

COMPLEXITY SCIENCE SEMINAR

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Physics and Astronomy

Complexity Science Group

Scaling and efficiency determine the irreversible evolution of a financial index (*)

Since the work of Bachelier in 1900, the unpredictable evolution of a financial index has been regarded as a stochastic process. However, in spite of many efforts, a unified framework for simultaneously understanding well established empirical facts like the non Gaussian form and the multiscaling of the distribution of returns, the linear decorrelation of successive returns, and volatility clustering, has been elusive. The difficulty is due to the lack of a powerful tool like the central limit theorem for independent variables, to construct the distributions of the sums of many, strongly correlated successive returns. By employing novel mathematical tools which recently led to a generalization of the central limit theorem to strongly correlated variables whose sum obeys anomalous scaling [1], we propose a model of index dynamics and a corresponding simulation strategy, which account for all the robust features revealed by the analysis of historical series. In this model, for periods reaching up to the year, the index is driven by an irreversible stochastic process whose return distribution obeys an unusual form of time-inhomogeneous scaling. In this process the spread of realizable returns grows in time at a rate which is definitely lower than for the empirically sampled distributions, and can be adjusted in order to be consistent with the mutiscaling of these distributions and with the power law decay of the empirical volatility auto-correlation function.

(*) Seminar based on work in collaboration with F. Baldovin.

[1] F. Baldovin and A. L. Stella, Central limit theorem for anomalous scaling due to correlations, Phys. Rev. E 75, 020101(R) (2007).

Monday, May 28th
At 3:00 p.m.
SB 105