Correlation and heterogeneity robust inference using conservativeness of test statistics

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We develop a new general approach to robust inference about scalar parameters of interest when the data is potentially heterogeneous and correlated in a largely unknown way. The approach is based on small sample conservativeness properties of the standard t-statistic and Behrens-Fisher statistic for testing equality of means. These properties show that, for commonly used significance levels, the t- and Behrens-Fisher tests remain conservative for underlying observations that are independent and Gaussian with heterogenous variances. One might thus conduct robust large sample inference as follows: partition the data into some number of groups, estimate the model for each group, and conduct standard t- or Behrens-Fisher test with the resulting parameter estimators of interest. This results in valid and in some sense efficient inference when the groups are chosen in a way that ensures the parameter estimators to be asymptotically independent, unbiased and Gaussian of possibly different variances. We provide examples of how to apply this approach to time series, panel, clustered and spatially correlated data. (joint with Ulrich K. Mueller, Princeton University)