

# Estimating the error distribution in multivariate heteroscedastic time series models

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*Abstract:* Copulas have attracted considerable interest for modelling multivariate observations and for stress testing in quantitative finance. In this paper, a semiparametric method is studied for estimating the copula parameter and the joint distribution of the error term in a class of multivariate time series models when the marginal distributions of the errors are unknown. The proposed method first obtains  $\sqrt{n}$ -consistent estimates of the parameters of each univariate marginal time-series, and computes the corresponding residuals. These are then used to estimate the joint distribution of the multivariate error terms, which is specified using a copula. The proposed estimator of the copula parameter of the multivariate error term is asymptotically normal, and a consistent estimator of its large sample variance is also given so that confidence intervals may be constructed. A simulation study was carried out to compare the estimators particularly when the error distributions are unknown. In this simulation study, our proposed semiparametric method performed better than the well-known parametric methods. An example on exchange rates is used to illustrate the method.