

$Var(\hat{Y}_{st}) = \frac{1}{4}(\hat{Y}_{st1} - \hat{Y}_{st2})^2$ , where  $\hat{Y}_{st1}$  and  $\hat{Y}_{st2}$  are the estimates for sub-sample 1 and sub-sample 2 respectively for stratum 's' and sub-stratum 't'.

(ii) for sub-stratum with 3 sub-samples:

$$Var(\hat{Y}_{st}) = \frac{1}{6} \sum_{m=1}^3 \left( \hat{Y}_{stm} - \frac{\hat{Y}_{st1} + \hat{Y}_{st2} + \hat{Y}_{st3}}{3} \right)^2, \text{ where } \hat{Y}_{stm} \text{ is the estimate for sub-sample 'm' for stratum 's' and sub-stratum 't'.$$

A.12 **For ratio  $\hat{R}$ :**

$MSE(\hat{R}) = \sum_s \sum_t MSE_{st}(\hat{R})$  where  $MSE_{st}(\hat{R})$  is given by

(i) for sub-stratum with 2 sub-samples:

$$MSE_{st}(\hat{R}) = \frac{1}{4\hat{X}^2} \left[ (\hat{Y}_{st1} - \hat{Y}_{st2})^2 + \hat{R}^2 (\hat{X}_{st1} - \hat{X}_{st2})^2 - 2\hat{R}(\hat{Y}_{st1} - \hat{Y}_{st2})(\hat{X}_{st1} - \hat{X}_{st2}) \right]$$

(ii) for sub-stratum with 3 sub-samples:

$$MSE_{st}(\hat{R}) = \frac{1}{6\hat{X}^2} \sum_{m=1}^3 \left[ \left( \hat{Y}_{stm} - \frac{\sum_{m=1}^3 \hat{Y}_{stm}}{3} \right)^2 + \hat{R}^2 \left( \hat{X}_{stm} - \frac{\sum_{m=1}^3 \hat{X}_{stm}}{3} \right)^2 - 2\hat{R} \left( \hat{Y}_{stm} - \frac{\sum_{m=1}^3 \hat{Y}_{stm}}{3} \right) \left( \hat{X}_{stm} - \frac{\sum_{m=1}^3 \hat{X}_{stm}}{3} \right) \right]$$

A.13 **Estimates of Relative Standard Error (RSE):**

$$RSE(\hat{Y}) = \frac{\sqrt{Var(\hat{Y})}}{\hat{Y}} \times 100$$

$$RSE(\hat{R}) = \frac{\sqrt{MSE(\hat{R})}}{\hat{R}} \times 100$$

A.14 **Multipliers:**

The formulae for multipliers at stratum/sub-stratum/second-stage stratum/ slum level for a sub-sample and schedule type are given below: