Forecasting the Inflation in Pakistan; The Box-Jenkins Approach

Nadia Iftikhar and Iftikhar-ul-Amin
Institute of Management Sciences, Peshawar, Pakistan

Abstract: The purpose of the study was the forecasting of inflation using the Box Jenkins approach. The data set of yearly CPI covered the period of 1961-2012. The most appropriate model was found to be ARIMA (1, 1,1). The model was used to forecast the inflation rate for the year 2013 which was estimated at 8.83%.

Key words: Box- Jenkins approach • ARIMA models • CPI • Forecasting • Inflation rate

INTRODUCTION

The growth and development of the economy in the dynamic settings of today are largely dependent on effective and timely policy making. This in turn requires a thorough monitoring of the trends emerging amongst different macroeconomic variables. This objective is very easily achieved through observing the time series data for different variables and then making forecasts on the basis of this data. The rationale behind forecasting is the need for a system to adapt to changes. The system might involve a business entity, an educational unit or even the political or economic systems of a country. The use of more accurate forecasts has grown with the increase in the complexity of our environments. Historical data has been analyzed using techniques like the moving averages, exponential smoothing and weighting, regression, state space and structural models and ARIMA models. However, time series data are difficult to handle and require complicated statistical and econometrics based procedures to model.

Therefore, the application of Box-Jenkins largely remains popular, specifically in the macroeconomic and monetary policy studies where it is used to forecast for a variety of macroeconomic indicators. One such indicator being the Consumer Price Index used as a proxy for inflation in the economy. The focus of this study also remains on forecasting the CPI inflation for Pakistan on short term basis by applying the Box Jenkins approach to the best forecasting model selection.

Box-Jenkins procedure-A Literature Review: The publication of the book by [1] heralded a new era in the field of forecasting. The methodology proposed by them altered the time series by making it stationary with the help of differences between data points. This allowed the model to pick out trends, typically using auto-regression, moving averages and seasonal differencing in the calculations. The decade saw extensive use of the method in diverse fields of study. Box-Jenkins was employed for forecasting accounting earnings and financial time series [3-5]. The methodology was used in sociological research by forecasting the impacts of employment policies [6]. It also found its use in operations management (Thomson and Tiao, 1971) as well as monetary economics [7]. Marketing research also saw the Box-Jenkins methodology as an available forecasting tool [8] as well as a superior methodology compared to the other available alternatives [9]. More recently the methodology has been used in political research by looking at the US presidents’ choices of issues being more liberal or conservative [10], sociological research where it explained the role of social integration in the changing suicide rates [11], the forecasting of US mortality [12] as well as the prediction of international tourism demand [13].

Many authors have demonstrated the superiority of the Box-Jenkins Procedure for forecasting, thereby considering it a structured and systematic forecasting methodology [3]. On the contrary, some researchers also consider it to be time consuming, requiring expertise and skill to produce an acceptable model [14] as well as expensive and complex [15]. However, as [16] puts it, a
balance needs to be drawn between the requirements of cost conflicting with accuracy in the decision to use the technique or not. Secondly, once experience is acquired on the application of the model, the chances of a successful forecast increases whereas no amount of experience can help in the application of fully automatic techniques to inappropriate situations.

**Forecasting Inflation:** The integral focus of any monetary policy is considered to be the maintenance and stability of a lower aggregate price inflation as defined by different measures like consumer price index (CPI), wholesale price index (WPI), sensitive price index (SPI) etc. however, the CPI remains as the popular measure encompassing the cost of living of the common man. The forecasting of inflation using the Box-Jenkins methodology has been the subject of many studies in the past.

[17] forecasted the Irish Inflation using the ARIMA Models by drawing up a comparison between the Box Jenkins Approach and the objective penalty function methods. [18] claimed that simple ARIMA model had robust forecast performance in the analysis of the Unite States inflation. [19] also suggested that the AR model had best forecast performance among several different versions of model.

[20] used the box jenkins methodology to forecast inflation in Nigeria with the help of data from 1961-2010. They found ARIMA (1,1,1) to be the most adequate model for forecasting inflation and the forecasted figure for 2011 was 16.27%. In Pakistan, [21] made a comparison between regression based approaches and Arima models. They found that estimates obtained by using ARIMA model are closer to the actual values of the variable. [22] also used Box Jenkins methodology to forecast the inflation in Pakistan on a short term basis.

**MATERIALS AND METHODS**

In Pakistan, there are four different types of price indices that are published. However, the focus of many remains on CPI as it represents the diverse group of households and their cost of living. In Pakistan also, the main focus is placed on CPI as it is used as benchmark in fixation of many wages and is more relevant in measuring inflation. This study also uses CPI as an indicator of Inflation. The data set for the yearly inflation rates has been obtained from the country database of the World Bank\(^1\). Many authors recommend a moderately long time series for the effective fitting of Box Jenkins models, however, following [23], who recommended at least 50 observations, this study takes the inflation rate from 1961-2012.

ARIMA model being a generalization of the ARMA model is used for forecasting by the application of the Box-Jenkins approach.

The Box-Jenkins methodology consists of five steps that help to identify, select and assess different conditional mean models [24]. The step by step process is given as follows;

- The time series is checked for stationarity and if non stationarity is observed, the series has to be differenced in order to establish the stationarity of the time series. The sample autocorrelation function (ACF) and partial autocorrelation function (PACF) of stationary series decay exponentially (or cut off completely after a few lags).
- A conditional mean model has to be selected for the data. The sample ACF and PACF functions could be helpful in this regard with the autoregressive (AR) process having the sample ACF decaying gradually, but the sample PACF cutting off after a few lags. Conversely, for a moving average (MA) process, the sample ACF cuts off after a few lags, but the sample PACF decays gradually. If both the ACF and PACF decay gradually, consider an ARMA model.
- The appropriate model is specified and the model parameters are estimated
- Certain goodness-of-fit checks are run so as to ensure the model describes the data adequately. Residuals should be uncorrelated, homoscedastic and normally distributed with constant mean and variance.
- The selected model could be used to forecast or generate Monte Carlo simulations over a future time horizon.

The same steps have been followed for this study and the results reported in the following section.

**RESULTS**

The data was checked for stationarity using the Augmented Dicky Fuller test and the results confirmed the stationarity but nevertheless, using the first difference of the inflation rate returned a better model and thus, the differenced series was used. The results for the different AR and MA models are given in Table 1 with the best model being ARIMA (1,1,1) with the least AIC.
CONCLUSION

This study was undertaken to forecast the inflation rate in Pakistan using ARIMA model by applying the Box Jenkins approach. After checking for the stationarity of the data series through ADF, the appropriate ARIMA (p, d, q) process. The corresponding correlogram helped in choosing the appropriate p and q for the data series. An ARIMA (1,1,1) model was generated through the Akaike Information Criterion (AIC). Using the ARIMA (1,1,1) model, the inflation rate for 2013 was forecasted to be 8.83%

REFERENCES


