Bangladesh J. Agric.Econs. XVI, 2(December 1993): 61-75

Research Note

AN ANALYSIS OF RICE PRICE IN MYMENSING TOWN MARKET: PATTERN AND FORECASTING

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ABSTRACT

The paper investigates the trend, seasonal and cyclic al variations of retail and wholesale prices of price in Mymensingh town market and forecasts the future prices based on ARIMA model. Compound growth rates of real prices indicate that consumers seem to he better off with respect to rice price since independence, particularly during 80's. Seasonal price variation of fine rice is found to be higher compared with coarse rice because of continuous flow of coarse rice in the market. Peak price month has changed to April from September and seasonal price variation has reduced markedly due to higher production of Boro paddy. Apart from seasonal cycles, there exist a five year cycle in rice price as revealed by the harmonic analysis. As the structure of rice price has changed since independence, the forecasting of prices based on ARIMA model for the whole period provides poor performance. However, the forecasting of prices improves considerably when the study period is reduced. Thus, it may be concluded that ARIMA model can be used to forecast short term rice price in Bangladesh.

I. INTRODUCTION

Prices play an important role in guiding production, consumption and government policies. Production decision of farmers and buying decision of consumers are governed by prices to a large extent. Many factors such as price support and stabilization measures, export and import of a commodity etc. are also influenced by past, present and future prices.

Agricultural commodity prices are much more volatile than those of most nonfarm goods and services. The biological nature of agricultural production is the principal cause of price instability. Yield vary from year to year because of favourable or unfavourable weather and/or the presence of disease or insect infestation. Furthermore, the influence of factors such as government policies, civil strifes may distort accurate estimation and contribute to source of error to die price analysis of agricultural markets at different market levels.

Since about 66% of the consumers' expenditure are spent on food of which 45% are on rice (BBS, 1991) and since 70% of cropped land is under rice (BBS, 1986), the study on rice price is important to producers, traders, consumers as well as to the government. Rice price which is determined by multiplicity of factors is very difficult to forecast by using

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econometric models. Moreover, data are not available for many factors. On the other hand, time series models are very simple and do not need data of factors influencing the prices. The present study is an attempt to investigate the pattern of retail and wholesale prices of rice in Mymensingh town and to forecast their future movement using ARIMA model. Following introduction, data sources and methodology are discussed in section II and III respectively. Section IV examines the agricultural market integration in Bangladesh. Findings are presented in section V. Conclusions have been drawn in the last section.

II. DATA SOURCES

Since 1972, the Department of Cooperation and Marketing at the Bangladesh Agricultural University, Mymensingh have been collecting weekly retail price data from four markets such as Mymensing town, Sutiakhali, Khakdor and Shambugonj. Since prices of four markets differ slighty, price data of Mymensingh town market were analysed in this study. This price data is more reliable in the sense that the investigator went to the markets almost everyday and collected data personally. The wholesale prices since 1972 were collected from the local office of the Department of Agricultural Marketing at Mymensingh.

III. METHODOLOGY

Compound growth rates (C.G.R.) of price were calculated by fitting exponential functions of the type

$$Y = ae^{bt}$$

$$\text{or } \log_e Y = \log_e a + bt$$

Where Y = price of rice in taka and

t = time.

Seasonal variations were estimated by ratio to moving average method considering multiplicative model. Trends were estimated by a simple 12 months moving average method and seasonal indices were worked out by averaging the detrended series.

To analyze nature of cycles influencing the behaviour of various agricultural commodities, harmonic and spectral analysis are commonly used. Harmonic analysis is simple as it involves an easy procedure of calculation while spectral analysis involves a somewhat difficult and tedious procedure. Some studies using harmonic analysis include Abel's (1962) study on cattle and hog cycles in U.S.A., Kulsreshta and Wilson's (1973) study on same subjects in Canada, Waugh and Miller's (1970) study on fish cycles and George and Govinda's (1975) study on potato cycles in India. Harmonic analysis is a technique in which a continuous function is represented by a sine and cosine functions. In this study, the following function was estimated.

$$Y = a_o + a_1 \sin (2ñ/p_1)\, t + b_1 \cos (2ñ/p_1)\, t + a_2 si\, (2ñ/p_2)\, t + b_2 \cos(2ñ/p_2)\, t + c_1 t$$

where, Y = price of rice

p_1 = period of 12 months (seasonal cycle)

p_2 = period of 5 years (long cycle) and

t = time.

Ordinary least squares method was used to estimate the unknow parameters a_o, a_1, a_2, b_1, b_2, and c_1,

In this study, the Box-Jenkins Autoregressive Integrated Moving Average (ARIMA) model was applied to the retail price of fine rice in Mymensingh town. The ARIMA method consists of three phases such as identification, estimation and diagnostics checking. This method has been developed by Box and Jenkins (1970) and used by Haugh and Box (1977), Granger and Newbold (1977), Lakshminarayan et al. (1977), Bogahawah (1988) etc. in economic research.

The seasonal ARIMA model with monthly data can be written as

$$a_p(L)\, A_p(L^S)\, \{(1-L)^d (1-L^S)^D Z_t - m\} = b_q(L)\, B_Q(L^S)\, e_t$$

where, $a_p(L) = 1 - a_1L - a_2L^2 - \ldots - a_pL^P$

(non-seasonal autoregressive operator)

$$A_p(L^S) = 1 - A_1L^S - A_2L^{2S} - \ldots - A_pL^{PS}$$

(seasonal autoregressive operator)

$$b_q(L) = 1 - b_1L - b_2L^2 - \ldots - b_qL^q$$

(non-seasonal moving average operator)

$$B_Q(L^S) = 1 - B_1L^S - B_2L^{2S} - \ldots - B_QL^{QS}$$

(seasonal moving average operator)

m = mean of the transformed series

L = lag operator

S = number of seasons

Z_t = $(Y_t^c - 1)\, c$; a Box - Cox transformation with parameter c

Y_t = the original time series; in our case price of fine rice at time t

e_t = random disturbance term.

First, (at identification stage) we estimated the value of the transformation parameter c and the orders of seasonal ARIMA (p, d, q, P, D, Q). Secondly, (at estimation stage) we estimated the parameters $a_1, a_2, ... a_p, A_1, A_2, ... A_p, b_1, b_2, ... b_q, B_1, B_2, ... B_Q$, m and the residual variance 6^2. Here it should be noted that the estimation procedure used was one suggested by Box and Jenkins (1970) for seasonal ARIMA model. Thirdly, diagnostic procedure suggested by Box and Jenkin was carried out until a suitable model was fitted. Finally, the predicted values were calculated on the basis of the estimated model.

IV. AGRICULTURAL MARKET INTEGRATION IN BANGLADESH

In many studies simple correlation coefficient was used to work out the spatial integration of the markets in Bangladesh. Correlation matrices prepared by Scot (1988) and Sabur (1990) showed that the correlation coefficients of monthly wholesale prices of vegetables in spatially separated urban markets in Bangladesh were very high and significant. Scot studied 20 markets and Sabur 5 markets during 1977-82 and 1972-89 respectively. These indicate that Bangladesh's urban markets are highly integrated.

Ahmed and Bernard (1989) also calculated correlation coefficients between district prices of Aman and Aus rice during 1976-82. In case of Aus rice only 48 out of 190 pairs of correlation are statistically insignificant; all remaining coefficients are highly significant. Of the 48 insignificant coefficients 18 relate Chittagong to other districts in the northern and southern parts of Bangladesh. In case of Aman rice, 63 out of 190 pairs are statistically insignificant. However, 51 out of the 63 insignificant correlations pertain to Barisal, Patuakhali, Dinajpur and Bogra. The first three are extremely backward in infrastructural development.

Ravallion (1986) developed a market integration model which can estimate the extent to which local prices are influenced by prices in the reference market (e.g. Dhaka market for Bangladesh). He employed his model for rice price in Bangladesh just prior to and during the 1974 famine. His test rejected the hypothesis that rice markets are segmented i.e. totally lacking of integration. But the test on short run integration of markets was inconclusive. Ahmed and Bernard (1989) also used this model in rice market of Bangladesh. Their results rejected the market segmentation hypothesis for all the studied markets. Index of market connection (IMC) developed by Timmer showed that half of the markets are integrated even in the short run. Chowdhury's (1992) finding based on Ravallion model was very similar to the one reached by Ahmed and Bernard. He analyzed monthly rice price of 42 markets and showed that all the markets were not segmented.

From the above results it may be inferred that Bangladesh's markets are integrated i.e. price behavior of all the markets are more or less similar. Therefore, results based on price analysis of a single market may be more or less applicable to all markets in Bangladesh. Additionally, for the purpose of this study the monthly rice price of Mymensingh town market and average rice price of Bangladesh are compared and are shown in appendix figures 1 & 2. They are almost similar and highly correlated (the correlation coefficient has been estimated at 0.98). Hence policy conclusions can be drawn on the basis of a single market price analysis.

V. FINDINGS OF THE STUDY

Trend

The compound growth rates given in Table 1 show rising trends in nominal prices and declining trend in real prices of both fine and coarse rice in Mymensingh town market. The rate of increase in retail nominal prices of fine rice (8.30%) was slightly higher than that of coarse rice (7.97%). On the other hand, real prices of coarse rice decreased at a faster rate compared with fine rice. This indicates that rise in retail price of rice lagged behind the rise in cost of living index during the study period. As rice constitutes the major share of consumers expenditure, consumers seem to be better off regarding rice purchase since independence.

When compound growth rates of two periods are compared, it is found that nominal price rise in the first decade (1972-73 to 1981-82) was much higher than that in the last decade (1882-83 to 1991-1992). However, in case of real price the situation is different. Although real price falls during both the periods, the rate of decline of fine rice price in the first decade was higher compared to last decade. This is reverse in case of coarse rice. Therefore, the study reveals that poor consumers who consume coarse rice was slightly better off in the 80's compared with 70's. On the other hand, the condition of rich consumer was reverse.

Table 1: Compound Growth Rate of Nominal and Real Retail Price of Rice in Percentage.

Period	Fine Rice		Coarse Rice	
	Nominal	Real	Nominal	Real
1972/73–1991/92	08.30	-02.59	07.97	-02.90
	(11.63)	(-06.33)	(10.77)	(-06.91)
1972/73–1981/82	09.02	-04.24	09.76	-03.54
	(03.23)	(-02.95)	(03.41)	(-02.30[a])
1982/83–1991/92	05.75	-03.71	05.62	-03.83
	(07.39)	(-05.80)	(06.07)	(-04.82)

Note: Figures in the parenthesis indicate t values. The coefficient market by 'a' is significant at 5% level and all other coefficients are significant at 1% level.

Seasonal Price Variation

Seasonal wholesale and retail price indices of fine and coarse rice are given in Table 2. The lowest price prevails in December due to the arrival of winter (Aman) paddy. The prices start rising from January and reach the peak level in September. There is a slight decline in rice price in June as this is the harvesting season of summer (Boro) paddy. The seasonal variations of rice prices are more or less same for all types and all markets in Mymensingh town. Seasonal wholesale and retail prices differ in respect of fall during the harvesting season of Boro paddy. Wholesale prices begin to decline from May whereas retail prices begin to decline from June. Seasonal price spread and coefficient of variation of monthly indices show that seasonal price variation is higher for fine rice compared with coarse rice and for each type of rice, retail price possesses higher seasonal variation. Since coarse paddy is harvested throughout year and government through various operation release mainly coarse rice and coarse rice is not a perfectly substitute of fine rice, the seasonal variation of fine rice is found to be higher compare with coarse rice.

In order to know the change in seasonal price variation of rice, the study period was divided into four subperiods (Table 3). Except last one, each subperiod consists of five years.

Table 2: Seasonal Indices of Rice Price During 1972-1992

Month	Fine Rice		Coarse Rice	
	Retail	Wholesale	Retail	Wholesale
January	88.30	90.41	90.52	92.94
February	91.30	91.42	94.93	95.77
March	96.90	95.95	100.13	101.11
April	102.71	101.29	106.34	104.33
May	103.01	100.69	103.54	98.39
June	102.41	101.90	100.93	100.30
July	105.71	104.52	102.64	102.22
August	107.42	109.46	104.34	104.84
September	109.12	109.25	106.64	106.15
October	108.42	108.05	105.94	105.74
November	98.71	98.67	96.83	98.69
December	85.99	88.39	87.22	89.52
Range	23.13	21.07	19.42	16.63
Price Spread	26.90	23.84	22.27	18.58
c. v.	7.55	6.97	6.11	5.01

Although the lowest price prevails in December in all subperiods, the highest price month shifts from September to April. Increased production of Boro paddy makes this change in seasonal price variation. Like other studies (Chowdhury, 1987: Rahman and Mahmud, 1988: Sabur and Elahi, 1992), the present study also shows that the seasonal price variation in both types of rice has decreased since independence. The seasonal price spread of fine rice has decreased from 60.69% in 1972-76 to 17.38% in 1987-92 and that of coarse rice from 61.73% to 15.85% during the same period.

Table 3: Seasonal Variation of Retail Price of Rice

Month	Fine Rice				Coarse Rice			
	1972-76	1977-81	1982-86	1987-92	1972-76	1977-81	1982-86	1987-92
January	79.33	87.35	91.88	95.17	79.21	87.63	99.18	96.59
Ferburary	85.85	89.45	89.67	97.16	89.94	90.82	98.06	98.49
March	97.18	92.64	93.79	102.35	97.66	94.31	104.53	101.59
April	102.70	100.11	100.12	106.55	104.88	101.59	109.98	106.80
May	103.40	104.20	104.34	102.16	101.97	104.78	100.29	106.10
June	101.60	103.21	101.72	99.86	101.87	104.48	95.03	98.69
July	104.30	110.69	104.74	104.35	104.38	114.05	91.50	101.69
August	115.94	110.69	106.44	102.06	115.81	111.75	94.93	100.29
September	120.55	108.39	108.15	102.65	119.52	109.56	103.82	100.79
October	119.35	106.60	107.45	102.05	118.01	104.98	103.22	101.19
November	94.78	100.71	102.23	94.87	92.85	92.91	101.60	95.59
December	75.02	85.96	89.47	90.77	73.90	83.14	97.86	92.19
Range	45.53	24.73	18.68	15.78	45.62	30.91	18.48	14.61
Price Spread	60.69	28.77	20.88	17.38	61.73	37.16	18.88	15.85
c. v.	14.07	08.63	06.68	04.38	13.77	09.58	04.83	03.95

Cyclical Variation: Harmonic Analysis

In analysing the cycles, it is assumed that apart from a linear time trend the retail price of rice contain a seasonal cycle and a hidden cycle of five years. Based on these assumptions, the estimated equations for fine and coarse rice are given below:

Fine rice :

(1) $Log_e P_f = 1.10 - 0.07sin30t^0 - 0.07cos30t^0 - 0.06sin6t^0 - 0.13cos6t^0 + 0.007t$

(-3.75) (-3.90) (-3.08) (-6.84) (38.55)

R^2 = 0.8636 (Adjusted for degrees of freedom)

Coarse rice:

2) $Log_e P_c = 0.94 - 0.03sin30t^0 - 0.06cos30t^0 - 0.05sin6t^0 - 0.13cos6t^0 + 0.007t$

(-1.69^a) (-3.23) (-2.44) (-6.32) (35.04)

R^2 = 0.8375 (Adj.)

where, figures in the parentheses are t values. The coefficient marketd by 'a' is significant at 10% level while all other coefficients are significant at 1% level.

Equations (1) and (2) indicate that the seasonal cycle, the five year cycle and the trend explained 86 and about 84 percent of the monthly retail prices of fine and coarse rice respectively in Mymensingh town market. All the coefficients are statistically significant; this confirms the existence of seasonal and five year cycles in price behaviour. The existence of five year cycle implies that two years rise in price is followed by another two years when price falls. In other words, successive good harvest in two years is followed by successive two years of bad harvest. The weather condition is mainly responsible for the existence of this type of production and price cycles.

Price Forecasting: ARIMA result

Table 4 shows the autocorrelations (AC) and partial autocorrelations (PAC) of original, seasonal difference and seasonal and first difference retail price series of fine rice during 1972-1992. The ACs of original series decline slowly, this is an indication of nonstationarity. The peaks that occur at 12, 24, 36 lags indicate seasonal cycle in the series. The autocorrelation function of 12 months difference series has the sinusoidal shape without any apparent damping. After first difference, the autocorrelation function quickly fall off close to zero at the first lag (k=1). The sample autocorrelation function appears stationary. Box-piearce's diagnostic cheeks shows that difference series is not white noise i.e. the true autocorrelation coefficients are not all zero (Pindyck and Rubinfeld, 1991). The series is then differenced a second time and the resulting autocorrelation function do not seem quantitatively different than the previous case. Therefore, it is concluded that differencing once (after seasonal differencing) should be sufficient to ensure stationarity.

Table 4: Autocorrelation and Partial Autocorrelation of Retail Price of Fine Rice during 1972-1992.

Lag	Original data		After 12th difference		After 12th and Ist difference	
	ACF	PACF	ACF	PACF	ACF	PACF
1	0.976	0.976	0.872	0.872	-0.053	-0.053
2	0.949	-0.077	0.758	-0.010	0.024	0.021
3	0.923	0.016	0.635	-0.095	-0.113	-0.113
4	0.901	0.072	0.544	0.053	0.008	-0.004
5	0.885	0.091	0.451	-0.059	0.004	0.009
6	0.871	0.029	0.356	-0.078	0.051	0.040
7	0.852	-0.097	0.248	-0.111	0.149	0.156
8	0.834	0.036	0.103	-0.251	-0.040	-0.024
9	0.820	0.077	-0.031	-0.097	0.012	0.014
10	0.810	0.081	-0.169	-0.157	-0.148	-0.118
11	0.803	0.042	-0.269	-0.036	0.213	0.199
12	0.789	-0.180	-0.424	-0.384	-0.508	-0.539
13	0.768	-0.078	-0.450	0.392	-0.151	-0.267
14	0.748	0.042	-0.439	0.184	-0.024	-0.025
15	0.726	-0.058	-0.420	-0.044	0.057	-0.055
16	0.709	0.024	-0.416	-0.006	0.019	-0.036
17	0.695	0.045	-0.416	-0.022	-0.133	-0.162
18	0.686	0.098	-0.384	0.107	-0.097	-0.139
19	0.675	-0.002	-0.326	0.101	-0.099	0.122
20	0.669	0.083	-0.245	-0.167	0.026	0.055
21	0.666	0.072	-0.170	-0.099	0.009	0.027
22	0.666	0.029	-0.098	-0.074	0.131	-0.084
23	0.663	-0.038	-0.057	0.028	-0.102	0.144
24	0.656	-0.045	0.012	-0.196	-0.014	-0.219

Note: ACF indicates 'Autocorrelation Function' and PACF idicates 'Partial Autocorrelation Function'.

In case of mixed autoregressive and moving average, it is very difficult to determine the orders simply by observing the autocorrelation and partial autocorrelation function. The model can be identified by trial and error method. Nineteen models of different orders have been fitted according to the principles given by Box and Jenkins and finally, the following model of order (1,1,5,0,1,5) has been selected on the basis of diagnostic checking. It is mentioned that a Box-Cox transformation has been used before analysis and the estimated transformation parameter is 0.3736. The estimated model is shown below:

$$(1 - .5670L)\ \{(1 - L)\ (1 - L^{12})\ Z_t + .0019\} =$$
$$\underset{(2.03)}{}$$
$$(1 - \underset{(2.95)}{.5750L} - \underset{(0.24)}{.0189L^2} - \underset{(1.11)}{.0860L^3} + \underset{(-1.11)}{.0904L^4} + \underset{(-1.46)}{.1154L^5})$$
$$(1 - \underset{(14.16)}{1.0045L} + \underset{(-1.59)}{.1518L^2} - \underset{(0.03)}{.0030L^3} + \underset{(2.23)}{.2167L^4} - \underset{(2.49)}{.1927L^5})e_t$$

Chi – square (60, 11) = 63.94

where figures in the parentheses are 't' values.

The Chi-square statistics (with 49 degrees of freedom) is insignificant at 5% level, allowing us to accept the hypothesis that the residuals are white noise.

A 12 months ex ante forecast together with 90% confidence interval from January to December, 1993 and the actual series during the same period are shown in Table 5. The result shows that all the actual prices except in the month of April fall within the confidence interval of forecasted price. The prices seem to be over estimated because after 1986 the pattern of the price series has changed from upward trend to near zero. Even after 1992, the retail prices of rice show a downward trend.

Table 5: Forecast with 90% Confidence Interval and Actual Retail Price of Fine Rice Based on ARIMA Model for the Years 1972 to 1992.

Month (1993)	Forecasted Price (in tk/kg)	Lower Limit	Upper Limit	Actual Price (in tk/kg)
January	12.82	11.66	14.05	12.03
February	12.99	11.36	14.75	11.59
March	13.30	11.31	15.50	11.37
April	13.96	11.67	16.51	11.62`
May	13.54	11.08	16.33	11.99
June	13.22	10.53	16.29	12.13
July	13.54	10.55	17.02	11.79
August	13.46	10.23	17.28	11.74
September	13.61	10.11	17.79	11.68
October	13.62	9.88	18.13	12.56
November	12.76	8.98	17.41	11.69
December	11.66	7.92	16.35	11.50

Alternatively, an ARIMA model for the period 1987 to 1992 has been estimated. The ACF and PACF are shown in Table 6. Both ACs and PACs drop close to zero after two lags, which indicates that the series is stationary. No differencing is necessary. It is found that the trend in price is very negligible during 1987–1992; compound growth rate of price was only 0.15% per month during 1987–1992 compared with 0.88% and 3.57% during 1972–75 and 1975–1986 respectively. However, the 12th and Ist difference ACF and PACF are given in Table 6. Autocorrelation of one and two lags and partial autocorrelation of one lag are significant. Evidence exist that a model of autoregressive with order 1 and moving average

Table 6: Autocorrelation and Partial Autocorrelation of Retail Price of Fine Rice during 1987–1992.

Lag	Original data		After 12th difference		After 12th and Ist difference	
	ACF	PACF	ACF	PACF	ACF	PACF
1	0.646	0.646	0.636	0.636	-0.251	-0.251
2	0.296	-0.208	0.434	0.050	0.006	-0.060
3	0.069	-0.049	0.251	-0.072	-0.072	-0.079
4	-0.031	-0.004	0.145	-0.004	-0.009	-0.048
5	-0.017	0.064	0.041	-0.063	-0.147	-0.179
6	0.064	0.088	0.051	-0.092	-0.055	-0.165
7	0.058	-0.086	0.102	0.107	0.291	0.239
8	-0.045	-0.128	-0.061	-0.307	-0.052	0.070
9	-0.060	0.100	-0.232	-0.240	-0.073	-0.096
10	0.003	0.087	-0.316	-0.051	-0.206	-0.304
11	0.116	0.112	-0.304	0.051	0.231	0.133
12	0.096	-0.163	-0.438	-0.306	-0.393	-0.294
13	0.046	0.007	0.279	0.197	0.079	-0.122
14	-0.013	0.026	-0.169	0.023	0.121	-0.027
15	-0.100	-0.088	-0.137	-0.082	0.043	-0.031
16	-0.181	-0.149	-0.179	-0.052	-0.015	0.018
17	-0.166	-0.005	-0.164	-0.053	-0.080	-0.075
18	-0.098	0.066	-0.082	0.064	0.036	-0.190
19	-0.112	-0.095	-0.018	0.181	0.040	0.219
20	-0.099	-0.029	0.015	-0.237	0.034	0.122
21	0.039	0.223	0.059	-0.181	0.103	0.098
22	0.087	-0.048	-0.004	-0.127	0.055	-0.155
23	0.144	0.127	-0.076	0.064	-0.033	0.150
24	0.148	-0.077	-0.090	-0.149	-0.041	0.004

Note: ACF indicates 'Autocorrelation Function and PACF indicates 'Partial Autocorrelation Function'.

with order 2 may be specified. An ARIMA of order (1,0,2) has been estimated and the result is given below:

$$(1 - .500L)(Y_t - 13.07) = (1 + .325L + .113L^2)\, e_t$$

$$\begin{matrix}(2.08) & & (-1.26) & (-0.57)\end{matrix}$$

chi–square (24, 3) = 18.43

where figures in the parentheses are 't' values.

The Chi-square is not significant even at 90% level indicating that the residual series is white noise. A 12 months forecast with 90% confidence interval and the actual series are shown in Table 7. The forecasting power of this model seems to be improved compared to the previous one as all the actual series are within the confidence interval and are closer to the forecasted series. Even then the prices seem to be over estimated because in the year 1993, the prices of rice have decreased. Good harvest of paddy leads the rice price to decline in 1993.

Table 7 : Forecast with 90% Confidence Interval and Actual Retail Price of Fine Rice Based on ARIMA Model for the Years 1987 to 1992.

Month (1993)	Forecasted Price (in tk/kg)	Lower Limit	Upper Limit	Actual Price (in tk/kg)
January	12.62	11.42	13.83	12.03
February	12.83	11.27	14.40	11.59
March	12.95	11.27	14.64	11.37
April	13.01	11.30	14.73	11.62`
May	13.04	11.32	14.76	11.99
June	13.06	10.33	14.78	12.13
July	13.06	11.34	14.79	11.79
August	13.07	11.34	14.79	11.74
September	13.07	11.34	14.79	11.68
October	13.07	11.35	14.79	12.56
November	13.07	11.35	14.79	11.69
December	13.07	11.35	14.79	11.50

VI. CONCLUSIONS

Since 1972, the real price of rice has decreased and the rate of fall in real price of coarse rice was higher compared to fine rice. Technological improvement which reduces the cost of cultivation and various government actions such as import of rice and release them through different channels cause the real price to decline since independence. Consumers, particularly the poor consumers, who spend a lion's share of their budget in rice seem to be better off, especially in the 80's.

The study reveals that the seasonal price variation of fine rice is higher than that of coarse rice, mainly due to the continuous flow of coarse rice in the market from internal production and import. Increased production of Boro paddy has shifted the highest priced month from September to April and has reduced the seasonal price variation of rice considerably in the recent past.

Harmonic analysis shows that there exists a five year cycle in rice price in Mymensigh town market. This implies that successive higher production in two years is followed by successive two years with lower production. If this exists in future, buffer stock of rice developed in two years of good harvest can be used to curb the higher price in the following two years by releasing this stock in the market.

Forecasting based on ARIMA model yields poor result since the price structure of rice is changed during the study period. However, the forecasting power of the model improves considerably when the study period has been reduced. Since the development of econometric model is a difficult and tedious job, ARIMA model can be used to forecast short term rice price in Bangladesh.

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APPENDIX

Fig. 1 Monthly Retail Price Of Fine Rice in Mymensingh Town Market: 1972-92

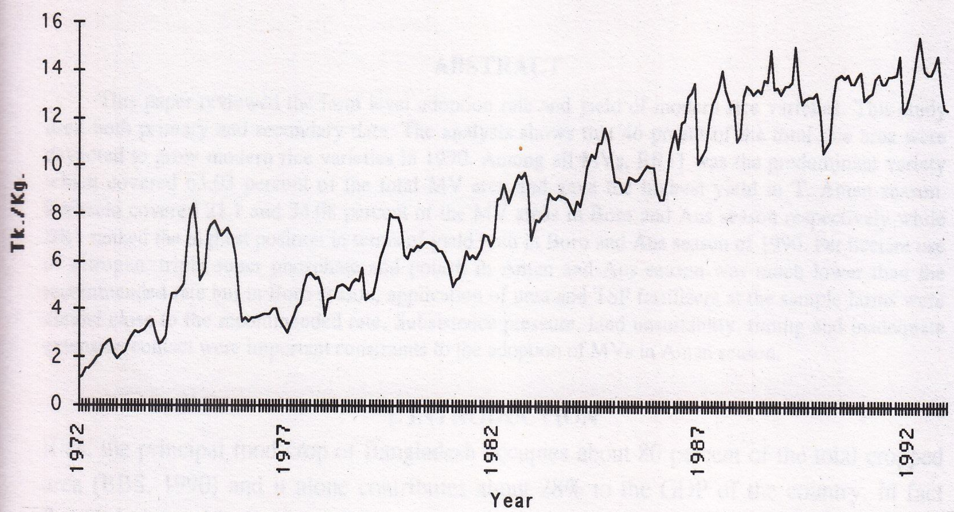

Fig. 2. Monthly Wholesale Price of Rice in Bangladesh: 1972-92