DETERMINANTS OF AGRICULTURAL FOOD GRAIN COMMODITY PRICES IN NIGERIA

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ABSTRACT

The study analyzed the determinants of agricultural food grain commodity prices in Nigeria. Secondary data was used for the study and covered the period of 1981-2018. Data obtained was analyzed using regression techniques. The findings revealed that inflation, importation policy, oil prices, quantity consumed of maize, corruption, population, that quantity supplied of maize and time variable significantly influenced the prices of maize in Nigeria within the period under review. Inflation, importation policy, quantity consumed, corruption, government capital subsidy, population and time variable significantly influenced the price of wheat in Nigeria within the period under study. The results further disclosed that on aggregate level, inflation, importation policy, quantity consumed of grains, corruption, government capital subsidy, population, quantity supplied of grains and time variable significantly ($P \leq 0.5$) influenced the price of food grains in Nigeria within the period under review based on the specified model. The study therefore, recommended that government should put in place necessary strategies to curb the rate of corruption and ensure political stability in the country that favours food grain price regulation as well as ensure that the prices of food grains in Nigeria, especially that of wheat and maize are made affordable to consumers and that it encourages the farmers to remain in the production of food grains in Nigeria.

Keywords: Agricultural, Commodity prices, Food grain, Determinants, Nigeria.

INTRODUCTION

The agricultural sector is a vital integral of economic growth of any country. The agricultural sector plays a fundamental role in the creation of income and employment opportunities in developing countries. The crop sector is by far the most significant subsector in the agricultural sector and covers a broad area of production, postharvest activities, packaged agricultural raw materials, industrial and technology intensive processing of intermediate goods and the fabrication of final products derived from agriculture (United States Department of Agriculture [USDA], 2008).

One of the determining factors to how much an average poor Nigerian can consume the available energy giving food is price. The nominal price of the individual food commodities has continuously fluctuated over the past years. Major grain crops in Nigeria have shown broad variations in nominal prices or producer prices over the decades (Akpan and Udoh, 2009). Currently, Nigeria is at the level of high food prices following the order of the surge in the international food market.

It has been observed that most urban and rural markets have been exhibiting historically high prices since 2007 which worsen in April 2008 and until now the prices are still high above its 2005 level (Famine Early Warning Systems Network [FEWSNET], 2008; Agboje *et al.*, 2013; and Odozi and Omonona, 2012). According to the World Bank (2012) price increase on grains will affect not only bread and processed food, but also animal feed and ultimately the

price of meat. While higher prices are generally good news for farmers, the impact on the poor in developing countries who spend a high proportion of their income on food can be devastating (Agboje *et al*., 2013). However, higher prices can bring desperately needed income to poor farmers, enabling them to invest, increase their production and thereby become part of the global food security solution (World Bank, 2012).

The challenge of feeding the growing world population, which is expected to reach 9 billion people in 2050, requires new strategies and new multicultural and multi-sectorial rethinking capable of generating new forms of dialogue, at different specialist levels, towards a more sustainable use of the available natural and human resources, to ensure food and nutrition security (Udoh, 2009) especially through agricultural commodity processing. Therefore, it becomes very crucial to investigate the determinants of selected agricultural food grain commodity prices in Nigeria.

The persistent variations in the prices of agricultural food grain commodities affect the consumer demands for food items and therefore hamper the challenges of attaining a sustainable food security status. The variability in commodity prices often has serious implications on food security status of the households. In an attempt to mitigate the effects of price fluctuations on the level of consumer demand (purchasing power) and household food security, the government had put in place some policy control measures/policies (Agboje *et al*., 2013). These are minimum price control (price floor) and maximum price control (price ceiling). The minimum price control is usually fixed above the market prices with the objective of helping the farmers get a good price for their produce in the face of low demand. On the other hand, the aim of the maximum price for a commodity is basically to increase consumers" purchasing power. This is usually done when the government feels that the prices of commodities are too high probably above the reach of the average consumer. Successive governments in Nigeria have at one time or the other attempted to fix prices of commodities with little success. Against this background it becomes imperative to investigate the determinant of selected processed agricultural commodity prices in Nigeria to be able to make relevant policy that will ensure that variability in agricultural commodity prices remains steady overtime.

The study attempted to provide answer to the research questions of what determines the price of agricultural food grain commodities in Nigeria. The broad objective of the study was determinants of agricultural food grain commodity prices in Nigeria. Food grains such as maize and wheat were selected for the study. The null hypothesis that guided the study stated that inflation rate, exchange rate, importation policy (tariff rates), population growth, water resources, quantity consumed of selected agricultural food grain commodities does not significantly and positively determine the relative prices of the selected agricultural food grain commodities while, political stability oil prices, corruption, government capital subsidy to agricultural and quantity supplied of agricultural food grain commodities does not significantly and negatively determine the relative prices of the selected agricultural food grain commodities in time t.

Due to the manner the researcher planned and carried the study, it preferred seasoned information to various interest groups and enhances effectiveness in their respective activities. The study would help to highlight the determinants of selected processed agricultural commodity prices in Nigeria with the period under investigation. The information that was revealed through the study helped government, stakeholders in agriculture and the farmers in formulating good policies as it affects relative commodity prices of processed agricultural commodities.

In spite of the extensive studies done elsewhere on the relationship between inflation and relative price variability within the agricultural sector, adequate studies have not been done in Nigeria. Rather, most studies on inflation focused on explaining Nigeria's inflationary process (Asogu, 1991; Egwaikhide *et al*., 1994; and Afolabi and Efunwoye, 1995). Only few studies analyzed the effects of inflation on the economy. Examples of such studies include Central Bank of Nigeria [CBN] (1974) and Osakwe (1982). Both of these studies focused on the impact of inflation on output growth and several other macroeconomic variables: gross fixed investment, savings, imports, inventories, residential investment, exports and foreign capital inflow. Inconclusive results were obtained because the coefficients were *not* statistically significant. Again, the studies did not analyze the effect of inflation on agricultural prices.

Abbot *et al*. (2008) explained in their study that shocks to the rise of financial assets, and especially to currencies, can affect the income of food commodity producers. Thus, changes in economic environment may result in significant price swings in the short run (Gardner, 1981). Alhalith (2010) showed fluctuations in oil prices can lead directly to variations in food prices and can also influence the dynamics of food prices via biofuel prices (Busse *et al*., 2010). In addition, there could be existence of volatility spillovers between the oil and food commodity markets (Nazlioglu *et al*., 2013; and Du *et al*., 2011). Speculation on commodity futures markets as investigated by Gilbert (2010) that its effect is more or less on price variability of Agricultural commodities.

MATERIALS AND METHODS
The Study Area
Nigeria as the study area for this study is the most populous African country south of the Sahara (Nnamerenwa, 2012). It is a geo-political and sovereign entity that is composed of 36 states and the Federal Capital Territory (FCT-Abuja). Nigeria is situated along the coast of West Africa between latitudes 4° and 14°N and longitudes 3^{0} and 15^{0}E. It shares a common boundary with Niger on the West, Cameroun Republic on the East, and Gulf of Guinea on the south. Nigeria occupies a land area of 98.3 million hectares, of which only about 34.2 million hectares are actually being cultivated and less than 1% of the arable land is irrigated (National Bureau of Statistics [NBS], 2008). Rice, wheat, acha, beans, cassava, potato, yam, cocoyam, plantain and vegetables are all major crops grown in Nigeria. Export crops include groundnut, cotton, rubber, oil palm, cocoa, tobacco and coffee.

Method of Data Collection
The study made use of secondary data, mostly time series. Data on relative prices of processed agricultural commodities, processed agricultural commodities and other variables were collected from the publications of development finance and research department of the CBN. Also documents of the National Bureau of Statistics (NBS), National Planning Commission (NPC), Transparency International, Food and Agriculture Organization (FAO) and other official sources served as supplementary data sources. Secondary data that was utilized by the research for the study covered 1981- 2018.

Analytical Techniques
The data obtained was analyzed using ordinary least square multiple regression technique. A regression model was formulated and estimated for each of the selected agricultural food grain commodities (maize and wheat). The model which was used to explain the determinants of relative price of selected agricultural commodities was specified, and in its implicit form, was given as:

$$RP_t = f(IFR_t, EXR_t, TR_t, GEA_t, QC_t, PS_t, OP_t, POP_t, Cor_t, QS_t, T_t) \qquad \dots (1)$$

where;

RP_t = relative prices of the selected agricultural food grain commodities (corn and wheat) measured in naira in time, t.

IFR_t, = Inflation rate (%) in time, t.

TR_t, = Importation policy (tariff rates) (%) in time, t. tariff rates is to be used to assess whether the trade policies of the government favours the local farmers and the consumers, the tariff rate was used. This will be computed using the weighted mean of the tariff shares of the primary products that are imported.

QC_t = Quantity consumed of selected agricultural food grain commodities (corn and wheat) measured in tons in time, t.

PS_t = Political stability in time, t. The state fragility index (SFI) published in Global Report (2018) was used to measure political stability. The range is from 0 to 25 wherein a score of 0 indicates a very stable situation, and a score of 25 indicates an extremely fragile situation.

OP_t = Oil prices, in time, t. This is estimated using the pump gas price; data is expressed in US dollar per liter.

Cor_t = corruption in time, t. this measures the stability of the national governments and the extent to which they are free from corruption, the corruption perceptions index (CPI) was used. The data is expressed in a scale from 1 through 10; a score close to zero suggests an extremely high level of corruption perception, while a score of 10 indicates that the government is corruption-free.

GEA_t = government capital subsidy to agricultural (₦'Million) in period t.

EXR_t = nominal exchange rate (₦/$) in period t.

POP_t = Nigeria's population (Millions) in period t.

QS_t = quantity supply of selected agricultural food grain commodity (corn and wheat) measured in tons in time, t.

T_t = linear trend time (T = 0, 1... 37), a proxy for technology, which measures productivity effect.

On *a priori* ground, it was expected that the coefficient estimates for IFR_t, EXR_t, TR_t, POP_t, QC_t, >0; and GEA_t, PS_t, OP_t, Cor_t, QS_t, T_t< 0.

The estimate of the determinants of selected agricultural food grain commodities prices was based on the assumption that the underlying data process is stationary. This assumption was verified by conducting a unit root test on the time series variables. Studies (Granger and Newbold, 1974; and Gujarati, 2006) have shown that the use of OLS with non-stationary variables may result in spurious regressions, thus, the need for the unit root test. Although various approaches (Dickey-Fuller test, Phillips-Perron test and variance root-test), have been devised for testing time series data for unit root problem. In this study, however, the Augmented Dickey-Fuller (ADF) test was adopted. The choice for ADF test is formed by its popularity, recommendation and use by various authors including Onyenweaku *et al.* (2008), Onyebinama and Nnamerenwa (2013) and Nnamerenwa (2012). Where the assumption of stationary does not hold in data processes, the Difference–Stationary Process (DSP) approach was employed in getting the non- stationary time series data to be stationary. Durbin Watson test was used to test for first order autocorrelation. Eviews10 statistical package of computer program was used in the data analysis (Eviews, 2016). The choice of the lead equation was judged based on the magnitude of the coefficients and conformity with a priority expectation of signs, explanatory power of the model (R^2), the significance of the regression parameters and the F-statistics.

RESULTS AND DISCUSSION
Diagnostic Test: Stationary Properties of the Variables used in the Analysis
     The Augmented Dickey Fuller (ADF) unit root test result for the logged variables used in the analysis is presented in Table 1.

Table 1: Result of Unit Root Test for Logged Variable used in the Analysis

Variables	Level	First Difference	Order of Integration
Price of maize$_t$	-3.011	-7.567***	1(1)
Price of wheat$_t$	-2.631	-6.445***	1(1)
Price of maize$_{t-1}$	-1.088	-7.221***	1(1)
Price of wheat$_{t-1}$	-2.344	-6.677***	1(1)
Maize output$_t$	-3.088	-7.344***	1(1)
Maize output$_{t-1}$	-6.566**	-	1(0)
Wheat output$_t$	-2.114	-6.991***	1(1)
Wheat output$_{t-1}$	-4.232***	-	1(0)
Inflation$_t$	-2.122	-6.453***	1(1)
Importation policy$_t$	-4.533	-	1(0)
Quantity consumed corn$_t$	-1.991	-5.223***	1(1)
Quantity consumed wheat$_t$	-2.485	-5.068***	1(1)
Political stability$_t$	-4.536**	-	1(0)
Oil prices$_t$	-1.662	-6.346***	1(1)
Corruption$_t$	-1.332	-5.770***	1(1)
Government capital subsidy$_t$	-1.678	-6.678***	1(1)
Nominal exchange rate$_t$	-2.425	-7.088***	1(1)
Population$_t$	-3.011	-6.890***	1(1)
Quantity supplied of corn$_t$	-1.662	-5.032	1(1)
Quantity supplied of wheat$_t$	-2.119	-4.893***	1(1)
Inflation$_{t-1}$	-7.452***	-	1(0)
Importation policy$_{t-1}$	-1.771	-6.552***	1(1)
Quantity consumed corn$_{t-1}$	-3.065	-7.221***	1(1)
Quantity consumed wheat$_{t-1}$	-2.895	6.046***	1(1)
Political stability$_{t-1}$	-1.778	-6.990***	1(1)
Oil prices$_{t-1}$	-4.636**	-	1(0)
Corruption$_{t-1}$	-4.144***	-	1(0)
Government capital subsidy$_{t-1}$	-1-932	-6.801***	1(1)
Nominal exchange rate$_{t-1}$	-1.766	-6.771***	1(1)
Population$_{t-1}$	3.221	-5.221***	1(1)
Quantity supplied of corn$_{t-1}$	4.881***	-	1(0)
Quantity supplied of wheat$_{t-1}$	-2.237	-5.639***	1(1)

Note: At level critical value at 1% = -4.234, and at 5% = -3.540 and at 10% = -3.202. At first difference critical value at 1% = -4.244, and at 5% = -3.544 and at 10% = -3.205.
Asterisk *, ** and *** represent 10%, 5% and 1% level of significant levels, respectively.

     The result in Table 1 showed that the logged variables of Inflation, importation policy, quantity consumed of maize, quantity consumed of wheat, quantity consumed of food grain, political stability, oil price, corruption, government capital subsidy, nominal exchange rate,

population, quantity supplied of maize, quantity supplied of wheat, quantity supplied of aggregate food grain, price of maize, price of wheat, and price of aggregate were stationary at order of integration one, 1(1), that is, at first difference. Therefore, all the logged variables used for the studies were integrated of order one, 1(1), the difference stationary values for the variables stationary at order one, 1(1) were generated and used for the analysis. This finding is consistent with the finding of Adeyemi *et al.* (2019), Kutu and Ngalawa (2016); and Omolade and Ngalawa (2014), who noted that for a proper inference to be drawn from a time series study, it is imperative that the variables are stationary to avoid spurious regression results. Ijirshar (2015) found macroeconomic variables he used in his study to be integrated at order one, 1(1) that is stationary at first difference.

Determinants of Agricultural Food Grain Commodity Prices
The estimated multiple regression result of the effect of determinants of selected agricultural food grain commodities prices in Nigeria within the period under review is presented in Table 2. The results showed that coefficient of multiple determinations (R^2) for maize; wheat and aggregate grain relative prices were 0.751, 0.853 and 0.823, respectively. This implies that the independent variables included in the model explained 75.1%, 85.3% and 82.3% of the variations in prices of maize, wheat and aggregate grain, respectively. The high values of the coefficient of mu multiple determinations (R^2) for maize; wheat and aggregate grain relative prices were high. This finding is in line with the finding of Ogbonna and Emerole (2018) and Adeyemi *et al*. (2019) who noted that high multiple determinations (R^2) suggests that the independent variable(s) included in the model has a very strong predictive relationship with the dependent variable. Similarly, the F-statistics for prices of maize, wheat and aggregate grain models were significant and confirms significance of each of the entire models.
The Durbin Watson (DW) value of 2.189, 1.872 and 2.188 for maize, wheat and aggregate price models respectively indicated that auto-correlation was not a problem in the models. The coefficients of inflation, importation policy, quantity consumed, oil price, corruption, government capital subsidy, population, quantity supplied and time variable were the significant determinants that influenced the price of maize in Nigeria. The coefficients of inflation, importation policy, quantity consumed, corruption, government capital subsidy, population and time variable were the significant determinants that influenced the price of wheat commodity. While inflation, importation policy, quantity consumed, corruption, government capital subsidy, population quantity supplied and time variable were the significant determinants that influence the price of aggregate food grain in Nigeria within the period under review based on the specified model.

Table 2: Determinants of Agricultural Food Grain Commodity Prices in Nigeria (1981-2018)

Variables	Price of Maize	Price of wheat	Aggregate grain price
Inflation	1.433(2.832)***	2.319(2.441)**	3.211(2.942)***
Importation policy	2.733(1.976)*	1.988(2.677)**	2.338(1.899)**
Quantity consumed	2.018(2.022)**	2.331(1.881)*	2.130(1.844)*
Political stability	3.022(1.299)	-1.399(-1.684)	3.411(1.118)
Oil prices	-2.881(-1.767)*	2.761(1.232)	2.830(0.889)
Corruption	1.266(2.277)**	2.100(2.330)**	2.877(2.784)***
Govt. capital subsidy	-1.618(-2.992)***	-1.755(-1.866)*	-1.922(-1.821)*
Nominal exchange rate	3.018(1.202)	1.218(1.455)	2.309(1.577)
Population	2.318(1.792)*	0.889(3.664)***	3.105(1.799)*
Quantity supplied	2.201(-1.743)*	2.009(0.788)	2.341(2.032)**
Trend	2.017.(2.092)**	0.198(1.883)*	1.993(1.769)*
Constant	18.018(2.872)***	7.637(1.778)*	22.399(2.992)***
R^2	0.751	0.853	0.823
Adjusted R^2	0.697	0.793	0.774
F-Statistics	16.211***	38.933***	42.848***
DW-statistics	2.189	1.872	2.118

***, **and* are 1%, 5% and 10% significance levels, respectively. Figures in bracket are t-values
Source: CBN Statistical Bulletin (2018)

The result of Table 2 further showed that inflation, importation policy, quantity consumed, corruption, population and time variable were significant and directly (positively) related to the price of maize. This implies that prices of maize increased as inflation, importation policy, quantity consumed, corruption, population and time increased and vice versa. This finding is in line with the findings of Nazlioglu *et al.* (2013) and Adeyemi *et al.* (2019), who noted that commodity prices are influenced by inflation and other macroeconomic variables. The result further revealed that prices of processed maize would be high with high periods of inflation, importation policy, quantity consumed, corruption, population and time. Oil price, government capital subsidy and quantity supplied, which was statistically significant but negatively related to the price of maize. This implies that increase in oil prices; government capital subsidy and quantity supplied would lead to decrease in the price of maize. The elasticity of response of price of maize relative to inflation, importation policy, and quantity consumed, corruption, population and time were 3.433, 2.733, 2.018, 1.266, 2.318 and 2.017, respectively. This finding is in line with Adeleke and Harold (2017), Verter and Becvarova (2016) and Gachara (2015) who noted that oil price and macroeconomic variables affect the real sector of Nigeria economy. This also suggest that a 10% increase changes in inflation, importation policy, quantity consumed, government capital subsidy, population and time will increase prices of maize by 34.33%, 27.33%, 20.18%, 12.66%, 23.18% and 20.17%, respectively.

Similarly, Table 2 shows that inflation, importation policy, quantity consumed, corruption, population and time variable were significantly and statistically related to the price of wheat. This indicate that the higher the level of inflation, importation policy, quantity consumed, corruption, population and time, the higher the prices of wheat and vice versa. The elasticity's of response of the respective determinant; inflation (2.319), importation policy (1.988), quantity consumed (2.331), corruption (2.100), population (0.889) and time (0.198)

suggest that a 10% increase in inflation, importation policy, quantity consumed, corruption, population and time will increase prices of wheat by 23.19%, 19.88%, 23,31%, 21%, 8.89% and 1.98%, respectively. This finding is in line with Adeyemi *et al*. (2019); and Joseph and Festus (2013). The coefficient of government capital subsidy was statistically significant but negatively related to the price of wheat. The implication of this is that increase in government capital subsidy would result to decrease in the price of wheat and vice versa. The study however showed that the coefficient of inflation, importation policy, and quantity consumed, corruption, population, quantity supplied and time variable were statistically significant and directly related to prices of aggregate grain. The result implies that as inflation, importation policy, quantity consumed, corruption, population, quantity supplied and time increases, prices of aggregate grain will increase. This finding is in line with Fasanya *et al.* (2019). Coefficient of government capital subsidy was statistically significant but negatively related to price of aggregate grain. This implies that the higher the level of government capital subsidy the lower the prices of aggregate grain.

CONCLUSION AND RECOMMENDATIONS

The estimated multiple regression result of the influence of the various determinants on the prices of maize, wheat and aggregate grain showed that inflation, importation policy, oil prices, quantity consumed, corruption, population, quantity supplied and time variable were the significant factors that influenced the prices of maize in Nigeria within the period of the study. Coefficients of inflation, importation policy, quantity consumed, corruption, government capital subsidy, population and time variable were the significant determinants that influence the price of wheat output. While inflation, importation policy, quantity consumed, corruption, government capital subsidy, population, quantity supplied and time variable were the significant determinants that influence the price of aggregate grain prices in Nigeria within the period under review based on the specified model.

Therefore inflation, importation policy, oil prices, and quantity consumed of maize, corruption, population, quantity supplied and time variable significantly influenced the prices of maize in Nigeria within the period under review. Coefficients of inflation, importation policy, and quantity consumed of wheat, corruption, government capital subsidy, population and time variable significantly influenced the price of wheat in Nigeria. Inflation, importation policy, quantity consumed, corruption, government capital subsidy, population, quantity supplied and time variable significantly influenced the price of aggregate grain prices in Nigeria within the period under review. Based on the findings of the study it was recommended that:

1. Government should put in place necessary strategies to curb the rate of corruption in the system and also maintain a stable political atmosphere in the country.
2. Adequate credit and government subsidies should be made available to grain producers in the country to enhance their output.

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