Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8538

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2021) *9*(1), 311-315

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Market Integration And Price Volatility Of Maize In Maharashtra

A.S. Tingre[1*] and A.A. Bhopale[2]

[1]Associate Professor, [2]Assistant Professor,

Department of Agricultural Economics & Statistics,

Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra) – 444104

*Corresponding Author E-mail: anandtingre@gmail.com

Received: 15.12.2020 | Revised: 17.01.2021 | Accepted: 22.01.2021

ABSTRACT

The present study aimed to study price movement of Maize i.e. seasonal and cyclical variations, price volatility and co-integration among the selected Maize markets of Maharashtra. For study purpose the data related to monthly average prices of Maize were collected for major APMC markets of Maharashtra viz. Nashik, Sangli, Jalna and Dhule for the period 2004-2015. The econometric tools like ADF test, Johansen's Multiple Co-integration test, Granger Causality Test and ARCH-GARCH model were used to study price volatility and co-integration among different markets. The results of study showed that the prices of Maize were higher from the month of June to September except Sangli market in which prices were higher from June to October. The cyclical variations observed in the prices of Maize in the selected markets.The higher prices were recorded during the year 2004, 2012 and 2013 in all selected markets. Maize prices series of all selected markets were stationary at level. The selected markets showed long run equilibrium relationship and co-integration between them. Most of the markets showed bidirectional Causality and influences the prices of each other. The volatility shocks in Maize prices are persistent in selected markets.

Keywords: *ADF test, ARCH- GARCH, Co-integration, Granger Causality Test, Price volatility.*

INTRODUCTION

USA, Argentina and Brazil are the top three Maize producing countries in the world. They are also major exporters. The prominent importing countries include Japan, European Union, Malaysia, Taiwan, Korea, etc. India ranks top 10 producers and exports to Bangladesh, Nepal, Sri Lanka, Middle East Asian countries. Maize is an important staple food in many countries and its acreage is on the increase continuously at global level. In India, Maize is emerging as third most important crop after rice and wheat .India produces around 15 million tonnes of Maize annually. This contributes to two per cent of the total world production. Maize is grown throughout the year in India. It is predominantly a kharif crop with 85 per cent of the area under cultivation in the season. It accounts for 9 per cent of total food grain production in the country.

Cite this article: Tingre, A. S., & Bhopale, A. A. (2021). Market Integration and Price Volatility of Maize in Maharashtra, *Ind. J. Pure App. Biosci. 9*(1), 311-315. doi: http://dx.doi.org/10.18782/2582-2845.8538

Maharashtra is one of the emerging Maize growing states in India, accounting for about 9 per cent of the total Maize area and equally contributing to the total Maize production in the country. Maize is grown in all the districts of the state in varying degrees. The major growing districts are Ahmednagar, Aurangabad, Buldhana, Dhule, Jalana, Nandurbar, and Nashik. The crop yield in these district has increased consistently during the past 10 years.

The major factors influencing on prices of Maize are the arrivals in market, climatic conditions during the various growth stages, carry forward stocks, price movement over the period of time, crop condition throughout the country, export and import, global and domestic demand and supply, etc. Seasonal variations observed in prices of Maize.The markets of Maize in Maharashtra are co-integrated and they influences on prices of each other. For better marketing of any agricultural commodity the information regarding seasonality, seasonal variations, price volatility, price movement across the state and country, etc. is necessary. Analysing the past trend in the price of commodities is also useful in understanding the present scenario and to formulate appropriate strategies to improve the marketing system. The present study has undertaken with following specific objectives:

Objectives

1) To study the seasonal and cyclical variations in prices of Maize.

2) To assess the price volatility and co-integration among the selected Maize markets in Maharashtra.

MATERIALS AND METHODS

For the present study the major markets of Maize in Maharashtra namely Nashik, Sangli, Jalna and Dhule were selected. The time series data on monthly average prices of maize for the period from 2004 to 2015 were collected from AGMARKNET website for respective markets and used for present study.

Tools of Analysis

Estimation of seasonal indices

To measure the seasonal variations in prices, seasonal indices were calculated by employing twelve months ratio to moving average method.

Estimation of cyclical indices

The residual method of estimating cyclical movement in time series was used for estimating cyclical indices, after eliminating the seasonal variations and trend components.

Testing of Stationarity in Price Series of Maize

Before analysing any time series data testing for stationarity is pre-requisite. The stationarity of time series data on maize prices was tested by applying the Augmented Dickey-Fuller test (ADF). The (ADF) test is the test for the unit root in a time series sample. A stationary series is one whose parameters are independent of time, exhibiting constant mean and variance and having autocorrelations that are invariant through time.

Market Co-integration

Johansen's Multiple Co-integration test was employed to determine the long run relationship between the price series of selected markets. The test shows whether the selected Maize markets are integrated or not. Johansen (1988) has developed a multivariate system of equations approach, which allows for simultaneous adjustment of both or even more than two variables. The multivariate system of equations approach is more efficient than single equation approach since it allows to estimating the co-integration vector with smaller variance.

Causality of price signals between selected markets

In order to know the direction of causation between the markets, Granger Causality test was employed. It is named after the first causality tests performed by Clive Granger (1969). It analyzes the extent to which the past variations of one variable explain (or precede) subsequent variations of the other. When a co-integration relationship is present for two variables, a Granger Causality Test can be

used to analyze the direction of this co-movement relationship. Granger causality test come in pairs, testing weather variable x_t Granger-causes variable y_t and vice versa. All permutations are possible.

Presence of Price Volatility

To access the presence of price volatility the ARCH-GARCH analysis was carried out. Auto Regressive Conditional Heteroscedasticity (ARCH) models are specifically designed to forecast conditional variances. ARCH model introduced by Engel (1982) and generalized as GARCH by Bollersllev (1986).

RESULTS AND DISCUSSION

Seasonal indices for Maize prices

The seasonal indices of monthly average prices of Maize for selected markets were worked out to study seasonal variations, which are presented in Table 1.

From Table 1 it is observed that in selected markets the prices were higher from June to September except sangli market in which prices were higher from June to October. The higher prices attributed to less arrivals of Maize in the markets. All the markets recorded lower prices in the months from October to May.

Table 1: Seasonal index for Maize prices in selected markets of Maharashtra

Month	Dhule	Jalna	Nashik	Sangli
Jan	97.08	99.75	93.37	88.35
Feb	97.53	98.30	93.59	94.12
Mar	97.55	78.92	96.09	94.25
Apr	94.64	96.33	98.67	97.24
May	94.00	95.63	98.59	98.40
Jun	**100.22**	**103.81**	**103.11**	**101.85**
Jul	**110.96**	**110.05**	**109.03**	**109.26**
Aug	**111.91**	**109.73**	**112.52**	**110.32**
Sep	**115.25**	**113.10**	**106.62**	**110.14**
Oct	95.92	98.34	99.47	**101.86**
Nov	90.11	98.02	96.18	97.83
Dec	94.79	98.03	92.76	96.37

Cyclical indices for Maize prices

The cyclical indices for Maize prices are presented in Table 2. From Table 2 it is observed that the cyclical variations were observed in the prices of Maize in the selected markets. The higher prices were recorded during the years 2004, 2012 and 2013 in all markets.

Table 2: Cyclical index for Maize prices in selected markets of Maharashtra

Year	Dhule	Jalna	Nashik	Sangli
2004	**110.12**	**108.04**	**114.89**	**114.97**
2005	98.56	**100.29**	98.70	96.59
2006	93.82	**105.79**	96.92	96.81
2007	94.38	**102.80**	96.64	94.33
2008	98.84	97.17	97.55	97.35
2009	94.49	94.07	92.76	90.01
2010	93.34	92.07	91.35	92.32
2011	**100.44**	95.20	98.13	**101.04**
2012	**106.16**	**100.05**	**103.86**	**107.05**
2013	**109.86**	**104.54**	**109.20**	**109.53**
2014	**103.58**	**105.17**	98.27	95.36
2015	87.87	99.56	96.50	94.74

Testing of stationarity in price series

The Augmented Dickey Fuller (ADF) test based on unit root test procedure was carried out to check whether Maize prices are stationary in the selected markets and the results are presented in Table 3.

Table 3: ADF test results of Maize prices in selected markets of Maharashtra

Market	Level (ADF)	Critical value (1%)
Dhule	-5.880	**-4.023**
Jalna	-6.699	
Nashik	-11.797	
Sangli	-5.465	

From Table 3, it is observed that at level with lag 1, the ADF values are lesser than the critical value at 1% level of significance indicating the nonexistence of unit root implied that the price series in all markets are stationary. This implied that the Maize prices series of all selected markets are stationary at level.

Presence of price volatility

To assess the presence of price fluctuations in the prices of Maize, ARCH-GARCH analysis was carried out and the results are presented in Table 4.

Table 4: Results of ARCH-GARCH analysis for Maize prices in selected markets of Maharashtra

Parameter	Dhule	Jalna	Nashik	Sangli
Alpha (α)	0.877	0.680	2.085	0.769
Beta (β)	0.129	0.330	-0.008	0.235
Sum of α & β	**1.006**	**1.010**	**2.077**	**1.004**

The sum of Alpha and Beta ($\alpha+\beta$), indicated ARCH and GARCH effect for the given market. It was observed that among the markets, the sum of Alpha and Beta is nearer to 1 i.e. 1.006, 1.010, 2.077 and 1.004 for Dhule, Jalna, Nashik and Sangli markets, respectively, indicated that the volatility shocks in the prices of Maize are persistent in these markets.

Market Co-integration

Johansen's Multiple Co-integration test is employed to determine the long run relationship between the price series of Maize. The test shows whether the selected Maize markets are integrated or not. The results of the test were presented in Table 5.

Table5. Results of multiple co-integration analysis for Maize prices in selected markets of Maharashtra

Hypothesized No. of CE(s)	Eigen Value	Trace Statistic	Critical Value (5%)	Prob.**	No. of Co-integrating Equation CE(s)
None *	0.501	171.432	63.876	0	**4**
At most 1 *	0.248	73.951	42.915	0	
At most 2 *	0.134	33.950	25.872	0.004	
At most 3 *	0.093	13.805	12.517	0.0303	

Note- Trace test indicates 4 co-integrating equations significant at the 0.05 level.

Presence of at least one co-integration equation at 5 per cent level of significance confirms that there exists long run equilibrium relation in the markets. The results of Co-integration test showed four co-integration equations were significant at 5% level of significance. It indicated that the selected Maize markets having long run equilibrium relationship and there existed co-integration between them.

Causality of price signals between selected markets

Granger Causality Test is a statistical tool which used F-test to know the cause and effect relationship between the two time series and this technique is employed to know the relationship between the prices of selected Maize markets. When a co-integration relationship is present for two price series, a Granger Causality Test (Granger, 1969) is used to analyse the direction of this co-movement relationship. The results of the test showing the relationship between selected Maize markets were presented in Table 6.

Table 6: Results of pair wise Granger causality test for Maize prices in selected markets of Maharashtra

Null Hypothesis	Observations	F-Statistic	Probability
JALNA does not Granger Cause DHULE	142	2.266	0.107
DHULE does not Granger Cause JALNA		**6.450***	0.002
NASHIK does not Granger Cause DHULE	142	**6.380***	0.002
DHULE does not Granger Cause NASHIK		**11.289***	3.00E-05
SANGLI does not Granger Cause DHULE	142	**4.829***	0.009
DHULE does not Granger Cause SANGLI		2.804	0.064
NASHIK does not Granger Cause JALNA	142	**8.249***	0.0004
JALNA does not Granger Cause NASHIK		**10.952***	4.00E-05
SANGLI does not Granger Cause JALNA	142	**6.162***	0.002
JALNA does not Granger Cause SANGLI		**3.597***	0.03
SANGLI does not Granger Cause NASHIK	142	**10.27***	7.00E-05
NASHIK does not Granger Cause SANGLI		**4.468***	0.013

From Table 6 It is observed that there was bidirectional causality in Maize prices between Nashik and Dhule, Nashik and Jalna, Sangli and Jalna and Sangli and Nashik. The prices of Dhule market exhibited unidirectional causality and affects prices of Jalna market. The prices of Sangli market exhibited unidirectional causality and affects prices of Dhule market. So the influence of Nashik and Sangli markets prices plays a significant role over the other selected markets. Thus a strong market integration of the selected markets are established through the results of the analysis.

REFERENCES

Bollerslev, T. (1986). Generalized Autoregressive Conditional Heteroscedasticity. Journal of Econometrics *31*, 307–27.

Engle, R. F., & Granger, C. W. J. (1987). "Cointegration and Error Correction: Representation, Estimation and Testing," *Econometrica*, *55*(2), 251-276.

Madhusudan, G. (2011). Agricultural policy reforms and spatial integration of food grain markets in India. *Jour. of Econ. Development 36*(2), 15-36.

Granger C. J. (1969). Investigating Causal Relationships by Econometrics Models and Cross Spectral Methods, *Econometrica*, *37*, pp. 425-435.

Johansen, S. (1988). "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control*, *12*, 231-254.

Mukim, M., Singh, K., Kanakaraj, A. (2009). Market Integration, Transaction Costs and the Indian Wheat Market: ASystematic Study. *Economic & Political Weekly XLIV* (22), 149-155.

Sekhar, C. S. C. (2003). Volatility of agricultural prices – an analysis of major international and domestic markets. Working Paper No. 103 (Indian Council For Research On International Economic Relations).