Problem Set 4

(Submit through the Hub by 12pm November 9th)

1. Use the data in meap00_01.RData to answer this question. The original source of this data set is Michigan Department of Education (`www.michigan.gov/mde`).

   (a) Estimate the model

   $$math4 = \beta_0 + \beta_1 lunch + \beta_2 \log(enroll) + \beta_3 \log(exppp) + u$$

   by OLS and obtain the usual standard errors and the robust standard errors. How do they generally compare?

   (b) Apply the White test for heteroskedasticity. What is the value of the F test? What do you conclude?

   (c) Obtain $\hat{g}_i$ as the fitted values from the regression $\log(\hat{u}_i^2)$ on $\widehat{math4}_i$, $\widehat{math4}_i^2$, where $\widehat{math4}_i$ are the OLS fitted values and the $\hat{u}_i$ are the OLS residuals. Let $\hat{h}_i = \exp(\hat{g}_i)$. Use the $\hat{h}_i$ to obtain WLS estimates. Are there big differences with the OLS coefficients?

   (d) Obtain the standard errors for WLS that allow misspecification of the variance function. Do these differ much from the usual WLS standard errors?

   (e) For estimating the effect of spending on $math4$, does OLS or WLS appear to be more precise?

2. Use the data from jtrain.RData for this exercise.

   (a) Consider the simple regression model

   $$\log(scrap) = \beta_0 + \beta_1 grant + u,$$

   where $scrap$ is the firm scrap rate and $grant$ is a dummy variable indicating whether a firm received a job training grant. Can you think of some reasons why the unobserved factors in u might be correlated with $grant$?

   (b) Estimate the simple regression model using the data for 1988. (You should have 54 observations.) Does receiving a job training grant significantly lower a firm's scrap rate?

   (c) Now, add as an explanatory variable $\log(scrap_{87})$. How does this change the estimated effect of $grant$? Interpret the coefficient on $grant$. Is it statistically significant at the 5% level against the one-sided alternative $H_1 : \beta_{grant} < 0$?

   (d) Test the null hypothesis that the parameter on $\log(scrap_{87})$ is one against the two-sided alternative. Report the p-value for the test.

   (e) Repeat parts (c) and (d), using heteroskedasticity-robust standard errors, and briefly discuss any notable differences.

Important: Please also submit the relevant portions of your log file (delete errant commands and output).