Matrix-Vector Notation

$$y = X\beta + e$$

- vector of observations: $y = \begin{bmatrix} 2.61 \\ 2.31 \\ \vdots \\ 3.16 \end{bmatrix}$

- vector of unknown herd effects: $\beta = \begin{bmatrix} herd_1 \\ herd_2 \end{bmatrix}$

- vector of random residuals $e = \begin{bmatrix} e_1 \\ \vdots \\ e_{16} \end{bmatrix}$

- Matrix X: Known incidence matrix, relating observations to herd-effects

$$\begin{matrix} 1 \\ 2 \\ \\ 16 \end{matrix}\begin{bmatrix} 2.61 \\ 2.31 \\ \vdots \\ 3.61 \end{bmatrix} = \begin{matrix} 1 \\ \\ \\ 16 \end{matrix}\begin{bmatrix} 1 & 0 \\ 1 & 0 \\ 1 & 0 \\ 0 & 1 \\ \vdots & \vdots \\ 0 & 1 \end{bmatrix} \begin{bmatrix} herd_1 \\ herd_2 \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \\ \vdots \\ e_{16} \end{bmatrix}$$

$$2.61 = 1 \cdot herd_1 + 0 \cdot herd_2 + e_1$$