Market Integration and Seasonal Prices of Paddy: An Economic Analysis

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ABSTRACT

To frame an inclusive agricultural policy, analysis of price and market arrivals overtime is essential. Variations in market arrivals mainly leads to price instability. Such study is beneficial for farmers in demand to select the appropriate time to sell their farm produce to get best economic profits. On this sight the present study was undertaken to examine the seasonality and market integration of Paddy in Gadchiroli District of Maharashtra. The secondary data were collected for a period of 15 years from 2006 to 2020. Data were analysed using simple tabular analytical tools and functional analysis approaches. The data showed a highest seasonal indices of arrivals in the month of January and lowest in month of August in Chamorshi and Gadchiroli markets, respectively. In terms of paddy price, the highest and lowest seasonal indices of prices were seen in the months of July and March in Chamorshi market where as in the months of September and March in Gadchiroli market. Contradictory relationship between arrival and prices was witnessed in the designated markets. The degree of integration was found strong and positive of prices. Transparency in price signal among both markets resulted in strong integration. For better operations of well integrated markets, there should be provision of more investments and for the less integrated markets, need of adoption of online marketing system and awareness creation is needed to eliminate the malpractices in agricultural markets. These results recommend market integration and competition rather than collusions of markets in the study area.

HIGHLIGHTS

⊙ Arrivals were highest in the month of January and December.
⊙ Strong and positive degree of association of prices existed in the selected markets of the study area.

Keywords: Market integrations, Seasonal indices, APMC, price signals

Spatial market integration refers to co-movements of prices, and, more generally, to the smooth transmission of price signals and information across spatially separated markets (Goletti *et al.* 1995). The efficient functioning of markets provides profitable prices to the producers and fair prices to the consumers (Mahalle *et al.* 2015). Fluctuations in market arrivals largely contribute to the price instability of food grains in the state. In order to device appropriate ways and means for reducing the price fluctuations of food grains commodities, there is a need to have a thorough understanding of the price fluctuations over time (Meera and Sharma, 2017). So the present study has been undertaken to know seasonality and integration of selected Paddy markets of Gadchiroli district. As Rice is one of the chief grains of India. Country has the largest area under rice cultivation, as it is one of the principal food crops (FAO in India. 2022). India is the world's second-largest producer of paddy after

china. According to the FAO, the rice production in India was 177.6 million metric tonnes in 2019. In the year 2018-19 in India, the area under paddy cultivation was 43 million hectares and production was 170 million tons with productivity about 1.5-6.0 tonnes/ha. (NRRI bulletin report 2020). The state of Maharashtra was selected to study because it accounts area of 14.99 lakh hectares with an annual production of about 32.37 lakh tonnes and the productivity is 2.01 tonnes/ha, in 2018-19 (Thavre *et al.* 2010) In Maharashtra, main rice growing region are the Konkan region, Bhandara, Gondia, Chandrapur, Gadchiroli and some part of Nagpur district in Vidarbha. As Gadchiroli district, the main agricultural crop is paddy and has maximum area under cultivation of paddy. The area, production and productivity of kharif rice in Gadchiroli district in 2019-20 is 1833.350 ha. 3157.514 tonnes and 1722.265 kg/ha, respectively.

MATERIALS AND METHODS

The nature of data used for the study is entirely based on secondary source of data. The times series data regarding market arrivals and prices were collected from 2005-2006 to 2019-2020, which includes 15 years of data. The data for arrivals and prices were compiled from two Agricultural Produce Market Committee (APMC) viz., one major APMC that is Chamorshi and the other from Gadchiroli. Data was analysed by using simple tabular analytical tools such as mean, frequencies, ratios, percentages, etc. Apart from this, functional analysis tools such as the seasonal indices and bivariate correlation coefficient were used for computation to derive a valuable conclusion from the study.

Peak and slack period in arrivals and prices

To determine the peak and slack period, monthly seasonal indices were worked out by using simple average method.

$$\text{Seasonal Indices} = \frac{Xi}{\bar{x}} \times 100$$

Where,

Xi = monthly average for 10 years

$\bar{x}$ = mean of 15 months, average

Standard deviation

Standard deviation was estimated by squaring the deviation of each observation from the mean, adding the squares and dividing it by the total number of observations (*n*) and extracting the square root.

$$SD = \sqrt{\frac{\sum_{I=1}^{n}\left(X_i - \bar{X}_i\right)^2}{n}}$$

Where,

X_i = arrivals/ prices

$\bar{X}$ = Mean of arrivals/ prices

N = number of years/ months

Coefficient of Variation

The coefficient of variation is the "Percentage variation in the mean as the standard deviation being stated as the total variation in the mean". The coefficient of variation of each market was worked out by comparing the variability present in market arrivals and prices.

$$C.V. = \frac{SD}{Mean} \times 100$$

Where,

SD = Standard deviation

Mean = Arithmetic mean

C.V. = Coefficient of Variation

Market Integration

Market integration was worked out by estimating bivariate correlation coefficient (*r*) between price changes in the selected market (Acharya & Agarwal, 1994).

$$r = \frac{\Sigma\left(P_{11} - P_1\right)\left(P_{21} - P_2\right)}{\sqrt{\left(\Sigma\left(P_{11} - P_1\right)^2\left(P_{21} - P_2\right)^2\right)}}$$

Where,

r = Simple correlation coefficient

P_{11} =Price of the commodity in first market

P_{21} = Price of the commodity in second market

P_1 = Mean of prices in first market

P_2 = Mean of the prices in second market

RESULTS AND DISCUSSION

The main purpose of the objective was to calculate the peak and slack periods and the relationship between price of paddy in Chamorshi and Gadchiroli markets for a period of 15 years from 2006 to 2020.

Market-wise monthly average, standard deviation and coefficient of variation of Arrivals of Paddy

Monthly average, standard deviation and coefficient of variation (CV) for arrivals and prices of Paddy in Chamorshi and Gadchiroli APMC were estimated to study the seasonal indices. The results obtained are discussed under the following section.

Market-wise monthly Mean, SD and CV of arrivals of Paddy

For the selected markets, the mean arrivals, standard deviation, and coefficient of variation of arrivals of Paddy were calculated and the results of the findings are presented in Table 1.

The results in table 1 shows that during the study period, in Chamorshi market, average arrivals were the highest in the month of January with arrival of 9568.27 quintals and the lowest average arrivals were in the month of August (2552.02 quintals). Gadchiroli market witnessed the maximum average arrivals in the month of January registering arrivals of 3420.13 quintals whereas the lowest arrivals were observed in the month of October with 1023.40 quintals.

In chamorshi market, the standard deviation were the highest in the month of January (5854.10) and the lowest standard deviation was observed in the month of August (1766.42). The standard deviation of Gadchiroli market was the highest in the month of February (3113.90) whereas the lowest standard deviation was found in the month of October (362.70). During the study period, Chamorshi market witnessed the highest coefficient of variation (82.53 per cent) in the month of June and the lowest coefficient of variation was found in the month of December (50.68 per cent). Gadchiroli market witnessed the maximum coefficient of variation in the month of March (112.84 per cent) was found to be the lowest in the month of October (35.44 per cent).

Market-wise monthly Mean, SD and CV of prices of Paddy

Similarly, the price per quintal of Paddy in the selected market was compiled and the mean, standard deviation, and coefficient of variation were computed and the results of the findings are shown in Table 2. The Chamorshi market witnessed the maximum average price per quintal in the month of July i.e. ₹ 2045.95/quintal whereas the minimum average price per quintal in the month of March i.e. ₹ 1545.15/quintal. The Gadchiroli market showed the highest average price per quintal in the month of September i.e. ₹ 1788.05 per quintal and the lowest average price per quintal in the month of March i.e. ₹ 1463.08 per quintal.

Table 1: Market-wise monthly Average, SD and CV of Arrivals of Paddy (2005-06 to 2019-20)

Month	Chamorshi			Gadchiroli		
	Average (qtls)	SD	CV (%)	Average (qtls)	SD	CV (%)
January	9568.27	5854.10	61.18	3420.13	2642.23	77.26
February	8237.60	5255.1	63.80	2821.80	3113.90	110.35
March	5122.33	3448.88	67.33	1732	1954.39	112.84
April	3402.43	1938.66	56.98	1199.67	1009.12	84.12
May	5579.24	3837.32	68.788	1565.20	1508.21	96.36
June	5218.74	4306.96	82.53	1489.80	1528.93	102.63
July	3334.31	2314.66	69.42	1106.43	846.93	76.55
August	2552.02	1766.42	69.22	909.33	423.13	46.53
September	3792.33	2400.32	63.29	1813.33	1993.81	109.95
October	4887.48	2889.52	59.12	1023.40	362.70	35.44
November	5786.47	3488.75	60.29	1381.10	678.41	49.12
December	9169.91	4647.54	50.68	2527.10	2066.94	81.79

Note: Simple average was used to find out monthly average arrivals.

Table 2: Market-wise monthly Average, SD and CV of Prices of Paddy (2005-06 to 2019-20)

Month	Chamorshi			Gadchiroli		
	Average (₹/qtl)	SD	CV (%)	Average (₹/qtl)	SD	CV (%)
January	1827.43	716.04	39.18	1543.58	559.40	36.24
February	1767.77	622.41	35.21	1571.20	545.16	34.70
March	1545.15	536.95	34.75	1463.08	586.44	40.08
April	1650.16	512.38	31.05	1612.28	541.67	33.60
May	1721.06	558.72	32.46	1668.41	579.44	34.73
June	1982.91	525.20	26.4	1677.13	559.24	33.35
July	2045.95	552.71	27.01	1646.59	499.79	30.35
August	2000.82	511.64	25.57	1690.40	508.58	30.09
September	1930.42	505.56	26.19	1788.05	558.17	31.22
October	1926.54	548.13	28.45	1753.84	566.54	32.30
November	1862.29	553.25	29.79	1681.78	535.27	31.83
December	1734.08	746.11	43.04	1662.58	559.56	33.66

Note: Simple average was used to find out monthly average prices.

The highest and the lowest coefficient of variation were registered in the month of December (43.04 per cent) and August (25.57 per cent) respectively. The highest coefficient of variation of paddy price was observed in the month of March (40.08 per cent) whereas lowest coefficient of variation of paddy price was found in the month of August (30.09 per cent). The results of standard deviation showed that the highest standard deviation was recorded in the month of December (746.11) while the lowest standard deviation in the month of September (505.56). The Standard deviation was observed to be at its maximum in the month of March (586.44) and at its minimum in the month of July (499.79). Similar finding were reported by Asmatoddin *et al.* (2009).

Seasonal Indices of Arrivals and Prices of Paddy

The seasonal indices evaluate the monthly percentages of arrivals and prices in the market. Seasonal indices of Paddy in Chamorshi and Gadchiroli market was worked out by using simple average method for the period 2005-06 to 2020-21 and the results obtained are presented in given sections.

Seasonal indices of arrivals of Paddy

The seasonal indices of arrivals of paddy in Chamorshi and Gadchiroli were computed and the results are presented in Table 3.

It is observed from table 3 that the monthly indices of arrivals were highest in the month of July and August. In Chamorshi market, the highest monthly indices were recorded in the month of January (172.27 per cent) followed by December (165.10 per cent). The lowest seasonal indices of arrivals were observed in the month of August (45.95 per cent) followed by July (60.03 per cent).

In Gadchiroli market, the highest seasonal indices of arrivals were in the month of January (195.54 per cent) followed by February (161.33 per cent) and the lowest seasonal indices were observed in the month of August (51.99 per cent) followed by October (58.51 per cent). The results conclude that in Gadchiroli district, Paddy arrivals are at its peak in the month of July and August. The results are in close agreement with the findings of Pawar and Misal (2004).

Table 3: Market-wise monthly seasonal indices of arrivals of Paddy (2005-06 to 2019-20)

Month	Chamorshi	Gadchiroli
January	172.27	195.54
February	148.31	161.33
March	92.22	99.02
April	61.26	68.59
May	100.45	89.49
June	93.96	85.17
July	60.03	63.26
August	45.95	51.99
September	68.28	103.67
October	88.00	58.51
November	104.18	78.96
December	165.10	144.48
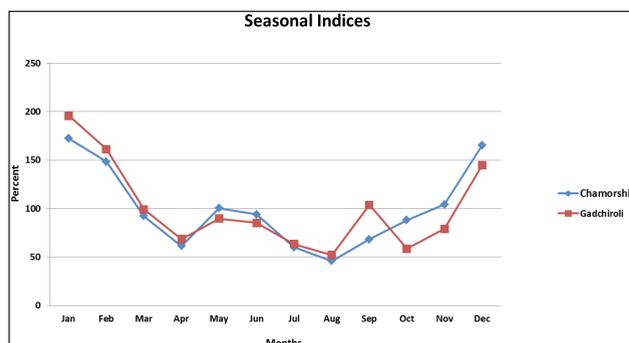
Fig. 1: Graphical representation of Seasonal indices of arrivals of Paddy in Chamorshi and Gadchiroli market
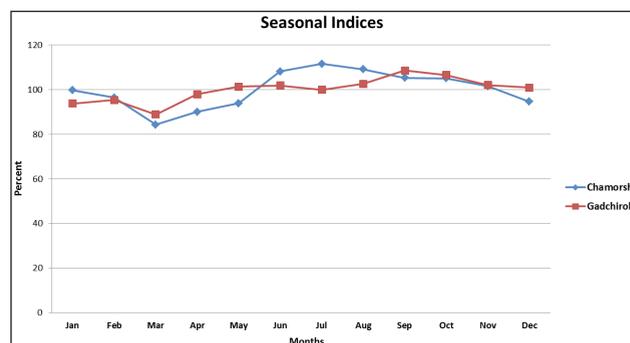
Fig. 2: Graphical representation of Seasonal indices of prices of Paddy in Chamorshi and Gadchiroli market

Seasonal indices of prices of Paddy

The results of the calculation of monthly seasonal indices of prices of paddy are presented in Table 4. The results in table 4 revealed that in Chamorshi market, peak period of prices of the Paddy were from the month of April to July. The highest Seasonal indices of prices were observed in the month of July (111.62 per cent) followed by August (109.16 per cent) whereas the lowest seasonal indices of prices were registered in the month of March (84.30 per cent) and April (90.03 per cent).

In Gadchiroli market, peak period for prices of the Paddy were from the month of May to September. The seasonal indices of prices were registered to be highest in the month of September (108.59 per cent) followed by October (106.51 per cent) and the lowest seasonal indices were observed in the month of March (88.86 per cent) followed by January (93.74 per cent). Similar findings were observed in the study conducted by Kanade *et al.* (2016) and Shelke and Kalyankar (2000).

Table 4: Market-wise monthly seasonal indices of prices of Paddy (2005-06 to 2019-20)

Market	Chamorshi	Gadchiroli
January	99.70	93.74
February	96.45	95.42
March	84.30	88.86
April	90.03	97.92
May	93.90	101.33
June	108.19	101.86
July	111.62	100.00
August	109.16	102.66
September	105.32	108.59
October	105.11	106.51
November	101.60	102.14
December	94.61	100.97

Market Integration

The level of integration of agricultural markets is a critical determinant of agricultural price policy (Wilson 2003 and Jha *et al.* 2008). So for studying market integration descriptive statistics expresses the basic elements and features of the data under study. It provides concise summary about the variables taken into consideration and the observation that have been recorded. It also serves as the basis of virtual analysis of quantitative data when used with simple graphical analysis.

Table 5: Descriptive Statistics of Prices data of Paddy markets

Markets	N	Average (₹/qtl)	SD	CV (%)
Chamorshi	180	1832.88	580.02	31.65
Gadchiroli	180	1646.58	540.14	32.80

Table 5 presents the descriptive statistics of monthly price of the Paddy in Chamorshi and the Gadchiroli APMC for fifteen years. The results obtained that the maximum average price per quintal was registered in Chamorshi market with ₹ 1832.88 per quintal and Gadchiroli recorded average price of ₹ 1646.58 per quintal during the study period. Coefficient of variation of paddy in the Chamorshi and Gadchiroli market over the study period was found to be 31.65 per cent and 32.80 per cent respectively. Standard deviation in Chamorshi market was 580.02 and Gadchiroli market was 540.14. In line with Bansal *et al.* (2022).

Pearson correlation analysis

Pearson Correlation of paddy prices between Chamorshi and Gadchiroli markets was worked

out and the results obtained are presented in Table 6. The results revealed that a strong and positive degree of association of prices of Paddy was found between Chamorshi and Gadchiroli market i.e. about 0.863. This was found to be statistically significant at one per cent level of significance. Transparency in price signal among Chamorshi and Gadchiroli markets resulted in strong integration. The results are in close association with the findings of Reddy (2012) Ddungu *et al.* (2015) and Mahalle *et al.* (2015).

Table 6: Estimation of Correlation Coefficient for prices of Paddy between Chamorshi and Gadchiroli markets in Maharashtra

Markets		Chamorshi	Gadchiroli
Chamorshi	Sig. (2-tailed)	0.0001	0.0001
	N	180	180
	Pearson Correlation	1	0.863
Gadchiroli	Sig. (2-tailed)	0.0001	0.0001
	N	180	180
	Pearson Correlation	0.863	1

Correlation is significant at 0.01 level (2-tailed).

CONCLUSION

The analysis and the results of the present study concluded that in Chamorshi market, the highest mean arrivals of paddy were in the month of January and lowest arrivals were in the month of August. While in Gadchiroli market, the highest mean arrivals of paddy were in the month of January and lowest arrivals were in the month of October. The highest and lowest mean prices of paddy in Chamorshi market was recorded in the month of July and March, respectively. Gadchiroli market showed highest mean price per quintal in the month of September and lowest mean price per quintal in the month of March. Clarity in price indicators between these markets resulted in strong market integration. The study presented the significance of product based analysis meanwhile it guides the agricultural policy makers to focus on market intelligence and market infrastructures in agriculture.

REFERENCES

Acharya, S.S. and Agarwal, N.L. 1994. Agricultural Price Policy. Oxford and IBH Publishing Co. New Delhi.

Asmatoddin, M., Satpute, T.G. and Maske, V.S. 2009. Arrival and price behavior of important oilseeds crops in Parbhani district, *Int. J. Agril. Sci.*, **5**(2): 349-350.

Bansal, R.K. and Shaikh, A.S. 2022. An econometric investigation on paddy market integration in India. *Ind. J. Agril. Market.*, **36**: 166-167.

Chandra, R., Dhinesh, B.K., Jadhav, V.T. and Teixeira da Silva, Jaime. 2010. A Origin, history and domestication of Paddy. Fruit, *Vegetable and Cereal Sci. and Biotechno.*, **4**((2): 1-6.

Ddungu, S.P., Ekere, W., Bisikwa, J., Kawooya, R., Okello, D. and Kalule, N. 2015. Market and Market Integration of Cowpea in Uganda. *J. Dev. and Agricl. Econ.*, **7**(1): 1-11.

FAO. 2020. World Food and Agriculture - Statistical Yearbook 2020. Rome. https://doi.org/10.4060/cb1329en

FAO in India. 2022. FAO. https://www.fao.org/india/fao-in-india/india-at-a-glance/en/

Goletti, F., Ahmed, R. and Farid, N. 1995. Structural Determinants of Market Integration: The Case of Rice Markets in Bangladesh. *Dev. Econ.*, **33**: 196-198.

Jha, R., Bhanu Murthy, K.V. and Sharma, A. 2008. Market integration in wholesale rice markets in India. Retrieved from https://www.researchgate.net/publication/200089784_Market_Integration_in_Wholesale_Rice_Markets_in_India

Kanade, A.U., Deshmukh, K.V., Pachpute, S.S. and Shelke, R.D. 2016. Trends in Arrivals and Prices of Wheat in Parbhani District of Maharashtra State. *Multilogic in Sci.*, **6**(27): 85-91.

Kharat, P.B., Chavan, R.V., Deshmukh, K.V. and Wagh, S.S. 2019. Economics of Marketing of Paddy in Solapur District of Maharashtra. *Int. J. Recent Scientific Res.*, **10**(9): 34636-34639.

Mahalle, S.L., Shastri, S. and Kumar, S. 2015. Integration of Wheat Markets in Maharashtra. *Agril. Econ. Res. Rev.*, **28**: 179-187.

Meera and Sharma, Hemant. 2017. "Seasonality and Exponential Smoothing Models for Price Forecasting of Rice in Selected Market of Uttar Pradesh. *Agril. Situa. in India*, **LXXIII**(11): 18-22.

Pal, R.K., Dhinesh, B.K., Singh, N.V., Maity, A. and Gaikwad, N. 2014. Paddy Research in India-Status and Future Challenges. *Progres. Horti.*, **46**(2): 184-201.

Pathak, H., Tripathi, R., Jambhulkar, N.N., Bisen, J.P. and Panda, B.B. 2020. Eco-regional Rice Farming for Enhancing Productivity, Profitability and Sustainability. NRRI Research Bulletin No. 22, ICAR-National Rice Research Institute, Cuttack 753006, Odisha, India, pp. 28.

Pawar, N.D. and Misal, D.H. 2004. Behaviour of prices andarrivals of pomegranate in western Maharashtra. *Agril. Market.*, **47**(4): 22-24.

Reddy, A. 2012. Market integration of grain legumes in India, The case of the Chickpea market. *SAARC J. Agric.*, **10**(2): 11-29.

Shelke, R.C. and Kalyankar, S.P. 2000. Prices spreads in marketing of selected vegetables in new Mondhe Market, Parbhani, *Ind. J. Agril. Market.*, **14**(1): 54-59.

Thaware, B.L., Kunkerkar, R.L. and Shivade, H.A. 2010. Status Paper on Rice in Maharashtra. Rice in Maharashtra, Rice Knowledge Management Portal (RKMP) Directorate of Rice Research, Rajendranagar, Hyderabad 500030 http://www.riceportal.in/sites/default/files/ris/rice-state-wise/Status%20Paper%20on%20Rice%20in%20Maharashtra.pdf. Last Accessed on 2nd January, 2022.

Wilson, E. 2003. 'Testing Market Integration in Indian Agriculture'. *In:* R. Jha (ed.) Indian Economic Reforms, Basingstoke, UK: Palgrave Macmillan, pp. 295–316.