Some inference issues regarding modeling, variance estimation and nonresponse in survey sampling

Abstract of 4 lectures

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Lecture 1: Discussion of design-based versus model-based inference. Likelihood and likelihood principle in sampling

Some issues in design-based inference are:

1. Design-based inference is with respect to *hypothetical* replications of sampling for a *fixed* population vector **y**
2. Variance estimates may fail to reflect information in a *given sample*
3. Difficult to combine with models for nonsampling errors like nonresponse
4. If we want to measure how a certain estimation method does in quarterly or monthly surveys, then **y** will vary from quarter to quarter or month to month. One needs to assume that **y** is a realization of a random vector.

The lecture will discuss likelihood and likelihood principle as guideline to give us a clearer picture of how to handle these problems.

Lecture 2. Variance estimation for different variance measures

The lecture will compare and interpret design-based variance, model-based variance and method variance (anticipated variance). Estimation methods based on resampling techniques like bootstrapping will be presented. In addition, predictive likelihood based variance will be briefly discussed.

Lecture 3. Nonresponse issues and imputation

Effect of nonresponse and estimation methods for reducing this effect will be discussed. The lecture will mostly deal with imputation, and will present an overview of standard imputation techniques

when the missingness can be assumed to depend on auxiliary variables also known for the nonresponse group; for example stratified hot-deck and regression-based methods. Nonignorable response mechanisms will also be discussed.

Lecture 4. Variance estimation in the presence of nonresponse. Multiple imputation methods for non-Bayesian imputation

This lecture deals with how to accommodate the imputation uncertainty into the variance estimate. A new multiple imputation method that does not require Bayesian imputations will be presented. Possible future research will be outlined.