

1.2 Data in Matrix Form

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Data

$$\begin{matrix}
 & & & j \\
 & & & X_3 \dots X_k \\
 \begin{matrix} i \\ Y \\ 70 \\ 73 \\ 65 \\ 70 \\ \vdots \\ \vdots \end{matrix} & \begin{matrix} X_1 & X_2 & X_3 & \dots & X_k \\ 60 & 50 & & & \\ 80 & 60 & & & \\ 75 & & & & \\ 90 & & & & \\ \vdots & & & & \\ \vdots & & & & \end{matrix}
 \end{matrix}$$

$X_0 = 1$ for all

$Y \quad X$

$$E(Y_i | X_i) = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots$$

$$Y_i = \underbrace{E(Y_i | X_i)} + \epsilon_i$$

Predictable

$$E(Y | X) = X\beta$$

↳ vector of unknowns
↳ X matrix

$$Y = X\beta + \epsilon$$

↳ residual matrix

$$\begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix} = \begin{bmatrix} 1 & X_{11} & X_{12} & \dots \\ 1 & X_{21} & \cdot & \cdot \\ \vdots & \vdots & \vdots & \vdots \\ 1 & X_{n1} & \cdot & \cdot \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \vdots \\ \beta_k \end{bmatrix} + \begin{bmatrix} \hat{\epsilon}_1 \\ \hat{\epsilon}_2 \\ \vdots \\ \hat{\epsilon}_n \end{bmatrix}$$

$i \in 1, 2, \dots, n$

$$Y = X\beta + \epsilon$$

$$Y_i = 1 \cdot \beta_0 + X_{i1} \beta_1 + X_{i2} \beta_2 + \dots + X_{ik} \beta_k + \epsilon_i$$

$$\dots Y_n = \dots + \epsilon_n$$