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# Price movement of cotton across major markets of Saurashtra region of Gujarat state

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**ABSTRACT :** The study of seasonal variations is considered to be important as a guide to the producer to market his produce and to the consumer to purchase his needs at the right time. It also serves as a guide to the Government to operate its policy measures (procurement and buffer release) at the appropriate time. The trends in arrivals and prices are the changes over years and observed in the long run. The trends in arrivals are associated with development in technology of production, input supply and infrastructure. Secondary monthly data were collected from major five markets of Saurashtra region viz., Amreli, Rajkot, Gondal, Jamnagar and Junagadh markets. Amreli, Rajkot and Gondal markets from period 1995 to 2013, while in case of Jamnagar and Junagadh markets, monthly data were collected from period 2004 to 2013. Time series data consist of a number of components like trend, cyclical, seasonal and irregular fluctuations. This was studied or isolated from the original monthly arrivals and prices data using seasonal indices. There are at least four methods to calculate seasonal indices from the original data. These are the ratio to trend, the ratio to moving average, simple averages and link relative methods. There is a continuous refinement in using these methods. Long ago, the method of link relatives was the most prominent method for computing the seasonal indices but now a day, it is not. The method of ratio to moving average has some advantages over others. A positive trend in cotton arrivals was observed in Amreli, Rajkot and Gondal markets, whereas the negative trend in cotton arrival was observed in Jamnagar and Junagadh markets. All the markets *viz.,* Amreli, Rajkot, Gondal, Jamnagar and Junagadh markets showed positive trend in cotton prices. Higher indices of market arrivals of cotton were noticed immediately after harvest in market and lower value of indices of arrivals during the period from May to September indicated lean period. The highest values of price indices were observed during lean period and in the lowest arrivals months of May to September in all the market.

**Key word :** Coefficient, cotton, implication, major market, price movement, seasonablity

The study of seasonal variations is considered to be important as a guide to the producer to market his produce and to the consumer to purchase his needs at the right time. It also serves as a guide to the Government to operate its policy measures (procurement and buffer release) at the appropriate time. The trends in arrivals and prices are the changes over years and observed in the long run. The trends in arrivals are associated with development in technology of production, input supply and infrastructure. The trends of prices are associated with increase in population, money supply, increased purchasing power and generally with inflation or deflation observed in the economy. The study of trends enables us to

indicate the general direction of change in arrivals and prices in different markets.

The variations in market arrivals and prices can be classified into two kinds. The first one comprises of fluctuations observed over time, and are generally referred as "Temporal variations" and is the result of complex mixture of changes associated with trend, cyclical, seasonal and irregular components. The second one comprises of fluctuations over space and are referred as "Spatial variation" and is the outcome of differences in location and seasonality of production, transportation bottlenecks, *etc*. These factors in turn, lead to changes in the cropping pattern and the income of the farmers.

**Objectives:** To estimate the trend and seasonality in prices of cotton in Saurashtra region.

## MATERIALS AND METHODS

Secondary monthly data were collected from major five markets of Saurashtra region viz., Amreli, Rajkot, Gondal, Jamnagar and Junagadh markets. Amreli, Rajkot and Gondal markets from period 1995 to 2013, while in case of Jamnagar and Junagadh markets, monthly data were collected from period 2004 to 2013.

**Trend analysis :** Time series data consist of a number of components like trend, cyclical, seasonal and irregular fluctuations. In the conventional method of time series analysis, the above four components are assumed to behave in additive or multiplicative scheme respectively, as under:

$$Y = T + C + S + I \quad \text{or} \quad Y = T \times C \times S \times I$$

Where Y is the original time series data, T is the trend, C is the cyclical, S is the seasonality and I is the irregular component of the time series.

Trend component can be defined as the tendency of prices or arrivals to move up or down over a long period of time. It is not concerned with the movement in prices from one year to another but for large number of years. The important causes of long term trend in prices are the changes in demand and supply over a long span and the general price level in the country.

Seasonal movements are caused by seasonality in production. One of the widely held benefits concerning agriculture in less developed countries is that seasonal fluctuations are violent. The implied logic is that farmers, because of their acute poverty, are forced to bring their products to the market immediately after harvest. This heavy influx into the market forces the immediate post harvest prices to very low levels. The seasonal variations in prices may vary from commodity to commodity. Even within the same commodity, the inferior quality is likely to have more fluctuations than the superior ones. Similarly seasonal variation in the prices in rural areas tends to be greater than in central markets.

The decomposition of time series data was helpful in various ways. An understanding of price fluctuations is a pre requisite for stabilization programme. It gives some idea to the government procurement agency regarding the suitable time for making purchases. To the farmers, it is helpful in providing guidance as to when and where it will be more profitable for them to dispose off their goods or products. An

understanding of the price behavior enables better price forecasts, as well.

Due to exponential nature of agricultural growth and unrealistic assumption used by additive scheme *i.e.* each component of the time series is dependent in the data, multiplicative scheme has been chosen for the present study. Schematically, it can be represented as:

$$Y = T \times S \times C \times I$$

In order to decompose the trend effect, first of all, the original data were deseasonalised. After that, the trend was computed. There are four methods of computing the trend component from the deseasonalised data. These methods are graphically (free hand), moving average, semi average straight line and least squares methods. Each method has its own advantages and disadvantages. Since the advantages of least squares method outweigh its disadvantages, this method was used with the specification as given below:

$Y = f(T)$

Where,

Y = deseasonalised prices in Rs/qtl. Or arrivals per month in qtl.

T = time period in months

The mathematical form of the model is:

$$Y = a + b_t + U$$

and

$$Y = a + Bt + U_t$$

Using ordinary least square estimation model, the parameters are computed as:

$$\hat{a} = \bar{Y} - bT$$

$$\hat{b} = \frac{\Sigma y_1 t_1}{\Sigma t_1^2}$$

Where, $y_1 = Y_1 -$

$t_1 = T_1 -$

The reliability of the estimates is tested using t statistics.

**Seasonality analysis :** This was studied or isolated from the original monthly arrivals and prices data using seasonal indices. There are at least four methods to calculate seasonal indices from the original data. These are the ratio to trend, the ratio to moving average, simple averages and link relative methods. There is a continuous refinement in using these methods. Long ago, the method of link relatives was the most prominent method for computing the seasonal indices but now a day, it is not. The method of ratio to moving average has some advantages over others. For example, in the ratio to trend method, it is impossible to separate the cyclical component from seasonal component. The seasonal indices computed by this method contains cyclical component also. But, in case of the method of ratio to moving average, the above type of problem does not arise. Therefore, the ratio to moving average method was employed in the study to compute the seasonal indices. The method used has following procedures.

1) The centered 12 month moving average should be computed from the original data. These centered 12 months moving average data contain the trend and cyclical component.
2) Divide the original data by the centered moving average.

   Y = TSCI

   Y / MA = = SI
3) The irregular component is eliminated by averaging the data for each month over the years that we get in step 2. After averaging the data, multiply it by hundred

then the result is seasonal index for each month.

4) The sum of the seasonal indices should be 1200. If it is greater or less than 1200 then adjust it using a correction factor.

$$K = \frac{1200}{S}$$

Where,

K = Correction factor

S = Sum of seasonal indices

The extent of seasonal price variation can be determined using different measures of intra year price variations. The three methods used to measure the intra year price variations are the intra-year price rise (IPR), coefficient of average seasonal price variation (ASPV) and the coefficient of variation (CV).

**Extent of intra year price rise :** The difference between the lowest and highest price within the year is termed as intra year price rise. The prices of most commodities usually remain the lowest in the harvest season and rise thereafter till they reach the highest level in the next pre-harvest season. The intra year price variation or rise was computed using the following formula.

$$ASPV = \frac{HSPI\text{-}LSPI}{\frac{HSPI\text{-}LSP}{2}} \times 100$$

Where,

HSPI = Highest Seasonal Price Variation

LSPI = Lowest seasonal Price Variation

The coefficient has some advantages over IPR and indicates the average variations in prices during the year.

**Coefficient of variation: (%)** : It expresses the variability of the price from its average. It indicates or measures the stability or instability of a given parameter .It computed using the formula:

$$C.V. = \frac{\partial}{\chi} \times 100$$

Where,

$\partial$ = The standard deviation

$\chi$ = Mean of the seasonal indices

Since the mean of seasonal indices is 100, then the coefficient of variation is the magnitudes of standard deviation.

**Relationship between prices and arrivals:** Regression analysis was carried out to determine the nature of relationship between arrivals and prices. The specification of the model used in the study is:

$$Pt = f(Yt)$$

Where, Pt is current price (Rs/Qtl.) in period t and Yt current arrivals (ton) in period t. Thus, the model used initially was:

$$Pt = a + bYt + Ut$$

Where, a and b are parameters to be estimated and Ut is the random term.

From the above regression model, often it was observed that the random terms was strongly correlated (positive serial correlation coefficient). Durbin Watson d-statistics, which ranged between 0 – 1, revealed that there was strong positive autocorrelation. The presence of strong serial correlation reduces the efficiency of parameter estimates. Thus, one has to find the solution for autocorrelation to improve the efficiency of OLS estimate. Among the sources of serial correlation, omission of explanatory variables or quasi-autocorrelation is the important ones. That is, the residual terms are correlated serially not by their nature but due to the omission of correlated explanatory variables

which are not included in the model. The solution for such type of auto correlation is to include the missing explanatory variables that improve the efficiency and explanatory power to the model. The result of this model was not encouraging, in the sense that coefficients associated with arrivals were positive as well as non-significant for most of the commodities and it explained very little variation in prices. Therefore, the current arrivals and growth of wholesale prices were plotted to see the behavior of arrivals and prices. It was observed that peak and trough of arrival and prices did not match in terms of explanation sought. The difference in peak and trough of arrivals and prices indicated that inclusion of lag price would better explain the behaviour of current prices.

The OLS estimates of parameters by including lagged price variable are consistent and asymptotically efficient for large samples (Johnston, 1999). The inclusion of lagged variable not only improved the sign of coefficient of arrivals but the coefficient also became significant. The value of also improved sufficiently. Therefore, the final form of method is:

$$Pt = a + bPt\text{-}1 + cYt + Ut$$

Where,

Pt = current price (Rs/Qtl) in period t

Yt = current arrivals (ton) in period t

Pt-1 = lagged price

a, b and c = parameters to be estimated

Ut = error term

## RESULTS AND DISUCSSION

The estimated parameters for trend value for arrivals (A) and prices (P) of cotton crop for different markets are given in Table 1 to 5 respectively. A positive trend in arrival was observed in the markets viz., Amreli, Rajkot and Gondal. The negative trends in arrivals were found in Jamnagar and Junagadh markets. All the markets *viz.,* Amreli, Rajkot, Gondal, Jamnagar and Junagadh markets showed positive trend in prices.

**Table 1.** Trend equations of cotton arrival and price in Amreli market

| Particulars | $R^2$ | Trend equation |
|---|---|---|
| Arrival (A) | 0.17 | P = 5813.92 + 115.57t + μ |
| Price (P) | 0.66 | P = 1156.71 + 14.05t + μ |

**Table 2.** Trend equations of cotton arrival and price in Rajkot market

| Particulars | $R^2$ | Trend equation |
|---|---|---|
| Arrival (A) | 0.01 | P = 40732.09 + 73.75t + μ |
| Price (P) | 0.59 | P = 1332.89 + 13.11t + μ |

**Table 3.** Trend equations of cotton arrival and price in Gondal market

| Particulars | $R^2$ | Trend equation |
|---|---|---|
| Arrival (A) | 0.01 | P = 20459.55 + 51.81t + μ |
| Price (P) | 0.61 | P = 1374.54 + 12.92t + μ |

**Table 4.** Trend equations of cotton arrival and price in Jamnagar market

| Particulars | $R^2$ | Trend equation |
|---|---|---|
| Arrival (A) | 0.28 | P = -2806.32 + 153.98t + μ |
| Price (P) | 0.74 | P = 1332.96 + 24.36t + μ |

**Seasonality in arrivals and prices of cotton** : Seasonality in arrivals and prices are such changes that occur regularly every year as a result of changes in season. These variations may be primarily due to the seasonal

**Table 6.** Seasonal indices of monthly arrivals and prices of cotton

| Sr. No. | Month | Amreli | | Rajkot | | Gondal | | Jamnagar | | Junagadh | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Arrivals | Prices | Arrivals | Prices | Arrivals | Prices | Arrivals | Prices | Arrivals | Prices |
| 1 | January | 192.96 | 98.45 | 209.09 | 92.74 | 217.34 | 94.73 | 200.16 | 101 | 235.22 | 99.76 |
| 2 | February | 117.68 | 98.71 | 161.53 | 93.16 | 178.54 | 96.81 | 156.02 | 99.36 | 140.61 | 98.65 |
| 3 | March | 94.21 | 99.28 | 97.06 | 97.46 | 112.38 | 99.05 | 117.37 | 95.16 | 66.89 | 99.55 |
| 4 | April | 92.64 | 100.53 | 82.45 | 97.97 | 81.18 | 100.66 | 97.99 | 95.63 | 47.56 | 90.97 |
| 5 | May | 66.29 | 101.89 | 61.8 | 100.81 | 55.14 | 101.65 | 63.86 | 105.72 | 32.99 | 95.45 |
| 6 | June | 33.96 | 102.59 | 30.43 | 101.98 | 23.6 | 103.72 | 21.53 | 100.87 | 28.74 | 104.87 |
| 7 | July | 19.28 | 104.13 | 14.14 | 108.29 | 8.78 | 106.43 | 18.88 | 106.33 | 24.14 | 112.9 |
| 8 | August | 20.29 | 104.62 | 12.73 | 108.98 | 12.01 | 106.38 | 9.27 | 104.71 | 24.29 | 110.25 |
| 9 | September | 55.99 | 101.42 | 38.04 | 105.13 | 20.55 | 102.83 | 37.48 | 101.89 | 21.59 | 104.21 |
| 10 | October | 143.11 | 95.47 | 105.88 | 96.55 | 99.04 | 97.57 | 80.62 | 92.04 | 66.06 | 93.58 |
| 11 | November | 176.5 | 97.05 | 185.18 | 98.35 | 182.07 | 96.72 | 204.35 | 95.03 | 206.71 | 92.16 |
| 12 | December | 187.09 | 95.85 | 201.67 | 98.58 | 209.37 | 93.46 | 192.47 | 102.26 | 305.21 | 97.64 |

great extent. Keeping such variations in demand in view, the growers can obtain better prices by matching supply to the market requirements during the period of high seasonal price index

**SUMMARY AND POLICY IMPLICATION :** A positive trend in cotton arrivals was observed in Amreli, Rajkot and Gondal markets, whereas the negative trend in cotton arrival was observed in Jamnagar and Junagadh markets. All the markets *viz.,* Amreli, Rajkot, Gondal, Jamnagar and Junagadh markets showed positive trend in cotton prices

Higher indices of market arrivals of cotton were noticed immediately after harvest in Amreli market and lower value of indices of arrivals during the period from May to September indicated lean period. The highest values of price indices were observed during lean period and in the lowest arrivals months of May to September in Amreli market.

Seasonal indices of arrivals of cotton in Rajkot market were more than 100 during October to February, the peak period of arrivals were found during December to January. While the lean period of arrivals was noticed in the month of June to September. The value of higher seasonal price indices for cotton were found in the month of May to September in Rajkot market, while that of the lowest price index was found during October to April.

**Table 7.** Coefficients of average seasonal variation of cotton

| Market | Magnitude of variation (%) | | |
|---|---|---|---|
| | IPR | ASPV | C.V. for price |
| Amreli | 9.55 | 9.20 | 39.83 |
| Gondal | 13.88 | 12.98 | 38.28 |
| Rajkot | 17.52 | 16.11 | 38.43 |
| Jamnagar | 15.53 | 14.41 | 36.41 |
| Junagadh | 24.10 | 21.51 | 35.72 |

IPR = Intra-year Price Rise
ASPV = Average Seasonal Price Variation

The highest index of arrivals was observed during the months of October to March in Gondal market. The decline in arrivals was more prominent from May to September and reached to the lowest in July in Gondal market. The price indices of cotton were found the highest in the lean period in months of April to September and the lowest in the peak period months of October to March.

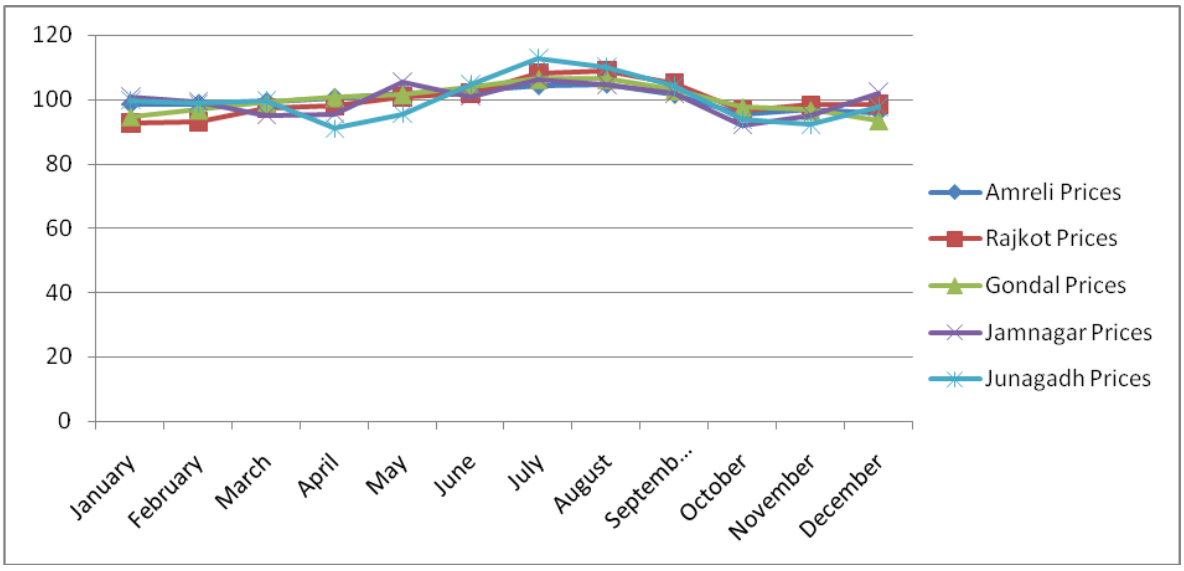


**Fig. 2.** Seasonal indices of monthly prices of cotton

In Jamnagar market, the highest index was observed during the month of November and lowest index was found during the month of August. The highest price indices of cotton were observed during the lean period in the month of May to September and declining the prices during peak period in month of October to April.

The lower arrivals were observed during the month of May to September indicating lean period for cotton in Junagadh market. The highest arrivals were found in the month of December and lower arrivals indices were found in the month of September. Highest values of price indices for cotton were found in the month of June to August and lower prices value was observed during the month of November.

Maximum value of the coefficient of seasonal variation for cotton was observed in Amreli market (39.83), followed by Rajkot (38.43), Gondal (34.81), Junagadh (34.81), and Jamnagar markets (36.41). As the coefficient of variation increased, the degree of stability of prices decreased. The variability in fresh arrivals, stock of the products in market and the demand affects the price to a great extent.

**Policy Implications** : Keeping in view the above results, a few policy measures are suggested as below:

1. There is a need to improve the productivity of cotton through more research and extension efforts.
2. The seasonal pattern of market arrivals was the result of the farmers' inability to withhold stocks and incur additional costs on storage and also to take on the consequence of price fluctuations. Hence, there is need to develop adequate marketing credit facilities and make them available to farmers to relieve them from financial pressures.

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