Unit B / FRAMEWORK

MULTIPLE LINEAR REGRESSION MODEL

MULTIPLE LINEAR REGRESSION MODEL OR GENERAL LINEAR REGRESSION MODEL:

The generalisation of two variable linear regression model is known as general linear regression model. It is just an extension of the two variable linear regression model. Here we generalised the two variable linear regression model, assuming that it contains 'K-1' independent or explanatory variables and 1 dependent ~~varias~~ or explain variable. The 'K' variable linear regression model can be written as ——

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \cdots + \beta_K X_{Ki} + U_i \quad \text{—— (1)}$$

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where, $i = 1, 2, 3, \ldots n$

Here, β_1 is the unknown parameter called intercept. It gives mean or average effect on Y when all the independent variable are zero.

$\beta_2, \beta_3, \ldots, \beta_K$ are the the unknown parameter known as the partial slope coefficients.

U_i is the random or disturbance or stochastic term. The eqn (1) can be written as follows ——

$$\left.\begin{array}{l} Y_1 = \beta_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots\cdots \beta_K X_{K1} + U_1 \\ Y_2 = \beta_1 + \beta_2 X_{22} + \beta_3 X_{32} + \cdots\cdots \beta_K X_{K2} + U_2 \\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \end{array}\right\} \text{—(2)}$$

$$Y_n = \beta_1 + \beta_2 X_{2n} + \beta_3 X_{3n} + \cdots\cdots + \beta_K X_{Kn} + U_n$$

The set of of eqn (2) can be express in the in the following matrix form ——

$$\begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix}_{n\times 1} = \begin{bmatrix} 1 & X_{21} & X_{31} & \cdots & X_{K1} \\ 1 & X_{22} & X_{32} & \cdots & X_{K2} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ 1 & X_{2n} & X_{3n} & \cdots & X_{Kn} \end{bmatrix}_{n\times K} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_K \end{bmatrix}_{K\times 1} + \begin{bmatrix} U_1 \\ U_2 \\ \vdots \\ U_n \end{bmatrix}_{n\times 1}$$

$$Y = X\beta + U \text{ —— (3)}$$

where,

$Y \rightarrow n\times 1$ Order column matrix of observation of the dependent variable Y.

$X \longrightarrow n\times K$ Order matrix giving 'n' observation of '$K-1$' explanatory variables.

$\beta \longrightarrow K\times 1$ column matrix of unknown Parameters

$U \longrightarrow n\times 1$ Order column matrix of disturbance term.

Thus, eqn (3) is known as the matrix representation of general linear regression model.