Problem Set 8
Econometrics 410
Prof. Taber
Due: Thurs April 28

Problem 1. Wooldridge 7.8

Problem 2. Wooldridge C7.7

Problem 3. Suppose that you want to look at how a student's test score varies with whether their father went to college or not and their race. Assume race is either african american, hispanic, or other and that these are mutually exclusive. Define the Dummy variables

$$FC_i = \begin{cases} 1 & \text{Father went to college} \\ 0 & \text{otherwise.} \end{cases}$$

$$A_i = \begin{cases} 1 & \text{Person is african american} \\ 0 & \text{otherwise.} \end{cases}$$

$$H_i = \begin{cases} 1 & \text{Person is hispanic} \\ 0 & \text{otherwise.} \end{cases}$$

$$O_i = \begin{cases} 1 & \text{Person is neither african american nor hispanic} \\ 0 & \text{otherwise.} \end{cases}$$

Let S_i represent the test scores and think of the following regression models

$$E(S_i \mid \text{Race, Fath Ed}) = \alpha_0 + \alpha_1 FC_i + \alpha_2 A_i + \alpha_3 H_i + \alpha_4 (A_i \times FC_i) + \alpha_5 (H_i \times FC_i)$$
$$E(S_i \mid \text{Race, Fath Ed}) = \beta_0 + \beta_1 A_i + \beta_2 H_i + \beta_3 (A_i \times FC_i) + \beta_4 (H_i \times FC_i) + \beta_5 (O_i \times FC_i)$$
$$E(S_i \mid \text{Race, Fath Ed}) = \gamma_1 A_i + \gamma_2 H_i + \gamma_3 O_i + \gamma_4 FC_i + \gamma_5 (A_i \times FC_i) + \gamma_6 (H_i \times FC_i)$$

Please interpret all of the parameters in terms of the underlying conditional probabilities as in class. That is explain what they mean in terms of conditional expectations of schooling conditional on the qualitative variables.

Problem 4. Consider the model

$$Y_i = \beta_0 + \beta_1 w_{1i} + \beta_2 w_{2i} + \beta_3 x_{3i} + \beta_3 x_{4i} + u_i$$

Assume that

$$E(u_i \mid z_{1i}) = 0$$
$$E(u_i \mid z_{2i}) = 0$$
$$E(u_i \mid x_{3i}) = 0$$
$$E(u_i \mid x_{4i}) = 0$$

Explain how to estimate this model by Instrumental Variables. That is there are 5 parameters. Come up with 5 equations depending on the data and the 4 unknown parameter estimates. You do not have to solve for the parameters, just write down the 5 equations you would use.

Problem 5. Suppose that

$$y_i = \beta_0 + \beta_1 x_i + u_i$$

and that for some variable z_i,

$$cov(z_i, u_i) = 0.$$

What is

$$\frac{cov(z_i, y_i)}{cov(z_i, x_i)}?$$

Problem 6. Wooldridge 15.7

Problem 7. Wooldridge C15.8 (i)-(iii) Then also do (v) but don't worry about "heteroskedasticity-robust standard errors."