

# New developments in multifractal analysis of data with application to finance — How to extract real multiscaling properties of data and where are they in finance? —

Dariusz GRECH<sup>† ‡</sup> and Grzegorz PAMUŁA<sup>‡</sup>

<sup>†</sup> Faculty of Physics and Astronomy, Institute of Theoretical Physics, University of Wrocław,

Pl. M. Borna 9, 50-204 Wrocław, Poland

<sup>‡</sup> Econophysics and Time Series Analysis Group (ETSA),

Pl. M. Borna 9, 50-204 Wrocław, Poland

E-mail: <sup>†</sup> [dariusz.grech@ift.uni.wroc.pl](mailto:dariusz.grech@ift.uni.wroc.pl), <sup>‡</sup> <http://etsa.ift.uni.wroc.pl/>

## Abstract

I will discuss known mechanisms for the appearance of false signals of multifractality. The particular emphasis will be given to the influence of random fluctuations manifesting as finite size effects (FSE), influence of nonlinear transformations in data as well as the effect of broad data distributions. The provided semi analytical formulas will show the link between the amount of false or apparent multifractal effects in time series and the length of data, its persistency level, and the maximal fluctuation moment order  $q$  used to amplify the ratio of respective small and large fluctuations. An implementation of proposed corrections will be shown in examples of data taken from stocks around the world. The characteristic time scale  $s$ , only above which the observed multifractal effects have chance to be generated by temporal autocorrelations between fluctuations of various sizes in data will be found.

**Keyword:** Multifractality, broad data distributions, generalized Hurst exponent, MF-DFA

## References

- [1] J. W. Kantelhardt, S. A. Zschiegner, E. Koscielny-Bunde, S. Havlin, A. Bunde, H. E. Stanley, “Multifractal detrended fluctuation analysis of nonstationary time series”, *Physica A* 316 (2002) 87.
- [2] K. Matia, Y. Aschkenazy, H. E. Stanley, “Multifractal properties of price fluctuations of stocks and commodities” *Europhys. Lett.* 61 (2003) 422.
- [3] J. W. Kantelhardt, “Fractal and Multifractal Time Series”, arXiv:0804.0747v1
- [4] J. Ludescher, M. I. Bogachev, J.W. Kantelhardt, A. Y. Schumann, A. Bunde, “On spurious and corrupted multifractality: The effects of additive noise, short-term memory and periodic trends”, *Physica A* 390 (2011) 2480
- [5] D. Grech, G. Pamuła, “On the multifractal effects generated by monofractal signals”, *Physica A* 392 (2013) 5845
- [6] D. Grech, G. Pamuła, “Multifractality of Nonlinear Transformations with Application in Finances”, *Acta Physica Pol. A* 123 (2013) 529.
- [7] D. Grech, G. Pamuła, “Influence of the maximal fluctuation moment order  $q$  on multifractal records normalized by finite size effects”, *Europhys. Lett.* 105 (2014) 50004.