

# Questions and Exercises - Tutorial #8

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## Heteroskedasticity (Wooldridge, p.268)

**8.1** Which of the following are consequences of heteroskedasticity?

- (i) The OLS estimators,  $\hat{\beta}_j$ , are inconsistent.
- (ii) The usual  $F$  statistic no longer has an  $F$  distribution.
- (iii) The OLS estimators are no longer BLUE.

**8.2** Consider a linear model to explain monthly beer consumption:

$$beer = \beta_0 + \beta_1 inc + \beta_2 price + \beta_3 educ + \beta_4 female + u$$

$$E(u|inc, price, educ, female) = 0$$

$$Var(u|inc, price, educ, female) = \sigma^2 inc^2.$$

Write the transformed equation that has a homoskedastic error term.

**8.3** True or False: WLS is preferred to OLS, when an important variable has been omitted from the model.

**8.4** Using the data in GPA3.RAW, the following equation was estimated for the fall and second semester students:

$$\begin{aligned} trmgpa = & -2.12 + .900 crsgpa + .193 cumgpa + .0014 tothrs \\ & (.55) \quad (.175) \quad (.064) \quad (.0012) \\ & [.55] \quad [.166] \quad [.074] \quad [.0012] \end{aligned}$$

$$\begin{aligned} + .0018 sat - .0039 hspcr + .351 female - .157 season \\ & (.0002) \quad (.0018) \quad (.085) \quad (.098) \\ & [.0002] \quad [.0019] \quad [.079] \quad [.080] \end{aligned}$$

$$n = 269, R^2 = .465.$$

Here, *trmgpa* is term GPA, *crsgpa* is a weighted average of overall GPA in courses taken, *tothrs* 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.

- (i) 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?
- (ii) 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 standard errors. Describe your conclusions.
- (iii) 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?