

e_6

Combining ① - ④ :

$$\begin{bmatrix} 4.5 \\ 2.9 \\ 3.9 \\ 3.5 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} \beta_{herd1} \\ \beta_{herd2} \end{bmatrix} + \begin{bmatrix} 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \\ u_5 \\ u_6 \end{bmatrix} + \begin{bmatrix} e_3 \\ e_4 \\ e_5 \\ e_6 \end{bmatrix}$$

$y = X\beta + Zu + e$

$$0 \cdot u_1 + 0 \cdot u_2 + 1 \cdot u_3 + 0 \cdot u_4 + 0 \cdot u_5 + 0 \cdot u_6$$

$$y_3 = 4.5 = \underbrace{1 \cdot \beta_{herd1} + 0 \cdot \beta_{herd2}}_{\text{matrix-vector}} + u_3 + e_3$$

calf number 3 is in herd 1

$$y_4 = 2.9 = 0 \cdot \beta_{herd1} + 1 \cdot \beta_{herd2} + u_4 + e_4$$

- Genetic Model : $y_i = \mu + u_i + e_i$

• Vectors β and u contained unknowns, and we want to estimate β and to predict u using properties described by BLUP, we get