Problem Set #1b

Danny Edgel
Econ 715: Econometric Methods
Fall 2021

December 2, 2021

Question 1

(a) The attached file, functions.jl, includes all functions used in this problem set, including an OLS function. edgel_ps1.tex includes the code the executes the commands for the problem set. Using these files, the coefficient for education is derived as 0.151 .

(b) The education coefficients for the .5 and .75 quantiles are below.

$$\hat{\beta}_1^{.5} = 0.139, \qquad \hat{\beta}_1^{.75} = 0.156$$

(c) The bootstrap SE of $\hat{\beta}_1^{.75}$ for 100 simulations is 0.00002100 .

Question 2

The moment function for GMM is:

$$m(y, x; \beta) = x \left[\mathbb{1} \left\{ y \le x'\beta \right\} (1 - \tau) - \mathbb{1} \left\{ y > x'\beta \right\} \tau \right] = x \left[\mathbb{1} \left\{ y \le x'\beta \right\} - \tau \right]$$

The attached code estimates $\hat{\beta}^{.5}$ and $\hat{\beta}^{.75}$ using this GMM moment condition.

The asymptotic variance-covatiance matrix is $\left(\Gamma' \Omega^{-1} \Gamma \right)^{-1}$, where, assuming correct specification:

$$\Omega = \mathbb{E} \left[X_i X_i' \right] \tau (1 - \tau)$$
$$\Gamma = \mathbb{E} \left[X_i X_i' \right] f_{\varepsilon_i | X_i}(0)$$

The estimated coefficient and standard error for $\hat{\beta}_1^{75}$ are below.

$$\hat{\beta}_1^{.75} = 0.151, \qquad se(\hat{\beta}_1^{.75}) = 0.352$$

Note that the estimated standard error is unrealistically high. This is true for the standard error of all coefficients in this model. While it is possible that I simply made a coding error that I cannot find, I believe that this is due to the use of a fitted normal distribution for the estimate of the conditional distribution of the residuals at zero. The value is above .7, which is very high. This value would likely be much lower under a different estimation method.

Question 3

The function FGLS() conducts all of the required steps for this question. The resulting standard error for $\hat{\beta}^{.75}$ is 3.940e-15 .

Question 4

(a) The results from 1 simulation are below.

Model	95% C.I.	Contains $\hat{\beta}_1^{.75}$?
Quantile Reg.	[0.021, -0.021]	no
GMM	[-0.399, 0.415]	yes
FGLS	[0.524, 0.524]	no

(b)