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Research Article

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# Pattern of market arrivals and prices of soybean in Akola District of Maharashtra, India

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**ABSTRACT**
In this study, an attempt has been made to study the pattern of market arrivals and prices of Soybean in the Akola district of Maharashtra. The present study was based on the time series data of monthly prices and the arrival of Soybean collected from major APMC'S of Akola district for the period of 10 years i.e. from 2011 to 2020. The study was carried out by employing econometric tools like ADF test, Johansen's Multiple Co-integration test, ARCH-GARCH model and Granger Causality test used to study price volatility and co-integration among selected markets. The study reveals that there is an inverse relationship between prices and the arrival of Soybean in the selected market of Akola district. The selected markets for Soybean have long-run equilibrium relationship for the prices of Soybean and there exist co-integration among them. The volatility shocks in the prices of Soybean is quite persistent in the selected markets.
**Keywords:** Seasonal variation, cyclical variation, ADF test, ARCH-GARCH, Co-integration, price volatility.

## INTRODUCTION

Agricultural Produce Market Committee (APMC) is the marketing board established by the state governments to eliminate the exploitation incidences of farmers by intermediaries, where they are forced to sell their produce at extremely low prices. The market information relating to market prices and arrivals over a period of time helps the farmers to decide on the future production pattern and sale of agricultural commodities in the market during a specific period. The price prevailing in the market is called the market price, which changes with the nature of the commodity.

The price fluctuation in agricultural commodities is a common phenomenon due to their seasonal nature of production, wide ecological imbalances compared to other crops and seasonal demand for agricultural commodities. Variability in the supply of many agricultural products subsequently leads to larger variation in market arrivals which shows much of the price fluctuation. Fluctuations in market arrivals largely contribute to price instability and price fluctuations of agricultural commodities, there is a need to have an understanding of the price behaviour over time.

Market integration is a powerful tool, which alters the decision of the producers and also the consumers. This kind of study helps the farming community to know the remunerative prices for their harvest and also widens the market for their produce. The price of agricultural products does not only decrease but also increasing the number of market arrivals therefore there is a need to have a perfect understanding of the behaviour of prices of different agricultural products and the responsiveness of market arrivals to price movements over a period of time. Therefore, the present study has been undertaken to study the seasonal and cyclical variations in prices and arrivals of the Soybean crop, stationarity and volatility in prices of the Soybean crop & co-integration and causality of price signals among selected markets of the Akola district.

## MATERIALS AND METHODS

For the present study the time series data on monthly average prices and arrivals of Soybean crops for period from 2011 to 2020 were collected from the record of APMC'S markets namely Akola, Akot, Murtizapur and Balapur as the arrivals Soybean crop in this market were highest. The most widely used method of measuring seasonal fluctuations i.e method of moving average was used to calculate seasonal indices. The residual method of estimating cyclical movement in time series was used for estimating cyclical indices, after eliminating the seasonal variation and trend components. Before analyzing any time series data testing for stationarity is a pre-requisite. The stationarity of time series data of selected market prices of Soybean crops is tested by applying the Augmented Dickey-Fuller test (ADF). Johansen's Multiple Co-integration test is employed to determine the long rum relationship between the prices of selected markets of Soybean crops. In order to know the presence of price volatility the ARCH-GARCH analysis was carried out. 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 Soybean crop markets.

## RESULTS AND DISCUSSION

### Seasonal and Cyclical variation in prices and arrivals of Soybean crop

Seasonal indices for Soybean crop prices and arrivals

In order to analyze the long-run seasonal variation in prices and arrivals of soybean in the selected markets, seasonal indices for prices and arrivals were computed by adopting 12 months moving average method.

The seasonal indices of monthly prices and arrivals of Soybean in the selected markets are presented in table 1. The seasonal indices of monthly average prices of Soybean in Akola, Akot, Murtizapur and Balapur markets were worked out to study seasonal variations, which are presented in Table 1. The arrivals of Soybean start hitting in the market in the month of October and January. The peak period of arrivals is October to January. Due to large arrivals during this period the prices decline. The lean period is from July to September. The prices were recorded higher from April to September. Most of the traders release the stored stock of Soybean during this period in anticipation of making a profit.

### Cyclical indices for Soybean crop prices and arrivals

The Cyclical Indices for Soybean prices and arrivals in Different Markets of Akola district were worked out for the period 2011-2020. From Table 1, it is observed that the cyclical variation observed in the arrivals of Soybean in the selected markets. It is seen from the table that the highest arrivals of Soybean were observed in the year 2015, 2016 in all selected markets of Akola district. The highest price indices were recorded in the year 2012, 2013, 2014, 2015 and 2016 in all selected markets.

**Table 1.** Seasonal indices for Soybean prices and arrivals in selected markets of Akola district

| Months | Akola | | Akot | | Murtizapur | | Balapur | |
|---|---|---|---|---|---|---|---|---|
| | Arrivals | Prices | Arrivals | Prices | Arrivals | Prices | Arrivals | Prices |
| Jan | 127.04 | 97.10 | 102.59 | 102.14 | 132.99 | 96.97 | 132.47 | 90.57 |
| Feb | 82.30 | 97.51 | 62.81 | 96.62 | 131.11 | 97.90 | 58.84 | 93.54 |
| Mar | 58.25 | 98.94 | 27.41 | 98.97 | 39.28 | 97.81 | 42.59 | 94.33 |
| Apr | 52.88 | 105.92 | 30.28 | 102.44 | 56.41 | 106.25 | 47.28 | 106.89 |
| May | 51.32 | 106.14 | 36.16 | 104.93 | 31.13 | 107.27 | 40.85 | 106.59 |
| Jun | 42.79 | 96.58 | 36.17 | 101.73 | 47.26 | 102.07 | 70.20 | 103.90 |
| Jul | 32.06 | 108.15 | 28.25 | 102.06 | 16.75 | 104.99 | 30.96 | 107.42 |
| Aug | 29.57 | 105.51 | 31.48 | 100.68 | 19.42 | 104.50 | 23.46 | 103.63 |
| Sep | 22.92 | 98.39 | 54.35 | 101.44 | 28.35 | 101.95 | 14.78 | 104.10 |
| Oct | 266.21 | 92.29 | 316.25 | 92.84 | 231.95 | 92.22 | 216.21 | 92.18 |
| Nov | 249.76 | 95.53 | 285.99 | 96.02 | 251.48 | 92.28 | 314.03 | 96.84 |
| Dec | 184.92 | 97.93 | 188.25 | 100.14 | 213.87 | 95.79 | 208.33 | 100.00 |

**Table 2.** Cyclical indices for Soybean prices and arrivals in selected markets of Akola district

| Years | Akola | | Akot | | Murtizapur | | Balapur | |
|---|---|---|---|---|---|---|---|---|
| | Arrivals | Prices | Arrivals | Prices | Arrivals | Prices | Arrivals | Prices |
| 2011 | 96.11 | 71.44 | 96.03 | 73.11 | 89.09 | 77.66 | 83.14 | 58.63 |
| 2012 | 86.59 | 111.02 | 77.86 | 107.34 | 86.42 | 108.99 | 125.04 | 115.05 |
| 2013 | 127.22 | 112.01 | 60.40 | 110.03 | 91.40 | 106.48 | 81.63 | 116.15 |
| 2014 | 81.46 | 117.43 | 60.47 | 119.21 | 109.94 | 114.57 | 91.35 | 120.60 |
| 2015 | 89.35 | 106.68 | 163.91 | 106.17 | 106.75 | 108.12 | 79.62 | 106.99 |
| 2016 | 121.58 | 102.00 | 185.25 | 99.64 | 91.11 | 103.22 | 121.36 | 104.75 |
| 2017 | 127.55 | 79.13 | 105.89 | 88.96 | 132.71 | 79.57 | 146.96 | 82.72 |
| 2018 | 73.18 | 98.15 | 59.35 | 96.51 | 125.33 | 98.08 | 84.65 | 97.23 |
| 2019 | 99.00 | 99.22 | 99.77 | 100.06 | 93.76 | 101.71 | 92.98 | 99.33 |
| 2020 | 97.97 | 102.91 | 91.06 | 98.97 | 73.49 | 101.60 | 93.26 | 98.55 |

### Testing of stationarity and volatility in prices of Soybean crop.

The Augmented Dickey-Fuller (ADF) based unit root test is carried out to check the stationary of the time series price data from four representative selected markets of Soybean.

From the table 3 it was observed that at level with lag 1, the ADF values of Akola, Akot and Balapur were less than the critical level at 1% level of significance indicating the existence of unit root implied that the price series in Akola, Akot and Balapur markets were stationary and the ADF value of Murtizapur is above the critical level at 1% level of significance indicating the existence of unit root implied that the price series in Murtizapur market were non-stationary. The table further showed that in first difference with lag 1, the ADF values are lower than that of the critical value at 1% level of first difference. This implied that the price series become stationary at first-order difference level.

**Table 3.** ADF test results of Soybean prices for selected markets

| Market | Level (ADF) | First Difference | Critical Value |
|---|---|---|---|
| Akola | -3.970 | -13.597 | |
| Akot | -4.340 | -15.027 | |
| Balapur | -4.676 | -11.827 | -3.486 |
| Murtizapur | -3.205 | -10.384 | |

**Price volatility in prices of Soybean crop**

Price volatility in Soybean prices

To assess the presence of price volatility in the prices of Soybean in Akola, Akot, Murtizapur and Balapur markets, ARCH-GARCH analysis was carried out and the results are presented in table 4.

The sum of Alpha and Beta (α+ β), indicated ARCH and GARCH effects for the given market. It was observed that among the selected markets, the sum of Alpha and Beta is nearer to 1 i.e., 0.869, 0.926, 0.916 and 0.883 for Akola, Akot, Murtizapur and Balapur markets respectively, indicated that the volatility shocks in the prices of Soybean are quite persistent for a long time in these markets.

**Table 4.** Results of ARCH-GARCH Analysis for Soybean prices for selected markets

| Parameter | Akola | Akot | Murtizapur | Balapur |
|---|---|---|---|---|
| Alpha (α) | 0.601 | 0.677 | 0.895 | 0.926 |
| Beta (β) | 0.268 | 0.248 | 0.021 | -0.043 |
| Sum of α & β | 0.869 | 0.926 | 0.916 | 0.883 |

**Market Co-integration and Granger Causality in prices of Soybean crop**

Johansen multiple co-integration trace test was applied for indicating the long-run relationship between the price series of selected markets. Co-integration is used instead of regular regression method because of its capacity in dealing with non-stationary series. The test shows whether the Soybean crop markets are integrated or not. The results of the test are presented below.

Market Co-integration between Soybean prices of selected markets

From table 21 it was observed that the presence of four co-integration equations at 5% level of significance confirms that there existed a long-run equilibrium relationship between the selected markets in terms of Soybean prices. The results of Co-integration test showed four co-integration equations were significant at 5% level of significance which implied that there existed co-integration among the markets.

**Table 5.** Results of multiple co-integration analyses of Soybean prices for the selected markets

| Hypothesized No. of CE(s) | Eigen value | Trace Statistic | Critical Value 5% | Prob.** | Number of Co-integrating Equation CE (s) |
|---|---|---|---|---|---|
| None * | 0.386 | 111.982 | 47.856 | 0 | |
| At most 1 * | 0.220 | 55.844 | 29.797 | 0 | Four |
| At most 2 * | 0.117 | 27.270 | 15.495 | 0.0006 | |
| At most 3 * | 0.107 | 13.004 | 3.841 | 0.0003 | |

**Note:** Trace test indicates 4 co-integrating equations significant at the 5 percent level of significance.

**Table 6.** Results of pairwise Granger Causality Test for Soybean prices

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| Akot does not Granger Cause Akola | 118 | 3.408* | 0.0365 |
| Akola does not Granger Cause Akot | | 10.598* | 6.00E-05 |
| Balapur does not Granger Cause Akola | 118 | 3.313* | 0.04 |
| Akot does not Granger Cause Balapur | | 6.937* | 0.0014 |
| Murtizapur does not Granger Cause Akola | 118 | 1.276 | 0.2833 |
| Akola does not Granger Cause Murtizapur | | 11.362* | 3.00E-05 |
| Balapur does not Granger Cause Akot | 118 | 4.948* | 0.0087 |
| Akot does not Granger Cause Balapur | | 1.420 | 0.246 |
| Murtizapur does not Granger Cause Akot | 118 | 4.048* | 0.02 |
| Akot does not Granger Cause Murtizapur | | 6.421* | 0.0023 |
| Murtizapur does not Granger Cause Balapur | 118 | 1.374 | 0.2574 |
| Balapur does not Granger Cause Murtizapur | | 6.342* | 0.0025 |

Note: - *denotes significant at 1% level of significance.

**Causality of price signals between Soybean crop 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 principal crops 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 Soybean crop markets were presented below.

Causality of price signals between selected Soybean markets

The results of the Granger Causality test showing the relationship of prices between selected Soybean markets are presented in table 6. It was revealed that there is bidirectional causality in Soybean prices between Akot and Akola, Murtizapur and Akot markets respectively. The prices of Balapur market exhibited unidirectional causality and affect prices of Akola and Akot markets. The prices of Akot market exhibited unidirectional causality and affect prices Balapur. The prices of Akola market exhibited unidirectional causality and affect prices Murtizapur. So, the influence of Akola market prices played a significant role over the other selected markets. From the, above discussion it can be concluded that Akola market can be considered as a lead market of Soybean and influence the prices of the remaining markets. Thus, a strong market integration of the four markets Akola, Akot, Murtizapur and Balapur established through the results of the analysis.

## CONCLUSION

This study examined the pattern of Arrivals and Prices of Soybean crops in Akola district using annual data covering the period from 2011- 12 to 2020-21. It is noticed that the inverse relationship between prices and arrival of Soybean in the selected market of Akola district. The study revealed that the pattern of arrivals and prices was directly supported in decision-making by the farmers and various intermediaries.

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