

Econometrics

13/March/2016

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + u$$

$$1. \quad x_1 = \gamma_0 + \gamma_2 x_2 + v_1$$

$$x_1 = \hat{x}_1 + \hat{v}_1$$

$$2. \quad y = \alpha_0 + \alpha_1 \hat{v}_1 + u$$

$$\hat{\alpha}_1 = \hat{\beta}_1 = \frac{\sum \hat{v}_{1i} y_i}{\sum \hat{v}_{1i}^2} \rightarrow \text{Important}$$

$\rightarrow SSR_1$

$$\underbrace{\text{Var}(\hat{\beta}_1) = \frac{\sigma^2}{SST(1-R^2)}}_{\text{Multiple Regression}} > \underbrace{\text{Var}(\hat{\beta}_1) = \frac{\sigma^2}{SST_1}}_{\text{Single Regression}}$$

$$\hat{\beta}_1 = \frac{\sum (x_i - \bar{x})}{SST_x} [\beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + u_i]$$

$$= \underbrace{\beta_0 \frac{\sum (x_i - \bar{x})}{SST_x}}_{=0} + \beta_1 \frac{\sum (x_{1i} - \bar{x}_1) x_{1i}}{SST_{x_1}} + \beta_2 \frac{\sum (x_i - \bar{x}_1) x_{2i}}{SST_{x_2}}$$

$$E(\hat{\beta}_1) = \beta_1 + \underbrace{\beta_2 \delta_{12}}_{\text{Bias}} \rightarrow \text{Cov}(x_1, x_2)$$

if	$\delta_{12} < 0$
	$\beta_2 < 0$
	$\Rightarrow \text{Bias} > 0$

SD($\hat{\beta}_j$) & SE($\hat{\beta}_j$)

$$\text{Var}(\hat{\beta}_j) = \frac{\sigma^2}{\text{SST}_j(1-R_j^2)}$$

$$\widehat{\text{Var}}(\hat{\beta}_j) = \frac{\hat{\sigma}^2}{\text{SST}_j(1-R_j^2)}$$

$$\text{SD}(\hat{\beta}_j) = \sqrt{\text{Var}(\hat{\beta}_j)}$$

$$\text{SE}(\hat{\beta}_j) = \sqrt{\widehat{\text{Var}}(\hat{\beta}_j)}$$

$$\sigma^2 = E(u^2) \iff \hat{\sigma}^2 = \frac{\sum \hat{u}_i^2}{n-k-1} \quad \begin{matrix} \nearrow \text{SSR} \\ \left(k=2 \text{ in case} \right. \\ \left. \text{of two-variable} \right. \\ \left. \text{regression} \right) \end{matrix}$$

$$\text{Hence, } \text{SE}(\hat{\beta}_j) = \sqrt{\frac{\text{SSR}}{(n-k-1)\text{SST}_j(1-R_j^2)}}$$

Adjusted R^2

$$\bar{R}^2 = 1 - \frac{\text{SSR}}{\text{SST}} \cdot \frac{n-1}{n-k-1}$$

$$= 1 - (1-R^2) \frac{n-1}{n-k-1}$$

$$\left(\frac{R_{\text{urs}}^2 - R_{\text{res}}^2}{1 - R_{\text{urs}}^2} \right) \frac{n-k-1}{q}$$

$\sim F$

$q = \# \text{ restrictions}$

STATA

Use 'avplot' to plot solely for the effect of one variable.

ex. \rightarrow reg wage educ exper

\rightarrow avplot educ