

Effect of Volatility Transmission on Domestic Stock Returns: Evidence from Nigeria

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Abstract

This study utilizes the structural unrestricted vector auto-regressive (SVAR) model to examine the intertwining relationship between oil price volatility and S&P 500 returns on stock returns in Nigeria. The stochastic properties of the series considered in the model were analyzed using the sensitivity and innovation criteria. The result from this study confirms that US inflationary spillover exert a negative impact on the domestic market in Nigeria. Economic downturn arising from dwindling foreign global economic activity raises uncertainty about the stability of the markets and thus increases stock market volatility. This research has two important connotations. First, that domestic stock returns are vulnerably exposed to volatility from inflationary spillover and energy prices and secondly, international portfolio diversification and trading decision by foreign investors into the local markets could result in decrease stock returns if proper effective hedging strategies are not adopted, particularly, during crisis periods.

Keywords: International Oil Price, Sensitivity analysis, Stock return, Volatility transmission, Global economic crisis

Introduction

The transmission of volatility across market and its effect on stock returns has continued to receive severe attention from economist and financial analyst. This is even more so given the increasing trend of global financial integrations across international markets.

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As stated by Arouri, Lahiani and Nguyen (2012) if return and volatility are found to spread from one market to another, portfolio managers and policymakers would have to adjust their actions to essentially prevent contagion risks in the event of market crashes or crises. This opinion which was upheld by Forbes and Rigobon, (2002) Syriopoulos, (2007) Skintzi and Refenes, (2006) further added that return and volatility spillovers across markets depends on the degree of spillover which is also highly dependent on economic and financial integration as well as on the coordination of monetary policy. Gupta (2013) further expounded that volatility in International oil prices are transferred to other countries through channels such as the transfer of wealth to oil-exporting countries, increased costs of domestic production, inflationary pressures and financial markets – through volatility in the equity market. It is therefore implied that improved knowledge of volatility spillover effect between the stock and currency markets, and consequently the degree of their integration, will expand the information set available to international portfolio managers, multinational corporations, and policymakers for decision-making.

Before we set forth to analyze the degree of the transmission effect of international crude oil price volatility on domestic stock markets, it is necessary to understand the intertwining relationship between oil price volatility on stock returns. The Discounted Cash flows (DCF) technique has been popularized in describing these oil price volatility-stocks return relationship. The Discounted Cash flows (DCF) technique posits that the value of a stock is equal to the sum of discounted expected future cash flows. Chang, McAleer and Tansuchat (2009) explained that the value of stock prices in an equity pricing model theoretically equals the discounted earnings expectation of companies, or future cash flows. Since oil is a crucial input for goods and services production, a rise in oil prices without substitute inputs increases production costs, which, in turn, decreases cash flows and stock prices. In addition, rising oil prices affects the discount rate by influencing inflationary pressures, which can also lead central banks to raise interest rates. Thus, corporate investment decisions can be affected directly by changes in the discount rate and changes in stock prices relative to book value. However the direction of the stock price change depends on whether a stock is a producer or consumer of oil and oil-related products. Since most companies in the world market are oil consumers, the performance of oil prices and the stock market may well be negatively correlated.

Within the same context Talukdar and Sunyaeva (2012) presented three conditions through which oil price shocks can affect stock returns as viz, Firstly, an unprecedented increase in oil price could increase the energy cost for companies (particularly if these companies did not hedge against the oil price risks). The consequence of this is that the earnings of the firm will fall as well as the present cash flows. Since the intrinsic stock value depend on the future cash flows, investors and analyst while valuing a stock would predict further oil price increases and estimate lower expected future cash flows, resulting in a lower stock value for the firm. Secondly, if the oil price shocks triggers inflation, the cost of production (material cost, labor cost, and overheads) could increase for most of the companies and consequently, the intrinsic stock values would be depressed duo to lower cash flows. If the stock markets reflect the intrinsic stock values in the stock prices, the price of stocks should fall and thus lead to a decline in stock returns.

With the advent of globalization and market integration investors have awakened to the benefits of greater portfolio diversification, particularly, to those markets where returns are expected to be greater. The flow of investible funds is now seen to move to the so called “emerging markets” where foreign investors have moved from holding almost no shares to holding a sizeable proportion of the market shares. Table 1 below comparatively depicts the inflow and out of portfolio investment in the Nigeria stock market.

Table 1. Comparison of Total Foreign Transactions with total Domestic Transactions

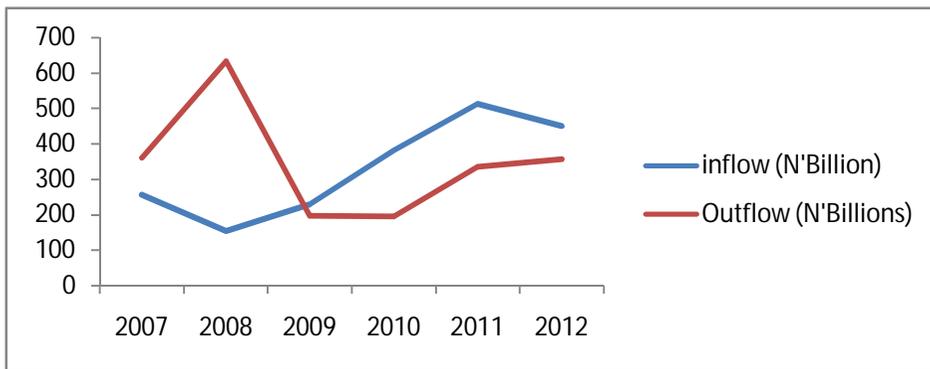
Year	Total Transactions on the Exchange (N'Billions)	Total Foreign Transactions (N'Billions)	Total Domestic Transactions (N'Billions)	Foreign Transaction %	Domestic Transaction %
2007	4,171.63	615.63	3,556.00	14.8	85.2
2008	4,758.27	787.4	3,970.87	16.5	83.5
2009	1,371.43	424.6	946.84	31.0	69.0
2010	1,598.93	577.3	1,021.63	36.1	63.9
2011	1,269.83	847.9	421.93	66.8	33.2
2012	1,317.00	808.4	508.6	61.4	38.6

Extracted from the Broker Dealer Regulation of the Nigeria Stock Exchange, July, 2013

The table above shows that total FPI transactions, which accounted for 14.8% of total transactions in 2007 consistently increased over the years to 66.8% in 2011 (An increase of 52% over the 4 year period).

However, this dropped to 61.4% in 2012. Domestic transactions on the other hand peaked at 85.2% in 2007 but dropped significantly to 33.2% of total transactions in 2011 (A sharp reduction of 52% in the 4 year period). This subsequently increased to 38.6% in 2012.

Figure 1: Graphical Comparison of the Inflows and Outflows Between 2007 and 2012



Graphically, the period between 2007 and 2009 (which witnessed huge outflow of funds from the Nigeria stock market) coincided with the era where stock markets the world over were experiencing slump in stock market activities. Many foreign investors that already have troubles in their home economies pulled out of the Nigerian stock market leading to dumping of shares beyond the ability of domestic investors to contain. Supply of equities has, in consequence of this, overwhelmed demand, leading to price fall. Shulz (1995) and Clark and Berko (1997) had suggested that such dramatic change in investors behavior have profound implication on pricing of shares in such markets, because of greater risk sharing and liquidity arising from such inflows, expected returns should fall and share prices should rise. Conversely, in situations where there is a dumping of shares arising from massive outflow of funds, the risk of share acquisition will be high; investors will develop apathy regarding share pricing, leading to a fall in the market value of shares.

Beside the vulnerability that emerging markets are exposed to in situations global market volatility, some researchers have opined that the emerging markets are even more severely affected by the up and down swings of international inflation.

Following the “base broadening” hypothesis which suggested that foreign inflow causes emerging equity price to rise, Merton, 1997; and Errunza and Losq(1989), expressed that broadening of investors base, particularly in emerging markets increases diversification and risk sharing, lowering the required risk premium, as well as lowering the perceived liquidity risk of market stocks. Furthermore, seasons of global crisis such as experienced in Argentina and Turkey in 2001 and the US in 2007 would also reduce the volume of flows of funds to the emerging markets, stock prices and the returns from these stocks. Many researchers have argued that globalization is at the heart of the volatility of stock returns, with highly diversified investors not paying much attention to economic fundamentals following the herd in the presence of asymmetric information.

Statement of the Problem

Volatility spillover “contagion” results from the normal interdependence of market economies. This interdependence amongst markets means that stock markets are inter-linked with each other, thus, factors that inhibit a particular market can be transmitted to other markets because of their financial linkages. That is to say, market disturbances can be transmitted to other market, and the emerging market (often characterized as highly volatile” are more affected by such disturbance transmission than the developed market. Thus, the returns from stock in the emerging economies respond either negatively or positively to market disturbances from the developed economies depending on the degree of foreign inflows of portfolio investment from these economies to the emerging stock markets.

The influx of capital investment into the Nigeria stock market has even created severe risk in the financial system. The recent global financial crisis has made the Nigeria capital market illiquid, thus causing a downward trend in the market. In turn, the capital is becoming less attractive to long-term investors and very risky to invest causing a diversion of funds from the Nigeria market to other emerging markets. The resultant effect of this crisis caused the NSE capitalization to dropped by over N8.1 trillion from its peak of N13 trillion in 2008, and furthermore to N4.9trillion as at the end of 2009. Crude oil price has been thought of as affecting the dividend yield via stock market returns through a reduction in company's earnings which in turn affect their dividends, retained earnings and the prices of stocks.

Thus, the particular impact of the spillover effect of fluctuations in the price of crude oil on domestic stock returns becomes a very crucial issue of discourse, particularly, as it affects the portfolio of foreign investment in Nigeria. For instance, in 2008, the market capitalization, which measures the value of stocks, sharply declined by over N6 trillion from a peak of N12.6 trillion to N6.8 trillion representing over 50 per cent fall. Within the same year Foreign Portfolio Investment (Inflows) in the Nigeria Stock Exchange reduced from N256billion obtained in 2007 to N154billion. Similarly, FPI outflows increased to N634billion in 2008 as against N360billion noticed in 2007 (NSE, 2013). The FPI outflow includes sales transactions or liquidation of portfolio investments through the stock market, whilst the FPI inflow includes purchase transactions on the Nigerian Stock Exchange (Equities only).

Nigeria stock market cannot be exonerated from these external shocks arising from oil price fluctuations and the variability in foreign portfolio investment. The Nigerian stock market appears to be very sensitive to oil price changes, similar to other developing and crude oil import-dependent countries, particularly, since there has been a large influx of capital inflows of funds into the financial market from foreign portfolio investors.. Thus, increasing the foreign portfolio of investment in the stock market exposes the country to shocks created from the international financial markets.

Objective of Study

This paper sets forth to explore the intertwining relationship between oil pricevolatility and S&P 500 returns on stock returns in Nigeria. Many researchers have advanced various results on the dynamic interaction between global stock markets and US stock markets. Eun and Shim (1989) have argued that the US market exercises dominance over other stock markets in the world, particularly, the emerging markets. Their research observed that US equity markets affect world markets. Furthermore, Tokic, (2003); Liu and Pan, (1997); Wu and Su, (1998); observed that the US equity markets exert a long-run effect on world markets. In contrast to the assumption that the US market exercises dominance over other stock markets in the world, Ghosh, Saidi and Johnson(1999); Byers and Peel(1993); and Kanas(1998) did not however find any linkage between US and European markets which constitute both developed and emerging markets.

Therefore, an understanding the spillover effect of international crude oil prices on domestic stock markets will help investors (willing to invest in Nigeria as an emerging country) to accurately forecast volatility and build accurate asset pricing models to hedge against these swings, especially, if the swings are said to persist for a longer time. This study will incorporate the recursive Structural VAR methodology to further expound on the volatility effect of oil price shocks, S&P 500 (global stock market) and U.S inflation rate on stock returns in Nigeria.

Research Questions

The study will be in pursuit of answering the following question.

1. What spillover effect does the volatility of Brent crude oil price have on domestic stock returns?
2. What is the correlation between global market volatility indexes (US S&P 500 index) and the Nigeria stock returns?
3. Which of these volatility indexes has greater spillover effect on the stock returns in Nigeria?
4. Does the U.S inflation spillover have any spillover effect on the Stock returns in Nigeria?

Literature Review

Given the advent of globalization financial markets have become increasingly interconnected. Individual and institutional investors have taken advantage of this financial integration to shift their portfolio investment from highly risky markets to the emerging markets where they hold the expectations of reaping huge returns on their investment. However, research has shown that economist and financial analyst hold varied opinions on the effect of financial integration among markets. While some researchers agree that returns on global stock markets, like S&P 500, have a strong corresponding spillover effect on returns on stocks from the emerging markets, others agree that this interrelationship is somewhat weak.

Berument and Ince (2005) examined the effect of US stock exchange performance on the Turkish stock exchange using S&P500 index to represent the US stock exchange and the ISE100 index for the Turkish stock exchange.

Their study utilized the Block recursive VAR model to examine daily observations from 23 October 1987 to 8 June 2004. Their study found that a positive shock to the US stock exchange increases the Turkish stock exchange in a statistically significant manner. On the same vein Peresetsky (2011) sort to empirically test the dependence of the Russian stock market on the world stock market (S&P 500 global index), world oil prices and Russian political and economic news during the period 2001-2010 using the GARCH 1(1) type model. His result found statistically significant influence of oil prices on Russian stock index returns. Furthermore, the US market index (S&P500) was found to have a predictive power over the Russian market index with the exception of the very volatile period during the 2008-2009 crises.

While the above researcher agree that world stock index exert significant influence on the stocks from emerging market, King and Wadhvani (1990) while investigating the time-variation in the co-variances between stock markets as well as assess the extent of capital market integrations concluded that the global stock markets are not integrated and “unobservable”, but rather historical factors been more important in explaining stock returns than the macroeconomic variables.

Ng (2000) examined the magnitude and changing nature of volatility spillovers from Japan and the US to six Pacific–Basin equity markets, by constructing a volatility spillover model which allows the unexpected return of any particular Pacific–Basin market be driven by a local idiosyncratic shock, a regional shock from Japan and a global shock from the US. The study observed that far above the impact of world factors exert on emerging markets, some other factors such liberalization, capital market reforms, exchange rate changes, sizes of trade and country fund premium are shown to affect the relative importance of the world and regional market factors over time.

Alikhanov (2013) investigated mean and volatility spillover effects from the U.S and EU stock markets as well as oil price market into national stock markets of eight European countries. The study found strong indication of volatility spillover effects from the US-global, EU-regional, and the world factor oil towards individual stock markets. While both mean and volatility spillover transmissions from the US are found to be significant, EU mean spillover effects are negligible. Additionally, the examination of only global and regional stock markets spillover transmissions into European stock markets also confirms the dominating presence of the U.S spillover transmissions.

The result further observed that the stock market returns of Hungary, Poland, Russia and the Ukraine are found to respond asymmetrically to negative and positive shocks in the US stock returns. Most interestingly, the result of the conditional model suggests that the spillover effects are partially explained by instrumental macroeconomic variables, out of which exchange rate fluctuations play the key role in explaining the spillover parameters rather than total trade to GDP ratios in most investigated countries.

Literatures on equity market segmentation implicitly suggest that dramatic changes in investor's base for emerging market equities have profound implication for the pricing of stocks, particularly because of greater risk sharing and liquidity. Some researcher (Stulz, 1995) suggest that when investors shift their financial asset holdings to the emerging market and liquidity increases as well as the risk sharing in such markets, expected returns should fall while prices should rise. His assertions are in tandem with the "base broadening" hypothesis which holds that foreign inflows causes emerging equity prices to rise.

In testing the base broadening hypothesis, Clark and Berko (1997) investigate economically and statistically significant positive correlation between monthly foreign purchases of Mexican stocks and Mexican stock returns. Their study observed that a 1 per cent of market capitalization of foreign inflow was associated with 13 per cent increase in Mexican stock. The study further observed a positive correlation in returns and price pressure following positive strategies of foreign inflows, an evident consistent with the base broadening hypothesis.

Oil has been shown to exert more volatility of stock returns in emerging market that world global factors. Crude oil price has been thought of affecting the dividend yield via stock market returns through a reduction in company's earnings which in turn affect their dividends, retained earnings and the prices of stocks. Tansuchat, Changand McAleer (2010) utilized daily returns from 2 January 1998 to 4 November 2009 of the crude oil spot, forward and futures prices from the WTI and Brent markets, and the

FTSE100, NYSE, Dow Jones and S&P500 index returns to investigate the conditional correlations and volatility spillovers between crude oil returns and stock index returns following the CCC model of Bollerslev (1990) VARMA-GARCH model of Ling and McAleer (2003), VARMAAGARCH model of McAleer, Hoti and Chan (2008), and DCC model of Engle (2002). Results indicate that, using the CCC model, the estimates of conditional correlations for returns across markets are very low, and some are not statistically significant, which means the conditional shocks are correlated only in the same market and not across markets. The result of the DCC model estimates revealed that the assumption of constant conditional correlations is not supported empirically. However, the result of the VARMA-GARCH and VARMA-AGARCH models provide little evidence of volatility spillovers between the crude oil and financial markets.

Berk and Aydogan (2012) had opined that the price of crude oil, which is the primary fuel of industrial activity, plays a significant role in shaping the countries' economic and political developments, not only by directly affecting the aggregate indicators, but also by influencing companies' operational costs, and thus their revenues. When the stock market is efficient, positive crude oil price shocks would negatively affect the cash flows and market values of companies, causing an immediate decline in the overall stock market returns.

Arouri, Lahiani and Nguyen (2011) investigated the linkages and volatility transmission between oil price and stock market in the Gulf Cooperation Council (GCC) countries over the recent period (2002 -2010) using the generalized VAR-GARCH approach which allows for transmissions in returns and volatility. Their result pointed the existence of substantial return and volatility spillover between the world oil prices and the GCC stock market. Their result also pointed out the crucial nature of international portfolio management in the presence of oil price risk. The result hereafter agrees that world oil price exhibit a substantial influence on the portfolio of investors in the GCC.

Skintzi, and Refenes, (2005) investigated the Volatility spillovers and dynamic correlation in European bond markets. The objective of the paper was to measure how and to what extent the volatility of a European bond market is affected by local shocks, regional shocks and world shocks. They model the price and volatility spillovers from the US bond market and the aggregate Euro area bond market to twelve individual European bond markets using an EGARCH model that allows for a dynamic correlation structure.

Their results suggested that significant volatility spillovers exist from both the aggregate Euro bond market and the US bond market to the individual European markets. Moreover, the results further indicate that the world market factor of US has a significant influence in the individual European bond market volatility process.

Kanas (2000) first uses EGARCH models in investigating the volatility spillover effects in US, Canada, Japan, UK, France, and Germany for the period between 1986 and 1998, his study shows significant symmetric spillover effects from stock market returns to foreign exchange rate changes. Also applauding the opinion of Kanas (2000) Yang and Doong (2004) investigated the same phenomenon using G-7 countries. Their results point to significant volatility spillovers and an asymmetric effect from the stock market to the foreign exchange market for France, Italy, Japan and the US, suggesting integration between stock and foreign exchange markets in these countries.

Wu (2005) investigated the same phenomenon among Japan, South Korea, Indonesia, Philippines, Singapore, Thailand and Taiwan for the period 1997-2000 splitting the sample into crises and recovery periods. He found a bi-directional relationship between the volatility of stock returns and exchange rate changes during the recovery period in all countries except South Korea, as well as significant contemporaneous relationships between the two markets for most of the countries. Furthermore, he found volatility spillovers increased in the recovery period.

Gupta's (2013) recent empirical work on South African stock market suggested that domestic stock returns are significantly affected by global international prices. He observed that stock prices in South Africa move in opposite direction in response to oil price shocks and speculative demand shocks in South Africa, further affirming that South Africa's stock returns reacted differently to international oil price shocks, depending on the underlying causes of the increase in the international oil prices. Shaharudin, Samad and Bhat (2009) also opined that oil prices affect company's earnings which in turn affect their dividends, retained earnings and the prices of stocks. In their studies carried out on the effect of oil price movement on the stock prices of three different markets (US, India and UK). Their studies revealed that oil price volatility transmission has persistent effect on the volatility of the stocks of companies in all the countries studied.

The findings of these studies above suggest that an increase in oil prices tends to favour stock market returns in oil-exporting economies, whereas a bearing behavior is observed on stock markets in oil-importing economies.

The effect of oil price shock on domestic economy could be traced to the direction from where the shock could be coming from. Researchers have posited that oil price shocks could either originate from the demand side or from the supply side. Supply-side oil price shocks are related to changes in oil prices due to changes in world oil production and supply.

Demand-side oil price shocks, on the other hand, are related to the increase in world aggregate demand.

Kilian (2009) attempted to identify the underlying demand and supply shocks in the global crude oil market. The identification of these shocks is important not just for explaining fluctuations in the real price of oil, but also for understanding the response of the US economy associated with oil price fluctuations. Using a newly developed measure of monthly global real economic activity, the author structural decomposed the real price of crude oil into three components is proposed: crude oil supply shocks; shocks to the global demand for all industrial commodities; and demand shocks that are specific to the global crude oil market. The result revealed that oil prices are driven by structural demand and supply shocks which may have direct effects on the US economy as well as indirect effects operating through the price of oil (as well as other commodity prices).

Miller and Ratti (2009) examine 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 conclude that international stock market indices respond negatively to increases in the oil price in the long run. They also establish the existence of a long-run co-movement between crude oil price and stock market during 1971:1–1980:5 and 1988:2–1999:9 with evidence of a breakdown in the relationship after this period. They found that it was suggestive of the possibility that the relationship between real oil price and real stock prices has changed in recent time period compared to the earlier period

Kumar (2009) assessed the oil prices-macro economy relationship by means of multivariate VAR using both linear and non-linear specifications.

Scaled oil prices model outperforms other models used in the study. It studies the impacts of oil price shocks on the growth of industrial production for Indian economy over the period 1975Q1-2004Q3. It is found that oil prices Granger cause macroeconomic activities. Evidence of asymmetric impact of oil price shocks on industrial growth is found. The study found out that oil price shocks negatively affect the growth of industrial production and we find that an hundred percent increase in oil prices lowers the growth of industrial production by one percent. Moreover, the variance decomposition analysis while putting the study in perspective finds that the oil price shocks combined with the monetary shocks are the largest source of variation in industrial production growth other than the variable itself.

Berk and Aydogan (2012) used daily observations of Brent Crude oil and Istanbul Stock Exchange National Index (ISE-100) returns to investigate the impact of crude oil price on the Turkish stock market returns using the vector autoregression (VAR) model. Their variance decomposition test result suggested that global liquidity conditions were responsible for the greatest amount of variation in stock market returns.

Talukdar and Sunyaeva (2012) using 11 member countries of OECD investigated the effect of oil price shocks on stock market returns. Their result stated that oil price shocks have negative impacts on real stock market returns depending on whether the country is a net oil exporting or an importing one. It is expected that the oil importing country's real stock returns are affected negatively due to oil price shocks compared to the oil exporting countries.

Data and Estimation

Our study examines the short-run volatility shock to domestic stock returns in Nigeria arising from innovation in international oil prices and global market using annual data from 1980 to 2010. The US stock market index, represented by Standard and Poor 500 (S&P 500) were obtained from forecastchart.com. U.S inflation rate was obtained from forecastchart.com. U.S inflation rate represent the level of economic activities in the United States. Nominal oil price is taken as an index in U.S dollar price for the U.K Brent crude oil was obtained from IMF.

Brent spot prices are used to represent the international crude-oil market since they usually serve as reference prices for pricing crude oil and many other derivatives products using oil as underlying asset. Nigeria average dividend ratio was obtained from the SEC statistical bulletin.

The variables included in the SVAR model are, Nigerian average dividend ratio (representing the returns investors receive on their portfolio holding), Brent Crude oil price (representing International crude oil price volatility), S&P 500 volatility index (representing the global market index and the U.S inflation rate. Basically, the model consists of three foreign variables and one domestic variable.

We begin by analyzing the time series of volatility. We use standard deviation as a proxy for variability in stock prices. As a first step, we calculate returns using logarithmic method as follows:

$$r_t = \text{Ln} (I_t/I_{t-1}) \dots\dots\dots(1)$$

Where, r_t and I_t indicate return and index value of security prices at time 't'.

Ln is the napierian logarithm. Equation 1 above is designed to estimate the quarterly volatility. The next step in estimating the volatility is to compute the average value of the returns,

$$\bar{R} = \frac{1}{n} \sum_{i=1}^n R_i , \dots\dots\dots(2)$$

where n is once again the number of returns, 365. If the volatility is v for one unit of time, then the volatility for t units of time is $v\sqrt{t}$. Thus we go from quarterly volatility to annual volatility by multiplying by 2 and we go from annual volatility to daily volatility by multiplying by $\sqrt{\frac{1}{252}}$.

The standard deviation, which is the measure of risk is used to estimate volatility,

$$\sigma = \frac{1}{\sqrt{dt}} \sqrt{\frac{1}{n-1} \sum_{i=1}^n (R_i - \bar{R})^2} \dots\dots\dots(3)$$

Before estimating the main model the study shall conduct a preliminary check on the variables to ascertain their validity. Augmented Dickey-Fuller (ADF hereafter) test (Dickey and Fuller, 1979, 1981) and the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS hereafter) test (Kwiatkowski et al., 1992) have been employed to investigate the degree of integration of the variables used in the empirical analysis. The study will test the blocked-exogenous restriction in other to check the validity of the assumption that domestic economy cannot influence the foreign economy. Jarque-Bera normality test will be applied to check if the residuals are normal, stationary and not autocorrelated.

Methodology

An assumptions usually held in literatures concerning international spillover effect is that the shock experienced in small open economies does not exert severe impact on major foreign economies, therefore, the foreign variables such as BNT, SP500, US_{inf} will be treated as exogenous to domestic economic variables.

To describe the reduced form of the VAR system for a small open economy, the first set of the variable Z_t is divided into two blocks as shownby Cushman and Zha (1997) and Zha (1996)

$$\begin{aligned} Z_{1,t} &= (\text{ADR}) \\ Z_{2,t} &= (\text{BNT}, \text{US}_{\text{inf}}, \text{SP500}) \end{aligned}$$

Where Z_{1,t} represent the domestic block and Z_{2,t} represents the foreign block. The VAR model is specified as follows

$$Z_t = \begin{bmatrix} Z_{1,t} \\ Z_{2,t} \end{bmatrix} \quad B(L) = \begin{bmatrix} B_{11}(L) & B_{12}(L) \\ B_{21}(L) & B_{22}(L) \end{bmatrix} \quad et = \begin{bmatrix} e_{1,t} \\ e_{2,t} \end{bmatrix}$$

The two block $B_{11}(L)$ and $B_{21}(L)$ contains the coefficients of foreign economy, while $B_{21}(L)$ and $B_{22}(L)$ contains the coefficients of the domestic economy.

The reduced form of the SVAR model is usually orthogonalized by applying the Cholesky decomposition. The Cholesky ordering allows the external variables in the model to be preceded by the domestic variables, following the assumption that shock experienced in small open economies does not exert severe impact on major foreign economies. This means that shock to Z_{1t} does not affect or spillover to Z_{2t} , restriction is imposed such that $B_{21}(L) = 0$. This is the block-exogeneity restrictions which implies that Z_{1t} block is exogenous to Z_{2t} block. Furthermore, block-exogeneity is imposed by excluding all domestic variables from the foreign block of both contemporaneously and the lag structure of the reduced form VAR. The recursive SVAR assumes that all the correlations between errors are assigned to the equation that is the earliest in the ordering, which mean that a shock to domestic variables cannot affect contemporaneously the world variables.

The inclusion of US_{inf} in the model follows the explanation posited by Doepke and Schneider (2006) that since unexpected inflation reduces the real value of nominal claims held by investors and thus aid the redistribution of wealth from lenders to borrowers. Therefore, the dynamic interaction might be biased if any variable (such as US inflation crisis), which affects both oil prices and global stock returns in the short-run, is omitted. In order to avoid such a consequence, we will specify a model that will present a disentangled result of the influence of US inflationary crisis on domestic stock returns with that that doesn't.

Sensitivity Analysis

Before investigating the effect of volatility transmission on the stock market, it was necessary to examine the stochastic properties of the series considered in the model by analyzing their order of integration on the basis of a series of unit root tests. The stationarity of the variables was examined using Augmented Dickey-Fuller (ADF) and KPSS unit root test. The result in table 1 revealed that all the variables were stationary at level differencing using 5% level of significance indicating that there exists no unit root amongst the variable.

The study tested the stability of the unrestricted VAR model. The stability test was aimed at finding out whether the residuals were normal, stationary and devoid of autocorrelation.

The result of the stability test presented in Table 2 and figure 1 shows that no root lies outside the unit circle, that is, the value of the AR root model were smaller than one. The VAR residual serial correlation LM test in Table 3 revealed the absence of serial correlation, meaning that the null hypothesis of no autocorrelation cannot be rejected. The result of the normality test presented in table 4 rejects the hypothesis of normality properties since the joint p-values of skewness, kurtosis and Jarque-Bera are 0.000, 0.0027 and 0.000 respectively. Thus, the result further confirms that our VAR model has a normal distribution.

The result of lag length selection criteria is presented in table 5. The Schwartz Criterion (SC) suggested that the lag length be zero, the Likelihood Ratio (LR) criterion, Hannan Quinn (HQ) information criterion, Akaike Information Criterion (AIC) and the FPE criterion all suggested that the lag length as 2. Since the sample size for our model is small, we will therefore select 2 for the lag length of the VAR as suggested by the AIC, FPE, LR, and the HQ criteria.

Table 6 presents summary of descriptive statistics for S& P 500, Brent Crude oil price, and Average Dividend Return on stock market. The result shows that mean returns for SP500, BRNT, US_{inf} and AVDR are all positive. In comparing the Nigeria and UK stock prices, the result shows that the standard deviation for SP500 (0.40) is higher than the Nigeria Stock returns (0.09) which indicate that there is higher volatility in the UK stock prices than in the Nigeria stock market. The measures for skewness and excess kurtosis indicate that the distributions of returns from the markets are positively skewed and leptokurtic relative to non-normal distribution. The measure of skewness which is larger in AVDR than SP500 reveals that the returns from the Nigerian stock market (AVDR) are larger than the returns from the U.K stock (SP500). This result explains why there appear to a greater surge of portfolio investment in the emerging markets where large positive returns are more frequent than large negative returns. The Jarque Bera (denoted by JB) statistic rejects normality at 1% level of significance in all cases. Excessive kurtosis also explain the reasoning for high Jarque-Bera statistics, which reject the null hypothesis of normality for all return series

Table 7 presents the correlation matrix result. The result reveal that both Brent Crude oil price (BRNT and Standard and Poor 500 volatility index were negatively correlated with Average Dividend return (AVDR) , while U.S inflation rate (US_{inf}) was positively correlated with Average Dividend return (AVDR).

The result shows that volatility in U.K stock prices (SP500) and International oil prices (BRNT) has a negative impact on dividend returns in the Nigeria stock market.

The Block Exogeneity Wald Test was used to test (a) the joint significance of each of the other lagged endogenous variables in the equation (b) the joint significance of the other entire lagged endogenous variable in each equation. The results in table 8 reveal that Average Dividend returns does not granger cause BRNT, SP500 and US_{inf} since their joint p-values of 0.1579, 0.8306 and 0.3072 respectively were not significant at 0.05 per cent level. This result shows that the null hypothesis (that the lagged coefficients of BRNT, SP500 and US_{inf} which is not equal to zero) can be rejected. The rejection of the null hypothesis confirms that small open economies do not granger cause external economies. Furthermore, since from the result of the joint probabilities of BRNT, SP500 and US_{inf} (which is 0.0542) is significant at 0.05 per cent, the result therefore suggest that the null hypothesis of BRNT, SP500 and US_{inf} being equal to zero cannot be rejected. The rejection of the block exogeneity of BRNT, SP500 and US_{inf} indicate that these variables can be treated as purely exogenous in the model. Furthermore, the Wald test reveals that there exists a unidirectional causality that runs from U.K volatility index (SP500), International oil price (BRNT) and U.S inflation (US_{inf}) to stock returns in Nigeria.

Having satisfied the preliminary conditions for conducting the SVAR analysis using the various test (unit root, stability, autocorrelation and normality) the study proceeded to conduct the innovation analysis

Innovation Analysis

Innovation analysis shall be performed with the impulse response function and variance decomposition test. Impulse response functions are dynamic simulations showing the response of an endogenous variable over time to a given shock. The purpose of impulse response function in VAR analysis is to examine the dynamic response of the system when the model receives an impulse. Thus, the impulse response function will enable us to assess how the volatility of stock prices is transmitted from one market to another market. Figure 2 presents the impulse response result. Shock 1 refers to International oil price shocks (BRNT), shock 2 refers to U.S inflationary shock (US_{inf}), shock 3 refers to U.K stock prices shock (SP500) while shock 4 refers to the Nigerian stock returns shock (AVDR).

The result shows the Nigerian stock returns respond negatively to shocks from the International oil prices only in the 1st period. The effect of this shock frizzles out after the 2nd period and somewhat becomes positive at the 5th period. Changes in world oil prices do not exert a significance impact (either positive or negative) on domestic stock prices. This implies that returns from the Nigeria stock market are not seriously affect by changes in International oil prices. This result agrees with the result obtained by Kilian (2009) and Degiannakis, Filis and Kitzys (2013) who argued that changes in oil production do not affect the returns of stock prices. The explanation for the response of the Nigerian stock returns to shocks from International oil price could be that in the 1st period, the sudden increase in oil prices may catch firms off-guard and raise uncertainty about future cash flow. To overcome such uncertainty, firms quickly evolve effective hedging strategies which will reduce and shield firms from further effect of the adverse oil price movement (which are often caused by either supply or demand specific shocks). Degiannakis, Filis and Kitzys (2013) have shown that a positive aggregate oil demand shock (which could be regarded as increase in economic activity) could be regarded as good news to the stock market since it reduces uncertainty about future cash flows, driving down stock market volatility. However, in periods such as the recent Asian crisis witnessed in 1997 and Global financial crisis of 2008, Bloom (2009) argued that such negative news about the global economic activity raises uncertainty about the stability of the markets and thus increases stock market volatility.

It is also observed that stock returns response negatively to shocks from the U.S inflation rate in the 1st period and deeps down further until the 3th period when it begins to rise again and flattens out at the 4th period. It is observable that innovations from U.S inflation do not exert any significant positive effect, but rather a negative effect on stock returns in Nigeria. This result confirms the poor inflation hedging characteristics of stock markets. This result confirms the opinion held by Caldas and Terra (2011) that active monetary management by the Central Banks does not have an effect over asset prices and raises further concern whether monetary authorities should continue not to take such effect into account when outlining monetary policies.

The result of the variance decomposition is presented in Figure 2. Variance decomposition measures the proportion of forecast error variance in one variable explained by innovations in itself and the other variables.

Each percentage shows how much of the unanticipated changes of real stock returns are explained by the variable indicated over a 10 months horizon.

Wherein Shock 1 refers to International oil price shocks (BRNT), shock 2 refers to U.S inflationary shock (USinf), shock 3 refers to U.K stock prices shock (SP500) while shock 4 refers to the Nigerian stock returns shock (AVDR). The result shows that in the first period AVDR does not respond to shock that arises from BRNT. However, the impact of the variation that arises from shock in BRNT begins to bear on AVDR in the 2nd period, as 15% percent variation in BRNT is explained by the variation in BRNT. The impact of oil price shock on dividend yield remains marginally constant at 14 percent over the remaining period.

The effect of US_{inf} variation on Dividend yield in Nigeria is remarkably different from the effect observed in S&P 500. Whereas US_{inf} accounts for a 1% variation in S&P 500 in the 3rd period and 5% variation in the 5th period, US_{inf} accounts for 6% variation in dividend yield in the 3rd period and a further 11% and 12% variation in the 4th and 6th period. The result shows that US_{inf} exerts greater spillover effect on dividend yield in Nigeria than it does to S&P 500 in U.K. Furthermore, the spillover effect of US_{inf} on stock returns in Nigeria increases as long as the inflation remains. This result confirms the previous result obtained by Doepke and Schneider (2006) asserting that spillover effect of inflation reduces the nominal claim by investors over time.

From our result it is apparent that shock in AVDR accounts for 29%, 27% and 25% variation in S&P 500 in the 1st, 2nd and 3rd periods. Given the global integration of stock markets, the assumption that shock experienced in small open economies does not exert severe impact on major foreign economies does not seem to be proven in this work. The result obtained in this study reveal that when emerging countries (such as Nigeria) experience some form of shocks in her domestic markets, such shock severely affect the decision to hold portfolio of investment in financial assets by foreign portfolio investors. Disturbances experienced by domestic markets have severe contemporaneous effect on global stock markets returns. Thus, the variance decomposition result suggest that shocks to domestic markets are a significant source of volatility in global market returns and are a prime factor when considering portfolio investment, particularly, in emerging markets.

Conclusion

This study investigates the transmission effect of international oil prices on stock return volatility in the Nigeria stock market using annual data from 1980 - 2010.

Preliminary sensitivity analysis were carried out in other to examine the stochastic properties of the series considered in the model by analyzing their order of integration on the basis of a series of unit root tests and the stability of the unrestricted VAR model. The result of the unit root test indicates that all the variables were stationary at their levels. The stability test which was aimed at finding out whether the residuals were normal, stationary and devoid of autocorrelation revealed that no root lies outside the unite circle, that is, the value of the AR root model were smaller than one. The VAR residual serial correlation LM test revealed the absence of serial correlation, meaning that the null hypothesis of no autocorrelation cannot be rejected.

In order to account for the transmission effect between the markets, the standard Structural unrestricted VAR (SVAR) model was adopted since it measures the effect of volatility transmission between the small open economies and major foreign economies. The result of the impulse response function revealed that the Nigerian stock return is slow to respond to shock from international oil price. Although the respond is positive in the 2nd month and runs through the 4th month, the effect frizzles out and then becomes negative in the 6th month. Changes in world oil prices do not exert an immediate significance impact on dividend yield in the short term, but does exert a positive effect on the long run. The variance decomposition result suggests that energy prices can affect the present value of the discounted stream of dividend payment. In the short run, the firms believe that the increase in energy prices would frizzle out soon. But with the increase in energy price oil lasting longer than necessary, the uncertainty about the product demand increases, such that the firm experiences a higher cost in production provoking a delay in implementing investment decisions in capital equipment. The higher cost of production reduces the income stream of the firms (particularly, firms that depend heavily on oil products for their production) and thus raises uncertainty about the future returns on the firm's investment.

In the same vein, the Nigeria stock market responds gradually to shock arising from variation in the US inflation level. The result suggests that dividend yield is not affected by US inflationary shock until the 2nd month when it responds negatively up till the 4th month. This result confirms that US inflationary spillover exert a negative impact on the domestic market in Nigeria. Economic downturn arising from dwindling foreign global economic activity raises uncertainty about the stability of the markets and thus increases stock market volatility. This result confirms the emerging markets (such as Nigeria) are poorly insulated from inflationary spillover. Thus, active monetary management policy by the Central Bank will required to shield the stock market from such inflationary spillover. This study confirms the opinion held by Caldas and Terra (2011) that active monetary management by the Central Banks does not have an effect over asset prices. The study therefore suggests that, in other to shield the stock market and protect stock investors returns from inflationary spillover, monetary authorities should evolve monetary policies that will take such effect into account

The study debunks the assumption held by financial economist that small open economies does not affect major foreign economies. This assumption does not seem to hold regarding the Nigeria stock market. In this study it was observed that disturbances experienced by domestic markets have severe contemporaneous effect on global stock markets returns. Thus, small open domestic markets are a significant source of volatility in global market returns and are a prime factor when considering portfolio investment, particularly, in emerging markets. Therefore, insulating the emerging markets from the spillover effect from large foreign economies will ensure the stability of these emerging markets and enhance stronger market integration.

This research has two important connotations. First, on investor portfolio formation and trading decisions, market participants should be aware of the dynamic relationships and integration that exist between international stock markets and local market performance. Domestic stock returns are vulnerably exposed to volatility from inflationary spillover and energy prices. Secondly, international portfolio diversification and trading decision by foreign investors into the local markets could result in decrease stock returns if proper effective hedging strategies are not adopted, particularly, during crisis periods. Withdrawal/reduction of foreign portfolio investment in domestic markets arising from uncertainty in the stability of such market has far reaching consequences on dividend yield of firms.

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Table 1 Unit Root Test

Variables	Augmented Dickey Fuller Test			Kwiatkowski-Phillips-Schmidt-S		
	Levels	Remark	Stationarity	Levels	Remark	Stationarity
BRNT	-3.243163	Has unit root	1(0)	0.413651	Stationary	1(0)
AVDR	-5.599770	Has unit root	1(0)	0.445065	Stationary	1(0)
SP500	-4.6682209	Has unit root	1(0)	0.214650	Stationary	1(0)
USinf	-3.513712	Has unit root	1(0)	0.337315	Stationary	1(0)

Critical value of ADF statistics at 5 percent level of significance was -2.967767

Critical value of KPSS statistics at 5 percent level of significance was 0.463000

Table 2: Residual Test

Roots of Characteristic Polynomial
 Endogenous variables: BRNT USINF SP500 AVDR
 Exogenous variables: C
 Lag specification: 1 2
 Date: 01/16/14 Time: 21:37

Root	Modulus
-0.784059	0.784059
0.263462 - 0.692942i	0.741337
0.263462 + 0.692942i	0.741337
0.634728	0.634728
-0.095971 - 0.573607i	0.581580
-0.095971 + 0.573607i	0.581580
-0.022121 - 0.329817i	0.330558
-0.022121 + 0.329817i	0.330558

No root lies outside the unit circle.
 VAR satisfies the stability condition.

Figure 1 AR Root Test

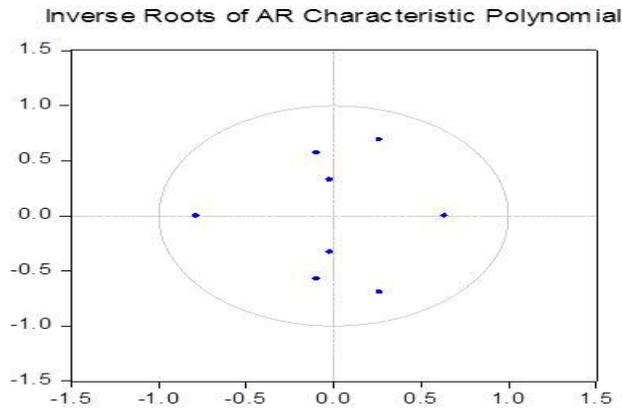


Table 3: Serial Correlation Test

VAR Residual Serial Correlation LM Tests
 Null Hypothesis: no serial correlation at lag order h
 Date: 01/16/14 Time: 21:45
 Sample: 1981 2010
 Included observations: 28

Lags	LM-Stat	Prob
1	16.18975	0.4398
2	19.91518	0.2241
3	14.41201	0.5680
4	19.36901	0.2500
5	27.79933	0.0334
6	15.84668	0.4637
7	5.620780	0.9917
8	16.63888	0.4093
9	13.24476	0.6548
10	9.991100	0.8671
11	14.11893	0.5899
12	25.40578	0.0630

Probs from chi-square with 16 df.

Table 4. VAR normality test

VAR Residual Normality Tests
 Orthogonalization: Cholesky (Lutkepohl)
 Null Hypothesis: residuals are multivariate normal
 Date: 01/16/14 Time: 21:46
 Sample: 1981 2010
 Included observations: 28

Component	Skewness	Chi-sq	df	Prob.
1	0.553548	1.429937	1	0.2318
2	1.193960	6.652526	1	0.0099
3	1.741175	14.14788	1	0.0002
4	1.087782	5.521928	1	0.0188
Joint		27.75227	4	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	2.711727	0.096951	1	0.7555
2	3.790019	0.728151	1	0.3935
3	6.404533	13.52265	1	0.0002
4	4.274261	1.894365	1	0.1687
Joint		16.24212	4	0.0027

Component	Jarque-Bera	df	Prob.
1	1.526889	2	0.4661
2	7.380677	2	0.0250
3	27.67053	2	0.0000
4	7.416293	2	0.0245
Joint	43.99439	8	0.0000

Table 5 Lag Order Selection Criteria

VAR Lag Order Selection Criteria
 Endogenous variables: BRNT SP500 AVDR USINF
 Exogenous variables: C
 Date: 01/16/14 Time: 20:19
 Sample: 1981 2010
 Included observations: 27

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-43.20949	NA	0.000388	3.496999	3.688975*	3.554084
1	-35.73847	12.17500	0.000743	4.128775	5.088654	4.414198
2	-3.352677	43.18105*	0.000241*	2.915013*	4.642796	3.428773*
3	11.81842	15.73299	0.000326	2.976413	5.472099	3.718511

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Table 6 Descriptive Analysis

	BRNT	SP500	AVDR	USINF
Mean	0.064938	0.434956	0.044959	0.136429
Median	0.029768	0.325177	0.007436	0.065737
Maximum	0.324179	1.842282	0.480453	0.921812
Minimum	4.00E-05	0.014551	0.000198	0.000000
Std. Dev.	0.084509	0.402327	0.096403	0.195980
Skewness	1.594481	1.524121	3.404736	2.495766
Kurtosis	4.662814	5.937107	15.18143	9.760175
Jarque-Bera Probability	16.16803 0.000308	22.39796 0.000014	243.4452 0.000000	88.26919 0.000000
Sum	1.948148	13.04867	1.348765	4.092857
Sum Sq. Dev.	0.207113	4.694149	0.269510	1.113841
Observations	30	30	30	30

Table 7: Correlation Result

	BRNT	SP500	AVDR	USINF
BRNT	1	-0.419752	-0.127962	0.218266
SP500	-0.419752	1	-0.012654	0.053822
AVDR	-0.127962	-0.012654	1	0.168045
USINF	0.218266	0.053822	0.168045	1

Table 8: Block Exogeneity Wald Test

VAR Granger Causality/Block Exogeneity Wald Tests

Date: 01/16/14 Time: 21:44

Sample: 1981 2010

Included observations: 28

Dependent variable: BRNT

Excluded	Chi-sq	df	Prob.
USINF	1.189248	2	0.5518
SP500	0.033181	2	0.9835
AVDR	5.699416	2	0.1579
All	9.735010	6	0.1363

Dependent variable: AVDR

Excluded	Chi-sq	df	Prob.
BRNT	9.500241	2	0.0087
SP500	1.856070	2	0.3953
USINF	1.770358	2	0.4126
All	11.90270	6	0.0542

Dependent variable: SP500

Excluded	Chi-sq	df	Prob.
BRNT	0.124765	2	0.9395
USINF	0.344444	2	0.8418
AVDR	0.371203	2	0.8306
All	0.809940	6	0.9918

Dependent variable: USINF

Excluded	Chi-sq	df	Prob.
BRNT	0.264619	2	0.8761
AVDR	2.003930	2	0.3672
SP500	0.312810	2	0.8552
All	2.406289	6	0.8788

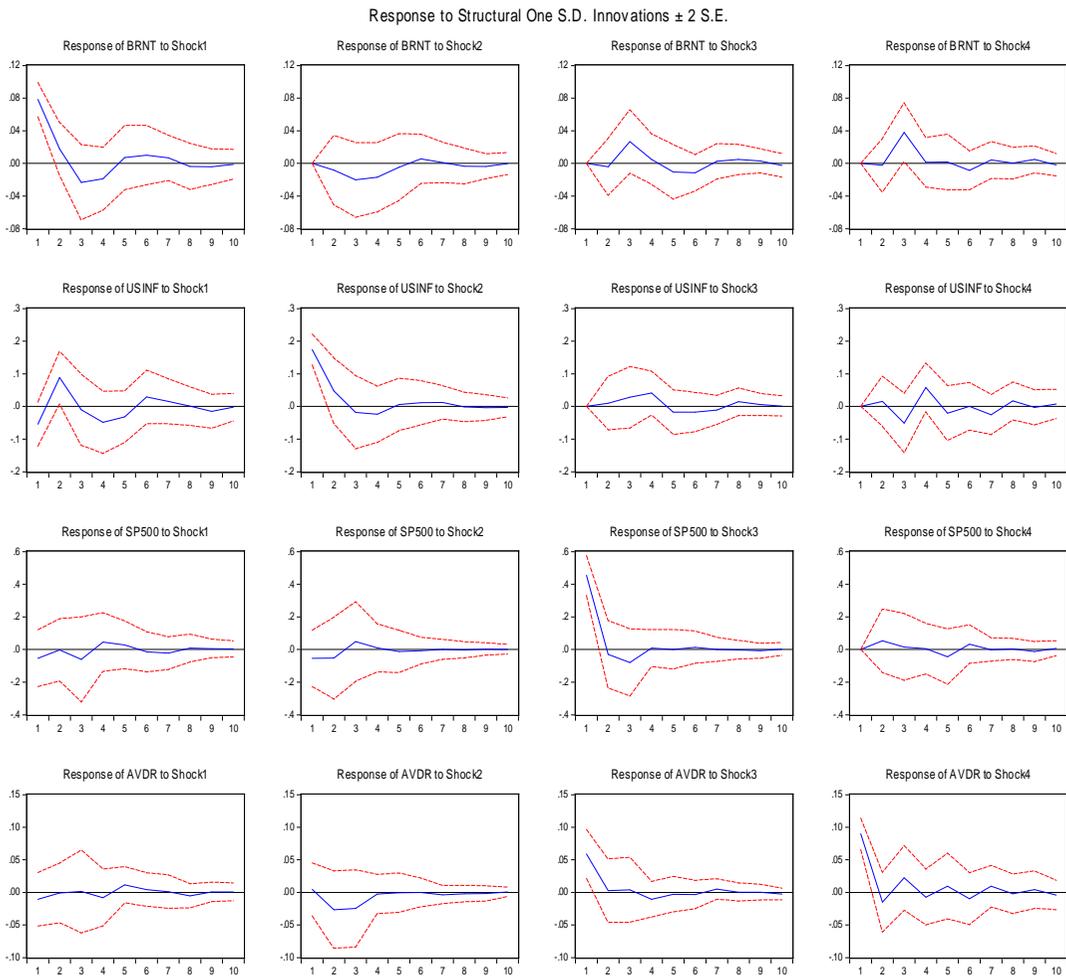


Figure 3. Result of Impulse Response Function

Figure 4: Result of Variance Decomposition Analysis

Variance Decomposition of BRNT:					
Period	S.E.	Shock1	Shock2	Shock3	Shock4
1	0.078286	100.0000	0.000000	0.000000	0.000000
3	0.098233	72.37530	4.986152	7.526541	15.11201
6	0.104188	69.04289	7.602843	9.196701	14.15757
9	0.105058	68.60013	7.713060	9.391324	14.29548

Variance Decomposition of USINF					
Period	S.E.	Shock1	Shock2	Shock3	Shock4
1	0.183021	8.870309	91.12969	0.000000	0.000000
3	0.218506	22.76897	69.34675	1.868412	6.015875
6	0.242520	25.68593	57.56610	5.416501	11.33147
9	0.246419	25.62900	56.03854	5.833318	12.49914

Variance Decomposition of SP500					
Period	S.E.	Shock1	Shock2	Shock3	Shock4
1	0.461458	1.343229	1.394046	97.26273	0.000000
3	0.481902	2.837787	3.489330	92.36893	1.303952
6	0.488866	4.051293	3.517506	89.86410	2.567102
9	0.489776	4.296346	3.511249	89.56007	2.632332

Variance Decomposition of AVDR:					
Period	S.E.	Shock1	Shock2	Shock3	Shock4
1	0.108373	0.956631	0.185709	29.78781	69.06985
3	0.117516	0.832768	9.702651	25.48822	63.97636
6	0.119979	2.278536	9.349482	25.36159	63.01039
9	0.120754	2.450483	9.366912	25.22284	62.95977

Factorization:
Structural
