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A PROFICIENT RANDOMIZED RESPONSE MODEL

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Abstract: In this article, we have suggested a new randomized response model and its properties have been studied. The proposed model is found to be more efficient than the randomized response models studied by Bar – Lev et al. (2004) and Eichhorn and Hayre (1983). The relative efficiency of the proposed model has been studied with respect to the Bar – Lev et al.'s (2004) and Eichhorn and Hayre's (1983) models. Numerical illustrations are also given in support of the present study.

Key words: Randomized response sampling,Estimation of proportion, Respondents protection, sensitive quantitative variable
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1. Introduction

Randomized response technique (RRTs) have been extensively used for personal interview surveys ever since the pioneering work of Warner (1965). The main aim of such procedures and techniques is to estimate the proportion of a population whose truthful response to a sensitive question would be "Yes" without exposing the respondents to the interviewer, and consequently avoiding social stigma or fear reprisals. Several randomized response models have been developed by researchers for collecting data on both the qualitative and the quantitative variables. For details, one can refer to Fox and Tracy (1986), Grewal et al. (2005-2006), Hong (2005-2006), Ryu et al. (2005-2006), Mahajan et al. (2007), Perri (2008), Singh and Chen (2009), Odumade and Singh (2009, 2010), Singh and Tarray (2012, 2013, 2014) and Barabesi et al. (2014) etc. Eichorn and Hayre (1983) suggested a multiplicative model to collect information on sensitive quantitative variables like income, tax evasion, amount of drug used etc. Let X be the true response and S be some scrambling variable, independent of X, with known mean θ and standard deviation σ_s . The respondent is asked to report the response Z as given by

$$Z = \frac{SX}{\theta} \tag{1.1}$$

Since $E(Z) = E(X) = \mu_x$. For estimating the population mean μ_x , a sample of size n is taken using simple random sample with replacement (SRSWR): Then an unbiased estimator of the population mean μ_x of X is given by

$$\hat{\mu}_{x(EH)} = \overline{Z} = \frac{1}{n}\sum_{i=1}^{n} Z_i \tag{1.2}$$

The variance of $\hat{\mu}_{x(EH)}$ is given by

$$V\left(\hat{\mu}_{x(EH)}\right) = \frac{\mu_x^2}{n}\left[C_x^2 + C_\gamma^2(1 + C_x^2)\right] \tag{1.3}$$

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