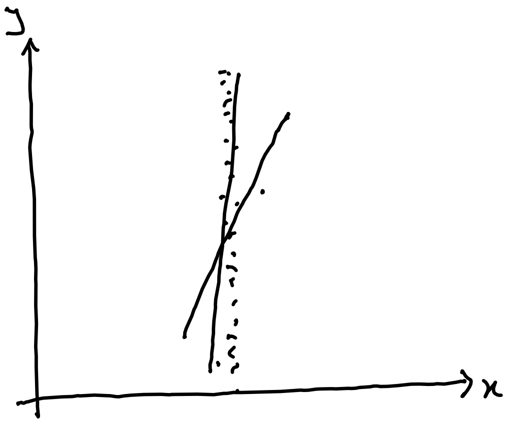
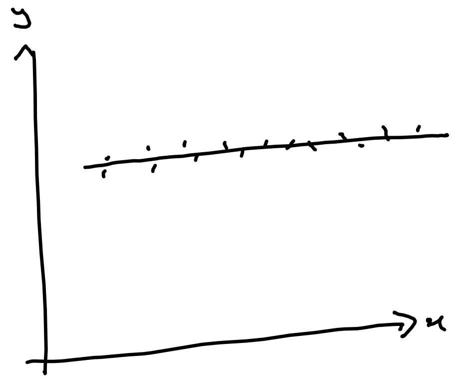
EC2020 Session 2

tomglinnan.github.io/EC2020





$$y_i = \alpha + \beta x_i + \varepsilon_i$$

4) $y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \varepsilon_i$ ←

$$Var(\hat{\beta}_2 | X) = \frac{\sigma^2}{\sum (X_{2i} - \bar{X}_2)^2} \cdot \frac{1}{1 - r^2}$$

MLR.1: ....] linear model

MLR.2: iid

MLR.3: $Var(X_{2i}) \neq 0$ and $Var(X_{3i}) \neq 0$] "No multi-collinearity"

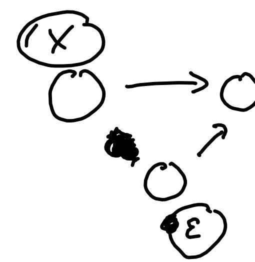
MLR.4: $\mathbb{E}(\varepsilon_i | X_{2i}, X_{3i}) = 0$] "exogeneity"

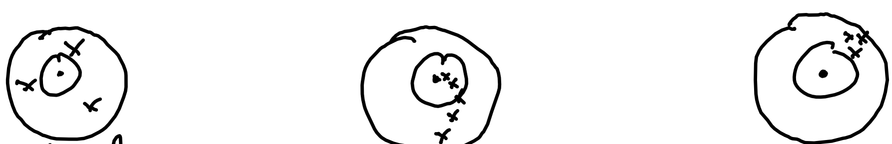
MLR.5: $Var(\varepsilon_i | X_{2i}, X_{3i}) = \sigma^2 \quad \forall i$ } "homoscedasticity"

6: $cor(\varepsilon_i, \varepsilon_j) = 0$ "no autocorrelation"

] OLS unbiased + consistent

] OLS eff.



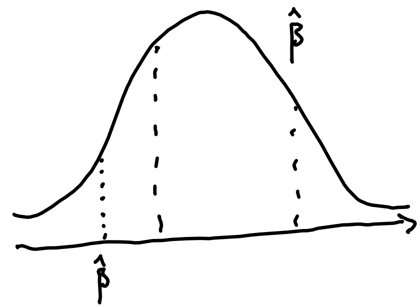


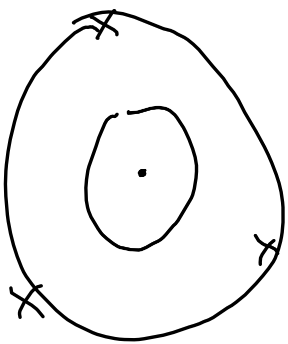
unbiased   consistency   eff.

$$y_i = \beta_1 + \beta_2 x_{2i} + \beta_3 x_{3i} + \varepsilon_i$$

$$\underline{Var(\hat{\beta}_2 \mid x)} = \frac{\sigma^2}{\sum (x_{2i} - \bar{x}_2)^2} \cdot \frac{1}{1 - r^2}$$

$$= \frac{\sigma^2}{\underline{(n-1)}\ \underline{\hat{Var}(x_{2i})}} \cdot \frac{1}{1 - r^2_{\underline{xy}}}$$





1) $\log(w_i) = \alpha + \beta \log(p_i) + \varepsilon_i$

$\hat{\alpha} = 4.25$

$\hat{\beta} = -0.83$

$w_i = ml.$ $\quad \underset{\smile}{\tilde{w}_i}$ in glasses

$p_i =$ GBP

1 glass $=$ $\underline{175 ml}$

$w_i = 175 \tilde{w}_i$

$\cancel{\alpha \; \tilde{w}_i = 175 w_i}$

$\log(\tilde{w}_i) = \gamma + \delta \log(p_i) + u_i$

$\log(175 \tilde{w}_i) = \alpha + \beta \log p_i + \varepsilon_i$

$\log 175 + \log \tilde{w}_i = \alpha + \beta \log p_i + \varepsilon_i$

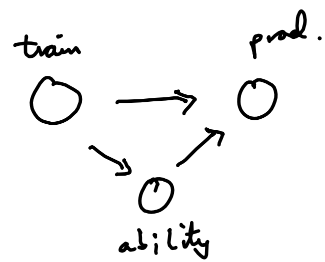
$\log \tilde{w}_i = \underbrace{[\alpha - \log 175]}_{\gamma} + \underbrace{\beta}_{\delta} \log p_i + \varepsilon_i$

2) $\text{avg prod}_i = \beta_0^l + \beta_1^l \text{ avg train}_i + \beta_2^l \text{ avg abil}_i + \varepsilon_i$ (1)

$$\beta_1^l = \frac{\partial\, \text{prod}_i}{\partial\, \text{train}_i} \qquad \beta_1^s = \frac{d\, \text{prod}_i}{d\, \text{train}_i}$$

$\text{prod}_i = \beta_0^s + \beta_1^s \text{ train}_i + u_i$ (2)

$$\frac{d\, \text{prod}_i}{d\, \text{train}_i} = \frac{\partial\, \text{prod}_i}{\partial\, \text{train}_i} + \frac{\partial\, \text{prod}_i}{\partial\, \text{ability}_i} \cdot \frac{\partial\, \text{ability}}{\partial\, \text{train}_i}$$



$$\beta_1^s = \beta_1^l + \underbrace{\beta_2^l \cdot \gamma}_{OVB}$$