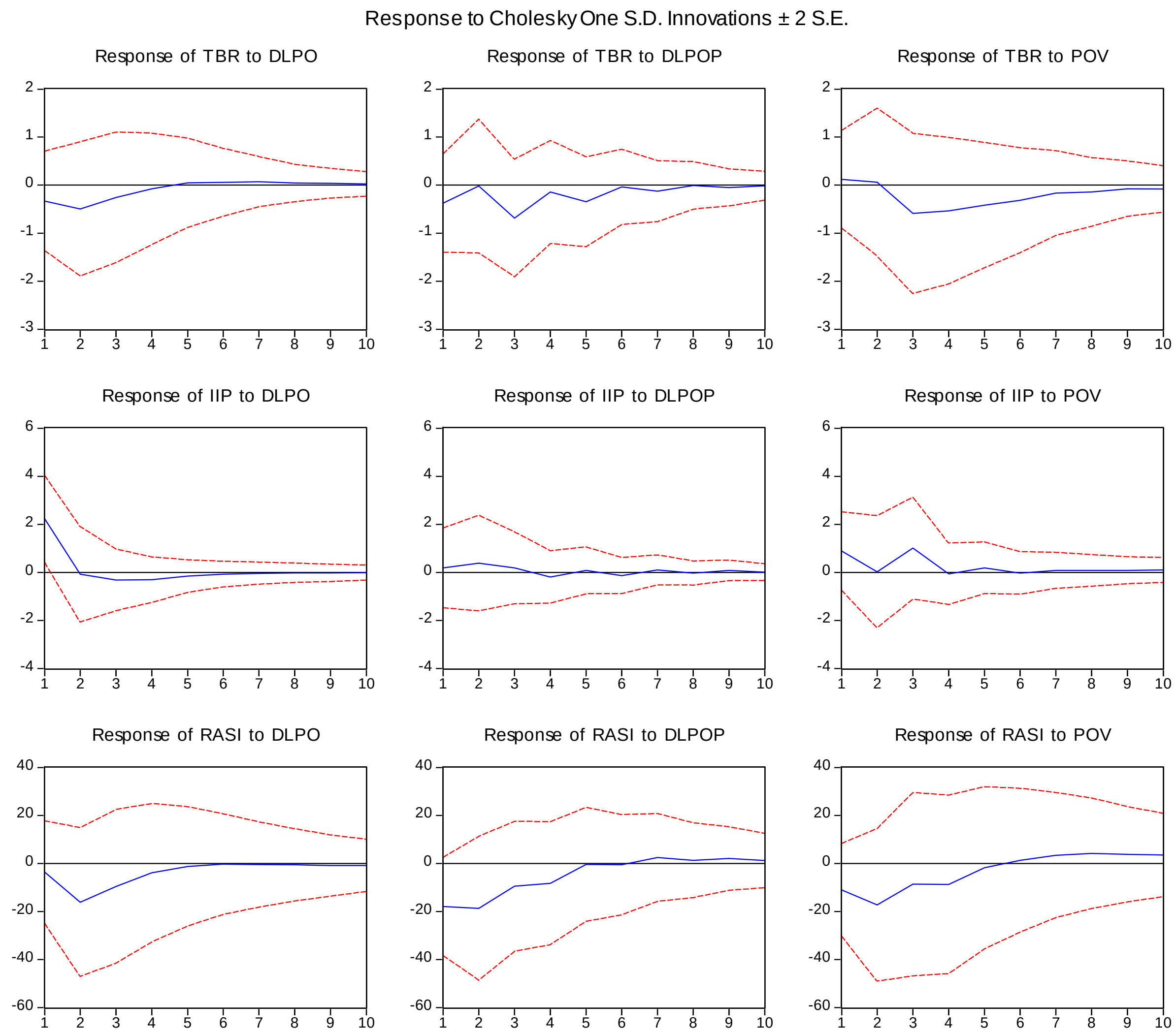
According to the literature which analyzes the impact of oil price shocks on industrial production or GDP, oil price shocks negatively affect them. This implies that oil price shocks affect the earnings of companies which use oil in production; thus causing their production to decline. If the stock market is efficient, those negative impacts of oil price shocks will be reflected in the stock price and the real stock returns will decrease. These impulse response analysis outcomes in Figures 4.1 to 4.3 could be interpreted to be consistent with the literature in that sense. In all the sub-samples and the entire sample, real stock returns respond to oil price shocks immediately. Thus, we can infer that stock markets in Nigeria are efficient.

Figure 4.2: Impulse Response Functions 1999-2008



It is expected that the impact of oil price shocks on stock returns in oil-exporting countries, like Nigeria, should be positive as shown in the literature, Park and Ratti (2007). This expectation is partly established in our study when the entire sample (1985:1 to 2008:4) is covered and oil price volatilities are used as oil specification. However, the general finding in this paper is that a significant negative response of real stock returns follows immediately when an oil price shock occurs, which is expected for an oil-importing country.

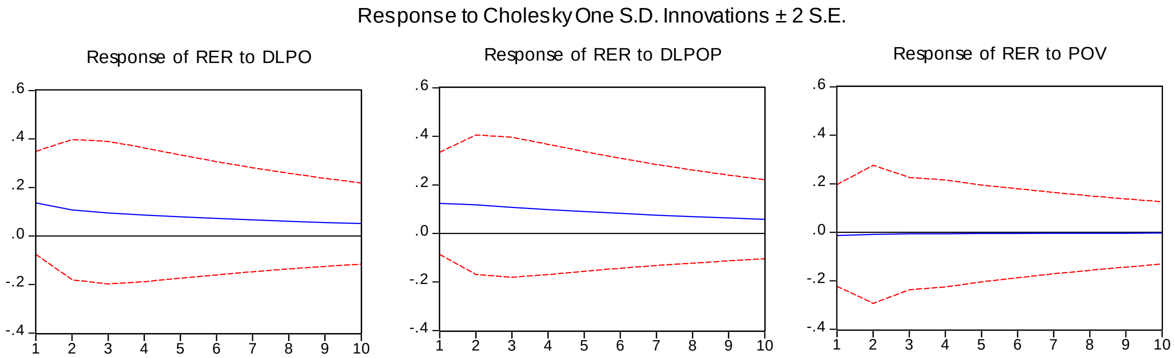
Figure 4.3: Impulse Response Functions 2004-2008



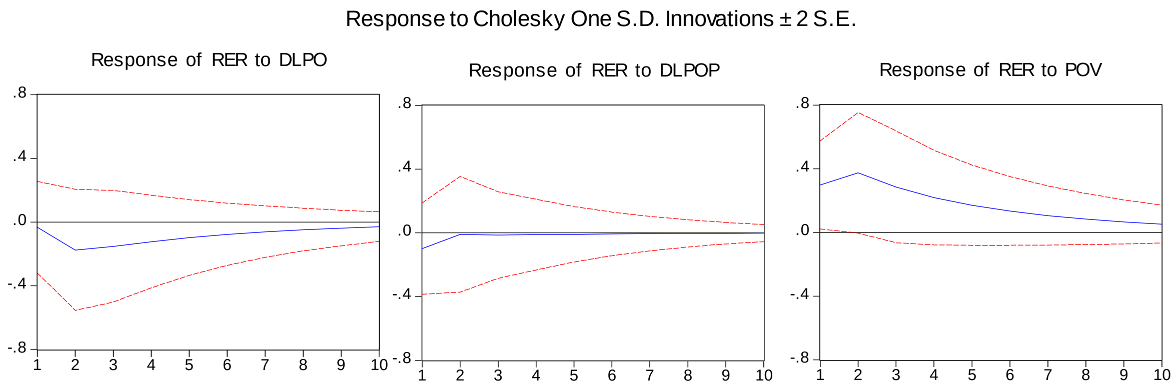
The impact oil price shock on real exchange rate is verified in Table 4.4 for different oil specifications under different regimes. When the log difference of real oil price is used, high oil price leads to appreciation of the real exchange rate. However, when oil volatility variables are used, oil price shocks lead to depreciation of naira in the short-run. Similar results are obtained when the periods are decomposed into different regimes.

Figure 4.4: Impulse Response Functions

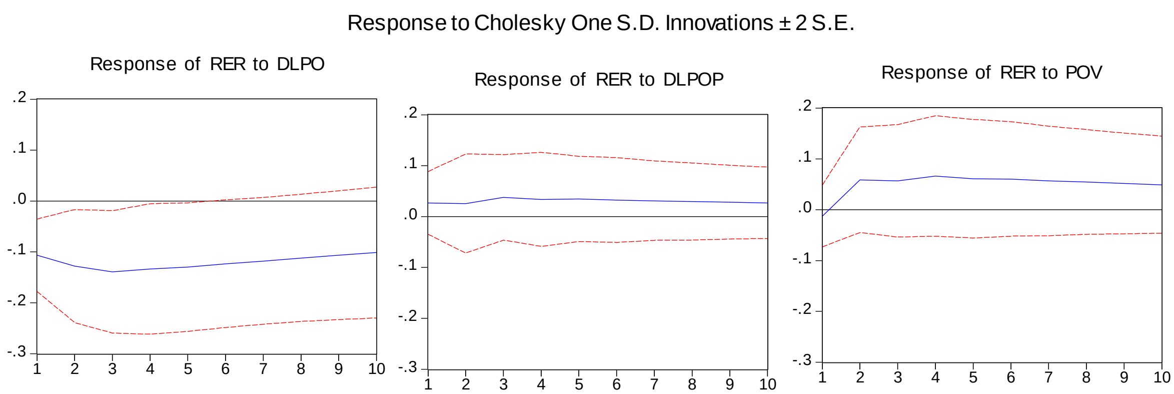
1985:1-2008:4



1999:1-2008:1



2004:1-2008:4



In terms of contributions of different variables to variance decomposition of real exchange rate, it is observed that apart from its own shocks which explained 46 per cent variation in exchange rate after 10-quarters, all-share index and log-difference of real oil price contributed 15 and 17 per cent, respectively, after 10 quarters. Other oil price shocks contributed about 16 per cent to variation in exchange rate after 10 quarters.

Table 4.4 Variance Decomposition of RER

Period	S.E.	DLPO	DLPOP	POV	TBR	RER	IIP	RASI
1	0.052524	33.98903	1.174860	0.233950	0.618127	63.98403	0.000000	0.000000
2	0.081156	30.61179	0.931550	7.079208	1.558451	56.95776	2.214389	0.646856
3	0.087612	29.62932	1.274629	5.581334	2.944008	57.29746	1.779983	1.493266
4	0.093762	26.86216	2.704238	6.168335	2.798932	56.23012	1.448618	3.787602
5	0.095393	24.61462	3.745231	6.512296	2.349196	54.96400	1.222516	6.592134
6	0.096314	22.31010	5.044093	7.222729	2.325884	52.47352	1.054185	9.569489
7	0.096579	20.48448	5.745735	7.854105	2.760023	50.24817	0.950535	11.95696
8	0.096690	19.08386	6.318313	8.354933	3.400245	48.28468	0.858138	13.69983
9	0.096790	18.09845	6.602499	8.784402	3.920586	46.93575	0.785098	14.87322
10	0.096869	17.43289	6.812559	9.073045	4.276734	46.02425	0.724865	15.65566

4.5.2 Impact of Oil Price and Interest Rate (Monetary) Shocks on Stock Market

The interest rates are seen to be one of the most important variables to explain the movement of the stock market, and the short-term interest rates is an influential monetary policy tool. It is argued that the interest rates are significant channel of oil price shocks to the economy because monetary policy tightens, presumably in response to the inflationary pressures from oil price shocks (Park and Ratti (2007).[7] By taking this argument into consideration, the paper further examines the impact of oil price and interest rate shocks on stock prices.

Tables 4.5(a) to 4.5(c) present the forecast error variance decomposition of real stock returns, which shows how much of the unanticipated changes of real stock returns are explained by oil price shocks and interest rate shocks, among others. Variance decomposition suggests that interest rates shocks are a considerable source of volatility for real stock returns in a basic VAR

[7] *This argument is based on the fact that oil and energy costs are too small relative to total production cost to account for the entire decline in output that has followed increases in the price of oil.*

model. Particularly, the contribution of interest rates shocks to the stock market is greater than that of oil price shocks in all the periods. This means that, apart from its ‘own shocks’, interest rates shocks are considered as an important factor when stock market movement is taken into account.

From the Table 4.5(a) to 4.5(c), the contribution of interest rate shocks to the real stock returns ranges from 0.9 per cent (1985:1- 2008:4), 3 per cent (1999:1- 2008:4) and 10 per cent (2004:1 - 2008:4) to 14 per cent, 26 per cent and 39 per cent, respectively, while oil price shocks in all the sub-samples do not exceed 10 per cent. Also, the model with sub-sample 2004 - 2008 shows a bigger contribution of an interest rate shock to the stock market than sub-samples 1999-2008 and the entire sample, 1985- 2008.

Table 4.5(a): Variance Decomposition (1985:1- 2008:4)

Variance Decomposition of RASI:

Period	S.E.	DLPO	DLPOP	POV	TBR	IIP	RASI
1	0.043716	0.108528	0.088821	0.127314	0.865758	0.826794	97.98278
2	0.044239	0.088219	0.371325	0.407493	2.495424	1.772060	94.86548
3	0.044266	0.114962	0.509742	0.349121	4.489285	2.890321	91.64657
4	0.044282	0.182418	0.544643	0.328230	6.494572	4.059443	88.39069
5	0.044296	0.269065	0.539024	0.306058	8.345423	5.199909	85.34052
6	0.044308	0.364278	0.519391	0.289606	9.968636	6.272339	82.58575
7	0.044320	0.460335	0.496181	0.276032	11.35172	7.260737	80.15499
8	0.044331	0.553331	0.473407	0.265084	12.50963	8.162147	78.03640

9	0.044341	0.641213	0.452517	0.256122	13.46897	8.980144	76.20103
10	0.044351	0.723149	0.433899	0.248773	14.25892	9.721195	74.61406

Cholesky Ordering: DLPO DLPOP POV TBR IIP RASI

Table 4.5(b): Variance Decomposition (1999:1- 2008:4)

Variance Decomposition of RASI:

Period	S.E.	DLPO	DLPOP	POV	TBR	IIP	RASI
1	0.021622	0.118907	1.102723	1.043855	3.430854	1.160370	93.14329
2	0.024245	1.142593	3.926338	1.637589	6.494793	2.158856	84.63983
3	0.024740	0.854765	4.968823	3.600348	10.96411	1.885751	77.72620
4	0.024968	0.833787	6.132576	4.710478	15.31469	1.512549	71.49592
5	0.025077	1.045173	7.087134	5.800801	18.84424	1.453053	65.76960
6	0.025148	1.298246	7.864913	6.748772	21.47097	1.703076	60.91402
7	0.025192	1.491768	8.482564	7.591502	23.33151	2.146826	56.95584

8	0.025222	1.608449	8.972387	8.330363	24.61713	2.677423	53.79425
9	0.025244	1.662413	9.362236	8.974006	25.49585	3.219385	51.28611
10	0.025260	1.674285	9.674949	9.531020	26.09601	3.729324	49.29441

Cholesky Ordering: DLPO DLPOP POV TBR IIP RASI

Table 4.5(c): Variance Decomposition (2004:1- 2008:4)

Variance Decomposition of RASI:

Period	S.E.	DLPO	DLPOP	POV	TBR	IIP	RASI
1	0.011714	0.601027	14.79664	5.584437	9.639026	6.688718	62.69015
2	0.016135	5.415796	13.35600	8.335030	14.12756	12.07369	46.69192
3	0.017375	5.347222	11.21540	7.277432	21.45892	13.62291	41.07811
4	0.018392	4.710357	10.32658	7.094298	28.62356	11.65407	37.59114
5	0.018694	4.331110	9.462136	6.535738	33.33225	10.82060	35.51817
6	0.018963	4.064871	8.882355	6.151669	36.09426	10.91781	33.88903
7	0.019076	3.896975	8.571577	6.015377	37.48333	11.26958	32.76316
8	0.019165	3.783248	8.331197	6.011619	38.26100	11.63741	31.97552
9	0.019213	3.712950	8.201827	6.030113	38.70608	11.89072	31.45832
10	0.01924	3.66614	8.09838	6.06503	39.0067	12.0542	31.109

	9	5	3	5	4	5	44

Cholesky Ordering: DLPO DLPOP POV TBR IIP RASI

Note: RASI is the all share price index in real term, IIP is the index of industrial production, TBR is the treasury bill rate, a proxy for monetary policy, dLPO stands for the log-difference of real oil price, dLPOP is the oil price increase, and POV represents oil price volatilities

Since innovations in short term interest rates could represent monetary shocks in the model, it can be interpreted that in Nigeria, oil prices play a less significant role in the stock market than monetary policy does.

Also, taking into account the argument that the interest rates are the critical channel of oil price shocks since monetary policy systematically responds to the oil price increase by raising the interest rates, the paper further examines the impulse response function of interest rate to the oil price shocks. It is evident in Figures 4.2 and 4.3 that interest rates increase significantly when oil price shocks occurs and real stock returns drop significantly in response to the increase of the interest rates. This is evident in Nigeria as monetary policy becomes tighter to prevent inflation when the oil price increases, which causes stock prices to decline. According to the variance decomposition analysis in Tables 4.5(a) to 4.5(c), the impact of interest rate shocks is greater than that of oil price shocks. Thus, systematic response of monetary policy to the oil price shocks explains why the influence of interest rate shocks on the stock market is greater in Nigeria.

5 Summary and Conclusion

There is a vast literature establishing robust results across many countries on the connection between oil price shocks and aggregate activity. This implies that connections should also exist between oil price shocks and stock markets. This study estimates the effects of oil price shocks and oil price volatility on the real stock returns of Nigeria over 1985:1-2008:4 using a multivariate VAR analysis. Variables ranging from, real stock returns, exchange rate, interest rate, index of industrial production to three types of oil specifications are employed. For oil price shocks, three kinds of oil price specifications are specified, which include log-difference of nominal oil price, oil price increase distinguished from oil price decrease, and oil price volatilities. Also, the study further classifies oil price shocks into sub-samples: for a first sub-sample (1985-1999), for a second sub-sample (2000-2004) and for a third sub-sample (2005-2008).

Empirical results from the impact of oil price shocks on real stock returns show that in Nigeria real stock returns respond significantly to oil price shocks immediately. That is oil price shocks have a significant negative impact on the stock market. It is expected, however, that the impact of oil price shocks on stock returns in oil-exporting countries, like Nigeria, should be positive, this expectation is partly established in our study when the entire sample (1985:1 to 2008:4) is used and oil price volatilities are used as oil specification.

The Granger causality test indicates that causation run from oil price shocks to stock returns between 1999:1 to 2008:4 and 2004:1 and 2008:4. This implies that variation in stock market is explained by oil price volatility. It is also interesting to know that causation runs from stock returns to real exchange rate, which implies that the authorities can focus on domestic economic policies to stabilize the stock market.

Comparing the impacts of oil price shocks and interest rate shocks on the stock market, interest rate shocks have a greater influence on the stock market than oil price shocks in Nigeria. Variance decomposition suggests that interest rates shocks are a considerable source of volatility for real stock returns in a basic VAR model. Particularly, the contribution of interest rates shocks to the stock market is greater than that of oil price shocks in all the periods. This means that, apart from its 'own shocks', interest rates shocks are considered as an important factor when stock market movement is taken into account.

Also, the paper conduct an impulse response function analysis to investigate whether systematic monetary policy (interest rates) to oil price shocks could explain the greater impact of interest rate shocks in Nigeria. The results show a significantly positive response of interest rates to oil price shocks. Strong evidence is found that the impact of interest rate shocks on the stock market is greater than oil price shocks and thus monetary policy responds systemically to oil price shocks by raising the interest rates, leading to a decline in real stock returns.

6 Limitations of the Study and Areas for Further Research

The study has not been able to address the following issues. First, to compare the impact of oil price shocks on oil-exporting nations with oil-importing countries. Second, to analyze the asymmetric effect of oil price shocks in oil-exporting and oil-importing countries by confirming whether or not oil price changes have the asymmetric effect on the stock market such that oil price increases have a greater impact on the stock market than oil price decreases. Also, there is need to examine the industrial classification of firms most affected by oil price shocks and see whether or not the results by industry differ between oil importing or exporting countries. Finally, there is need to present an economic model relating oil prices to firm's dividends and performance. These issues are subjects for future work.

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Appendix 1

Table 4.6: Pairwise Granger Causality Tests

1985:1 2008:4

Pairwise Granger Causality Tests
Sample: 1985Q1 2008Q4
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
TBR does not Granger Cause DLPO	93	0.00142	0.9700
DLPO does not Granger Cause TBR		0.04119	0.8396
RER does not Granger Cause DLPO	93	0.64077	0.4255
DLPO does not Granger Cause RER		0.02525	0.8741
RASI does not Granger Cause DLPO	93	2.08924	0.1518
DLPO does not Granger Cause RASI		0.01061	0.9182
IIP does not Granger Cause DLPO	94	0.13668	0.7125
DLPO does not Granger Cause IIP		0.50388	0.4796
TBR does not Granger Cause DLPOP	93	0.00115	0.9730
DLPOP does not Granger Cause TBR		0.19906	0.6566
RER does not Granger Cause DLPOP	93	0.36266	0.5485
DLPOP does not Granger Cause RER		0.01171	0.9141
RASI does not Granger Cause DLPOP	93	1.26109	0.2644
DLPOP does not Granger Cause RASI		0.50749	0.4781
IIP does not Granger Cause DLPOP	94	0.06267	0.8029
DLPOP does not Granger Cause IIP		0.33786	0.5625
TBR does not Granger Cause POV	93	0.02604	0.8722
POV does not Granger Cause TBR		0.07297	0.7877
RER does not Granger Cause POV	93	0.01251	0.9112
POV does not Granger Cause RER		0.00461	0.9460
RASI does not Granger Cause POV	93	0.63779	0.4266
POV does not Granger Cause RASI		0.73253	0.3943
IIP does not Granger Cause POV	94	1.17585	0.2811
POV does not Granger Cause IIP		0.01840	0.8924

RER does not Granger Cause TBR	94	4.69955	0.0328
TBR does not Granger Cause RER		0.10332	0.7486
RASI does not Granger Cause TBR	94	0.99391	0.3214
TBR does not Granger Cause RASI		0.99154	0.3220
IIP does not Granger Cause TBR	94	0.19915	0.6565
TBR does not Granger Cause IIP		0.18696	0.6665
RASI does not Granger Cause RER	94	2.63465	0.1080
RER does not Granger Cause RASI		0.05557	0.8142
IIP does not Granger Cause RER	94	3.15091	0.0792
RER does not Granger Cause IIP		1.68455	0.1976
IIP does not Granger Cause RASI	94	1.16156	0.2840
RASI does not Granger Cause IIP		2.23771	0.1381

1999-2008

Pairwise Granger Causality Tests
Sample: 1999Q1 2008Q4
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
TBR does not Granger Cause DLPO	38	0.17272	0.6802
DLPO does not Granger Cause TBR		2.54791	0.1194
RER does not Granger Cause DLPO	38	0.04038	0.8419
DLPO does not Granger Cause RER		1.14084	0.2928
IIP does not Granger Cause DLPO	39	4.05559	0.0515
DLPO does not Granger Cause IIP		1.70410	0.2000
RASI does not Granger Cause DLPO	38	0.26502	0.6099
DLPO does not Granger Cause RASI		3.12273	0.0859
TBR does not Granger Cause DLPOP	38	0.32458	0.5725
DLPOP does not Granger Cause TBR		0.79278	0.3793
RER does not Granger Cause DLPOP	38	0.00071	0.9788
DLPOP does not Granger Cause RER		0.67799	0.4159
IIP does not Granger Cause DLPOP	39	2.44730	0.1265

DLPOP does not Granger Cause IIP		2.34317	0.1346
RASI does not Granger Cause DLPOP	38	0.14367	0.7070
DLPOP does not Granger Cause RASI		4.30202	0.0455
TBR does not Granger Cause POV	38	0.53036	0.4713
POV does not Granger Cause TBR		0.95443	0.3353
RER does not Granger Cause POV	38	0.24821	0.6215
POV does not Granger Cause RER		1.04407	0.3139
IIP does not Granger Cause POV	39	1.67274	0.2041
POV does not Granger Cause IIP		3.08310	0.0876
RASI does not Granger Cause POV	38	0.14648	0.7042
POV does not Granger Cause RASI		2.40133	0.1302
RER does not Granger Cause TBR	38	3.53655	0.0684
TBR does not Granger Cause RER		0.72340	0.4008
IIP does not Granger Cause TBR	38	4.68443	0.0373
TBR does not Granger Cause IIP		0.87916	0.3549
RASI does not Granger Cause TBR	38	0.20567	0.6530
TBR does not Granger Cause RASI		4.75979	0.0359
IIP does not Granger Cause RER	38	4.25685	0.0466
RER does not Granger Cause IIP		6.01168	0.0193
RASI does not Granger Cause RER	38	2.79531	0.1035
RER does not Granger Cause RASI		1.98538	0.1676
RASI does not Granger Cause IIP	38	3.86189	0.0574
IIP does not Granger Cause RASI		0.21101	0.6488

2004:1-2008:4

Pairwise Granger Causality Tests
Sample: 2004Q1 2008Q4
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DLPOP does not Granger Cause DLPO	19	0.18650	0.6716
DLPO does not Granger Cause DLPOP		4.17007	0.0580

POV does not Granger Cause DLPO	19	0.61456	0.4445
DLPO does not Granger Cause POV		1.15930	0.2976
TBR does not Granger Cause DLPO	18	0.90606	0.3562
DLPO does not Granger Cause TBR		0.01944	0.8910
RER does not Granger Cause DLPO	18	0.51217	0.4852
DLPO does not Granger Cause RER		0.28234	0.6030
IIP does not Granger Cause DLPO	19	6.41684	0.0221
DLPO does not Granger Cause IIP		1.59031	0.2254
RASI does not Granger Cause DLPO	18	1.48869	0.2413
DLPO does not Granger Cause RASI		3.19865	0.0939
POV does not Granger Cause DLPOP	19	7.11767	0.0168
DLPOP does not Granger Cause POV		1.25965	0.2783
TBR does not Granger Cause DLPOP	18	0.38963	0.5419
DLPOP does not Granger Cause TBR		0.17239	0.6839
RER does not Granger Cause DLPOP	18	0.06280	0.8055
DLPOP does not Granger Cause RER		0.24143	0.6303
IIP does not Granger Cause DLPOP	19	0.29910	0.5920
DLPOP does not Granger Cause IIP		1.00487	0.3311
RASI does not Granger Cause DLPOP	18	3.19116	0.0943
DLPOP does not Granger Cause RASI		2.65687	0.1239
TBR does not Granger Cause POV	18	0.87022	0.3657
POV does not Granger Cause TBR		0.54566	0.4715
RER does not Granger Cause POV	18	4.03041	0.0631
POV does not Granger Cause RER		0.00662	0.9362
IIP does not Granger Cause POV	19	4.22084	0.0566
POV does not Granger Cause IIP		0.03904	0.8459
RASI does not Granger Cause POV	18	9.81469	0.0068
POV does not Granger Cause RASI		0.92212	0.3521
RER does not Granger Cause TBR	18	0.94443	0.3466
TBR does not Granger Cause RER		1.57093	0.2293
IIP does not Granger Cause TBR	18	2.40907	0.1415
TBR does not Granger Cause IIP		0.00838	0.9283

RASI does not Granger Cause TBR	18	0.29296	0.5963
TBR does not Granger Cause RASI		2.03860	0.1738
IIP does not Granger Cause RER	18	0.06970	0.7954
RER does not Granger Cause IIP		2.24170	0.1551
RASI does not Granger Cause RER	18	1.51720	0.2370
RER does not Granger Cause RASI		0.34079	0.5680
RASI does not Granger Cause IIP	18	0.61190	0.4462
IIP does not Granger Cause RASI		0.45156	0.5118