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ONION PRICE FORECASTING IN YEOLA MARKET OF WESTERN MAHARASHTRA USING ARIMA TECHNIQUE

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ABSTRACT
The present study is an attempt to forecast the prices of onion at Yeola market of Western Maharashtra, as being a primary market the arrivals of Onion were found to be maximum in this market. The time series data on monthly price of onion required for the study was collected from the registers maintained in the Yeola APMC from year 2004 to 2013. The ARIMA model forecasted prices revealed an increase in the prices of onion in the future years and also demand for onion. Hence, farmers need to plan the production process in such a way that good price for the produce could be expected. ARIMA model is an extrapolation method that requires only historical time series data on the variable under study. The Box-Jenkins model provides a verified approach for identifying and filtering most appropriate variations for the series being analyzed, for diagnosing the accuracy and the reliability of the models that have been estimated and lastly, for forecasting the price. Similar model was used by Almemaychu Amera (2002), Punitha (2007) and Jalikatti and Patil (2015) to forecast the prices and arrivals of agricultural commodities and drawn conclusions.

KEYWORDS: Akike Information Coefficient, Auto-Correlation Function, Swarz Information Coefficient.

INTRODUCTION

Auto Regressive Integrated Moving Average (ARIMA) models are extensively used to study market fluctuations particularly of agricultural commodities. The main advantage of this class of models lies in its ability to quantify random variations present in any economic time series. Hence the data on prices of onion in the selected markets were subjected to ARIMA analysis to quantify the variation and also to predict the future prices of onion. Since ARIMA model used only stationary series, there was also a need to change the non-stationary series into stationary series by applying appropriate order of differencing to the series. Thereafter, the autocorrelation and partial autocorrelation coefficients of the working series were computed and confirmed the absence of trend component in the series. An examination of such tables revealed that this is justified by the autocorrelation function of the series dropping to zero after second or third lag. The present study is an attempt to study the forecasting of prices of onion at Yeola market of Western Maharashtra.

MATERIALS & METHODS

The Yeola regulated market is one of the most important and primary market in Western Maharashtra. The Yeola market was chosen for the present study as it is one of the largest markets for arrivals of onion in Western Maharashtra. The time series data on monthly price of onion required for the study was collected from the registers maintained in the Yeola APMC from the year 2004 to 2013. This market maintains data on daily, monthly and yearly prices of agricultural commodities. The data on prices refers to modal prices in a month. Modal price was considered superior to the monthly average price as it represented the major proportion of the commodity marketed during the month in a particular market. A mixed Auto Regressive Integrated Moving Average (ARIMA) model developed by Box and Jenkins (1976) was employed for analysis of the data, which involved selection of appropriate model, estimation of parameters, diagnostic checking and finally forecasting the prices.

RESULTS & DISCUSSION

Identification of the model was concerned with deciding the appropriate values of (p,d,q) (P,D,Q). It was done by observing Auto Correlation Function (ACF) and Partial Auto Correlation Function (PACF) values. The Auto Correlation Function helps in choosing the appropriate values for ordering of moving average terms (MA) and Partial Auto-Correlation Function for those autoregressive terms (AR). The number of non-zero coefficients in ACF determines order of MA terms and the number of non-zero coefficients in PACF plots determines order of AR terms. Based on the Akike Information Coefficient and Swarz Baysian Criteria, the model (1,1,3) was found to fit the series suitably. The results of these coefficients are given in Table 1. ARIMA model was estimated after transforming the variables under study into stationary series through computation of either seasonal or non-seasonal or both, order of differencing. The attainment of stationary series could be through computation of auto-correlation and partial autocorrelation functions which are provided in the Table 2. A careful examination of ACF and PACF upto 20 lags revealed the presence of seasonality in the data. However, the series was found to be stationary, since the coefficient dropped to zero after the second lag. Each individual coefficient of ACF and

PACF were tested for their significance using‘t’ test. Further, the absence of peak at first values clearly indicated suitability of the choice of non-seasonal difference d=1 to function, accomplish stationary series. Hence based on ACF and PACF many models were tested. Finally model (1, 1, 3) was identified as the best model for forecasting of prices of onion in Yeola market.

Having tentatively identified the model, next the parameters which minimize the sum of squares of error were estimated through iteration process. The parameters of the tentatively identified model were estimated and are presented in the Table 3. The standard error values of MA1.1 were significant and the other values were non-significant. Here the standard error of seasonal and non seasonal autoregressive both at first lag and second lag were non-significant, whereas the standard error of moving average were statistically significant. The estimated models were then subjected to diagnostic checking to validate the adequacy of the estimated model prior to carrying out forecasting. The residual of estimated models were examined for testing the randomness of series and analyzed to determine the adequacy. Model verification is concerned with checking of the residuals of the model to see if they contain any systematic pattern, which can still be removed to improve the chosen ARIMA model. Seasonality was found and the forecast consideration was best. The residual of the estimated models was random in all cases since none of the coefficients were significantly different from zero which also supported by the non-significance of Box-Pierce ‘Q’ statistics. These entire joint statistics approved that, all the tentatively identified and estimated models were appropriate for forecasting the onion prices of the selected market. Manasa (2010) arrived at similar conclusions regarding validation of ARIMA modeling in her study on the pigeon pea price. The values of these statistics are shown in Table 1.

TABLE 1: Residual analysis of monthly prices of onion in Yeola market of Western Maharashtra

Sr. No.	Market	Model	Akaike Information Coefficient (AIC)	Bayesian Information Criterion (BIC)
1	Yeola	(1,1,3)	1721.57	1735.46

The model (1,1,3) was found to be the best model for prices in Yeola market, since the statistic of AIC and Q statistics was found to be non-significant. The principal objective of ARIMA model for a variable is to generate post sample period forecast for the variable price. Both Ex-ante and Ex-post forecasting were done and it was compared with actual values of observations. The forecasting was done upto Dec, 2015. The results of ex-ante and ex-post forecast of prices of onion in the market are shown in the Table 4. The forecasts depicted in Fig. 2 indicate that there are narrow variations in between the actual and forecasted values of prices of onion in the Yeola market and the forecasted values of prices showed an increasing trend in the future months. . The prices of onion in the market during 2014 will be high i.e. Rs. 1807 per q and low i.e. 1061 per q during the month of January and December respectively. In 2015 the prices will be high in the month August i.e. Rs. 1982/q and low during the month of September i.e. Rs. 1009/q.

Thus, from foregoing discussion, it is clearly noted that, such forecasting of future onion prices can help the farmers to decide the area allocation for onion and marketing. Besides this, the farmers can also take the decision of marketing of stored onion immediately or after some months. The limitations of the ARIMA model is that it require a long time series data. Just like any other method, this technique also does not guarantee perfect forecasts. Nevertheless, the model is handy have been successfully used for forecasting in the future.

Similar model was used by Almemaychu Amera (2002), Punitha (2007) and Jalikatti and Patil (2015) to forecast the prices and arrivals of agricultural commodities and drawn conclusions. ARIMA model is an extrapolation method that requires only the historical time series data on the variable under study. The ARIMA model forecasted prices revealed an increase in the prices of onion in the future years and also demand for the crop. Hence, increase in the area of production of onion and their sale in the suitable markets can be planned suitably.

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