Consumer Preference and Price Behavior Analysis for Selected Rice Varieties in Sri Lanka

Kuruppu. I. V.*

Marketing, Food Policy & Agribusiness Division,
Hector Kobbekaduwa Agrarian Research & Training Institute, Colombo 07, Sri Lanka

**Corresponding Author:*
Tel: (94)716393775 Email: kuruppu.i@harti.gov.lk

ABSTRACT

Price of agricultural commodities acts as a significant driving force in any economy. In many developing countries price of agricultural commodities creates food insecurity hence, this is more prominent in countries that depend on agriculture. Agriculture has been identified as the backbone of the Sri Lanka and rice is considered as the staple food in the country. Therefore, continuous analysis and monitoring of rice price is a must to identify potential market behavior for rice price and to take necessary actions to maintain stability. In light of that, this study aims to analyze the price behavior of most common rice varieties (Samba, Nadu, Raw White, and Raw Red) in Sri Lanka, linking it with consumer preference. Both nominal market price (NMP) and real market price (RMP) was analyzed. NMP of all rice types had increased continuously. However, RMP from 2008 to 2013 had gradually decreased. The average price of Samba always retained LKR 15.00/kg higher than Nadu, LKR 18.00/kg higher that Raw Red and LKR 21.00/kg higher than Raw White. Further, NMP of Samba had increased by eight per cent, Nadu by nine per cent, Raw White by 11 per cent and Raw Red by 10 per cent annually. Time series plots were derived for each rice types separately. Price increment or decrement of different rice varieties demonstrated a strong positive relationship with each other. Also, 60 percent of Sri Lankans are preferred to consume Samba, Nadu and Raw White. Raw Red consumption is mainly concentrated in the Southern Province of Sri Lanka. Few large scale millers scattered within the major paddy producing areas exercise an oligopolistic behavior and, as a result sudden variations in prices were observed in off-seasons.

KEYWORDS*:* Consumer preference, Price behavior, Rice varieties

Introduction

Prices of agricultural commodities are playing a pivotal role in any given economy around the world. When considering the agricultural commodity prices, there are numerous factors to be considered and price variations result from different interactions of those factors including basic aggregates of market supply and demand (Borychowski and Czyzewski, 2015). Moreover, prices of agricultural commodities tend to fluctuate in a wide range. Frequent fluctuations are highly risky hence; it causes issues for both consumer and producer. Therefore, the countries and regions those are highly depend on agriculture will suffer negative consequences from time to time (Backman and Sumelius, 2009; Huka *et. al.,* 2014). This could lead to a less production

in agricultural products from the point of producer as well as the less purchasing preference from the point of consumer. Suli and Xhabija (2013) in their study described that, agriculture markets face various problems, which arise from the producer but also by lowering the purchasing power of consumers. Hence, to measure the impact, it is always recommended to monitor price behavior of domestic agricultural products continuously with linking it with consumer preference.

Further, frequent price fluctuations do not form a conductive environment for farmers to plan the production for the coming year. Besides, it is observed that rise in agriculture commodity prices result price rise in other commodities as well, causing inflation. Therefore, in many developing countries stabilization of prices become a key concern of the government. Consequently, price is one of the most important macro environmental factors for economic development and policy implementation (Xie and Wang, 2017). Price is also considered as one of the key driving forces that increases and decreases consumer demand for agricultural commodities. Further, several studies revealed that price is the utmost concern of consumers when deciding agricultural commodities. These studies also disclosed that this phenomenon mostly applied in developing countries specifically concentrated within the African and Asian continents. Jayasuriya *et. al.,* 2012 revealed that in late 2007 and by the first half of 2008 world food prices rose very sharply and this created food insecure population of the world by about 9 per cent, bringing the number of undernourished people to over one billion.

Agriculture has been identified as the backbone of the Sri Lanka for many centuries with one-third of the population being dependent on agriculture. In present agriculture sector contributes 7.1 per cent of the country's GDP (Central Bank Annual Report, 2016). Paddy cultivation is done based on the water availability and for two seasons per annum namely: yala and maha. There are mainly four common rice varieties that can be found in Sri Lankan agricultural markets namely; Samba, Nadu, Raw White and Raw Red. Rice is the principal food commodity in Sri Lanka with per capita consumption around 114 kg per year. It is also estimated that demand for rice will increase by 1.1 per cent per year (Senanayake and Premaratne, 2016). Further, Food Production National Program 2016-2018, published by the Presidential Task Force on Food Production has illustrated that, annual rice consumption requirement in Sri Lanka is 2.27 million metric tons. As a predominant agricultural crop, paddy is cultivated in almost all parts of the country, except in few areas with high altitude. Therefore, rice is considered as an important food commodity in Sri Lanka. Many Asian countries including Sri Lanka view rice as a strategic commodity for its importance in the diet of the poor as a living and income generation of farmers (Wijesooriya *et. al.,* 2017). In light of this, study attempts to analyse the price behaviour of selected rice verities over a period of 15 years and to derive possible price forecasting models for each rice variety. Further, study aims to elicit the changes in consumer preference in relation to rice price in Sri Lanka.

Methodology

Secondary data was used for this study and data consisted of year-wise nominal retail market prices for Samba, Nadu, Raw White and Raw Red, period starting from 2002 to

2016. Prices were obtained from the Hector Kobbekaduwa Agrarian Research and Training Institute of Sri Lanka. Further, Colombo Consumer Price Index (CCPI) was used to calculate the real market prices of different rice varieties. Base year of the CCPI was considered as 2002 (Base 2002=100). CCPI is constructed to measure changes over time in the general level of prices of consumer goods and services and it's a prominent social and economic indicator in Sri Lanka (Gunawardhana, 2009). CCPI was obtained from annual reports of the Central Bank and also via Department of Census and Statistics Sri Lanka. Different secondary source such as journals, research papers, reports and agrarian publications related to paddy and rice prices in Sri Lanka were also used to elicit valuable insights. Time Series (TS) plots were initially used to elicit the major price patterns and behavior of four different rice types against the time factor. Subsequently, both Nominal Market Price (NMP) and Real Market Price (RMP) of rice varieties were plotted and analyzed with the time. RMP was calculated via CCPI (Base 2002=100) and derived through employing the equation [1] (Sandika, 2009; Hadley, 1969).

$$\text{RMP} = (\text{NMP} \times 100) / \text{CCPI} \qquad [1]$$

Further, correlation between price increment and decrement over the past years (from 2002 to 2016) of four different rice types was analyzed by deploying Karl Pearson's product movement correlation coefficient. The correlation coefficient was defined in the equation [2].

$$r = \frac{N\varepsilon xy - (\varepsilon x)(\varepsilon y)}{\sqrt{[N\varepsilon x^2 - (\varepsilon x)^2][N\varepsilon y^2 - (\varepsilon y^2)]}} = \frac{\text{cov}(x, y)}{\sqrt{\text{var}(x).\sqrt{\text{var}(y)}}} \qquad [2]$$

Where,

r = Correlation Coefficient
N = Number of Observations
εxy = Sum of the Prices of Paired Scored
εx = Sum of Prices of One Type of Rice
εy = Sum of Prices of Second type of Rice

Correlation can take on any value in the range minus one to plus one. Further, value zero implies there is no any relationship between the two variable and minus one or plus one implies perfect relationship between two variables. In addition, time series plots were derived for each rice types separately to find out the best fit model.

Results and Discussion

Figure 1 illustrates the Nominal Market Price (NMP) behavior of four selected rice varieties over the period of 15 years. According to the Figure 1, NMP had increased

continuously over the last few years. Among four varieties the highest price was applied for Samba rice type. The second highest price was applied for Nadu variety. The lowest price was observed for Raw White rice type. Results revealed that, average price of Samba always retained LKR15.00/kg higher than Nadu, LKR18.00/kg higher that Raw Red and LKR21.00/kg higher than Raw White. Average retail rice prices of Samba, Nadu, Raw White and Raw Red rice types in year 2016 were LKR101.00/kg, LKR78.00/kg, LKR70.00/kg and LKR67.00/kg respectively. Interestingly, three distinct regions could be identified from the TS plot for NMP. Period starting from 2002 to 2007 illustrates a stabilized price range for all four rice types and average prices for all four varieties ranged between LKR20.00/kg and LKR43.00/kg. However, later part of year 2007 prices of all four rice types had increased significantly. This increment had prevailed until mid-2008. This was mainly due to the world food prices crisis in 2007 to 2008. Mok, 2009 explained in his report, food price index had increased 57.8 per cent during the first few months of 2008 when compared to the same period of the previous year. Consequently, inflation rates of China, Malaysia and Philippines have also increased considerably with the increased food prices.

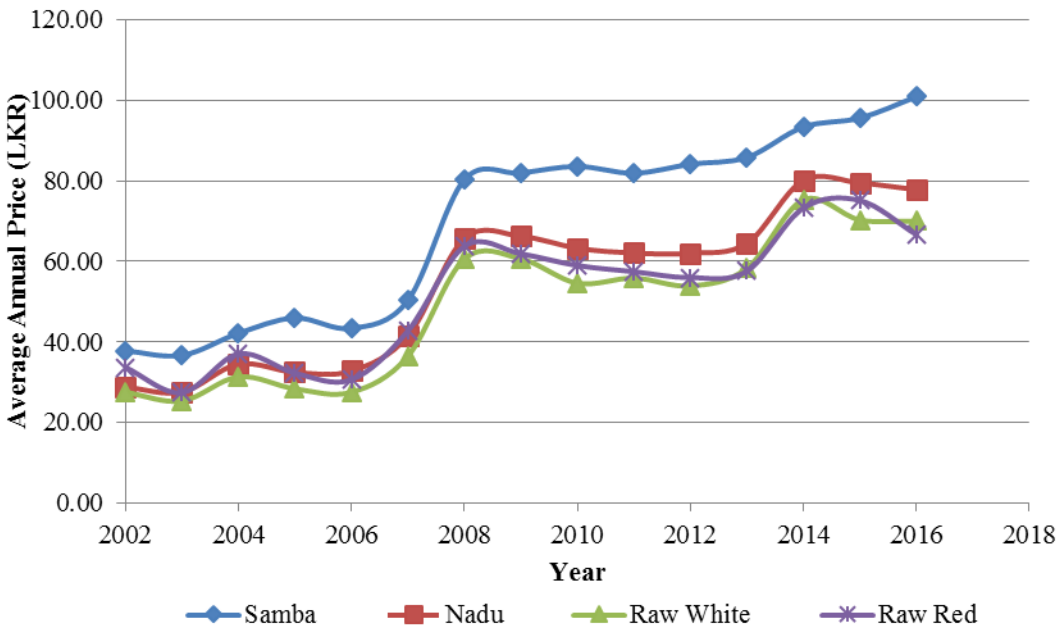

Figure 1: Nominal Market Price of Different Types of Rice Varieties

Wiggins *et. al.,* 2010, revealed that even though there were numerous reasons for the 2008 food price spike, lower grain stocks, widespread inflation resulting from rapid growth of the world economy, rise in oil price, tight export policies and depreciation of the US dollar caused this situation. However, from the later part of 2008 to 2014 prices were again behaved in a stabilized pattern. With the 2008 price shock, there was no any down ward trend in prices for different rice types. Further, Samba rice types had continuously increased in an increasing pattern and widen the

price gap with the other three rice types. Third region starts from 2015 to present. Prices of all three varieties had again increased. This was mainly due to unfavourable weather pattern. Sri Lanka and several South Asian countries had undergone a severe drought condition during this period. Hence, as a result of water scarcity, drastic reduction in paddy yield has been experienced by Sri Lanka for three seasons namely: 2016 yala, 2016.17 maha and 2017 yala. Interestingly, price of Samba rice had increased continuously without any drop. In overall, RMP of Nadu, Raw White and Raw Red behaved almost in a same pattern.

Figure 2 exhibits the Real Market Price (RMP) of four different rice types. In there also three different regions could be observed. First region started from 2002 and ended in 2008.

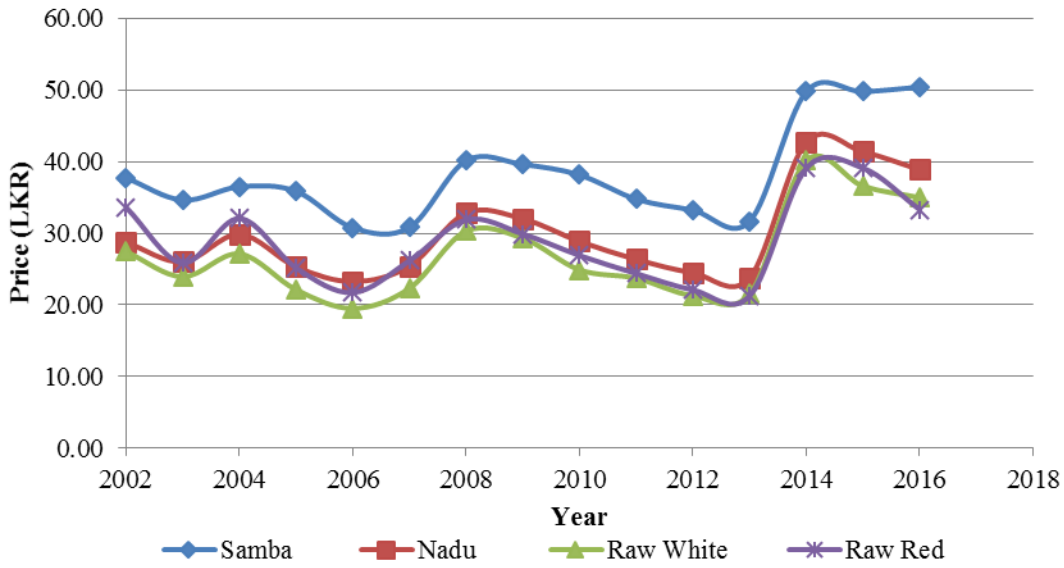

Figure 2: Real Market Price of Different Types of Rice Varieties

In that period RMP of all four rice types had fluctuated continuously. However, in between 2008 and 2013 RMP had been declined gradually. This decreasing trend in RMP was supported by the studies of Hathurusinghe and Ravichandran 2004; Rupasena *et. al.,* 2008 and Sandika, 2009. Therefore, the period starting from 2008 to 2013 has identified as the second region. In 2014 real market prices had increased drastically. Therefore, from 2014 to present could be stated as the third region. Department of Census and Statistics of Sri Lanka has introduced a new price index in 2013 which is National Consumer Price Index (NCPI) instead of CCPI. NCPI covers all provinces in Sri Lanka and consisted of 12 major groups and 105 sub-groups in the market basket. Also, percentage of 44.04 was dedicated for food and the rest (55.96%) for non-food (Department of Census and Statics, 2013). This was a major change compared to the previous indexes of 2002 and 2006. Conversely, base year of 2013 was used to derive the CCPI of 2013 to 2016. In fact, derived CCPI values from 2013 to

2016 are not in line with previous years' values. This could be the possible reason for this sudden surge.

According to the Table 1, price increment or decrement for different rice varieties presented a positive relationship with each other. The best correlation was formed between Nadu and Raw White. The second best correlation had formed between Nadu and Raw Red. The least correlation had formed between Samba and Raw red. However, all rice types showed strong relationship in relation to price increment or decrement. In other words, this means that increment or decrement of one type of rice price leads to an increase or decrease of other varieties. Even though, an increment in price of Samba rice type affected somewhat less for other varieties compared to correlations between other three varieties. When considering the origins of these four rice varieties, Raw Red rice production mainly concentrated in the Southern region in Sri Lanka. Productions of other three varieties are concentrated in the Northern, Eastern and Western regions in Sri Lanka. Most of the time, consumers in the Southern region of Sri Lanka consume Raw Red rice type. Studies revealed that approximately 60 per cent of Sri Lankans are consuming Samba, Nadu and Raw White rice types due to their palatability. It is envisaged that, origin of rice type is irrelevant for price increment or decrement. Further, NMP of Samba had increased by eight per cent, Nadu by nine per cent, Raw White by 11 per cent and Raw Red by 10 per cent annually.

Table 1: Correlation Matrix for Price Increment / Decrement in Different Rice Types

	Samba	**Nadu**	**Raw White**	**Raw Red**
Samba		r = 0.89 (p=0.00)	r = 0.87 (p=0.00)	r = 0.76 (p=0.00)
Nadu	r = 0.89 (p=0.00)		r = 0.98 (p=0.00)	r = 0.94 (p=0.00)
Raw White	r = 0.87 (p=0.00)	r = 0.98 (p=0.00)		r = 0.93 (p=0.00)
Raw Red	r = 0.76 (p=0.00)	r = 0.94 (p=0.00)	r = 0.93 (p=0.00)	

The second best correlation had formed between Nadu and Raw Red. The least correlation had formed between Samba and Raw red. However, all rice types showed strong relationship in relation to price increment or decrement. In other words, this means that increment or decrement of one type of rice price leads to an increase or decrease of other varieties. Even though, an increment in price of Samba rice type affected somewhat less for other varieties compared to correlations between other three varieties. When considering the origins of these four rice varieties, Raw Red rice production mainly concentrated in the Southern region in Sri Lanka. Productions of other three varieties are concentrated in the Northern, Eastern and Western regions in Sri Lanka. Most of the time, consumers in the Southern region of Sri Lanka consume Raw Red rice type. Studies revealed that approximately 60 per cent of Sri Lankans are

consuming Samba, Nadu and Raw White rice types due to their palatability. It is envisaged that, origin of rice type is irrelevant for price increment or decrement. Further, NMP of Samba had increased by eight per cent, Nadu by nine per cent, Raw White by 11 per cent and Raw Red by 10 per cent annually.

Table 2 represents best fit time series models for each rice types separately. Accordingly, results revealed Winters' Additive model was the best fit model for price forecasting of Samba, Nadu and Raw Red rice types. Subsequently, analysis revealed ARIMA (0,1,8) model was the best fit model for price forecasting of Raw White rice type. In other words, it utilizes one differencing and eight moving averages in forecasting of Raw White rice price. Further, table 2 represents respective R-squared and Mean Absolute Percentage Error (MAPE) values for each model. Maximum Absolute Percentage Error (MaxAPE) represents the largest forecasted error expressed as a percentage. Figures 3, 4, 5 and 6 illustrate times series plots with observed and fitted values for each rice type. Also, rice price forecast was done for the next six-month time duration.

Table 2: Best Fit Time Series Models For Different Rice Types

Rice Type	Best Fit Model	Stationary R-squared	R-squared	MAPE	MaxAPE
Samba	Winters' Additive	0.55	0.99	2.53	15.22
Nadu	Winters' Additive	0.56	0.99	2.70	18.52
Raw White	ARIMA (0,1,8)	0.70	0.95	5.73	29.33
Raw Red	Winters' Additive	0.51	0.98	3.33	17.16

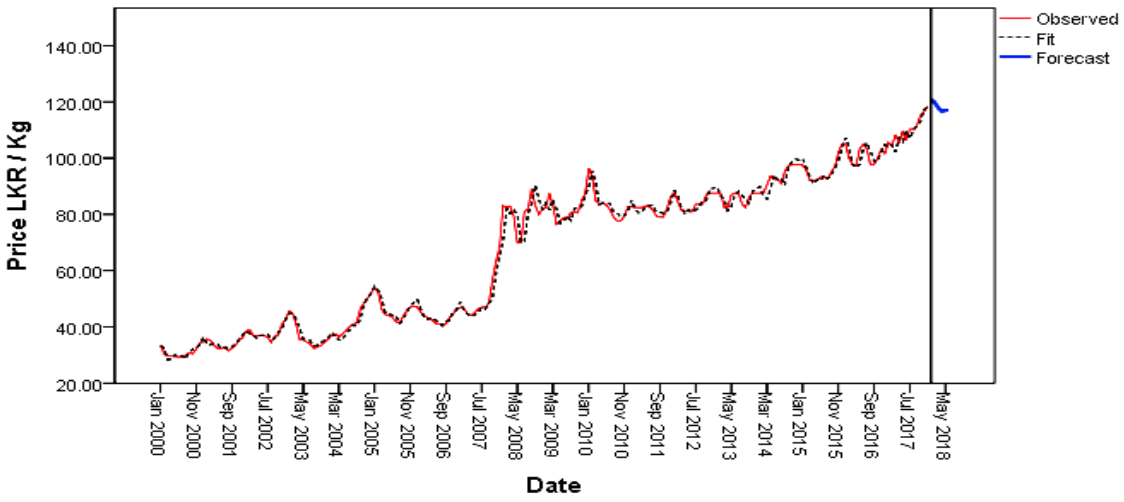

Figure 3: Time Series Plot for Price of Samba Rice

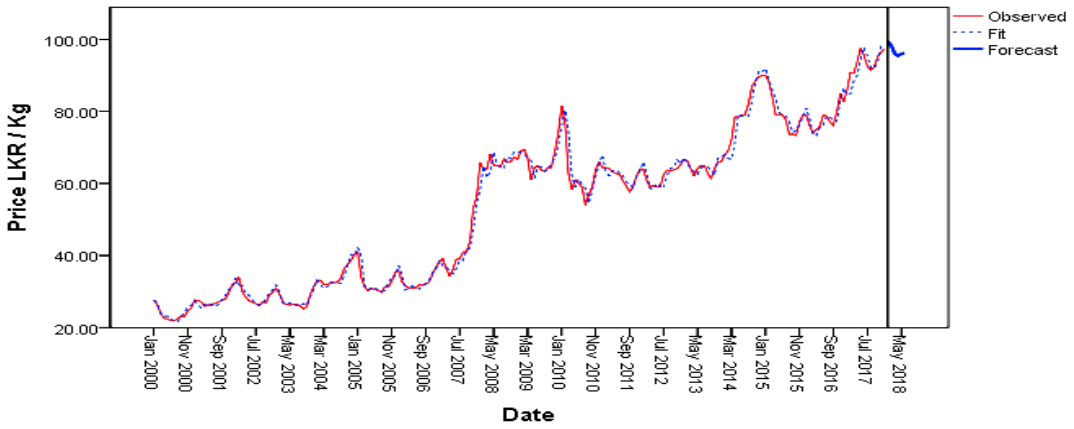

Figure 4: Time Series Plot for Price of Nadu Rice

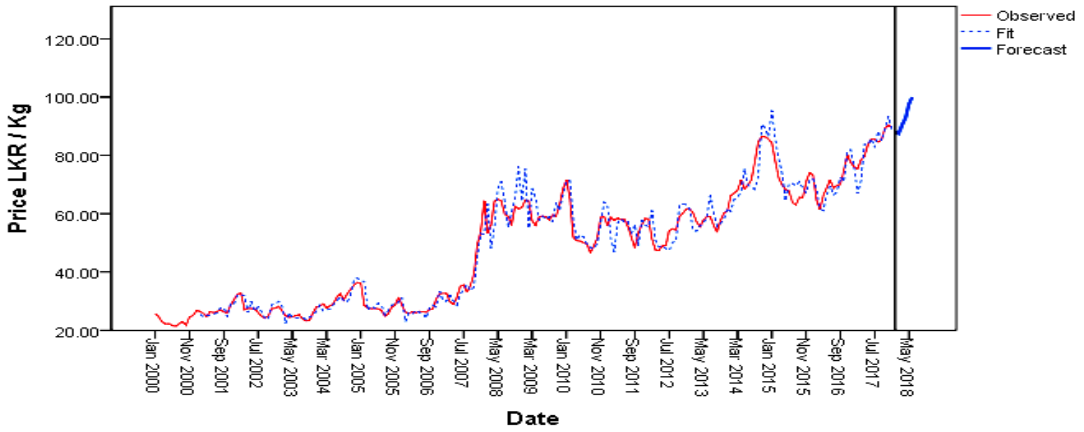

Figure 5: Time Series Plot for Price of Raw White Rice

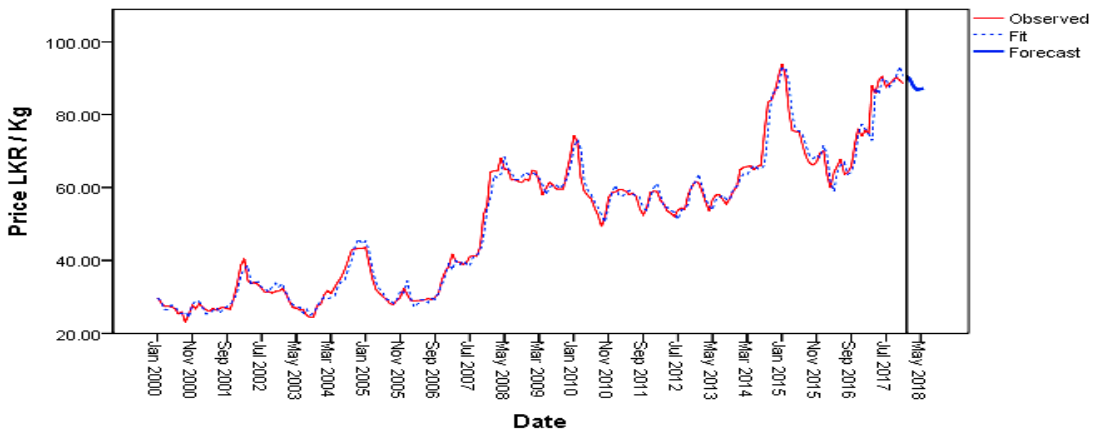

Figure 6: Time Series Plot for Price of Raw Red Rice

According the forecasted results, prices of Samba, Nadu and Raw White were demonstrated an increasing trend, while the price of Raw Red was illustrated an increasing trend for the next six-month time period. However, paddy harvesting in 2017/18 maha season in Sri Lanka will be expected to initiate in mid-February to April in 2018. Therefore, when the peak harvesting period starts prices of all the rice varieties would decrease. However, final retail rice price would be reduced by only few percentages due to monopolistic market behaviour of rice distribution in Sri Lanka. Referring to rice imports, in 2016 Sri Lanka had imported 29,524 metric tons of rice to the country. However, in 2014 and 2015 Sri Lanka had imported 599,718 metric tons and 285,604 metric tons of rice respectively. As a result of a prolonged drought period in 2014, extent of paddy cultivation decreased drastically. Therefore, rice production was sufficient to cater the domestic consumption only for 11 months. This directly resulted an increment in retail rice price. To maintain a stabilized price Sri Lanka had to import nearly 600,000 metric tons in the year of 2014. However, Sri Lanka is facing the same issue in 2017 as well. Due to prolonged drought, Sri Lanka had imported 653,161 metric tons of rice so far between January and November 2017 (Hector Kobbekaduwa Agrarian Research and Training Institute, 2017). Currently, this quantity is identified as the highest rice imports ever recorded in the Sri Lankan history. Even though there are many reasons to facilitate this issue, mainly inadequate storage facilities yield this vicious cycle of rice price increment in Sri Lanka.

Rambukwella *et. al.,* 2017 described world rice consumption can be categorized into three distinct groups namely: habitual consumers, consumers who change their diet regular basis and consumers who consume rice occasionally as a special diet. Sri Lanka could be categorized under first group; people who rely on rice most of their nutritional intake. Further, study also revealed that, approximately, 60 per cent, 30 per cent and 10 percent rice consumption made up of long grain white rice, short grain white rice and parboiled red rice and other local rice varieties respectively. In addition, Sri Lanka imports basmati rice varieties from India and Pakistan. Increased wheat flour prices, increased age of the household head and increased household size positively impact on local rice consumption in Sri Lanka. However, urbanization has a negative impact on rice consumption. Furthermore, inelastic price demand for rice stresses the importance of having a strong policy related to supply management, buffer stock maintenance and storage potentials at farm level (Wijewardana *et. al.*, 2017).

Conclusions

Study analysed year wise NMP and RMP of four most common rice types (Samba, Nadu, Raw White and Raw Red) in Sri Lanka starting from 2002 to 2016. Results revealed that NMP of all types of rice had increased continuously. Among the four varieties the highest average rice price was observed for Samba variety. The lowest average price was observed for Raw White rice type. The average price of Samba always retained LKR15.00/kg higher than Nadu, LKR18.00/kg higher that Raw Red and LKR21.00/kg higher than Raw White. However, when considering the RMP of all rice types, gradual decrement was observed particularly from 2008 to 2013. This implies that the increment in farmer income level was not maintained during these years. Price

increment or decrement for different rice varieties presented a strong positive relationship with each other. Further, NMP of Samba had increased by eight per cent, Nadu by nine per cent, Raw White by 11 per cent and Raw Red by 10 per cent annually. Quadratic model was the most appropriate model to forecast NMP of Samba, Nadu, Raw White and Raw Red. Winters' Additive model was the best fit model for price forecasting of Samba, Nadu and Raw Red rice types. Subsequently, analysis revealed ARIMA (0,1, 8) model was the best fit model for price forecasting of Raw White rice type. Apart from the natural causes, both farmers and consumers are assumed that main reason for sudden price increment occurs as a result of oligopolistic behaviour of few large scale paddy millers located in the major paddy producing areas in the country. Inelastic price of rice behaviour further intensified this situation. Therefore, government has to focus more on viable policy concerns related to paddy supply and marketing process to maintain price stability.

References

Backman, S. & Sumelius, J. (2009). Identifying the Driving Forces behind Price Fluctuations and Food Crisis, Discussion Paper no. 35, Department of Economics and Management, University of Helsinki, Finland.

Borychowski, M. & Czyzewski, A. (2015). Determinants of Prices Increase of Agricultural Commodities in a Global Context. *Management. 19*(2), 152-167. DOI: 10.1515/manment-2015-0020.

Central Bank of Sri Lanka. (2016). *Central Bank Annual Report.*

Department of Census and Statistics (2013). *National Consumer Price Index for Sri Lanka. Technical Note.*

Food Production National Program 2016-2018. (2016). *Presidential Task Force on National Food Production.* Government of Sri Lanka.

Gunawardhana, D. C. A. (2009). *Measurement of Inflation: New Colombo Consumers' Price Index (CCPI). Economic Review.*

Hadley, G. (1969). *Elementary Statistics*. London: Holden Day Inc.

Hathurusinghe, C. P. & Ravichandran, T. (2004). An Analysis of the Price of Rice of rice in Sri Lanka for the Period 1985 to 2002. *Sri Lanka Journal of Agrarian Studies*. *11*(1), 63-69.

Hector Kobbekaduwa Agrarian Research and Training Institute. (2017). *Monthly Reports.*

Huka, H., Ruoja, C. & Mchopa, A. (2014). Price Fluctuation of Agricultural Products and its Impact on Small Scale Farmers Development: Case Analysis from Kilimanjaro Tanzania. *European Journal of Business and Management*, *6*(36), 155-160.

Jayasuriya, S., Mudbhary, P. & Broca, S. S. (2012). *Food Price Spikes, Increasing Volatility and Global Economic Shocks: Coping with Challenges to Food Security in Asia. A Comparative Regional Study of the Experiences of Ten Asian Economies.* Bangkok, Food and Agriculture Organization of the United Nations. Regional Office for Asia and the Pacific. ISBN: 978-92-5-107320-9.

Mok, K. (2009). Impact of the Economic Crisis on Education. Working Paper for UNICEF Conference East Asia and the Pacific Island, Singapore.

Rambukwella, R., Priyadarshana, D. & Wijesooriya, N. (2017). Consumption and Consumer Preference for Different Rice Varieties in Selected Districts in Sri Lanka (Research Report No. 204). Hector Kobbekaduwa Agrarian Research and Training Institute Colombo, Sri Lanka. ISBN: 978-955-612-223-7

Rupasena, L., Kerur, N. M. & Naik, A. D. (2008). Review of Price Behavior of Rice during Pre and Post Liberalization Period. *Sri Lanka Journal of Agrarian Studies*, *12*(1), 1-12.

Sandika, A. L. (2009). An Analysis of Price Behavior of Rice in Sri Lanka after Liberalization of Economy. *Tropical Agricultural Research and Extension*, *12*(2), 81-84.

Senanayake, S. M. P. & Premaratne, S. P. (2016). An Analysis of the Paddy / Rice Value Chains in Sri Lanka. ASARC Working Paper 04. Australia South Asian Research Centre.

Suli, D. & Xhabija, G. (2013). The Effect of the Price Change, on the Demand of Agricultural Products during Summer Time. *European Journal of Sustainable Development*, *2*(4), 293-302.

Wiggins, S., Keats, S. & Compton, J. (2010). What Caused the Food Price Spike of 2007/08? Lessons for World Cereal Markets. London, UK: Food Prices Project Report. Overseas Development Institute.

Wijesooriya, N., Champika, J., Priyadarshana, D. & Vidanapathirana, R. (2017). Government Intervention in Paddy Marketing: Issues in Purchasing and Post Stock Management (Research Report No. 205).Hector Kobbekaduwa Agrarian Research and Training Institute Colombo, Sri Lanka ISBN: 978-955-612-222-0

Wijewardana, K. T. I., Rupasena, L. P. & Ginigaddara, G. A. S. (2017). Determinants of Future Rice Demand in Sri Lanka. *Sri Lanka Journal of Agrarian Studies*, *18*(1), 55-62.

Xie, H. & Wang, B. (2017). An Empirical Analysis of the Impact of Agricultural Product Price Fluctuations on China's Grain Yield. *Sustainability, 9*(6), 906. DOI: 10.3390/su. 9060906