Problem set 1

July 12th, 2011
due July 14th, 2011

1 Question 1

Define the following random variable:

$$Y = \beta_0 + \beta_1 X + U$$

where X and U are random variables with the following mean and variance:

$$\begin{aligned} E(X) &= \mu_x \\ Var(X) &= \sigma_x^2 \\ E(U) &= 0 \\ Var(U) &= 1 \end{aligned}$$

1. Assuming X and U are uncorrelated random variables, compute $E(Y)$ and $Var(Y)$.
2. Assuming X and U are correlated random variables with $Cov(X, U) = \sigma_{XU}$, compute $E(Y)$ and $Var(Y)$.

2 Question 2

Consider the following model derived from economic theory:

$$Y = K^\alpha L^\beta$$

where Y is output produced using capital, K, and labor, L, inputs. α and β are two unknown parameters. You have a cross-sectional data set containing information for many firms. For each output, capital and total labor input is recovered for the last year. Write down an econometric model with the objective to estimate the parameters α and β. (Hint: what functional form have we been working with? how do you get to this form?)

3 Question 3

Consider the following linear regression model:

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

If $E(u_i|x_i) = 4$, how can you rewrite the model so that the zero mean assumption holds?

4 Question 4

Consider the following model often used to study returns to experience:

$$ln(w_i) = \beta_0 + \beta_1 e_i + \beta_2 e_i^2 + u_i$$

where w_i is the hourly wage of individual i in your cross-sectional data set and e_i is years of experience in the labor market. The following estimates are obtained:

$$\begin{aligned} \hat{\beta}_1 &= 0.12 \\ \hat{\beta}_2 &= -0.001 \end{aligned}$$

- a. calculate $\frac{dln(w_i)}{de_i}$
- b. do you think that returns to experience are positive (more experience, higher wages), negative (more experience, lower wages) or mixed. Briefly provide some economic intuition to explain this result.