

# Distributions of finite and infinite quadratic forms in R

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Distributions of quadratic forms in normal random variables, or equivalently, distributions of weighted sums of  $\chi^2$  random variables, arise in a number of situations.

Distributions of finite quadratic forms occur in connection with power and robustness studies in the linear model, for example when one is interested in the size of the  $F$  test when disturbances are nonspherical. They are also encountered in connection with the determination of exact critical values for certain tests, a prominent example is the Durbin-Watson test.

Distributions of infinite quadratic forms arise in diagnostic checking of linear models, for instance in testing for structural change against random coefficient alternatives, and also in testing for stationarity against integrated alternatives in time series econometrics. Further applications include goodness of fit tests, for example the Cramér-von Mises and Anderson-Darling statistics.

We provide R functions for the evaluation of the CDF of these distributions. Users may choose between two routines: (i) the numerical method of Imhof (*Biometrika*, 1961) and (ii) the saddlepoint approximation of Kuonen (*Biometrika*, 1999). Procedures for the computation of power functions of some diagnostic tests in the linear model will be made available in a forthcoming version of the R package `lmtest`.