

RELATIVE EFFICIENCY OF TWO SAMPLE SELECTION PROCEDURES IN PROBABILITY PROPORTIONAL TO SIZE SAMPLING WITHOUT REPLACEMENT

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ABSTRACT

In probability proportional to size sampling, units have unequal chances of being selected. It is necessary to consider the unequal probability nature of units. It is important to compare the relative efficiency of a complex design with that of a simple design, so as to know if there would be any gain or loss in efficiency. Here, two sample selection procedures in probability proportional to size sampling without replacement are considered as complex designs. They are: Dawodu and Adewara, and Basit and Shahbaz procedures. Simple random sampling without replacement is used here, as a simple design. The complex sample designs are compared with the simple one. Results are compared with simple random sampling without replacement, in order to get the relative efficiency. It was found that, for this dataset, there was more gain in efficiency when Dawodu and Adewara procedure was used, than when Basit and Shahbaz procedure was used.

1. Introduction

Horvitz and Thompson (1952) gave the estimator of the population total in probability proportional to size sampling without replacement (ppsswor) as:

$$\hat{Y}_{HT} = \sum_{i=1}^N \frac{Y_i}{\pi_i} \quad (1)$$

with the unbiased variance estimator as:

$$\hat{V}(\hat{Y}_{HT}) = \sum_{i=1}^n \left(\frac{1 - \pi_i}{\pi_i^2} \right) y_i^2 + \sum_{i=1}^n \sum_{i \neq j}^n \left(\frac{\pi_{ij} - \pi_i \pi_j}{\pi_{ij}} \right) \left(\frac{y_i y_j}{\pi_i \pi_j} \right) \quad (2)$$

which may give negative results.

Sen (1953), Yates and Grundy (1953) independently gave the expression for the unbiased variance of Horvitz and Thompson (1952) estimator as follows:

Keywords: Probability Sampling; Probability Proportional To Size; Sampling Without Replacement; Inclusion Probability.