TRENDS AND VARIATIONS IN ARRIVALS AND PRICES OF COTTON

G. CHAITHANYA KUMAR, G. MOHAN NAIDU*, B. RAVINDRA REDDY AND I. BHAVANI DEVI

Department of Statistics and Maths, S.V. Agricultural College, Tirupati – 517 502

ABSTRACT

Cotton is an important cash crop among the major commercial crops grown in Andhra Pradesh. The present study seeks to make a modest attempt to examine the nature and magnitude of the arrivals and price fluctuations in Khammam regulated market of Khammam district of Andhra Pradesh, considering secondary time-series data for the period of 14 years (From April 2000 to March 2014). The analysis of the data showed that seasonal indices of cotton arrivals were minimum during the month of September and maximum in the month of November. The maximum prices were observed during the month of July whereas minimum prices in the month of October. The results revealed that with regard to arrivals, there was a presence of seasonality within a year (p = 1.02E-32) and seasonal pattern did not change over the years (p = 0.8442). While in prices, there was no seasonality within a year (p = 0.7889) as well as between years (p = 0.6953) at five per cent level of significance. The results showed that there was an increasing trend in the arrivals and prices in the market over the years. Definite cycles were not observed in the market during the study period. A positive significant relationship was exhibited between arrivals and prices in the market for the study period.

KEY WORDS: Correlation, Cyclical, Irregular, Seasonal variations, Trend and two way ANOVA.

INTRODUCTION

Cotton is an important cash crop among the major commercial crops grown in India as well as in Andhra Pradesh. Cotton, popularly known as 'White Gold', dominates India's cash crops, and makes up 65 per cent of the raw material requirements of the Indian textile industry. India is the third largest cotton producer in the world behind China and the United States, accounting for 25 per cent of the world acreage but only 14 per cent of world production (*USDA 2001*).

Major Cotton producing countries are China, USA, India, Pakistan and Brazil. India ranks first in the world with respect to area and it ranks third and fifth with respect to production and productivity of cotton respectively. Cotton in India occupies area of 110 lakh hectares with a production of 325 lakh bales and productivity of 503 Kg/ ha. (*www.indiastat.com*).

The major cotton growing States are Maharashtra, Gujarat, Andhra Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan, Karnataka and Tamil Nadu. Among the cotton growing states, Andhra Pradesh occupies third position in the country in respect of area, production and productivity of cotton.

It was observed that cotton production in Andhra Pradesh is fluctuating with the vagaries of rainfall. Over the years, it has witnessed several ups and downs in area, production and productivity.

Farmers always experience with lower prices for their produce when bumper crop is harvested. They always commit the mistakes in disposing off their produce at right time in order to get remunerative prices for their produces. Usually, they sell their produce when there is a glut in the market i.e., immediately after the harvest of the crop. For this inappropriate time of sale, one can quote several reasons, but among them the most important is lack of awareness and knowledge about the proper time to sell their produce. This kind of study helps in formulating appropriate policy measures to contain both over production as well as forecasting of the remunerative prices for the commodity.

The seasonal fluctuations are regularly recurring pattern that are completed once in twelve months. Such seasonality is seen in the arrivals as well as in the prices of farm products (*Nahatkar et al., 1998*). It arises from the nature of production, supply and demand in the markets and price formations for crops, seasonal variations that arise from climatic factors and biological growth process

*Corresponding author, E-mail: naidu_svag2001@yahoo.com

of plants. Following the seasonality in production and arrivals, the prices also exhibit seasonal variations. Normally the prices of storable produce are lower at harvest time and then rise as the season progresses, reaching their peak just prior to the next harvest. The study of seasonal fluctuations is considered to be an important as a guide to the consumer to purchase his needs at the right time. It also serves as guides to the Government operate its policy measures (procurement and buffer release) at the appropriate time.

The trends in arrivals and prices are the changes over years and are associated with changes 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 study of cyclical variations is extremely useful in framing suitable policies for stabilizing the level of business activity, i.e., for avoiding periods of booms and depression as both are bad for economy – particularly depression which brings about a complete disaster and shatters the economy. Amongst all the methods of arriving at estimates of the cyclic movements of time series, the residual method is most commonly used.

Irregular variations resulted from unpredictable forces which operate in irregular manner. Such variations do not exhibit any definite shape, so these are called irregular variations. Irregular variations are caused by sudden changes in demand or very rapid technological progresses may also be included in this category. By their very nature these movements are very irregular and unpredictable.

The study of relationship between market arrivals and prices is very useful. Large productions as well as large arrivals reflect adversely on the price which finally leads to their downfall. The behaviour of market arrivals and prices has been studied by Kumar et al., (2005), Munidinamani et al., (1993), Pawar and Misal (2005). Kumuda Keerthi et al., (2013), Mohan Naidu et al., (2014). Mohan Naidu (2014) have studied a statistical study on arrivals and prices of cotton in Karimnagar district of Andhra Pradesh.

MATERIAL AND METHODS

This study was undertaken with an overall objective of analysing the arrivals and prices of cotton from Khammam Agricultural Market Committees of Andhra Pradesh (A.P.). The secondary data collected for the study was monthly arrivals (Q) and prices (Rs/Q) of cotton from the Khammam Agricultural Market Committee of A.P. for a period of 14 years (2000-01 to 2013-14).

Methodology

Time series analysis was done to study the variations in monthly prices and arrivals of cotton for the period of 14 years. A time series is a complex mixture of four components namely, Trend (T_t), Seasonal (S_t), Cyclical (C_t) and irregular (I_t) variations. These four types of movements are frequently found either separately or in combination in a time series. The relationship among these components is assumed to be additive or multiplicative, but the multiplicative model is the most commonly used method in economic analysis, which can be represented as

$$y_t = T_t * S_t * C_t * I_t$$

where,

y_t = Original observation at time t

t = monthly data of cotton arrivals in quintals and prices (Rs/Q) i.e. t = 1,2,….,168

T_t = Trend component at period t; S_t = Seasonal component at period t

C_t = Cyclical component at period t; I_t = Irregular component at period t

Seasonal indices

This is one of the widely accepted sophisticated tools of analysis of time series data for season-wise variations in prices and arrivals. The first step is, to estimate the seasonal indices of 12 month centred moving averages.

The multiplicative model permits the estimation of each of the above four components. As a first step to estimate the seasonal indices, a 12-month moving averages was calculated as follows

$$M_1 = \frac{Y_1 + Y_2 + Y_3 + ... + Y_{12}}{12} \; ;$$

$$M_2 = \frac{Y_2 + Y_3 + Y_4 + ... + Y_{13}}{12} \; ; \; ...etc.,$$

where, M_1, M_2, M_3,........ etc., are called 12 months centered moving averages

This is in sequential manner for each point of time t. In this manner a 12 month centered moving average removes a large part of fluctuation due to seasonal effects, so that what remains is mainly suitable to other sources viz., long term effects (T_t), cyclical effect (C_t). The irregular variation (I_t) was due to random causes and the same was minimised as process of smoothing out effect. Thus, it affords a mean of not only estimating trend component effect but also estimating seasonal components.

Trend analysis

The polynomial regression analysis was adopted to study the trends in arrivals and prices of cotton in Khammam market of A.P. When definite mathematical model cannot be identified to fit trend data, the polynomials are used to determine the long term behaviour. These polynomials are fitted by the method of least squares

1st degree $Y_t = a + bt + e$

2nd degree polynomial $Y_t = a + bt + ct^2 + e$ etc.,

are the coefficients to be estimated. Since the objective is to find the polynomial of lowest degree that seems to be an adequate fit for the data, it is necessary to test for the significance of each 'b' regression coefficient in successive 'b's turn out to be non- significant. The suitable model for data is judged based on regression coefficient and adjusted R^2.

RESULTS AND DISCUSSION

Seasonal indices of cotton arrivals and prices

The patterns of variation in arrivals and prices within a year as revealed by the seasonal indices were computed for each month. The peak arrivals were observed during the months of November (254.32) and December (201.68) while the lowest arrivals were observed that during the months of September (11.42) and August (15.11). The prices were high during the month of July (106.77) and

August (104.33) whereas lowest prices were observed during the months of October (93.48) and November (96.06).

The results of two-way ANOVA reveal that with regard to arrivals, there was a presence of seasonality within a year (p = 1.02E-32) and seasonal pattern did not change over the years (p =0.8442) at 5 per cent level of significance. While in prices, there was no seasonality within a year (p =0.7889) as well as between years. Similar pattern of arrivals and prices of cotton was noticed by Mohan Naidu, 2014. The seasonal indices of arrivals and prices were presented in Table 1 and illustrated in Figure 1.

Table 1. Seasonal indices in arrivals and prices of cotton

Month	Arrivals	Prices
January	155.26	98.7
February	134.66	99.22
March	141.08	101.52
April	82.56	102.65
May	31.27	100.54
June	32.72	98.62
July	29.28	106.77
August	15.11	104.33
September	11.42	99.53
October	110.65	93.48
November	254.32	96.06
December	201.68	98.58

Secular trend in monthly arrivals of cotton

In order to determine the nature of trend movement in the arrivals of cotton in Khammam market, the data was fitted to the first degree polynomial equation. This model has adjusted R^2 equal to 0.0607, which means that about 6.07 per cent of arrivals can be explained in terms of time. The trend equation in the form of

$$Y_t = 29374.77 + 303.6123t$$

It can be seen from above equation the arrivals of cotton, displayed an increasing trend in arrivals over the years. The monthly increase in the arrivals of cotton was observed to be 304 quintals per month. The graph of the trend in arrivals over years was shown in Figure 2.

Secular trend in monthly prices of cotton

In order to determine the nature of trend movement in the prices of cotton in the market, the data was fitted to
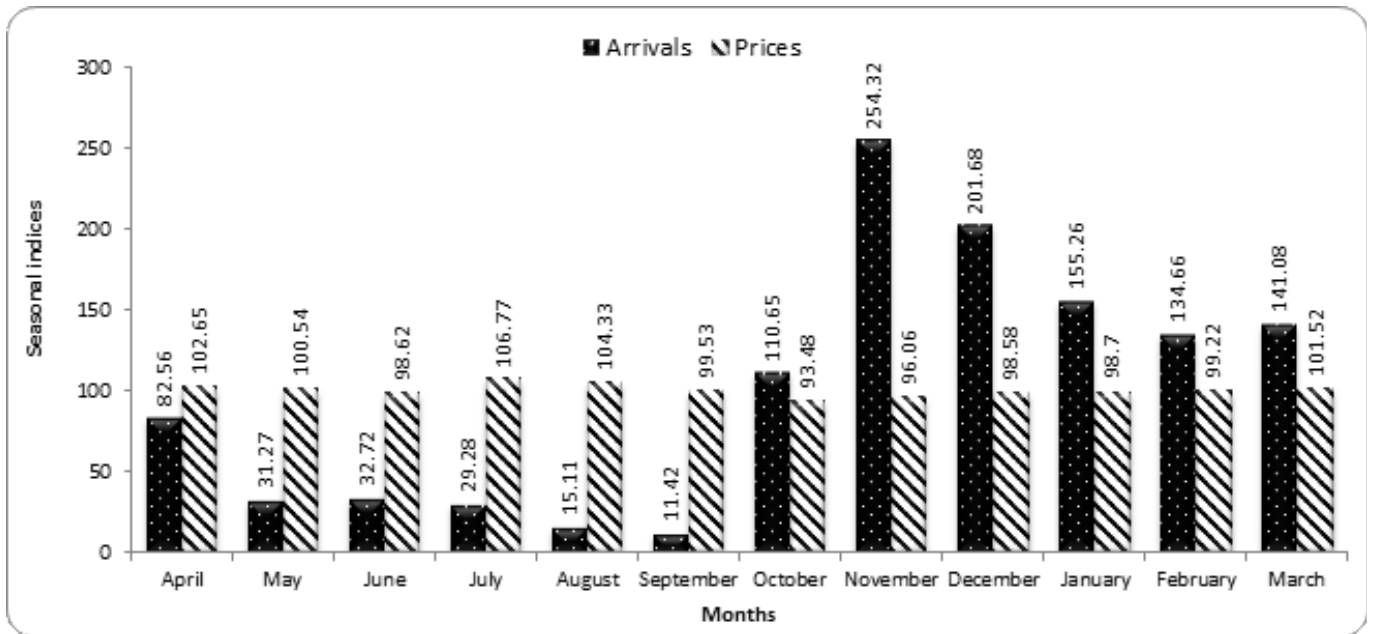
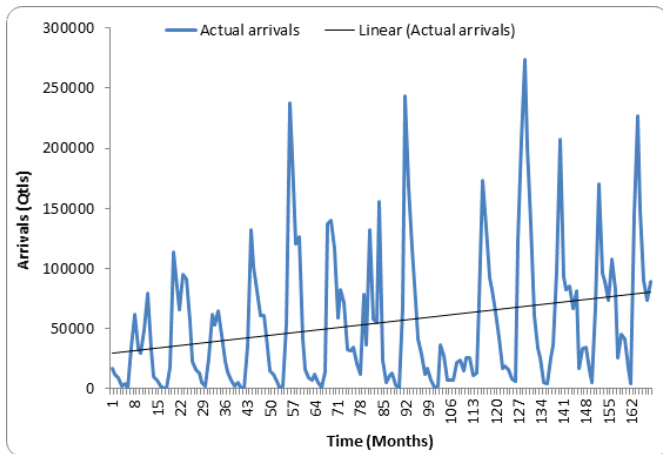Fig.1. Seasonal indices of arrivals and prices of cotton

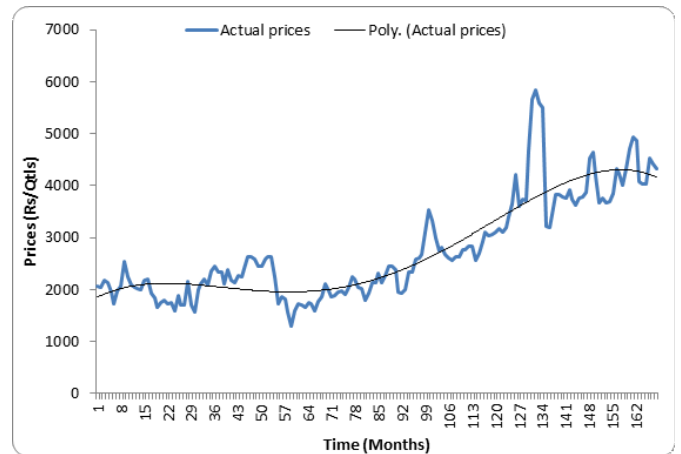Fig. 2. Secular trend in monthly arrivals of cotton

Fig. 3. Secular trend in monthly prices of cotton
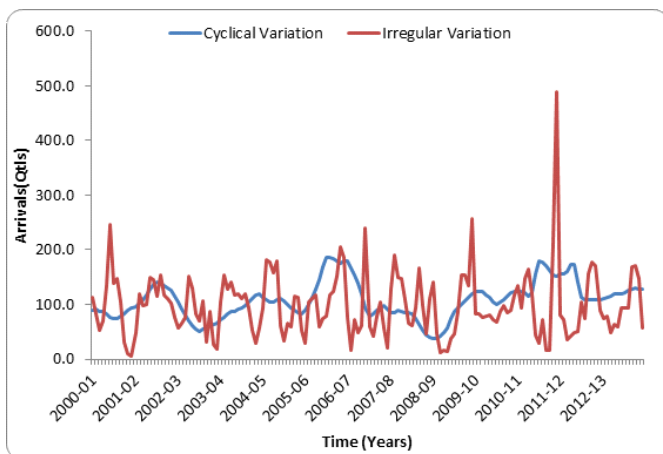

Fig.4: Cyclical and irregular variations of cotton arrivals
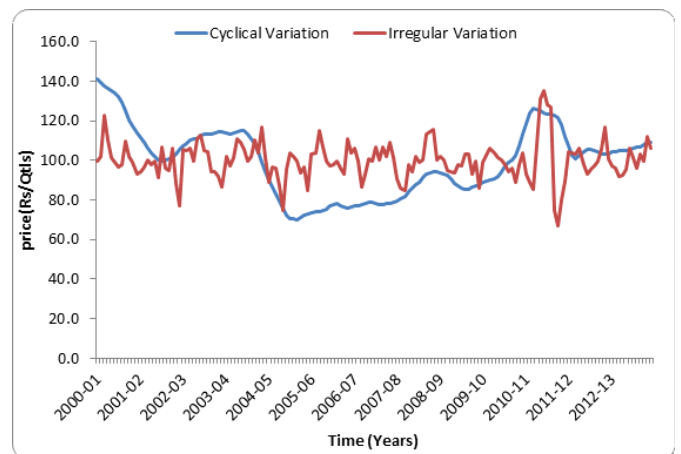

Fig.4: Cyclical and irregular variations of cotton prices

the fourth degree polynomial equation. This model has adjusted R^2 equal to 0.7937, which means that about 79.37 per cent of prices can be explained in terms of time. The trend equation in the form of

$$Y_t = 1819.228 + 33.0718t - 1.1600t^2 + 0.0133t^3 - 4.2E - 05t^4$$

It can be seen from the above equation the prices of cotton, had showed an increasing trend in prices over the years. The graph of the trend in prices over the years was shown in Figure 3.

Cyclical and Irregular variations

The cyclical and irregular variations in arrivals and prices of cotton were illustrated in Figures 4 and 5. It can be seen from the figures that the cyclical variations showed a smooth trend whereas there existed fluctuations because of irregular variations. But these quit low as compared to the observed values. Form the figures it could be observed that there was no definite cycles existed in the selected market.

A positive significant relationship was seen between arrivals and prices in terms of correlation coefficient (0.1576) over the years and months in the market. The result is similar to Mohan Naidu, 2014.

CONCLUSIONS

The results showed that there was increasing trend in the arrivals as well as prices during the study period. The seasonal fluctuations revealed the peak arrivals during the month of November while lower arrivals during the month of September. The maximum prices were observed during the month of July whereas minimum prices were during the month of October.

From the foregoing, it may be concluded that with regard to arrivals, there was a presence of seasonality within a year and seasonal pattern did not change over the years. While in prices, there was no seasonality within a year (p =0.7889) as well as between years. The results of the study have confirmed the positive significant relationship between market arrivals and prices in terms of correlation coefficient over the years and across months in the market for the study period.

REFERENCES

Kumar, T.V., Bhat, A.R.S and Path, S. J. 2005. Price forecasting of different classes of teak by the application of exponential smoothing model, *Karnataka Journal of Agricultural Sciences*. 18(3): 55-59.

Kumuda Keerthi, P and Mohan Naidu, G. 2013. Seasonality in Market Arrivals and Prices of Tomato in Madanapalli Market of Chittoor District. *The Andhra Agricultural Journal*. 60(1): 152-156.

Mohan Naidu, G., Meena Kumari, V and Sri Kala, M. 2014. Behaviour of market arrivals and prices of red chillies (Capsicumannuum). *Plant Archives*. 14(1): 511-519.

Mohan Naidu, G. 2014. A statistical study on arrivals and prices of cotton in Karimnagar district of Andhra Pradesh, *International Journal of Agricultural and Statistical Sciences*. 10(2): 321-324.

Mundinamani, S.M., Sastry, N.R and Shankar Murthy, H.G. 1993. Market structure for oil seeds in Karnataka – A case study of groundnut, *Indian Journal of Agricultural Marketing*. 7(2): 201-212.

Nahatkar, S.B., Kiradiya, B.S and Sharma, H.O. 1998. Price variation of cotton: A case study of Kukshi regulated market of Dhar district of Madhya Pradesh. *Indian Journal of Agricultural Marketing*. 53(3): 414-421.

Pawar, N.D. and Misal., D.H. 2005. Behaviour of prices and arrivals of pomegranate in western Maharashtra. *Agricultural Marketing*. 47(4):22-24.

United States Department of Agriculture 2001.

www.indiastat.com