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STAT 5100

Spring 2022

Homework #7

Exercise 1

a) The p-value for the simple linear regression for the effect of price on rating is <0.0001. Yes, the effect is significant at the a = 0.05 significance level.

b) The residuals are fairly well centered around the 0 mean. They also have a fairly random pattern and constant variance with the exception of one spike around 14 months and a dip at around 90 months. Apart from those two points, the error points appear to be independent (uncorrelated).

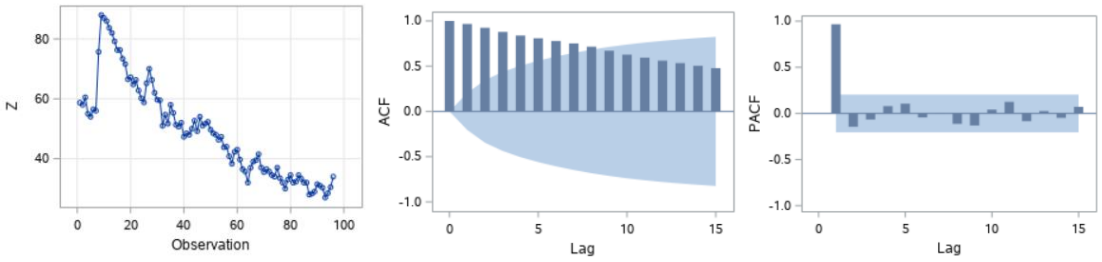
Exercise 2

a) The positive autocorrelation p-value is equal to <0.0001.

b) Based on this p-value, the conclusion is to reject the null hypothesis that the residuals are uncorrelated. There is evidence that the residuals are autocorrelated. This is contrary to the conclusion made in exercise 1 part b.

Exercise 3

a)



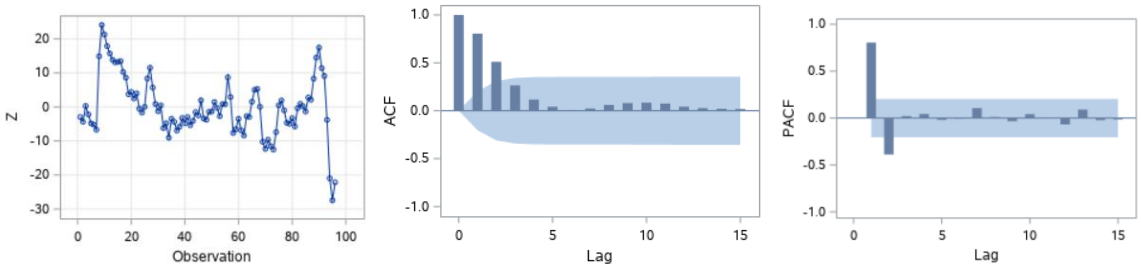
b) Based on the SACF graph, the die-down looks roughly linear, this indicates maybe not-stationarity. However, the SPACF graph clearly cuts off after the first lag. This indicates stationarity. A transformation may be required based on the SACF graph.

c) The lag-6 P-value for “Autocorrelation Check for White Noise” for Z is <0.0001. This is strong evidence that there is dependency among observations.

d) The SACF and SPACF graphs are not yet good indicators of the dependence structure. This is because the SACF graph dying off linearly may indicate the need for a transformation. This should be applied first.

Exercise 4

a)



b) There is good evidence for stationarity in Z after the transformation. The SACF graph shows a quick die down in steady fashion, indicating stationarity. The SPACF graph shows a cut off after the second lag which is also good evidence for stationarity.

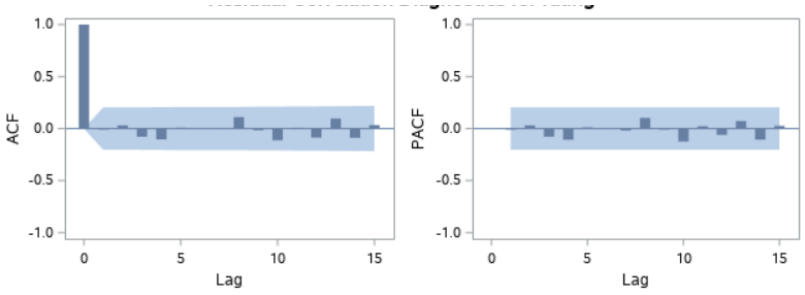
c) The lag-6 P-value for “Autocorrelation Check for White Noise” for Z is <0.0001. This is strong evidence that there is some dependency among observations.

d) Especially based on the SPACF graph, there is good evidence for an AR(2) model dependency. The oscillation and two lag die down is indicative of AR(2).

e)

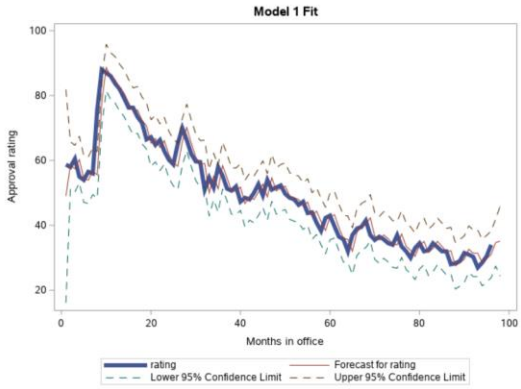
i. The p-value for parameter AR 1, 1 is <0.0001. The p-value for parameter AR 1, 2 is 0.2135. The first parameter p-value shows significance of being able to predict the data.

ii. The autocorrelation check of residuals is now 0.7778 or higher for all lag amounts. This is good evidence that the residuals are no longer autocorrelated and the model is capturing the time dependence well. Another way to say it, is that there is no more information to extract. The autocorrelation check for white noise p-values are both <0.0001. This is evidence that there is some dependency among observations.



iii. The RASC plot shows a quick cut-off die down which indicates stationarity. Similarly, the RPASC plot shows good evidence for stationarity.

f) The forecast plot of rating vs. months in office through March 2009 for Model 1, with 95% confidence bounds, shown below. This graph shows good agreement between the predictions and the actual rating. It appears that rating only exits the 95% confidence for a short period around the 10 months spike. This is acceptable. The model appears to be a good fit for the data.



g) The p-value for the variable price is now 0.4745. This shows that the effect of price on rating is rating is not significant for an a =0.05 significance level. The lag values are what are significant.

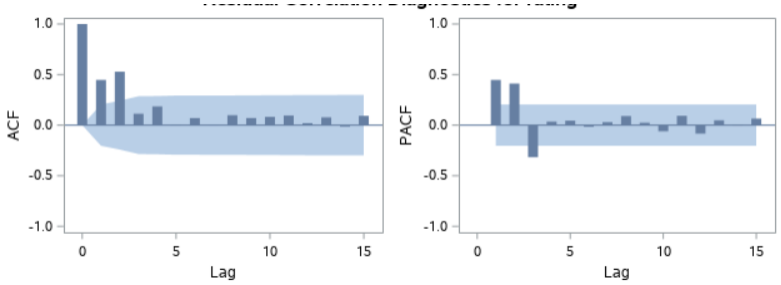
Exercise 5

Yes, there is a significant relationship between monthly average gas prices and rating. However, the relationship depends on a lag between the prices and rating. So even though the effect of price of that specific month, is not significant, as shown in exercise 4, part g; the rating does depend on the time lag of price. Thus, the rating does depend on monthly average gas prices.

Exercise 6

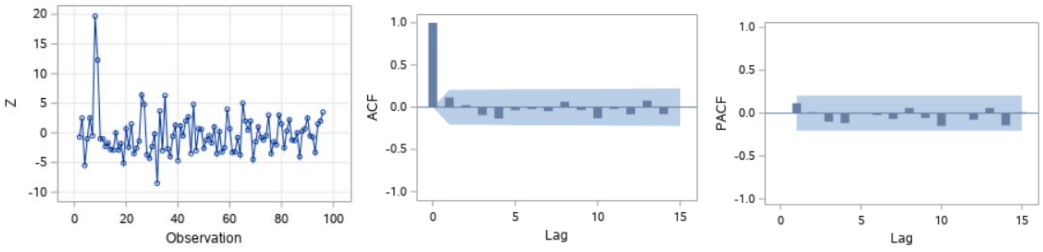
a) P-value for the MA model parameter is <0.0001. This shows that the parameter is significant at predicting the data.

b) For the autocorrelation check for residuals, all of the lag amount p-values are <0.0001. This shows that there is still some autocorrelation present, and the model is perhaps not fully capturing the time dependence.

c) 

The RSAC plot does not die down in a smooth fashion. Similarly, the RSPAC plot does not die down until after the 3rd lag. These indicate possible issues with stationarity.

Exercise 7

a) 

b) The Z vs time graph shows constant variance and is centered on the 0 mean. The SACF graph shows a quick cutoff die down which indicates stationarity. The SPACF graph also shows no high values, which indicates stationarity.

c) The lag-6 P-value for "Autocorrelation Check for White Noise" for Z is 0.6412. This indicates that there is not dependency among the observations.

d) The differencing procedure appears to remove the dependence among the observations. Or rather handles it.