

Economics 522A, Homework 5

Due Tuesday, February 20

1. Write a Matlab function that takes as its input a regressor matrix X , and values for β and σ^2 , and generates a random vector y distributed as $N(X\beta, \sigma^2 I_n)$. Note: for random number generation, use only `randn` (which generates standard normal draws), rather than some function that generates multivariate normal draws.
2. Take the matrix X given in `hw5.dat`, and set $\beta = (1, 1)$, $\sigma^2 = 2$. Run a simulation experiment in which you generate a draw for the vector y and use y, X to calculate $\hat{\beta}$ and s^2 , repeating this 1000 times. (So you will have 1000 simulated $\hat{\beta}$ vectors, and 1000 simulated s^2 values.) Calculate the sample mean vector and sample joint variance matrix of $(\hat{\beta}', s^2)$, and compare these to their theoretical values.
3. According to the theory presented in the notes s^2 should be independent of $\hat{\beta}$. Is the variance matrix from your simulation experiment consistent with this?
4. Repeat steps 1-2, but generating the y_i as:

$$y_i = x_i' \beta + v_i - 1,$$

where the v_i are independent χ_1^2 random variables. (Again, use only `randn` for random number generation.) In this setting, do $\hat{\beta}$ and s^2 appear to be unbiased? Explain what should be the theoretical mean and variance of $\hat{\beta}$ and s^2 .