Neil Yejjey Financial Time Series Project

Step 1

Importing dataset into R

Graphical user interface, application

Description automatically generated

98 observations, two variables imported into R, variable 1 is mydata$date variable 2 is mydata$z

Scatterplot and mydata naming code: A picture containing graphical user interface

Description automatically generated

Chart, scatter chart

Description automatically generated

Step 2

Tell R the data that is in the time series data with ts() function

Text

Description automatically generated

Graphical user interface, text, application

Description automatically generated

Plotting ts()



Chart, line chart

Description automatically generated

Step 3 determine if data is stationary or not using informal methods

Based on the above graph, informal method #1 of inspecting the plot does not give a definite answer of whether the data is stationary or not

Informal method #2, inspecting the ACF

ACF Function to draw graph:



Chart

Description automatically generated

ACF is gradually declining, and not all equal to 1, therefore the data can be stationary.

Step 4 : determine if the data is stationary or not using formal methods (unit root test)

Install and activate URCA package to conduct ADF test

Text

Description automatically generated with medium confidence

Text

Description automatically generated

Based on the ADF root test, the BIC determines that the model has 1 lag 𝜏 = -0.33651 . the T statistic of 𝜏 is less than the those critical values meaning the alternative hypothesis is true where 𝜏 is negative and data is stationary.

Step 5 : fit the stationary data into the appropriate univariate time series model

Acf graph:

A picture containing icon

Description automatically generated

Chart

Description automatically generated

PACF graph:



Chart

Description automatically generated

As shown in the graphs, ACF decays gradually and PACF cuts off at lag 1, so the model should be the AR(1) 𝑦𝑡 =𝜙0 +𝜙1𝑦𝑡−1 +𝑢𝑡

Step 6 : Formally estimate the parameters of AR(1) model, 𝜙0 and 𝜙1

Use arima() function to fit to an ARIMA(k,d,q) model

Graphical user interface, text, application

Description automatically generated with medium confidence

First, 𝜙1 = 0.6588

Mean is = 19.6842, R makes a mistake where it wrongly displays the mean as 𝜙0

Using coefficient function to find true value of 𝜙0 :

Graphical user interface, text, application

Description automatically generated

The 6.716494 is the correct value for the AR(1) intercept 𝜙0

𝜙0 = 6.716494

The AR(1) model is estimated as following :

𝑦𝑡 =𝜙0 +𝜙1𝑦𝑡−1 +𝑢𝑡

𝑦𝑡 =6.716494 +0.6588𝑦𝑡−1 +𝑢𝑡

Step 7 : check to see if the fitted model is adequate

Method 1 : check the ACF of the residual ut:

Table

Description automatically generated

Chart

Description automatically generated

Method 2 : Use Lyjung-Box testtA picture containing text

Description automatically generated

The P-value is 0.9668 which is greaten 5%, meaning the null hypothesis is true and that the fitted AR(1) Model is adequate

Step 8 : Conduct point forecast for the future 8 months

Graphical user interface, text

Description automatically generated

R prediction function predicts that the future price in march is 20.19925 and the future price in April is 20.02351

Using theoretical formula to calculate the prediction:

H1 1 step ahead point forecast calculation:

Text

Description automatically generated with medium confidence

Forecasted result in February is exactly the same as that of the prediction function

H2 2 step ahead point forecast calculation:

A picture containing logo

Description automatically generated

The forecasted result of April price is exactly the same as the prediction function.

Step 9 : Conduct Interval Forecast

Install and activate forecast package



Text

Description automatically generated