



Difference Benchmarking Multivariate Fay-Herriot Model for Small Area Estimation and Its Implementation in R Package

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Abstract:

In recent decades, the use of small area estimation (SAE) in producing official statistics has been widely recognized by many National Statistics Offices including BPS-Statistics Indonesia. Multivariate Fay-Herriot model in SAE is the development of a univariate model which leads to more efficient estimators of small area means and takes advantage of the correlations between the variables of interest, unlike the univariate model. For official statistics use, a set of small area estimates is expected to be numerically consistent and more efficient than unbiased direct estimates that cannot be guaranteed by the multivariate Fay-Herriot model. Difference benchmarking method for multivariate Fay-Herriot models to estimate small-area indicators are introduced by combining Multivariate Fay-Herriot Model with difference benchmarking. An approximation to the matrix of mean square error (MSE) is given by adjusting the estimation of difference benchmarking MSE in the univariate form proposed by Prasad and Rao. Simulation experiments are performed to assess behavior of the difference benchmarking method for the multivariate Fay-Herriot model and for comparing the MSE. The result shows that multivariate benchmarking can produce a more efficient MSE than univariate benchmarking. Furthermore, an R package was built to implement the method to be used easier and be able to be accessed on the CRAN website. The package has been evaluated using validity, performance, case studies, and usability tests. These evaluations show that the package is suitable for use.

Keywords:

Small area estimation, multivariate Fay-Herriot model, difference benchmarking, R.