

## Utilizing Sample Size Information in Ratio-Product Estimation of Population Mean

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**Abstract:** The estimation of population parameters, particularly the mean, remains a central focus in sampling theory. Significant contributions have been made by researchers to enhance the efficiency of estimators through the development and refinement of diverse methods and techniques. This study introduces a novel approach to address the estimation of population means by leveraging auxiliary information on sample size. Specifically, a ratio-cum-product estimator for the population mean under simple random sampling is proposed. The bias and mean squared error (MSE) of the proposed estimator are derived to the first order of approximation using a Taylor series expansion. The performance of the proposed estimator is compared to existing estimators both theoretically and numerically. Conditions under which the proposed estimator outperforms its counterparts are explicitly identified. Numerical results demonstrate the superiority of the proposed estimator over competing methods, supporting its practical applicability for efficient mean estimation.

**Keywords:** Ratio-cum-product Estimator, Population Mean Estimation, Bias And Mean Squared Error, Sample Size Utilization, Statistical Sampling Techniques, Numerical Comparison of Estimators

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