Department of Agricultural and Applied Economics
2010 PhD Econometrics Qualifying Exam

1. What is multicollinearity? Explain the consequences of the presence of multicollinearity in a multiple regression model. Discuss two alternative procedures commonly used to detect multicollinearity. Outline three actions that can be undertaken to alleviate multicollinearity. Can a model that, according to the commonly used detection procedures suffers from multicollinearity, be reliably used to make statistical inferences (please explain your answer)?

2. Suppose a model suffers from a substantial heteroskedasticity problem, which has proven difficult to address through non-linear (generalized) least squares methods. What alternative course of action would you suggest that will make it possible for the model to be useful for making statistical inferences? Explain in detail the computations involved in this "correction." Also indicate any disadvantages of this approach and under which condition(s) it would not be suitable.

3. Why is OLS such an attractive estimation approach? When is it most appropriate or inappropriate? Explain using both words and math.

4. The economic health of a farm economy is measured by the variable y which can be explained quite well by the model: $y = X\beta + \varepsilon$, where β is a (5 x 1) vector and the five variables in X include a constant. The government changed farm policy ten years ago in a manner that was hoped to have a positive effect on y, although the impact might have occurred slowly over several years. Assuming you have time series data on (X, y) how would you modify the model above to test a hypothesis about the impact of the new farm policy. Be specific in what you assume, what your modified model is, the hypothesis you are testing, and how you would perform the hypothesis test.

5. Consider the following model: $y_t = \beta x_t + u_t \;\; t = 1, \ldots, T$, where y_t is the dependent variable, x_t is the explanatory variable and u_t is an error term with mean 0. Assume that the explanatory variable can be described by the following equation: $x_t = \alpha z_t + \delta u_t + w_t$

   Also assume the following:

$$\alpha \neq 0 \qquad p\lim \frac{1}{T}\sum z_t u_t = 0 \qquad p\lim \frac{1}{T}\sum u_t^2 = \sigma_u^2 \neq 0$$
$$p\lim \frac{1}{T}\sum w_t u_t = 0 \qquad p\lim \frac{1}{T}\sum w_t^2 = \sigma_w^2 \neq 0$$
$$p\lim \frac{1}{T}\sum z_t w_t = 0 \qquad p\lim \frac{1}{T}\sum z_t^2 = \sigma_z^2 \neq 0$$

   a. Is the OLS estimator of equation (1) consistent or inconsistent? Explain your answer.
   b. Show that z_t is a valid instrument for x_t and state the auxiliary equation.
   c. Explain how your answer to part a changes if $\delta=0$, and explain how one can test the hypothesis H_0: $\delta=0$.