

# MULTIVARIATE VARIANCE COMPONENTS TESTS FOR MULTILEVEL DATA

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We consider the multivariate linear model for multilevel data where units are nested within a hierarchy of clusters. We propose permutation procedures to test for variance components at any given level. The tests are moment based and require no distributional assumptions. We introduce a R package, which implements the tests. It can perform tests based on the original observations or by using ranks or signs. A simulation study shows that the new tests maintain the desired type I error. It also compares their power. The results suggest that the tests based on the original observations and the rank-based tests are very competitive. With univariate data, the former one is even more powerful than a likelihood ratio test based on a mixture of chi-squared distributions.

**Keywords:** Multilevel data, Hierarchical data, Permutation test, Multivariate ranks, Multivariate signs, Variance components, Random effect.