

Interactions and Risks

- Traditional approaches to risk management treat risk elements as **independent** or *at best* **statistically correlated**
- Misses **functional & dynamic nature** of relations: terminal–mainframe/input errors–results/manufacturer–supplier relations, economic interactions/dependencies in network of creditors (credit contagion), spillover . . .
- Effect of interactions:
 - Avalanches of risk events (crashes, blackouts).
Cannot be understood without interactions.
Yet still not represented in Basel III.
 - Fat tails in loss distributions
 - Volatility clustering in markets (intermittency)

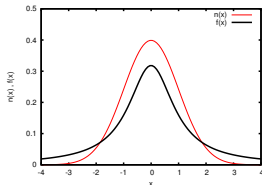
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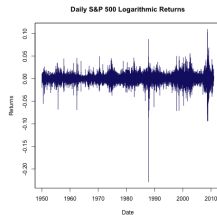
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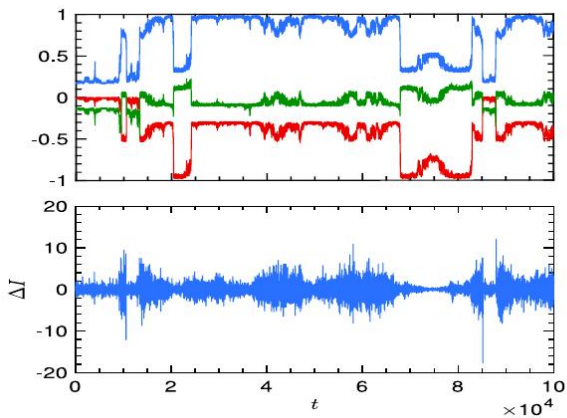
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- Role of interactions for risk more or less obvious for
 - operational risks: processes **depend** on others for input.
Think of a factory, a production line, payment systems, power grids.
 - credit risks: credit contagion, spillover
 - market risks: perhaps less obvious, but see below.
- Note
 - interactions invalidate some of the assumptions underlying insurance mechanics (CDS)
 - functional process networks can become meta-stable, no observable signatures of that happening!
 - unless interactions are 'simple', may generally get a multiplicity of system states \implies rugged energy landscapes, glassy dynamics.
 - Can rationalize volatility clustering as interplay between dynamics within states and occasional transitions between them.

Volatility Clustering and Attractors



Testing relation between volatility clustering and attractor structure: Top: similarity of system state with three (random) attractors embedded in a market. Bottom: index returns as function of time. (K. Anand, J. Khedair and RK, 2017)