Endogeneity Bias

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$$Y = X\beta + u$$

$$\hat{\beta} = (X'X)^{-1}X'Y$$

Unbias $\Rightarrow E(\hat{\beta}) = \beta$

$$\hat{\beta} = (X'X)^{-1}X'(X\beta + u)$$

$$= (X'X)^{-1}X'X\beta + (X'X)^{-1}X'u$$

$$\hat{\beta} = \beta + (X'X)^{-1}X'u$$

$$E(\hat{\beta}) = E[\beta + (X'X)^{-1}X'u]$$

$$= \beta + E[(X'X)^{-1}X'u]$$

$$E(\hat{\beta}) = \beta + (X'X)^{-1}E(X'u)$$

$E(X'u) = 0$

$E(X'u) \neq 0$

Endogeneity Bias

Linearity ✗ → Non linear

Normality ✗ → Non normal

$$Y = X\beta + u$$

Beta

Linear & Normal

$$Y = h(X, \theta) + u$$

$$f(X, \theta) + u$$

theta

$$Y = \beta_1 + \beta_2 X_2 + \beta_3 X_3 + u$$

$$Y = \beta_1 + \beta_2 X_2 + \beta_3 X_2^2 + u$$

$$Y = \beta_1 + \beta_2^{\beta_3} X_2 + \beta_4^{\beta_3} X_3 + u$$