

Systemic risk: Banking networks and shock propagation

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Agenda

- 1 Introduction
- 2 Financial networks and systemic risk
- 3 Network structure and shock propagation

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Do you recognise this?

- Tumultuous times and financial crisis
- Losses from leveraged investments
- Few non-essential institutions fail
- Interconnections propagate losses
- Loss of confidence
- Massive withdrawal of liquidity
- Mild recession becomes far worse

(Yellen, 2011)

Banking panic of 1907, USA



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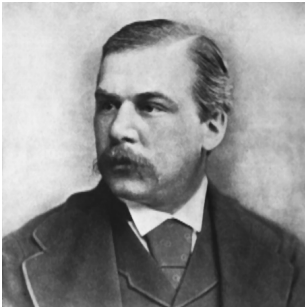


Figure: Key roleplayers: JP Morgan and President Wilson

More recent systemic crises

- Latin American debt crisis
- Mexican peso crisis
- East Asian financial crisis
- Global financial crisis
- Euro crisis

Looking ahead - the next crisis?

- Not if, but when and where ...

Sources of trigger events: International

- China

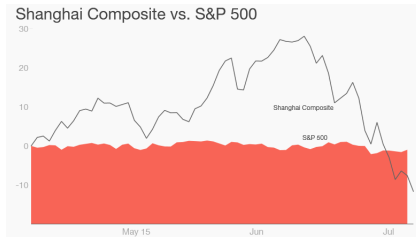
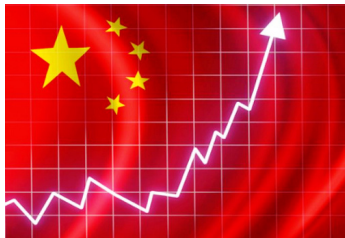


Figure: Is China's growth sustainable?

Sources of trigger events: International

- Greece and the Eurozone



Figure: Greece may just be the beginning

Sources of trigger events: International

- US debt

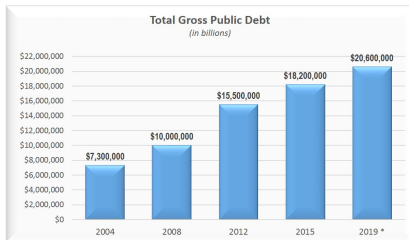


Figure: Several recent near misses

Sources of trigger events: South Africa

- Fiscal management



- Debt to GDP ratio increasing
- Corruption allegations

Sources of trigger events: South Africa

- Political radicalism and social instability



Figure: Rampant poverty a breeding ground for radicalism

Sources of trigger events: South Africa

- Infrastructure and resources?



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Towards a definition of systemic risk

Common features of systemic shocks

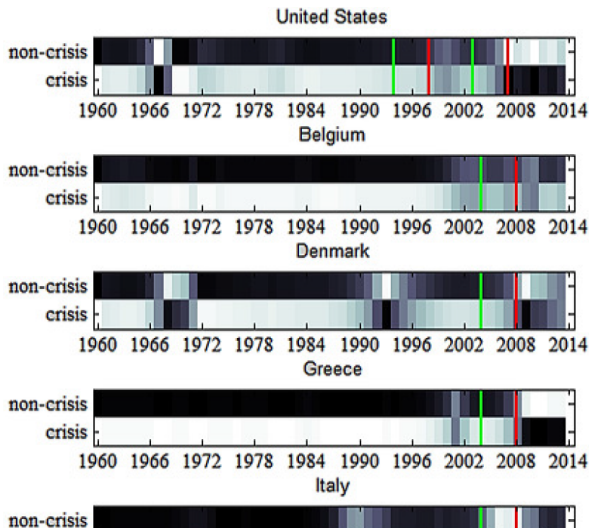
- General phenomenon: ecology, epidemics, electrical grids, social networks, finance ...
- Complex adaptive systems under stress
 - Complex: interconnected, heterogeneous
 - Adaptive: interactions between locally optimising agents
- Triggering event relatively mundane
- Severe and widespread collateral damage

Network structure and shock propagation (today's focus) I

Research project 1

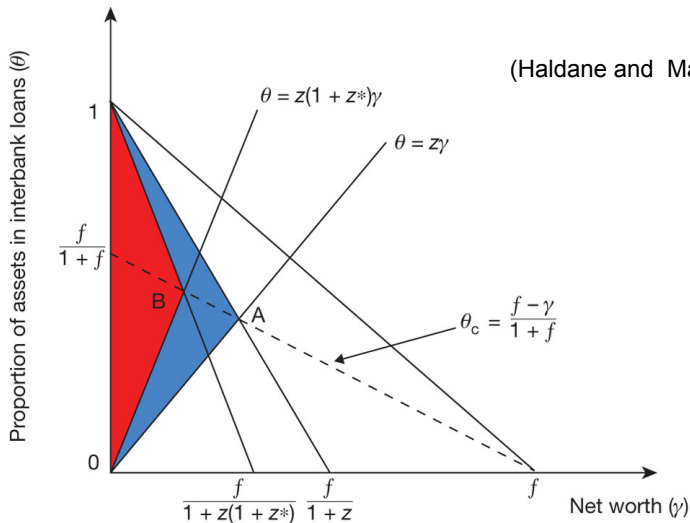
Early warning systems

Research project 2



Regulatory intervention: Optimization and Impact

Research project 3



Special case: Banking networks

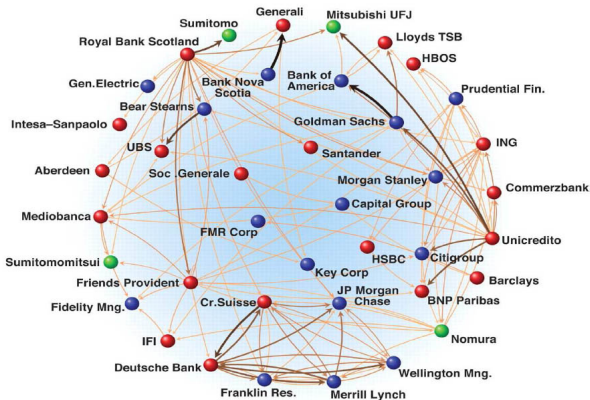


Figure: International banking network (Korowics, 2012)

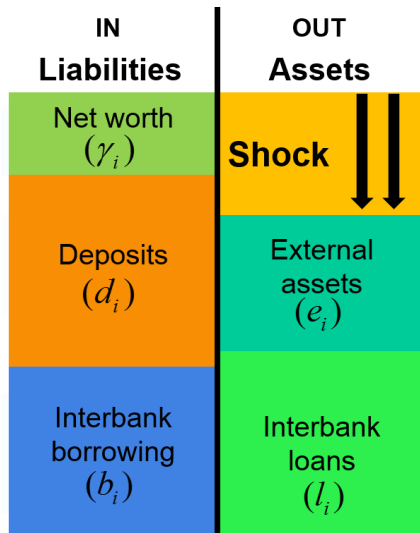
Bank balance sheets

Bank balance sheet	
Liabilities	Assets
Borrowed capital Deposits Financial instruments Bonds Derivatives Interbank borrowings	Loans Mortgages Consumer loans Interbank lending Lending to other companies Lending to govt bodies
Equity Share capital Etc	External assets Shares, corporate bonds Government bonds Real estate Derivatives Goodwill Etc
Liabilities	Assets

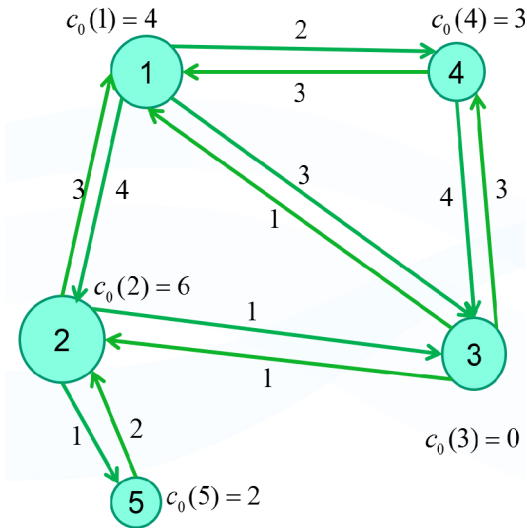
Simplified “classical” bank balance sheet

IN	OUT
Liabilities	Assets
Net worth (γ)	External assets (e)
Deposits (d)	
Interbank borrowing (b)	Interbank loans (l)

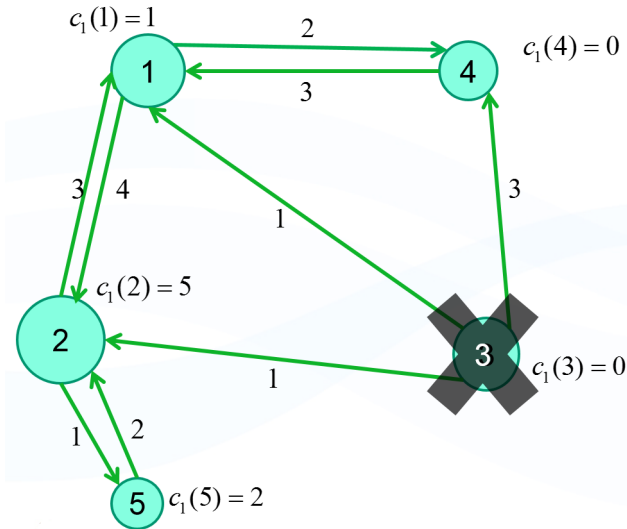
Simplified case: Shock to a bank



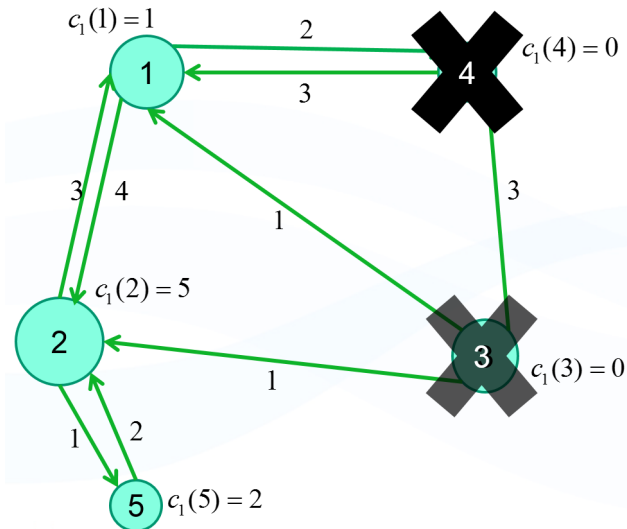
Simplified loss cascade



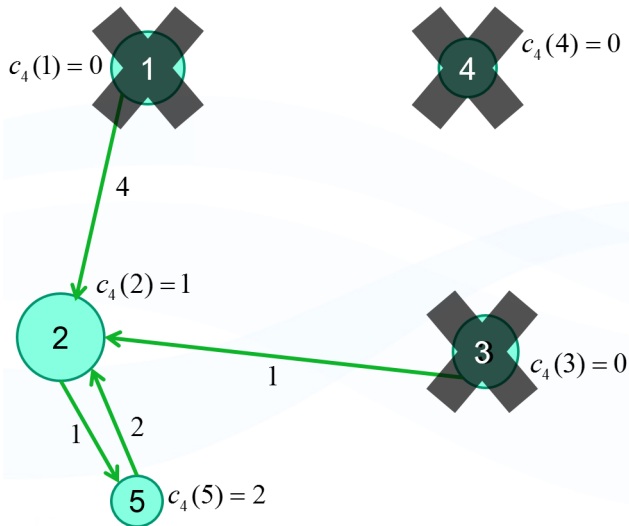
Simplified loss cascade



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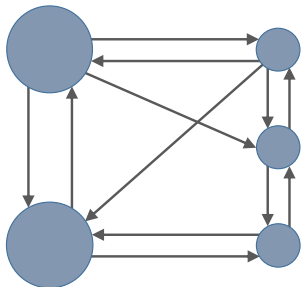
Secondary shocks

- Given that initial bank fails due to asset class A:
 - Weak Liquidity Shock (WLS): Asset class A's value reduced in all banks
 - Strong Liquidity Shock (SLS): All asset classes held by failing bank are shocked throughout the system
 - Proximity Shock (PS): Additional shock to banks that are “close” to failing bank

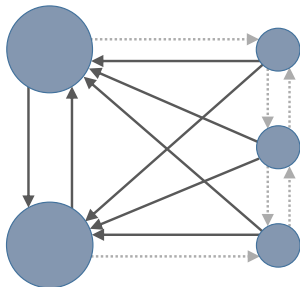
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Network structures I

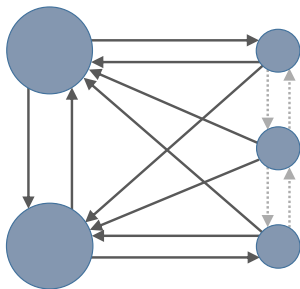


(a) Erdős Rényi network

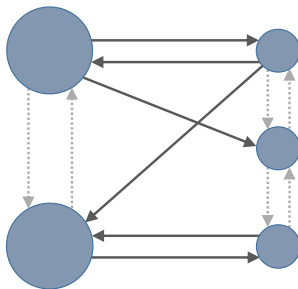


(b) "Flight to quality"

Network structures II

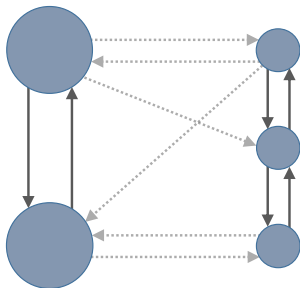


(c) Small nodes generally don't interact

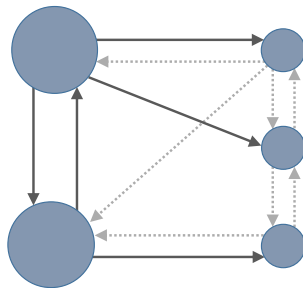


(d) Disassortativeness

Network structures III



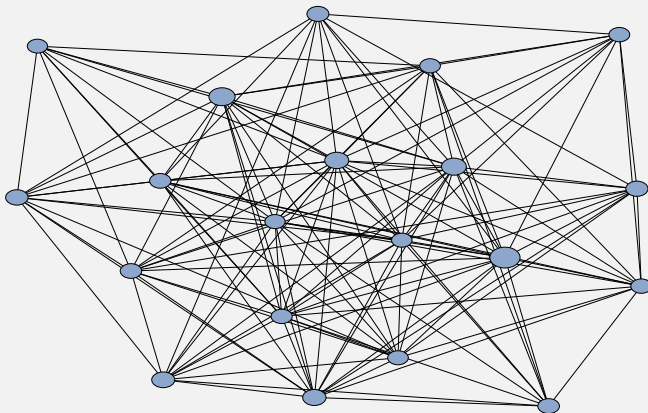
(e) Assortativeness



(f) Tiered structure

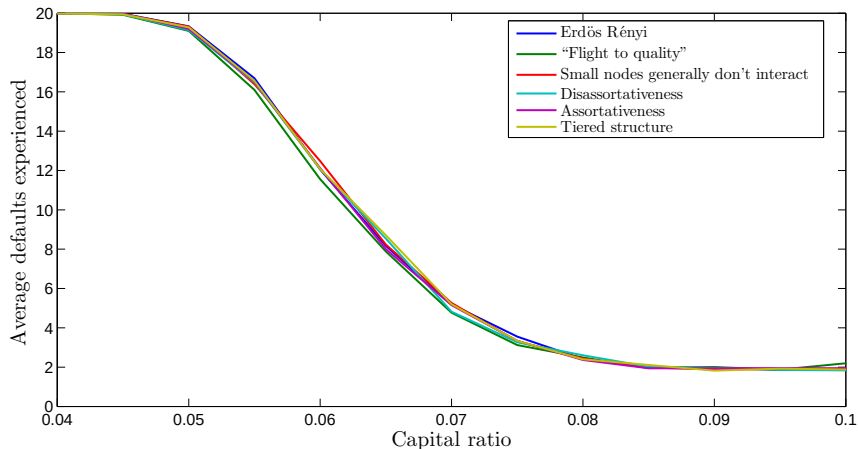
Illustrative results: Defaults vs Capital Buffer

Evenly distributed node sizes



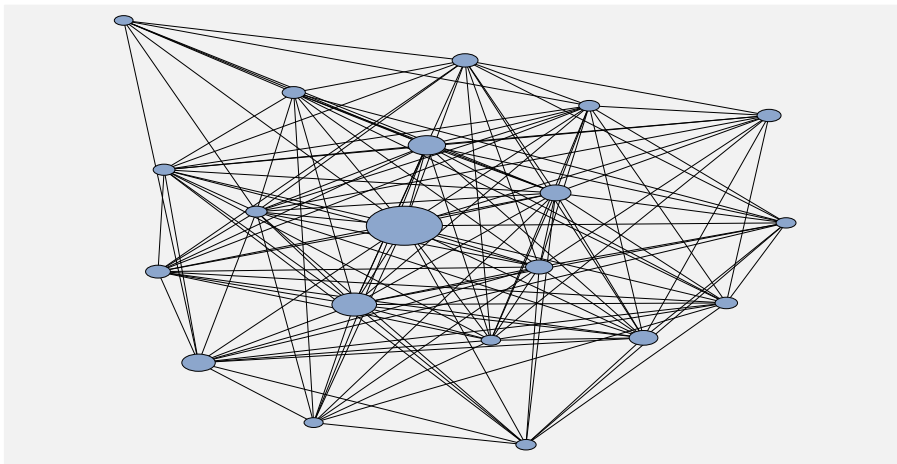
Illustrative results: Defaults vs Capital Buffer

Evenly distributed node sizes



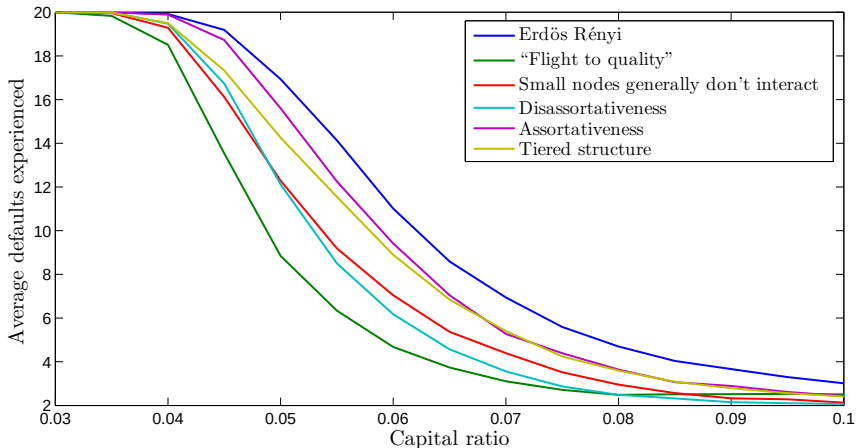
Illustrative results: Defaults vs Capital Buffer

"Lopsided" node sizes



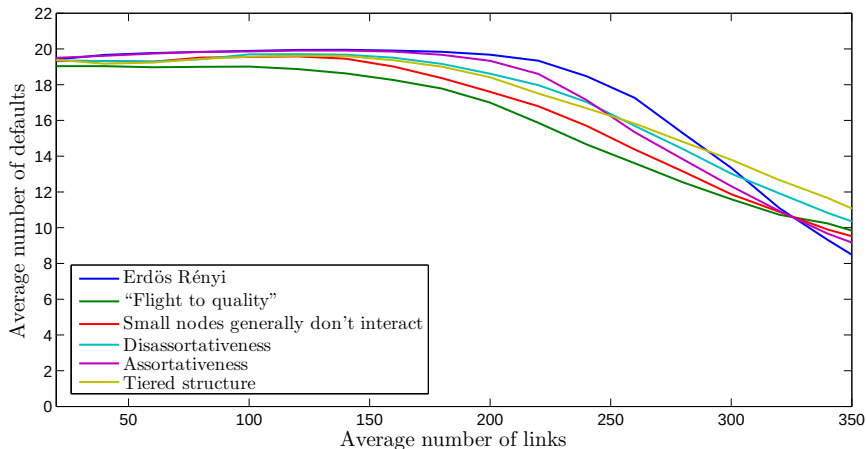
Illustrative results: Defaults vs Capital Buffer

“Lopsided” node sizes



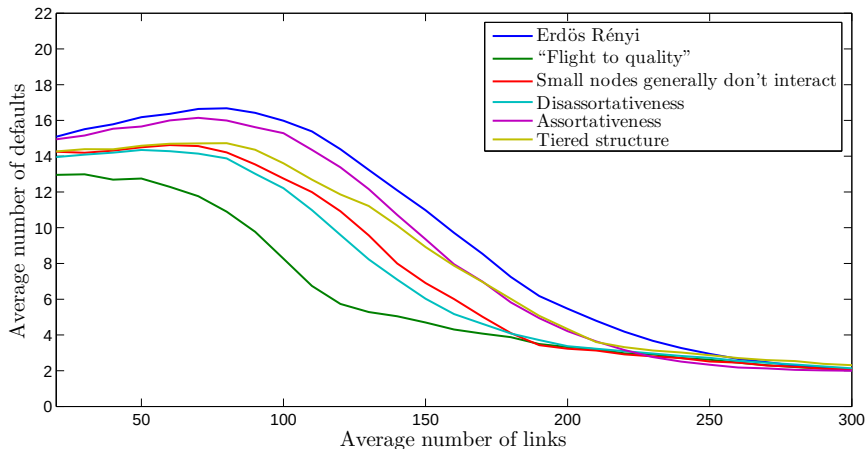
Illustrative results: Defaults vs Interconnectedness

Low capital buffer, 4%



Illustrative results: Defaults vs Interconnectedness

Higher capital buffer, 6%



Current and future work

- Different measures of systemic risk
- Different ways to generate, compare networks
- Calibrate to real-world networks
- Consider a range of regulatory interventions
- Investigate impact/cost of regulation
- Include non-regulated (“shadow”) segments
- Develop early warning systems

Questions

Any Questions?

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