Applied Tropical Agriculture
Volume 22, No. 1, 43-51, 2017.

Price Volatility Transmission in Nigerian Agricultural Commodity Markets

Ojogho, O.

Department of Agricultural Economics and Extension Services, Faculty of Agriculture, University of Benin, Benin City, Nigeria
Corresponding author: igomercy@yahoo.com

ABSTRACT

Price rise of agricultural commodities at peak seasons and/or decline during the off-peak periods with the attendant price transmission is often followed by adjustments. However, the speed and efficiency with which the various price adjustments occur given the common attributes of market structure in Nigeria, the price volatility spillover effects and its attendant uncertainty on other agricultural commodity prices remains pertinent. The study, therefore, examined the price volatility transmission among the Nigerian agricultural food commodity prices using the Bayesian Vector Autoregression (BVAR) model for monthly aggregated data on price of meat, cereals, sugar, dairy and aggregate food for the period of January 1990 to February 2014. The results showed that a shock in the price of each agricultural food commodity exhibits complex dynamics of the one- and two-period lags among the commodities, impacting not only on its own price volatility but those of related commodities with a low adjustment speed. Meat price volatility had negative effect on the volatility of cereals, dairy, aggregate food and sugar price that lasted for not less than 11 months. However, the price of sugar first price-lag had negative effect on the volatility of cereals, aggregate food, meat and dairy, got to their minimum after 5, 5, 2 and 4 month respectively and returned to their initial values 16, 11, 5 and 10 months later respectively. The volatilities of agricultural food commodity market prices in Nigeria are influenced by the price shock of the commodities themselves and on the price volatility of other agricultural food commodities. Market-based insurance mechanisms that provide a way to transfer risk and assist farmers and consumers alike in making production and consumption decisions respectively can be made available with proper market integration while government may buy surplus at a competitive price to maintain a buffer stock.

Key words: Price, volatility, transmission, agricultural commodity, markets

INTRODUCTION

World agricultural commodities prices have experienced an increasing degree of volatility in the last decade (Food and Agriculture Organization *et al.,* 2011; Ojogho and Egware, 2015). This is of particular interest to farmers and other stakeholders who may react by reducing output supply and investments in productive inputs (Rezitis and Stavropoulos, 2009; Sckokai and Moro, 2009; Piot-Lepetit, 2011), particularly in a competitive market where prices are taken as given. A measure of this possible variation in this particular economic variable or some functions of it has usually been based on either observed realisations of the variable over some historical periods in the case of realised volatility or from the Black-Scholes formula in the case of implicit volatility (Aizenman and Pinto, 2005). One of the most important limitations of these realisations comes from the insufficiently long-time series that make estimation of a comprehensive econometric model virtually impossible.

In previous statistical literature on the analysis of time series data, it was a common practice to classify the types of movements that characterised a time series as trend, cyclical, seasonal and irregular components; and modelled these movements within a flexible and unified framework (Westerhoff and Reitz, 2005; Wolf, 2005; Reitz and Westerhoff, 2007; Balcombe, 2009). Besides, time series data of product coverage focused on the meat market with practically no studies for cereal and other agricultural food commodity markets while period coverage also has been limited in that the last decade, and especially since 2006, has been inadequately covered while country coverage has been dominated by the United States market.

In terms of methodologies used to investigate price volatility transmission, the application of multivariate general autoregressive conditional heteroskedasticity (MGARCH) models are common modelling approaches in studies for food supply chains and for energy-agricultural commodity chains (Hernandez, Ibarra, and Trupkin, 2014; Beckmann and Czudaj, 2014) with the BEKK form of MGARCH models in particular use in most of the studies. The possible causes of volatility of agricultural commodity price has been attributed to micro-level factors only (Pender and Alemu, 2007; Otieno *et al.,* 2009; Egbetokun and Omonona, 2012; Onoja *et al.,* 2012; Ele *et al.,* 2013) without consideration of commodities prices volatility interaction and transmission. Others have opined that forecasting food prices and food price volatility would be better appreciated if volatility of agricultural commodity prices is linked (Ghysels *et al.,*2006; Gilbert, 2010; Kumornu *et al.,*2011) and linked to some impacting factors (Schnepf, 2005; Mitchell, 2008; Clapp, 2009; Robles*et al.*, 2009; Alhalith, 2010; Busse *et al.*, 2010; Chakravorty *et al.,* 2010; Ghosh *et al.*, 2010; Headey, 2011; von Braun, 2011; Wright, 2011; Babcock, 2012; Chandrasekhar, 2012; Martin and Anderson, 2012; Shi and Arora, 2012; Udoh and Egwaikhide, 2012).

From the foregoing, the study seeks to provide answers to the issues of the speed and efficiency with which the various price adjustments occur given the common attributes of market structure in Nigeria, the price volatility spillover effects and its attendant uncertainty on other agricultural commodity prices. These are important in understanding the nature of agricultural commodity price variability of a particular commodity, and the food sub-sector in the agricultural commodity market effects in Nigeria in the long-run.

The study, therefore, examined price volatility transmission among the Nigerian agricultural commodity prices using the Bayesian Vector Autoregression (BVAR) model in order to allow for the feedback effects on how price uncertainty in one market affects price uncertainty in the others. To achieve this, the study examined the relationships between the commodities price volatility, and examined the effects of volatility shocks among agricultural commodity markets prices.

MATERIALS AND METHODS

The study used monthly aggregated price data obtained from various publications of the Central Bank of Nigeria, Nigeria Statistical Bulletin, Food and Agriculture Organisation (FAO), World Trade Organisation (WTO) and the vintages of the World Bank database for meat, cereals, sugar, dairy and aggregate food for the period of January 1990 to February 2014. The data were analysed using both descriptive and inferential statistics. The descriptive statistics used the mean, standard deviation, coefficient of variation, skewness and kurtosis while the inferential statistics fitted the Bayesian vector autoregressive (BVAR) model using Minnesota prior distribution as the Bayesian prior information in the Vector Autoregression (VAR) framework. The model, in its generic form, was specified as:

$$y_t = \theta_0 + \theta_1 y_{t-1} + \cdots + \theta_m y_{t-m} + \epsilon_t,\ \epsilon_t \sim iidN_m(0_m, \Sigma)$$

Where y_t is $p \times 1$, θ_0 is $p \times 1$, θ_l is $p \times p$ with $l = 1, \cdots, m$, ϵ_t is $p \times 1$ such that

$$y_t = \begin{bmatrix} y_{1t} \\ y_{2t} \\ \vdots \\ y_{pt} \end{bmatrix}, \theta_0 = \begin{bmatrix} \theta_{10} \\ \theta_{20} \\ \vdots \\ \theta_{p0} \end{bmatrix}, \theta_l = \begin{bmatrix} \theta_{l,11}\theta_{l,12}\cdots\theta_{l,1p} \\ \theta_{l,21}\theta_{l,22}\cdots\theta_{l,2p} \\ \vdots \quad \vdots \quad \cdots \quad \vdots \\ \theta_{l,p1}\theta_{l,p2}\cdots\theta_{l,pp} \end{bmatrix},$$

$$\epsilon_t = \begin{bmatrix} \epsilon_{1t} \\ \epsilon_{2t} \\ \vdots \\ \epsilon_{pt} \end{bmatrix}$$

The likelihood function was derived from the sampling density $\Pr(y|\alpha, \Sigma)$ and $\alpha = vec(\theta_l)$. The Minnesota prior assumes that Σ is diagonal. If Σ_i denotes the block of Σ associated with the K parameters in the i^{th} equation and $\Sigma_{i,jj}$ are its diagonal elements, then $\Sigma_{i,jj}$ is given by:

$$\Sigma_{i,jj} = \begin{cases} \frac{\alpha_1}{n^2}, & own\ lag\ n\ coefficient\ \ \forall n = 1, \cdots, p \\ \frac{\alpha_1 \sigma_{ii}}{r^2 \sigma_{jj}}, & lag\ r\ coefficients\ j \neq i, \forall r = 1, \cdots, p \\ \alpha_3 \sigma_{ii}, & exogenous\ variables\ coefficients \end{cases}$$

For the five agricultural commodities in the study, the model was given explicitly as:

$$\begin{aligned} y_{ct} = \beta_0 + \beta_1 y_{c,t-1} + \beta_2 y_{c,t-2} + \beta_3 y_{a,t-1} + \beta_4 y_{a,t-2} \\ + \beta_5 y_{m,t-1} + \beta_6 y_{m,t-2} + \beta_7 y_{d,t-1} \\ + \beta_8 y_{d,t-2} + \beta_9 y_{s,t-1} + \beta_{10} y_{s,t-2} + \epsilon_{1t} \end{aligned}$$

$$\begin{aligned} y_{at} = \theta_0 + \theta_1 y_{c,t-1} + \theta_2 y_{c,t-2} + \theta_3 y_{a,t-1} + \theta_4 y_{a,t-2} \\ + \theta_5 y_{m,t-1} + \theta_6 y_{m,t-2} + \theta_7 y_{d,t-1} \\ + \theta_8 y_{d,t-2} + \theta_9 y_{s,t-1} + \theta_{10} y_{s,t-2} + \epsilon_{2t} \end{aligned}$$

$$\begin{aligned} y_{mt} = \gamma_0 + \gamma_1 y_{c,t-1} + \gamma_2 y_{c,t-2} + \gamma_3 y_{a,t-1} + \gamma_4 y_{a,t-2} \\ + \gamma_5 y_{m,t-1} + \gamma_6 y_{m,t-2} + \gamma_7 y_{d,t-1} \\ + \gamma_8 y_{d,t-2} + \gamma_9 y_{s,t-1} + \gamma_{10} y_{s,t-2} + \epsilon_{3t} \end{aligned}$$

$$\begin{aligned} y_{dt} = \delta_0 + \delta_1 y_{c,t-1} + \delta_2 y_{c,t-2} + \delta_3 y_{a,t-1} + \delta_4 y_{a,t-2} \\ + \delta_5 y_{m,t-1} + \delta_6 y_{m,t-2} + \delta_7 y_{d,t-1} \\ + \delta_8 y_{d,t-2} + \delta_9 y_{s,t-1} + \delta_{10} y_{s,t-2} + \epsilon_{4t} \end{aligned}$$

$$\begin{aligned} y_{st} = \vartheta_0 + \vartheta_1 y_{c,t-1} + \vartheta_2 y_{c,t-2} + \vartheta_3 y_{a,t-1} + \vartheta_4 y_{a,t-2} \\ + \vartheta_5 y_{m,t-1} + \vartheta_6 y_{m,t-2} + \vartheta_7 y_{d,t-1} \\ + \vartheta_8 y_{d,t-2} + \vartheta_9 y_{s,t-1} + \vartheta_{10} y_{s,t-2} + \epsilon_{5t} \end{aligned}$$

where the sampling density Pr $(y|\alpha, \Sigma)$ is the Minnesota prior distribution (Litterman, 1986; Sims and Zha 1998) with α_1, α_2, and α_3 set to 0.5, 0.5 and 100 respectively, and $y_{c,t}$, $y_{a,t}$, $y_{m,t}$, $y_{d,t}$, and $y_{s,t}$ are the prices of cereals, aggregate food, meat, dairy and sugar respectively. The data were first transformed to render them stationary by taking the first difference after the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) test while the Schwarz Information Criterion (SIC), Akaike Information Criterion (AIC) and the Hannan–Quinn Information Criterion (HQIC) were used to select the appropriate lag.

RESULTS AND DISCUSSION

The summary statistics of the variables are presented in Table 1. The results showed that the price per Kg of the commodities ranged between ₦133 and ₦174. Sugar had the highest price (₦174.50) during the period, followed by that of cereals (₦133.10) and least with meat (₦129.47). However, the variability measure was highest with sugar (43.98%) and least with meat (15.03%). The results also show that the agricultural food commodities prices have experienced high variability in the years under consideration. This may be attributed to the relatively unstable conditions of supply and demand, and the low elasticities of demand and supply as noted by Schnepf (2005), FAO (2008), Christiaensen (2009), Robles *et al.*(2009), Gilbert (2010) and Ojogho and Egware (2015).

The skewness and kurtosis measure indicate the meat, dairy, and aggregate food prices are positively skewed and platytokurtic relative to the normal distribution while the kurtosis of cereals and sugar prices are respectively mesokurtic (3.0) and leptokurtic (3.92) relative to the normal distribution. The value and statistical significance of the kurtosis indicated by the Jarque-Bera statistics imply the non-gaussianity of the agricultural food commodity prices.

Table 2 shows the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) statistics for the variables. The DF and ADF statistic values for the variables in their first difference form were lower than the critical values at 1%, 5% and 10%, so that the null hypothesis that it has a unit root at first difference was rejected. However, the DF and ADF statistical values for the variables at level form were greater than the critical values at 1%, 5% and 10%, so that the null hypothesis that it has a unit root at level form was not rejected. Augmented Dickey-Fuller (ADF) test for the variables indicates that all variables are non-stationary at levels but stationary at first difference. Therefore, the first differences of all series under consideration are stationary.

The results of the lag-length test are presented in Table 3. The results showed that the values of the Schwan Information Criterion and the Hannan-Quinn Information Criterion at 5% level of significance are respectively 29.24 and 28.81 at lag 2. Using Schwan information criterion and the Hannan-Quinn information criterion, it can be concluded that the optimal lag length is 2 if the principle of parsimony is adhered to.

The results of the unrestricted and Bayesian vector autoregrssion are presented in Table 4. The results show that prices of the five different agricultural commodities were influenced positively by their own first price-lag and negatively by their own second price-lag except for meat which was only affected negatively by its own first price-lag. First prices-lag of meat and the second price-lag of cereals had a negative influence on cereals price while the first price-lag of aggregate food, first price-lag of cereals and the second price-lag of meat had positive impact on cereals price. Unit increase in the one period lag in the prices of cereals and aggregate food, and a two period price-lag of meat would increase the price of cereals by ₦1.08, ₦0.67 and ₦0.27 respectively while a two period price-lag of cereals and one period price-lag of meat would reduce the price of cereals by ₦0.24 and ₦0.36 respectively. The first price-lag of cereals and dairy sugar have positive impact on the price of aggregate food but display more complex dynamics for the price of aggregate food, positive effect for the first price-lag, then negative effect for the second price-lag, with a positive combined effect. Unit increases in the one period price-lag of cereals and dairy would increase the price of aggregate food by ₦0.13 each while a two period price-lag of the same commodities would reduce the price of aggregate food by 0.12 and ₦0.10 respectively. Thus, aggregate food also displays complex dynamics of the first and second price-lags between the prices of cereals and dairy.

This display of complex dynamics of price seems like a trend among the agricultural commodities with either positive effect for the first price-lag, then negative effect for the second price-lag or negative effect for the first price-lag, then positive effect for the second price-lag. The combined effect of price of sugar on the price of dairy is positive, implying complementarities in consumption. This may create a major consumption problem in terms of higher expenditure share particularly for poor households whose children and nursing mothers share is more in household composition. The producers of these commodities and their products are likely to be the worst hit during any price shock, as a combination of poverty and low risk-taking ability makes them vulnerable to any shocks in price with low speed of adjustment.

Table 1: Summary Statistics of Agricultural Commodities Prices in Nigeria, 1990-2014

Parameters	CEREAL	AGFOOD	MEAT	DAIRY	SUGAR
Mean	133.10	134.38	129.47	132.92	174.50
Median	105.99	116.12	125.38	107.84	153.40
Maximum	267.69	240.09	189.74	275.38	420.16
Minimum	80.16	85.08	84.53	66.06	72.94
Std. Dev.	53.11	43.90	27.72	57.26	76.75
Coefficient of Variation	39.90	32.67	21.41	43.08	43.98
Skewness	1.17	1.03	0.71	1.04	1.22
Kurtosis	3.01	2.65	2.67	2.73	3.92
Jarque-Bera	66.43***	52.47***	25.57***	53.18***	82.35***
Probability	0.00	0.00	0.00	0.00	0.00

Source: Author's calculation, ***significant at 1% level

Table 2: Dickey-Fuller and Augmented Dickey-Fuller Estimate for Stationarity

Variable	Dickey-Fuller (DF)		Augmented Dickey-Fuller (ADF)	
	Level	*First Difference*	*Level*	*First Difference*
Cereals Price	*-2.06*	*-6.59****	*-2.11*	*-6.55****
Aggregate Food Price	*-0.84*	*-6.03****	*-0.90*	-6.04***
Meat Price	-1.73	-1.42***	-1.70	-7.74***
Dairy Price	2.80	-8.63***	1.98	-8.53***
Sugar Price	-1.37	-4.47***	-1.45	-6.87***

***Significant at 1% level

Table 3: Vector Autoregression Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-6106.74	NA	4.60e+12	43.35	43.41	43.37
1	-4100.15	3927.80	3621846.00	29.29	29.68	29.45
2	-3967.45	255.05	1687600.00	28.53	29.24*	28.81*
3	-3943.2	45.75	1697290.00	28.53	29.57	28.95
4	-3912.11	57.54	1626844.00	28.49	29.85	29.03
5	-3882.33	54.07	1574546.00*	28.46*	30.14	29.13
6	-3863.2	34.06	1644441.00	28.50	30.50	29.30
7	-3843.5	34.36	1711882.00	28.54	30.86	29.47
8	-3814.41	49.73*	1668480.00	28.51	31.15	29.57

* indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

Table 4: Vector Autoregression Estimates

PRICES	Unrestricted Vector Autorgression Model					Bayesian Vector Autorgression Model				
	CEREALPRICE	FOOD PRICE	MEAT PRICE	DAIRY PRICE	SUGAR PRICE	CEREAL PRICE	FOOD PRICE	MEAT PRICE	DAIRY PRICE	SUGAR PRICE
CEREALPRICE (-1)	1.127663	-0.003449	-0.008617	-0.161777	-0.286763	1.075888***	0.129720**	0.003476	-0.032607	-0.246672
	(0.14638)	(0.07987)	(0.08322)	(0.14071)	(0.33278)	(0.10836)	(0.05915)	(0.06310)	(0.10258)	(0.24364)
	[7.70344]	[-0.04319]	[-0.10355]	[-1.14974]	[-0.86172]					
CEREALPRICE (-2)	-0.275817	0.002951	0.049618	0.201829	0.251164	-0.236443**	-0.119686**	0.032436	0.082384	0.192437
	(0.14486)	(0.07903)	(0.08235)	(0.13924)	(0.32931)	(0.10655)	(0.05816)	(0.06205)	(0.10086)	(0.23957)
	[-1.90408]	[0.03734]	[0.60255]	[1.44952]	[0.76270]					
FOODPRICE (-1)	0.626433	1.587268	0.241172	1.005726	0.886725	0.665641***	1.192893***	0.207538	0.637001***	0.868737
	(0.37989)	(0.20727)	(0.21596)	(0.36516)	(0.86363)	(0.26728)	(0.14591)	(0.15564)	(0.25301)	(0.60096)
	[1.64897]	[7.65812]	[1.11675]	[2.75418]	[1.02674]					
FOODPRICE (-2)	-0.386086	-0.605665	-0.257163	-1.078406	-0.706475	-0.395028	-0.244711*	-0.207552	-0.747308***	-0.633540
	(0.37643)	(0.20538)	(0.21399)	(0.36184)	(0.85576)	(0.26598)	(0.14520)	(0.15489)	(0.25179)	(0.59805)
	[-1.02564]	[-2.94903]	[-1.20174]	[-2.98038]	[-0.82555]					
MEATPRICE (-1)	-0.366670	-0.249397	0.957719	-0.412538	-0.392896	-0.361580**	-0.094308	0.937939***	-0.216737	-0.395362
	(0.17494)	(0.09545)	(0.09945)	(0.16816)	(0.39770)	(0.14144)	(0.07721)	(0.08236)	(0.13389)	(0.31802)
	[-2.09595]	[-2.61296]	[9.63021]	[-2.45328]	[-0.98792]					
MEATPRICE (-2)	0.281819	0.228323	-0.039792	0.440159	0.451450	0.265562*	0.080590	-0.027159	0.252157*	0.440881
	(0.17131)	(0.09346)	(0.09738)	(0.16467)	(0.38945)	(0.13708)	(0.07483)	(0.07983)	(0.12977)	(0.30823)
	[1.64508]	[2.44288]	[-0.40861]	[2.67303]	[1.15921]					
DAIRYPRICE (-1)	-0.043064	0.055711	-0.009142	1.310472	0.089235	-0.046433	0.125888***	0.001203	1.334878***	0.092387
	(0.09028)	(0.04925)	(0.05132)	(0.08677)	(0.20523)	(0.07353)	(0.04014)	(0.04282)	(0.06961)	(0.16533)
	[-0.47703]	[1.13112]	[-0.17815]	[15.1020]	[0.43481]					
DAIRYPRICE (-2)	0.040932	-0.037621	0.013078	-0.318913	-0.132194	0.039367	-0.099407**	-0.000381	-0.334356***	-0.146832
	(0.09079)	(0.04953)	(0.05161)	(0.08727)	(0.20639)	(0.07519)	(0.04105)	(0.04379)	(0.07118)	(0.16906)
	[0.45087]	[-0.75955]	[0.25340]	[-3.65453]	[-0.64052]					
SUGARPRICE (-1)	-0.051279	-0.026258	-0.027320	-0.110270	1.255468	-0.048647	0.006456	-0.023828	-0.072315**	1.213914***
	(0.03927)	(0.02142)	(0.02232)	(0.03775)	(0.08927)	(0.03240)	(0.01769)	(0.01887)	(0.03067)	(0.07285)
	[-1.30586]	[-1.22559]	[-1.22384]	[-2.92139]	[14.0636]					
SUGARPRICE (-2)	0.039748	0.031766	0.039271	0.121591	-0.343342	0.034866	0.003133	0.034583*	0.089929***	-0.309303***
	(0.03888)	(0.02122)	(0.02210)	(0.03738)	(0.08840)	(0.03242)	(0.01770)	(0.01888)	(0.03069)	(0.07289)
	[1.02220]	[1.49734]	[1.77660]	[3.25312]	[-3.88405]					
Constant	0.923340	2.082143	4.859688	0.266552	-6.067096	1.002119	2.405764**	4.939467***	0.809353	-6.499550
	(2.29543)	(1.25236)	(1.30489)	(2.20642)	(5.21830)	(2.35747)	(1.28694)	(1.37284)	(2.23166)	(5.30065)
	[0.40225]	[1.66257]	[3.72422]	[0.12081]	[-1.16266]					
R-squared	0.987894	0.994723	0.985643	0.990369	0.970044					
Log likelihood	-916.9491	-742.4528	-754.2857	-905.5590	-1153.469					
Akaike AIC	6.444091	5.232311	5.314484	6.364993	8.086594					
Schwarz SC	6.583996	5.372216	5.454389	6.504898	8.226498					
Mean dependent	133.1998	134.4623	129.5084	133.0595	174.3822					

Source : Author's calculation; values in parenthesis are standard errors, values in square brackets are t-values, *significant at 10%, **significant at 5%, ***significant at 1%

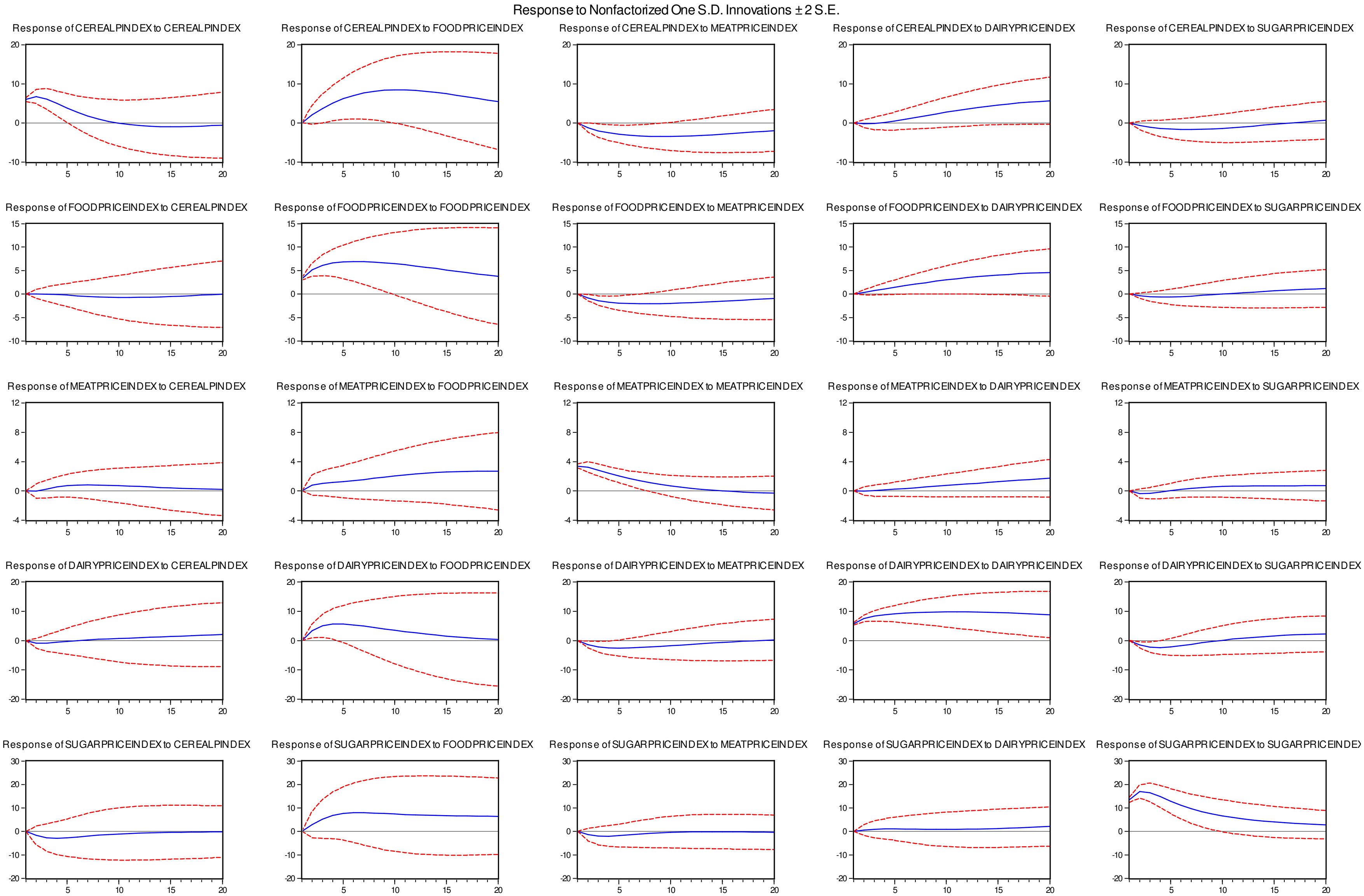

Figure1: Impulse response functions (IRF) graph of food volatilities from the BVARs

The impulse response function of agricultural commodities price volatility to shocks is shown in Figure 1. The results showed a shock to price of meat has negative effect on the volatility of cereals, dairy, aggregate food and sugar price that lasts for more than 20 months except in the case of dairy and sugar, the volatilities of which revert to its initial value after 17 and 11 months respectively. Meat price volatility displays a specific pattern, with volatility decreasing first to initial value after 14 months then dropping further, the volatility of which lasts for more than 20 months. A similar shock to the price of aggregate food first has positive effect on the volatility of cereals, dairy and sugar that last for 5 months and then a negative effect that last more than 20 months except in the case of dairy, the volatility of which revert to its initial value after 18 months. A shock to the price of sugar first has negative effect on the volatility of cereals, aggregate food, meat and dairy that peak at 5, 5, 2 and 4 month before returning to their initial values at 16, 11, 5 and 10 months respectively, and then increased, the volatilities that last more than 20 months. The price volatility of sugar first increased, peaked at the second month and the decreased, a volatility that last for over 20 months. A dairy price shock leads to an increase in the volatility of cereals, aggregate food, meat, and sugar from their initial value except for volatility of dairy itself. The implication of these is that they pose significant problems for farmers and other agents in food chains who risk losing their productive investments if price falls occur while they are locked into strategies dependent on higher price levels to be viable. Those most affected are rural dwellers, mainly smallholders heavily dependent on their own production. Thus, both the welfare of the family and the viability of the small-holder farm families are threatened by excessive volatility.

CONCLUSION

Agricultural commodities experience large variations and characteristics which cause their prices to rise sharply at peak times and then fall back during the off-peak periods. To provide answers to the issues of the speed and efficiency with which the various price adjustments occur given the common attributes of market structure in Nigeria, the price volatility spillover effects and its attendant uncertainty on other agricultural commodity prices,the study examined the volatility interaction among the Nigerian agricultural commodity prices using the Bayesian Vector Autoregression (BVAR) model.

The results showed that prices of the five different agricultural food commodities are influenced positively by their own first price-lags and negatively by their own second price-lags with a display of complex dynamics of the first and second price-lags among the agricultural food commodities with either positive effect for the first price-lag, then negative effect for the second price-lag or negative effect for the first price-lag, then positive effect for the second price-lag. A shock to price of meat has negative effect on the volatility of cereals, dairy, aggregate food and sugar price that lasts for more than 20 months except in the case of dairy and sugar, the volatilities of which revert to its initial value after 17 and 11 months respectively. However, meat price volatility displays a specific pattern with respect to a shock in its price, with volatility decreasing first to initial value after 14 months then dropping further, the volatility of which lasts for more than 20 months. A similar shock to the price of aggregate food first has positive effect on the volatility of cereals, dairy and sugar that last for 5 months and then a negative effect that last more than 20 months except in the case of dairy, the volatility of which revert to its initial value after 18 months. The price of sugar first has negative effect on the volatility of cereals, aggregate food, meat and dairy, peak at 5, 5, 2 and 4 month respectively before returning to their initial values after 16, 11, 5 and 10 months respectively, and then increased, the volatilities that last more than 20 months. The price volatility of sugar first increased, peaked at the second month and the decreased, a volatility that last for over 20 months. A dairy price shock leads to an increase in the volatility of cereals, aggregate food, meat, and sugar from their initial value except for volatility of dairy itself.

In microeconomic terms, these have serious consequences in the efficiency of resource-use, terms of trade, real incomes and fiscal position of Nigeria as commodity dependent country and complicate the task of development planning. The producers of these commodities and their products are likely to be the worst hit during any price shock, as a combination of poverty and low risk-taking ability makes them vulnerable to any exogenous shocks in price with low speed of adjustment. For an importing country like Nigeria, increasing prices would result in rising import bills while high prices come with the attendant impact on the ability of poor consumers to purchase necessary food items in general. The ex-ante effects of these are the decisions of farmers and other stakeholders in the Nigeria agricultural sector to alter their resource allocation away from agricultural activities. Consumer prices would not follow commodity prices directly due to the attendant contracting and relatively low percentage of raw commodity in the processed products.

The volatilities of agricultural commodity market prices in Nigeria are influenced by the price shock of the commodities themselves and on the price volatility of other agricultural commodities. Market-based insurance mechanisms that provide a way to transfer risk and assist farmers in making production decisions can be made available to farmers with proper market integration while government may buy surplus at a competitive price to maintain a buffer stock.

REFERENCES

Aizenman J. and Pinto B. (2005). Managing volatility and crisis overview. In B. Pinto, J. Aizenman, (Eds.). *Managing volatility and crisis: a practitioner's guide overview.* Cambridge: Cambridge University Press, pp. 1-43.

Babcock, B. A. (2012). The impact of US biofuel policies on agricultural price levels and volatility. *China Agricultural Economic Review*, *4*(4), 407–426.

Balcombe, K. (2009). *The nature and determinants of volatility in agricultural prices. An empirical study from 1962–2008.* Rome: FAO.

Beckmann, J. & Czudaj, R. (2014). Volatility transmission in agricultural futures markets. *Economic Modelling* 36: 541–546.

Busse, S., Brummer, B. & Ihle, R. (2010). Interdependencies Between Fossil Fuel and Renewable Energy Markets: The German Biodiesel Market. *DARE Discussion Paper No. 1010*.

Chandrasekhar, C. P. (2012). Food Price Levels and Volatility: Sources, Impact and Implications. *IDS Bulletin*, *43* (Supplement s1), 74–83.

Chakravorty, U., Hubert, M., Moreaux, M. and Nøstbakken, L. (2010). Do Biofuel Mandates Raise Food Prices? *IDEI, Working Paper No. 653*.

Christiaensen, L. (2009). Revisiting the Global Food Architecture. Lessons from the 2008 Crisis. *Review of Business and Economics*, *54*, 345–361.

Clapp, J. (2009). Food Price Volatility and Vulnerability in the Global South: Considering the Global Economic Context. *Third World Quarterly*, *30*(6): 1183–1196.

Egbetokun, O. A. and Omonona, B. T. (2012). Determinants of Farmers' Participation in Food Market in Ogun State, *Global Journal of Science Frontier Research Agriculture and Veterinary Sciences,12* (9): 24–30.

Ele, I. E., Omini, G. E., & Adinya, B. I. (2013). Assessing the Extent of Commercialization of Smallholding Farming Households in Cross River State, Nigeria, *IOSR Journal of Agriculture and Veterinary Science*, *4*(2): 49-55

Food and Agriculture Organization of the United Nations, FAO (2008). The State of Food and Agriculture—Biofuels: Prospects, Risks, and Opportunities. Rome: FAO.

FAO, IFAD, IMF, OECD, UNCTAD, WFP, the World Bank, the WTO, IFPRI and the UN HLTF (2011). Price volatility in food and agricultural markets: policy responses. Retrieved in October 2012 from http://www.oecd.org/dataoecd/40/34/48152638.pdf.

Ghysels, E., Santa-Clara, P., and Valkanov, R. (2006). Predicting Volatility: Getting the most out of return Data sampled at different frequencies," *Journal of Econometrics*, *131*(1-2): 59-95.

Ghosh, N., Chakravarty, S., & Rajeshwor, M. (2010). Effect of trade liberalisation on volatility: the experience of Indian agriculture. *International Journal of Economic Policy in Emerging Economies*, *3*(3): 253–271.

Gilbert, C. L. and Morgan, C. W. (2010). Food price volatility. Philosophical Transactions of the Royal Society B, *365*, 3023–3034. doi:doi:10.1098/rstb.2010.0139

Gilbert, C. L. (2010). How to Understand High Food Prices, *Journal of Agricultural Economics*, *61*: 398–425.

Headey, D. D. (2011). Rethinking the Global Food Crisis: The Role of Trade Shocks. *Food Policy, 36*(2): 136-146.

Hernandez, M. A., Ibarra, R. and Trupkin, D. R. (2014). How far do shocks move across borders?: Examining volatility transmission in major agricultural futures markets. *European Review of Agricultural Economics,41*(2): 301-325.

Huchet-Bourdon, M. (2011). Agricultural Commodity Price Volatility - Papers – OECD iLibrary. Paris. doi:DOI :10.1787/18156797

Kuwornu, J. K. M. Mensah-Bonsu, A andIbrahim, H. (2011). Analysis of Foodstuff Price Volatility in Ghana: Implications for Food Security. *European Journal of Business and Management*, *3*(4): 100-118

Litterman R.B. (1986). Forecasting with Bayesian Vector Autoregressions: Five Years of Experience. *Journal of Business and Economic Statistics, 4*(14): 25-38.

Martin, W. and Anderson, K. (2012). Export Restrictions and Price Insulation During Commodity Price Booms. *American Journal of Agricultural Economics, 94*(2): 422-427.

Mitchell, D. (2008). *A Note on Rising Food Prices.* Washington, DC: World Bank, Development Prospects Group, Policy Research Working Paper No. 4682.

Piot-Lepetit, I. (2011). Price volatility and price leadership in the EU beef and pork meat market (Piot-Lepetit, I. and M'Barek, R., Eds.). In *Methods to Analyse Agricultural Commodity Price*

Volatility (pp.85-106). New York: Springer Science+Business Media

Ojogho, O and Egware, R. A. (2015). Price Generating Process and Volatility in Nigerian Agricultural Commodities Market, *International Journal of Food and Agricultural Economics,* 3 (*4*): 55-64

Onoja, O., Usoroh, B. B., Adieme, D. T., and Deedam N. J. (2012). Determinants of Market Participation in Nigerian Small Scale Fishery Sector: Evidence from Niger Delta Region. *Journal of Sustainable Development, 9*(1): 69-84.

Otieno, D. J., Omiti, J., Nyanamba, T. and McCullough, E. (2009). "Market Participation by Vegetable Farmers in Knya: A comparison of Rural and Peri-urban Areas." *African Journal of Agricultural Research*, *4*(5): 451-460.

Pender, J., and Alemu, D. (2007). Determinants of smallholder commercialization of food crops: Theory and evidence from Ethiopia, IFPRI (International Food Policy Research Institute), Discussion Paper No. 75, Washington DC, USA

Reitz, S. and Westerhoff, F. (2007). Commodity price cycles and heterogeneous speculators: a STAR–GARCH model. *Empirical Economics*, *33*(2): 231–244.

Rezitis, A. N. and Stavropoulos, K. S. (2011). Price transmission and volatility in the Greek broiler sector: A Threshold Cointegration analysis, *Journal of Agricultural and Industrial Organization*, *9*(1): 1-35

Robles, M., Torero, M. and Braun, J. V. (2009). When Speculation Matters. *IFPRI Issue Brief No. 57*.

Schnepf, R. (2005). *Price determination in agricultural commodity markets: a primer*. CRS – Congressional Research Service – Report for Congress, RL33204.

Sckokai, P. and Moro, D. (2009). Modelling the impact of the CAP single farm payment on farm investment and output, *European Review of Agricultural Economics*, *36*(3): 395-423

Sims C. A. and Zha, T. (1998). Bayesian Methods for Dynamic Multivariate Models. International Economic Review*, 39*(4): 949-1155.

Shi, S. and Arora V. (2012). An Application of Models of Speculative Behaviour to Oil Prices. *Economics Letters,115*(3): 469-472.

Udoh, E., and Egwaikhide, F. O. (2012). Does International Oil Price Volatility Complement Domestic Food Price Instability in Nigeria? An Empirical Enquiry. *International Journal of Economics and Finance*, *4*(1), 235–246.

von Braun, J. (2011). Increasing and More Volatile Food Prices and the Consumer. *In: Lusk, J. and Shogren, J. (Eds.),The Oxford Handbook of the Economics of Food Consumption and Policy*, Oxford University Press, 612-628.

Westerhoff, F. and Reitz, S. (2005). Commodity price dynamics and the nonlinear market impact of technical traders: empirical evidence for the US corn market. *Physica A: Statistical Mechanics and its Applications*, *349*(3-4): 641–648.

Wolf, H. (2005). Volatility: definition and consequences. In B. Pinto, J. Aizenman (Eds.). *Managing volatility and crisis: a practitioner's guide overview.* Cambridge: Cambridge University Press, 45–64.

Wright, B. D. (2011). The Economics of Grain Price Volatility. *Applied Economic Perspectives and Policy*, *33*(1): 32–58.

*****

Research in the United Statesâ€™ agricultural futures markets have found maize (what they refer to as corn) to be the commodity that most broadly received and transmitted volatility transmissions. South Africa is the main emerging market for price discovery of maize in Africa, with white maize being the largest and most liquid agricultural commodity futures contract traded on the South African Futures Exchange (SAFEX). This paper examines volatility spillover effects in white maize futures against several other domestic grain and external market futures listed on SAFEX. Using daily return data, a multivariate GARCH approach is employed to study spillover effects between grain... Hedge your price risk in the expanding global Agricultural marketplace with benchmark products â€“ Wheat, Corn and Soybean futures and options. Find new opportunities to execute event-driven trades with precision using liquid, actively-traded Agricultural contracts. Explore Our Featured Products.Â Agriculture News and Events. Get the latest updates on the Agricultural futures and options market with product news and information, macro trends, and more. View all. Loading... Agricultural commodity prices are an indicator of changes in supply and demand, and as such, can detect abnormal conditions that need to be brought to attention. Price monitoring supports well-functioning international and national markets through the provision of timely and transparent market information, and constitutes a basis for evidence-based decision making and food security strategies. Past price volatility events have put in evidence the value of timely market information and analysis in order to mitigate the negative effects on low-income groups of population whose expenditure on food represents a large proportion of their total expenses.Â APP also enable analysts to analyse price transmission and volatility. Producer Prices â€“ Annual. Agricultural commodities are a huge part of the global economy. Read more to learn about how they play a part and which products dominate.Â Many agricultural commodities trade on stock and derivatives markets. We show you how and where you can trade the ones you're interested in. Browse All. Trading Guides. Barley Trading. Canola Trading. Corn Trading. Oil price volatility spillover eects on food prices in Nigeria. Azeez, Rasheed Oluwaseyi. University of Ibadan, Nigeria September 2018. Online at https://mpra.ub.uni-muenchen.de/93188/ MPRA Paper No. 93188, posted 22 Apr 2019 13:22 UTC.Â Johansen Co integration test and VECM. Developed commodity markets exhibit co-movement with crude oil. soybeans, in the long-run.Â Crude oil volatility spillover causes sharp changes in the agricultural markets especially in wheat and corn markets been sources of input for biofuels. No cross volatility effect from oil to corn markets. Oil prices and all prices of food except that of rice converge in the long run with a one way directional causality from oil prices to food prices.