

matrix of estimable functions;

$$\text{mat_est_fun} = \begin{matrix} & \text{Intercept} & \text{Augus} & \text{Limousin} & \text{Simmental} \\ \text{Intercept} & 1 & 0 & 0 & 0 \\ \text{Limousin} & -1 & 1 & 0 & 0 \\ \text{Simmental} & 0 & 0 & 1 & 0 \end{matrix}$$

For given solution $b^{(0)} = \begin{bmatrix} \mu_0 \\ \alpha_1^0 \\ \alpha_2^0 \\ \alpha_3^0 \end{bmatrix}$ of the normal equations; $q^T b^{(0)}$ is estimable

$$q^T = [0 \quad -1 \quad 1 \quad 0]$$

$$\Rightarrow \text{Limousin Effect: } q^T \cdot b^{(0)} \\ = 0 \cdot \mu_0 + (-1) \alpha_1^0 + (1) \alpha_2^0 + 0 \alpha_3^0$$

By default in R: treatment contrast

- First factor level: control.
- other levels are taken as treatments.