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## POLICY RESPONSE TO COMMODITY PRICE FLUCTUATIONS: THE CASE OF NIGERIA<sup>1</sup>

Magnus O. Abeng\* & Margaret J. Hilili

### Abstract

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*Commodity price shocks have, over the years, posed major challenges for the conduct of monetary policy and economic management in Nigeria. Several studies dedicated to investigating these phenomena had focused only on oil price (Nigeria's major commodity) with little or no attention to food price shock. In this study, however, the effect of food price shocks on some selected macroeconomic indicators is examined, in addition to oil price shock using the structural autoregressive (SVAR) model. Evidence from the results show that exchange rate and interest rate responses to net oil and food price shocks is negative, while inflation response is mixed. The contribution to the variation in the macroeconomic variables by oil price shocks is found to be more profound compared with food price shock. Further evidence identified the exchange rate channel as the dominant channel for the transmission of both oil and food price shocks to the domestic economy. This is followed by interest rate and stock returns channels, in the cases of oil and food price shocks, respectively. This intuitively suggests the prioritisation of these channels in the design and conduct of monetary policy, if the monetary authority has to deliver on the 'price stability' and 'stable exchange rate' mandate for inclusive and sustainable growth.*

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**Key words:** Monetary Policy, Impulse Response, Commodity prices, SVAR

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## INTRODUCTION

The two major episodes of energy crises of 1973 and 1979 brought to the fore the critical influence and effect of commodity prices, especially crude oil price shocks, on the activities of the real economy. The crises engendered series of research interests, pioneered by Hamilton (1983) who, alongside Frankel (1984), Mork (1989), Jones and Kaul (1996), Balaz and Londarev (2006), Kilian (2008), and Rault and Arouri (2009) and many others, overwhelmingly attributed the associated inflationary pressures, high interest rate and sluggish output growth during the crisis episodes to oil price shocks and the prevailing monetary conditions. Fostered by the increasing complexity and sophistication in the management of the economies, policymakers became gradually apprehensive of the possible implications of these conclusions on the conduct of monetary policy.

Empirical literature on the relationship between commodity prices and monetary policy is replete, with several of these studies focused mainly on the US economy, albeit interspersed studies on other countries such as Japan (Hamori, 2007), Australia and Canada (Bloch et al, 2006) and South Africa (Ocran and Biepeke, 2007). In investigating the impact of commodity prices on monetary policy, Furlong (1989), and Cody and Mills (1991) highlighted the role that commodity prices play in inflation and output outcomes. According to Svensson (2005) and Anzuini, Lombardi and Pagano (2013), developments in commodity prices, especially oil and food prices, are critical in the conduct of monetary policy. Garner (1985), Boughton and Branson (1988) and Polley and Iombra (1999), argue that though commodity prices provide useful information that track movements in the general domestic prices, such movements nevertheless do not influence the conduct of monetary policy, especially as they are exogenously determined and are beyond the purview of the central bank.

While a large body of literature supports this postulation, Barsky and Kilian (2002); Frankel (2007); Kilian (2008); and Hamilton (2009), however, argue in the contrary, stating a feedback mechanism exists between the prevailing monetary conditions and the trajectory of commodity prices, citing the 1973 oil crisis to buttress their finding. According to them, this is especially applicable to the advanced economies, where sophisticated financial institutions give their monetary policy actions the ability to influence global commodity prices. However, for small open economies that are price-takers, the conduct of monetary policy exerts little or no influence on the international prices of commodities. Instead, monetary policy rather responds to changes in global commodity prices.

Whereas literature on the impact of crude oil price movements on the Nigerian economy are on the increase (Akpan, 2009; Mordi and Adebisi, 2010; and Iwayemi and Fowowe, 2011), the implications of rising prices of other commodities such as food has not received much research attention. The need to consider the impact of the movements in global food prices, in addition to oil price, is borne by the observed decline in domestic food production, and the rising import bill for food products over the years as government resort to food importation to bridge the widening supply gap. For instance, Nigeria's import bill for food products has remained high over the years despite government intensified efforts at improving local food production. During the period 2008 - 2015, the CBN (2015) reported Nigeria's total food import at US\$34.0 billion, representing an average of 16.4 per cent of total visible imports. Food import recorded 11.3 percent increase from US\$3.9 billion in 2008 to US\$4.8 billion in 2010 and later peaked at US\$5.4 billion in 2012 but moderated marginally by 7.4 percent, to US\$5.0 billion in 2014. This has implications for domestic prices, and by extension, the conduct of monetary policy. The persistent increase in food import is attributed to several factors including government's lack of commitment to sustainable food security and the pervading insecurity and insurgency that had led to the displacement of a huge proportion of the productive population. Given the quantum of imports, this raises the probability of imported inflation into the economy especially as the food component currently accounted for about half of the consumer price index basket.

This study follows the small open economy argument that monetary policy responds to, rather than, influence commodity prices. Accordingly, the paper investigates how interest rate, inflation, exchange rate and market returns respond to the trajectory in commodity prices (oil and food) for Nigeria. The motivation is premised on the fact that so much has been assumed about the implicit or explicit effect of high food import bills, the magnitude and direction of which are yet to be empirically determined. It is expected that extending the analysis of commodity prices beyond oil prices to include the effects of food prices would not only enhance the conduct of monetary policy but also establish the dominant channels of monetary policy transmission mechanism in the Nigerian economy.

In an attempt to measure the response of monetary policy to commodity price shocks for Nigeria from 1998 to 2016, this study employs the structural vector autoregressive (SVAR) framework. The choice of the sample period covers the implementation of indirect monetary policy regime introduced in 1993, and coincided with several episodes of expansion and contractions in commodity prices, as well as policy shifts in the system (Barsky and Kilian 2004). The rest of the paper is organized as follows: Section two reviews related literature, while the data and methodology are presented in sections three and four, respectively. Analysis of structural parameters, impulse response and forecast error variance decompositions are the focus of section five. While section six discusses policy implications, section seven concludes and makes recommendations.

## **LITERATURE REVIEW**

Empirical literature on the relationship between oil and food prices and monetary policy is replete especially in the early 1980s. However, most of these studies, focused principally on the US and other advanced economies, and concentrated on oil price and macroeconomic relationship. Findings from these studies are mixed owing largely to difference in methodologies and heterogeneous economic fundamentals of the economies examined. For instance, in examining the impact of oil prices on economic activities in the US during the period 1948 to 1980, Hamilton (1983), found strong correlation between oil price and economic growth, attributing the successive recessions in the US after the World War II to oil price changes. Subsequent studies by Geisser and Goodwin (1986), Mork (1989), Lee et al. (1995), Hooker (1996), Hamilton (1996, 2003) all align with Hamilton (1983) early findings of a negative impact of oil price changes on the GDP of the USA. Blanchard and Gali (2007) attribute the generally negative relationship to the lack of concurrent adverse shock with recent oil shocks, smaller share of oil in production, more flexible labour markets and improved monetary policy. For the economies of the US, UK, Germany and Norway, Bjornland (2000) shows that oil price shock maintains negative relationships with GDP for all countries, except Norway. The findings of Cunado and Gracia (2003) for some European countries also were not different as oil price posted negative effects on overall economic activities, even though mixed results were obtained for different countries.

In contrast, Hooker (1996), Segal (2007) and Kilian (2009) contend that oil price no longer granger cause many macroeconomic variables in the US especially after 1973 and as such oil price shock was no longer a shock given that its effect on the macroeconomy is minuscule. Extending the argument of the insignificance of oil price shock, Kilian (2009) claim oil price change not to be a cause but rather a symptom. The paper cautioned monetary policymakers to rather respond directly to the underlying demand and supply shocks that affect real oil price and other macroeconomic variables instead of oil price changes. Given the mixed findings, Bodenstein, Guerrieri and Kilian (2012) suggest that the best central bank policy response to changes in oil price should depend on the reasons for the change in crude oil prices. Hence, policymakers need to disentangle the demand and supply shocks components and adapt monetary policy response to the observed mix of shocks.

Literature that considers the issue from other jurisdictions is also growing. For instance, for the Chinese economy, Lescaroux and Mignon (2009) found a positive relationship between oil price and CPI, PPI

and interest rates but a negative impact on output, consumption and investment. Tang, Wu and Zhang (2010), using the SVAR approach, found oil price shock exerting a negative effect on the macroeconomy. In Japan, the study by Zhang and Reed (2008) showed the existence of asymmetric effects of oil price shocks to economic growth.

Khan and Ahmed (2011) examine the impact of global food and oil price shocks and their transmission channel on inflation rate, output, money balances, interest rate and real effective exchange rate for Pakistan. The results suggest that oil price shocks negatively affect industrial production, appreciates real effective exchange rate and positively affect inflation and interest rate. Real effective exchange rate, however, has the dominant source of variations in the Pakistani economy.

Alom (2011) examines the economic effects of oil and food price shocks in selected Asia and Pacific countries, including Australia, New Zealand, South Korea, Singapore, Hong Kong, Taiwan, India and Thailand using the SVAR framework and quarterly data covering 1980 to 2010. The findings show that international oil price largely affects resource-poor countries (Korea and Taiwan), having specialized heavy manufacturing industries. Oil price shock had a negative effect on industrial output growth and exchange rate and a positive effect on inflation and interest rates. On the other hand, the oil-poor natural resource-rich nations of Australia, Thailand and New Zealand, were not affected by oil price shocks. Only exchange rates are affected by oil price shocks in these countries. Also India, with specialized international financial services but limited reserves of oil was not affected by oil price shock. Furthermore, limited impact of food prices were recorded for India, Korea and Thailand in terms of industrial output, inflation and interest rate. The major impact of food prices was that it helped depreciate real effective exchange rate for almost all the countries, except Singapore.

Galesi and Lombardi (2009) show that oil and food price shocks have varying inflationary effects. Their findings reveal that inflationary effects of oil price mainly affects developed countries, while food price shocks only affects emerging economies. The concern of whether or not food price shocks are beneficial or detrimental for net importers was examined by Aksoy and Ng (2008). The study showed mixed results indicating that while for low income countries, food price shocks worsened the food trade balances, for middle income countries, the trade balances improved as a result of food price shocks. Other studies, such as Von Braun (2008), have also shown that net food importing countries were highly vulnerable to increased food prices. Alley et al. (2014) equally used the General Method of Moment (GMM) to show that oil price increase has a significant positive effect on economic growth, specifically for oil exporting countries. However, none of these studies, to the best of our knowledge had considered the impact of world food price increase on Nigeria. This served as the motivation for this study.

For Nigeria, attempts have also been made to examine the macroeconomic effect of oil price shock on the economy. Using a structural vector autoregressive (SVAR) model, ThankGod and Maxwell (2013) analysed the direct effects of oil price shocks on the economy and the reaction of monetary variables to external shocks for the 1970 – 2010 period. The paper finds evidence of long-run relationship among oil price, inflation rate, treasury bills rate, exchange rate, interest rate and money supply. In particular, an unexpected oil price shock was found to follow an increase in inflation rate and a decline in exchange rate and interest rate.

Findings by Olomola (2006) were mixed. While oil price shocks were not observed to exert significant effect on output and inflation in Nigeria, which is contrary to earlier findings, real exchange rate was strongly impacted. Mordi and Adebisi (2010) similarly used monthly data spanning 1999:01 to 2008:12 to show that the impact of oil price shocks on output and prices is asymmetric in nature; with the impact of oil price decrease being significantly greater than oil price increase. In addition, oil price was found

to significantly influence variation in output and prices. Alley et al. (2014) used the General Method of Moment (GMM) technique to examine the impact of oil price shocks on the oil-exporting economy of Nigeria. The study finds oil price increase having significant positive effect on economic growth.

### Data and Variable Definition

Monthly data used in the model are prime lending rate and exchange rate sourced from the Central Bank of Nigeria statistical bulletin, consumer price index (CPI) obtained from National Bureau of Statistics (NBS), all share index (ASI) sourced from the Nigerian Stock Exchange, world oil price, proxied by Nigeria's Bonny light measured in US dollars per barrel and collected from Reuters and world food price index from the Food and Agricultural Organization with 2002-2004=100. The data span from January 1998 to December 2014 covering about 204 observations. Monthly series are considered to contain more information than lower frequency data and more appropriate in the description of monetary policy stance (Basher and Sadorsky, 2006). The selection of variables was guided by the need to capture the effect of world oil and food price shocks on key economic indicators such as inflation (real sector channel), interest rate (monetary sector influence) and exchange rate (external impact or channel). Stock price index is also included in the model to measure the financial sector response to these shocks. Oil price and food price index are included in the model to control for imported inflation, the effect of which we are interested in recovering.

In the literature different approaches and data transformation processes have been employed in measuring the effect of oil and food price shocks on the macroeconomy. The overwhelming consensus of most studies had been that the effect of oil price shock is asymmetric and vary across time and countries (see Darby, 1982; Burbidge and Harrison, 1984, Mork, 1989; and Hooker, 1996). In demonstrating the asymmetric relationship for the US economy, using a six-variable quarterly VAR, Mork (1989) showed that a decrease in oil price do not necessarily induce a positive effect of equal magnitude in output as increases in oil price. The paper computed the asymmetric rate of change of oil and food prices as

$$op_t^* = op_t, \text{ if } op_t > 0 \text{ or } 0 \text{ otherwise} \quad (1)$$

and

$$fp_t^* = fp_t, \text{ if } fp_t > 0 \text{ or } 0 \text{ otherwise} \quad (2)$$

Where:  $op$  and  $fp$  are contemporaneous oil and food prices, respectively.

Meanwhile Engle (1982), Bollerslev (1986), Bollerslev, et al (1988) and Lee, et al. (1995) used a GARCH representation to argue that since changes in oil price was transitory; such change will only have smaller effect when the computed component of conditional variances are large. Consequently, oil price change was separated into two regimes: the stable and the erratic environments and the GARCH (1, 1) process for oil constructed as follows

$$O_t = \alpha + \sum_{i=1}^k \beta_i O_{t-i} + \varepsilon_t \quad (3)$$

$$\varepsilon_t = e_t \sqrt{h_t} \quad e_t \approx N(0,1) \quad (\text{erratic component})$$

$$h_t = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 h_{t-1} \quad (\text{stable component})$$

$$o_t^* = \max(o, \frac{\hat{\varepsilon}_t}{\sqrt{h_t}})$$

Hamilton (1996) criticizes the data generating processes of this approach, which according to him, led to unsatisfactory results that were not in consonance with the observed economic performance. Instead, he suggested that for a more reliable measure of the impact of oil price increase on investment and consumer decisions, “it is more appropriate to compare the current price of oil with where it has been over the previous year rather than during the previous quarter alone” (p2) since oil price increases, particularly after 1986, had always been followed by oil price decreases. He referred to this concept as the net oil price increase (NOPI), defining it as the amount by which oil price in a given period is above its peak value over the previous year. NOPI is computed as the maximum of (a) zero, and (b) the difference between the current price log-level and the maximum value of oil price log-level during the previous year. This is expressed algebraically as

$$NOPI_t = \max[0, OP_t - \max(op_{t-1}, op_{t-2}, op_{t-3}, op_{t-4})] \quad (4)$$

Where  $op_{t-1} \dots op_{t-4}$  are the lagged values of percentage changes in oil prices for the four quarters. If the current value of oil price exceeds the previous four quarters' maximum, NOPI becomes the percentage change over the previous year's maximum. If on the other hand, the current value is less than the maximum at some point in the previous four quarters, NOPI is defined as zero for that period.

In examining the impact of world oil and food prices on six key indicators in eight Asian and Pacific economies, selected on the basis of their oil consumption, economic growth, share in world GDP and economic openness, Alom (2011:21) employed all the previous data transformation approaches and specifications for oil and food prices. The study observed that Hamilton (1996) “models with net oil price index (NOPI), as proxy for oil price, and net food price index (NFPI), as proxy for food prices performed better than models that include other specifications”.

We, therefore, follow Hamilton (1996) and Alom (2011) to specify and derive our NOPI and NFPI as follows:

$$NOPI_t = \max[0, OP_t - \max(op_{t-1}, op_{t-2}, \dots, op_{t-12})] \quad (5)$$

and

$$NFPI_t = \max[0, FP_t - \max(fp_{t-1}, fp_{t-2}, \dots, fp_{t-12})] \quad (6)$$

All variables, except interest rate, enter the model in their growth form.

Since the interest of this paper is to evaluate the impact of oil and food prices on key macroeconomic variables, three SVAR models were estimated. The first and second models focus on oil price and food price index as exogenous variables, respectively, while the third model included both variables as exogenous shocks.

## METHODOLOGY

### Structural Var Specification and Identification

This paper applies the structural VAR to measure the impact of oil price and food price index on key economic indicators such as inflation, exchange rate, interest rate, and stock returns in the Nigerian economy, and how these outcomes influence the conduct of monetary policy. This choice is premised on the technique's flexibility to test for the nature of economic relationships as well as its ability to capture the dynamics among the variables in the system in the event of change induced by exogenous factors (global oil and food price changes). Variables in the model are linear functions of own lagged values and the lagged values of other variables. We order the identifying assumptions from the most exogenous variable (see Kilian, 2009; and Kilian and Park, 2009) from which the magnitude and direction of impulse response of the variables of interest to a one-time shock in commodity prices are tracked. The contribution of each of the sources of shocks to the variance of the forecast error is captured by the forecast error variance decomposition.

The structural representation of the VAR model of order  $p$  is expressed as:

$$A_o z_t = \alpha + \sum_{i=1}^p A_i z_{t-i} + u_t \quad (7)$$

where  $A_o$  is a matrix of contemporaneous coefficients,  $z_t$  is the vector of endogenous (consumer price index, exchange rate, interest rate, stock returns) and exogenous (oil and food price index) macroeconomic variables,  $\alpha$  is a vector of constant terms or the intercept vector,  $p$  represent the number of lags that allows for dynamic adjustment,  $A_i$  is the autoregressive coefficient matrix and  $u_t$  captures the contemporaneous relationship (shocks) among the structural disturbances. The VAR models are traditionally sensitive to lag structure as sufficient lag length captures long-term effect of the shocks on each other, remove serial correlation and render the error terms stationary i.e., integrated of order zero (I(0)).

Since the left hand side of equation (7) do not contain information about the “deep parameters” or “structural parameters” (Harris and Sollis, 2003), implying that the structural model is directly observable, a reduced form VAR is estimated to avoid inconsistent parameter estimation. The reduced-form structural VAR is derived by multiplying both sides of equation (1) by  $A_o^{-1}$  resulting in equation (8) as

$$z_t = A_o + \sum_{i=1}^p A_i z_{t-i} + \varepsilon_t \quad (8)$$

Where:  $A_o = A_o^{-1}\alpha$ ,  $A_i = A_o^{-1}A_i$ , and  $\varepsilon_t = A_o^{-1}u_t$ . In equation (8), the reduced-form residuals  $\varepsilon_t$  are correlated between each equation and as such cannot be considered as structural shocks. An exact identification of the structural equations requires imposing  $n(n-1)/2$  restrictions on matrix  $A$  since one of the matrices is assumed to be an identity (see Breitung, Bruggemann and Lutkepohl (2004). The recursive structure (structural factorization) of the contemporaneous terms is such that the reduced form errors are linear combinations of the structural errors  $\varepsilon_t$  as follows



$$\begin{aligned}
 A_t &= \begin{bmatrix} opi \\ rex \\ cpi \\ ret \\ int \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_t^{opi} \\ \varepsilon_t^{rex} \\ \varepsilon_t^{cpi} \\ \varepsilon_t^{ret} \\ \varepsilon_t^{int} \end{bmatrix} \\
 B_t &= \begin{bmatrix} opi \\ rex \\ cpi \\ ret \\ int \end{bmatrix} \begin{bmatrix} a_{11} & 0 & 0 & 0 & 0 \\ 0 & a_{22} & 0 & 0 & 0 \\ 0 & 0 & a_{33} & 0 & 0 \\ 0 & 0 & 0 & a_{44} & 0 \\ 0 & 0 & 0 & 0 & a_{55} \end{bmatrix} \begin{bmatrix} \varepsilon_t^{opi} \\ \varepsilon_t^{rex} \\ \varepsilon_t^{cpi} \\ \varepsilon_t^{ret} \\ \varepsilon_t^{int} \end{bmatrix} \quad (9)
 \end{aligned}$$

Where  $\varepsilon_t^{opi}$ ,  $\varepsilon_t^{rex}$ ,  $\varepsilon_t^{cpi}$ ,  $\varepsilon_t^{ret}$  and  $\varepsilon_t^{int}$  capture the oil price, exchange rate (rex), consumer price index (cpi), stock returns shocks (ret) and interest rate (int), respectively. Guided by economic intuition, we assume that in the first model, oil price is contemporaneously exogenous. This implies that though oil price can influence other variables in the model, it does not itself respond to contemporaneous change in other variables within a given month. Being a small open economy, changes in oil price is considered driven primarily by external factors such as aggregate demand and OPEC production quotas rather than domestic macroeconomic fundamentals. Exchange rate is included in the model to capture the economy's reaction to external influences, which is in sync with prevalent economic theory.

Exchange rate equation is modelled to react to oil price and itself only. For instance, since oil price is denominated in foreign currency (dollar), it plays the critical role of serving as the channel through which international oil price innovations are transmitted to the domestic economy, especially given the high dependence of the economy on crude oil revenue for the financing of the entire economic structure. Similarly, inflation rate is assumed contemporaneously affected by itself as well as oil price and exchange rate but not stock returns and interest rate. While an appreciation of the exchange rate contracts the demand for real money balances (dampening the general price levels), the monetization of oil proceeds, on the one hand, increases money supply (liquidity surfeit), exerting undue pressure on domestic prices, under the "inflation is a monetary phenomenon" hypothesis.

Stock returns equation is modelled to contemporaneously respond swiftly to all variables in the economy, except interest rate. Nominal interest rate (opportunity cost of holding money by the financial market) equation describes the equilibrium in the system and is modelled last and assumed to be affected contemporaneously by the movement in all the variables in the system (Pastor and Veronesi, 2012). Under the monetary targeting framework, which Nigeria is operating, interest rate is the major tool of monetary policy used to reflate or deflate the economy especially after the introduction of Monetary Policy Rate in 2006.

In the second model, food price index simply replaces oil price and is also assumed exogenous given that the economy exerts no price influence on world food prices. The exogeneity assumption is premised on the very nature of food crop production, which renders a short-run response to increased demand shocks very costly and almost impossible, given the food production structure in Nigeria. *A priori*, food price shocks are assumed to transmit to a slowdown in economic growth and poor resource allocation as available resources are committed to meeting huge import bill obligations in the face of shrinking local production. Increasing food price is also identified as a major contributor to exchange rate movement and has a debilitating effect on domestic price level. The arguments rendered

for oil price shock specification are considered plausible under the food price model. Both variables are regarded as contemporaneously exogenous in the third model for the same arguments.

The third model is a six-variable SVAR model modified to include both oil and food prices as exogenously contemporaneous shocks in the system, with food price responding only to oil price and to its own innovation. The 6-variable model has 15 restrictions and is represented as

$$C = \begin{bmatrix} opi \\ fpi \\ rex \\ cpi \\ ret \\ int \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} \mathcal{E}_t^{opi} \\ \mathcal{E}_t^{fpi} \\ \mathcal{E}_t^{rex} \\ \mathcal{E}_t^{cpi} \\ \mathcal{E}_t^{ret} \\ \mathcal{E}_t^{int} \end{bmatrix},$$

$$D = \begin{bmatrix} opi \\ fpi \\ rex \\ cpi \\ ret \\ int \end{bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & a_{22} & 0 & 0 & 0 & 0 \\ 0 & 0 & a_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & a_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & a_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & a_{66} \end{bmatrix} \begin{bmatrix} \mathcal{E}_t^{opi} \\ \mathcal{E}_t^{fpi} \\ \mathcal{E}_t^{rex} \\ \mathcal{E}_t^{cpi} \\ \mathcal{E}_t^{ret} \\ \mathcal{E}_t^{int} \end{bmatrix} \quad (10)$$

Given that VARs are generally sensitive to lag length, the traditional SIC and AIC suggested the selection of two (2) as the optimal lag length. However, following many oil price literatures (Killian, 2009) and Anzuini, Lombardi and Pogano (2013), twelve lags were used to allow for sufficient dynamics in the system since the data frequency is monthly. This lag structure does not only capture the dynamics within the twelve month period, but is also long enough to satisfy the model stability condition.

## EMPIRICAL ANALYSIS

### Results of Unit Root Test

To ensure that the model is stable and not spurious, stationarity test was performed on the time series using the traditional Augmented Dickey Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin tests. The null hypothesis of ADF and PP are the presence of unit root I(1). If the series are stationary I(0), the null hypothesis is rejected, while the null hypothesis for KPSS, in contrast, assumes the series to be stationary I(0). Table 1, which report the results for each series show different levels of stationarity as stock returns, inflation rate and interest rate were not stationary at level but at first difference while the other variables show evidence of stationarity at levels. Under the KPSS, all the variables were stationary except exchange rate. Given the mixed order of integration of the series, that is I(0) and I(1), the SVAR model was estimated in level for the short-run, following Farzanegan (2009), Tang, Wu and Zhang (2010), without losing the exact properties of the data.

**Table 1: Unit Root Test**

Variable	ADF	PP	KPSS	Order of Integration
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Stock Returns	-12.395	-12.552	0.081	I(1)
Exchange Rate	-3.805	-3.595	0.245*	I(0)
Inflation Rate	-11.725	-11.510	0.037	I(1)
Interest Rate	-12.727	-12.726	0.097	I(1)
Net Oil Price	-10.774	-11.285	0.078	I(0)
Net Food Price	-8.217	-8.536	0.167	I(0)

#### Critical Values

1%	-4.004	0.216
5%	-3.432	0.146
10%	-3.139	0.119

**Note:** Means series not stationary. ADF means Augmented Dickey Fuller, PP means Phillips Perron and KPSS stands for Kwiatkowski-Phillips-Schmidt-Shin Tests.

#### Granger Causality Test

A cursory observation of the Granger causality and Block exogeneity tests reported in Table 2 show that exchange rate and net food increase were highly exogenous as they exhibit no causality with all other variables in the system. Meanwhile, a uni-directional causality was observed from stock market returns to net food increase; interest rate to exchange rate, inflation rate and NOPI; and from net oil price increase to exchange rate, inflation rate and net food price increase.

**Table 2: Granger Causality Test**

Variable	RET	REX	CPI	INT	NOPI	NFPI
Stock Returns	-	1.9	0.18	2.68	2.22	<b>6.30*</b>

		(0.38)	(0.91)	(0.26)	(0.33)	(0.04)
Exchange Rate	0.37	-	2.83	1.74	0.56	0.02
	(0.83)		(0.24)	(0.42)	(7.5)	(0.99)
Inflation Rate	0.24	0.34	-	4.59	<b>4.69**</b>	2.94
	(0.89)	(0.84)		(0.10)	(0.09)	(0.23)
Interest Rate	2.22	<b>6.24*</b>	<b>8.33*</b>	-	<b>8.47*</b>	2.72
	(0.33)	(0.04)	(0.02)		(0.01)	(0.26)
Net Oil Price Index	0.30	<b>7.07*</b>	<b>8.52*</b>	<b>6.26**</b>	-	<b>9.19*</b>
	(0.86)	(0.03)	(0.01)	(0.04)		(0.01)
Net Food Price Index	3.06	0.72	2.45	1.45	0.24	-
	(0.22)	(0.69)	(0.29)	(0.49)	(0.88)	

**Note:** \* and \*\* represent uni-directional and bi-directional causality, respectively.

Equally noted was the bi-directional causality between inflation rate and net oil price increase at 10 per cent level of significance, and between net oil price increase and interest rate at 5 per cent. Generally, it could be deduced from the table that past values of net oil price increase affect or help improve the forecast of the values of all variables except stock returns, while past values of interest rate equally affect all the selected variables except stock returns and net food increase.

The structural factorization of the unrestricted VAR was estimated with a lag specification of 12, as earlier explained. Before that, a test was conducted to determine the stability of the VAR. The result shows that the VAR was stable as no roots lie outside the unit circle as indicated in Table 3. The ordering of the VAR was guided by economic theory complemented by knowledge of the economy and granger causality test. All the variables enter the model in their logarithm form, except interest rate.

**Table 3: VAR Stability Test**

Root	Modulus
0.997372	0.997372

0.962843 - 0.012911i	0.962930
0.962843 + 0.012911i	0.962930
0.904127	0.904127
0.812183	0.812183
0.399697	0.399697
0.191107 - 0.118139i	0.224675
0.191107 + 0.118139i	0.224675
-0.135783	0.135783
-0.018159	0.018159

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*Roots of Characteristic Polynomial*

**Endogenous variables:** OPI REX CPI RET INT

### Estimation Results and Analysis

The model results show that, similar to the findings of Alom (2011) for the Asia and Pacific countries, some of the responses are not statistically significant; though they are consistent with economic expectations (see Tables 4 and 5). Garrat et al. (2006:109) argue that “statistically insignificant variables may be retained when they are economically important, and statistically significant variables may be deleted when they are likely to be economically unimportant, since misleading statistical significance can arise for many reasons”. Leaning on these argument and empirical support, analyses of results were carried out and inferences drawn from the three models estimated using NOPI and NFPI as shocks. The first is the response of macroeconomic variables to shocks in net oil price increase; the second is the response to food price increase while the third model measures the combined effect of both oil and food shocks on the economy. The third model was estimated and the result was found not significantly different from the individual oil and food shock models. It was, therefore, not reported here for purposes of repetition and space.

### Structural Parameter Estimation

Results from contemporaneous estimates of the structural factorization for the changes in net oil price and net food price index are shown in Tables 4 and 5 below.

**Table 4: Estimation of Contemporaneous NOPI Structural Parameters**

$$\hat{A} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0.001 & 1 & 0 & 0 & 0 \\ -0.001*** & -0.112* & 1 & 0 & 0 \\ 0.001 & 0.182 & -0.242 & 1 & 0 \\ 0.01 & 0.489 & -2.206 & 0.929*** & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_t^{OPI} \\ \varepsilon_t^{EXR} \\ \varepsilon_t^{CPI} \\ \varepsilon_t^{RET} \\ \varepsilon_t^{INT} \end{bmatrix}$$

$$\hat{B} = \begin{bmatrix} 3.421* & 0 & 0 & 0 & 0 \\ 0 & 0.043* & 0 & 0 & 0 \\ 0 & 0 & 0.013* & 0 & 0 \\ 0 & 0 & 0 & 0.065* & 0 \\ 0 & 0 & 0 & 0 & 0.500* \end{bmatrix} \begin{bmatrix} \varepsilon_t^{OPI} \\ \varepsilon_t^{EXR} \\ \varepsilon_t^{CPI} \\ \varepsilon_t^{RET} \\ \varepsilon_t^{INT} \end{bmatrix}$$

**Note:** \*, \*\*, and \*\*\* denotes significance at 1%, 5% and 10% level, respectively

The parameter estimates shown in matrix Table 4 indicate that most of the coefficients are not statistically significant. The estimated coefficient of domestic prices is rightly signed and significantly influenced by oil price ( $a_{31} = -0.001$ ) implying that a shock in oil price exacerbates inflationary pressures. The increased demand for real balances induced by inflationary shock depreciates the domestic currency by 0.112 per cent. Stock market returns, on the other hand, appreciates exchange rate but exert significant pressure on inflation (0.24 per cent). The relationship between oil price and domestic prices is theoretically valid and expected since as an oil-exporting nation, an increase in oil price necessarily result in reserve accretion. In contrast, the rising oil price implies increased money supply as a result of the monetization of oil proceeds resulting in high inflation rate. The observed negative coefficient of stock returns and interest rate is inconsistent with the *a priori* expectation. Interest rates in any economy benchmark the riskiness of investments, implying that higher rates naturally should attract higher reward or returns. This counter-intuitive result, however, suggests the existence of structural rigidities such that cost of doing business (infrastructure, power, other utilities), other than oil price, drive interest rate in the Nigerian economy. This indicates a distortion in the monetary policy transmission mechanism.

**Table 5: Estimation of Contemporaneous NFPI Structural Parameters**

$$\hat{A} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0.003 & 1 & 0 & 0 & 0 \\ 0.001** & -0.095* & 1 & 0 & 0 \\ -0.001 & -0.041 & 0.285 & 1 & 0 \\ 0.013 & -0.930 & -1.147 & 0.97 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_t^{FPI} \\ \varepsilon_t^{EXR} \\ \varepsilon_t^{CPI} \\ \varepsilon_t^{RET} \\ \varepsilon_t^{INT} \end{bmatrix}$$

$$\hat{B} = \begin{bmatrix} 1.642* & 0 & 0 & 0 & 0 \\ 0 & 0.046* & 0 & 0 & 0 \\ 0 & 0 & 0.013* & 0 & 0 \\ 0 & 0 & 0 & 0.067* & 0 \\ 0 & 0 & 0 & 0 & 0.507* \end{bmatrix} \begin{bmatrix} \varepsilon_t^{FPI} \\ \varepsilon_t^{EXR} \\ \varepsilon_t^{CPI} \\ \varepsilon_t^{RET} \\ \varepsilon_t^{INT} \end{bmatrix}$$

**Note:** \*, \*\*, and \*\*\* denotes significance at 1%, 5% and 10% level, respectively

The parameters of NFPI in matrix Table 5 appear relatively weaker and generally positive compared with those of NOPI, as only inflation rate coefficients of  $a_{31}$  and  $a_{32}$  are statistically significant in the model. The negative effect of world food price index at ( $a_{31} = 0.001$ ) to inflation rate is theoretically inconsistent even though statistically significant at 5 per cent level. Increase in world food price is expected to exert positive pressure on domestic food price, especially where food component constitute about 50.7 per cent of the consumer price index basket. The contrary result is a pointer to the marginal contribution of imported food component in the basket of imports in Nigeria. This goes to debunk the supposed overwhelming dependence of the country on imported food and supports the fact that much of what is consumed is domestically produced. However, since food imports are settled in foreign currency, depletion of the reserve arising from increased imports, depreciates the exchange rate ( $a_{32} = -0.095$ ), especially for a small open economy that is hugely import-dependent.

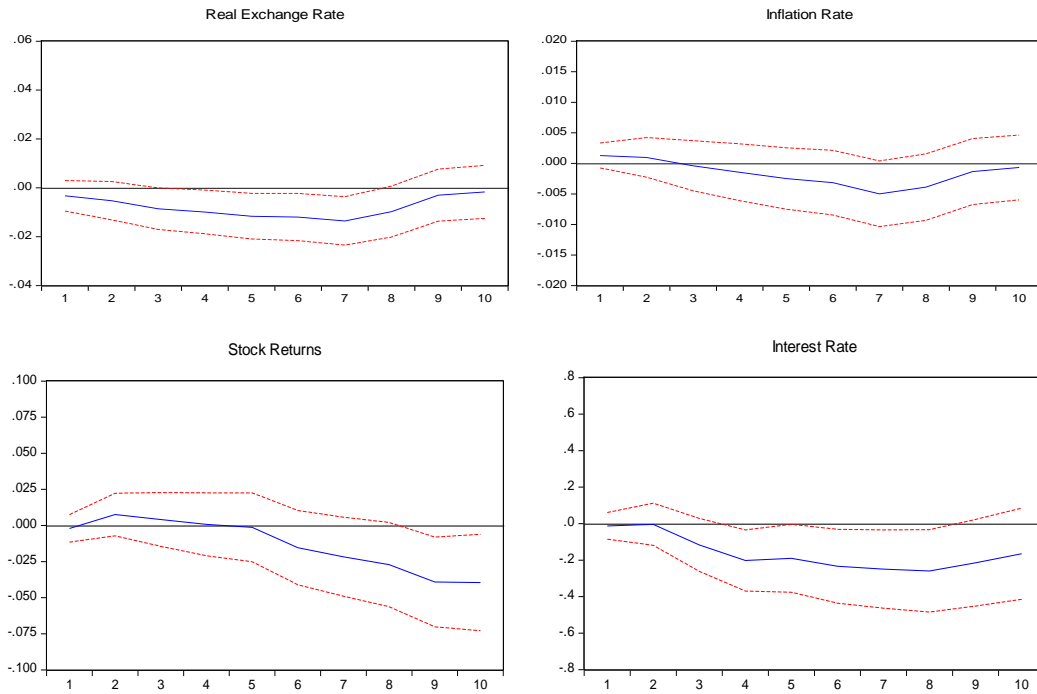
Having identified and estimated the structural model, the effects of the shocks  $\varepsilon_t$  are investigated through an impulse response function analysis, which according to Breitung et al. (2004) contains more information than the structural parameter estimates.

### Impulse Response Functions

Figures 1 and 2 show the responses of key macroeconomic indicators to one standard deviation innovation in net oil and food price increase in Nigeria. In line with Bernanke and Mikov (1998) and Sims (1980) arguments, the impulse response functions were generated using level series. According to them, this yields more consistent estimates, whether the series are cointegrated or not, compared with differenced series. They contend that if a series contain unit root, differencing it causes it to lose vital information concerning the existing correlations in the series.

#### Response of Exchange Rate, Inflation, Stock Returns and Interest Rate to Net Oil Price Increase (NOPI)

The short-run impulse response function show that, except for inflation rate, all other variables exhibit negative responses to shocks in net oil price increase. A shock in oil price was found to trigger a gradual decline in exchange rate up to month seven, at which point, the trend reversed to ease off at the tenth period. This is in tandem with the observation by Alom (2011) for Australia's economy. Interest rate inertia was observed as it responded negatively to oil price shock only after two period lag and do not return to equilibrium or zero level even after the tenth period.

**Figure 1: Impulse Response of Economic Indicators to NOPI**

The negative reaction of interest rate is economically consistent for Nigeria as an increase in oil price implies a revenue boost for government. Increased government revenue ultimately impact on money supply, reducing government appetite for loans and slowing down interest rate movement in the process. Though the response of inflation to oil shock was instantaneous, the effect, however, was minimal and short-lived as the reaction lasted only for two periods when it reverts to zero. Stock returns response, which was marginally negative during the first month quickly turned positive thereafter. However, the positive impact could not be sustained for long as the effect died out at the fourth period.

#### **Response of Exchange Rate, Inflation, Stock Returns and Interest Rate to Net Food Price Increase (NFPI)<sup>2</sup>**

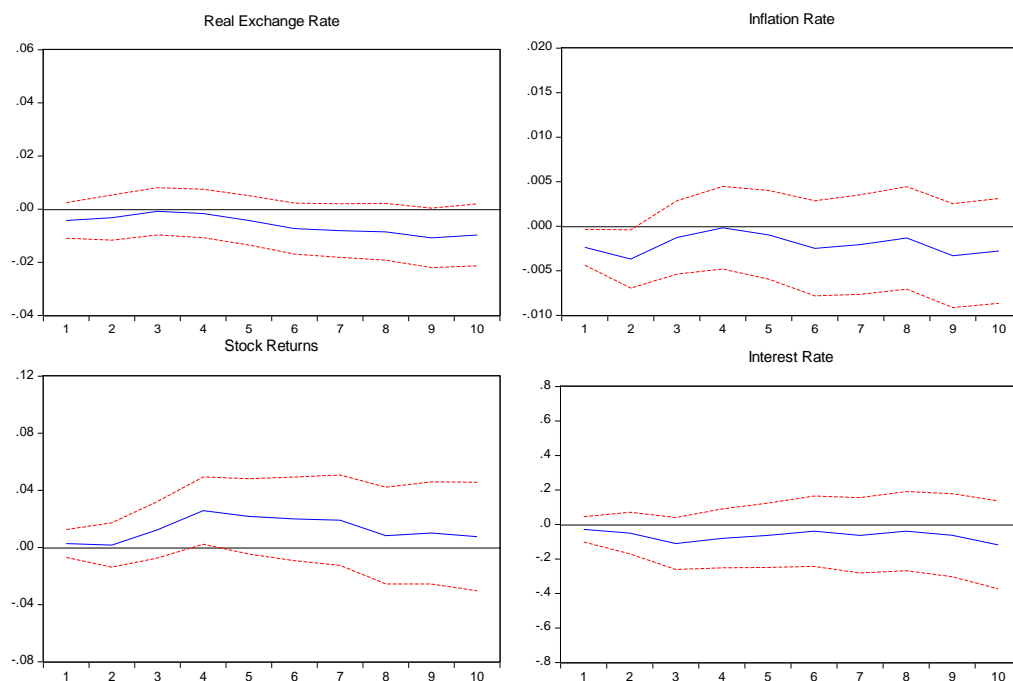
Similar to the responses to oil price shock, the response of all the variables to increase in world food price were generally negative and pronounced except for stock returns as illustrated in Figure 3. Stock returns response, though positive, was marginally above the zero line up to period two. It peaked at period four before easing off but do not die out. Contrary to common economic expectation, inflation rate posted an instantaneous and significant negative response to a one standard deviation shock from world food price. This inverse response may not be unconnected with the counter-effect of higher imported food prices, which stimulates domestic production. It also suggests that the proportion of food import to total GDP or import is minimal, indicating that domestic price level are reasonably influenced by domestic factors rather than world food price innovations.

<sup>2</sup> The accumulated impulse response functions is presented at the Appendix



While exchange rate response to food price shock is short-lived as the effect speedily vanished at month three, interest rate response remained negative throughout the estimation horizon. The response of exchange rate is theoretically expected as food import depletes reserves and exerts pressure on the exchange rate. Finally, the effect of food price shock on interest rate is not direct but derived from the negative response of domestic prices.

**Figure 2: Impulse Response of Economic Indicators to NFPI**



### Forecast Error Variance Decomposition (FEVD) Analysis for NOPI and NFPI

The contribution of net oil and food price shocks to variations in exchange rate, inflation rate, stock returns and interest rate are as shown in Table 4 for ten periods. In terms of self-explanation, the table shows that both NOPI and NFPI ascribed 100 percent of the variation to self-innovation in the first period. However, while for NOPI the impact of the proportion declined very steadily to about 87.9 percent and 82.3 percent at the fourth and eighth periods, respectively, the decline was not as speedy for NFPI, as up to the seventh period over 92.6 percent of the variation was still explained by itself. By the end of the forecast horizon, oil and food shocks contribution to own variation had reduced substantially to 80.8 percent and 81.9 percent, respectively.

The proportion of the forecast error variance for exchange rate, attributed to NOPI increased from 0.6 percent in the first period to 13.3 percent and 16.3 percent in the sixth and eighth month, respectively. The contribution, however, declined to 14.5 percent at end of the tenth month. On the other hand, food price shock, which contributed only 0.8 percent variation in exchange rate in the first month, witnessed a strong and consistent rise from 2.8 percent by the sixth month to 5.2 percent by the eighth month and ended the year at 8.1 percent. Comparatively, in spite of the strong performance of food

price shock, it could be deduced from the following that oil price increase explains more of the variation in exchange rate movement than food price shocks.

Oil price and food price meaningfully contributed to the variation in domestic prices with food prices explaining a reasonable 2.8 per cent at the first period relative to the corresponding 0.8 percent for oil price shock. However, while the contribution of oil shock gradually increased to 2.0 percent and 4.7 percent in the sixth and eighth months, respectively, food price shock declined to an average of 2.5 percent in these two periods. By the tenth month, the contribution of oil shock has dwindled marginally to 4.6 per cent, while food price contribution increased significantly to 3.6 per cent, though still lagging behind oil price shock in terms of the contribution to the variation in inflation rate in the economy.

Although variation in stock returns was explained by 0.2 percent for both oil and food prices in the first period, the contribution of food leaped substantially to 5.0 percent by half year at a point when oil price explained only a paltry 1.2 percent. However, the trend was reversed when the proportion of stock returns variation explained by food price fell to 4.7 percent and 3.9 per cent in the eight and tenth period, respectively. Oil price contribution to the variation doubled from 4.1 per cent to close at 8.9 per cent at the tenth period.

**Table 6: Forecast Error Variance Decomposition for NOPI and NFPI**

	Period	NOPI	Exchange Rate	Inflation rate	Stock Returns	Interest Rate
Net Oil Price Increase (NOPI)	1	100.00	0.57	0.82	0.10	0.06
	2	99.03	1.71	0.60	0.69	0.03
	3	94.11	4.16	0.43	0.59	1.70
	4	87.94	7.01	0.60	0.44	5.07
	5	87.66	10.46	1.18	0.38	6.92
	6	85.77	13.30	1.95	1.23	9.04
	7	83.65	16.04	3.80	2.53	10.85
	8	82.29	16.26	4.69	4.13	12.49
	9	81.97	15.41	4.63	6.97	12.67
	10	80.77	14.53	4.56	8.90	12.02
	Period	NFPI	Exchange Rate	Inflation rate	Stock Returns	Interest Rate
Net Food Price Increase (NFPI)	1	100.0	0.83	2.83	0.16	0.31
	3	97.23	0.99	3.11	1.05	1.72
	4	95.99	0.10	2.45	3.67	1.89
	5	95.16	1.48	2.20	4.69	1.85
	6	93.37	2.83	2.46	4.99	1.66
	7	92.59	4.11	2.57	5.14	1.65
	8	89.23	5.19	2.54	4.68	1.55
	9	84.86	6.96	3.17	4.30	1.54
	10	81.94	8.12	3.62	3.88	1.88

A significant contribution in the decomposition of the variance of NOPI emanate from exchange rate and interest rate movements. Exchange rate, for instance, accounts for up to 13.3 percent and 14.5 percent of the variance of NOPI in the medium (5-6 months) and long term (10 months and above), respectively. This is as a result of the importance of oil to the economy of Nigeria through the monetization of crude oil proceeds, which has been identified as the major source of liquidity surfeit. This has a strong bearing on money supply and ultimately the inflation rate and interest rate variations. Interest rate is one of the primary tools of monetary policy used to regulate the quantum of money in the system. This probably explains why the contribution of oil to interest rate variation moved from a marginal 0.06 percent in the first period to a huge 9.0 percent and 12.5 percent by the sixth and eighth month, respectively. Even though it declined to 12.0 percent at the end of forecast horizon, it was still significantly higher than food price contribution, which rose from a negligible 0.3 percent in the first period to 1.7 percent and 1.9 percent by the sixth and tenth month, respectively.

### **Policy Implications**

The study results are quite elucidating and consequential for the conduct of monetary policy in Nigeria. First, the empirical results show the higher vulnerability of the Nigerian economy to the vicissitudes of oil price shock than food price increase. Given that oil price impulses permeate the economy and affect all key indicators especially inflation, policy making thus require careful consideration of oil price evolutions if the central bank has to deliver on its mandate. Exchange rate was identified as the leading channel of oil price shock to the economy, accounting for 14.5 per cent variation at month ten. The dominance of exchange rate channel is expected and clearly mirrors the fundamentals of an economy that is highly dependent on crude oil exports for its foreign exchange earnings, on the one hand, and highly import-dependent, not only for the acquisition of capital and intermediate materials for production but also for most of its consumables. This plausibly explains the continuous intervention by the CBN in the market to stabilize the exchange rate with a view to engendering inclusive growth and sustainable development. The challenge here is for policy makers to put in place proper intervention sequencing framework and the determination of the quantum of injection or sales, which calls for careful monetary policy actions.

Following the exchange rate channel in importance, are the interest rate (12.0 per cent) and stock returns channels (8.9 per cent) in that order. As earlier argued, the interest rate channel reflects the money supply condition arising from the monetization of oil proceeds. It is an indicator for the demand for real balances by economic agents to meet the importation of goods and services including finished petroleum products. Since the introduction of monetary policy rate (MPR) in 2006 as the anchor rate in the economy, interest rate channel had been effectively used by the CBN to regulate the money market. Stock returns channel achieve prominence, sequel to the banking sector consolidation exercise, which coincided with increasing international oil prices. The increased oil price boosted investor confidence in the face of rising reserves, attracting capital inflows to the Nigerian stock market that was considered a safe haven for investment in the region.

Generally, food price shocks are observed to be more accommodative than oil price shocks. The effect of world food price increase was expectedly channeled more to the economy through exchange rate, as it accounted for about 8.1 per cent compared with 3.9 per cent for stock returns and 3.6 per cent for inflation rate. The ostensible reason for the prominence of exchange rate channel may not be unconnected with the fact that being an open economy, it is the channel through which import bills and other international obligations are settled. The impact of these transactions on exchange rate trickles down to other key macroeconomic variables within the economy and influence the conduct of monetary policy. The stock returns channel indicated the role and share of food-related firms listed at the stock market in the economy.

An increase in world food price reduces food imports but boosts domestic production while the reverse holds when world food price declines. Imported inflation represents the level of influence of world food prices on domestic prices. This establishes a link between world food prices and domestic prices especially as the food component comprise about 50.7 per cent of the CPI basket. This implies that if the central bank of Nigeria had to deliver on its price mandate, a watchful eye must be kept on the developments at the world food market. The findings relating food prices to interest rate was weak and not significant indicating the apparent disconnect between monetary policy and the real sector. More importantly, the central bank must sustain its developmental initiatives in agriculture and other sectors to boost domestic production. This will not only reduce imports but also conserve foreign exchange hitherto committed to settling import obligations.

## CONCLUSION

International oil and food price shocks have, over the years, posed major challenges for the conduct of monetary policy and economic management in Nigeria. Several studies dedicated to investigating these phenomena had focused mainly on oil price. In this study, however, the effect of world food price on some selected macroeconomic indicators was examined in addition to oil price for Nigeria, using the structural vector autoregressive (SVAR) model. Results from the impulse response show that though the variables of interest were statistically insignificant they were, nevertheless, consistent with economic theory. Exchange rate and interest rate response to net oil and food price shocks were negative while inflation responded positively to oil price shock and negatively to food price increase.

The contribution of oil price and food price shocks to the variation in the variables in the system were instructive as oil price innovation was found to exert more profound influence on all the variables of interest compared with food price shock. The dominance of the exchange rate channel was evidenced for both the oil and food price shocks. The leading role of exchange rate channel was explained by the fact that both shocks are exogenous and affect the domestic economy only through the channel. While interest rate was identified as the second dominant channel for oil price shock, stock returns was next to exchange rate in the case of food price shock. This serves as a guide to monetary authority as to which of the channels to give prominence to in the design and conduct of monetary policy if they have to deliver on their 'price stability' and 'stable exchange rate' mandate for inclusive and sustainable growth.

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### Appendix: Impulse Response of Economic Indicators to Net Oil Price Increase and Net Food Price Increase

Impulse Response Function to NOPI					Impulse Response Function to NFPI				
Period	Exchange Rate	Inflation	Stock Returns	Interest Rate	Period	Exchange Rate	Inflation	Stock Returns	Interest Rate
1	0.001131 (0.00299)	0.001349 (0.00101)	-0.002194 (0.00482)	-0.008007 (0.03507)	1	-0.006244 (0.00297)	-0.002714 (0.00100)	0.003309 (0.00482)	-0.030951 (0.03504)
2	-0.000736 (0.00391)	0.000897 (0.00166)	0.006460 (0.00763)	-0.004608 (0.05763)	2	-0.006728 (0.00396)	-0.004518 (0.00166)	0.002332 (0.00772)	-0.066740 (0.05823)
3	-0.003958 (0.00425)	-0.000275 (0.00213)	0.004769 (0.00968)	-0.139140 (0.07327)	3	-0.003125 (0.00426)	-0.001390 (0.00212)	0.009369 (0.00962)	-0.172945 (0.07207)
4	-0.005248 (0.00447)	-0.000728 (0.00243)	0.002424 (0.01136)	-0.225528 (0.08464)	4	-0.004367 (0.00443)	9.28E-05 (0.00239)	0.020801 (0.01114)	-0.148548 (0.08211)
5	-0.007718 (0.00462)	-0.001579 (0.00262)	0.001176 (0.01241)	-0.204256 (0.09329)	5	-0.006973 (0.00457)	-0.000679 (0.00260)	0.015228 (0.01232)	-0.125985 (0.09162)
6	-0.008434 (0.00477)	-0.002038 (0.00275)	-0.009421 (0.01327)	-0.251715 (0.10052)	6	-0.009624 (0.00478)	-0.002455 (0.00280)	0.011552 (0.01352)	-0.107341 (0.10104)
7	-0.010414 (0.00490)	-0.003427 (0.00278)	-0.014685 (0.01389)	-0.259044 (0.10567)	7	-0.011217 (0.00509)	-0.002609 (0.00296)	0.011860 (0.01472)	-0.134859 (0.11035)
8	-0.007292 (0.00515)	-0.002437 (0.00281)	-0.016639 (0.01467)	-0.274304 (0.11065)	8	-0.010035 (0.00542)	-0.001688 (0.00308)	0.001726 (0.01587)	-0.104550 (0.11810)
9	-0.001654 (0.00531)	0.000185 (0.00282)	-0.024226 (0.01556)	-0.246831 (0.11598)	9	-0.010986 (0.00564)	-0.003481 (0.00312)	0.003714 (0.01694)	-0.116522 (0.12535)
10	-0.001915 (0.00543)	0.000548 (0.00280)	-0.021902 (0.01669)	-0.198732 (0.12212)	10	-0.009748 (0.00581)	-0.002953 (0.00314)	0.001719 (0.01827)	-0.170674 (0.13347)