

Specification Analysis / Specification error

Specification errors in regression are the errors that occur because of a mistake in one of the variables or other assumptions of the model.

Generally we assume that there is a linear relationship between dependent variable and independent variable -

$$Y = \alpha + \beta X_1 + U_1 \rightarrow \textcircled{1}$$

Sometimes dependent variable and independent variable is not linear

There are 4 types of specification error -

① Omission of important or relevant independent variable:-

The model that we accept as a good model is

$$Y_i = \beta_1 + \beta_2 X_2 + \beta_3 X_3 + U$$

Note

Y = Dependent variable
 α = intercept term / mean effect of excluded factors on Y .

$\beta = \frac{\partial Y}{\partial X_1}$ = Change in Y per unit change in X_2 , other factors remain constant

βX_1 = Total impact of X_1 on Y .

U = Random variable or disturbance term / error term

X_1 = Independent / explanatory variable.

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + U_i \rightarrow \textcircled{\text{ii}}$$

But suppose for some reason, a researcher decides to use the following model.

$$Y_i = \alpha_1 + \alpha_2 X_{2i} + U_{ii} \rightarrow \textcircled{\text{iii}}$$

~~But~~ In ~~this~~ ^{wrong} model we omit X_3

$$U_{ii} = \beta_3 X_{3i} + U_i \quad \left(\begin{array}{l} \text{By omitting } X_3, \text{ its} \\ \text{effect becomes a part of} \\ \text{the error term in the} \\ \text{reduced model} \end{array} \right)$$

Consequences

If the dropping dependent variable is related with included dependent variable then OLS (Ordinary least squares) will not only bias but also inconsistent.