EE 325
Practice V

Students must submit question 1-2 to receive HW credits. Due date: Dec 9, 2019 by email. (Please convert to pdf file before you submit)

1. From the annual data from the U.S. manufacturing sector for 1899-1922, Dougherty obtained the following regression results:

$$\widehat{\log Y_t} = 2.81 - 0.53 \log K + 0.91 \log L + 0.047t$$
$$\text{se} = (1.38) \quad (0.34) \qquad (0.14) \quad (0.021)$$
$$R^2 = 0.97 \;\; F = 189.8 \tag{1}$$

Where Y = index of real output
K = index of real capital input
L = index of real labor input
t = time or trend

Using the same data, he also obtained the following regression:

$$\widehat{\log\left(\frac{Y}{L}\right)} = -0.11 + 0.11 \log\left(\frac{K}{L}\right) + 0.006t$$
$$\text{se} = \qquad (0.03) \quad (0.15) \qquad (0.006)$$
$$R^2 = 0.65 \;\; F = 19.5 \tag{2}$$

a. Is there multicollinearity in regression (1)? How do you know?
b. How would you justify the functional form of regression (1)? (Hint: Cobb-Douglas production function)
c. Interpret regression (1).
d. What is the logic behind estimating regression (2)?
e. If there was multicollinearity in regression (1), has that been reduced by regression (2)? How do you know?
f. If regression (2) is a restricted version of regression (1), what restriction is imposed by the author? (Hint: returns to scale.) How do you know if this restriction is valid? What test do you use? Show all your calculations.
g. Are the R^2 values of the two regressions comparable? Why or why not? How would you make them comparable, if they are not comparable in the present form?

2. For pedagogic purposes Hanushek and Jackson estimate the following model:

$$C_t = \beta_1 + \beta_2 GNP_t + \beta_3 D_t + u_t \qquad (1)$$

Where $C_t =$ aggregate private consumption expenditure in year t
$GNP_t =$ GNP in year t
$D_t =$ national defense expenditures in year t
The objective of the analysis being to study the effect of defense expenditure on other expenditures in the economy.

Postulating that $\sigma_t^2 = \sigma^2 (GNP_t)^2$, they transform (1) and estimate

$$C_t/GNP_t = \beta_1\,(1/GNP_t) + \beta_2 + \beta_3\,(D_t/GNP_t) + (u_t/GNP_t) \qquad (2)$$

The empirical results based on the data for 1946-1975 were as follows (standard errors in the parentheses):

$$\widehat{C_t} = 26.19 + 0.6248\,GNP_t - 0.4398 D_t$$
$$(2.73) \qquad (0.0060) \quad (0.0736)$$
$$R^2 = 0.999$$

$$\widehat{C_t/GNP_t} = 25.92\,(1/GNP_t) + 0.6246 - 0.4315\,(D_t/GNP_t)$$
$$(2.22) \qquad (0.0068) \quad (0.0597)$$
$$R^2 = 0.875$$

a. What assumption is made by the authors about the nature of heteroscedasticity? Can you justify it?
b. Compare the results of the two regressions. Has the transformation of the original model improved the results, that is, reduced the estimated standard errors? Why or why not?
c. Can you compare the two R^2 values? Why or why not?