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AGRICULTURE IN AN INTERCONNECTED WORLD

Effect of Price Variation on Rice Production in Nigeria (1970 – 2011)

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ABSTRACT

Food price instability is a frequent forerunner of macroeconomic shocks and political turmoil that can discourage long-run investment and curtail growth. There is a general shortage in the domestic supply of food grains in Nigeria; this has often resulted in increased market prices of the commodities, thus leading to change in the prices of rice overtime. The main thrust of this study is to unveil the effect of price variation on production of rice in Nigeria. This study employed time series data of a period of 42 years. The following recommendations were made: The government should stabilize the quantity of rice produced in the country; more effort should be given to production of rice considering its relevance to food security. The Cobweb theory can Be used by the government to regulate the response of price to rice production.

Key words: Price, Variation, Rice production and Nigeria.



1. Introduction

Rice is the seed of the monocot plants *Oryza sativa* (Asian rice) or *Oryza glaberrima* (African rice). As a cereal grain, it is the most widely consumed staple food for a large part of the world's human population. It is the agricultural commodity with the third-highest worldwide production, after sugarcane and maize (FAO 2012) Rice is normally grown as an annual plant, although in tropical areas it can survive as a perennial and can produce a ratoon crop for up to 30 years. World production of rice rose steadily from about 200million tonnes of paddy rice in 1960 to over 678million in 2009. Rice consumption in West Africa has increased substantially over the past decade, rapidly outpacing the growth rate of local production. The importance of rice in local consumption and production varies widely across countries in the region. Coastal countries in particular, have been largely dependent on importation to meet the growing gaps between production and consumption (Awoyemi 2010).

Nigeria spans an area of 924,000 square kilometers, bordered by the Gulf of Guinea, Cameroon, Niger, Benin, and Chad. The topography ranges from mangrove swampland along the coast to tropical rain forest and savannah to the north. Nigeria is endowed with many natural resources. With its reserves of human and natural resources, Nigeria has the potential to create a prosperous economy and provide for the basic needs of the population. If its enormous resource base is well managed could support a vibrant agricultural sector capable of ensuring the supply of raw materials for the industrial sector as well as providing employment for the teeming population Rice is cultivated in virtually all agro ecological zones in Nigeria. Agricultural production plays an important role in economic development of Nigeria. An estimated 60% of Nigerians live in rural areas and majority are engaged in small scale agricultural production (Okunneye, 2003). Before 1970's, agriculture was the pride of the Nigerian economy and it contributed over 60% to the Gross Domestic Product (Famoriyo, 1981). Historically, rice production in Africa has been low-yielding and uncompetitive against low-cost Asian imports, even when protected by high freight costs and substantial trade barriers (Gilbert 2009). Skyrocketing prices in world markets, however, were a shock to African consumers, producers, and governments alike. Numerous initiatives have been announced to stimulate rice production on the continent. Food price volatility therefore has a greater impact on the developing world. Depending on the region, maize and rice are the most important food staples (Gilbert & Morgan 2010). Unstable prices for important food staples, such as maize, rice, and wheat, can have acute

economic, social, and political consequences (Timmer 1995). Highly unstable prices can lead to inefficient agricultural production decisions, especially when markets for credit and risk are poorly developed. The human costs of food price shocks can be disastrous for the poor, because food staples often constitute a large share of poor farmers' incomes and poor consumers' expenditures. Food price instability is a frequent forerunner of macroeconomic shocks and political turmoil, which discourage long-run investment and curtail growth. Agricultural prices vary because production and consumption are variable (Gilbert & Morgan 2010). Economists have distinguished between predictable and unpredictable variability, the latter being characterized in terms of shocks. Shocks to production and consumption transmit into price variability. Production can vary either because of variations in area planted or because of yield variations, typically owing to weather (Gilbert 2010).

Stating the problem of rice production in Nigeria shows emphatically that rice production is plagued and epileptic, just like in most Africa countries (Awoyemi 2010). High cost of production as a result of increase in price of input, low farm income, low efficiency of resource utilization are some of the reasons that can be responsible for shortage in rice to augment local supply. Particularly, the land area under the cultivation of cereals has declined so tremendously due large to reduction in size and technology of the farming population and poor soil fertility. This study looks at the effect of the change in price on rice production in Nigeria.

1.1 OBJECTIVE OF THE STUDY

The general objective of the study is to examine the effect of price variation of rice on Agricultural production in Nigeria. The specific objectives are to;

1. Describe the trend of Rice production in the study area.
2. Examine the effect of price variation on rice production in Nigeria.

2. LITERATURE REVIEW

Economic theory asserts that in a free market economy the market price reflects interaction between supply and demand: the price is set so as to equate the quantity being supplied and that being demanded. In turn these quantities are determined by the marginal utility

of the asset to different buyers and to different sellers. The theory of price in economics is both profound and tremendously useful. First, of all the theory of price claims that price will influence both suppliers and customers. Price is a matter of communication in economics. Price, a matter of communication in economics, is useful by communicating simultaneously to both customers and to other potential would-be suppliers (Vianello 1989 and Roberts 2007).

1. If price increases, demand decreases; inversely, if price decreases, demand increases.
2. From a supplier's perspective, if price increases (enough) more of something will be supplied, if the price of something decreases (enough) less of something will be supplied. Only decision-makers move the prices.

The problem of volatile prices is that:

- A sharp drop in price leads to a fall in revenue for farmers. Farmers could easily go out of business if there is a glut in supply because prices can plummet below cost.
- **Cobweb Theory:** The cobweb theory is an economic model that explains why prices might be subject to periodic fluctuations in certain types of market. It describes cyclical supply and demand in a market where the amount produced must be chosen before prices are observed; it is based on the time lag between supply and demand decisions. The cobweb theory suggests that prices can become stuck in a cycle of ever-increasing volatility. E.g. if prices fall, many farmers will go out of business, the next year supply will fall. This causes price to increase. However, this higher price acts as incentive for greater supply. Therefore, next year supply increases and prices plummet again (Pashigian 2008).

The fluctuation in prices of commodities affects the fortunes of individuals in the economy. Prices give signal to the producers regarding the commodities to be produced in the economy and how to earn money and sustain the process of production. Subba et al. (2008) observed that, most agricultural commodities are affected by price variation arising from seasonal fluctuations in demand, supply and marketing, agricultural prices are volatile in the sense that they are subject to changes over time and space. Prices in agricultural markets are often much more volatile than other industries. This is because: Supply is price inelastic in short term (it takes a

year to grow most crops), demand is price inelastic. (Food is essential and people are not usually put off by higher prices) and supply can be due to climatic conditions (Mutt 1961).

Owing to the complexity of pricing, and hence revenue generated from sales, the Federal Ministry of Agriculture (FMA) (2008) asserts that one of the cardinal objectives of agricultural pricing policy of Nigeria is the stabilisation of prices and revenues to farmers. This may not be unconnected with the profound effect price and revenue fluctuations may have on the growth, equity and stability of the economy. For instance, incomes and living standards of the farmers, labourers and consumers are very affected by price and revenue fluctuations [Subby *et al.*, 2008]. According to Shively (1996), increased price variability can have detrimental impacts on both consumers and producers of agricultural commodities. He continued that since stocks are a large proportion of a farm household's portfolio in developing countries, and since the level of market risks and ability to bear risks may be correlated with income, low-income farmers are likely to be sensitive to price risks. Juselius (2006) observed that, higher food prices have affected price increases in downstream and upstream products and services. Consequently, these result in people eating less frequently and in lesser quantities, as well as cheaper and less nutritious food.

According to Awoyemi (2010), Stabilization of prices of essential agricultural commodities continues to be an area of major concern for policy makers. This is important because high growth in the prices of rice may spill over to other sectors of the economy leading to an increase in the overall rate of inflation. These concerns about commodity price fluctuations have led to pervasive commodity policy interventions by national governments. There is thus a need to study the price behavior of essential agricultural commodities and the reasons that underlie the large variations in their prices in order to devise improvements in the system. His study analyses the behaviour of the rice prices over some years. Results indicate that there is fairly stability in the price of rice but instability in domestic rice prices can occur due to fluctuations in local rice markets and a large shortfall in domestic production.

In their journal report on rice production in Nigeria, Eco-systems development organization (EDO, 2003), said that “Although rice is a traditional crop in Nigeria, local production was limited until recently. Internal demand is growing and, at the same time, rice is a major commodity of world trade. Nigeria is therefore under pressure from international bodies

not to restrict imports; production under local conditions to match prices of rice produced on large mechanised farms therefore represents a considerable challenge.”

This study seeks to determine the effect of price variation on rice production in Nigeria, considering the importance of rice in the food security of the nation, in other to determine the causality effect between rice price variation and rice production, a number of statistical tools can be used, but granger causality will be employed.

Mori kogid et al, (2011) Employed bivariate causality to analyse the effect of import on the economic growth of Malaysia. The major findings were that economic growth is significantly influenced by import and vice versa. Oooke and Uche 2010 used the causality and co integration in finding the relationship between Export, Domestic demand and economic growth in Nigeria. The major findings were that long term relationship was found not to exist between export, domestic demand and economic growth. Onnwioduokit (2002) used the causality, regressing autoregressive distributed lag model of ratio of fiscal deficit to gross domestic product, level of fiscal deficit and inflation rate. The major findings were that the result from fiscal deficit and inflation rate was significant indicating the presence of instantaneous causality. Emokaro and Ayantoyinbo (2014) Used granger causality test to determine the leading markets between urban and rural market. Granger causality test provides additional evidence as to whether, and in which direction, price integration and transmission is occurring between two price series or market levels. Granger causality test will also be used to determine the effect of price variation on rice production in this study.

3. METHODOLOGY

3.1 SCOPE OF STUDY

This study employed time series data of a period of 42years, obtained from various sources spanning from 1970 - 2011. They are various AGROSTAT bulletins which includes editions of National Bureau of Statistics review of external trade, National Bureau of Statistics summary and annual abstract of statistics, Central Bank of Nigeria’s economic and financial review and an online database maintained by Food and Agricultural Organization (FAO).

3.2 ANALYTICAL TECHNIQUE

3.2.1 DESCRIPTIVE STATISTICS

Descriptive and inferential statistical technique such as graph is used to show the trend of Crop production. Percentage is used to get the levels of production in other to represent them on a graph.

3.2.2 GRANGER CAUSALITY TEST

Granger causality approach as proposed by Granger (1996) is to see how much of the current Y can be explained by the past values of Y and then to see whether lagged values of X can improve the prediction of Y, or equivalent if the coefficient on the lagged X's are statistically significant. This test assumes that the information relevant to the prediction of the variables in question is contained solely in the time series data on these variables.

$$Y_t = \alpha Y_{t-1} + \beta i X_{t-1} + U_t \dots \dots \dots (1)$$

$$Y_t = \sum \beta_i X_{t-i} + U_t$$

$$Y = Y_t - Y_{t-1}$$

Where it is assumed that the disturbance terms U_t is uncorrelated

Y_t and X_t are time series

Y_t = Rice production at time t

X_t = Rice price at time t

U_t = error

$t-1$ = lag variables

By this model, variable that causes the other is identified. This leads to a bivariate regression model with lag variables:

Where Y_t = dependent variable identified by the causality model (W_t or Z_t)

Y_{t-1} , X_{t-1} = lagged dependent and independent variable

U_f = disequilibrium term

According to Gujarati (2003), the regression of non-stationary time series on stationary time series data would produce a spurious result; thus the non-stationary data is transformed by differencing as in equation (3)

3.2.3 UNIT ROOT TEST (Table 1)

Unit root test was done using the Augumented Dickey-Fuller (ADF) (Dickey and Fuller, 1979). This is used to test for being stationarity or non stationarity. A stationary series is one with a mean value which will not vary with the sampling period. A non-stationary series will exhibit a time varying mean (Juselius, 2006). (Table 1)

3.3 RESULT AND DISCUSSION

3.3.1 DESCRIPTIVE STATISTICS (Table 2)

Table 2 shows descriptive statistics where mean, minimum and maximum were analysed for the data series of rice. Rice having an all-time maximum production of 4,567,320 tonnes in 2011 and all-time minimum production of 218,000 in 1976. The all-time maximum price is 196202.30 in 1992, while the lowest price of rice through the 42years considered in this research is 37814.33 in the year 1983.

3.3.2 TREND OF RICE PRODUCTION (Figure 1)

A visual plot of the data is usually the first step in the analysis of any time series. The trend of rice production can be described thus: rice production increased at a relatively inc reasing rate, production fell in 1975 all through 1976 from where there has been significant rise in production of rice. Rice production fell drastically in 1990 and rose in 1991 from where production was relatively stable till 1992, from where there was a fall in 1994 Paddy rice production has been increasing between 2001 and 2006, followed by a decline in 2007 and a positive peak in 2008. From 2008 to 2010 production statistics show a decreasing trend in production, associated with a decline in area harvested between 2006 and 2010. This trend resulted into higher yields between 2008 and 2010, despite declining production (see Figure 1). Increasing production between 2002 and 2006 can be explained as result of the implementation of the Presidential Initiative on increased Rice Production, although decreasing production between 2008 and 2010 is not in line with policies aimed at the development of the rice sector during those years, such as the National Rice Development Strategy and the Federal Market Stabilization Programme (Erenstein 2003). There were differently levels of increases, decreases and stability in rice production from 1994 to 2010, with the highest production level in 2011, probably because of increasing population and consumption

3.3.3 TREND OF RICE PRICE (Fig 2)

From the graph above, it is seen that from 1970 the price of rice increased at an increasing rate till 1971 from where it was relatively stable till 1972. There was a significant increase from 1972 to 1974, from where the price of rice fell drastically all through the years to 1984 where it began to rise again at a high speed till 1988. There was fall in price between 1988 and 1989. The price of rice increased at an alarming rate from 1989 to the highest point ever in which rice price has ever gotten to in Nigeria in 1993. The price of rice has its highest point in 1993 from where it reduced progressively till 1995. The price of rice has been rising and fallen around a particular point from 1995 to 2008, from where there has been an increase at a relatively decreasing rate till 2011.

3.4 RESULTS FOR GRANGER CAUSALITY TEST

3.4.1 GRANGER CAUSALITY WALD TESTS

Table 3 here.

From Table 3, there is bidirectional granger causality. There is a bivariate relationship between rice production and rice price. A decrease in price will thus cause a decrease in production and a reverse causality also suggests the same. This corresponds with the findings of Christiaensen (2009) and theory of supply which states that the higher the price, the higher the quantity supplied. This also goes in line with the cobweb theory which suggests that price can remain stuck in a cycle of ever-increasing volatility, which means lower price acts as incentive for lower supply in the next year and higher prices act as incentive for greater supplies in the following year.

3.4.2 ORDINARY LEAST SQUARES ANALYSIS OUTPUT (Table 4)

From table 4, rice price shows a positive relationship to rice production. Decrease in rice price leads to a decrease in rice production, thus the effect that rice price has on rice production is a positive one. A variation in rice price will give a corresponding change on production which corresponds with the findings of Akpan (2007). The result corresponds with the Cobweb theory which says lower price acts as incentive for lower supply in the next year and higher prices acts as incentive for greater supplies in the following year.

3.5 CONCLUSION AND RECOMMENDATIONS

From the empirical analysis result, it is evident that price of rice and quantity of production has a positive effect on each other, which corresponds with the theory of supply. Thus a decrease in price of rice reduces the quantity that is being produced by the farmers so as not to run into a loss in production.

Based on the result from this study, the following recommendations are necessary:

- I. The government should stabilize the quantity of rice produced in the country, at a point in which the price of rice will favor the both consumers and producers.
- II. More effort should be given to production of rice considering its relevance to food security and the rising population of the country and efforts should be placed to counter the excessive rise in price.
- III. The Cobweb theory can be used by the government to regulate the response of price to rice production.
- IV. Since increase in price brings about an increase in production, In line with the theory of Supply which states that the higher the price, the higher the quantity supplied: government should implement policies that will subsidize the price of rice to consumers and increase the level of food security in the country.

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TABLES

Table 1: unit root table

Explanatory variable	Dependent variable	Estimation Method
Stationary	Stationary	OLS
Non-Stationary	Non-Stationary	Co-integration
Stationary	Non-Stationary	Logically Inconsistent
Non-Stationary	Stationary	Logically Inconsistent

Source; Gujarati (2003)

Table 2 Summary statistics for dependent and explanatory variables

	N	MINIMUM	MAXIMUM	MEAN	STD.DEVIATION
PRICE	42	37814.33	196202.30	75118.74	35703.36
PRODUCTION	42	218000	4567320	2240105	1314271.66

Source: Data analysis 2014

Table 3: Granger causality Wald tests

SAMPLE 1970 – 2011

Equation Excluded	F- statistics	optimum lag	Probability	Decision
Prod → price	37.148	13	0.0265	Accept
Price → prod	22.514	13	0.0433	Accept

Source : Data analysis 2014

Table 4: ORDINARY LEAST SQUARES ANALYSIS OUTPUT

	Coefficient	Std. Error	t-ratio	p-value
Const	1.45017e+06	157447	9.2105	<0.00001***
Rice price	34.7899	4.17715	8.3286	<0.00001***

Mean dependent var	2240105	S.D. dependent var	1330204
Sum squared resid	2.65e+13	S.E. of regression	814458.6
R-squared	0.634255	Adjusted R-squared	0.625112
F(1, 40)	69.36592	P-value(F)	2.85e-10
Log-likelihood	-630.2025	Akaike criterion	1264.405
Schwarz criterion	1267.880	Hannan-Quinn	1265.679
Rho	0.843804	Durbin-Watson	0.280506

Source : Data analysis 2014

OLS, using observations 1970-2011 (T = 42) Dependent variable: rice_production

FIGURES

TREND OF RICE PRODUCTION (FIG. 1)

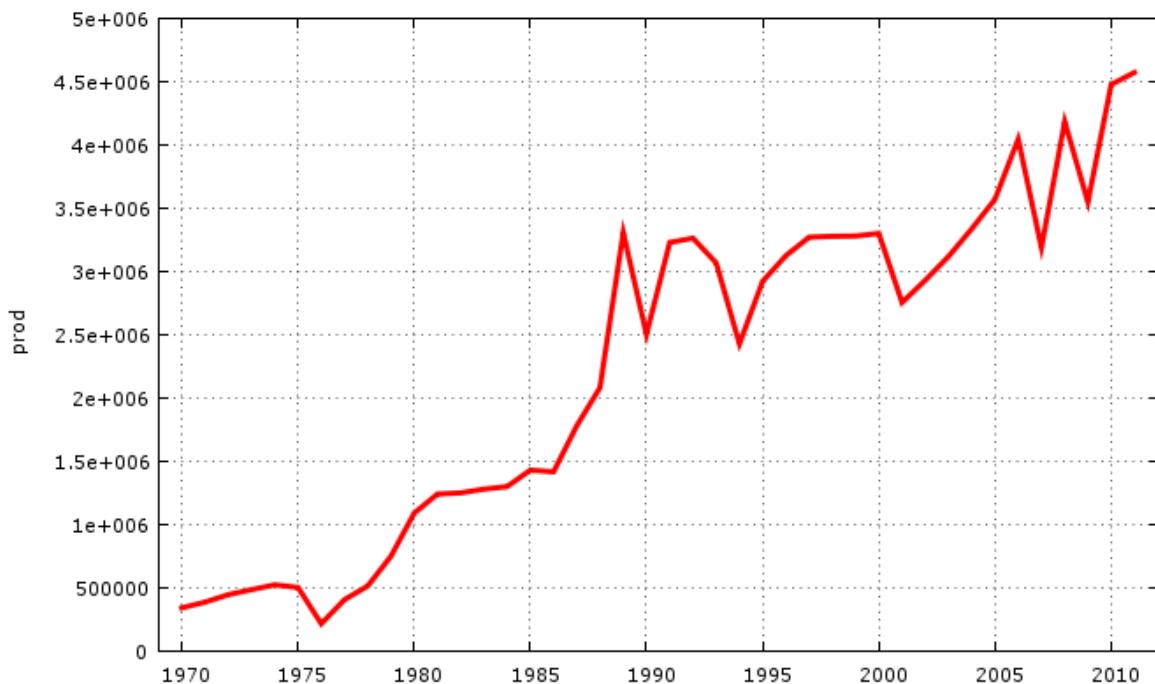


Fig 1. Source: Data analysis 2014

TREND OF RICE PRICE (FIG. 2)

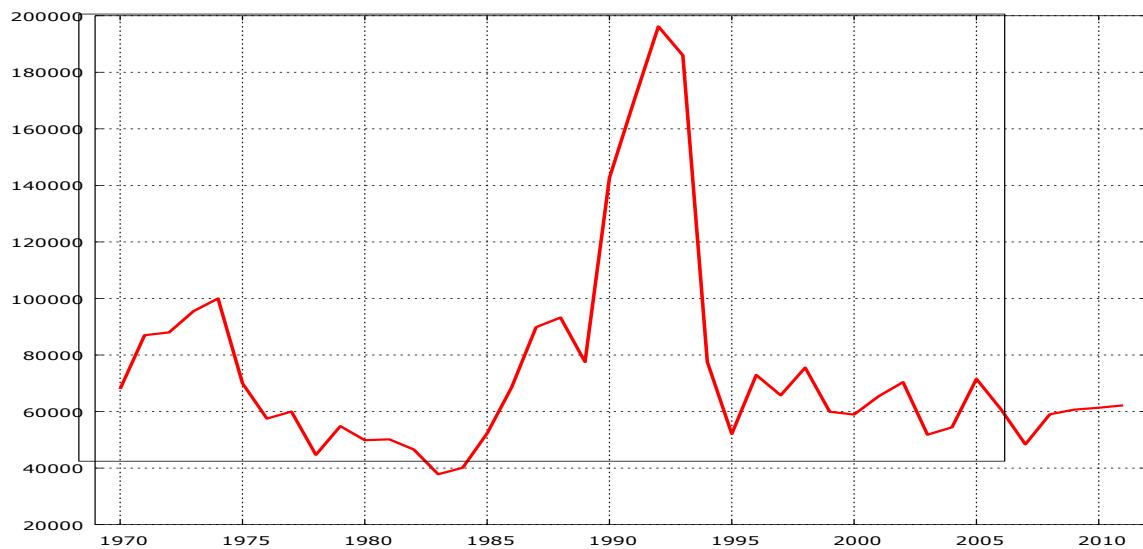


Fig 2. Source: Data analysis 2014