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Asymptotic expansions in the singular value decomposition for cross covariance and correlation under nonnormality

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Abstract Asymptotic cumulants of the distributions of the sample singular vectors and values of cross covariance and correlation matrices are obtained under nonnormality. The asymptotic cumulants are used to have the approximations of the distributions of the estimators by the Edgeworth expansions up to order $O(1/n)$ and Hall's method with variable transformation. The cases of Studentized estimators are also considered. As an application of the method, the distributions of the parameter estimators in the model of inter-battery factor analysis are expanded. Interpreting the singular vectors and values in the context of the factor model with distributional conditions, the asymptotic robustness of some lower-order normal-theory cumulants of the distributions of the sample singular vectors and values under nonnormality is shown.

Keywords Singular value decomposition · Edgeworth expansion · Studentized estimators · Asymptotic robustness · Nonnormality · Inter-battery factor analysis