Multifractal cross-correlation analysis of financial time series

Paweł Oświęcimka[1], Stanisław Drożdż[1,2] and Jarosław Kwapień[1]

[1]Institute of Nuclear Physics, Polish Academy of Sciences, Kraków, Poland
[2]Faculty of Physics, Mathematics and Computer Science, Cracow University of Technology, Kraków, Poland

Abstract

Multifractal analysis constitutes a commonly accepted and robust tool to quantitatively describe the nonlinear, long-range correlations in time series. In recent years, the fractal formalism has also been extended to investigate the fractal character of cross-correlations between two time series. In this contribution we present application of our novel computational scheme - Multifractal Cross-Correlation Analysis (MFCCA) - that offers a consistent extension of the corresponding monofractal procedure (DCCA) to the multifractal case [1]. We demonstrate that MFCCA is able to identify and reliably quantify the multifractal cross-correlation structure of analysed processes in terms of the scaling exponent λ_q. Moreover, an analysis of the relation between λ_q and the average generalized Hurst exponent calculated for each time series separately provides additional information about fractal similarity of the data under study. Our conclusions are supported by a study of the cross-correlation structure of certain artificially generated mathematical and of the empirical time series. In the case of financial time series we show that, if applicable, they are typically cross-correlated for large fluctuations, whereas the small fluctuations are mutually independent. We also indicate possible utility of MFCCA to study effects of the time-lagged cross-correlations.

[1] P. Oświęcimka, S. Drożdż, M. Forczek, S. Jadach, J. Kwapień, Detrended Cross-Correlation Analysis Consistently Extended to Multifractality, arXiv:1308:6148 (Phys Rev E 2014 in print)

* *corresponding authors; e-mail: Pawel.Oswiecimka@ifj.edu.pl*