Systemic Risk and Interconnectedness in the Interbank Market

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Systemic risk and macroprudential regulation: perspectives from network analysis
Bank of England, October 13, 2014

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Introduction

Two alternative network methodologies

- **Common holdings → Correlation networks (inferred links)**
  - Diebold & Yilmaz (2014); Billio, Getmansky, Lo, Pelizzon (2012); Barigozzi & Brownlees (2013).

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- **Correlation and Physical Networks**
  - This paper.

Introduction - cont'd

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- Develop an accounting framework to describe both correlation and physical networks.
- We build correlation and physical network for the European interbank market (eMid).
- Compare and contrast the two network structures:
  - Response to economic shocks;
  - Policy implication: Forecasting.

eMid Platform

The eMid platform is the only electronic market for interbank deposits in the Eurozone. All European banks can trade in the eMid.

How trades occur:

1. Bank posts a limit order (trade request) that identifies desire to lend/borrow, price, quantity, bank ID.
2. After another bank responds to the limit order, they call each other and have 1 minute to come to final terms.
3. If terms are mutually agreed upon, the trade occurs.

Physical network

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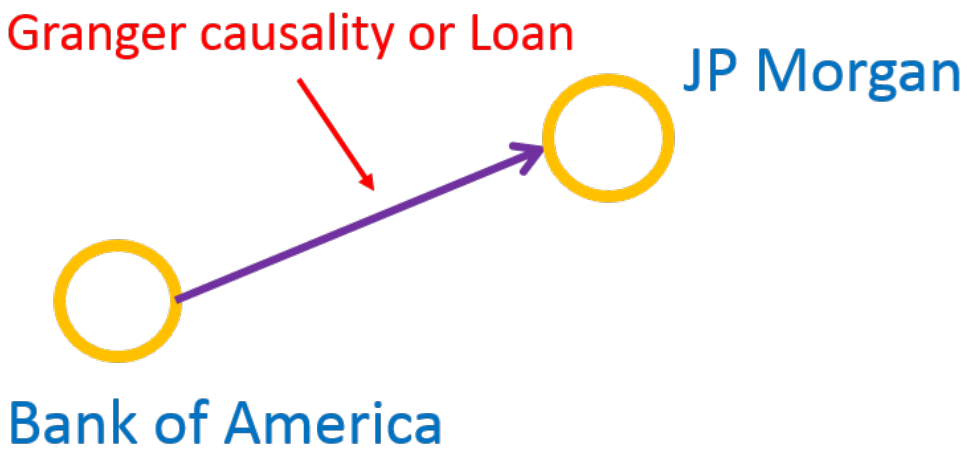
January 2006 through March 2010

Two Network Types



1. Correlation: Bank of America's stock returns Granger cause (are predictive of) JP Morgan's stock returns
2. Physical: JP Morgan borrows from Bank of America

An Accounting Framework

Similar to Shin (2009) and Elliott, Goluband & Jackson (2014):

Assets	Liabilities
$\sum_k w_{i,k} y_{i,k}$	e_i
	x_i
$\sum_j x_j \pi_{i,j}$	d_i

An Accounting Framework - cont'd

Bank i's balance sheet identity is then

$$\begin{aligned} \sum_k w_{i,k} y_{i,k} + \sum_j x_j \pi_{i,j} &= e_i + x_i + d_i \\ (I - \Pi)X &= WY - E - D \\ \text{Interbank market} &= \text{Assets} - \text{Equities} - \text{Liabilities} \end{aligned}$$

An Accounting Framework - cont'd

Consolidated balance sheet for the banking sector becomes:

Assets	Liabilities
$\sum_i \sum_k w_{i,k} y_{i,k}$	$\sum_i e_i$
	$\sum_i d_i$

An Accounting Framework - cont'd

The consolidated balance sheet identity becomes

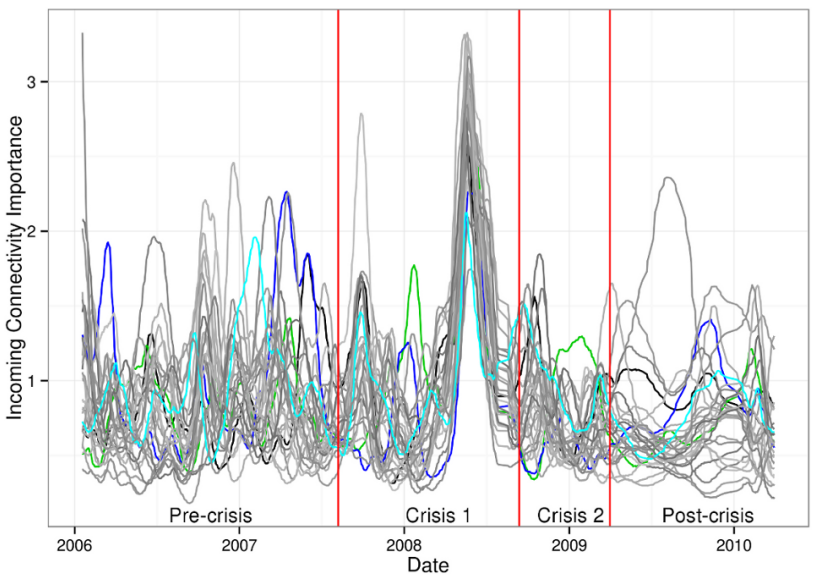
$$E = WY - D.$$

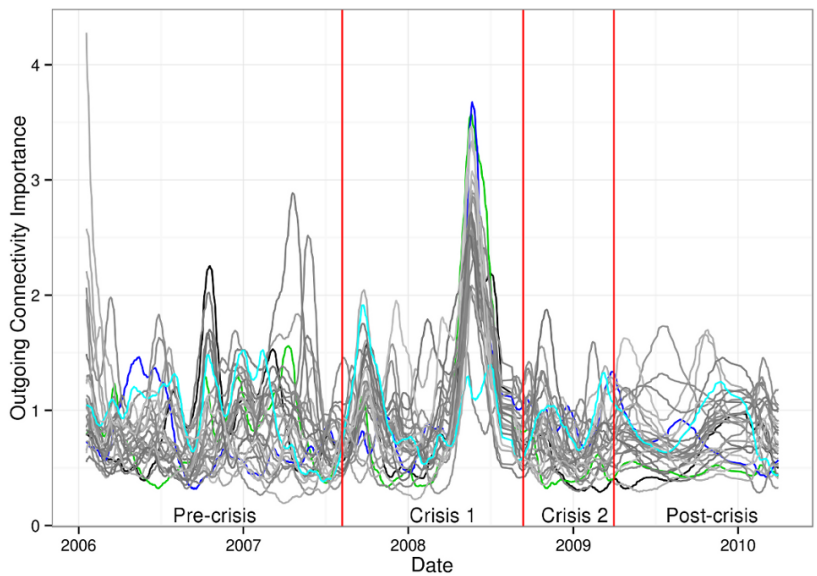
Thus, if we compare the two identities

$$\begin{aligned} (I - \Pi)X &= WY - E - D \\ E &= WY - D. \end{aligned}$$

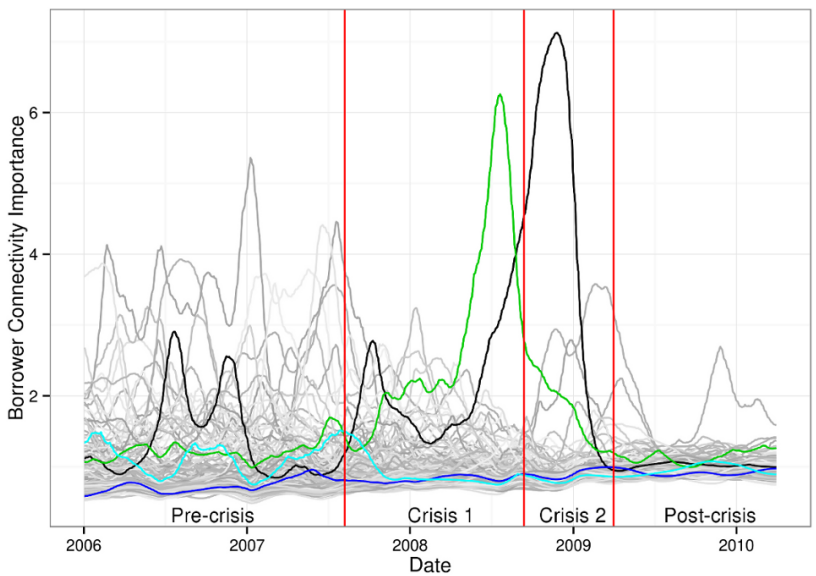
The two networks subsume different information sets.

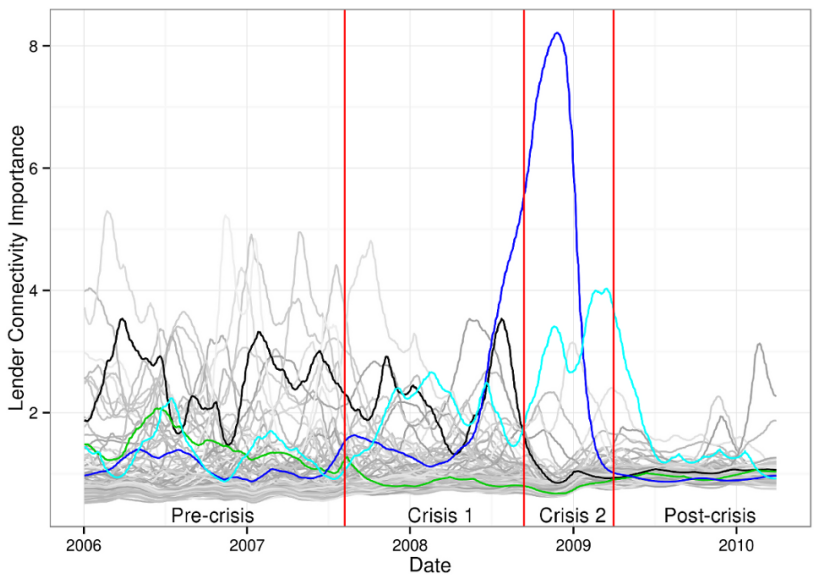
Correlation Network Dynamics (With Smoothness Penalty)

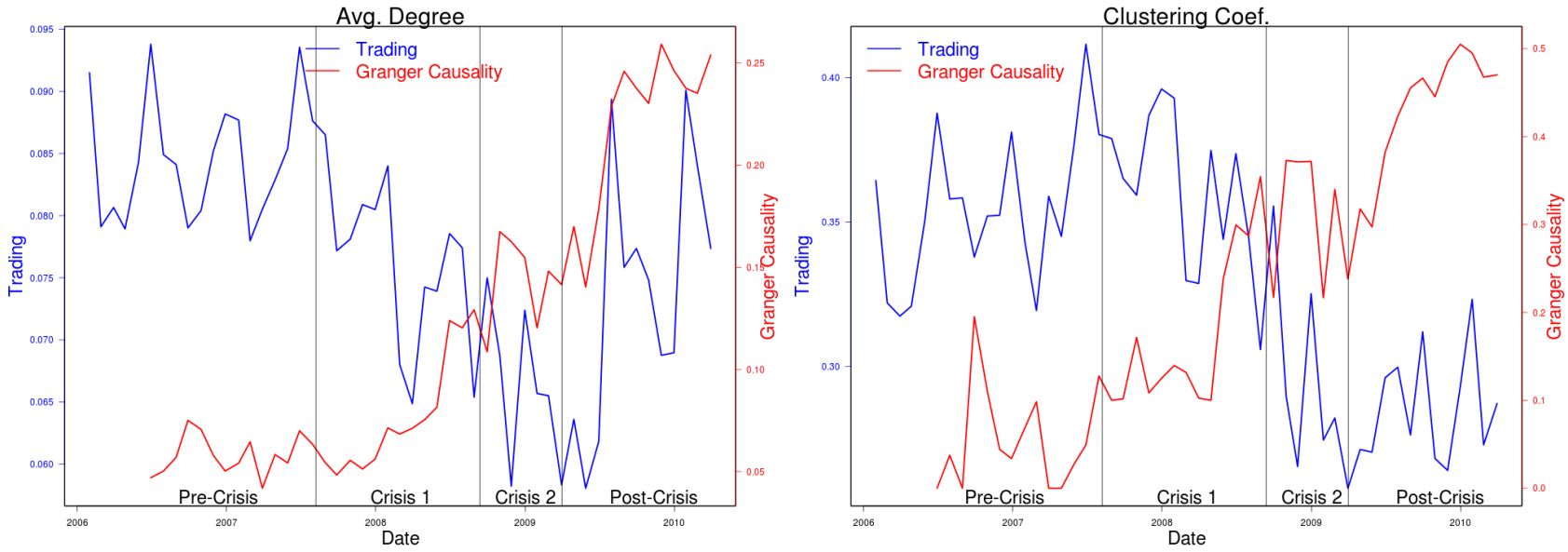




Physical Network Dynamics (With Smoothness Penalty)







Interconnectivity within the interbank market (physical network) decreased during the crisis, while the correlation network became more connected.

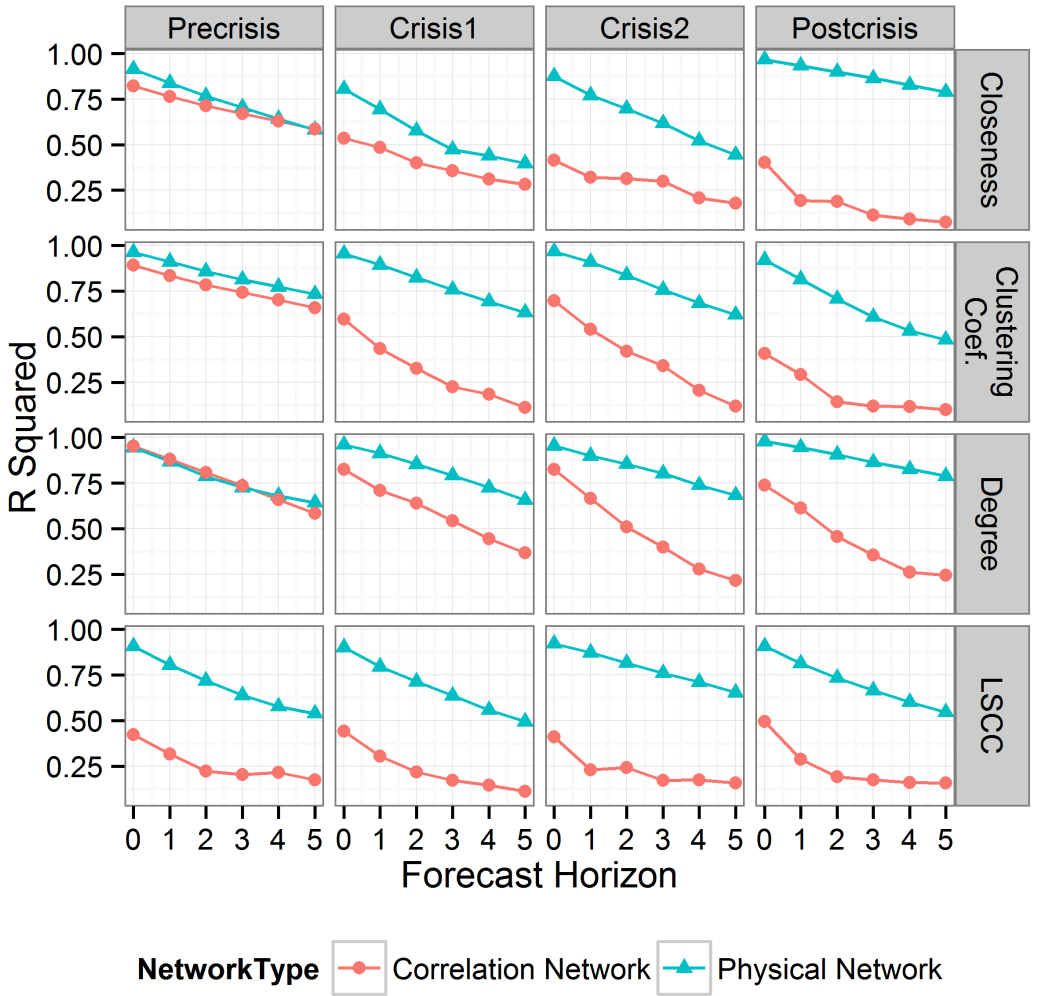
Response to Economic Shocks

We test how the two networks respond to macro-economic and monetary shocks

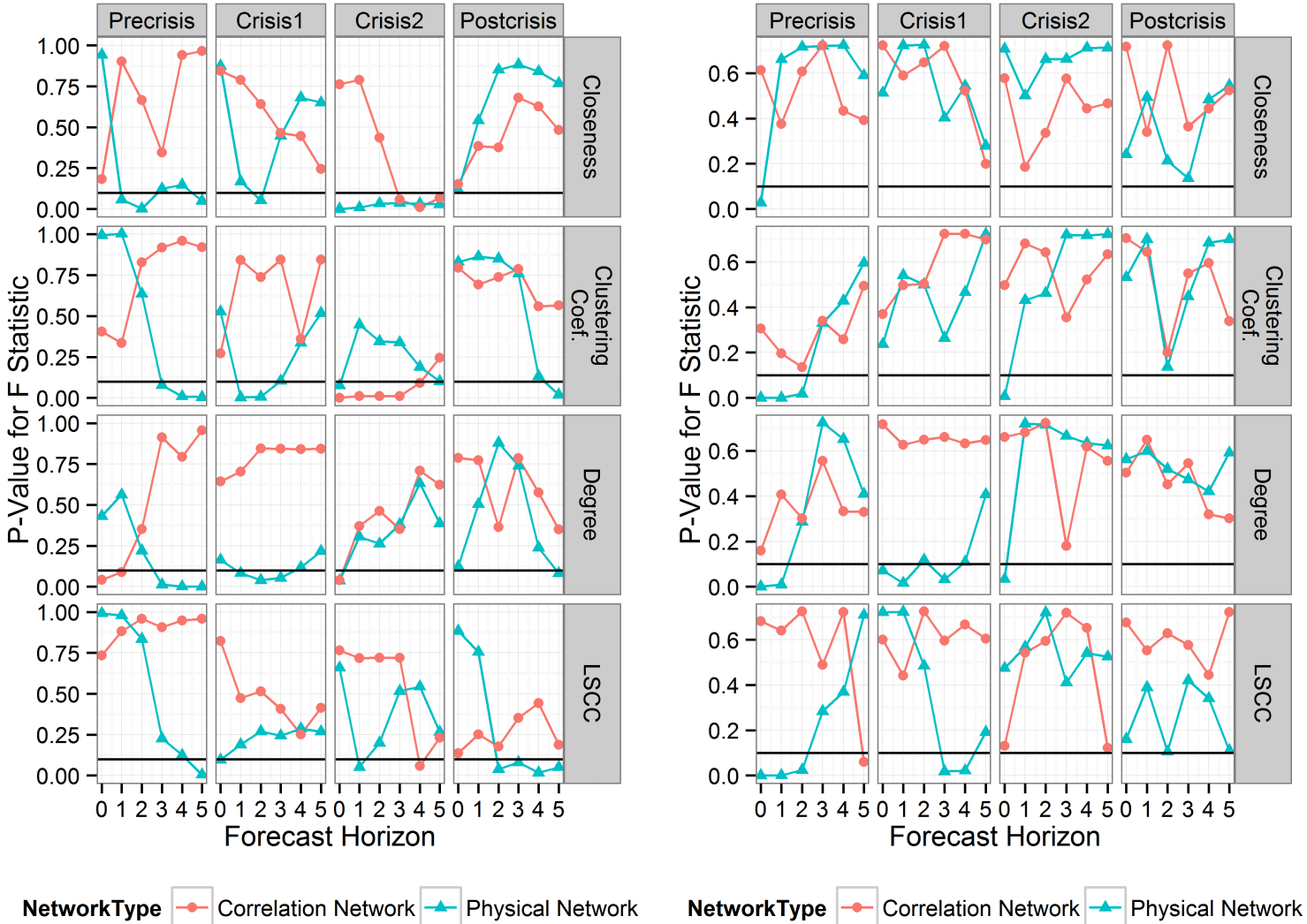
$$y_{t+k} = \beta \mathit{MacroVars} + \gamma \mathit{MonetaryVars} + \epsilon.$$

- y_{t+k} are network statistics
- *MacroVars* are European Dow Jones Index, Libor rate, Uncertainty index, Surprise index (Scotti, 2013).
- *MonetaryVars* are ECB inteventions: LTRO, MRO, other operations.

Response to Economic Shocks: R^2



Response to Economic Shocks: *F – test*



Policy Implications: Forecasting

Can we forecasts relevant economic variables?

- IP: Industrial production
- PMI: Purchasing managers index
- RS: Retail sales
- LIBOR-OIS Spread (1 month)
- DJST: European Stock Index
- ITSP: Germany - Italy 10-yr yield
- PTSP: Germany - Portugal 10-yr yield
- GRSP: Germany - Greece 10-yr yield
- SPSP: Germany - Spain 10 yr yield

Monthly observations: forecasting from June 2009 to March 2010.

Policy Implications: Forecasting - cont'd

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Policy Implications: Forecasting - cont'd

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- Purchasing managers index, Portuguese, Greek and Spanish spreads:
  physical networks better forecasting power than correlation networks.

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THANK YOU