Assignment 2

STAT317/ECON323

Due 5pm Tuesday, 14 September 2021

A reminder that graphs help in interpretation and explanation and you are expected to present them properly.

1 Question 1 – 9 Marks

a Using one of the time series options from assignment #1 – you can use the same one or a different one – do the decomposition of the time series using the `stl` command. Comment on the the three components.

b Using `stl` command specify `t.window = 5`. How are your graphical outputs different? Why (hint: what does `t.window` option do)?

c Using the same command as for **part a.** do the decomposition of the logged series using the `stl` command. Comment on the the three components. Are the shape or characteristics – the values of course will be different – of any of the three components different from those from the previous decomposition? Or do they look similar? Explain why a component differs or remains the similar.

d From the two decompositions would you model the whole series or just part? Justify you conclusions.

2 Question 2 – 16 Marks

Using the same time series you are asked to do a time series regression. You can use either the `lm()` function or the `tslm()` function from the `forecast` package (recommended).

a Fit the simple regression model $y_t = \beta_0 + \beta_1 t + \epsilon_t$, $t = 1, \ldots, N$ to this data. From your outputs write the fitted model $y_t = \hat{\beta}_0 + \hat{\beta}_1 t + \epsilon_t$ with values for the parameters and residuals.

b Using various graphical displays of the residuals (e.g. time series, ACF, Normal Distribution) show and explain why the residuals are what you would expect from a fitted time series model.

c Fit the regression model $y_t = \beta_0 + \beta_1 t + \sum_{j=1}^{11} \delta_j D_{jt} + \epsilon_t$, where D_{jt} is the estimate for seasonal dummy for months $j = 1, 2, \ldots, 11$. Again from your outputs write the fitted model $y_t = \hat{\beta}_0 + \hat{\beta}_1 t + \sum_{j=1}^{11} \delta_j \hat{D}_{jt} + \epsilon_t$.

d What is your estimate for $\hat{D}_{12t}$? Show your working.

e Compare the graphs of residuals from this model to those from the previous model. What are the differences, if any, and explain why this is so?

f Fit the regression model $\log(y_t) = \beta_0 + \beta_1 t + \sum_{j=1}^{11} \delta_j D_{jt} + \epsilon_t$, where D_{jt} is the seasonal dummy for months $j = 1, 2, \ldots, 11$. Again from your outputs write the fitted model $\log(y_t) = \hat{\beta}_0 + \hat{\beta}_1 t + \sum_{j=1}^{11} \delta_j \hat{D}_{jt} + \epsilon_t$ along with your estimate for $\hat{D}_{12t}$.

g Compare the residuals from this model to those from the previous two models. What are the differences, if any, and explain why this is so?