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FIXING THE SIZE OF A SAMPLE TO DRAW IN A RANDOMIZED RESPONSE SURVEY

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ABSTRACT

A usual unbiased estimator for a population total, mean or a proportion based on randomized response data from a probability sample has a variance as a ‘sum’ of a term containing the values of a variable of interest and another term involving the variances of unbiased estimators of the variate values obtained by randomized responses. The first term may be controlled by an appropriately chosen sampling design and a suitably specified sample-size. But it is not easy to get the second term suitably and naturally controlled. Thus it remains a problem to suitably fix a sample-size to control the magnitude of this ‘sum’. An exercise is presented to implement this task.

KEYWORDS

Equal Probability Sampling; Randomized Response Survey; Sample-size fixation

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1. INTRODUCTION

Suppose on a finite survey population $U = (1, \dots, i, .., N)$ is defined a real variable y taking on it the values y_i for i in U. Let us need to unbiasedly estimate the population total $Y = \sum_{i=1}^{N} y_i$ employing an unbiased estimator t for it based on a probability sample s with n $(2 \leq n < N)$ as its size suitably drawn from U. Suppose we need the estimator t to be so accurate that

$$Prob[|t - Y| \leq fY] \geq 1 - \alpha \tag{1.1}$$

Suitably choosing f and α as positive proper fractions, say, for example $f = 0.1$ or 0.2 etc. and α as close to 0 as $0.1, 0.01, 0.05$, say.

Chebyshev’s inequality tells us

$$Prob\left[|t - Y| \leq \lambda\sqrt{V(t)}\right] \geq 1 - \frac{1}{\lambda^2} \tag{1.2}$$

for a positive number λ.

