Economics 471: Econometrics

Department of Economics, Finance and Legal Studies
University of Alabama

Problem Set #7

1. Consider a linear model to explain monthly beer consumption:

$$beer = \alpha + \beta_1 inc + \beta_2 price + \beta_3 educ + \beta_4 female + u$$

Assume that

$$\begin{aligned} E\left(u \mid inc, price, educ, female\right) &= 0 \\ V\left(u \mid inc, price, educ, female\right) &= \sigma^2 inc^2 \end{aligned}$$

Write the transformed equation that has a homoskedastic error term.

2. Using the data in GPA3.RAW, the following equation can be estimated for the fall and second semester students

$$\begin{aligned} \widehat{trmgpa} &= -2.12 + 0.900 crsgpa + 0.193 cumgpa + 0.0014 tothrs + 0.0018 sat - 0.0039 hsperc \\ &\quad + 0.351 female - 0.157 season \end{aligned}$$

where *trmgpa* is term GPA, *crsgpa* is a weighted average of overall GPA in courses taken, *cumgpa* is GPA prior to the current semester, *tothers* is total credit hours prior to the semester, *sat* is SAT score, *hsperc* is graduating percentile in high school class, $female$ is a gender dummy, and *season* is a dummy variable equal to unity if the student's sport is in season during the fall. The usual and heteroskedasticity-robust standard errors are reported in parentheses and brackets, respectively.

   (a) Replicate the results both with and without robust standard errors.

   (b) Do the variables *crsgpa*, *cumgpa*, and *tothrs* have the expected estimated effects? Which of these variables are statistically significant at the 5% level? Does it matter which standard errors are used?

   (c) Why does the hypothesis $H_0 : \beta_{crsgpa} = 1$ make sense? Test this hypothesis against the two-sided alternative at the 5% level, using both types of standard errors. Describe your conclusions.

   (d) Test whether there is an in-season effect on term GPA, using both standard errors. Does the significance level at which the null can be rejected depend on the standard error used?

3. Using the data in GPA1.RAW, consider the following equation:

$$colGPA = \alpha + \beta_1 hsGPA + \beta_2 ACT + \beta_3 skipped + \beta_4 PC + u$$

where *colGPA* is college GPA, *hsGPA* is high school GPA, *ACT* is the ACT score, *skipped* is the average lectures missed per week and *PC* is a dummy variable if the student has a personal computer.

(a) Use OLS to estimate the model. Obtain the OLS residuals.

(b) Compute the special case of the White test for heteroskedasticity. In the regression of $\widehat{u}_i^2$ on $\widehat{colGPA}_i$ and $\widehat{colGPA}_i^2$, obtain the fitted values, say $\widehat{h}_i$.

(c) Verify that the fitted values from part (b) are strictly positive. Then, obtain the weighted least squares estimates using the weights $1/\widehat{h}_i$.