Econometrics 710
Midterm Exam
March 11, 2010

1. An economist friend tells you that the assumption that the observations $(y_i, \boldsymbol{x}_i)$ are iid implies that the regression $y_i = \boldsymbol{x}_i'\boldsymbol{\beta} + e_i$ is homoskedastic. Do you agree with your friend? How would you explain your position?

2. You estimate a least-squares regression

$$y_i = \boldsymbol{x}_{1i}'\tilde{\boldsymbol{\beta}}_1 + \tilde{u}_i$$

and then regress the residuals on another set of regressors

$$\tilde{u}_i = \boldsymbol{x}_{2i}'\tilde{\boldsymbol{\beta}}_2 + \tilde{e}_i$$

Does this second regression give you the same estimated coefficients as from estimation of a least-squares regression on both set of regressors?

$$y_i = \boldsymbol{x}_{1i}'\hat{\boldsymbol{\beta}}_1 + \boldsymbol{x}_{2i}'\hat{\boldsymbol{\beta}}_2 + \hat{e}_i$$

In other words, is it true that $\tilde{\boldsymbol{\beta}}_2 = \hat{\boldsymbol{\beta}}_2$? Explain your reasoning.

3. Out of an iid sample $(y_i, \boldsymbol{x}_i)$ of size n, you randomly take half the observations and estimate the least-squares regression of y_i on $\boldsymbol{x}_i$ using only this sub-sample.

$$y_i = \boldsymbol{x}_i'\hat{\boldsymbol{\beta}} + \hat{e}_i$$

Is the estimated slope coefficient $\hat{\boldsymbol{\beta}}$ consistent for the population projection coefficient? Explain your reasoning.

4. You have two regressors x_1 and x_2, and estimate a regression with all quadratic terms

$$y_i = \alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{1i}^2 + \beta_4 x_{2i}^2 + \beta_5 x_{1i} x_{2i} + e_i$$

One of your advisors asks: Can we exclude the variable x_{2i} from this regression?

How do you translate this question into a statistical test? When answering these questions, be specific, not general.

(a) What is the relevant null and alternative hypotheses?
(b) What is an appropriate test statistic? Be specific.
(c) What is the appropriate asymptotic distribution for the statistic? Be specific.
(d) What is the rule for acceptance/rejection of the null hypothesis?