UNIVERSITY OF SOUTHAMPTON

ABSTRACT

FACULTY OF SOCIAL SCIENCES
DEPARTMENT OF SOCIAL STATISTICS

Doctor of Philosophy

A COMPARISON OF TESTS OF EQUALITY OF COVARIANCE MATRICES, WITH SPECIAL REFERENCE TO THE CASE OF CLUSTER SAMPLING

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In this thesis we compare tests of the equality of two covariance matrices. The distribution of likelihood ratio test for elliptical distributions is obtained. The One and Two moments adjustments to the test are proposed. The size, power and asymptotic convergence of normal-theory, asymptotically robust and elliptical-theory tests are examined for samples from normal, hypothetical non-normal and natural populations. Our proposed elliptical-theory tests perform very well with large samples from elliptical distributions. For moderate size of bivariate non-normal samples the standard error test is recommended.

Estimators of asymptotic covariance matrices of vectors of second-order sample moments under cluster sampling from finite populations consisting of separate clusters are obtained using the delta method. When finite populations cut across the clusters an estimator of the covariance matrix of the difference between vectors of second-order moments from first and second cluster samples is also obtained. The standard error test for both types of finite populations is based on the respective estimators.

The further empirical study only for asymptotically robust tests is based on cluster samples from normal and non-normal distributions with different levels of intracluster correlation, number of primary and secondary units. Independent and dependent cluster samples from natural populations are drawn. The effects of sampling design are examined. Applicability of transformations of second-order sample moments is established. Again the standard error test is found reasonable for moderate size of non-normal samples.

Asymptotically robust tests for stratified cluster sampling are also described.