Stat 6021: Homework Set 11

1. The data set "mcgill.txt" contains the seasonally adjusted quarterly sales for the McGill Company (response variable, first column, in million dollars) and for the entire industry (predictor, second column, in million dollars).

   (a) Explain why fitting a simple linear regression model with autocorrelated errors is a better choice than a simple linear regression model with i.i.d. errors for this data set.

   (b) Use the Cochrane-Orcutt method to fit a simple linear regression model with AR(1) errors.

      i. Report the estimated autocorrelation at lag 1 for the errors.

      ii. Write out the model with the estimated values of the coefficients.

      iii. Assess if the regression model assumptions are met.

      iv. Are the seasonally adjusted quarterly sales for the McGill Company significantly linearly related to the seasonally adjusted quarterly sales for the entire industry? Be sure to state the hypothesis statements, test statistic, and p-value, as well as an appropriate conclusion in context.

2. Show how to apply the Cochrane-Orcutt method to a multiple linear regression model with AR(1) errors, i.e. what kind of transformations to the variables need to be made. Show how you derived your answer.

3. Consider a applying the Cochrane Orcutt method, but now to a simple linear regression with AR(2) errors, where $\epsilon_t = \phi_1 \epsilon_{t-1} + \phi_2 \epsilon_{t-2} + a_t$.

   (a) Show how the Cochrane-Orcutt method should be applied, i.e. what kind of transformations to the variables need to be made. Show how you derived your answer.

   (b) What do you think are the transformations to the variables for a simple linear regression model with AR(p) errors, where p is a positive integer. You do not have to show how you arrived at your answer.

   Hint: For questions 2 and 3, the derivation from the textbook page 482, equation (14.7) will be helpful. Please note the typo in the last line of (14.7), ϵ_t should be a_t.

4. Submit your group's code and estimated test MSE from guided question set 11.

5. Please remember to complete the Module 11 Guided Question Set Participation Self- and Peer-Evaluation Questions via Test & Quizzes on Collab.