- Standard assumptions:

1. The disturbance has an expection of zero:

$$E(\varepsilon_i) = 0 \quad \text{for all i}$$

2. The disturbances have a constant variance (homoscedasticity):

$$Var(\varepsilon_i) = E(\varepsilon_i^2) = \sigma^2 \quad \text{for all i}, \quad \sigma^2\text{: error variance}$$

3. The disturbances are uncorrelated (lack of autocorrelation):

$$Cov(\varepsilon_i, \varepsilon_j) = E(\varepsilon_i \cdot \varepsilon_j) = 0 \quad \text{for all } i \neq j$$

Assumptions 1-3 in compact form:

$$\underset{n\times n}{Cov(\underline{\varepsilon})} = E\{[\underline{\varepsilon} - \underbrace{E(\underline{\varepsilon})}_{=0}][\underline{\varepsilon} - \underbrace{E(\underline{\varepsilon})}_{=0}]'\} = E(\underline{\varepsilon}\,\underline{\varepsilon}')$$

$$E(\boldsymbol{\varepsilon}) = \mathbf{o} \quad \text{and} \quad Cov(\boldsymbol{\varepsilon}) = E(\boldsymbol{\varepsilon} \cdot \boldsymbol{\varepsilon}') = \sigma^2 \cdot \mathbf{I}$$

o: nx1 vector of zeros, **I**: nxn identity matrix

$$= E\begin{bmatrix} \varepsilon_1^2 & \varepsilon_1\varepsilon_2 & \cdots & \varepsilon_1\varepsilon_n \\ \varepsilon_2\varepsilon_1 & \varepsilon_2^2 & \cdots & \varepsilon_2\varepsilon_n \\ \vdots & \vdots & \ddots & \vdots \\ \varepsilon_n\varepsilon_1 & \varepsilon_n\varepsilon_2 & \cdots & \varepsilon_n^2 \end{bmatrix} = \begin{bmatrix} E(\varepsilon_1^2) & E(\varepsilon_1\varepsilon_2) & \cdots & E(\varepsilon_1\varepsilon_n) \\ E(\varepsilon_2\varepsilon_1) & E(\varepsilon_2^2) & \cdots & E(\varepsilon_2\varepsilon_n) \\ \vdots & \vdots & \ddots & \vdots \\ E(\varepsilon_n\varepsilon_1) & E(\varepsilon_n\varepsilon_2) & \cdots & E(\varepsilon_n^2) \end{bmatrix}$$

$$= \begin{bmatrix} \sigma^2 & 0 & \cdots & 0 \\ 0 & \sigma^2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \sigma^2 \end{bmatrix} = \sigma^2 \underline{I}$$

For carrying out statistical tests normality of the errors is assumed:

$$\varepsilon_i \sim N(0, \sigma^2) \quad \text{for all i or} \quad \boldsymbol{\varepsilon} \sim N(\mathbf{o}, \sigma^2\mathbf{I})$$