A comparative study of arrivals and prices of agricultural commodities at APMC using Time Series Analysis

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Abstract- Agricultural marketing Price plays an important role based on the arrival of agricultural commodities. This paper shows comparative analysis of performance of cumin and fennel marketing system in market at APMC, Unjha. The information on price and arrivals of cumin and fennel were collected from the APMC of Unjha.

A trend and cyclic trend component were obtained for agricultural products cumin and fennel. A significant relationship between arrivals and prices was studies for both the agricultural products. Regression Analysis was done for forecasting future values of arrival and their relationship on prices in the agricultural commodities cumin and fennel at APMC.

Keywords— **Time Series, trend, Seasonal Components, Arrival, Prices.**

I. INTRODUCTION

Agriculture sector in India employments about 64 % of the labour force, which contributes about 22 % of GDP and accounts for 11.8 % portion of the worth of the country's exports. It supplies loose wage required by non-agricultural zone and raw materials for a huge number of manufacturing industries. Throughout the different plan periods, there has been a significant development in agriculture sector in terms of multiple rise in volume of output. In meanness of this outstanding progress, the country could not increase substantially the economic situation of agriculturists. This mainly on reason of absences in agricultural marketing system such as deficiency of facilities in the market, transport jams, lack of scientific, technical and systematic storage system, lack of competitive situations in the markets, lack of categorising etc. As a result of these, the producer is not able to get fair deal in the market.

Marketing plays, a significant role in the economic and industrial development as it influences production, avoids needless fluctuation in production and prices and reduces costs of production. However, for realizing these benefits, marketing system and marketing technology have to keep speed with the production technology and socioeconomic development of the state as well as country. The vide experience of many countries recommends that in the absenteeism of an efficient marketing system policy for agricultural development cannot go very far to encourage production (Khalon and George, 1985).

Agricultural marketing plays a key role in the effort of commodity from the producer to the consumer and in steadying the prices. The strategic increase in agricultural output must be synchronized with variations in the demand and supply for agricultural commodities and marketing, This can be productive only when producer's sharer in consumer's rupee increase considerably regardless of the volume of the marketable surplus produced with the farmers. Therefore, marketing rightly considered as essential input in addition to better seed and fertilizer in recent agriculture.

The farmers sell their product in the markets established by the Agricultural Produce Market Act of 1939, with the introduction of regulated markets and tough regulations. The farmers started receiving a considerable share in the consumer's rupee for some commodities. Unreasonable market charges by the intermediaries, illegal deductions in weights and sale proceeded, use of faulty weights and measures, drawing large amount of product as sample for which no payment was made to producers, were the misconducts widely prevalent before the introduction of APMC act. The stable development of arrivals of commodities in the regulated markets owing to which the sale of agriculture produce in the village has been observed to decline over time. This has directed to significant development in the market organization, behaviour and performance.

The nature and supply of agricultural commodities generally results in unsteadiness of prices and income within agricultural areas as well as in other areas of the economy. On

demand side, the unsteadiness in prices of agricultural items has been one of the major factor affecting the income level of the farmers as well as the tempo of agricultural produce. This instability in the prices of agricultural commodities are influenced by number of factors such as annual variation in production, low price elasticity of demand and seasonability of agricultural production (Khalon and Tyagi, 1989). The statistics about behaviour of the price in terms of price level, trend and variations are the most important factors in determining effectiveness of the commodity in the local and international level to draw effect for future prices and to formulate the long term strategy on trade (Chand Ramesh, 2002). The past trend in area, production and market arrivals of commodities are also useful in understanding the present and to forecast the future.

For adoption of new technology for improving the yields in agriculture, it is important for a farmer to remove the farm harvest as early as possible. The arrangement of movement of the product from farm to the final buyer acting a critical role in shaping the returns to the farmers. Without the marketing system improves, incentives/policies focused towards bringing developments in production will not advantage the farmer to the desired extent. For better revenues, stable price and attractive terms of trade will encourage the cultivator to produce more and to market a major proportion of what they have produce. Suitable growth of market systematisation seems to be critical in this context.

The study of association between market arrivals and prices is very useful. Higher production and higher arrivals reveal unfavourably on the prices. As a result the prices generally go down. But in a mixed economy, a certain amount of bearing is given to the market services and this regulation may not always holds worthy. This control mechanism of the market forces may aim at regulating market supplies or consumption or both, particularly in the case of commodity in the short return among the venders and consumers and effect of these returns at once reflected in the supply and price position. Thus, in a mixed economy it would be necessary to study the market arrivals and prices and to know the factors affecting to them. The study of the market concentration and role of middlemen will be of greater important to the policy makers to assess the market performance and to remove the bottleneck if any in the system of marketing of cumin and fennel, to improve the income of the farmers.

Therefore, the present study is an attempt to measure the performance of cumin and fennel marketing system in Unjha's Agriculture Produce Market Committee, which is well known markets for trading of Jira and Isabgul in Gujarat.

II. OBJECTIVE

Keeping the above-mentioned aspects, the following specific objectives were framed for the study.

1. To predict the trend in arrivals and prices of cumin and fennel in Unjha's APMC
2. To measure and compute the relationship between arrivals and prices of selected commodities.
3. To estimate the arrivals and prices of selected commodities, and
4. To suggest appropriate policy measures

III. HYPOTHESIS

1. There is an increasing trend in arrivals and prices of cumin and fennel commodities in Unjha's APMC.
2. There is a negative relationship between the arrivals and prices of selected commodities.

IV. REVIEW OF LITERATURE

An attempt has been made to critically review the literature of the past research work relevant to the present study. The available literature on the subject has been reviewed and presented under the following headings:

A. Time series analysis
B. Price and arrivals of cumin and fennel
C. Market Concentration
D. Box-Jenkins model and its application

A. *Time Series Analysis.*

Parson (1925) clearly defined different components of a time series as (a) a long term or secular trend, (b) cyclical variations, (c) Seasonal variations, and (d) irregular variations.

Analysis of time series is the decomposition of an observation of a series into above four components. In the observation of a time series all the above four components are exist. The time series model is of two types termed as additive model and multiplicative model. Normally a mathematical function is fitted over the whole development of time series by Rhodes(1921) and Quennouille(1949) proceed by fitting of a polynomial to the fragments into which the series is divided.

Singh (2000) adopted a linear equation and moving averages to examine the trend as well as seasonal variation of arrivals and price of rapeseed-mustard in Haryana from 1985-86 to 1995-96.

Mehta (2000) analysed the seasonality in prices of groundnut and maize. The results showed linear trend in maize prices. The oscillatory movements affecting the prices are regular in period and amplitude. The long-term price behaviour is approximately linear and the cyclical trend is less pronounced.

Ravi Kumar (2001) resolved that, in general, arrivals revealed mixed trend, whereas, prices indicate an increasing trend for the selected commodities in Anakapalle regulated market of Andhra Pradesh. There exists an opposite association between seasonal indices of arrivals and prices of selected commodities.

Virender kumar (2005) studied the performance of market arrivals and prices of selected vegetable crops in four metropolitan markets of Delhi, Mumbai, Bangalore and Kolkata from 1990-2001. However, through different months, there have been several occurrences of positive relationship between arrivals and prices in all the four markets.

B. *Price Arrivals of Cumin and Fennel*

Awasthi (1985) studied the association between arrivals and prices of groundnut in three markets of western region of Madhya Pradesh and reported a positive relationship between prices and arrivals of the product during the study period.

Muniyandi (1985) in his study on pricing efficiency of groundnut marketing system in North Arcot district had observed two seasonal channels in price movements. He concluded that there was no definite relationship between arrivals and prices of groundnut and indicated that prices of groundnut increased without corresponding decrease in arrival of groundnut and vice versa.

Dinakar (1990) analysed the association between arrivals and prices of groundnut in three markets of Raichur district of Karnataka state. He calculated monthly index number of market arrivals and prices for the years 1979-80 to 1985-86. He observed Positive correlation between arrivals and prices. This discovered that arrival pattern may not influence the price and forces not taken into account in the analysis may determine the price.

Chitra (2000) studied the market arrivals and prices of groundnut in Challakere market for the period 1990-99 and observed that estimated trend in arrivals of groundnut was statistically non-significant, while prices of groundnut showed a steady increase, which was significant.

C. *Market Concentration*

Ravi kumar (2003) analysed the structural performance of groundnut in Anakapalle, Adoni and Warangal markets of Andhra Pradesh. The results revealed that there exists higher degree of competitiveness for groundnut in Adoni market and market concentration was low as the arrivals were distributed among more number of intermediaries.

D. *BOX-JENKINS Model and its Application*

A class of ARIMA (Auto Regressive Integrated Moving Average) model is called Box-Jenkins model. This model was popularised in late sixties. The application of these models for predicting prices of agricultural commodities is very few.

Kirby(1966) worked on three different time series methods viz, moving averages, exponential smoothing and regression method. It reveals that in terms of month-to-month forecasting accuracy, exponential smoothing method did best, with smoothing averages and exponential smoothing giving analogous results when the forecasting horizon was increased by six months.

Lijung and Box(1978) suggested an alternate test to the Box Pierce Q statistic on the grounds that the value of the Q statistic becomes inflated for large values of n.

V. RESEARCH METHODOLOGY

A brief description of the resources which provide the necessary data base for this study and to highlight the important statistical tools engaged in the analysis.

The methodology is presented under the following heads.

A. Description of the APMC Unjha
B. Nature and sources of data
C. Analytical tools and techniques applied

A. *Description of the APMC Unjha*

Unjha Market Yard is the Asia'a first biggest market for purchase and sale of Agricultural Commodities in Market area.

Arrivals of Agricultural Commodities in Unjha Market Yard is from 300 K.M. radius i.e. Mehsana Dist., Sabarkantha Dist., Banaskantha Dist., Saurashtra, Kutch and Rajasthan in the Market area to extend sale and purchase facilities.

The objective of Market Act. is to regulate the Market for protecting agriculturist sellers by cash and kind to launch modern Market Yard with essential amenities for producers and traders.

B. *Nature and Sources of Data*

The study was based on secondary data. The quantity of market arrivals of some specific commodities ending 2011-12 were collected from the Unjha's APMC. The commodities were grouped into different categories and based on the highest quantum of average arrivals of cumin and fennel were selected.

The time series data on monthly arrivals and price of cumin and fennel seeds are required for study were collected from the registers maintained at APMC. This market maintain data on daily, monthly and yearly arrivals and prices of agricultural commodities. The data on arrivals refer to the total arrivals during the month in quintals in a market place. The data on prices refer to modal prices in a month. Modal price is considered superior to the monthly average price as it represents the major proportion of the commodity marketed during the month in a particular market.

C. *Analytical tools and techniques*

Time series analysis is used to study the variations of arrivals and prices of cumin and fennel of APMC,Unjha. Monthly data of arrivals and prices were collected about 10 years for selected commodities for the purpose. A multiplicative model is used to determine the variation in the values due to trend, cyclical trend or any short term variations like seasonal or irregular. For trend, a long period of time about 10 years shows tendency to increase or decrease in the prices and arrivals of selected commodities, which may be due to growth of population, changes in their taste, technological advances in the agricultural field etc. The possible resons for Seasonal variations are customs, climates which can be analysed through harmonic analysis. Cyclical variations are long term variation depends upon business cycles. Effect of irregular variable is completely unpredictable and occurs in a random manner. A seasonal indices are calculated for monthly data.

The residuals after eliminating seasonal effects and cyclical effects from original observations trend is determined using mathematical model fitted by principle of least square.

Correlation co-efficient is obtained to measure the nature and magnitude of association between arrivals and prices of selected commodities of the market. Regression analysis is used to estimate price for a change occurs in the arrivals. Lorenz curve and gini concentration ratio is used to study

market concentration i.e. market commodities are competitive or not.

Box-Jenkins method is used to fit mixed auto regressive integrated moving average(ARIMA) for the data of arrivals and prices.

VI. RESULTS

In the present study, data collected on the arrivals and prices of cumin and fennel in the APMC, Unjha have been subject to various statistical methods. The result of such analysis is based on

A. Behaviour of arrivals and prices of cumin and fennel seeds
B. Relationship between arrivals and prices of cumin and fennel seeds
C. Forecasting of arrivals and prices

A. *Behaviour of Arrivals and prices of cumin and fennel.*

In order to determine the nature of trend movement in the arrivals of cumin crop in APMC, Unjha market, the data was fitted 6^{th} degree polynomial equation. The multiple co-efficient of determination(R^2) is obtained as 69%. The trend equation is in the form $Y=7.5069X_6+449.21X_5+9552.4X_4+92668X_3-432695X_2+6X-591437$

Where Y=Predicted value of trend at time X

X=Years, X=0,1,2,…,n

From the equation it was observed that the arrivals of fennel, shows and increasing trend over the years. Following is the graph of the trend in arrivals over the years:

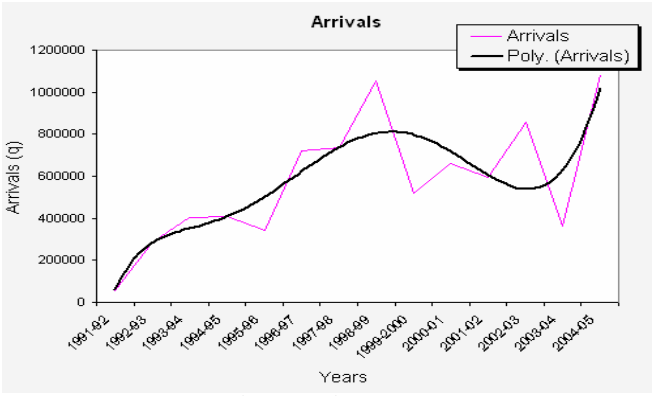

Fig.1 A graph of arrivals of agricultural commodity

Similarly, in order to determine the nature of trend movement in the prices of cumin crop in APMC, Unjha market, the data was fitted to 6^{th} degree polynomial equation. The multiple co-efficient of determination (R^2) is obtained as 83%. The trend equation was in the form of

$Y=0.0014X_6-0.3406X_5+14.65X_4-214.9X_3+1355.7X_2-3220.8X+5744.5$

Where Y=Predicted value of trend at time X

X=Years, X=0,1,2,…,n.

It could be seen from the above equation that the prices of fennel shows an increasing trend over the years. The graph of the prices over the years is as follows:

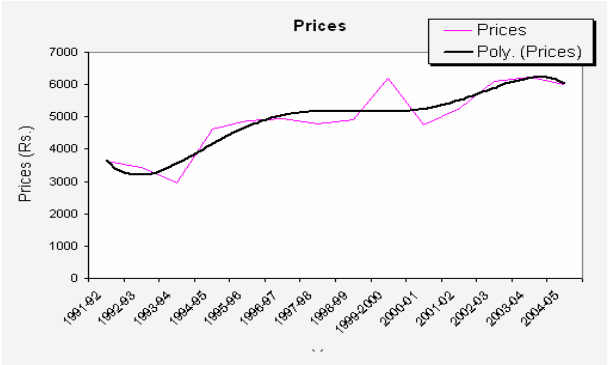

Fig.2 A graph of prices of agricultural commodity

Seasonal indices of cumin's arrivals and prices in the APMC, Unjha market are shown in the following table and graph.

TABLE I
SEASONAL INDICES OF MONTHLY ARRIVALS AND PRICES OF CUMIN

Month	Arrival	Prices
January	49.8	101.7
February	41.7	106.2
March	24.6	109.7
April	22.7	114.7
May	15.8	109.5
June	105.5	97.2
July	233.2	91.1
August	214	90.5
September	200.8	92.1
October	143.1	94.3
November	70.8	95.2
December	77.9	97.6

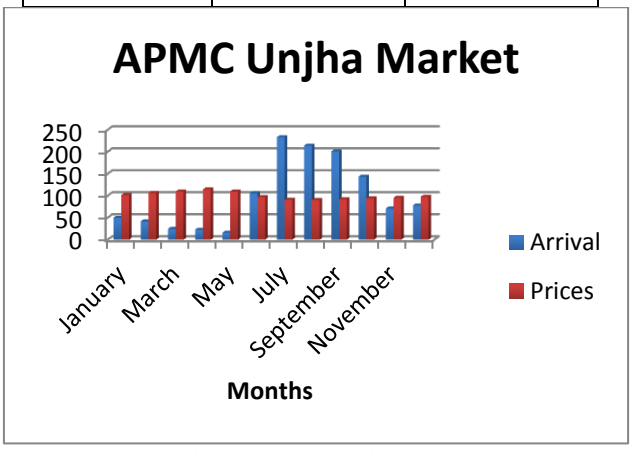

Fig.3 Bar graph of arrival and prices of agricultural commodity

B. *Relationship between arrivals and prices*

Correlation coefficients between arrivals and prices of cumin and fennel in APMC, Unjha were computed to ascertain the pattern of association between market arrivals and prices of cumin and fennel. Positive relationship is

noticed between arrivals and prices of cumin and a negative relationship is noticed between arrival and prices of fennel.

To ascertain the relationship between the arrivals and average prices of cumin and fennel regression analysis was done. Among the models tried viz., linear, quadratic, power, cubic, inverse, logarithmic, the logarithmic model was appropriate with higher multiple coefficient of determination (R^2).

C. *Forecasting of arrivals and prices*

Box-Jenkins model is used to the multiplicative time series model for forecasting. First of all tentative model is identified using Auto Correlation Function(ACF) and Partial Auto Correlation Function(PACF) for the different series. An examination of ACF and PACF shows presence of seasonality. The series was found to be stationary, while the co-efficient dropped to zero after the first and second lag. Each individual coefficient of ACF and PACF are tested for their significance using 't' test. Further, the absence of peak at first values clearly indicate suitability of the choice of non-seasonal difference d=1, to accomplish stationarity series. Hence, based on ACF and PACF many models were tried, finally model (1,1,1) (2,1,1) was tentatively identified for arrivals and price times of maize in selected markets.

VII. POLICY IMPLICATION

The implications based on the findings of the present study are as follows.

1. The seasonal indices of arrivals indicated the heavy arrivals of cumin during April-June in APMC. Whereas in case of fennel, heavy arrivals were noticed during July to September. So the Agricultural Produce Market Committee (APMC's) should come forward to provide necessary storage facilities and other infrastructural facilities in order to avoid market surplus and price.

2. The impact of market arrivals on prices has been found to be negative. In the light of such finding if fluctuations in market arrivals are regulated through market extension, the risk of fluctuations in price would be minimized.

3. The forecasted value of arrivals indicated the higher arrivals in the coming years. Therefore, the APMC need to plan for providing necessary infrastructural facilities to handle the situation.

4. There is a need to establish a few processing units to create value addition to the selected commodities. These would help the farmers to get better income on the one hand and reducing price fluctuation on the other hand.

VIII. CONCLUSION

Agricultural marketing plays a significant role in the movement of commodity from the

producer to the consumer and in stabilizing prices. The planned increase in agricultural output must be coordinated with changes in the demand and supply for agricultural commodities and marketing. This can be fruitful only when producer's share in consumer's rupee increases considerably irrespective of the volume of the marketable surplus produced with the farmers. Therefore, marketing rightly considered as much as essential input in addition to improved seed and fertilizer in modern agriculture.

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