

Q p.d.s. (e.g. $X'X$)

$Q = CC'$ C lower triangular

$$Q^{-1} = (CC')^{-1} = C'^{-1}C^{-1} = C'^{-1}C^{-1}$$

$$C'Q^{-1}C = \underbrace{C'C'^{-1}}_I \underbrace{C^{-1}C}_I = I$$

$$C = (X'X)^{\frac{1}{2}}$$

$$M = I - P_X = I - X(X'X)^{-1}X'$$

$$X'M = X' - X'X(X'X)^{-1}X' = X' - X' = 0$$