Assignment 4: Selected solutions

December 3, 2021

- Problem 1 (see R file, part (b) and (c) we use default confidence level $\alpha = 0.05$):
  - (a) Yes, according the residual versus index plot.
  - (b) $d = \frac{\sum_{t=2}^{n}(e_t - e_{t-1})^2}{\sum_{t=1}^{n} e_t^2} = 0.194536 < d_L(29, 1) = 1.34$, hence we reject H_0 and the autocorrelation is statistically significant using Durbin-Waston test.
  - (c) According to the residual versus index plot, we have # of runs= 5 with $n_1 = 19$ and $n_2 = 10$, hence |runs test statistic| $= 3.825054 > z_{1-\alpha/2} = 1.96$. Hence we reject H_0 and the autocorrelation is statistically significant using runs test.
  - (d) After Cochrane and Orcutt procedure for one iteration, the D-W test statistic $d_{new} = 0.8017476 < d_L(28, 1) = 1.33$, still reject H_0. The correlation still exists, we might try more iterations or look for alternative methods (using runs test is also acceptable).
- Problem 2: Omitted. You can either use P_{t-1} or S_{t-1} as a predictor. In either case, the collinearity has been eliminated.
- Problem 3: See R file
  - (a) A reasonable choice of bias parameter might range from 0.1 to 0.3.
  - (b) One iteration is good enough, which is equivalent to the fixed point method. We have $k_1 = \frac{p\hat{\sigma}^2(0)}{\sum_{j=1}^{p}[\hat{\theta}_j(0)]^2} = 0.2356$
- Problem 4: (part (a,b,c) omitted.)
  - (d) The final model is $Y = \beta_0 + \beta_1 X_1 + \varepsilon$