Bivariate long-range dependent time series models with general phase

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Abstract

Univariate long-range dependent (LRD) time series models have been studied extensively in theory and have been popular in a wide range of application areas such as statistical physics, computer networks, finance, hydrology and geosciences. Bivariate and, more generally, multivariate (vector-valued) LRD time series models have also been considered by a number of researchers, however, proper theoretical foundations for a general class of such models have not yet been established. An important issue emerging in the study of bivariate LRD series, for example, is the so-called phase parameter, which appears at the cross spectrum at the zero frequency and controls the asymmetry of the series at large time lags. Previously considered bivariate LRD models have necessarily special phase parameter values, and hence can be unsuitable to capture general LRD behavior in bivariate time series. To solve this problem we introduce several bivariate LRD models that allow for general phase, including a bivariate extension of the celebrated FARIMA class with a proposed set of identifiable parameters. For the proposed models, we investigate the performance of a maximum likelihood estimation method and consider an application to the annualized monthly U.S. inflation rates for goods and services.