TESTS FOR NON-CORRELATION OF TWO MULTIVARIATE TIME SERIES: A NONPARAMETRIC APPROACH

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Most of the recent results on tests for non-correlation between two time series are based on the residual serial cross-correlation matrices resulting from appropriate modelling of the two series. However in the stationary case, test procedures can be defined from the serial cross-correlation of the original series, avoiding therefore the modelling stage. This paper aims at describing two such tests that take into account a finite number of lagged cross-correlations. The first one that is essentially valid for Gaussian time series makes use of a procedure for estimating the covariance structure of serial correlations described in Mélard, Paesmans and Roy (1991). The second one that is valid for a general class of mixing processes is based on the property that the cross-covariance at a given lag between two stationary processes is in fact the mean of the product of the two processes, the second one being lagged appropriately. For both approaches, the asymptotic distributions of the test statistics are derived under the null hypothesis of non-correlation between the two series. The level and power of the proposed tests are studied by simulation in finite samples and an example is presented.

1. Introduction

The existence of possible relationships between univariate or multivariate time series is a central question in many applications. Of particular interest in this context is the problem of testing non-correlation (or independence in the Gaussian case) between the observed series. It is therefore important to have methods which are simple both to apply and to interpret for checking non-correlation of two time series.

Most of the work done in this context is parametric and is based on the residuals of estimated models. In the case of two univariate time series $\{X^{(1)}(t)\}$ and $\{X^{(2)}(t)\}$, Haugh (1976) developed a procedure in which both series are supposed to be generated by stationary ARMA models. Non-correlation under such an assumption is equivalent to non-correlation of the two corresponding innovation processes. Denoting $\hat{a}^{(1)}(t)$ and $\hat{a}^{(2)}(t)$ the residuals resulting from fitting ARMA models to each of the two series separately and by $r_{\hat{a}}^{(12)}(k)$ the corresponding empirical cross-correlation at lag k,

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