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Research Article

Estimation of Population Mean Using Calibrated Weights in Stratified Random Successive Sampling in Presence of Incomplete Data

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This article proposes a new sampling method to address challenges that often occur in estimation problems when mixed response and nonresponse patterns are observed. It introduces a range of estimators to mitigate the nonresponse effects in survey data. The properties of the proposed estimators are deeply analyzed, and calibrated weights for each stratum are derived. Numerical studies demonstrate the superiority of the proposed estimation approach over the standard conventional methods. Finally, recommendations are made to survey statisticians.

Keywords: calibration technique; random nonresponse; scrambled response; simulation study; stratified random sampling; two-occasion successive sampling

1. Introduction

Accurate estimation of population means is crucial across various disciplines. However, traditional survey methods often struggle with mixed response patterns, including random scrambled responses and nonresponse. These issues can introduce bias and reduce the precision of estimates. This article proposes a novel approach to address these limitations in the context of stratified successive sampling.

The exploration of repetitive or successive sampling, involving conducting surveys of the same the population at various times, has been a key area of research for survey statisticians. A single survey conducted on a dynamic population provides information only for that specific occasion, failing to capture trends or average values over time. To address this, successive sampling across different occasions becomes essential. This is evident in various scenarios such as collecting monthly data on daily consumable goods prices for the consumer price index or conducting regular political opinion surveys. The theoretical foundation of successive sampling dates back to [1] work and has been extended by researchers like [2–8], among others.

In practical applications, populations often comprise heterogeneous units, necessitating consideration of various strata. For example, socioeconomic surveys may involve populations from rural, suburban, and urban areas or individuals residing in different settings like domestic hostels, houses, hospitals, and even jails. Treating each sector as a separate stratum is essential due to the differing nature of the study variable and sampling challenges. Stratified random sampling is employed to obtain estimates for different