Performance Assessment of SARIMA Model with Holt-Winter's Trend and Additive Seasonality Smoothing Method on forecasting Electricity Production of Australia an Empirical Study

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Abstract

Australia is a leading developed country which is indispensable a proper planning and management of power generation. To take a unique planning decision forecasting of electricity production is badly in need so that electricity generation copes with the demand of the electricity smoothly. The main task of this study is to assess the performance of two time series models in forecasting electricity generation in Australia. Two time series forecasting methods such as ARIMA and Holt-Winter?s additive trend and seasonality smoothing methods are considered. Applying Theil?s U-statistic as the key performance measure, the study concludes that Holtwinter?s method is more appropriate model.

Index terms— electricity production, seasonal ARIMA, smoothing, forecasting, time series analysis.

1 Introduction

t present electricity has become a first and foremost precondition of macroeconomic development of a territory. Each day, electricity plays key rolein keeping homes and business running smoothly, powers transportation that take people work, school and other places, and supplies electricity to appliances in all sectors. The demand of electricity especially in for industrial sector need not to say. Without electricity not only a single day but also a moment is unimaginable. A country's economic growth directly related to electricity production. That's why sustainable electricity production badly in needs to fulfill the demand of households as well as industry and communication sectors. To manage such kind of demand of electricity a country's power development board has to take sophisticated decision to produce electricity that can cope with demand with supply of energy.

Being a developed country monthly electricity production of Australia is a seasonal and trending behavior. So, electricity production authority of Australia should take plan for proper management of production with demand. To overcome uncertainty of future production smoothing or forecasting approach time series analysis is the most applied method. For predicting Australian electricity production, we will use conventional smoothing methods and well known ARIMA modeling. Hence we want to show the comparative performance of referred model. This paper is divided into six sections. The section one of this study is the introductory part. The second section of the study will present forecasting approach where we present stationarity, Holt's-Winter trend and additive seasonality, Box-Jenkins methodology SARIMA modeling and accuracy measurement approach. Section three is the empirical data analysis and forecasting while sections four is the accuracy measurement and finally conclusion Basic Terminologies: The following keywords are used throughout the research approach.

Stationarity: Stationarity means that there is no growth or decline in the data. The data must be horizontal along the axis. A time series is said to be stationary if its mean and variance are constant over time and the value of the covariance between the two time periods depends only on the distance or gap or lag between the two

time periods and not the actual time is computed. Suppose t y be a stochastic time series then, ( )( ) ( ) 2 2 var t t t E y y E y μ μ ? = = ? =

Holt's-Winter's trend and additive seasonality method The basic equations of Holt-Winters' trend and additive seasonality method are as follows:Level ?? ?? = ??(?? ?? ? ?? ?????) + (1 ? ??)(?? ???1 + ?? ???1) Trend: ?? ?? = ??(?? ?? ? ?? ???1) + (1 ? ??)?? ???1 Seasonal: ?? ?? = ??(?? ?? ? ?? ??) + (1 ? ??)?? ????? Forecast: ?? ??+?? = ?? ?? + ?? ?? ?? + ?? ?????+??

Where s is the length of seasonality (e.g., number of months or quarters in a year), ?? ?? represents the level of the series, ?? ?? denotes the trend, ?? ?? is the seasonal component, and ?? ??+?? is the forecast for m period ahead. ?????? = 1 ?? ? ???? ?? ?? ??=1

Mean Absolute Percentage Error:???????? = 1 ?? ?|???? ?? | ?? ??=1

If smaller the any above index is considered the better forecasting technique.

Theil's U Statistic: It is defined as follows:?? = ? ? (?????? ??+1 ? ?????? ??+1) 2 ???1 ??=1 ? (?????? ??+1) 2 ???1 ??=1

Where ?????? ??+1 = If ?? < 1: the forecasting technique being used is better than the naïve method. The smaller the U statistic is considered the better forecasting technique.

2 II. Empirical Results

Now, it is revealed to us that the above figure of monthly Australian electricity production exhibits an additive seasonal and steadily increasing trend pattern. Obviously the data series is non-stationary.

Before model building first and foremost task is to differentiate the original data first difference as well as seasonal first difference.

Obviously, first difference of original time series data is now of stationary.

The model SARIMA (0, 1, 1) (0, 1, 2) [12] We may say from the above accuracy measurement table that the performance of SARIMA (0, 1, 1) (0, 1, 2) [12]

3 Conclusion

The main goal of this paper was the performance assessment between seasonal ARIMA modeling with Holt-Winters' exponential smoothing approach. The empirical analysis revealed that SARIMA (0, 1, 1) (0, 1, 2) [12] were the better model than counterpart 1. Anderson, T.W. **??**1994)

4 References Références Referencias

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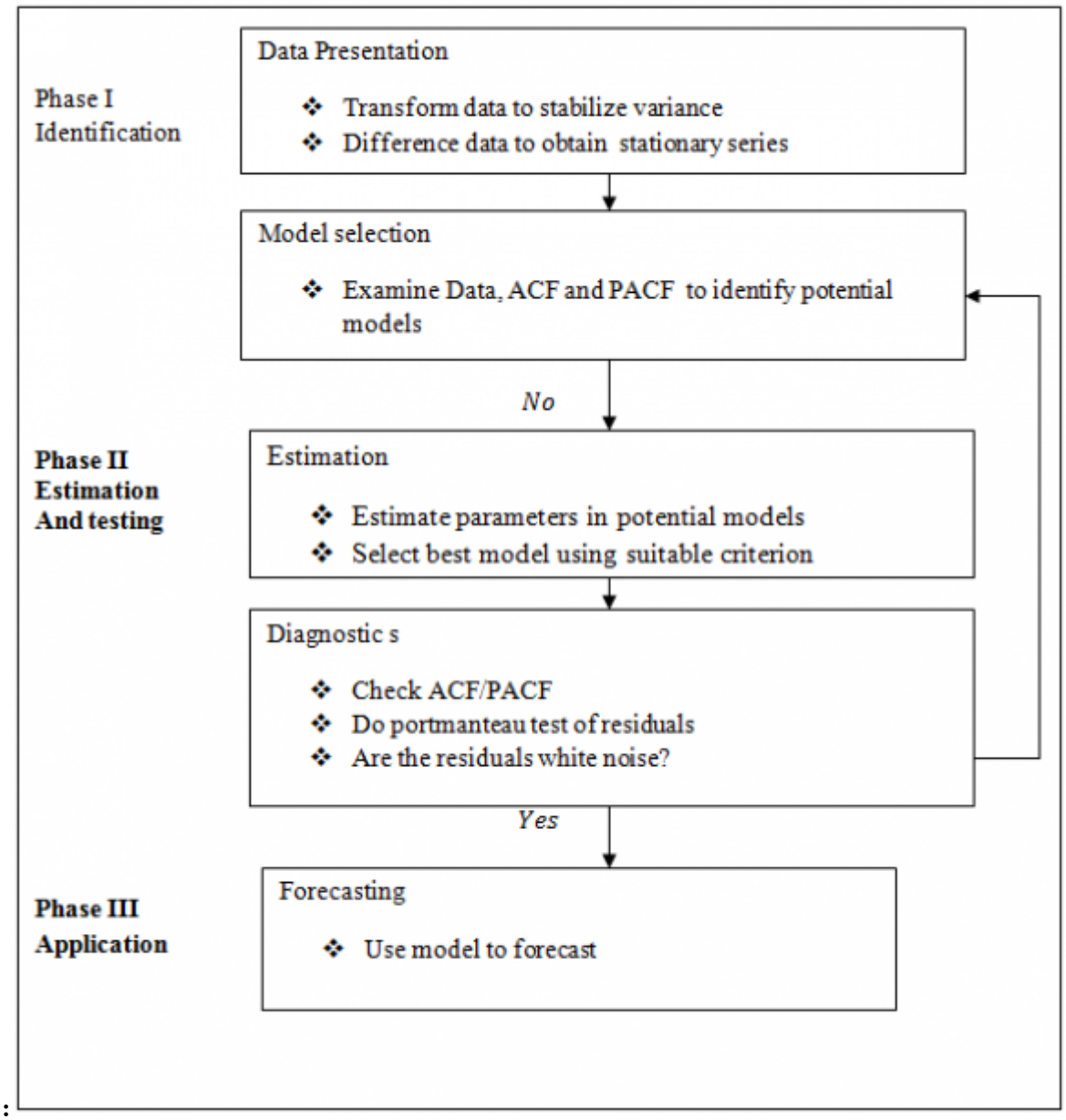
Figure 1: 8 2016 JFigure 1 . 1 :



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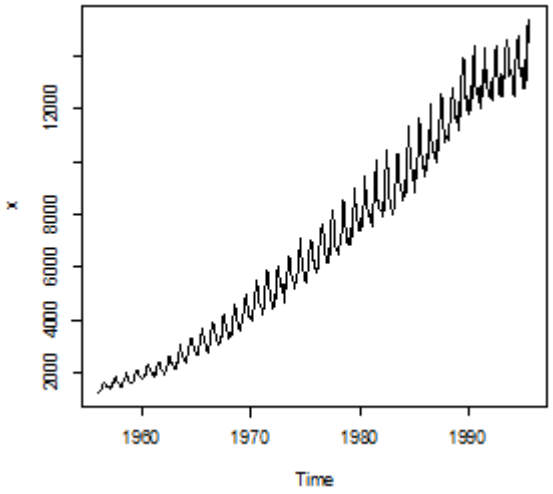

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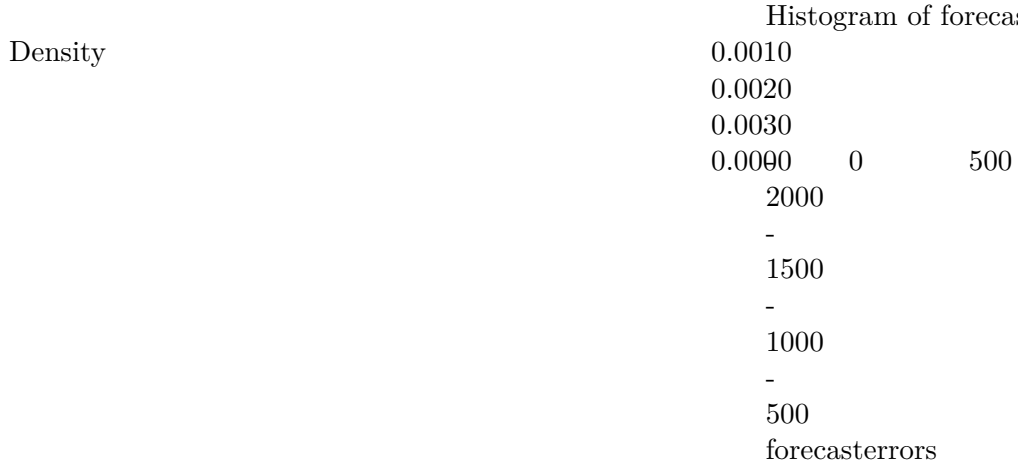

model is better than Holt's-Winter Now, we want to represent the histogram of the respective method sequentially method.

Comment: On the basis of above two histogram of forecast error, it is revealed tha

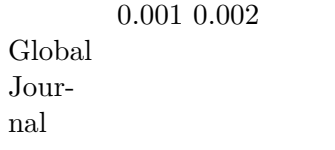

Figure 4:

Figure 5:

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