Improving Risk Estimation in Multifractal Financial Records

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In difficult economic periods of times, risk estimation is one of the most critical issues. In this talk, we suggest a risk estimation method that is based on the statistics of the interoccurrence times between events above (below) a certain threshold Q and is able to account for the multifractal character of the data. In financial records, the events usually considered are the relative price changes $p_i = (P_i - P_{i-1})/P_{i-1}$ ("returns") between succesive days $i-1$ and i. We show that due to the nonlinear correlations inherent in the stock market, the interoccurrence times between returns above a positive (or below a negative) threshold are long-term correlated and their probability density function decays by a power law. This allows us to obtain an analytical expression for the probability $W_Q(t;dt)$ that within the next dt units of time at least one event below a negative threshold Q occurs, if the last event occurred t time steps ago. We show explicitely that decision algorithms based on W_Q are superior to the algorithms based on the conventional precursory pattern recognition technique. The proposed method is easier to implement than the pattern recognition technique and can be applied successfully also to other records that are known to exhibit multifractality, as e. g. heartbeat records.

Keywords
financial markets, time series analysis, nonlinearity, risk

References

[1] M. Bogachev, J. F. Eichner, and A. Bunde, "Effect on Nonlinear Correlations on the Statistics of Return Intervals in Multifractal Data Sets", *Phys. Rev. Lett.* 99, 240601-240604, 2007.
[2] M. Bogachev, and A. Bunde "Improving Risk Estimation in Multifractal Records: Applications to Physiology and Financing", Preprint, 2008.