

Methods of Variance Estimation in Two-Phase Sampling

Authors : Raghunath Arnab

Abstract : The two-phase sampling which is also known as double sampling was introduced in 1938. In two-phase sampling, samples are selected in phases. In the first phase, a relatively large sample of size is selected by some suitable sampling design and only information on the auxiliary variable is collected. During the second phase, a sample of size is selected either from, the sample selected in the first phase or from the entire population by using a suitable sampling design and information regarding the study and auxiliary variable is collected. Evidently, two phase sampling is useful if the auxiliary information is relatively easy and cheaper to collect than the study variable as well as if the strength of the relationship between the variables and is high. If the sample is selected in more than two phases, the resulting sampling design is called a multi-phase sampling. In this article we will consider how one can use data collected at the first phase sampling at the stages of estimation of the parameter, stratification, selection of sample and their combinations in the second phase in a unified setup applicable to any sampling design and wider classes of estimators. The problem of the estimation of variance will also be considered. The variance of estimator is essential for estimating precision of the survey estimates, calculation of confidence intervals, determination of the optimal sample sizes and for testing of hypotheses amongst others. Although, the variance is a non-negative quantity but its estimators may not be non-negative. If the estimator of variance is negative, then it cannot be used for estimation of confidence intervals, testing of hypothesis or measure of sampling error. The non-negativity properties of the variance estimators will also be studied in details.

Keywords : auxiliary information, two-phase sampling, varying probability sampling, unbiased estimators

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