GSS and Financial Networks

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Related International Activities

- GSDP Global Systems and Policies
- FOC (Forecasting Financial Crises)
- MULTIPLEX (Theory of networks of networks)
- INET - Systemic Risk Task Force: Working Group on Financial Interlinkages

foc
forecasting financial crises

Network Science and Financial Regulation

FOCUS | COMMENTARY

Complex Derivatives

Stefano Battiston, Guido Caldarelli, Co-Pierre Georg, Robert May and Joseph Stiglitz

The intrinsic complexity of the financial derivatives market has emerged as both an incentive to engage in it, and a key source of its inherent instability. Regulators now faced with the challenge of taming this beast may find inspiration in the budding science of complex systems.

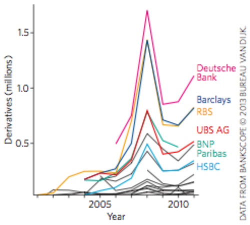
When financial derivatives were cast[1] in 2002 as latent 'weapons of mass destruction', one might have expected the world at large to sit up and listen — particularly in the wake of subsequent events that led to the financial crisis of 2008. Instead, the derivatives market continues to grow in size and complexity (Fig. 1), spawning a new generation of financial innovations, and raising concerns about its potential impact on the economy as a whole.

A derivative instrument is a financial contract between two parties, in which the value of the payoff is derived from the value

Proponents of derivatives have long argued that derivatives help to stabilize markets by distributing risk, but it has been shown recently that in many situations risk sharing can also lead to instabilities[2,3].

Market as network

Players engaging in the derivatives market can enter into an unlimited number of contracts with other parties, so the market can be seen as a complex financial network, in which interactions between the nodes are nonlinear[4]. A derivative contract can itself be made arbitrarily complex — it has been estimated[5] that if one of these contracts were



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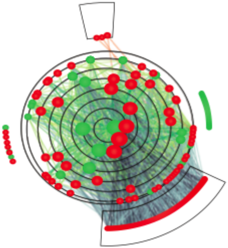
commentary

The power to control

Marco Galbiati, Danilo Delpini and Stefano Battiston

Understanding something of the complexity of a financial network is one thing, influencing the behaviour of that system is another. But new tools from network science define a notion of 'controllability' that, coupled with 'centrality', could prove useful to economists and financial regulators.

The financial crisis that erupted in 2008 has made plain the shortcomings of old paradigms in economics and finance, and researchers have turned to other disciplines to seek fresh insight. Network science — thoroughly studied in mathematics and physics for decades — has thus made its way into economics, with financial institutions imagined as the nodes of a network, linked by financial flows, contracts or other interactions [Au:OK?]. Two main kinds of tool have been provided for the study of financial networks: the first is network statistics, which summarize global properties of a network in one (or few) numbers; the other, centrality measures[1], provides a measure



been contemplative, so to speak, aimed at describing rather than controlling the network.

Only very recently has the issue of how to influence networks has been tackled explicitly in network science[3,4]. Suppose we are given a network of 'influences', determining the evolution of the 'state' of a set of nodes. What is the smallest subset of vertices that we should control, to be able to steer the system in any desired direction? As an example (fictitious, but nevertheless concrete), imagine a banking authority that wishes to ensure each bank under its supervision maintains a level of capital above a certain threshold. Assume this authority has the possibility to influence

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The Architecture of Global Corporate Control

- Ownership conveys influence, information, practices, interests
- No prior study on the network of Transnational Corporations (TNC)

- Ownership data: **30M** shareholders and corporations in **194 countries** from 2007.
- From ownership to control: results are robust across methods

- First cross-country study [1] **48 stock markets**, 131K firms
- First global study[2] **TNC network)**, 600 th. actors and 1M links

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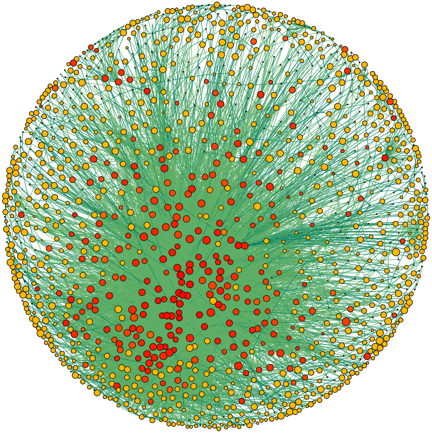
[1] Backbone of Complex Networks of Corporations; Glattefelder, **Battiston** 2009, PRE

[2] The Network of Global Corporate Control; Vitali, Glattfelder, **Battiston** 2011, PLoS-ONE

The Architecture of Global Corporate Network



- 30M $\longrightarrow$ 400K firms $\longrightarrow$ 1300 firms
- Highly hierarchical structure, high concentration of control

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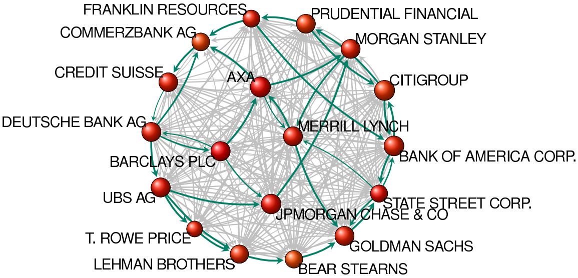
The Architecture of Global Corporate Network



- 1300 $\longrightarrow$ a nexus of 110 financial firms
- Results raise crucial questions regarding **systemic risk** and **competition**: attention also in the media

Applications

- Provide
  - open code to central bankers: Italy, Brazil, Austria, ECB, Germany
  - assistance in understanding
- contribute to EWS
  - communication issues

Conclusions I

- Network Science and Financial Regulation: teaming up is possible!
- DebtRank and alike: ICT, “big data” and simple indicators going beyond state of the art
- complement to **Early Warning System**
- can be extended towards **VaR**

References: A New Approach to Systemic Risk

- Financial systems as **Complex Networks**[3]
- **Derivatives**: Network effects matter[4]
- Risk diversification vs systemic risk: **Liaisons Dangereuses**[5]
- Big Data in Economics, e.g. **Global Corporate Control**[6]
- SIFI indicator **DebtRank**[7]

[3] Galbiati, Delpini, **Battiston**, 2013, Financial Networks: Observing them or Influencing them? Nature Phys forth.

[4] **Battiston**, Caldarelli, Georg, May, Stiglitz, 2013, The Complexity of Financial Derivatives Network, Nature Phys forth.

[5] **Battiston**, Delli Gatti, Gallegati, Greenwald, Stiglitz, 2012, Liaisons Dangereuses, JEDC

[6] Vitali, Glattfelder, **Battiston** 2011 The Network of Global Corporate Control, PLoS-ONE

[7] **Battiston**, Puliga, Kaushik, Tasca, Caldarelli 2012, Sci. Rep.

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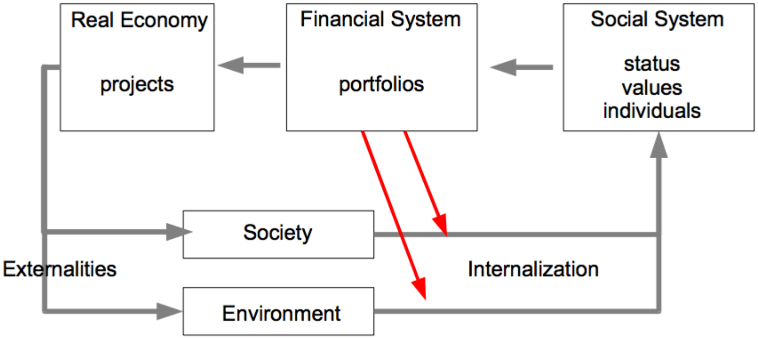
International Networks and Moral Hazard

- too-big-too-fail
- too-connected-to-fail
- too-central-to-fail

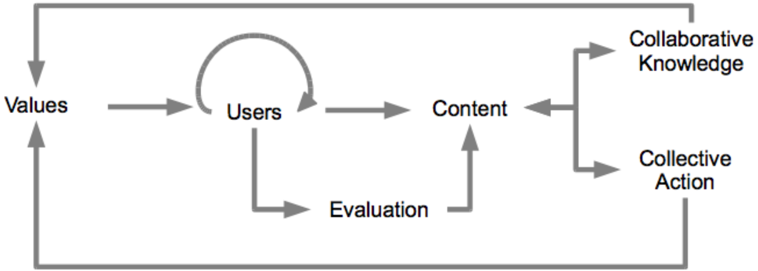
- Should we regard financial institutions as an international nexus?
- A sustainable global financial system has to cope with global moral hazard.

The Doomsday Machine



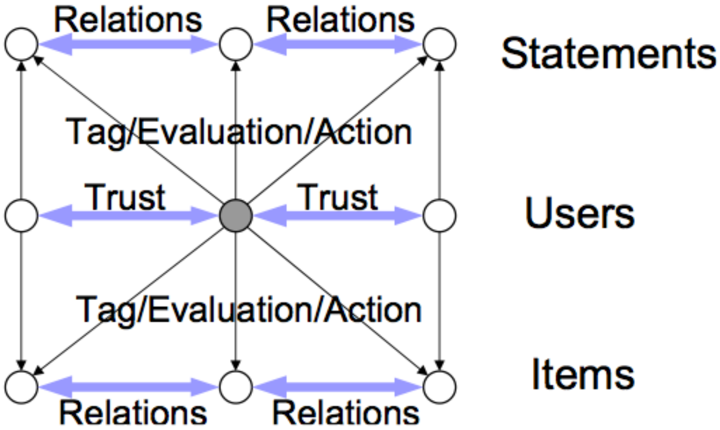
- Securitization decouples activities from their external effects

Social Intelligence Networks (SIN)



- General framework to foster collective action

Social Intelligence Networks



Applications of SIN

- Collective evaluation of policies and bottom-up policy proposals by citizens
- Crowd-mapping of network of influence and groups of economic interests in politics
- Sustainable finance and crowd-funding of local green economy enterprises
- Interaction and cooperation among companies and entrepreneurs
- Energy-aware life style among citizens and daily mobility in the cities. Energy-saving strategies for enterprises.
- A sustainable global financial system has to cope with global moral hazard.

Applications of Policy Modelling

- Develop an ICT knowledge sharing platform to enable the crowd-sourcing of data collection and data analysis regarding policy-relevant socio-economic networks.
- Develop an ICT infrastructure to gather semantic web data for policy relevant socio-economic networks.
- Demonstrate the possibility to empower citizens by enabling real-time collective mapping of networks of influence in policy making processes.
- Collective evaluation of policies and bottom-up policy proposals by citizens

Conclusions II

- Doomsday machine: decoupling actions from externalities
  - Feedback loops and networks of influence are a serious issue
  - Fundamental issues: similar to debate on emergence of cities
  - Value system
- ICT for crowd-sourcing collective problem solving: Social Intelligence Networks
  - ICT seem to offer promising tools, but remain in the same loop!