Quantitative Methods Preliminary Examination
Department of Agricultural and Applied Economics
July 15, 2014

Answer all parts of all questions. Show intermediate steps where appropriate and make your work easy for the graders to follow. Relax and good luck.

1. An econometrician estimates the following equation for output:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 M_t + u_t$$

where u_t is a random shock and M_t is some policy variable, say money growth. The econometrician estimates that β_2 is significantly positive.

a. What does this say about policy effectiveness?

b. Could β_2 be estimated as positive even if the policy is ineffective? Use a combination of statistical theory, mathematics and verbal explanation to fully justify your answer.

2. Consider the linear regression model $y = X\beta + \varepsilon$ where X is a $(t \times k)$ matrix which is fixed in repeated samples and $\varepsilon \sim N(0, \sigma^2\Omega)$ with Ω known. Show that $\widehat{\beta}_{GLS}$ is the MLE for β and that $\widehat{\sigma^2} = (1/T)(y - X\widehat{\beta}_{GLS})\Omega^{-1}(y - X\widehat{\beta}_{GLS})$ is the MLE of σ^2.

3. At your next job, suppose you have estimated a model:

$$y = \beta_1 + \ln(x)\beta_2 + \ln(z)\beta_3 + \varepsilon.$$

Your boss disagrees and suggest running the model without logging the regressors. Describe a formal hypothesis tests of whether your functional form is appropriate, complete with null hypothesis, test statistics, steps involved in computing the test, etc.