

An Asymptotically distribution-free Aligned Rank Test for Location in a Repeated Observation Model

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Abstract: Rank tests are known to be distribution-free for simple linear models, where the observations are i.i.d. For general linear models with nuisance parameters, however, the alignment principle can be useful in deriving asymptotically distribution-free rank tests. This is especially so when the centered design matrices have full rank. However, when the centered design matrices are not of full rank, the classical Chernoff - Savage approach, as opposed to Hájek's approach, can be applied to yield asymptotically distribution-free rank tests. The asymptotic distribution of an aligned rank test for location in a repeated observations model where the centered orthonormal design matrix is not of full rank is derived. The distribution turns out to be chi-square under the null hypothesis as well as local alternatives. Simulation studies regarding the Type I error rate and power in testing for linearity in a nonparametric regression model with standard Cauchy random errors corroborate these theoretical results.