ETW3420

Principles of Forecasting and Applications

Topic 6 Exercises - Part 3

Question 1

This question will follow the ARIMA procedure on Slide 82 of your lecture notes.

Consider `austourists`, the quarterly number of international visitors to Australia for the period 1999–2009.

(a) Describe the time plot. Is the variance and mean stationary?

```
autoplot(austourists)
```

(b) Apply a Box-Cox transformation and note the value of lambda.

```
lambda <- BoxCox.lambda(austourists)
lambda
```

(c) Plot the ACF and PACF of the logged data series. What can we learn from these graphs?

```
austourists %>% log() %>% ggtsdisplay()
```

(d) Produce plots of the seasonally differenced data $(1 - B^4)lnY_t$. Test if a further first difference is needed. What ARIMA models do these graphs suggest?

```
#Plot of seasonally differenced data
austourists %>% log() %>% diff(lag = 4) %>% ggtsdisplay()
```

```
#OR ggtsdisplay(diff(log(austourists),lag = 4))


#Test if a further first difference is needed
austourists %>% log() %>% diff(lag = 4) %>% ndiffs()
```

(e) Estimate your identified models and perform residual diagnostic checks. If they do not look like white noise, try a modified model.

(f) Does `auto.arima()` give the same model that you chose? On the basis of the AICc, which model do you think is better?

```
auto.arima(austourists, lambda = 0)
```

(g) Write the best fitted model in terms of backshift operator, then without using the backshift operator. Also plot the forecasts using the best-fitted model.

Case Study: Tourist Arrivals in Post-Tsunami Japan

Students are to complete this question in pairs.

Background:

On March 11, 2011, a 9.0 magnitude earthquake, better known as the Great East Japan Earthquake (GEJE) struck Tohoku, Japan. It was the deadliest and largest in the country's history. This was followed by a 40 metre high tsunami which devastated three reactors of Fukushima Daiichi nuclear power plant resulting in high radiation leakage into the sea, soil and air. Unprecedented fear was rife amongst the locals as well as international tourists that such leakage would affect the whole ecosystem.

Subsequent to this triple disaster are:

- The harmful impact from the radiation leakage adding complication to the challenge of disaster management for both earthquake and tsunami despite Japan being renowned

for its leadership in disaster management.

- Tourism is one of the top six income generating industries in Japan (MLIT, 2012). It is the most impacted by the disaster.

Research Problem and gap

- Japan is renowned for disaster management leadership. Given the unique case of GEJE-triple disaster challenge (earthquake, tsunami, nuclear radiation leakage), Japan has successfully developed different disaster management strategies to recover its tourism industry. This success with practical lessons has not been studied.

Research Objectives

- To investigate the extent to which the Japanese government's efforts in disaster management and promotion strategies of Japan tourism attract international tourists (tourist arrival statistics).

Data

- Monthly tourist arrivals from Jan 1996 to Oct 2015

Tasks

- Plot the time series of the monthly tourist arrivals and consider whether the variance and mean need to be stabilized.

- Set the training set to be from Jan 1996 to Dec 2008; and the test set from Jan 2009 to Feb 2011.

- Also create 2 additional data sets:

```
    * Pre-disaster to be from Jan 1996 to Feb 2011

    *  Post-disaster to be from Mar 2011 to Oct 2015
```

- Using the training set data, use the ARIMA process to determine the best model for forecasting, based on the forecasting accuracy for the test set data.

- Using your selected model, re-estimate the whole model using the predisaster data set from January 1996 to February 2011, and produce forecasts for the post-tsunami period, March 2011 to October 2015.

- Did the actual tourist arrivals exceed the forecasts during this post-tsunami period? If so, when did it happen? What can you conclude about the effectiveness of Japan's tourist promotion strategies?

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