ECONOMETRICS I, SPRING 2025

Homework 1. Due Wednesday January 22.

1. Consider the regression model

$$y_i \;=\; \beta_0 + \beta_1 z_i + \beta_2 q_i + \epsilon_i \; ; \quad i = 1, ..., n \; ,$$

where z_i and q_i are regressors, find the first order conditions form minimizing the sum of square residuals wrt. (with respect to) β_0, β_1, and β_2.

Collect the first order conditions in vector-matrix notation and verify that the solution for $\beta = (\beta_0, \beta_1, \beta_2)'$ is

$$\hat{\beta} = (X'X)^{-1}X'Y \; ,$$

where $Y = (y_1, ..., y_n)'$, and

$$X \;=\; \begin{pmatrix} 1 & z_1 & q_1 \\ . & . & . \\ . & . & . \\ 1 & z_n & q_n \end{pmatrix}$$

2. Computer question. In Matlab, regress real per capita U.S. data consumption growth on income growth and the interest rate using the posted dataset. We have posted the Matlab program for you. In the posted program, you need to put in the actual regression where "To do" is written. (You can use the data posted or update from the Bureau of Economic Analysis or St Louis FRED database. We will use the same data for most of the homeworks. The purpose of the Matlab questions in this course is to see how the formulas work in practice, not to find new results.) You can do the computer homeworks with other students, but if you want to be an empirical economist you should play around with it yourself also. To provide some incentive, I will include Matlab code in the midterms and exam.

a) Using vectors and matrices (i.e., do not use the built-in regression commands, except to check you results, if you want) regress consumption growth on (constant, income growth, and the interest rate) using the OLS formula. Calculate and print the estimated coefficients (next week, we will add a lot more, using the same data). Include your code with your answers.)
b) Regress income on (constant and interest rate) and calculate the residuals, which we can call $MInc$.
c) Now regress consumption on constant, interest rate and $MInc$. Also regress consumption on $MInc$. Verify that the coefficients to income/$Minc$ are the same in all the regressions.