Autoregressive Integrated Moving Average Models for Inflation and Exchange Rates in India

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ARIMA model

Autoregressive integrated moving average (ARIMA) model was advanced by Box and Jenkins (hence also known as Box-Jenkins' model) in 1960s for forecasting a variable. Its appropriate use requires long time series data. Box and Jenkins introduced the concept of seasonal non-seasonal (S-NS) ARIMA models for describing a seasonal time series and also provided an iterative procedure for developing such models. The general functional form of ARIMA model is expressed as ARIMA(p,d,q)(P,D,Q)^s , which is condensed as

$$\phi_P(B)\, \phi^*_P(B^s)\, (1-B)^d\, (1-B^s)^D\, X_t = \theta q\, (B)\, \theta^*_Q\, (B^s)\, e_t$$

where X = Variable under forecasting

B = lag operator

e = error term (X-X^, where X^ is the estimated value of X)

t = time subscript

$\phi p(B)$ = non-seasonal AR

$\phi^*_P(B^s)$ = seasonal AR

$(1-B)^d$ = non-seasonal difference

$(1-B^s)^D$ = seasonal difference

$\theta_q(B)$ = non-seasonal MA

$\theta^*_Q(B^s)$ = seasonal MA

ϕ' s, ϕ^*' s, θ' s, θ^*' s are parameters to be estimated. ARIMA method is an extrapolation method for forecasting and, like any other such method, it requires only the historical time series data on the variable under forecasting.

The models fitted in case of Domestic Inflation Rate and Exchange Rate are ARIMA (1,1,0) and ARIMA(1,1,1)respectively, which are elaborated as ;

$(1-\phi_1 B)(1-B)X_t = e_t$ & $(1-\phi_1 B)(1-B)X_t = (1-\theta_1 B)e_t$

$X_t - (1+\phi_1)X_{t-1} + \phi_1 X_{t-2} = e_t$ $X_t - (1+\phi_1)X_{t-1} + \phi_1 X_{t-2} = e_t - \theta_1 e_{t-1}$

$X_t = (1+\phi_1)X_{t-1} - \phi_1 X_{t-2} + e_t$ $X_t = (1+\phi_1)X_{t-1} - \phi_1 X_{t-2} - \theta_1 e_{t-1} + e_t$

Here B is lag operator i.e $B(X_t) = X_{t-1}$, $B^2(X_t) = X_{t-2}$ etc.

The lagged values of X variable indicates the presence of only autoregressive component.

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RESUME

An attempt to develop ARIMA models for making inflation and exchange rate forecasts has been made in this study. Proper care has been taken for the nonstationarity present in the data and there is no seasonal effect in the original series. Computer Software SPSS has been used for estimating the parameters of the models considered. Adequacy of the fitted model have also been checked using Ljung and Box test-statistic based on all the residual autocorrelations.