

The mechanics of markets: How to accurately monitor and control systemic risk

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What I won't talk about

- Agent-based model of housing market in collaboration with the Bank of England
 - Tang, Pugh, Hinterschweiger, Galbiati, Uluc, Low Farmer (2015?)
- The Intrafirm Complexity of Systemically Important Financial Institutions
 - Lumsdaine, Rockmore, Foti, Leibon, Farmer (2015)
- Why agent-based modeling are an essential tool for understanding systemic risk

Mandate of the OFR (Dodd-Frank)

- GENERAL DUTIES.—The Research and Analysis Center, on behalf of the Council, shall develop and maintain independent analytical capabilities and computing resources—
 - A. to develop and maintain metrics and reporting systems for risks to the financial stability of the United States;
 - B. to monitor, investigate, and report on changes in systemwide risk levels and patterns to the Council and Congress;
 - C. to conduct, coordinate, and sponsor research to support and improve regulation of financial entities and markets;

How to achieve this?

How well can it be done?

Systemic risk

- Systemic risk in financial markets occurs when activities that are beneficial to an agent in isolation cause unintended consequences due to collective interactions.
 - microprudential vs. macroprudential regulation
- Two channels of contagion in financial markets:
 - networks of counterparty exposures (lending)
 - overlapping portfolios (common assets)

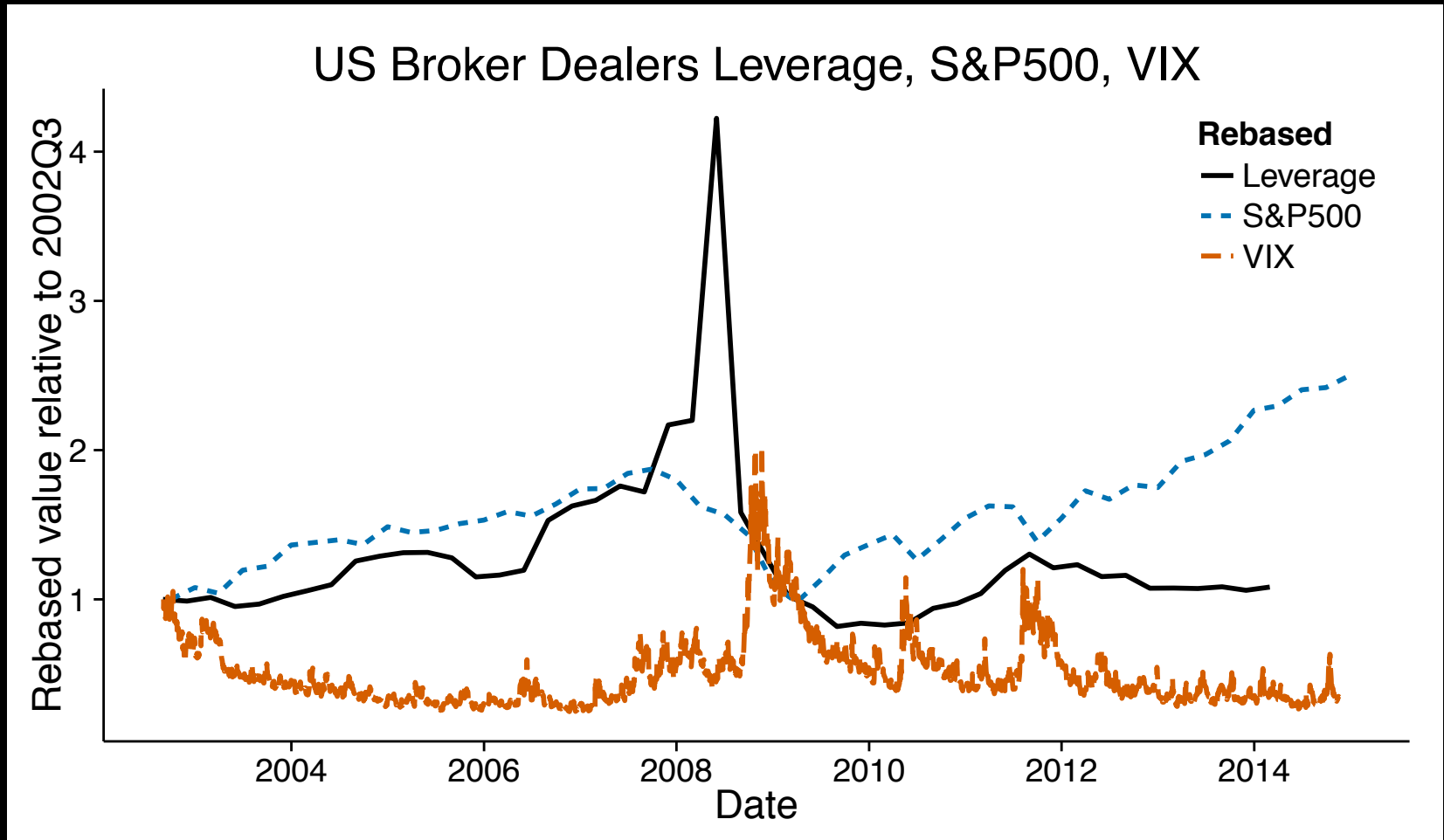
Key factors

- Dynamic effects
 - changing positions (e.g. deleveraging to reduce risk) can turn a market correction into a crisis
- Network effects
 - need to take into account number of systemically risky institutions a given institution connected to
 - connections can be via loans or common assets
- Ecological effects
 - shifts in the composition of investor strategies

Dynamic effects

- E.g. leverage cycles (Minsky, Geanakoplos, 2003)
 - now a large literature
- Agent-based model of leveraged value investors
 - Thurner, Farmer, Geanakoplos (2012); Poledna, Thurner, Farmer, Geanakoplos (2014)
 - leverage creates clustered volatility and fat tails in returns similar to those actually observed
 - risk control forces selling into falling markets
 - Basel makes crises more frequent at high leverage

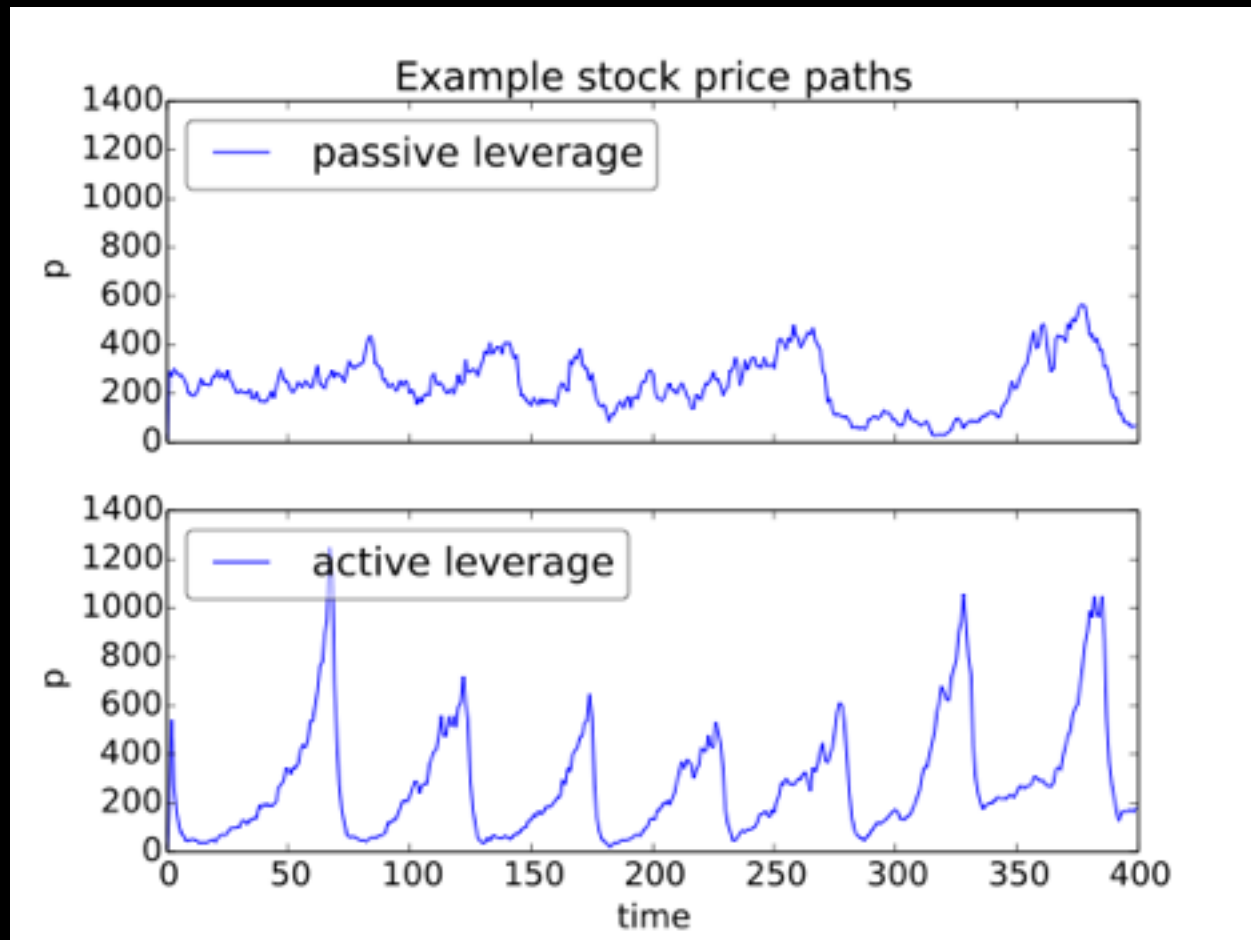
Cause of Great Moderation + crisis?

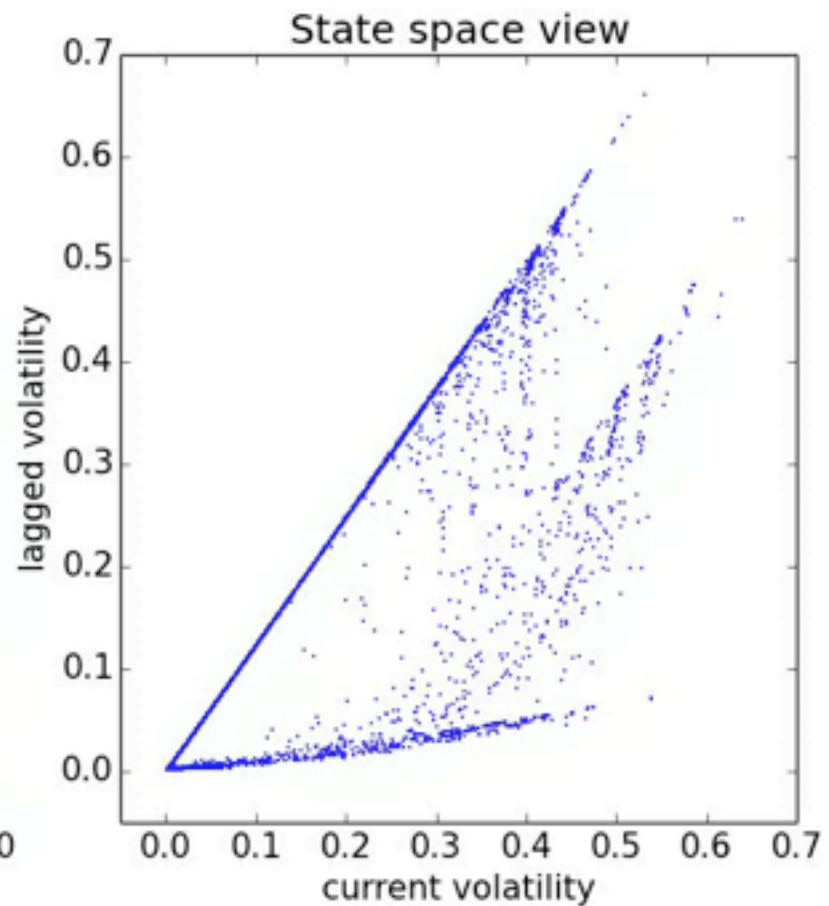
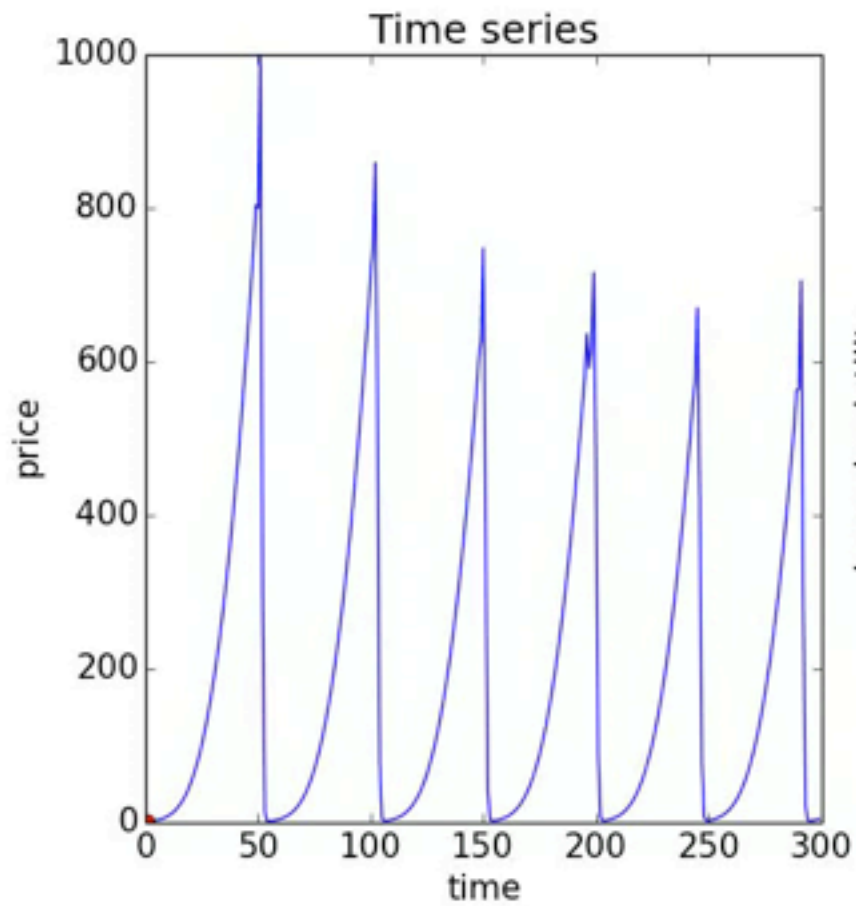


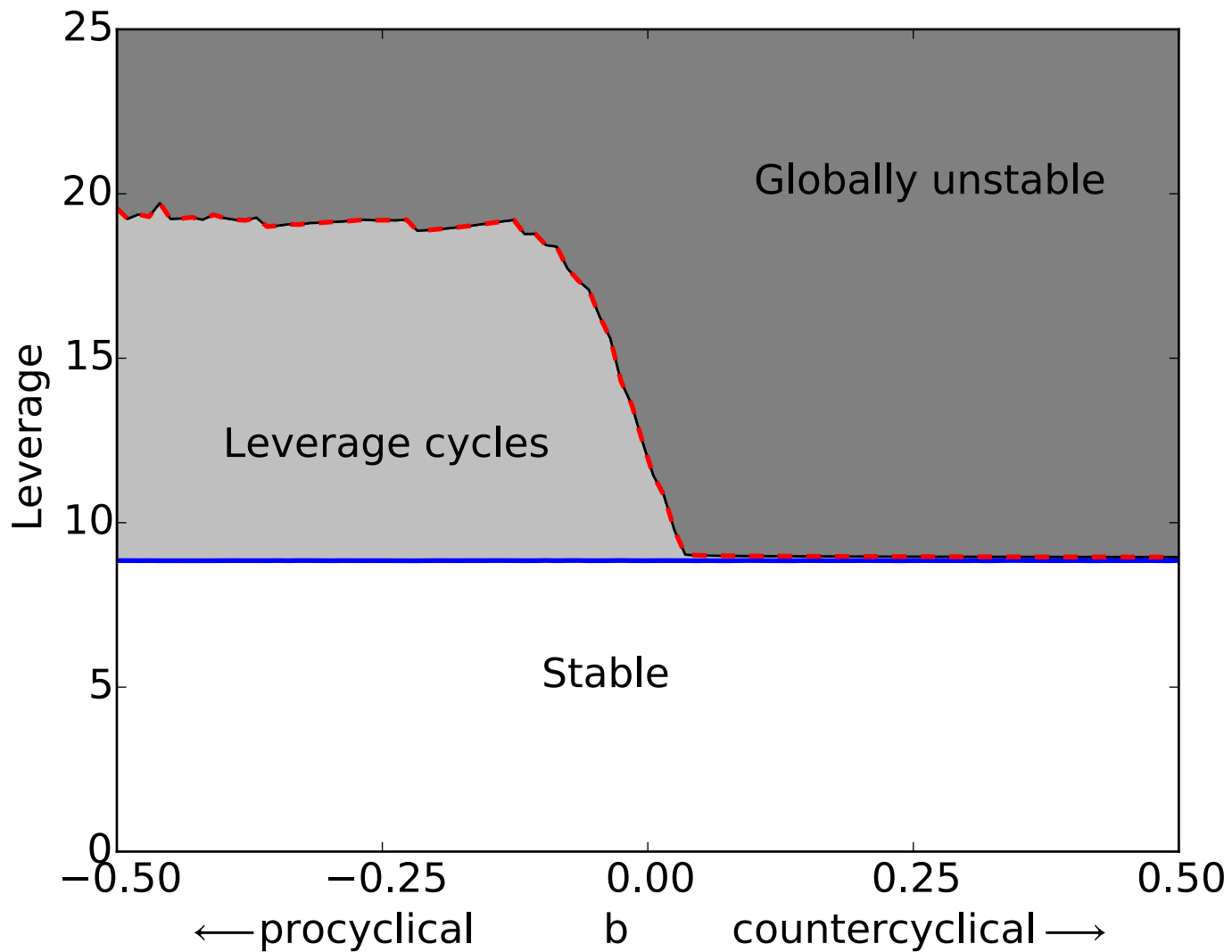
ABM of Basel leverage cycle

- Banks use leverage targeting, which is inherently destabilizing (Adrian and Shin, 2008)
- Simple model
 - Aymanns and Farmer (2015), Aymanns, Caccioli, Farmer and Tan (2015)
 - Investors: bank and fundamentalist; one risky asset
 - Bank follows leverage targets, e.g. from Basel II
 - Moving average of historical vol to compute risk

Agent-based model of interacting banks

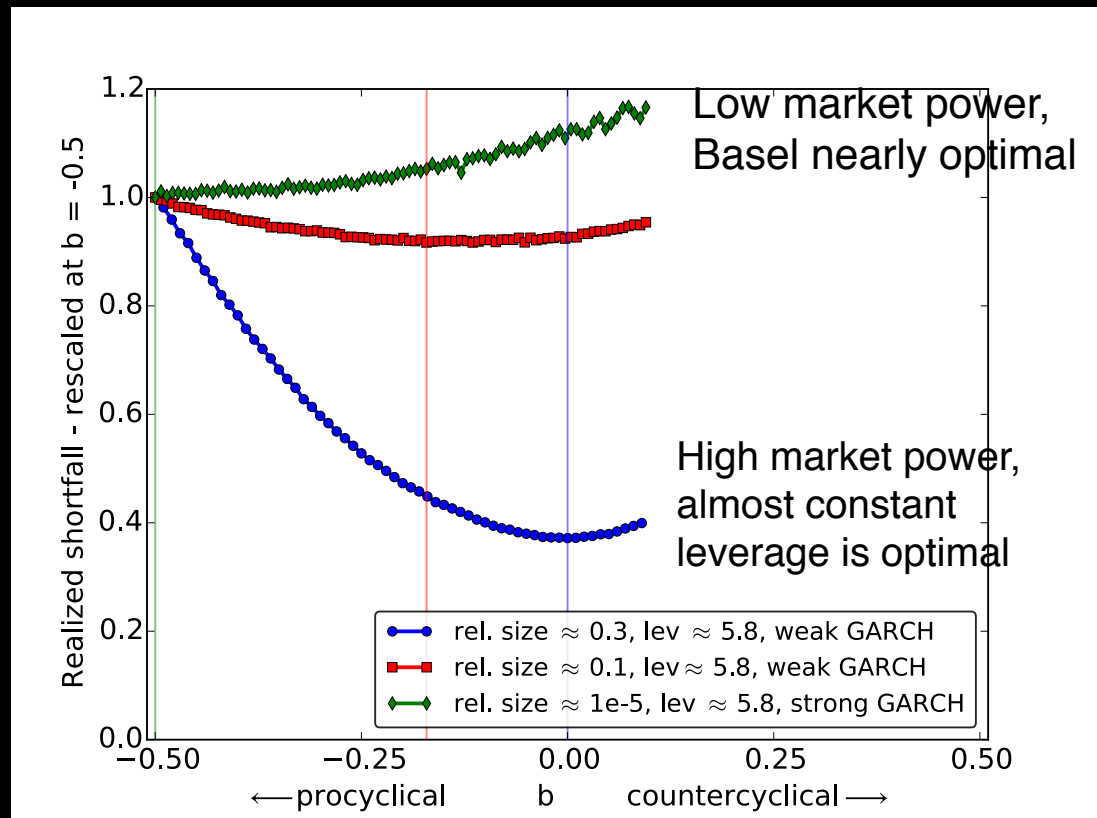






Optimal policy depends on market power of banking sector

- Low market power:
Basel optimal
- High market power:
constant leverage
- Microprudential vs.
macroprudential
regulation



policy recommendation on leverage

- Know where threshold is!
- Leave a large margin of error
- Best policy depends on size of banking sector
 - when banking sector larger, leverage must go down
 - limits must change sufficiently slowly (compromise between microprudential and macroprudential risk)
 - need carefully designed countercyclical buffers

Network effects

- For counterparty exposure networks Debt Rank is the right way to measure systemic risk
 - Battiston et al, (2012);
 - Uses same principle as Page Rank (Google)
 - Requires knowledge of network of debt exposures
- Can construct a systemic risk tax that (in an ABM simulation) costlessly eliminates systemic risk.
 - Poledna and Thurner, (2015)
- Developing an analog for overlapping portfolios
 - Caccioli, Shrestha, Moore, Farmer (2014);

Networks + Dynamics

- Two or more channels of contagion imply multiplex network (multiple overlapping networks)
 - risk greater than the sum of the individual risks
 - Caccioli, Farmer, Foti and Rockmore (2015)
- Need to combine dynamics and network properties
 - Aymanns, Caccioli, Farmer, Kleinnijenhuis, Poledna, Thurner (?)
 - Will provide accurate early warning of systemic risk
 - Requires knowledge of positions of SIFIs

Charter of the OFR (Dodd-Frank)

- The Office shall collect, on a schedule determined by the Director, in consultation with the Council, financial transaction data and position data from financial companies.

Summary

- Knowledge of positions would give *vastly* better understanding of systemic risk
 - early warning, policy advice to reduce risk, ...
- Approach needed is very different than usual
 - representative agents, utility maximization, equilibrium, motivations, not needed
 - need to understand dynamics and stability of the financial network
 - knowing positions of SIFIs permits the luxury of using a mechanical approach to understanding risk

Leverage amplifies noise

- Doesn't just increase probability of bankruptcy, it alters prices, spreads contagion

