



GLOBAL OIL PRICE SHOCKS AND STAPLE FOOD PRICES RESPONSE IN KADUNA STATE, NIGERIA

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Abstract

Oil prices traditionally have been more volatile than many other commodity or asset prices since World War II and have a lot implications on major macroeconomic variables such as inflation, money supply, capacity utilisation and inflation to mention a few. This paper identifies and analyses the short-run and long-run relationships, and dynamic interactions among staple food grains prices to global crude oil price shocks in Kaduna State using time series techniques of Vector Error Correction Model (VECM). The objective of this study is to examine the short-run and long-run effect of crude oil price shocks on selected staple food grains prices in Kaduna State-Nigeria using time series techniques of Vector Error Correction Model (VECM). The price data was collected for the periods of 312 months that is, 26 years (Jan. 1990-Dec. 2015) from Kaduna State Agricultural Development Program (K.A.D.P.), Central Bank of Nigeria (CBN) and the US Energy Information Administration (EIA). The variance decompositions and impulse response functions based on a VECM specification suggests the presence of cointegration among the variables. The estimated VECM model affirms the presence of asymmetries in the food price behavior. The results show that in the short-run and long-run, global oil price shock has significance impact on staple prices fluctuations such as: cowpea, maize, rice, soya beans. The response of crude oil price fluctuation on the staple food grains prices was negative meaning that an increase in global oil price leads to decrease in staple foodstuffs production and agricultural marketing in the state. Hence, the study found significant positive oil price changes in all cases with the expected positive sign, implying that increases in oil price lead to increases in agricultural commodities. The study recommended that since oil price was important in agricultural commodities prices, efforts should be geared towards local development of the oil sector as this will bring about positive spillover effect on the agricultural sector and ensure food availability at affordable prices thereby improving standard of living and welfare.

Keywords: *Crude Oil; Price Fluctuations; Price Response and Staple Food Grains.*

1. Introduction

The Nigerian economy is known also for her predominance in the production and consumption of agricultural commodities as this accounted for over 75 per cent of the country's revenue before the discovery of oil (FAO report 2008). Fluctuations in the price of oil basically affect every other economic activity within the country. This is because oil remains the engine room of the Nigerian economy both as a source of foreign income earning and a source for powering industrial, manufacturing and agricultural activities (Azeez, 2018). It also acknowledges that, by affecting energy-intensive inputs such as fertilizers and fuel and influencing transportation costs, the oil price changes directly affect food production costs and subsequently food prices. In addition, given the increasing costs of global food production, food import bills would surge during times of rising oil price for food-importing countries like Nigeria and accordingly further



exert an upward pressure on domestic prices of food items. Finally, the food versus fuel debate also links food price to oil price through the increase in food demand for the production of biofuels (Amadeo, 2018).

Two possible transmission mechanisms among energy and food commodity prices have been explained by researchers. According to Nazlioglu and Soytaş (2011), the first linkage is based on the direct effects from oil prices to agricultural commodity prices which is based on the argument that soaring oil prices result in higher agricultural commodity prices through cost-push effects by increasing cost of production and through higher demand for the agricultural commodities used in bio fuel production by increasing the demand for bio fuels. This is because a substantial amount of diverse fuels (e.g. crude oil, coal, gas and bio fuels) are required for agricultural activities such as: planting, the application of fertilizer, harvesting, storage and transportation.

The second link is the indirect effect of energy prices on food commodity prices through the exchange rate. According to Subba *et al.*, (2004), a rise in oil prices externally leads to exchange rate effects by increasing current account deficit which depreciates the local currency. There is yet another channel, which is the co-movement of oil price with agricultural commodities due to investment fund activity (Nazlioglu *et al.*, 2012).

Abubakar (2015) says agricultural sector performed well in the 1950's and 1960's. However, in recent years, the Agricultural sector has witnessed a tremendous decline in contribution to nation development. For example, the contribution of agriculture to GDP was about 67% in 1960, 47.6% in 1970, 39% in 1990 and 28.4% in 2002 as well as 26.8% in 2007. The share of agricultural products in total exports and GDP has plummeted from over 70% and 67% in 1960 to less than 2% and 21.6% in 2015.

Maize (*Glycinemax*), Rice (*OryzaSavita*), Cowpea (*Vignaunguiculata*) and Soya beans (*Glycinemax*) are among food grains (Ayinde & Adejobi, 2002), whose prices are highly unstable between seasons in North-West part of the country due to the oil price volatility. Hence the study selects and analyses staple food grains prices response to crude oil price fluctuations in Kaduna State, Nigeria.

The performance of agriculture since the discovery of crude oil in Nigeria has been low. This has led to food shortages which in turn has caused food insecurity. Before the discovery of oil in the 1970's, the Nigerian economy held the promise of a vibrant agricultural sector. As soon as oil was discovered, the problem of food shortage became pertinent due to the neglect of agriculture. The Nigerian food crisis has been on for three decades and price volatility has been an important component of it. Staple food price movement have important effect on the transitory food security. The majority of these staple food consumers are poor people where consumption pattern is more prices responsive. With their low incomes, they have no savings to fall back on or other assets to buffer the fluctuation in seasonal or inter-annual prices of food. The shortage of food means escalating food prices and for the majority of low income families, this is a threat to food security in Nigeria. Excessive volatility of staple food prices destabilizes and jeopardizes household incomes and investment among students and poor people particularly among rural and urban people (Nwoko, Goodness & Benjamin, 2016).



The high cost of oil price has paralyzed social and economic activities in and around Kaduna State due to high increase in staple food prices and other agricultural products in markets. The high cost of diverse fuels (e.g. crude oil, coal, gas diesel, and bio fuels) that required for agricultural and industrial activities such as: production of seedlings, planting, the application of fertilizer, machines, pesticides and herbicides, harvesting, storage and transportation have direct corresponding increase on staple food grains which affect the populace (Abubakar, 2015).

The previous studies regarding the association between crude oil prices and staple food grains prices produced mixed results because of the differences in scope and methodology. Such studies include the research works of Alvalos (2013), Gogoi (2014), Ibrahim (2015) and Nwoko *et al.* (2016) found causality relationship between oil price and food price volatility. Therefore, the present study wants to bridge the gap by investigating the effect of oil price variability on four selected staple food prices in Kaduna state, Nigeria. This is because studies relating to this topic are scanty in Nigeria and within this period that these staple food grains witnessed the high rate of their price fluctuations due to volatility in oil price globally. This study will contribute to existing body of knowledge and beneficial to policy makers like: CBN, NNPC, NBS as well as reference material to potential academic researchers.

It is against this background that the study put forward the following research question. What is the response of crude oil price fluctuation to staple food grains prices in Kaduna State? In order to answer the above research question, the following objective arises. The objective of this study is to empirically examine the short-run and long-run responsiveness of staple food prices due to global oil price shocks in Kaduna State-Nigeria. The above objective is achieved through the following null hypothesis after testing. H_0 : Staple food price is not responsive to global oil price fluctuations in the study area.

2. Literature Review and Theoretical Frame Work

2.1. Concept of Agriculture

Campiche, Richardson and Outlaw (2007) state that agriculture involves the cultivation of land, raising, rearing of animals, for the purpose of production of food for man, feed for animals and raw materials for industries. Aye (2015) defines agriculture as it involves cropping, livestock, forestry, and fishing, processing and marketing of these agricultural products.

2.2. Concept of Staple Food

Dahiru, (2013) defines staple food as a food that is “eaten regularly and in such quantities as to constitute the dominant part of the diet and supply a major proportion of energy and nutrients”. Staple foods vary from place to place, but are typically inexpensive or readily available foods that supply one or more of the three macronutrients needed for survival and health: carbohydrate, protein, and fat, such as grains, tubers, legumes, or seeds.

Yusuf (2014) opines that most staple foods derive either from cereals such as wheat, maize, rice, or starchy root vegetables such as potatoes, yams and cassava. Other staple foods include pulses (dried legumes), and fruits such as breadfruit and plantains. Staple foods may also contain, depending on the region, olive oil, coconut oil and sugar.



2.3. Concept of Crude Oil Fluctuations

Lewrence and Muhammed (2015) define crude oil fluctuations as a source of oil shocks (fluctuations) that affect economic performance differently: oil price increase due to higher oil demand shocks affect output differently than oil price increase due to lower world oil supply shocks. They argued that positive oil supply shocks decrease domestic production. According to Loy and Weaver (1998), price volatility refers to the variation, instability or fluctuation in prices. Loy and Weaver (1998) define oil price shocks as price volatility which refers to the variation, instability or fluctuation in prices oil. Aye (2015) also sees oil price shocks are predominantly defined with respect to price fluctuations resulting from changes in either the demand or supply side of the international oil market.

Kachikwu (2016) seem to believe that current development strategies are aimed at increasing production to about 10 million bpd by this year, 2016 when our owned four refineries such as Kaduna, Port Harcourt and two Warri refineries resumed operation at full capacity. Although petroleum production and export play a dominant role in Nigeria's economy and account for about 90% of her gross earnings, but all these have reduced drastically due the fall in oil prices globally and other problems associated with activities of pipeline vandalism by Niger Delta militants, poor power supply to petroleum oil industries, mal-administration by the Nigeria National Petroleum Corporation (NNPC), Poor staffing and so on which shifted government policies and programmes to diversify her economy to other sectors especially agriculture and mining sectors of the economy.

2.4. Related Empirical Literature

Arshad and Abdel Hameed (2009) investigated if there is a long-term relationship between petroleum and cereal prices using monthly data over the period of January 1980 to March 2008. The bivariate co-integration approach using the Engle–Granger two-stage estimation procedures was applied and the result revealed unidirectional long-run causality from petroleum price to cereal prices. Esmaeili and Shokoohi (2011) found no direct long-run relationship between oil prices and agricultural commodity prices. Huchet-Bourdon (2011) statistically analyzed the historical commodity price volatility over the last half century for an extended range of agricultural commodities such as beef, maize butter, rice, soybean oil, sugar, wheat, and whole milk. The paper also investigated the relationship between oil price, fertilizer price, and each of these agricultural commodities; also, using spearman's correlation coefficient on monthly data which can only indicate the existence of a relationship but cannot indicate which one has a predictive power on the other.

Alvalos (2013) investigated whether oil price Granger cause corn and soybeans prices using a VAR model on monthly prices from January 1986 to April 2006 using international prices. His findings showed that oil price shocks exhibited no predictive causality over corn and soybeans prices. Oil prices have a negative impact both in the long- and short-run price dynamics of the two food commodities. AnoSujithan, Avouyi-Dovi, and Kolia (2014) used Bayesian multivariate framework to assess the effect of oil price and other drivers on the volatility of global prices of cocoa, coffee, sugar, and wheat in recent periods. Using monthly data covering the period January 2001–March 2013, an impulse response function of food volatility to oil price shocks revealed that an oil price shock leads to an increase in the price volatility of cocoa, coffee, sugar, and wheat for 2–3 months followed by a downward peak after 4 months. The



result showed a negative impact on the volatility of soya beans and sugar and a positive impact on cocoa, coffee, corn, and wheat prices. Gogoi (2014) investigated the long-run relationship between crude oil and world food commodity prices such as maize, rice, soybean, and wheat for the period between 1980 and 2011 using time series econometric technique. The co-integration test revealed that there is a long-run relationship between crude oil prices and the prices of maize, soybean, and wheat with the exception of rice prices. He also conducted a Granger causality test to check whether causality exists between the two prices. He found that there is unidirectional causality, with only crude oil prices “Granger causing” each of the four food commodity prices, while crude oil prices were not found to be influenced by price of food commodities.

Ibrahim (2015) investigated the relations between food and oil prices for Malaysia using a nonlinear autoregressive distributed lags (NARDL) model. The bounds test of the NARDL specification suggests the presence of cointegration among the variables, which include the food price, oil price and real GDP from 1975 to 2010. The findings suggest that there is evidence for the presence of asymmetries in the long run as well as in the short run. More specifically, in the long run, an oil price increase tends to lead to the increase in the food price while the oil price reduction does not seem to be related to food price. Likewise, in the short run, only the changes in the oil price increase are significantly related to the food price inflation. These results are largely similar regardless of whether the oil price in ringgit or the oil price in the US dollar is used.

Nwoko *et al.* (2016) investigated the relationship between oil price and food price volatility in Nigeria. Specifically, the study examined the long run and short run relationships between oil price and food price volatility using domestic food prices and also investigated the causality between them. Analysis shows some level of volatility in domestic food prices. Based on Johansen’s co-integration test, the study concludes that there exists a long run relationship between oil price and aggregate food price volatility. A VECM model was used so as to show the dynamics of oil price and food price volatility from 2000 to 2013 using time series econometric technique. The vector error correction model findings indicated a positive and significant short run relationship between oil price and food price volatility. The Granger causality test revealed a unidirectional causality with causality running from oil price to food price volatility but not vice versa.

Owyang & Shell (2016) examined the reasons the effect of oil price rises on food price on United States of American (USA) using graphical illustrations in examining the relative inflation of food, corn and oil to the overall inflation rate in the U.S. economy. The findings suggest that if there is any link between increased food and oil prices, it is extremely small. Even after increased use of ethanol in oil, the evidence for pass-through is weak.

Fowowe (2016) found that Structural breaks co-integration tests showed no evidence of a long-run relationship between oil prices and agricultural commodity prices in South Africa. Also, nonlinear causality tests showed no evidence that agricultural commodity prices in South Africa respond to oil prices. The results show that agricultural commodity prices in South Africa are neutral to global oil prices. Siakwah, (2017) in the study titled Actor Network Theory, globalized assemblages and the impact of oil on agriculture and industry in Ghana; found that oil has only



diversified Ghana's dependency on natural resources without structurally changing the national economy. The fact that the exploitation of oil merely reinforces and reconstructs a deep-seated structural dependency has profound consequences for national and local politics and for the country's prospects of economic development.

Amadeo (2018) examined the reasons of food price rising between 2008 and 2017 in U.S.A. and world in general especially in both short and long term which includes effect of demand and supply, high oil price, climate change, subsidy on corn production for biofuel, world trade organization and high number of population eating more food. The findings showed that food prices rose to 8.2 percent in 2017, the highest annual average since 2014.

From the review of the previous studies, the gaps identified are scope and methodology. Therefore, this research study is different from past studies and intends to contribute to knowledge by investigating the effect of global oil price on food prices in Kaduna State, Nigeria.

2.5. Theoretical Framework Underpinning the Study

So many theoretical explanations have been given for instantaneous changes in agricultural food prices. It is usually assumed that agriculture is a sector in which prices are more flexible than non-agricultural sectors (Yusuf 2014). Pricing efficiency theory is used to underpin this study. It analyses how the wishes of final consumers are transmitted through the marketing system as manifested in the resultant prices at the various levels in the system. Pricing efficiency studies attempt to appraise the system by comparing actual prices with the ones that are generated by the perfectly competitive market (Baumeister and Kilian, 2013). Under this theoretical construct, the theory expects that an efficient market will establish prices that are interrelated through space by transportation costs, through form by costs of processing, through time by costs of storage, and through competition of middlemen by the size of their net margins. Pricing efficiency enable us determine the mark up earnings accruing to marketing intermediaries as well as determining the extent of marketing efficiency (Yusuf, 2014).

3. Methodology

The study made use of Vector Error Correction Model (VECM) of analysis. Secondary data was used for the purpose of this study due to all data were in secondary source. Secondary data covered the wholesale monthly prices for 312 months (1990:1-2015:12) for each staple food product which was obtained from the Kaduna Agricultural Development Programme Office (K.A.D.P.), and National Agricultural Extension and Research Liaison Service (NAERLS), A.B.U Zaria for the agricultural marketing in Kaduna State of Nigeria. The oil price is the Brent crude oil price obtained from the US Energy Information Administration (EIA). The data collection was focused on the following grains: maize, rice soya beans and cowpea (white-beans) which is some of the major food grains produced and traded in the Kaduna State, Nigeria and where detailed-prices over time period (1990:1-2015:12) are available obtained by K.A.D.P.

The Cointegration and Vector Error Correction Model (VECM) approach are used to identify the short- and long-run dynamics of the staple food grains prices and global oil price from Jan. 1990 to Dec. 2015 in Kaduna State, Nigeria. While the VECM conveniently combines the long-run behavior of the variables and their short-run interactions and thus can better reflect the relationship among variables. A VECM is a restricted VAR designed for use with non-stationary time series that are known to be cointegrated and VECM is the only model which avoids the



quasi-regression. The causal relationship between the variables will be tested with Granger causality test. When the study analyses the causality between the two variables, the research said that the first variable causes another included variable. The Granger test shows whether a variable causes another variable in the statistical sense, but not necessarily in a general (economic) sense (Granger, 1969). The Johansen cointegration test reveals an existence of long-run relationship of staple food variables prices (cowpea, maize, rice and soya beans) as a result of a long run and dynamic interactions among them with crude oil prices.

Thus, this study is conducted by adapting the work of Nwoko *et al.* (2016) in the field of social sciences after slight modifications in his model. The modifications affect the period, study variables and modelling. The VECM tests can indicate only the Granger causality of the dependent variable within the sample period and provide little evidence on the dynamic properties of the system. The VDCs, by partitioning the variance of the forecast error of a certain variable into the proportions attributable to innovations (or shocks) in each variable in the system including its own, can provide an indication of these relativities and may be termed as out-of-sample causality tests (Kling & Bessler, 1985). The variable that is optimally forecast from its own lagged values will have all its forecast error variance explained by its own disturbances (Sims, 1982). Furthermore IRFs show the effects of shocks on the adjustment path of the variables.

The study computed variance decompositions and impulse-response functions, which serve as tools for evaluating the dynamic interactions and strength of causal relations among variables in the system. In economic time series analysis, a spurious relationship arises when it applies a vector autoregressive (VAR) model to series that are integrated. Two solutions are recommended: using a VAR model on first difference or using a vector error correction model (VECM). The economic techniques that will be used in order to determine the degree of staple food prices response to crude oil price fluctuations in Kaduna State of Nigeria, is the use of Vector Error Correction (VECM) model pioneered by Sims (1980) which insisted that there should not be any a priori distinction between endogenous and exogenous variable. VECM model will be used to evaluate the long-run and short-run relationships and dynamic interactions between crude oil price and staple food prices (cowpea, maize, soya beans and rice) in Kaduna State over a long period of time, which is from January 1990 to December 2015; and this will be adopted in order to achieve objective (i): to evaluate the response of staple food prices to oil prices in Kaduna State.

The process of estimating a VECM involves the following steps:

Step 1: Test for stationarity of the series, before conducting cointegration analysis. The augmented Dickey–Fuller (ADF) unit root test is used as following:

$$\Delta Y_t = \alpha_0 + \gamma Y_{t-1} + \alpha_2 t + \sum_{i=1}^k \beta_i Y_{t-i} + \epsilon_t \text{-----} 3.1$$

To test whether the series have a unit root or not

Step 2: specify and estimate a VAR model for the integrated multivariate time series. A *p*th-order VAR is defined as:

$$Z_t = A^{-1} B_1 Z_{t-1} + A^{-1} B_2 Z_{t-2} + \dots + A^{-1} B_p Z_{t-p} + A^{-1} u_t \text{-----} 3.2$$

It checks for serial correlation and heteroscedasticity, and normality will be conducted for the residuals.



Step 3: Determine the optimum lag length using Akaike information criterion (AIC), or Schwarz information criterion (SIC) or Hannan–Quinn criterion (HQC).

Step 4: Apply Johansen’s (1988) cointegration test and also Johansen and Juselius’ (1990) full information maximum likelihood of a VECM. The model is given as follows:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta y_{t-i} + \mu + \varepsilon_t \tag{3.3}$$

Where y_t is a $(n \times 1)$ vector of the n variables, m is a $(n \times 1)$ vector of constants, C represents a $(n \times (k - 1))$ matrix of short-run coefficients, f_t denotes a $(n \times 1)$ vector of white noise residuals and P is a $(n \times n)$ coefficient matrix. If the matrix P has reduced rank $(0 < r < n)$, it can be split into a $(n \times r)$ matrix of loading coefficients a , and a $(n \times r)$ matrix of cointegrating vectors b . The former indicates the importance of the cointegration relationships in the individual equations of the system and of the speed of adjustment to disequilibrium, while the latter represents the long-term equilibrium relationship, so that $P = ab'$, where k is the number of lags, t denotes the time and D is a difference operator.

3.3.2 Causality Test

To capture the short-term deviations of series from their long-term equilibrium path, Granger causality requires inclusion of an error term in the stationary model (Granger, 1986).

$$\Delta y_t = \alpha_0 + \alpha_y (y_{t-1} - BZ_{t-1}) + \sum_{i=1}^p a_{11} \Delta y_{t-i} + \sum_{i=1}^q a_{12} \Delta z_{t-i} + \varepsilon_{yt} \tag{3.4}$$

The terms in parentheses are the error correction terms (ECTs). Z_t is said not to Granger-cause Y_t if Z_t cannot help predict future Y .

4. Results and Discussions

4.1. Result of Optimal Lag Structure

After formulating a VAR system containing crude oil price, cowpea price, maize price, rice price and soya beans price, VAR lag order selection criterion provided in Table 4.1 determines the optimal lag structure by testing the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), Hannan Quin Information Criterion (HQ) Final Prediction Error (FPE) and Sequential likelihood ratio (LR) with called for five lags is considered as optimum lag in our model.

Table 4.1 VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-696.7040	NA	0.000149	5.377042	5.445328	5.404491
1	491.2539	2321.297	2.01e-08	-3.534513	-3.124798*	-3.369821
2	550.4497	113.4020	1.54e-08	-3.796550	-3.045406	-3.494614*
3	576.0582	48.07721*	1.54e-08*	-3.801212*	-2.708639	-3.362033
4	587.6591	21.33492	1.71e-08	-3.698537	-2.264534	-3.122114
5	603.8371	29.13281	1.83e-08	-3.630935	-1.855504	-2.917270

Source: Author’s analysis, 1990:1 – 2015:12

* 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

4.2 Vector Error Correction Model (VECM)

VECM in first difference was used in the model because the endogenous and exogenous variables are at I(0) and this implies that the variables are to be cointegrated at first difference I(1). Accordingly, the study proceeded to evaluate the variance decompositions and impulse response functions based on a VECM specification for the purpose. In line with the Johansen cointegration test, the research set the lag length of the VECM in first difference to 24, which is sufficient to render the error terms serially uncorrelated.

Table 4.2 showed that Vector Error Correction Model (VECM) in all the equations has the negative and positive sign. However, the ECT in the crude oil price equation showed a coefficient of 0.110, indicating that adjustment towards the equilibrium takes place by 11.0 per cent per annum. On the other hand, the VECM for cowpea price, maize price and soya beans shows a non-significant result, while for rice price showed a significant result.

Table 4.2 Vector Error Correction Model

Error Correction: D(LOILP)	D(LCWP)	D(LMZP)	D(LRCP)	D(LSYP)	
CointEq1	-0.110146	-0.068640	-0.268070	0.005369	-0.111849
	(0.04591)	(0.08013)	(0.12968)	(0.16911)	(0.13770)
	[-2.39903]	[-0.85664]	[-2.06715]	[0.03175]	[-0.81226]

Research Results, 1990:1 – 2015:12

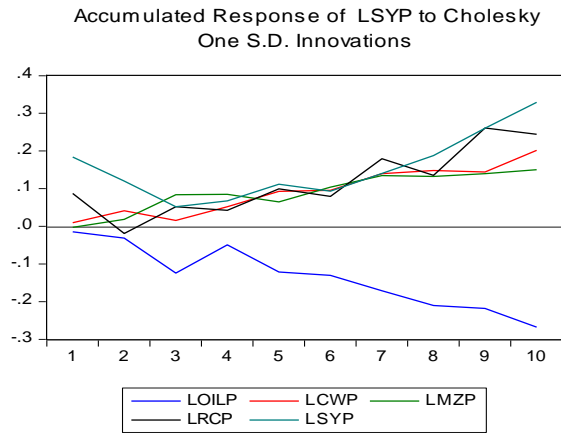
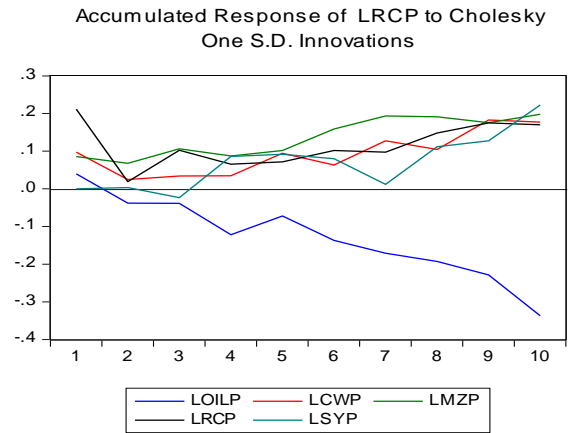
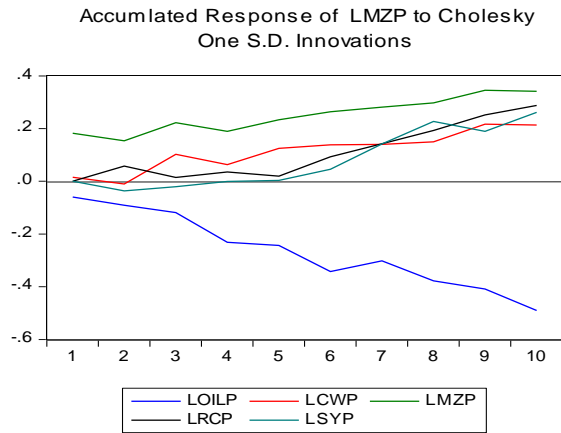
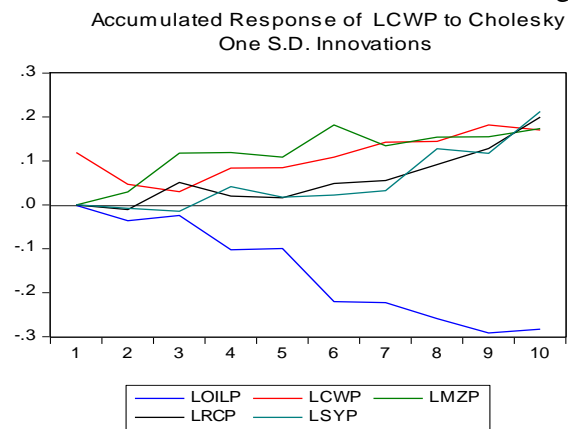
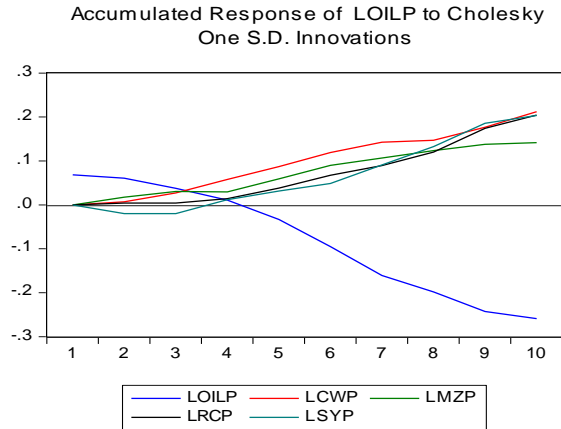
4.8 Impulse response functions for Oil price and Staple Food Prices

An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. The figure 4.1 below shows the impulse response functions for agricultural products prices. In impulse response analysis, ordering of the variable is important and the analysis is subject to change under different ordering. The Cholesky factorisation allows us to make decision on which variable behaves more exogenously, and then the same variable comes first.

Therefore, the Cholesky factorisation was used for impulse response functions on the basis of a priori expectation. The study then applied the following ordering on the basis of economic theory to the Cholesky factorisation. The Volume of Agricultural Products Prices was assumed to be exogenous and is a function Oil Price (OILP), Cowpea Price (CWP), Maize Price (MZP), Rice Price (RCP) and Soya beans Price (SYP). The impulse response function for these staple food products prices suggests that changes in oil price and output impacted negatively on the volume of these agricultural products prices. Also, the positive oil price shocks decrease the staple food products (cowpea, maize, soya beans and rice) thereby leading to a reduction in the volume of their productions and marketing in Kaduna State of Nigeria in particular and the country in general. This may be due to the constraints in the agricultural sector such as: fluctuations in the prices of petrol in Nigeria and of crude oil globally, poor infrastructural facilities like: poor road



networks for transporting these staple food grains and other agricultural products from farmers in rural areas to rural and urban markets for marketing transactions, the neglect of the agricultural sector, high costs of production in terms of increase in the costs of agricultural inputs and machines that dampen the output growth which make government to resort to importation such as: seedlings, herbicides and pesticides, fertilizer, tractors, blending machines, and macroeconomic instability in the economy especially in importing such agricultural inputs and machines in Kaduna State of Nigeria.



Source: Research results, 1990:1 – 2015:12



To examine further the dynamic interactions among these variables, the research generates impulse response functions from the estimated VAR. Since the results for the ordering are presented in Table 4.3, the study presents the plots of the functions only under ordering. Keeping in line with the discussion on variance decompositions, the research first looks at the interactions between the oil price and other variable prices. The plots are given in Figure 4.1 then, the research shifts to the interactions between staple food prices variables and the oil price.

The figure 4.1 shows combined graph of accumulated staple food grains prices to oil price fluctuations (shocks) which examines the long run dynamic interactions among these variables, the research generates impulse-response functions from the estimated VAR. Since the results for the ordering are presented above in Table 4.2, the study presents the plots of the functions only under ordering. Keeping in line with the discussion on variance decompositions, the research first looks at the interactions between the oil price and other variables prices. The reaction of rice price (LRCP) as a result of fluctuations in oil price (LOILP) is present for a short time period (a first month), but after that it stabilizes at 23% but started ups and downs up to less than 10%. Also, for soya beans price (LSYP) response to shocks in oil price (LOILP) begins at 18% at first month and positively keeps fluctuating up to 30% after 24 months which is significant. Moreover, for cowpea price (LCWP) response to fluctuation in oil price (LOILP) starts at 12% from first month downwards to negative side at -1% for quarterly month and also begins to rise upwards to less than 5%. However, for maize price (LMZP) response to fluctuation in oil price (LOILP) starts at 18% from first month to downwards sloping as a result of its shocks up 3% after 24-month horizons. In all cases the impact is positive, which means that the shock in one variable makes positive reaction to the other one.

4.9. Variance Decompositions of Oil Price and staple Food Products Prices

While an impulse response functions trace the effects of a shock to one endogenous variable on to the other variables in the VAR, variance decomposition separates the variation an endogenous variable into the component shocks to the VAR. Thus, the variance decomposition provides the information about the relative importance of each random innovation in affecting the variable in the VAR. From the result, the forecast error of variance decomposition results are presented in figure 4.2 below which shows the effects of oil price shock on these staple food prices (cowpea, maize, soya beans and rice prices). This indicates that an increase in oil price lowers the agricultural production of these staple food grains as the costs of agricultural inputs and machines (seedlings, herbicide and pesticide, tractors, blending machines and so on) would also increase thereby leading to rise in costs of transportation of the staple food products from farm land areas to rural and urban markets as well as its negative effects on consumption patterns of the households in Kaduna State of Nigeria. The effect of an increase in oil price on the staple food prices between January 1990 and December 2015 in Kaduna State, Nigeria was positive due to the fact that prior to the discovery of oil in commercial quantity, the country depended heavily on agricultural sector.

Table 4.3
Variance Decompositions of LOILP

Explained by innovations in

Horizons (Monthly)	S.E.	LOILP	LCWP	LMZP	LRCP	LSYP
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1	0.06	100.	0.00	0.00	0.00	0.00
3	0.10	91.4	0.07	2.63	1.29	3.61
6	0.11	77.2	4.52	7.46	1.56	3.23
9	0.13	57.9	20.1	6.94	3.30	4.79
12	0.16	34.7	31.1	7.68	9.21	7.36
15	0.19	28.9	37.9	6.55	15.6	10.0
18	0.24	31.9	37.8	5.03	17.2	16.2
21	0.27	33.8	34.0	3.91	20.2	20.5
24	0.32	33.9	26.9	2.75	26.2	25.1
26	0.37	32.9	23.0	2.20	31.2	26.5

Source: Author’s analysis, 1990:1 – 2015:12

Table 4.4
Variance Decompositions of LRCP

Explained by innovations in

Horizons (Monthly)	S.E.	LOILP	LCWP	LMZP	LRCP	LSYP
1	0.12	2.29	0.00	0.00	97.7	0.00
3	0.13	2.30	0.12	3.92	91.9	1.73
6	0.16	2.21	1.39	5.09	89.4	1.88
9	0.20	4.85	1.24	4.90	77.7	11.3
12	0.21	4.43	3.05	5.44	72.9	14.2
15	0.24	4.39	3.24	6.47	71.6	14.3
18	0.26	5.55	4.22	7.95	68.0	14.3
21	0.28	5.64	4.09	7.71	67.2	15.4
24	0.30	5.47	4.64	7.55	67.0	15.4
26	0.36	7.83	4.27	6.64	59.2	22.0

Source: Author’s analysis, 1990:1 – 2015:12

Table 4.5
Variance Decompositions of LSYP

Explained by innovations in

Horizons (Monthly)	S.E.	LOILP	LCWP	LMZP	LRCP	LSYP
1	0.20	0.27	0.00	0.00	13.9	85.8
3	0.24	0.46	7.45	6.78	10.2	75.1
6	0.29	8.85	6.03	15.1	11.3	58.7
9	0.31	8.17	5.39	17.2	18.2	51.0
12	0.33	10.9	5.14	14.3	26.5	43.1
15	0.35	11.1	4.12	15.6	31.4	37.8
18	0.37	9.48	3.14	11.9	42.0	33.5
21	0.40	10.1	3.60	9.92	43.1	33.3



24	0.43	9.00	2.64	7.92	47.4	33.1
26	0.46	8.86	2.12	6.05	47.0	36.0

Source: Author’s analysis, 1990:1 – 2015:12

Table 4.6
Variance Decompositions of LCWP

Explained by innovations in

Horizons (Monthly)	S.E.	LOILP	LCWP	LMZP	LRCP	LSYP
1	0.23	0.72	93.4	0.00	5.73	0.18
3	0.24	0.66	86.3	8.09	4.79	0.15
6	0.25	1.43	58.5	22.1	17.0	1.06
9	0.28	3.47	41.7	29.2	17.5	8.13
12	0.29	3.16	39.1	32.8	16.8	8.08
15	0.29	8.89	31.7	34.7	18.5	6.22
18	0.30	12.6	31.6	29.1	19.3	7.27
21	0.31	14.6	29.4	25.2	18.7	12.2
24	0.31	15.7	27.3	22.3	21.9	12.8
26	0.34	13.1	19.5	16.1	25.6	25.8

Source: Author’s analysis, 1990:1 – 2015:12

Table 4.7
Variance Decompositions of LMZP

Explained by innovations in

Horizons (Monthly)	S.E.	LOILP	LCWP	LMZP	LRCP	LSYP
1	0.20	2.50	0.02	90.6	5.48	1.37
3	0.23	3.47	5.41	77.3	12.7	1.15
6	0.26	4.44	4.29	76.0	14.1	1.13
9	0.29	7.30	3.78	75.1	12.8	1.01
12	0.34	9.46	3.80	73.3	12.5	0.92
15	0.39	13.5	3.95	68.6	13.0	0.99
18	0.49	12.8	3.75	63.2	14.6	5.66
21	0.58	12.3	3.75	55.4	16.1	12.4
24	0.67	12.1	3.26	48.9	23.2	12.6
26	0.80	13.1	2.94	42.2	25.3	16.5

Cholesky Ordering: LOIPL LCWP LMZP LRCP LSYP

Source: Author’s analysis, 1990:1 - -2015:12

The VDC can also be used as an alternative method to examine the effect oil price shocks on the staple food grains prices (cowpea, maize, soya beans and rice prices). It shows how much of the forecast error variance for any variable in a system is explained by innovations to each variable,



over a series of time horizons. Normally, own variable shocks explain most of the error variance, although the shock will also affect other variables in the system. In this case, the VDC substantiate the significant role played by LOILP in accounting for fluctuations in these agricultural products prices namely: LCWP, LMZP, LRCP and LSYP.

Initially in Table 4.3, at 1-month horizon, all forecast error variances in LOILP are explained by their own innovations at 100 per cent, while all the explanatory variables of staple food products prices started from 0 per cent, but LCWP and LMZP which account for 23% and 2.2% of the variations in the forecast error respectively; while LRCP and LSYP also contribute for additional 31.2% and 26.5% of the variations in the forecast error after 24 months respectively. Moreover, about 7.83% and 4.27% of LRCP forecast error VDC is explained by the LOILP and LCWP respectively; whereas 6.64% and 22% by the LMZP and LSYP from first month to 24 months respectively in Table 4.4. Also LOILP and LCWP contribute 8.86% and 2.12% for the variation in the forecast error of LSYP respectively; while LMZP and LRCP account for 6.05% and 47% in the forecast error of LSYP at 24-month horizons respectively in Table 4.4. More so, from the result in Table 4.5 shows that the variations in the forecast error of LCWP after 24 months as results of contributions by LOILP and LMZP to 13.1% and 16.1% respectively; whereas LRCP and LSYP account for 25.6% and 25.8% respectively. It can also see from Table 4.6 for LMZP, where LOILP and LCWP contribute 13.1% and 2.94% for the variations in the forecast error respectively; while LRCP and LSYP also account for 25.3% and 16.5% at 24-month horizons respectively. The study can conclude that there is great impact of change in oil price on the staple food products prices over periods of time under study. This result supports the earlier findings of Chuku (2012), Fowowe (2016), Nwoko *et al.* (2016) and Azeez (2018) that found causality relationship between oil price and food price volatility.

Conclusion and Recommendations

Exploring the various sectors of the Nigerian economy, scholars have studied the responsiveness between oil price shocks and disaggregated prices of food but the prices of food-oil price shocks nexus is an area yet to be properly explored. The major objective of this paper was to examine the response of staple food prices due to crude oil price volatility; hence, the study adopts the VECM model with impulse response and variance decompositions to measure volatility and responsiveness of both global oil price and food prices. It therefore, affirmed that oil price shocks positively affects average prices of food more significantly in the same periods. On the other hand, Oil price shocks greatly affects average price of food negatively, although significant, this is shown by the impulse response and impulse decomposition results. The partial sum decomposition of oil price into positive and negative has been found to be significant in explaining the movement in agricultural commodity prices over the years. It is also made obvious from the findings that structural breaks in the selected agricultural commodities of cowpea, rice, maize and soybean were relevant phenomena that must be captured when examining the asymmetric relationship between oil and food. Based on the foregoing, the following were recommended: first, efforts geared towards developing the oil sector locally as it will bring about positive response on the agricultural sector thereby making food available at affordable prices. Second, development of the oil sector should diversify into producing relevant inputs for agriculture. This may include the production agrochemicals such as herbicides, insecticide, and fungicides e.t.c



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