- Structure $X^TX$

$$X^TX = \begin{bmatrix} N & \#Angus & \#Limousin & \#Simmental \\ \#An & \#An & 0 & 0 \\ \#Li & 0 & \#Li & 0 \\ \#Si & 0 & 0 & \#Si \end{bmatrix}$$

- $X^TX$ has linear dependence between columns, and therefor cannot be inverted. This can also be seen from Determinant of $X^TX$
  In R: det(xtx)

- Least Squares: Minimise $SSQR = (y - Xb)^T(y - Xb)$
  Result of minimization are Least Squares Normal Equations
  $$(X^TX)\, b^{(0)} = X^Ty$$ ; where $X^TX$ cannot be inverted

- Instead of using the non-existent inverse of $(X^TX)$, we can use a "generalized" inverse $(X^TX)^-$ of $(X^TX)$. Then a solution $b^{(0)}$ can be computed as $b^{(0)} = (X^TX)^- X^Ty$