



ASSESSMENT OF THE PRICE FLUCTUATION ON PRODUCTION OF SELECTED FOOD GRAINS IN NIGERIA (1981-2020)

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ABSTRACT

The study assessed price fluctuation on production of selected food grains in Nigeria (1981-2020). A longitudinal-trend design was adopted for the study. Time series data were collected from secondary sources. The data were analyzed using regression analysis [Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model]. Findings of the study showed that price fluctuation of the selected food grains are challenges toward achievement of small-scale farmers' development which resulted to loss of capital and farmers shifting to other production activities. The results further revealed that, maize had a higher mean of ₦1,714.375 per ton; the maximum price fluctuation was found in rice (₦26,516 per ton) than maize (₦19,247 per ton) and wheat (₦15,999 per ton); maize (1.342703) and rice (0.874336) were skewed positively to the right tail implying the presence of more values that are higher than the sample mean and wheat (-3.08378) skewed negatively to the left tail implying the presence of more values that are lower than the sample mean; rice and maize price fluctuations may be described as leptokurtic (positive excess kurtosis) with a kurtosis greater than 3 relative to the normal while wheat has a kurtosis less than 3 (negative excess kurtosis) and may be described as platykurtic implying that the distribution has a flattened curve relative to the normal. The Jarque-Bera probability test of normality showed that the price fluctuations of rice, maize and wheat were not statistically significant at $P \leq 0.05$ level of significance, thereby rejecting the null hypotheses. This implies that, price fluctuation has effects of on outputs and prices of selected food grains such as rice, maize and wheat grains in Nigeria for the period under study. The result of the price fluctuation test in prices of maize and wheat also showed that the ARCH [RESID(-1)²] and GARCH [GARCH(-1)] terms are significant at $P \leq 0.05$ level, but rice revealed ARCH [RESID(-1)²] and GARCH [GARCH(-1)] terms was significant at $P \leq 0.05$ level. These implies that the price of maize, wheat and rice will continue to fluctuate in line with *their apriori* expectations. The study concluded that pattern of real prices of food (rice, maize and wheat) gains movements in Nigeria fluctuate from 1981 to 2020. The study recommended that fiscal and monetary policies that can help increase food (rice, maize and wheat) grains' production and keep its price within the reach of common men should be pursued by government and other stakeholders in the agricultural sector of Nigeria.

Keywords: Causes, Contributions, Solutions, Price fluctuation, Food grains, Nigeria.

INTRODUCTION

Fluctuation in prices seriously affects food grains productivity in Nigeria. For instance, the closure of poultry and poultry processing companies following the outbreak of avian influenza in Nigeria has adversely affected the demand for maize, a major component of poultry feeds across the country. With last year's stock of grains still in the market, serious concern has been raised about the impact of the abundant supplies on prices with the exception of wheat which is commonly demanded by bread manufacturing bakeries in Nigeria.



Conversely, the low demand for maize has discouraged many farmers from maize production and consequently increased the price of maize in 2008 (Ikuemisan and Deacue, 2017).

The Nigerian government realizing the importance of the grain sub-sector had several times intervened in standardizing grain prices through agricultural price policy reformation. Some of the instruments used, as pointed out Taru (2014), included input subsidies, strategic grain reserve scheme of 1976, ban on importation of rice and maize in 1985, wheat in 1987 and the liberalization of the economy in 1986 among other measures. Some of the programmes launched in Nigeria to boost food grains' production vary from Agricultural Transformation Agenda (ATA), Green Alternative and the International Center for Agricultural Research in the Dry Areas (ICARDA) to cut down the cost of food importation by African countries and Technology for African Agricultural Transformation (TAAT) mainly to scale up technology generated by ICARDA in recent period (Haruna *et al.*, 2017). Despite these lofty attempts, the producer prices of grains continued to fluctuate in Nigeria.

Price is an important factor in markets and food security analysis for the reason that it serves as an indicator for food availability and food access. According to Togun *et al.* (2019) agricultural marketing and trade plan in Nigeria is still conquered by the challenge of how to effectively deal with food price stability, as a result of middlemen activities who try to take away all the gains and create artificial scarcity, poor pricing policies, non-efficient food commodity regulatory bodies for food crops, seasonal price fluctuations, inadequate of good roads among others. In recent time, the high price trend of international commodities has aroused curiosity of scholars to thoughtfully study spatial market integration of domestic markets with international or with other domestic ones while only but few studies have revealed why prices of important food crops fluctuate from year to year. The urgent needs to assess the causes of price fluctuation on production of selected food grains in Nigeria, examine the contribution of good price toward achievement of small farmers' development and find out the possible solutions on how price fluctuation could be addressed cannot be over-stretched. This is because, information from the study will help to gain understanding of how per capita income, exchange rate, inflation among other factors influence prices of food grains in Nigeria.

Price fluctuation is a multifaceted problem attributed by numerous factors which, when combined, culminated in dangerous consequences for the most vulnerable (Enghiad *et al.*, 2017). Though high prices can technically be good news for farmers, price fluctuation is extremely dangerous, as farmers and other agents in the food chain risk losing their investments if prices fall (Haruna *et al.*, 2017). One commonly cited reason for increased prices is 'market fundamentals' as demanded is thought to be outstripping supply and thus leading to increased prices (Enghiad *et al.*, 2017).

Research works on price fluctuation of agricultural products and its impact on small scale farmers' development have been conducted and a lot of recommendations made. Taru (2014) worked on price fluctuation and market integration of selected cereal in North-Eastern Nigeria. He established the major source of variability in the price series from 2001-2010. According to Huka *et al.* (2014), development of small-scale farmers depends entirely entire on the price stability of their farm produce. Food grains' marketing is a very important but rather neglected aspect of agricultural development. Their works still left out the aspect of pricing and did not make any particular reference to rice, maize and wheat.

Despite the intensity of research work done on price fluctuation, the conversation about understanding the effect of food price fluctuation is to first, distinguish between food net purchaser and net food sellers (Taru, 2014). On that account, therefore, net food purchasers always face the effect of high food prices resulting from food price fluctuation. To have the above dichotomy for studies is good but to think of how a society will exist without such is



unimaginable. The dual can be found across rural and urban sectors. In developing countries such as Nigeria where the higher proportion of the population who engaged in agriculture are considered poor. Not only are they characterized with low income, most of their countries are still net food importers as government often spend huge on food importation (Ikue-misan and Deacue, 2017).

Extrapolating from different literature, one fundamental issue about all food price fluctuation remains lack of transparency in the inventory and arbitrage perhaps in response to macro-economic dynamics (Minot, 2014). Some countries have made efforts to intervene by building storage (silos) for food grains so that they can effectively manage distribution during scarcity. This has been found to significantly stabilize food price fluctuation. Beyond this, food demand is increasing daily and there is that compelling need to match it up with supply to keep that market equilibrium in shape. Many other factors keep raising the apprehension of food traders (middlemen) about the food market for possible fall in return and so, the need to be prepared for this too. By so doing, the risk premium dictates the increased new price (Taru, 2014).

The specific objectives of the study were to: (i) assess the causes of price fluctuation on production of selected food grains in Nigeria (1981-2020), and (ii) examine the contribution of good price toward achievement of small farmers' development; Based on the specific objectives of the study, the following null hypothesis was tested: H_{01} : There is no causal relationship between price fluctuation and outputs of rice, maize and wheat grains in Nigeria.

In terms of the causes of price fluctuation on the production of food grains in Nigeria, price fluctuation is a frequent rise and fall of commodity prices in the market as a result of changes in the market situations. It can be seasonal whereby prices of commodities changes during certain seasons of the year due to increases in supply and demand. Price fluctuation in the market can take a short term due to a slight change in demand or supply of commodities in the market. But it can also last long due to the increased inflation rate which highly affects the prices of commodities in the market and its effect last long and limit the ability of customers to purchase commodities in the market (Ikue-misan and Deacue, 2017).

Prices of food grains have been fluctuating widely over the years, thereby hunting both consumers and producers (Minot, 2014). The Food and Agriculture Organization (FAO) of the United Nations (2017) showed that, the price index of food have fluctuated widely over the years. The index show that price rose from 122 in 2006 to 214 in June 2008 (FAO, 2017). This was caused by the following factors changing petroleum prices which result to high translation of food price like transportation cost, crop yield, food stock levels as stock fall price rise, change exchange rate especially of major exporting countries, trade policies, drought, low technology, demand of food is in elastic as small changes in supply can cause big change in prices, the role of speculation purpose and seasonal production Also according to United Nations (2015) the agricultural commodity markets have experienced extreme price fluctuation more and more frequently, the main reason for this changes are supply and demand factors this include population growth, weather condition this affect the output related to price.

On the contribution of good price toward achievement of small-scale farmers' development, Osaihiomwam and Robert (2015) argued that price contribute much toward achievement of small-scale farmers' development but this is measured by considering price if it covers the cost of production. For example, when the price of food grain is good or high compare to the cost production result to the high profit to the producer of such grain or its product. Farmer maximize their profit this is due to Return on Investment (ROI) which is high than cost of production, increase per capital income of farmers hence reduce the poverty, increase the production (output) due to capital accumulation, maximize market share, increase



cash flow of the producer, effective planning and decisions making on production and reduce the risk of losses.

For the possible solution on how price fluctuation could be address in Nigeria, Minot (2014) suggested various methods which can be adopted by the government and other stake holders in order to reduce price fluctuation of food grains to include effective management and control of markets. For example, by maintaining buffer stocks, high investment in agriculture sectors particularly in research development and infrastructure that promotes irrigation, improvement of trade policies particularly agricultural subsidies, improving market transparency whereby the FAO should intensify its information gathering and disseminating information. Financing instrument where by existing financial instruments such as the IMF must made more flexible and usefully for developing countries during crises, commodity exchanges the regulatory frame works governing must also be reviewed to reduce speculative behaviour and thus limit fluctuation.

MATERIALS AND METHODS

The Study Area

A longitudinal-trend design was adopted for the study. The study area is Nigeria. It lies roughly between latitudes 4°N and 14°N as well as longitudes 3°E and 15°E (Federal Ministry of Environment, 2012). It covers a landmass of approximately 923,768 km² representing about 14% of the land area in West Africa (Water and Sanitation Programme, 2012). The population of Nigeria stood at 211.40 million inhabitants in April 2021 (O'Neil, 2021). This makes the country the most populated nation and one of the largest countries in Africa [Central Bank of Nigeria (CBN), 2013]. The country is bordered by the elongated territory of Benin to the west, the semi-arid country of the Niger Republic to the North, the sub-equatorial Cameroun to the East, and the Atlantic Ocean to the South.

Method of Data Collection

The data was obtained from records of the National Bureau of Statistics (NBS), Food and Agriculture Organization Statistical Database (FAOSTAT) publications, databases and annual reports. These sources were selected because of the consistency and long period of the coverage of data. The variables for which data was collected consists of production and prices of rice, maize and wheat grains in Nigeria for a period of forty years (1981-2020).

Data Analytical Techniques

Data for this study was analyzed using both descriptive and inferential statistics. Specifically, descriptive statistics such as mean, maximum and minimum were used to achieve objective i. While the inferential statistic like regression analysis [Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model] was used to achieve objective ii.

The GARCH model was used to measure the fluctuation on outputs and prices of selected food grains such as rice, maize and wheat in Nigeria:

$$Y_t = \alpha + \sum_{i=1}^k n_i x_t - 1 \varepsilon_t \quad \dots(1)$$

where;

Y_t = measure of food grain price fluctuation at time t.

α = mean,

$x_{t-1} \dots x_t$ = exogenous variables

$$\delta = \sqrt{\frac{1}{N} \sum_{i=1}^k (X_i - \bar{X})^2} \quad \dots(2)$$

where;

δ = variance,



\bar{X} = mean,

x_i = standard deviation.

$$\delta_t^2 = w + \sum_{i=1}^p a_i \epsilon_{t-i}^2 + \sum_{i=1}^q \beta_i \delta_{t-i}^2 \quad \dots(3)$$

where;

δ_t^2 = conditional variance,

P = order of the GARCH,

δ_{t-i}^2 = k GARCH term.

$$Y_t = \alpha + \sum_{i=1}^k n_i R p_{t-1} + \sum_{i=1}^k n_2 M p_{t-1} + \sum_{i=1}^k n_2 W p_{t-1} + \sum_{i=1}^k \epsilon_t \quad \dots(4)$$

RESULTS AND DISCUSSION

Summary Descriptive Statistics of Price Fluctuation Variable

The summary of statistics is presented in Table 1. The result showed that, the mean for maize was ₦1,714.375 per tonne, that of wheat was ₦1,696.00 per tonne and rice had ₦1,615.50 per tonne. For maximum price fluctuation, rice had ₦26,516 per tonne, maize got ₦19,247 per tonne and wheat stood at ₦15,999 per tonne. The skewness, which is a measure of asymmetry indicated that maize (1.342703) and rice (0.874336) were skewed positively to the right tail implying the presence of more values that are higher than the sample mean and wheat (-3.08378) skewed negatively to the left tail implying the presence of more values that are lower than the sample mean. This is in line with the findings of Ikuemisan and Deacue (2017) that, same can better be interpreted as long fat right for maize and rice and left tails for wheat skewness accordingly. Thus, it is therefore convenient to accept Generalized Autoregressive Conditional Heteroskedasticity (GARCH) variants to estimate these food return series (Ikuemisan and Deacue, 2017).

Table 1: Summary Statistics of the Variables

Statistics	Rice	Maize	Wheat
Mean	1615.500	1714.375	1696.000
Median	550.0000	1760.000	1205.000
Maximum	26516.00	19247.00	15999.00
Minimum	-20150.00	-9697.000	-44500.00
Std. Dev.	7791.578	5212.285	9250.802
Skewness	0.874336	1.342703	-3.083780
Kurtosis	7.026174	7.079435	16.75496
Jarque-Bera	32.11323	39.75532	378.7294
Probability	0.000000	0.000000	0.000000
Sum	64620.00	68575.00	67840.00
Sum Sq. Dev.	2.37E+09	1.06E+09	3.34E+09
Observations	40	40	40

Source: Data analysis (2021).

On one hand, the result of Table shows that rice and maize price fluctuations may be described as leptokurtic (positive excess kurtosis) with a kurtosis greater than 3 relatives to the normal while wheat has a kurtosis less than 3 (negative excess kurtosis) and may be described as platykurtic implying that the distribution has a flattened curve relative to the normal. The Jarque-Bera probability test of normality shows that the price fluctuations of rice, maize and wheat were not statistically significant at 5% level of significance, thereby rejecting the null hypotheses. This implies that, price fluctuation has effects of on outputs and prices of selected food grains such as rice, maize and wheat grains in Nigeria for the period under study. It also



shows that price fluctuation of the selected food grains are challenges toward achievement of small-scale farmers' development which results to loss of capital and farmers shifting to other production activities. This in line with the findings of Ikuemonisan and Deacue (2017) that, volatility persistence in the selected food grains were higher.

Price Fluctuation on the Production of Selected Food Grains in Nigeria

The result of the price fluctuation test in prices of maize is presented in Table 2. The result showed that the ARCH [RESID(-1)²] and GARCH [GARCH(-1)] terms are significant at 1% level. The result shows that prices of maize fluctuated during the period under study. The summation of the coefficients of ARCH (0.197267) and GARCH (0.823421) is very close to one (1). This shows that the price of maize will continue to fluctuate and it is in line with *apriori* expectation. The result is in line with the findings of Hartman and Wiklander (2012) that, frequently traded food grains are better suited for volatility forecasting than the less traded grains.

Table 2: GARCH result for the fluctuations in prices of maize

Variable	Coefficient	Std. error	z-statistics	Prob.
C	-0.476463	0.132046	-3.608300	0.0003
LNMAIZE_PRICE(1)	1.039855	0.018035	57.65675	0.0000
Variance Equation				
C	-0.001787	0.000202	-2.873297	0.0041
RESID(-1) ²	0.197267	0.027190	7.255272	0.0000
GARCH(-1)	0.823421	0.046099	17.86198	0.0000
R-squared	0.977784	Mean dependent var		9.305681
Adjusted R-squared	0.977184	S.D. dependent var		1.997335
S.E. of regression	0.301697	Akaike info criterion		-0.024935
Sum squared residual	3.367788	Schwarz criterion		0.145687
Log likelihood	4.486234	Hannan-Quina criteria		0.036283
Durbin-Watson stat	2.203206			

Source: Data analysis (2021).

The result of the fluctuation test in prices of rice is presented in Table 3. The result showed that the ARCH [RESID(-1)²] and GARCH [GARCH(-1)] terms are significant at 5% level. The result shows that rice price has fluctuated during the period under study. The summation of the coefficients of the ARCH (0.209791) and GARCH (0.803158) is very close to one (1). This shows that prices of rice continue to fluctuate and it is in line with *apriori* expectation of the study. Which is in line with the findings of Hartman and Wiklander (2012) that, frequently traded food grains are better suited for volatility forecasting than the less traded grains.



Table 3: GARCH result for the fluctuations in prices of rice

Variable	Coefficient	Std. error	z-statistics	Prob.
C	0.780637	0.165811	4.707989	0.0000
LNPRICE_PRICE(1)	0.929000	0.016623	55.88517	0.0000
Variance Equation				
C	0.000729	0.002382	0.306123	0.7595
RESID(-1)^2	0.209791	0.289385	2.107196	0.0351
GARCH(-1)	0.803158	0.185696	2.709578	0.0067
R-squared	0.974049	Mean dependent var		9.633334
Adjusted R-squared	0.973348	S.D. dependent var		1.760234
S.E. of regression	0.287368	Akaike info criterion		0.148605
Sum squared residual	3.055482	Schwarz criterion		0.361882
Log likelihood	2.102203	Hannan-Quinn criteria		0.225127
Durbin-Watson stat	1.691067			

Source: Data analysis (2021).

The result of the fluctuation test in wheat prices is presented in Table 4. The result showed that the ARCH (RESID(-1)^2) and GARCH (GARCH(-1)) terms are significant at 1% level. The result shows that wheat price has fluctuated during the period under study. The summation of the coefficients of the ARCH (0.203382) and GARCH (0.872469) is very close to one (1). This indicates that price of rice will continue to fluctuate and it is in line with *a priori* expectation of the study. The result coincides with the findings of Hartman and Wiklander (2012) that, frequently traded food grains are better suited for volatility forecasting than the less traded grains.

Table 4: GARCH result for the fluctuations in prices of wheat

Variable	Coefficient	Std. error	z-statistics	Prob.
C	0.842082	0.275253	3.059306	0.0022
LNWHEAT_PRICE(1)	0.924706	0.030092	30.72964	0.0000
Variance Equation				
C	0.039159	0.105365	3.659300	0.0012
RESID(-1)^2	0.203382	0.267336	4.707989	0.0000
GARCH(-1)	0.872469	1.290580	7.255272	0.0000
R-squared	0.974448	Mean dependent var		9.582828
Adjusted R-squared	0.973757	S.D. dependent var		1.787899
S.E. of regression	0.289632	Akaike info criterion		0.547964
Sum squared residual	3.103810	Schwarz criterion		0.761241
Log likelihood	-5.685298	Hannan-Quinn criteria		0.624486
Durbin-Watson stat	1.295613			

Source: Data analysis (2021).

CONCLUSION AND RECOMMENDATIONS

The study concluded that pattern of real prices of food (rice, maize and wheat) gains movements in Nigeria fluctuate from 1981 to 2020. Nigeria rice, maize and wheat industries experienced growth rates in prices. More importantly, per capita income, exchange rate as well as roots and tubers used as substitute among other variables were found to be significant drivers of rice, maize and wheat prices in Nigeria. The study recommended that fiscal and monetary policies that can help increase food (rice, maize and wheat) grains' production and keep its



price within the reach of common men should be pursued by government and other stakeholders in the agricultural sector of Nigeria.

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