EC2020 Session 9 class 1

2) Y_t is % change in GDP between years $t-1$ and t

$Y_{1980}, Y_{1981} \dots Y_{2020}$

$O_t = \max\{0, \text{\% change in oil prices}\}$

$$Y_t = \alpha + \beta_1 O_t + \beta_2 O_{t-1} + \varepsilon_t$$

we have

$t = 1, \dots, 184$

a, b) $t = 5$ $\quad O_t = 25$

$t = 6$ $\quad O_t = 0$

- if $O_5 \uparrow$ by 1, $Y_5 \uparrow$ by β_1
- if $O_5 \uparrow$ by 1, $Y_6 \uparrow$ by β_2

~~c) give 95% CI for the effect after 1 period~~

~~$25\beta_1$~~

$$Y_t = \alpha + \beta_1 O_t + \beta_2 O_{t-1} + \varepsilon_t$$

$t = 1, \dots, 184 \rightarrow$ we have $Y_1, \dots, Y_{184}$ and $O_1, \dots, O_{184}$

At time $t = 1$: $Y_1 = \alpha + \beta_1 O_1 + \beta_2 O_0 + \varepsilon_1$

at time $t = 2$: $Y_2 = \alpha + \beta_1 O_2 + \beta_2 O_1 + \varepsilon_2$ ✓

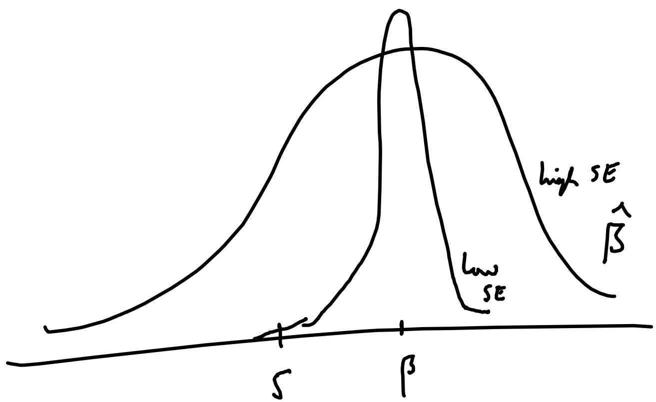
I can run OLS using $Y_2, \dots, Y_{184}$

~~178 is 184 - 8~~

184

176

d)



$$T = \frac{\hat{\beta} - \beta_0}{se(\hat{\beta})}$$

$$y_t = \beta x_t + \varepsilon_t$$

3a) $y_t = \beta_1 y_{t-1} + \varepsilon_t$ with $|\beta_1| < 1$

find the OLS estimator for β_1

$$\hat{\beta}_1 = \underset{b}{\operatorname{argmin}} \sum (y_t - b y_{t-1})^2$$

$$\hat{\beta} = \underset{\beta}{\operatorname{argmin}} \sum \hat{\varepsilon}_t^2$$

$$= \underset{\beta}{\operatorname{argmin}} \sum (y_t - \beta x_t)^2$$

$$\hat{\beta}_1 = \underset{b}{\arg\min} \underline{\sum (y_t - b\, y_{t-1})^2}$$

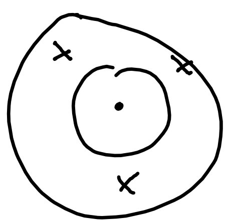
~~FOC~~ $\quad -\cancel{2} \sum_t (y_t - \hat{\beta}_1 y_{t-1}) y_{t-1} = 0$

$$\Rightarrow \sum y_t y_{t-1} - \sum \hat{\beta}_1 y_{t-1}^2 = 0$$

and so $\boxed{\hat{\beta}_1 = \dfrac{\frac{1}{n}\sum y_t y_{t-1}}{\frac{1}{n}\sum y_{t-1}^2}}$

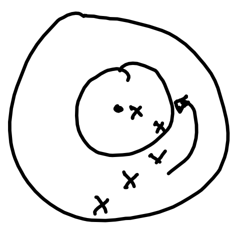
$\uparrow$

b)



UNBIASED

$\underline{\mathbb{E}(\hat{\beta}) = \beta}$



CONSISTENT

$\hat{\beta} \xrightarrow{p} \beta \iff \underline{\text{plim}\, \hat{\beta} = \beta}$

$y_t = \beta x_t + \varepsilon_t$ $\qquad$ $\underline{x_t = y_{t-1}}$

OLS unbiased: $\mathbb{E}(\varepsilon_t \mid X_t) = 0$

$\Updownarrow$

$\mathbb{E}(\varepsilon_t \mid x_1, \cancel{x_2} \dots, x_T) = 0$ [MLR 4] "strict exogeneity" $\times$

$\Downarrow$ LIE

OLS ~~consist~~ consistent: $\mathbb{E}(\varepsilon_t x_t) = 0 \iff \underline{\mathrm{cor}}(x_t, \varepsilon_t) = 0$ $\square$

$\mathbb{E}(\varepsilon_t) = 0$. $\qquad \mathbb{E}(\varepsilon_t \mid x_1, x_2 \dots, x_T)$ $\qquad$ y_t IR at time t

$=$

$\mathbb{E}(\varepsilon_t \mid y_2, \dots, y_{T-1}) = 0$ $\qquad$ $y_t = \beta \, IR_t + \varepsilon_t$

$\Downarrow$

$\mathbb{E}(\varepsilon_t \mid y_t) = 0$

~~[illegible]~~