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Analysis of Seasonal price Variatin of Rice in India

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Abstract

The study was conducted to describe the price variations in price of rice in India 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 in India showed a deviation from hundred (Table 1), meaning that seasonality existed in the country. Grand seasonal index for January (2004–14) in India was found to be 96.57 which means that the price in India on an average is 3.43 per cent lower than the average of the entire period as whole. However, the result further revealed coefficients of variation of the domestic price of rice to be higher in the years 2004, to 2009, as well as 2013 and 2014 and lowest coefficients of variation were recorded in the years 2010 to 2012 thus, these was as a result of the higher price variations of rice in the country between the harvest and the lean periods. This means that in India, the law of demand applied wherein, prices fall during the harvest season and rises during the lean period. However, findings of this study showed that seasonality of rice is one of the major causes of variation in prices in India hence to reduce the seasonal price fluctuations, it is therefore recommended that, government of India should ensure strict adherence to ceiling and floor price so as to limit the speculative practices in the markets.

Keywords: Seasonal, Price variation, Rice, India.

Introduction

Rice is one of the major food crops in the world. It is consumed by more than half of the world population. Data available showed that world output has witnessed some decline for the recent past. World milled rice Production has increased from 409.2 million tonnes in 1999 to 496.4 million tonnes in 2014[1]. The International rice market accounts for only about 5-6 per cent of global output despite the trade expansion. Unlike other bulk commodities, the rice market is segmented into a number of different varieties and qualities, each with strong consumer loyalty. Recently, the major rice exporters are India,Thailand, Vietnam, Pakistan and USA[1].

In most of the developing nations, the objectives 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 intervensions by various governments to stabilize their market, either through changes in border measures or through government procurement programmes[2]. However, there were slowed progress in hunger reduction in recent years, and the numbers of undernourished people are much growing in most of the developing countries. More so, the re-occurence 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. However, rice price variation has fallen relative to the other cereals since the 1990s[3]. Coinciding with the arrival to the market of the main paddy crops in major northern-hemisphere exporting countries, international rice prices have retreated since October, 2012. This resulted in a 3.3 percent decline in the FAO All Rice Price Index between October 2012 and January 2013[4]. Rice is of special importance for the nutrition of large extream of the population in Asia, some parts of Latin America and the Caribbean and, increasingly so, in Africa. As a result, it plays an important role for the food security of more than half of the world population. It is also a central component of the culture of a number of communities. India is among the five world's exporter of rice exporting over 4 million MT at Rs. 948,281. Therefore it is the intension of this paper to asses the seasonal price variation of rice (if any) in India.

Methodology

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 ddescriptive 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[5], Abba[6], and Kariuki[7] 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[5].

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

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.

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

Where, T = 1, 2, 3…n and P = nominal price

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

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

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, ti = 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

$$CMAt = \overset{n}{\sum} p_i/n \quad (4)$$

i = t - ½ (n – 1)

Thus, CMA will now be

$$\overset{12}{\left(\sum_{i=t-6}^{i=t+5} P_i + \sum_{i=t-5}^{i=t+6} P_i \, 24\right)} \div 24 \quad (5)$$

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"[5]. CMA has the same trend as the price, show cyclical fluctuations appearing in the original series.

In terms of equation (1)

$$\overset{12}{CMA_i} = TC_i \quad (6)$$

The CMA represents the trend and cyclical components of the original series, and eliminates seasonality and randomness.

The formula for seasonal index (SI) can then be written as:

$$SI = TCSE_i/TC_i = SE_i = \overset{12}{(P_i/CMA_i)} * 100 \quad (7)$$

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 can be calculated as follows,

$$CI_i = TC_i/T_i = C_i = \overset{12}{CMA_i}/T_i \quad (8)$$

(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,

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

However, the Grand seasonal index (GSI) as used by Abba[6] and Kariuki[7], 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:

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

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

This seasonal component is represented by a Grand Seasonal Index (GSI) for each calendar month[8]. The average value of the seasonal indices (SI) for all the calendar month was set to hundred (100), thus the summation of the average values for all months is set to one thousand two hundred (1200). 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 1200 specifically:

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

$\overline{SI_i}$= 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 Indian markets is 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 India showed a deviation from hundred (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 India 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[9] 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 tonnes per hectare. This depressed productivity levels mostly attest to the climatic difficulties endured by various important producers in Asia.

The Grand seasonal index (GSI) represents the typical seasonal behavior of time series. Table-1 showed the GSI for India. A Grand seasonal index for January (2004–14) in India was found to be 96.57 which means that the price in India on an average is 3.43 per cent lower than the average of the entire period as whole.

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 unpredictable.

Table-1
Grand Seasonal Index of rice price in India (2004 – 2014)

Seasonal price variation of Rice in India												
Month/Parameters	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Mean SI	96.6	94.9	98.6	99.6	99.3	95.9	97.7	99.9	93.2	97.1	96.4	95.1
GSI	99.3	97.9	101.4	102.5	103.2	100.6	101.7	103.1	103.9	99.8	98.9	98.6
GSI+SE	102.6	102.4	105.3	106.9	109.7	107.3	107.3	109.4	110.9	106.8	105.5	105.1
GSI-SE	96.1	93.4	97.5	98.1	96.6	93.9	96.2	96.9	97.1	92.9	92.5	92.1
Trend coefficient	37.1	29.8	33.5	35.6	24.9	27.9	38.5	40.2	22.1	27.1	30.0	26.6

GSI = Grand Seasonal Index, SE= Standard Error

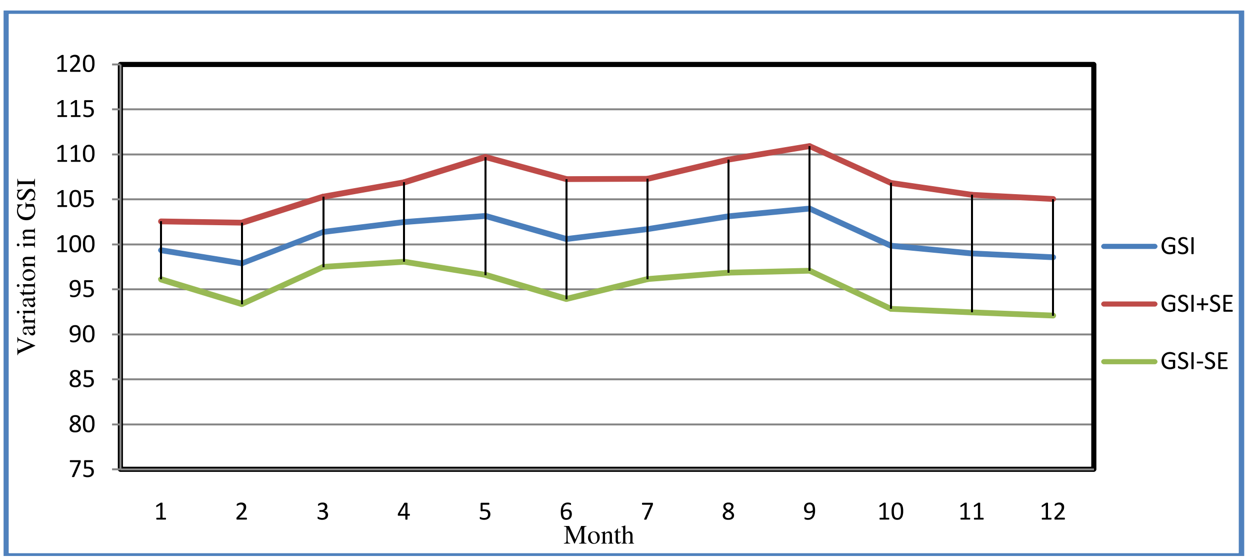

Figure-1
Movement of Grand Seasonal Index of Rice in India

In India the indices for the month of March to September were above the annual average of 100 while January, February, October, November and December (2004–14) were below the 100- annual average (Table-1 and Figure-1). Also, India rice price increased by almost 5.41 per cent from Deceember when the price was low to its peak in September.

Results of the analysis of the domestic wholesale price in the country that further shows the coefficient of variations as well as the month of lowest and highest point as presented in Table-2. It can be observed from Table-2 that, coefficients of variation of the domestic price of rice were higher in the years 2004, 2005, 2006, 2007, 2008, 2009, 2013 and 2014 and were lower in the years 2010, 2011, and 2012.

Thus we can say that, the higher variations was because of the higher price variations of rice in India between the harvest and the lean periods. This means that in India, the law of demand applied wherein, prices fall during the harvest season and rises during the lean period. The years 2010, 2011, 2012 and 2014 showed low fluctuations in price as compared to other periods. This could be due to the reason that, in 2014 for instance, lowest price (US$ 456/ton) was in December when farmers starts or are about to start harvesting and was high (US$ 727/ton) in the month of August when season was peak.

Moreover, in India the prices did not follow stable pattern wherein, highest prices were recorded in the month of September for the years 2004, 2005, 2009, 2011 and 2013 while in the years 2006, 2008, 2010 and 2014 highest price were recorded in August, and in 2007 and 2012 highest price were recorded in the month of October. Lowest prices were however mostly recorded in January, February, November and December.. Lowest prices were however mostly recorded inbetween November to January. Similar study by Sharma and Kumar (2001)[10] reported that highest price of rice in India occurred mostly in the lean season months of August and September.

The centred moving average and all the decomposed components of the price series are shown in Figure-2 to 5.

Conclusion

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 both India and therefore the Government of India 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.

Table-2
Price Fluctuations of Rice in India

Year	Fluctuations (%)	Coefficient of Variations	Month of Lowest Price point	Month of Highest Price point
2004	20.56	6.07	Dec	Sept
2005	3.25	7.05	Jan	Sept
2006	15.68	12.82	Dec	Aug
2007	30.73	9.39	Jan	Oct
2008	24.39	7.87	Jan	Aug
2009	15.53	10.03	Feb	Sept
2010	0.58	3.18	Dec	Aug
2011	0.89	3.93	Jan	Sept
2012	1.54	4.71	Dec	Oct
2013	8.90	7.94	Jan	Sept
2014	2.54	16.94	Dec	Aug

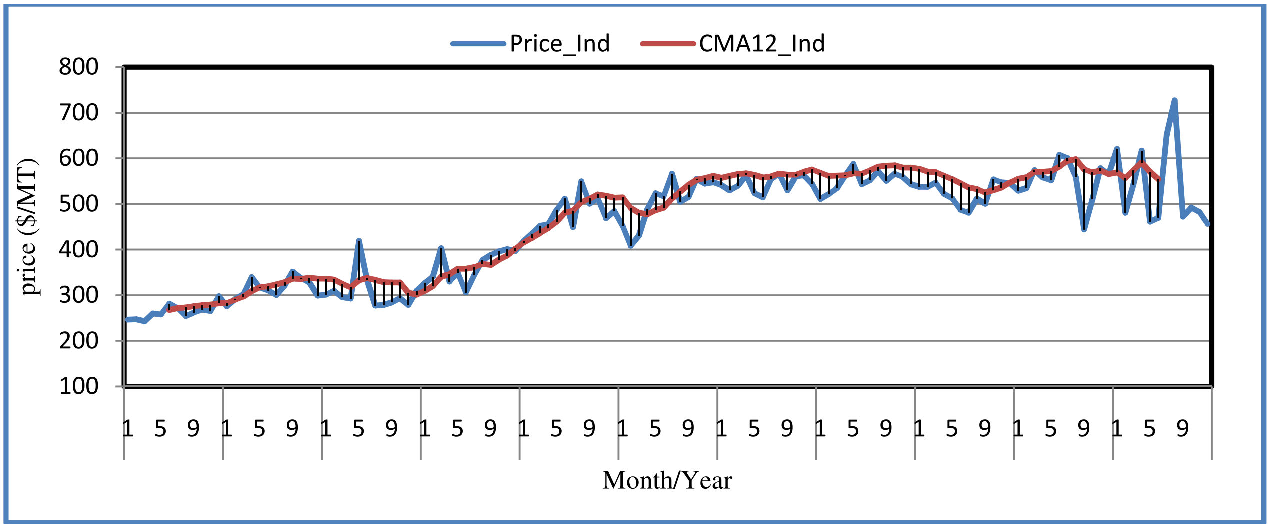

Figure-2
Price and Moving Average of rice for India

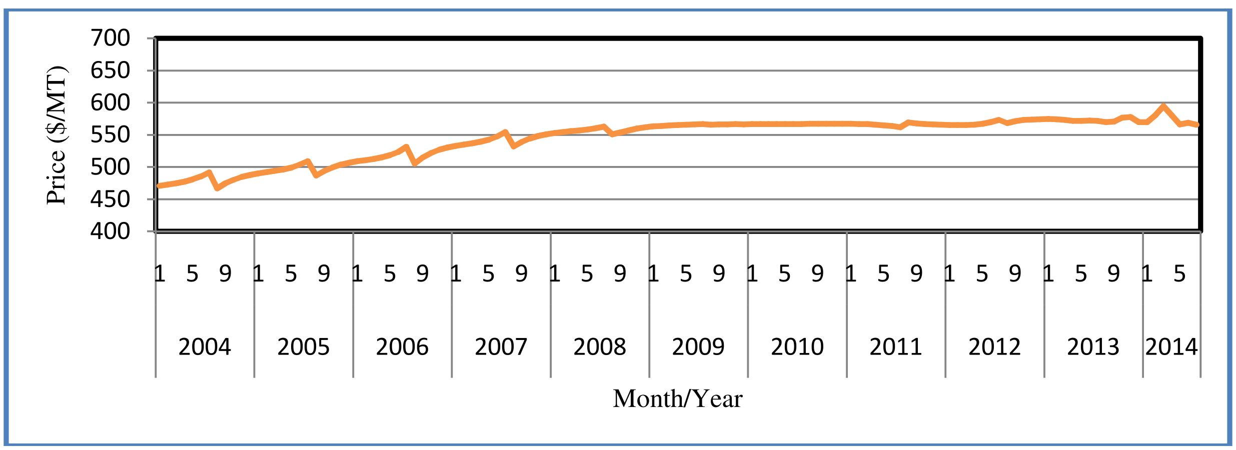

Figure-3
Trend of rice price in India

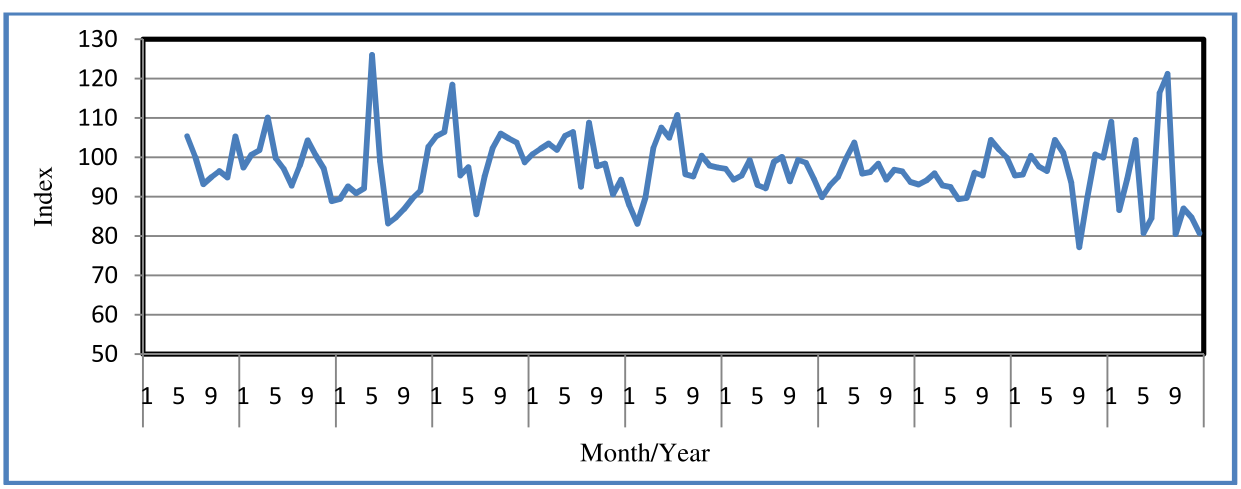

Figure-4
Seasonal Indices of rice price in India

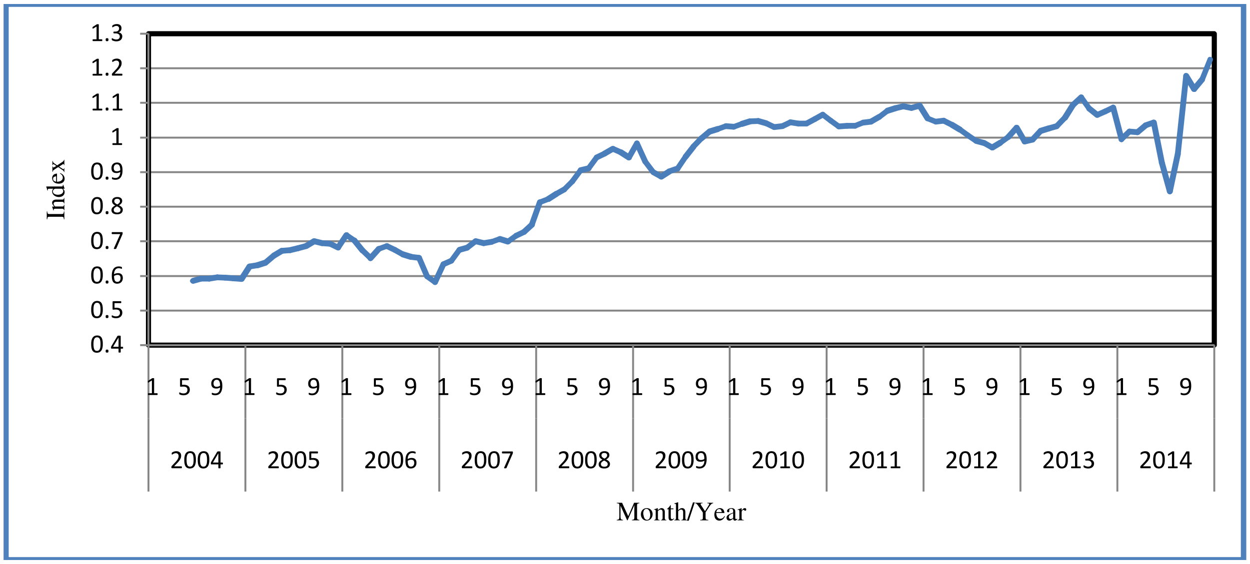

Figure-5
Cyclical Indices of rice price in India

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