Testing (cont.)

Model (with assns reqd. for unbiased $\hat{\beta}$)

$$y = \beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k + u$$

Null hyp. of homosk.

$$H_0 : \text{var}(u \mid x_1 \ldots x_k) = \sigma^2$$

or $$H_0 : E(u^2 \mid x_1 \ldots x_k) = \sigma^2$$

Suppose

$$u^2 = \delta_0 + \delta_1 x_1 + \ldots + \delta_k x_k + v$$

$$H_0 : \delta_1 = 0$$
$$\vdots$$
$$\delta_k = 0$$

Can estimate

$$\hat{u}^2 = \delta_0 + \delta_1 x_1 + \ldots + \delta_k x_k + v$$

Joint test in H_0.

Works only in case of large samples.

Can also include squares, interactions, and fitted values ($\hat{y}$).

Weighted Least Squares

Model : $y = \beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k + u$

say $\quad var(u | x_1 \ldots x_k) = \sigma^2 h$

Transformed model :

$$\frac{y}{\sqrt{h}} = \frac{\beta_0}{\sqrt{h}} + \beta_1 \frac{x_1}{\sqrt{h}} + \ldots + \beta_k \frac{x_k}{\sqrt{h}} + \frac{u}{\sqrt{h}}$$

$$var\left(\frac{u}{\sqrt{h}} \mid x_1 \ldots x_k\right) = \frac{\sigma^2 h}{h} = \sigma^2$$

Generalized / weighted least squares (GLS/WLS).

Feasible / Estimated GLS (FGLS/EGLS) : h must be estimated.