

Risk sharing or contagion in the build up to the crisis?

Evidence from the international interbank market 1985-2009

CABDyN Seminar

February 14th 2012

http://www.econ.ucsb.edu/~garratt/faculty/contagious_capacity.pdf

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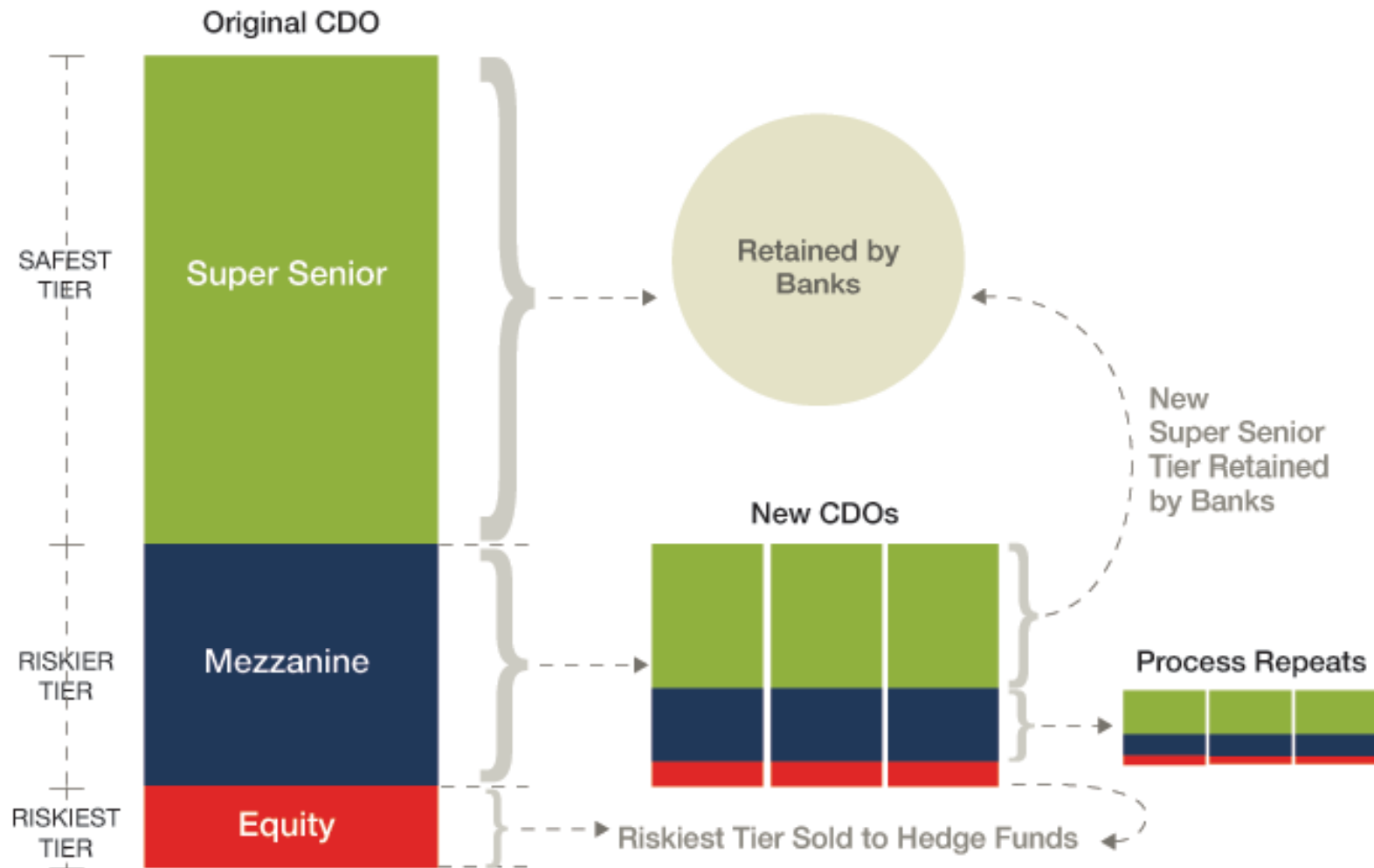
Overview

- **Motivation:** Understand spread of contagion and role of interconnectedness
- **Focus:** International interbank network
- **Key question:** Was the pattern of interconnectedness prior to the crisis contagious?

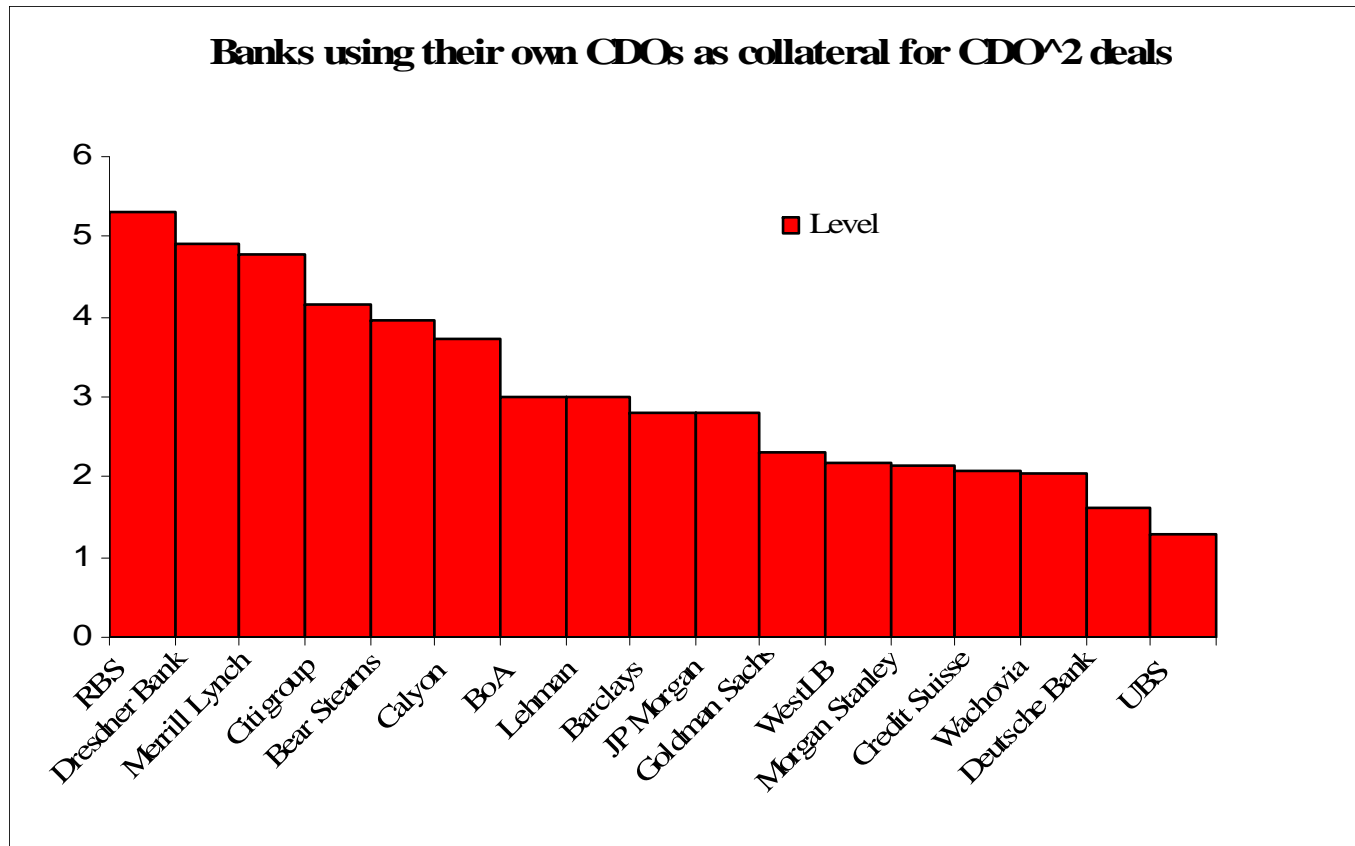


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CDOs

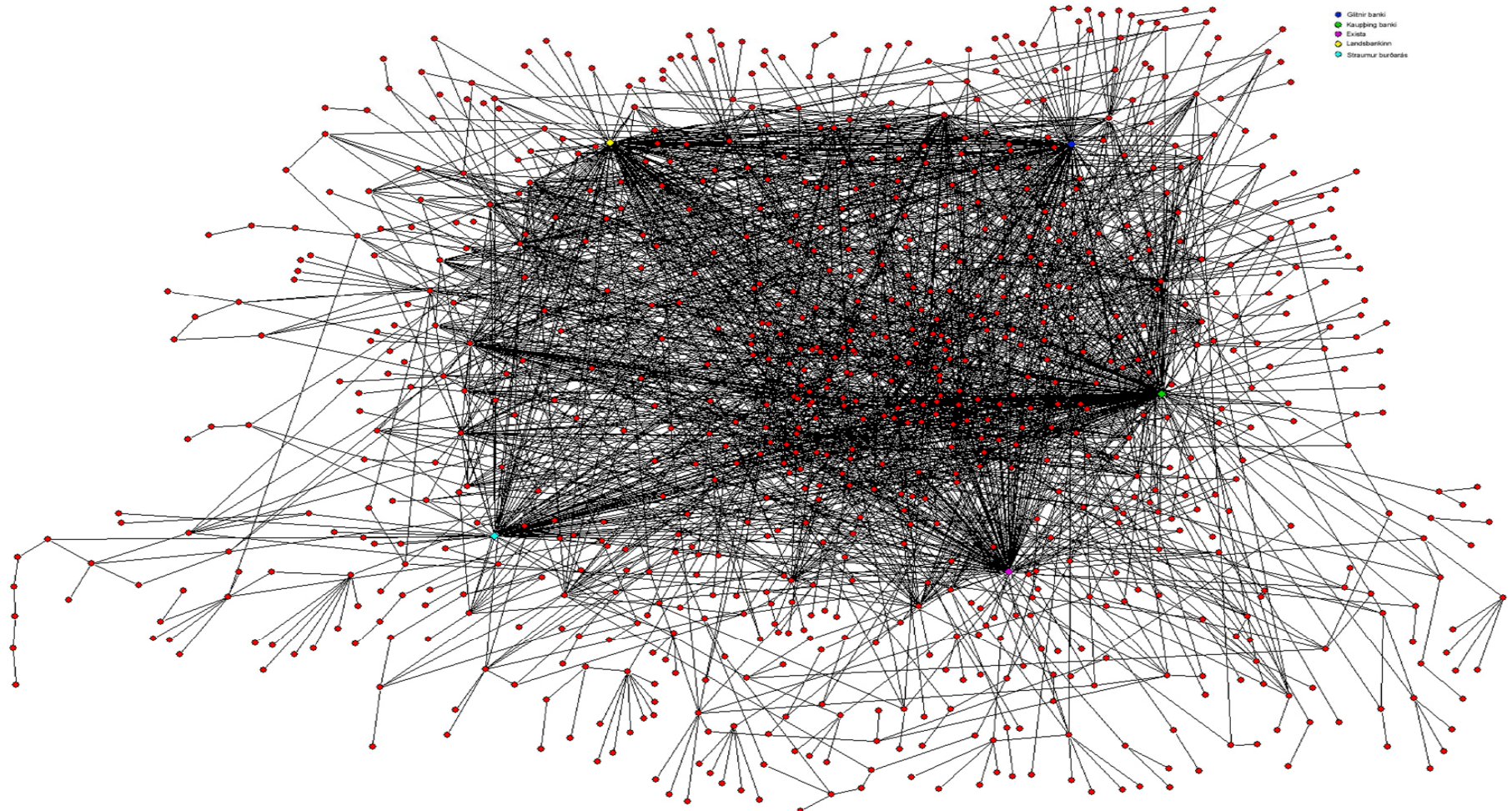


Source: The Story of the CDO Market , Barnett Hart 2009

Cross-holding of CDOs 2005-2008

Propublica data on cross holdings

Cross-holdings among Icelandic Banks



Source: SIC report, Vol. 9., Appendix 2, pp. 23

When is this methodology not applicable?

When markets are complete, and all risks are fully priced in contracts (incl remuneration!)

- Our focus is on the international banking network
- A set of bilateral claims (links) of different banking groups (nodes) on each other
- A banking group includes all the banks operating in a particular country
- Our aim is to summarize and compare the network pattern-highlighting risk of contagion
- Compare against a calibrated model of contagion
- Two interacting channels of contagion
 1. Banks defaulting on loans transmit stress to their creditors via a credit channel.
 2. Banks refusing to make loans transmit stress via a funding channel.

Data

- Bank for International Settlements locational statistics.
- We included the following 21 reporting countries in our network: Austria, Australia, Belgium, Canada, Cayman Islands, Switzerland, Germany, Greece, Denmark (excluding Faeroe Islands and Greenland), Spain, Finland, France (including Monaco), United Kingdom (excluding Guernsey, Isle of Man and Jersey), Ireland, Italy, Japan, Luxembourg, Netherlands, Portugal, Sweden, and the United States.
- Includes many short-term claims between banks
- These countries representing about 73% of total reported claims on banks.
- 1985 Q1 to 2009 Q3

Matrix of Contagion Frequency

$$V = (v_{\alpha_J \beta_K})_{\alpha_J \beta_K}$$

where $\alpha, \beta \in \{1, \dots, n\}$, $J, K \in \{C, F\}$.

- $2n \times 2n$ matrix
- Premise is that stress is transmitted through the financial network in a manner that is proportional to these capacities.

Probability Transition Matrix

$\Pi = (\text{matrix_of_normalized_link_weights})$

now describes conditional movement:

$$p_t = \Pi p_{t-1}$$

where $p_t = [p_{1t}, \dots, p_{2nt}]'$

is the probability of stress being at each bank in round t

Long run

$$p_{lr} = \Pi p_{lr}$$

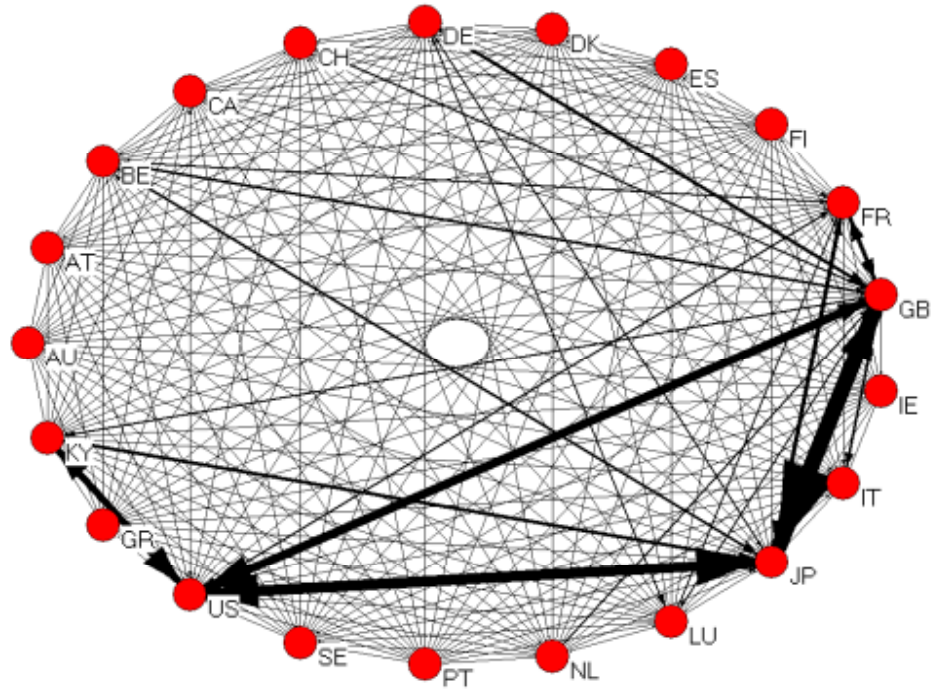
where $p_{lr} = [p_{1lr}, \dots, p_{2nlr}]'$.

Video: see the FNA package (<http://fna.fi/>)

[Pie chart](#)

[Network](#)

Raw data 1989 Q3





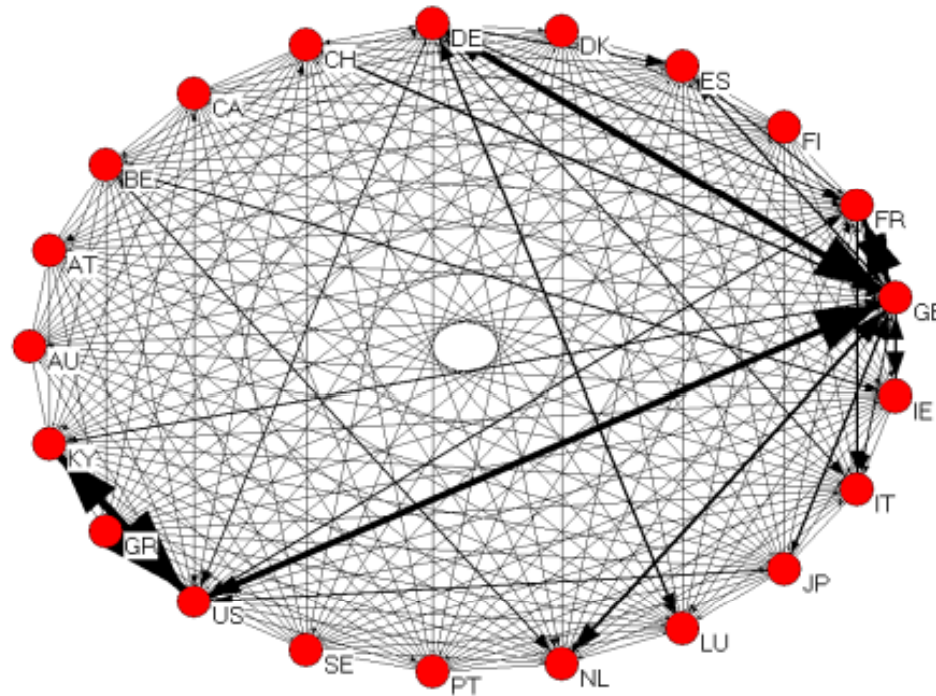
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Raw data 2008 Q2



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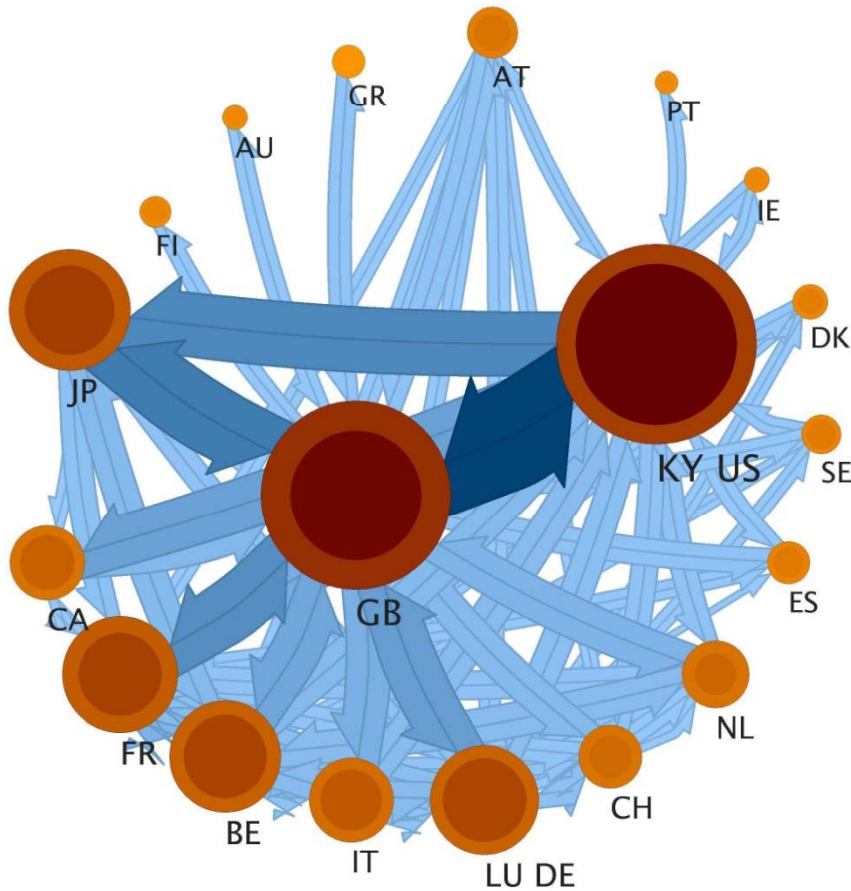
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Modular network (1985 Q1)

1985 Q1



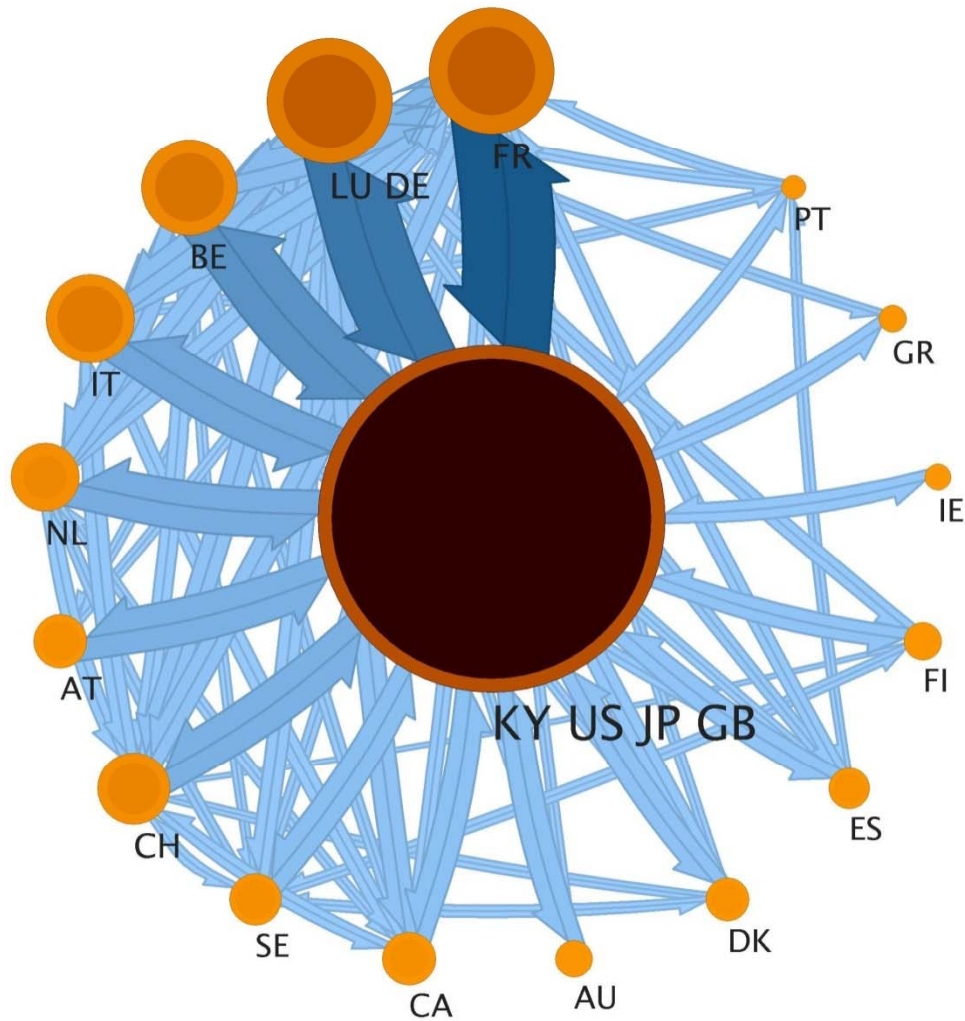
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Source: Bank for International Settlements, Locational by Residence data and own calculations.

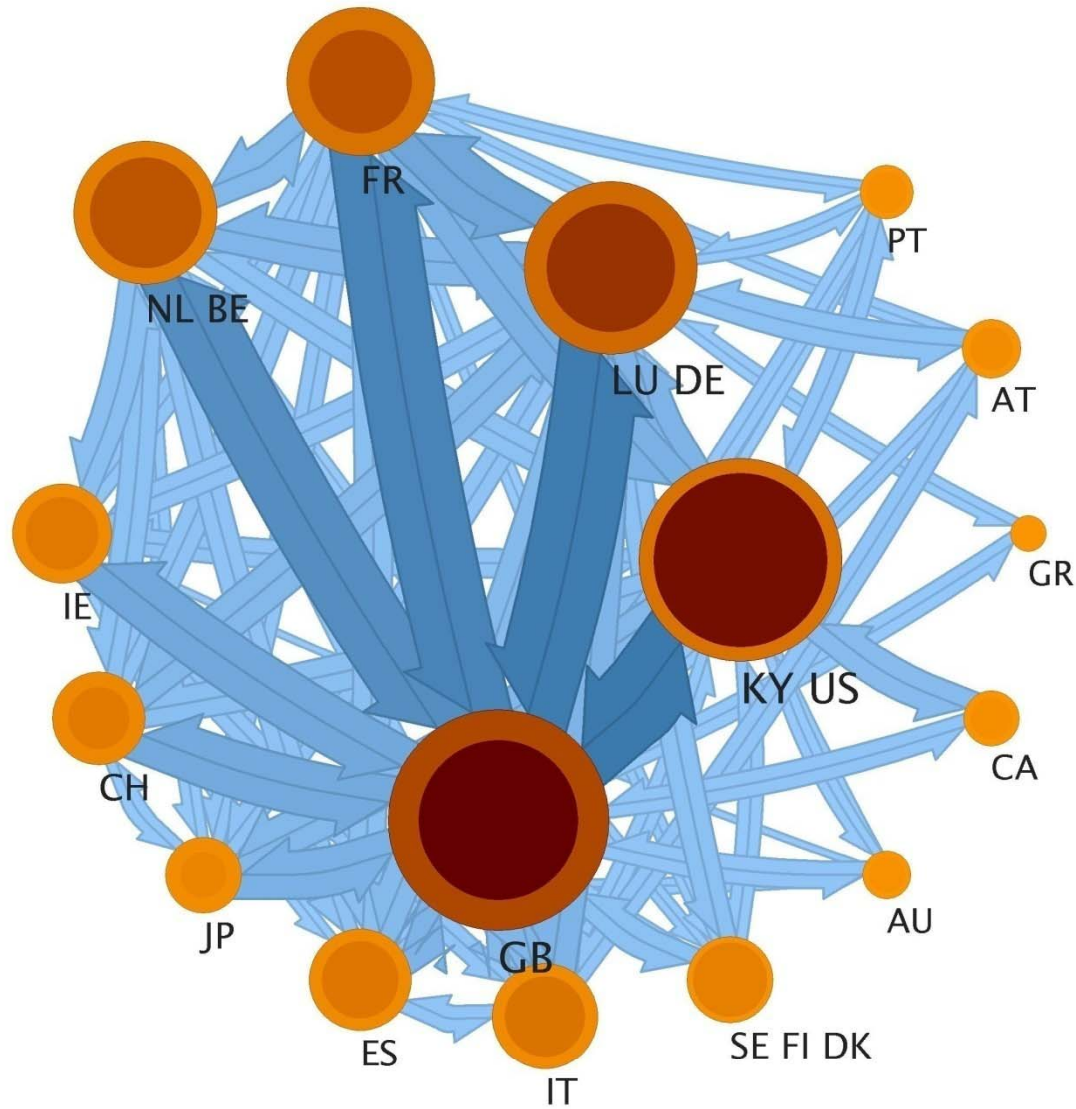
Modular network (1989 Q3)

1989 Q3



Modular network (2008 Q2)

2008 Q2



Risk diversification or contagion?

$$p_t = \Pi p_{t-1} + e_{t-1}$$

$$e_{it} = s(\textit{acceleration, diversification})$$

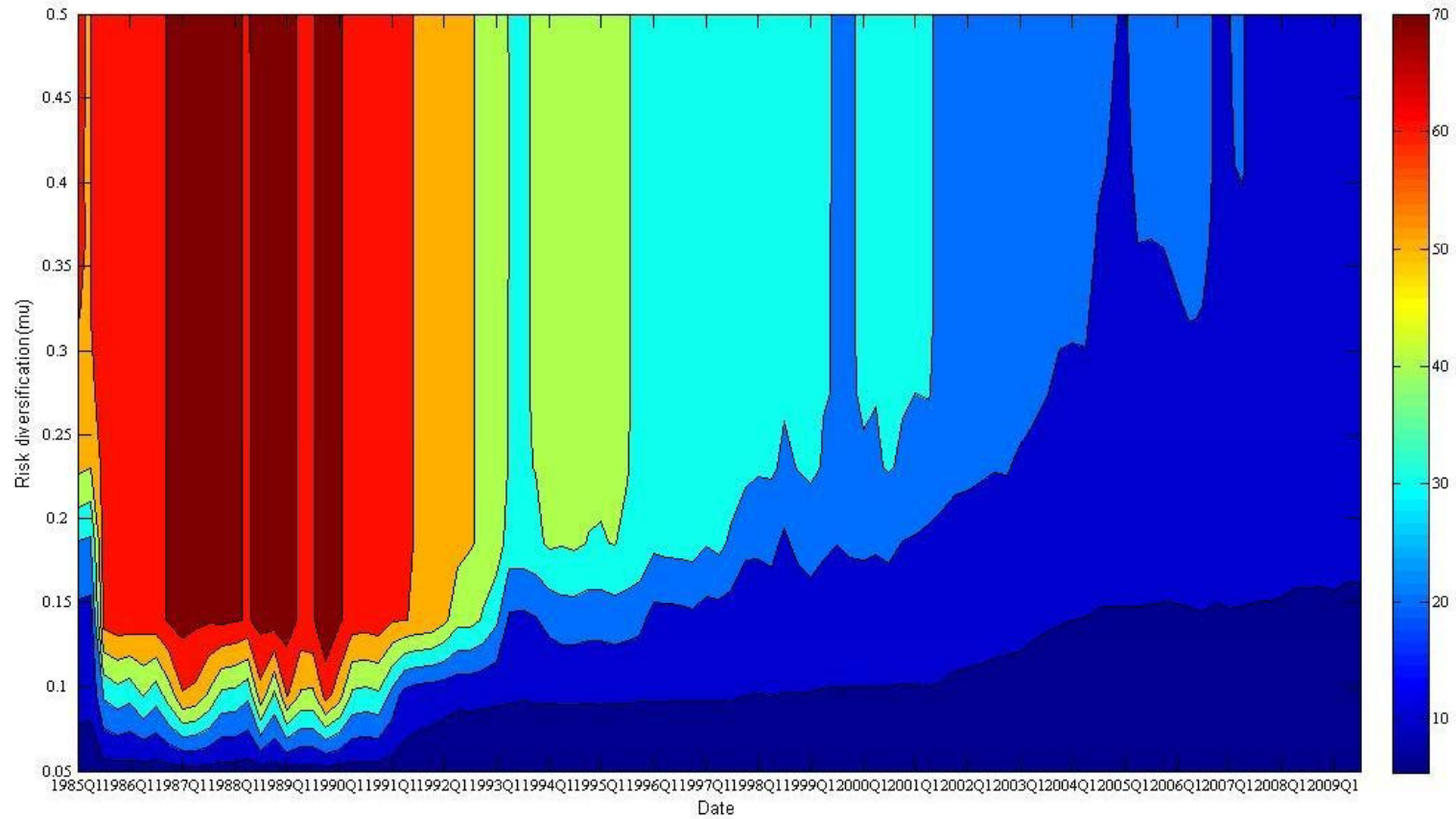


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Conclusion

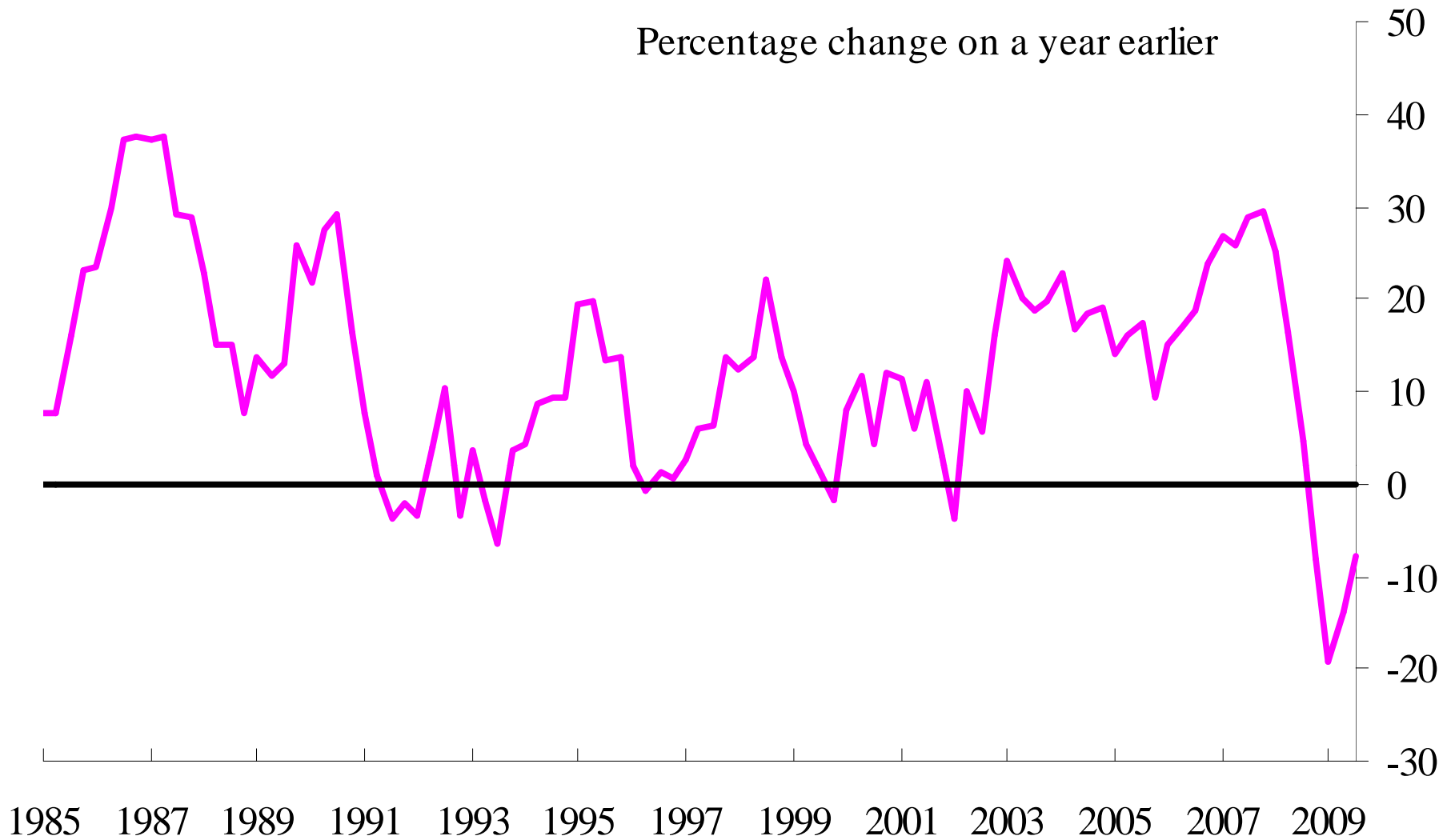
- Key result: Network became more contagious prior to the crisis .
- Interconnectivity did not imply risk-sharing
- Next step:
- How are interbank networks formed?
- What happens under stress? Risk-sharing versus contagion

Allen, Franklin and Douglas Gale, (2001). "Financial Contagion," Journal of Political Economy, University of Chicago Press, vol. 108(1), pages 1-33, February.

Battiston, Stefano, Delli Gatti, Domenico, Gallegati, Mauro, Greenwald, Bruce C. N. and Stiglitz, Joseph E., (2009) Liaisons Dangereuses: Increasing Connectivity, Risk Sharing, and Systemic Risk (January 2009). NBER Working Paper Series, Vol. w15611, pp. -, 2009. Available at SSRN: <http://ssrn.com/abstract=1532069>

Lancichinetti, A. and S. Fortunato, (2009) "Community detection algorithms: a comparative analysis," Physical Review E 80, 056117, 2009

Percentage change on a year earlier



Source: Bank for International Settlements, Locational by Residence data.

Notes: (a) The countries are Austria, Australia, Belgium, Canada, the Cayman Islands, Switzerland, Germany, Greece, Denmark (excluding Faeroe Islands and Greenland), Spain, Finland, France (including Monaco), United Kingdom (excluding Guernsey, Isle of Man and Jersey), Ireland, Italy, Japan, Luxembourg, Netherlands, Portugal, Sweden, and the United States.

Findings

- Significant changes in modular structure since 1985
 - Late 1980s saw formation of large super cluster: Japan, United Kingdom, the United States and the Cayman Islands.
 - That cluster breaks up by the beginning of the 1990s
- Persistent relationships
 - US & KY and DE & LU almost always together (except 2008 Q4)
 - Scandinavian group together since 2001
- Relevance and irrelevance of geographic location
 - Scandinavian group, DE & LU
 - Canada not with US (except 1997 Q1)
- Increase in systemic risk up to 2008 Q2
 - Still relatively high

Conclusion

- Key result: Network became more contagious prior to the crisis .
- Interconnectivity did not imply risk-sharing

Key Concepts

- Networks: risk-sharing versus contagion
- There may be a self-serving cognitive bias in attributing crisis to shocks rather than a malfunctioning network
- See also Papers on Colombia by Carlos Leon and others

Paper to accompany this presentation

http://www.econ.ucsb.edu/~garratt/faculty/contagious_capacity.pdf

Map equation

Rosvall M., D. Axelsson and C.T. Bergstrom, The map equation, [arXiv:0906.1405v2](https://arxiv.org/abs/0906.1405v2) [physics.soc-ph]

Rosvall, M. and C. T. Bergstrom, Mapping change in large networks, [arXiv:0812.1242v1](https://arxiv.org/abs/0812.1242v1) [physics.soc-ph]

<http://www.tp.umu.se/~rosvall/livemod/mapequation/index.html>

Page Rank and markov transition

Langville Amy N. and Carl Dean Meyer (2006) Google page rank and beyond: Princeton University Press, Jul 3, 2006

Examples of interconnectedness in the build up to the crisis

CDOs

<http://orgnet.com/cdo.html>

<http://ftalphaville.ft.com/blog/2010/11/04/394416/collateralised-contagion/>

<http://www.propublica.org/article/banks-self-dealing-super-charged-financial-crisis>

<http://www.propublica.org/special/interactive-cdos-interlocking-ownership#cdo/b43awlr>

Barnett Hart, A (2009), The Story of the CDO Market Meltdown <http://www.hks.harvard.edu/m-rcbg/students/dunlop/2009-CDOmeltdown.pdf>

<http://www.philadelphiafed.org/research-and-data/publications/working-papers/2011/wp11-30.pdf>

Heitfield, E (2009). "Parameter Uncertainty and the Credit Risk of Collateralized Debt Obligations," Board of Governors of the Federal Reserve System Working Paper

Iceland

[An Autopsy Report of the Icelandic Financial System: Guðrún Johnsen, The Special Investigation Commission](http://www.voxeu.org/index.php?q=node/4965)
<http://www.voxeu.org/index.php?q=node/4965>

Empirical evidence of contagion

Kaufman, Bank Contagion: A Review of Theory and Evidence, Journal of Financial Services Research, 1984

On the key question: Contagion or risk sharing?

Franklin Allen and Douglas Gale, 2001. "Financial Contagion," Journal of Political Economy, University of Chicago Press, vol. 108(1), pages 1-33, February. Battiston, Stefano, Delli Gatti, Domenico, Gallegati, Mauro, Greenwald, Bruce C. N. and Stiglitz, Joseph E., Liaisons Dangereuses: Increasing Connectivity, Risk Sharing, and Systemic Risk (January 2009). NBER Working Paper Series, Vol. w15611, pp. -, 2009. Available at SSRN: <http://ssrn.com/abstract=1532069>

Methodology of simulations

Gai and Kapadia (Bank of England Working Paper, 2010).
IMF GFSR April 2009 Chapter 2.

Colombian applications

León y Machado (2011) Designing an expert knowledge-based Systemic Importance Index for financial institutions. Borrador de BdR 669
Machado, León, Sarmiento, Chipatecua (2011) Riesgo Sistémico y Estabilidad del Sistema de Pagos de Alto Valor en Colombia: Análisis bajo Topología de Redes y Simulación de Pagos Borrador de 627
León C , C. Machado, Cepeda and Sarmiento, . "[Too-connected-to-fail Institutions and Payments System's Stability: Assessing Challenges for Financial Authorities](#) Borrador de BdR 644

