STA30005 week 11 tutorial: part 1

Learning outcomes:

1. Generate stationary AR and MA processes.
2. Generate Random Walk, Random Walk with drift, and Trend stationary processes.
3. Differentiate between Random Walk and Trend stationary series.
4. Differentiate between global and stochastic trends.
5. Interpret ACF and PACF plots of the stationary/nonstationary series.
6. Apply ADF test to the level and first difference of the data.
7. Create the return series.

Task 1:
1. Generate stationary AR(1) processes with ϕ_1 (1) 0.2; (2) 0.6; and (3) 09. Compare the line graph and ACFs.
2. Generate stationary MA(1) processes with θ_1 (1) 0.2; (2) 0.6; and (3) -0.6. Compare the line graphs and ACFs.

Task 2:
1. Generate Random Walk, Random Walk with drift, and Trend stationary processes. Compare their line graphs and ACFs.
2. Create the first difference of the series above and discuss their line graphs and ACFs.

Task 3:
1. Apply ADF test to (1) Random Walk, (1) Random Walk with drift, and (3) Trend stationary processes. Write down the hypothesis testing steps.
2. Apply ADF test to the first differences of the above series. Write down the hypothesis testing steps.

Task 4:
1. Download USD/ Euro exchange rate* from oanda.com. Plot the data series and discuss if data is stationary.
2. Generate the first difference. Plot the data series and discuss if the first difference is stationary.
3. Split the data into the training set (about 80% of observations) and test set (the remaining 20%).
4. Plot both ACF and PACF for the training set and find an appropriate model using suggestions on slide 59.
5. Does auto.arima give the same model you have chosen in part (4)?
6. If your results in part (4) and (5) are different fit both models and compare the results based on information criteria. Select the model with the lowest AIC and BIC values.
7. Plot the ACF of residuals. Are they random (White Noise)?
8. Apply the models that pass the residual test to the test data and compare the accuracy measures (MAE, RMSE, MASE, MAPE). Which model is the best and why?

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*The list of symbols can be found:
https://oanda.secure.force.com/AnswersSupport?urlName=Currency-ISOCodes&language=en_US

Task 5:

1. Download the most recent Dow Jones Industrial Average index from https://au.finance.yahoo.com/world-indices starting from 2016-09-11. Plot the data series and discuss if data is stationary.
2. Generate return series. Plot the data series and discuss if the return series is stationary.
3. Split the data into the training set (about 80% of observations) and test set (the remaining 20%).
4. Plot both ACF and PACF for the training set. You will find that suggestions on slide 59 are not always helpful.
5. use auto.arima to choose an appropriate model?
6. Fit a few alternative models and compare the results based on information criteria. Select the model with the lowest AIC and BIC values.
7. Plot the ACF of residuals. Are they random (White Noise)?
8. Apply the models that pass the residual test to the test data and compare the accuracy measures (MAE, RMSE, MASE, MAPE). Which model is the best and why?

STA30005 week 11 tutorial: part 2

Learning outcomes:

Apply ARMA modelling techniques for model building and forecasting.

Task 1:
1. Download Aluminium Alloy Price LME/PR_AA.1 from Quandl.com. Plot the data series and discuss if data is stationary.
2. Generate the first difference. Plot the data series and discuss if the first difference is stationary.
3. Conduct ADF test for both the level and the first difference of Aluminium Alloy Price.
4. Split the data into the training set (about 80% of observations) and test set (the remaining 20%).
5. Plot both ACF and PACF for the training set and find an appropriate model using suggestions on slide 101.
6. Does auto.arima give the same model you have chosen in part (4)?
7. If your results in part (4) and (5) are different fit both models and compare the results based on information criteria. Select the model with the lowest AIC and BIC values.
8. Plot the ACF of residuals. Are they random (White Noise)?
9. Apply the models that pass the residual test to the test data and compare the accuracy measures (MAE, RMSE, MASE, MAPE). Which model is the best and why?

Task 2:

1. Download OMX Stockholm Mid Cap Index NASDAQOMX/OMXSMCGI.1 (which captures the current status and changes in the Stockholm Mid Cap market). Plot the data series and discuss if data is stationary.
2. Generate return series. Plot the data series and discuss if the return series is stationary.
3. Conduct ADF test for both the level and the return of Stockholm Mid Cap Index.
4. Split the data into the training set (about 80% of observations) and test set (the remaining 20%).
5. Plot both ACF and PACF for the training set. You will find that suggestions on slide 101 are not always helpful.
6. Use auto.arima to choose an appropriate model?
7. Fit a few alternative models and compare the results based on information criteria. Select the model with the lowest AIC and BIC values.
8. Plot the ACF of residuals. Are they random (White Noise)?
9. Apply the models that pass the residual test to the test data and compare the accuracy measures (MAE, RMSE, MASE, MAPE). Which model is the best and why?