



TEMPORAL PRICE VARIATION OF RICE IN NIGERIA

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ABSTRACT

The study was conducted to describe the price variations in price of rice in Nigeria using monthly prices of rice for a period of ten years (2004 – 2014). The result of the Grand Seasonal Index which represents the typical seasonal behavior of time series of the 12 calendar months for rice prices showed a deviation from hundred (Table 1), meaning that seasonality existed in the country. Grand seasonal index for January (2004 – 14) was found to be 95.13 which means that the price in Nigeria on an average is 4.87 per cent lower than the average of the entire period as whole. The result further revealed coefficients of variation of the domestic price of rice to be higher in the years 2007 and 2008 and lowest coefficients of variation were recorded in the years 2013 and 2014 thus, this was as a result of the higher price variations of rice in the country between the harvest and the lean periods. The period 2013, 2012 and 2011 showed low fluctuations in price as compared to other periods. Moreover, the Nigeria prices did not follow stable pattern wherein, in 2004, 2005, 2007, 2010 and 2013 the highest prices were recorded in the month of September while in the years 2006, 2011 and 2012 were recorded in October. However, findings of this study showed that seasonality of rice is one of the major causes of prices variation in Nigeria, hence to reduce the seasonal price fluctuations, government should introduce measures of market stabilization policies such as availing strict measures of making information available to both producers and consumers so as to reduce the seasonal price fluctuations thereby ensuring strict adherence to ceiling and floor price which would help limit the speculative practices in the markets.

Keywords: Nigeria, Price, Rice, Seasonal, Variation

INTRODUCTION

Rice is one of the leading food crops in the world as it is consumed by more than half of the world population. In most of the developing nations, the objective of self-sufficiency in rice continued to be pursued as one of the ways of achieving food security due to which, trade in rice remains to a large extent residual option, and thus it is not surprising to see nations shifting from importer to a net exporter, depending on their production outcome. Therefore, to protect producer and consumers from high price fluctuations, there were a number of interventions by various governments to stabilize their market, either through changes in border measures or through government procurement programmes (Makama *et al.*, 2016). However, the re-occurrence of high food prices in 2010 prompted fears of a repeat of the 2007-08 food crises frightening an increase in food insecurity, rampant food price inflation and civil unrest. International rice prices have infamously been prone to large swings and volatility, much larger than those experienced for the case of wheat and maize prices. This is evidenced by the measures of annual price variability, which are averagely higher for rice than for wheat or maize between the period 1961-2003.

Price variation is necessary for the existence of a market, as it creates the incentives that attract market players to engage in trade. In a well-functioning market, prices reflect the relative scarcity of the commodity, thus, variations in prices reflect differences in scarcity. The



differences in price create an opportunity for arbitrage, in which traders buy from low-price markets to sell in higher-price markets. In doing so, they reduce the scarcity in the high-price markets and increase scarcity in low-price markets, which has the effect of reducing the price in the former and raising the price in the latter. In the process of attempting to profit from the price difference, traders paradoxically tend to reduce the price difference below what it would have been without trade. It is therefore useful to differentiate between price variation across different locations and price variation over time. Although the process of arbitrage is similar in both cases, the causes of price variation differ.

Temporal analysis is a model for price determination which explains the patterns of price behavior through time, seasonal patterns of change, trend and cycles. It provides an understanding of why temporal changes occur. Two types of temporal variations in prices have been identified; inter year and intra year (seasonality of price). However, fluctuation and decomposition of nominal prices are examined (Bashir, 2003).

Therefore, it is the intension of this paper to provide proves to the hypothesis that says; there is no significant price variation as regard to rice marketing in Nigeria.

MATERIALS AND METHODS

The study was based on secondary data compiled from various published sources. A monthly price data for a period from 2004 – 2014 was considered and analysed using descriptive and inferential statistics (Mean, Standard deviation, Regression Analysis. The price series collected were decomposed into four component parts which is according to classical price multiplicative model. (Price = Trend x Cyclical x Seasonal x Random/Irregular components).

In agricultural production, seasonality is one of the most vital characteristics and therefore, the analysis in this study followed the work of Bashir, 2003, Abba, 2009, and Kariuki, 2011 which focused on the seasonal component thereby removing other components (viz; trend, cyclical and random) from price series. It estimates the trend (T), cyclical (C), seasonal (S), and random (E), indices of the price series as adopted by Bashir, 2003.

$$P = T * C * S * E \quad \dots (1)$$

where;

P = price, T = Trend component, C = Cyclical component, S = Seasonal component, E = Random component.

T is expressed as price per unit while C, S, and E are all indices.

Linear trend is calculated as a simple linear regression of price against a time variable and is specified as:

$$P = f(T) \quad \dots (2)$$

where;

T = 1, 2, 3...n and

P = nominal price

To calculate the trend regression result is needed for constant and trend coefficient,

$$T_i = a + bt_i \quad \dots (3)$$

where;

T_i = trend value during period i.

a = the constant coefficient as estimated by the regression analysis.

b = the trend coefficient estimated by the regression.

t_i = the value of the variable (Rice price) during period i.



To estimate the seasonal price index of a time series, central moving average (CMA) must be estimated using the following formula:

$$n \quad MA_t = \sum p_i / n \quad \dots (4)$$

$$i = t - \frac{1}{2}(n - 1)$$

Thus, CMA will now be 12.

$$(\sum_{i=t-6}^{i=t+5} P_i + \sum_{i=t-5}^{i=t+6} P_i) \div 24 \quad \dots (5)$$

where;

CMA = Central Moving Average

P = Nominal price, n = number of periods

The technique of using the central moving average for any given number of periods “n” substitute the observed value in the time series by the average of that value and a given number of the observations taken immediately before and after it. Consequently, the CMA eliminates random variations and emphasizes systematic movements of variables series duration equal to “n” (Bashir, 2003). CMA has the same trend as the price, show cyclical fluctuations appearing in the original series.

In terms of equation (1),

$$CMA_i = TC_i \quad \dots (6)$$

The CMA represents the trend and cyclical components of the original series, and eliminates seasonality and randomness. The seasonal index (SI) is calculated using the following formula written as:

$$SI = TCSE_i / TC_i = SE_i = (P_i / CMA_i) * 100 \quad \dots (7)$$

The SI includes seasonal fluctuation in addition to randomness (E). The SI is already deflated as it is calculated by dividing nominal price series (the original price) by another nominal series (the CMA12).

The cyclical index (CI) of a time series is calculated as follows,

$$CI_i = TC_i / T_i = C_i = CMA_i / T_i \quad \dots (8)$$

(CI_i) can be calculated by dividing the CMA by the Trend. To remove the effect of irregular movement from the SI values, the averaging of SI for each month over the different years is used, then adjusting SI figure series by the adjustment factor,

$$\text{Adjustment factor} = 1200 / \sum_{i=1}^{12} SI \quad \dots (9)$$

However, the Grand seasonal index (GSI) as used by Abba (2009) and Kariuki (2011) is important in summarizing the typical seasonal behavior of a time series. It is calculated by obtaining the average seasonal index for each month of a given year and then adjusting this 12 - figure series in such a way that it adds up to 1200 specifically:

$$GSI = \overline{SI}_i * 1200 / \sum_{i=1}^n SI_i \quad \dots (10)$$

where;

$\overline{SI}_i$ = the average seasonal index for month i

This seasonal component is represented by a Grand Seasonal Index (GSI) for each calendar month (Goetz and Weber, 1986). The average value of the seasonal indices (SI) for all the calendar month was set to 100, thus, the summation of the average values for all months



is set to 1,200. The Grand seasonal index (GSI) is useful to summarize the typical seasonal behavior of a time series. It is calculated by obtaining the average seasonal index for each month of a given year and then adjusting this 12 - figure series in such a way that it adds up to 1,200, specifically;

$$GSI = \overline{SI}_i * 1200 / \sum_{i=1}^n SI_i \quad \dots (11)$$

where;

$\overline{SI}_i$ = is the average seasonal index for month i

The GSI is an average of the seasonal indices that removes all irregular movements of the time series. Consequently, the GSI represents the pure seasonal average of the series during the period under analysis.

RESULTS AND DISCUSSION

Seasonality was measured as any single month deviation from the average value of 100. Results of the analysis of seasonal variations of rice in Nigerian markets are presented in tables and figures. It can be seen from Table 1 that, the values of GSI of all the calendar months for the rice prices in Nigeria showed a deviation from 100. This means that seasonality existed in the country and hence our null hypothesis which suggested that there was no significant variation in the price of rice in Nigeria may be false and therefore rejected. Also, the trend coefficients of all the calendar months showed a positive sign, thus, indicated an increase in the prices of rice. This is in accordance with report of FAO (2014) Rice Markets Monitor in which it stated that rice prices have followed diverging trends in the past. Prices in the medium grain segment rose sharply which is due to the fact that, the average yields look set to decline by 1.2 per cent to 4.5 tons per hectare. strong production growth in the western and eastern parts of the continent were offset by a weather and pest related shortfall in Madagascar, as well as the Boko Haram calamity in Nigeria which is causing output in the region to stagnate (FAO, 2014). Also, torrential rains and release of water from reservoirs located in neighbouring Cameroon also led to severe floods between September and October 2012 and hence the increase in prices of rice in the subsequent year (2013). The inundations inflicted significant damage over fourteen states situated in the basins of the Niger and Benue rivers, where over 1.9 million hectares of crops were estimated to have been lost. Official assessments indicate that up to 31 percent of rice growing areas in the country were impacted by the floods, with eleven states expected to incur production shortfalls as a result (FAO, 2013).

The Grand seasonal index (GSI) represents the typical seasonal behavior of time series. Table 1 showed the GSI for Nigeria. A Grand seasonal index for January (2004 – 14) was found to be 95.13 meaning that on average, the rice price in Nigeria is 4.87 per cent lower than the average of the whole period. These indices described the recurrent seasonal pattern in the original prices. The GSI indicated that the trend in seasonal prices is pronounced, but not stable. Figure 1 showed GSI+SE (upper line) and GSI-SE (lower line) indicating that fluctuations are erratic and unpredicted.

Table 1: Grand Seasonal Index of Rice Price in Nigeria (2004 – 2014)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	95.1	96.8	99.4	96.2	99.9	97.3	100.	99.5	101.	98.0	98.7	95.15
SI	3	7	9	1	4	6	60	4	35	1	4	
GSI	96.4	95.2	102.	100.	103.	103.	103.	104.	104.	102.	100.	96.23
	2	4	53	01	04	99	83	33	76	28	75	
GSI+	106.	104.	111.	109.	113.	109.	111.	115.	113.	113.	112.	113.3
SE	45	41	60	84	39	35	71	65	74	74	63	0
GSI-	86.3	86.0	93.4	90.1	92.6	98.6	93.0	95.7	91.9	95.7	91.9	88.20
SE	9	7	6	8	9	3	1	8	3	8	3	
Trend												
Coef.	72.1	79.9	73.4	72.1	78.3	70.5	67.5	73.8	60.4	60.4	67.1	57.73
	0	3	7	5	1	4	1	4	2	2	5	

GSI = Grand Seasonal Index, SE= Standard Error, Coef. = Coefficient

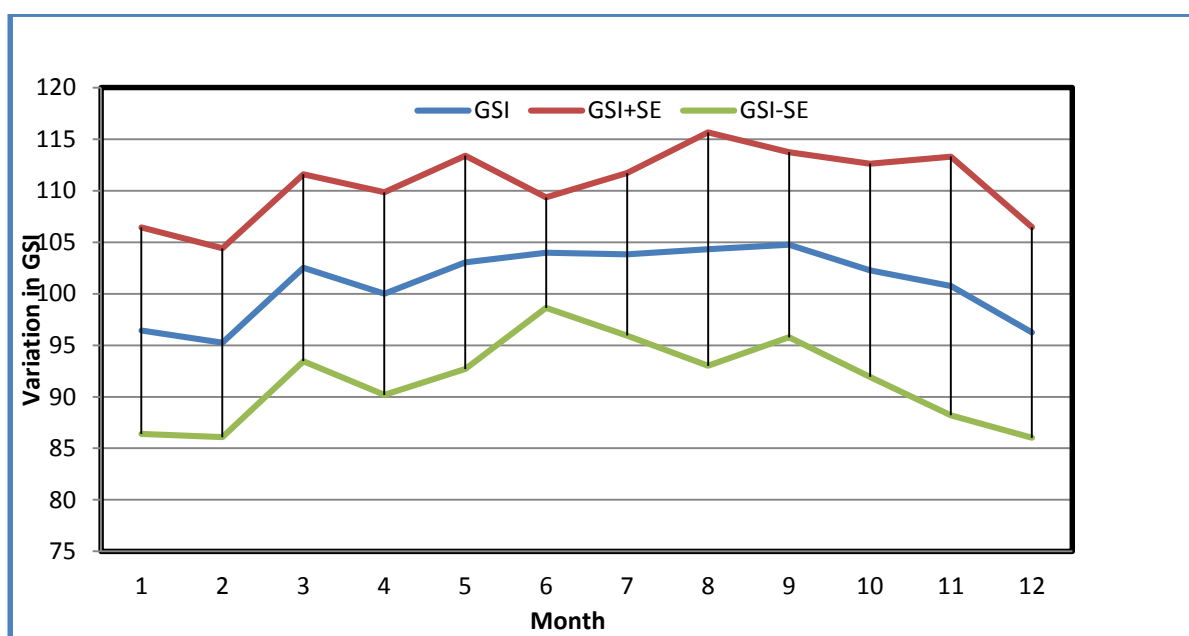


Figure 1: Movement of grand seasonal index of rice in Nigeria

Indices of Nigerian rice market for the months of March to November exceeded 100-annual average. While that of January, February, and December (2004–14) were less than 100-annual average unless we add the standard error (Table 1 and Figure 1). However, Nigerian rice price increased by about 9.52 per cent from February when the seasonal price was at its lowest level to the peak of the season in September.

Results of the analysis of the domestic wholesale price in the country that further shows the coefficients of variation of the domestic price of rice in Nigeria was higher in the years 2007 to 2008 and low in the years 2013 to 2014. In general, the variation is high. This is because of the higher variation in prices of rice in Nigeria between the harvest and the lean for the periods under study. At harvest period, prices fall and rise during the lean period thus, following the law of demand. The period 2013, 2012 and 2011 showed low fluctuations in price as compared to other periods. Moreover, the Nigeria prices did not follow stable pattern wherein, as in 2004, 2005, 2007, 2010 and 2013 the highest prices were recorded in the month



of September while in the years 2006, 2011 and 2012 were recorded in October. However, in 2008 and 2009 highest price was recorded in November, and highest price was recorded in the month of August in the year 2014.

Table 2: Price Fluctuations of Rice in Nigeria

Year	Fluctuations (%)	Coefficient of Variations	Month of Price point	Lowest	Month of Highest Price point
2004	24.89	9.54	Jan		Sept
2005	11.58	7.00	Jan		Sept
2006	23.61	8.78	Jan		Oct
2007	-14.49	14.42	Dec		Sept
2008	115.29	18.39	Jan		Nov
2009	38.71	7.57	Feb		Nov
2010	8.34	4.99	Dec		Sept
2011	1.93	4.10	Feb		Oct
2012	1.57	4.51	Jan		Oct
2013	-0.72	3.95	Dec		Sept
2014	11.36	2.82	Nov		Aug

Data source: NAERLS, Nigeria (www.naerls.gov.ng , 2014)

The centered moving average and all the decomposed components of the price series are shown in Figure 2 to 4.

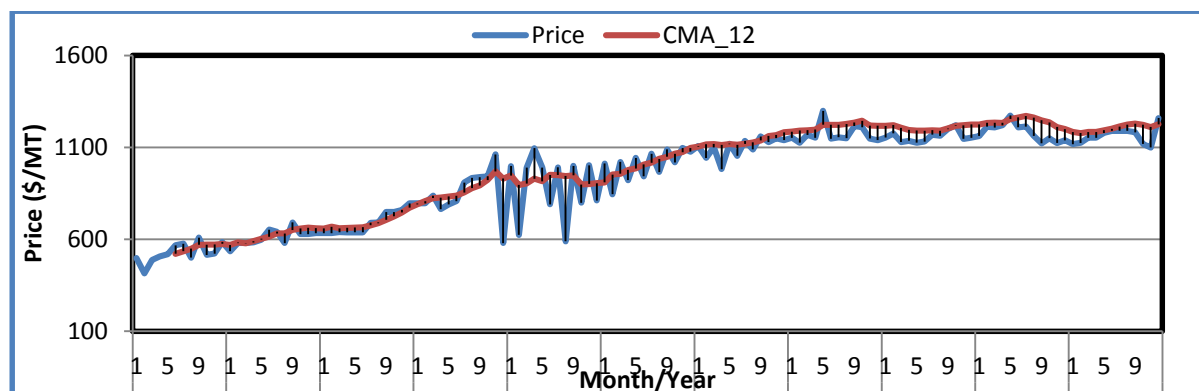


Figure 2: Price and moving average of rice for Nigeria

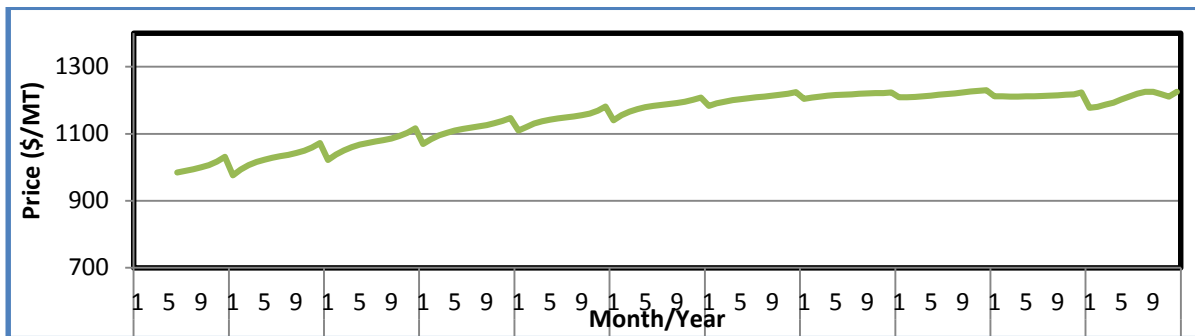


Figure 3: *Trend of rice price in Nigeria*

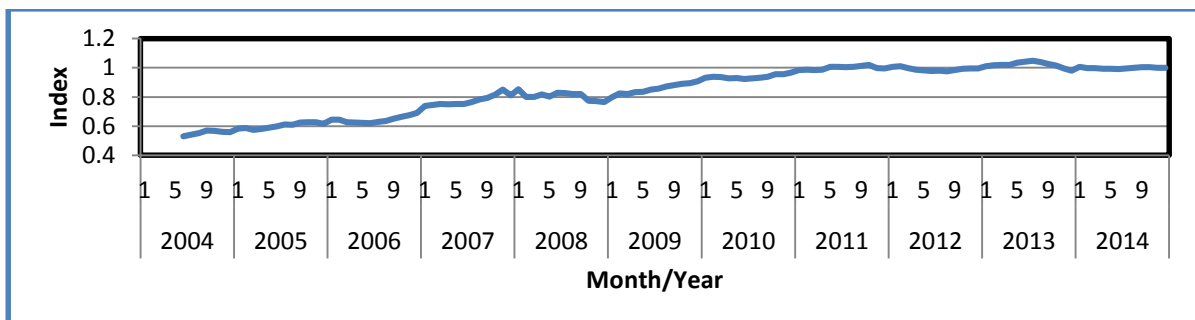


Figure 4: *Cyclical indices of rice price in Nigeria*

CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study, it can be concluded that, seasonality of Rice is one of the major causes of variation in prices in Nigeria and therefore the Government of Nigeria should introduce measures of market stabilization policies such as availing strict measures of making information available to both producers and consumers so as to reduce the seasonal price fluctuations thereby ensuring strict adherence to ceiling and floor price which would help limit the speculative practices in the markets. Also, to reduce the seasonal price fluctuations, government should introduce measures of market stabilization policies such as availing strict measures of making information available to both producers and consumers.

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