

Tests of serial independence for continuous multivariate time series based on a Möbius decomposition of the independence empirical copula process

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Abstract Genest and Rémillard have recently studied tests of randomness based on a decomposition of the serial independence empirical copula process into a finite number of asymptotically independent sub-processes. A generalization of this decomposition that can be used to test serial independence in the continuous multivariate time series framework is investigated. The weak limits of the Cramér–von Mises statistics derived from the various processes under consideration are determined. As these statistics are not distribution-free, the consistency of the bootstrap methodology is investigated. Extensive simulations are used to study the finite-sample behavior of the tests for continuous time series of dimension one to three, and comparisons with the portmanteau test are provided, as well as, in the one-dimensional case, with the ranked-based version of the Brock, Dechert, and Scheinkman test. Finally, the studied tests are applied to a real trivariate financial time series.

Keywords Serial copula · Test of serial independence · Empirical process · Möbius decomposition · Cramér–von Mises statistic · Bootstrap · Permutation