$$\bar{R}^2 = 1 - \frac{(n-1)}{(n-k)}(1-R^2) = R^2 - \frac{(k-1)}{(n-k)}(1-R^2)$$

PROOF:

$$\bar{R}^2 = 1 - \frac{(n-1)}{(n-k)} \cdot \frac{RSS}{TSS}$$

$$= 1 - \frac{n-k+k-1}{(n-k)}(1-R^2)$$

$$= 1 - \left(\frac{(n-k)}{(n-k)} + \frac{(k-1)}{n-k}\right)(1-R^2)$$

$$= 1 - \left(1 + \frac{(k-1)}{(n-k)}\right)(1-R^2)$$

$$= 1 - (1-R^2) - \frac{(k-1)}{(n-k)}(1-R^2)$$

$$= R^2 - \frac{(k-1)}{(n-k)}(1-R^2)$$

Q.E.D

SINCE $1 = \frac{ESS}{TSS} + \frac{RSS}{TSS}$

$1 = R^2 + \frac{RSS}{TSS}$

SO, $(1-R^2) = \frac{RSS}{TSS}$