Investigating the Determinants of Food Price Inflation in Nigeria

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Abstract: *The main purpose of this paper is to investigate the determinants of food price inflation in Nigeria. The paper employed the Johansen co-integration test and vector error correction model approach. The paper used quarterly time series data for the selected macro-economic variables: food prices, gross domestic product, money supply, exchange rate and energy prices over the period 2004 to 2014. The results indicate significant and long run relationship between food price inflation and its determinants. The findings show that gross domestic product and energy price contributes to food prices inflation, while money supply and exchange rate reduces food prices inflation in the long run. In the short run, the results show that all the determinants were insignificant in explaining food price inflation which suggests that food price inflation is a long run phenomenon in Nigeria. It is recommended that the government should provide measures that will reduce the prices on energy inputs and encourage private sector credits towards agricultural activities in order to lower the cost of production and higher prices on food items in the country.*

Keywords: *Co-integration, Food Price, Inflation, Nigeria, VECM*

1. Introduction

Since the commodity crisis of 2006, the price of food in most countries has been experiencing continuous volatility. And as a result, several low-income countries experienced high price levels, trade deficits, and unstable macroeconomic environments (Durevalls *et al*, 2013). Some of the drivers of global food price identified include rise in oil price (Baffes & Dennis 2013; Abdul-Rahim & Zariyawati, 2010; Arshad & Hameed, 2009), high demand for biofuels (Kristoufek *et al*, 2012; Harri et *al*, 2009), increased demand and climate change (Chen *et al*, 2010) and economic growth of developing countries (Gohin & Chantret, 2010; Udoh & Egwaikhide, 2010). However, there is little information on the major factors driving domestic food prices in most developing countries; particularly Sub-Saharan Africa (see Minot, 2010, Durevalls *et al*, 2013).

Nigeria is an oil rich country, ranked as Africa's largest producer of oil and the sixth largest oil producing country in the world (NNPC, 2014). Prior to the 1970s, the agricultural sector contributed to about 50% of the country's labour force, 65% of the Gross Domestic Product (GDP) and 75% of foreign exchange earnings revenue (Abdullahi, 2014). Since the 1970s, oil has been the major source of revenue to the country contributing about 75% to its GDP. Despite the huge resources from oil, Nigeria is characterized by threat of hunger, about 70 per cent of the population living on less than N100 ($0.7) per day, youth unemployment and high food imports (Dada, 2011). World Bank (2007) reported that about 35% to 40% of the population suffer from food insecurity. Coupled with these like many other developing countries Nigeria is experiencing fluctuations in food prices. The composite food index (with a weight of 507.3) of Nigeria, rose to 51 index point in 2006 after several years of relative stability of 25 index between the years 1995 and 2000. The index increased by 18% year-on-year basis to 88.6 in 2008 and 128 in 2011. It then rose by 0.9 per cent month-on-month to 154.4 in 2013 and reached 168 index points by December 2014. On year-on-year basis, food inflation index reached 172.8 with 9.4 year-on-year basis in 2015 (CBN, 2012, 2015).

Food price inflation has a very strong influence on the economy. High food price have serious effect on household that are food consumers because they either spend a large share of their income on food items (Mohsin & Zaman, 2012) or make reductions in some areas of food consumption leading to malnutrition (Abdullah & Kalim, 2008). It can create problems for the poor especially on account of allocation of budgets on non-food items (Ahsan *et al*, 2011). Food price inflation can hinder the growth of saving and investment especially in the developing nations (Joiya & Shahzad, 2013). Higher food price is also an indication of how the economy is poorly managed while a stable food price reflects a well-functioning environment (Kalyoncu, 2008).

The purpose of this paper is to examine the determinants of food price inflation in Nigeria over the period January 2004–December 2014. Most of the previous studies focused on the inflation and the major components of Consumer Price Index (CPI) (see Doguwa, 2013; Osuala *et al*, 2013; Chude *et al*, 2015). To my knowledge this is the first attempt to investigate the dynamic relationship between food price formation and macro-economic variable such as gross domestic product, exchange rate, money supply and energy price in Nigeria.

2. Literature Review

2.1 Concept of Inflation

Inflation is a sustained increase in the general price level over time. This increase in the overall level of prices can result from an increase in aggregate demand or cost increase in the supply side or some combination of both giving rise to demand pull inflation, cost push inflation or expected- induced inflation (Joseph & David, 2004). Umaru and Zubairu, (2012) defined inflation as a persistent rise in the general price level of broad spectrum of goods and services in a country over a long period of time. They state that Inflation has been intrinsically linked to money, as captured by the often heard maxim "inflation is too much money chasing too few goods". Chude, *et al* (2013) defined inflation as a continuing rise in prices as measured by an index such as the consumer price index (CPI) or by the implicit price deflator for Gross National Product (GNP).

2.2 Impact of Inflation on Food in Nigeria

Over the years, the proportion of food inflation in the components of the Consumer Price Index (CPI) in Nigeria have been fluctuating which has a serious impact on the country. First, on year-on-year basis, food inflation for June 2015 accelerated to 10.04 per cent. The peak level of food inflation since August 2014 when it was recorded was 9.96 per cent. The 10.04 per cent year-on-year food inflation was largely accounted for by the contributions of farm produce (yam, potatoes & other tubers; vegetables; rice agric sold loose; rice local sold loose; fruits and millet) and processed food, (fish & sea food; meat; garri yellow sold loose; oil & fats; bread unsliced; garri white sold loose and milk, cheese & eggs) which contributed 5.23 and 4.81 per cent, respectively (CBN, 2015). It can be seen that majority of households in Nigeria where food represents 60-80 percent of their spending, will suffer from domestic food inflation. Low income earners will be forced to allocate a larger share of their income on food items eventually pushing them to near or poverty line and can also lead to hunger death in the country. The continuous rise in the food prices will also force the central banks to control the upward pressure on prices, slowing down growth in the process.

Secondly, the statistical record indicate that the year-on-year headline inflation for June 2015 accelerated to 9.2 per cent which indicates the highest rate since 2013 and was largely accounted for by the increase in the relative contributions of food and non-alcoholic beverages (CBN, 2015). This suggests that food expenditure shares will exceed expenditure shares in other goods by a large margin in Nigeria which will reduce savings and investment, slowing economic growth. Lastly, the imported food inflation index (with a weight of 13.3 per cent),on year-on-year basis accelerated to 9.86 per cent in 2015 and was largely accounted for by the contributions of rice; frozen fish; bread; tea, coffee, chocolate; cake and spirit (CBN, 2015). The problem of the imported food inflation is that it will improve external in balances and as a result the country will be facing great challenge on maintaining macroeconomic stability while dealing with rising foreign exchange inflows. In sum, higher food prices have strong effect in the country because it will increase consumer price index, reduce the level of savings and investment, reduce consumer spending on non-food items, increase problem of balance of payment and slow economic growth in Nigeria.

2.3 Empirical Literature

Quite a number of studies have examined the factors influencing food prices in different countries especially with the recent sharp increase in food prices at global level. Sasmal (2015) investigated the factors responsible for food price inflation in India a growing economy with sluggish agriculture sector. They found that increase in per capita income and shortage in supply is responsible for food price rise. Increasing public expenditure and unfavourable foreign exchange rate have some effects on price although the results are not robust. Global food crisis, increased grain production and money supply does not explain price rise in the country. Irz *et al* (2013) investigate the dynamics of food price formation in

Finland with particular interest on the role of energy and found that food prices and the main elements of the food marketing bill; namely agricultural commodities, energy, and labour have a long run equilibrium relationship. The results show that agricultural prices were the main determinant of food prices with a long-run pass-through rate of nearly one third, while energy prices is significant but play a limited role in determining the equilibrium level of food prices. Joiya & Shahzad (2013) find that GDP, food export, food import and total credit to agriculture sector show significant impact on Pakistan food prices in both the short and long run. They also found that GDP and food export significantly contributed towards high food prices while food imports and credit to agriculture sector caused the reduction in the food prices.

Ahsan *et al* (2013) using different variables found that per capita income, agriculture output, agricultural subsidies, money supply, and world food prices have a significant impact on food prices in Pakistan. The results show that money supply played the most significant role in food prices increase in both the short-run and long-run. Lee & Park (2013) investigated the extent to which domestic food price inflation and volatilities of Asian countries are influenced by those of the other countries in the region, as well as global food price inflation and volatility during the period 2000–2011. Using the panel data of 72 countries, they found that lagged value of global food price inflation, intra- and extra- regional food price inflation rates and volatilities strongly affect domestic food price inflation and volatilities in Asia. Adam *et al* (2012) estimate a 'multiple determinant' single-equation models for month-on-month headline inflation and its principal components (food, energy and core inflation) in Tanzania. They found that food price inflation is mainly driven by supply-side factors: domestic agricultural supply shocks, and the pass-through from world prices for food and fuel have strong influence on domestic food prices while excess money supply have insignificant effect on food inflation. Rangasamy (2010) reports that although external factors do influence South Africa's food price movements, domestic influences such as national policy play the main role in influencing domestic food price inflation. Baek & Woo (2009) found that agricultural commodity price and exchange rate determine food prices movement in both short- and long-run, while in recent years, energy price show significant influence on U.S. food prices in the long-run. In sum, it can be seen that previous studies explaining the determinants of food price inflation in Nigeria and other African countries is lacking. Majority of the previous studies also employed the co-integration test to investigate the long run relationship between food prices using different macroeconomic variables.

3. Data and its Properties

The study used quarterly data for some selected variables (food price, Gross Domestic Product, foreign exchange, money supply and energy price) in Nigeria. The Consumer Price Index for food is used as a proxy for food price inflation in Nigeria as in Irz *et al* (2013). Data obtained started from January 2004 and ends December 2014. The choice of the sample is to cover the period before and after the international food crisis of 2006 and 2008. Data for all the variables were sourced from Central Bank of Nigeria Statistical Bulletin (2015). The following notations are used in the study: food price inflation (FPI_t), Gross Domestic Product (GDP), foreign exchange rate (ER_t), money supply (MS_t) and energy price (EP_t). The domestic oil price for Nigeria was used as proxy for energy price. These variables were selected because empirical evidence has shown that they can have strong influence on food prices. All the variables were converted into logarithm form to reduce the problem of heteroskedasticity.

4. Empirical Results and Discussions

4.1 Descriptive Statistics of the Selected Variables

Table 1 shows results of the summary statistics of the selected macro-economic variables and food prices in Nigeria. The results show that the sample mean and standard deviation are higher for the money supply and GDP. The variables are negatively skewed except gross domestic product and exchange rate, implying that they are characterised with fatter tail than the normal distribution. Kurtosis is less than 3 except for GDP and energy prices, indicating that they are leptokurtic. The Jarque-Bera test indicates that the time series for all the selected variables are not normally distributed.

Table 1: Summary Statistics of the Selected Variables

	FPI	GDP	M2	ER	EP
Mean	4.576620	15.85969	15.86805	4.962915	4.890623
Std. Dev.	0.358653	0.719068	0.706112	0.114348	0.217502
Skewness	-0.042647	0.879395	-0.603213	0.008828	-2.079595
Kurtosis	1.741198	3.875478	1.973527	2.329549	8.662410
Jarque-Bera	2.984731	7.237129	4.704585	0.843405	92.55328
Prob	0.224840	0.026821	0.095151	0.655929	0.000000

Note: *All the selected variables series are in natural logarithmic form. Figures in bracket are probabilities of the Jarque-Bera test which indicate that all series are not normally distributed*

4.2 Unit Root Test

First the Augmented Dickey Fuller (ADF) (1979) unit root test is used to investigate the time series properties of the variables (food price, gross domestic product, exchange rate, money supply and energy price) i.e whether they are stationary or otherwise based on the following regression equation:

$$\Delta x_t = \gamma x_{t-1} + \sum_{i=1}^{p} \beta_i \Delta x_{t-i} + \varepsilon_t \qquad (1)$$

Where: $x_t = [FPI_t, GDP_t, ER_t, MS_t, EP_t]$ and Δx_{t-i} are the lagged first differences of the variable to correct for higher-order serial correlation in the errors. FPI_t Represents the Food Price Inflation (CPI food as proxy for food price inflation), GDP_t is the Gross Domestic Product, ER_t is the foreign exchange rate, MS_t is money supply and EP_t is the energy price. The ADF test the null hypothesis $H_O: \gamma = 0$, series x_t is non-stationary against stationarity, H_1: $\gamma_1 < 1$ by allowing for either an intercept, intercept and deterministic trend and none in equation (1).

Table 2 presents the results of the ADF unit root test undertaken with constant and deterministic trend. The lag length for the order of the estimated auto-regression was selected based on the Schwarz Information Criterion (SIC). The results indicate that the null hypothesis of non-stationarity cannot be rejected at the 5% level for all the variables in their levels. However, the results indicate that each of the time series is stationary in first difference, suggesting that they are integrated of order 1 and they are I (1).

Table 2: Result of Unit Root Test

Variables	ADF (level)	ADF(Difference)
FPI	-2.9233(0.1663)	-3.6546(0.0394)*
GDP	-5.8885(0.0001)	-4.5055(0.005)*
M2	-0.9466 (0.941)	-7.4525(0.000)**
ER	-2.0825(0.541)	-4.1006(0.0125)**
EP	0.4888(0.999)	-4.3221(0.0071)**

Source: *Authors computation using secondary data obtained from CBN (2004-2014)*
*Note: p-values were reported beside the ADF t- statistics. *, ** indicates significant at 1% and 5% respectively.*

4.3 Long Run Relationship

The Johansen (1988) co-integration procedure is applied to investigate the long run relationship between food prices, gross domestic product, exchange rate, money supply and energy price in Nigeria. The method based on vector auto regression (VAR) can be expressed as follows:

$$x_t = \mu + \sum_{i=1}^{p} \Pi_i x_{t-i} + \varepsilon_t \quad (2)$$

Where: $x_t = [FPI_t, GDP_t, ER_t, MS_t, EP_t]$ is the $N \times 1$ vector of I(1) variables, Π is the N × N matrix parameter, μ is a vector of constant and ε_t is a vector of mean -zero error with covariance matrix Λ. Equation (2) can be expanded to an error correction representation form as follows:

$$\Delta x_t = \mu + \sum_{i=1}^{p-1} \Gamma_i \Delta x_{t-i} + \Pi x_{t-p} + \varepsilon_t \quad (3)$$ Where:

$\Delta x_t = [FPI_t, GDP_t, ER_t, MS_t, EP_t]$ and Π is the parameter that contains the long-run information and represents the stationary linear combination of the I(1) variable. All the variables in difference form contain short-run information and those in levels contain long-run information. Therefore, Δx_{t-p} and ε_t will be zero when the long run equilibrium is attained. The rank of Π matrix which ranges from G to zero indicates whether co-integration exists between the variables and it takes three possible forms: (a) If rank Π= 0, then the variables are not co-integrated. (b) If rank = G, then the variables are not co-integrated. (c) If 0 < rank Π < G, then the variables in are co-integrated.

Table 3 presents the results of the Johansen co-integration approach conducted with an intercept and no trend specified for the co-integrating equations. The optimal lag lengths of the VAR specification range from one to four lags selected by Akaike Information criterion (AIC), Sequential Modified LR statistics (LR) and Final Prediction Error (FPE) criterions. The results indicate that the Trace test and maximum eigenvalues tests reject the null of no co-integration between food prices, gross domestic product, exchange rate, money supply and energy price but cannot reject the null hypothesis of utmost one co-integration equation at the 5% significant level. This implies that there is co-integration relationship between the food prices, gross domestic product, exchange rate, money supply and energy price in Nigeria. The results show significant long-run equilibrium relationship between variables which is consistent with the findings of Sasmal (2015), Irz *et al* (2013) and Ahsan *et al* (2013). The implication of this findings is that the co-movement between the food prices and the selected macroeconomics variables suggest that both determinants of food price and other variables may have influence on each other driving them toward long term equilibrium level.

Table 3: The Johansen Co-integration Test Results

Unrestricted Co-integration Rank Test (Trace)

Ho	Hi	Trace Statistic	0.05 Critical Value	Prob.**
r =0 *	r=1	119.7560	69.81889	0.0000
r =1*	r=2	72.90482	47.85613	0.0001
r=.2	r=3	35.00284	29.79707	0.0115
r= 3*	r=4	14.03732	15.49471	0.0819
r= 4	r=5	5.326953	3.841466	0.0210

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Ho	Hi	Max-Eigen Statistic	0.05 Critical Value	Prob.**
r =0 *	r=1	46.85122	33.87687	0.0009
r =1*	r=2	37.90198	27.58434	0.0017
r =2	r=3	20.96552	21.13162	0.0527
r= 3*	r=4	8.710366	14.26460	0.3111
r= 4	r=5	5.326953	3.841466	0.0210

Note: ** indicates that the null hypothesis of no co-integration is rejected at 5% level of significance. The t-statistics are shown in parentheses beside the critical values at 5% level are taken form λ trace and λ max, MacKinnon-Haug-Michelis (1999).The results indicate co-integration relationship between the food prices, gross domestic product, exchange rate, money supply and energy price in Nigeria.*

The results of the normalised long-run cointegration relationship among the variables are estimated by the Johansen technique as follows:

$$LFPI = 9.651 + 0.908\,LGDP - 0.1087\,LM2 - 1.392\,LER + 1.722\,LEP \qquad (4)$$

[-9.23] [-2.43] [-3.39] [-7.10]

Equation (4) indicates the long run coefficients of the co-integration and t ratios of the estimated coefficients are reported in parentheses. The estimated results indicate that the variables are significant in explaining food price inflation. The gross domestic product and energy price indicate significant positive influence on food price inflation this is consistent with the work of. Joiya & Shahzad (2013); Irz *et al* (2012); Abdullahi & Kalim (2008). The results also indicate that money supply and exchange rate show negative influence on food price inflation in line with Adam *et al* (2012) and Sasamal (2015) but contrasting Beak & Woo (2009) who show that exchange rate contributes to food price inflation in US. However, this is not surprising given the differences in their study area. The implications for these results are that increase in gross domestic product caused high food price because income level will increase domestic consumption and importation of foreign goods into the country. Secondly, the exchange rate appreciation will increase the flow of foreign capital and production of food export at lower cost which caused a decline in food price inflation in Nigeria. Thirdly, the influence of money supply shows that government expansionary monetary policy to increase credit facilities for small scale farmers will cause increase in production, lowering the cost of input and decline in the price of food in the country. Lastly, energy prices increase caused the cost of production to increase which increased food price in the country.

4.4 Short Run Relationship

The short run relationship can be determined using the following VECM representation:

$$\Delta FPI = \alpha_0 + \sum_{j=i}^{n} \alpha_1 \Delta GDP_{t-1} + \sum_{j=i}^{n} \alpha_2 \Delta MS_{t-1} + \sum_{j=i}^{n} \alpha_3 \Delta ER_{t-1} + \sum_{j=i}^{n} \alpha_4 \Delta EP_{t-1} + \delta ECT_{t-1} + \varepsilon_t$$

Where: ECT represents the error correction term which determines the short-run relationship between variables. If the coefficient δ is negative and significant, then short run relationship exists among the variables in the model. Likewise, positive sign of δ implies that the variables converge towards the long run equilibrium position.

Table 4: Results of the Vector Error Correction Model (VECM)

Dependent variable: FPI_t		
Variables	coefficient	T statistics
ΔFPI_{t-1}	-0.340961	-1.27885
ΔGDP_{t-1}	0.148078	1.38022
$\Delta M2_{t-1}$	0.208178	1.77243
ΔER_{t-1}	-0.350284	-1.23860
ΔEP_{t-1}	0.314874	1.50626
ECT_{t-1}	0.212503	1.48552

Note: *All the variables are insignificant in explaining food price inflation in the short run*

Table 4 presents the results of the short run dynamic of the variables. The empirical estimate indicates that all the variables: gross domestic product, energy price, money supply, exchange rate are insignificant in explaining food price inflation in the short run. All the variables have positive relationship with food price inflation except exchange rate in line with Abdullahi & Kalim (2008) but contrasting Ahsan *et al* (2013). The coefficient of the error correction of our short run analysis is positive and statistically insignificant. This implies that the variables do not move together towards the long run equilibrium point. The results suggest that food price inflation is a long term phenomenon in Nigeria.

4.5 Major Findings

The major findings of the study are as follows: First, there exists significant and long-run relationship between food price inflation and its determinants: gross domestic product, money supply, exchange rate and energy prices in Nigeria. Second, increase in gross domestic product and energy price were found to contribute to food prices inflation, while increase in money supply and appreciation in USD/Nigeria exchange rate were found to reduce food prices inflation in the long run. Lastly, it was found that all the selected variables were insignificant and have no relationship, with food price increase in Nigeria in the short run.

5. Conclusion and Recommendations

5.1 Conclusion

This paper examined the determinants of food price inflation in Nigeria using the Johansen co-integration and vector error correction model approach (VECM). The study used time series data for the selected macroeconomic variables food price inflation, gross domestic product, money supply, and exchange rate and energy prices over the period 2004 to 2014. Empirical results provide strong evidence of long-run relationship between food price inflation and its determinants: gross domestic product, money supply, exchange rate and energy prices. Furthermore, gross domestic product and energy price are the main drivers of food price inflation in the country because increase in these variables caused high food price in Nigeria. The findings suggest that higher economic growth rates and increase in energy price leads to higher domestic food price inflation while appreciation of exchange rate, increase in money supply lead to lower domestic food price inflation. The short run analysis indicates that all the variables were insignificant and do not converge toward the long run equilibrium.

5.2 Recommendations

It is recommended that policy makers should understand that food price inflation is a long-run phenomenon in Nigeria, and they should consider economic growth and energy prices when making policies and strategies that will reduce food prices. Government should provide measures that will reduce the prices on energy inputs such as petroleum, diesel and electricity to reduce production cost. It should encourage private sector to increase credit especially towards the agricultural activities to reduce cost of production.

5.3. Suggestions for Future Studies

Future research should investigate the determinant of food price inflation in Nigeria using high frequency data such as monthly or daily, and covering a longer period in order to confirm the findings. It is suggested that future research should examine the determinants of food price inflation in the country using more advanced models such as the ARDL which may provide new evidence.

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