Formulas

- Mean of $\hat{\beta}_j$

$$E[\hat{\beta}_j] = \beta_j + cor(X_j, u)\frac{\sigma_u}{\sigma_{X_j}}$$

- Variance of $\hat{\beta}_j$

$$var[\hat{\beta}_j] = \frac{1}{(1 - R_j^2)} \times \frac{SER^2}{n \times var(X_j)}$$

Omitted Variable Bias

- True model: $\widehat{Y}_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + u_i$
- Omitted Model (omitting X_{2i}): $\widehat{Y}_i = \alpha_0 + \alpha_1 X_{1i} + \epsilon_i$
- Auxiliary Regression: $X_{2i} = \delta_0 + \delta_1 X_{1i} + \nu_i$
- Relationship: $\alpha_1 = \beta_1 + \beta_2 \delta_1$

Quadratic Model

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_i + \hat{\beta}_2 X_i^2$$

F-test

$$F_{q,n-k-1} = \frac{\left[\frac{(R_u^2 - R_r^2)}{q}\right]}{\left[\frac{(1 - R_u^2)}{(n-k-1)}\right]}$$

Panel Data & Fixed Effects for group i at time t:

$$\widehat{Y_{it}} = \beta_0 + \beta_1 X_{it} + u_{it}$$

$$\widehat{Y_{it}} = \beta_0 + \beta_1 X_{it} + \alpha_{\mathbf{i}} + \theta_{\mathbf{t}} + \epsilon_{it}$$

Difference-in-Difference

$$\widehat{Y_{it}} = \beta_0 + \beta_1 \text{Treated}_i + \beta_2 \text{After}_t + \beta_3 (\text{Treated}_i \times \text{After}_t) + u_{it}$$

$$\Delta\Delta Y = (Treated_{after} - Treated_{before}) - (Control_{after} - Control_{before})$$

$$\widehat{Y_{it}} = \alpha_i + \theta_t + \beta_3 (\text{Treated}_i \times \text{After}_t) + u_{it}$$