

# GREG estimators

The Generalized Regression (GREG) estimator is a model-based that improves precision by accounting for auxiliary information through a regression model while retaining design consistency.

Let  $Y$  denote the population total of a variable of interest. Then the GREG estimator is :

$$\hat{Y}_{\text{GREG}} = \sum_{i \in S} d_i y_i + (\bar{X} - \sum_{i \in S} d_i \underline{x}_i)^T \hat{\beta}$$

with  $y_i$ , the value of the variable for unit  $i$ ,  $\underline{x}_i$  the vector of auxiliary variables for unit  $i$ ,  $d_i = 1/\pi_i$  the sampling weight,  $\bar{X} = \sum_{i \in U} \underline{x}_i$  the population total for the auxiliary variables. Moreover,

$$\hat{\beta} = \left( \sum_{i \in S} d_i \underline{x}_i \underline{x}_i^T \right)^{-1} \sum_{i \in S} d_i \underline{x}_i y_i$$

GREG estimators are widely used in survey sampling when auxiliary information is available and in Official statistics and small area estimation when direct estimators may be less reliable.

See Särndal et al., 1992