Introductory Econometrics
Tutorial 9

PART A: This homework is a review of dummy variables and heteroskedasticity. After reviewing Week 7 and 8 lecture slides and studying chapter 7 and 8 of the textbook, attempt Week 9 Part A quiz on Moodle. You need to submit the quiz before your tutorial and attend the tutorial to obtain 1 point for Week 9 participation.

Part B: This part will be covered in the tutorial. It is still a good idea to attempt these questions before the tutorial.

1. The workfile profits.wf1 includes data on profits and assets of 88 firms (some firms having missing data). The variables in the data set are $profits$ and $assets$, which are each firm's profit and assets in million dollars, and mno, which is a dummy variable which is equal to 1 if the CEO of the firm is not the owner of the firm, and is zero otherwise. Our objective is to test the hypothesis that the relationship between profits and assets is the same for owner-managed and non-owner-managed firms. The general model is:

$$profits_i = \beta_0 + \delta_0 mno_i + \beta_1 assets_i + \delta_1 (mno_i \times assets_i) + u_i \tag{1}$$

   (a) Formulate the null hypothesis that the nature of ownership of the firm (i.e. whether the firm is managed by its owner or not) does not effect the relationship between profits and assets in a firm and the alternative that it does.

   (b) Estimate the model using OLS and test whether the errors are homoskedastic using the following tests (in each case, answer the question as if this was a question on the final exam, i.e. write down the null and the alternative, the test statistic and its distribution under the null, the auxiliary regression you should estimate to compute the test statistic, then compute the test statistic and compare it with the critical value you get from statistical tables):

      i. Breusch-Pagan test when the alternative hypothesis is $Var(u_i \mid mno_i, assets_i) = \alpha_0 + \alpha_1 mno_i + \alpha_2 assets_i$

      ii. White test

      iii. The special form of the White test that uses the predicted value of $profits$ and its square as predictors of variance.

   (c) Is it likely that a log-log formulation that uses $\log(profits)$ and $\log(assets)$ would solve the heteroskedasticity problem in this application? Explain.

   (d) In each of the following scenarios, determine the appropriate weight that solves the problem of heteroskedasticity when it multiplies both sides of equation (1):

      i. $Var(u_i \mid mno_i, assets_i) = \sigma^2 \times assets_i$

      ii. $Var(u_i \mid mno_i, assets_i) = \sigma^2 \times assets_i^2$

      iii. $Var(u_i \mid mno_i, assets_i) = \sigma^2 \log(assets_i)$