

LAB EXERCISES 3, March 24, 2023

We'll work with different data files for this lab. The files are available on the blackboard page.

1. Fitting a standard ARMA model

- (a) Generate 500 realizations from the following the ARMA(1,1) process:

$$Y_t = 100 + 0.5Y_{t-1} - 0.8\epsilon_{t-1} + \epsilon_t$$

where ϵ_t are normally distributed with mean zero.

- (b) Plot the data, the ACF and the PACF.
- (c) Fit an AR(1) model to the data. Perform one-step ahead predictions and find the in-sample MSE, MAE and MAPE. Check the AIC.
- (d) Fit an MA(1) model to the data. Perform one-step ahead predictions and find the in-sample MSE, MAE and MAPE. Check the AIC.
- (e) Fit an ARMA(1,1) model to the data. Perform one-step ahead predictions and find the in-sample MSE, MAE and MAPE. Check the AIC. Plot the in-sample predictions against the observations. Plot also the residual analysis.

2. Fitting a non-standard ARMA model

- (a) Generate 500 realizations from the following the MA process:

$$Y_t = 100 - 0.8\epsilon_{t-2} + \epsilon_t$$

where ϵ_t are normally distributed with mean zero. Note that this is not a standard MA(2) process since the coefficient at lag 1 is zero.

- (b) Fit an MA(2) model with an only non-zero coefficient at lag 2. Perform one-step ahead predictions and find the in-sample MSE, MAE and MAPE. Check the AIC.
- (c) Fit an MA model with a non-zero coefficient at lag 2. Perform one-step ahead predictions and find the in-sample MSE, MAE and MAPE. Check the AIC.. Check the AIC.

3. Australian beer production

- (a) Download the Australian Beer Production data from the file.
- (b) Recall that the data is seasonal. Fit a SARIMA(0,0,0)(0,1,0,12) model (what does this correspond to?). Perform one-step ahead predictions and find the in-sample MSE, MAE and MAPE. Check the AIC. Check the AIC.
- (c) Fit a SARIMA(1,0,0)(0,1,0,12) model. Perform one-step ahead predictions and find the in-sample MSE, MAE and MAPE. Check the AIC. Check the AIC.
- (d) Use the data upto month 40 to make multiple month ahead predictions starting from month 41 onwards.
- (e) Plot the data, the one-step ahead predictions and the multi-step ahead predictions from month 41 onwards.
- (f) Obtain 95% prediction intervals around the one-step ahead predictions from the model. Plot the data, the predictions and the prediction intervals.

4. Dishwasher Sales

- (a) Download the Dishwasher Sales data from the file.
- (b) Perform the necessary transformations and check the ACF and PACF after the transformations.
- (c) Fit an appropriate SARIMA model to the first 200 months of data (this constitutes the training data). Perform one-step ahead predictions and find the in-sample MSE, MAE and MAPE. Check the AIC.
- (d) Test the error performance of the fitted model based on the training data, on the test data. Perform one-step ahead predictions and find the in-sample MSE, MAE and MAPE for the test data. How does error performance change between training and test sets.