Optimal domain estimation under summation restriction

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Abstract

The users of official statistics assume consistency of estimates. For example the estimated domain totals should sum up to the population total (additivity). Inconsistencies occur due to several reasons: estimators are random, domain estimators are not additive, different estimation methods are used for different domains, estimates are taken from different surveys, only some domain or population parameters are known, others are to be estimated. The aim is to adjust the initial estimators in an optimal way.

The following topics will be discussed in the lecture:

- The general restriction (GR) estimator of Knottnerus (2003) is developed for domain estimation with the aim to satisfy known relationships between estimates. Minimum variance property of the GR estimator ensures the optimal domain estimators among all other estimators constructed on the same initial estimators and which satisfy the same restrictions.

- GR estimator for domains in the case with the non-additive ratio initial estimators is presented assuming known population total. Special cases under SI- and HG-designs are presented.

- The theoretical results are illustrated with simulations. The performance of the GR-estimator is evaluated in a practical situation where SI- and HG-designs with sample sizes on the average of 200 persons were carried out in the population of 2000 persons with three domains. It is shown that the restrictions are satisfied for the GR-estimator and the variance of GR-estimator is smaller than the one of the initial estimator.