



Big Step Conference
Bruxelles, April 14-15, 2010



PANEL DISCUSSION:
SYSTEMIC RISK IN FINANCE

Luciano Pietronero

Institute of Complex Systems, CNR, Rome Italy
and University of Rome Sapienza

(WEB page: <http://pil.phys.uniroma1.it>)

Systemic Risk Problem

- After the subprime crisis there have been many conjectures for the possible origin of this instability. Most suggestions focus on concepts like **collective behavior, contagion, network domino effect, coherent portfolios, lack of trust, liquidity crisis, leverage effect and, in general psychological components** in the traders behavior.
- Standard risk analysis is usually linear analysis within a cause-effect relation. Possibly new insight to the risk problem could profit could be inspired by **complex systems theory**.
- Different perspective in which the **interaction between agents (direct or in direct)** is explicitly considered together with the idea that the system may become **globally unstable** in the sense of **self-organized criticality**. The analysis is therefore shifted from the linear cause-effect relation to the study of the possible (nonlinear) **intrinsic instabilities**.
- To achieve this goal it is essential to **increase the number and quality of the Stylized Facts** are identified from the massive data available. This should lead to a **quality analysis for Agent Based Models. From Methaphoras to Real Scientific Tools**.

The Economist

NOVEMBER 1ST - 7TH 1997

CAMBODIA'S
MISERY
page 27

SUHARTO AND
THE IMF
page 31

A week on the wild side



Official reports on the Crisis:

- **Mid 2008:** Danish Central Bank
Worst scenario: subprime continues, US recession, increase of 2.5% of interbank interest. **Basic stability of the bank system !!!**
- **Feb. 25, 2009:** de Larosiere EEC Report
Financial crisis - real economy - No more Trust
Risk mispriced, excessive leverage
**Regulations on individuals but not on macro systemic risk -
Contagion - Correlations**
- **NB: SAME STARTING INFORMATION BUT
COMPLETELY DIFFERENT CONCLUSIONS
(A FEW MONTHS LATER)**

PROBLEMS WITH CAUSE-EFFECT RELATION

Classic theory of economics:

(New Scientist editorial, 2008)

- *Situation of equilibrium with agents (quasi) rational and informed*
- *Important price changes correspond to new information which arrives on the market*
- *This information modifies the ratio between offer and demand and then also the price*
- *Relation cause - effect*

Problems with the classic theory:

- *Great catastrophic events like the '87 crash, the Internet bubble of 2000 and the recent case of the Subprimes do not seem to have any relation with specific events or new information*
- *Also the Stylized Facts at smaller scales cannot be really explained within the standard model*
- *Breaking of the cause-effect relation:
then what is the real origin of large price changes?*

Physics, Complexity, Socio-Economics:

Physics: *try to discover the laws of nature*

Economics: *are there laws to be discovered?*
evolutive elements, adaptivity,
the whole society is involved

Complexity: *new vision and possible point of contact*

Simplicity vs Realism (*reproducing vs understanding*)

NEW perspective:

- *The market seems to evolve spontaneously towards states with intrinsic instability which then collapse or explode (endogenous) triggered by minor perturbations*
- *Importance of social interactions (herding) effects especially in situations of uncertainty with respect to the fundamentals of economics (fear, panic, euphoria)*
- *Breaking of the cause-effect relation and of the traditional economic principles*
- *Relation to Critical phenomena and SOC in physics(?)
Feedback, amplification, nonlinearity*

MODELS AND BASIC PROBLEMS

*Ising * (1911)*

Scaling, Criticality (64 - 70)

and RG Group (>72)

Percolation ('70-'80)*

Glasses Spin Glasses* etc.(>74)

Deterministic Chaos* (78)

Fractal Geometry ('80-'90)

Polymers and Soft Matter

Dynamical Systems and Turbulence

Fractal Growth Physical Models:

DLA/DBM (82-84)*

Selforganized Criticality

Sandpile* (87)

Granular Systems ('90)

Minority Game ('97)

Rare Events

Complex Networks (>2000)

INTERDISCIPLINARY APPLICATIONS

Condensed Matter problems

Phase Transitions

Magnetic Systems

Bio-inspired Problems

Astrophysics

Geophysics

Information Theory

Optimization

Economics and Finance

Social Sciences (Random Walk,

Bachelier 1900)

Agent Based Models (very many)

***Apply old Models or
develop New Models?***

Universality?

In nature trees are alike but not identical. Similarity and common basic structure but no strict universality. Exponents can therefore depend on specific situations: richness to be explored.

Be careful with our stately treasures.

Universality?



OUR PERSPECTIVE

- *Workable* ABM, clear math and properties
- New elements: N variable, Stylized Facts due to Finite Size Effects, Self-organization
- Approximate scaling, no strict universality: effective exponents depend on situation
- Liquidity crises: Order Book Model for finite liquidity
- ABM in the Global Network, Leverage
- Coherence, correlated portfolios, similar behavior; risky

Stylized Facts (Very few; Universal?):

- *Arbitrage -- Random Walk (B&S)*
- *Fat tails, Volatility Clustering etc.*

AND ALSO

- *Non stationarity*
- *Self-organization, Liquidity*
- *Global Network*

Key Concepts:

TO IDENTIFY FROM REAL DATA

- Market sentiment, stabilizing vs destabilizing
- The effective independent agents N^* in a market
- Analysis of Herding, Contagion, Correlations
- Liquidity analysis of order book
- Network oriented approach - Direct interaction vs global Trust.
- Coherence problem, similar behavior

Forecasting Financial Crisis: Measurements, Models and Predictions (ISC-FET Open Call 2010-2014)

- ISC-CNR, Italy (G. Caldarelli, S. Leonardi and LP)
- Univ. delle Marche, Italy (M. Gallegati, D. Delli Gatti)
- ETH Zurich (F. Schweitzer, S. Battiston)
- City Univ. London, UK (G. Iori, A. Banal-Estanol, S. Jafarely)
- Univ. of Oxford, UK (F. Reed-Tsochas, R. May, E. Lopez)
- Yahoo Research, Barcelona, Spain (R. Baeza-Yatez)
- European Central Bank, Frankfurt, D