Heteroscedasticity

Part II.

$$Var(\varepsilon_i) = E(\varepsilon_i^2) \neq \sigma_\varepsilon^2$$

WLS.

$$Y_i = \alpha + \beta I_i + \varepsilon_i \qquad \varepsilon_i \sim N(0, \sigma_\varepsilon^2 I_i^2)$$

$$Var(\varepsilon_i) = \sigma_\varepsilon^2 \cdot h(I_i)$$

$$Var(u_i) = Var\left(\frac{\varepsilon_i}{\sqrt{h(I_i)}}\right) = \sigma_\varepsilon^2$$

Robust or HC s.e. (White)

$$Var(\hat\beta) = \frac{\sigma_\varepsilon^2}{\sum (x_i - \bar{x})^2}$$

unbiased cons. $\rightarrow \hat\beta = (X'X)^{-1}X'y$

$$Var(\hat\beta) = \sigma_\varepsilon^2 (X'X)^{-1}$$

$$\widehat{Var}(\hat\beta) = \hat\sigma_\varepsilon^2 (X'X)^{-1}$$

$$\widehat{se}(\hat\beta) = \sqrt{\frac{\frac{1}{n-2}\sum \hat\varepsilon_i^2}{\sum (x_i - \bar{x})^2}}$$

$$\widehat{se}_{HC}(\hat\beta) = \sqrt{\frac{1}{n} \frac{\frac{1}{n-2}\sum (x_i - \bar{x})^2 \hat\varepsilon_i^2}{\widehat{Var}(x_i)^2}}$$

P1(a) H_0: homoscedasticic error

H_a: heterosced. error

$(\sigma_\varepsilon^2 \sim I_i)$

$$F = \frac{RSS_2 / 30-2}{RSS_1 / 20-2} = 7,84 \qquad F^{1\%}_{crit}(28,18) = 2,98$$

(b) H_0: homoscelasticic errors

H_a: heterosc. errors

$\hat{\varepsilon}_i^2 \mid I, I^2, u, e, \cancel{I^2}, u^2, \cancel{e^2}, \oplus \underbrace{C_2^4}_{=6}$ cross-terms

$n \cdot R^2_{aux} \sim \chi^2_q$

$q = 12$ (# reg in aux model)

$82 \cdot 0,57 = 46,7 \qquad \chi^2_{1\%, 12} = 23,2$