FNA

Systemic Stress Testing and Central Clearing Interdependencies

Kimmo Soramaki

Fifth Annual Risk Management Conference:
Examining Regulatory Initiatives

Chicago, 16 October 2018

Motivation

The **New Systemic Risk**

Three CCP failures in the past (Paris, Kuala Lumpur and Hong Kong)

Interest by regulators, CCPs and members.

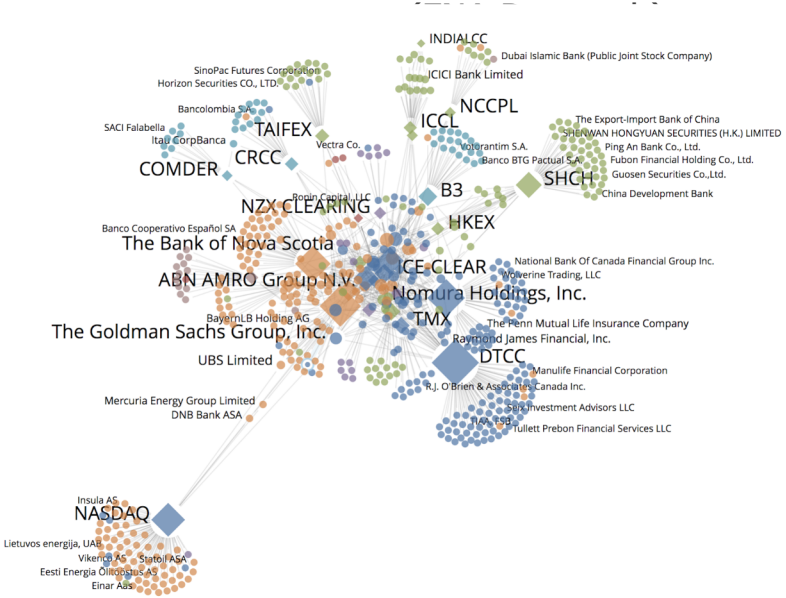
Especially with tie in to Cyber, IT and other operational risks.

"*They [CCPs] are not equipped, however, to test the impact of their failure on the financial system as a whole nor are they equipped to assess the potential contagion effect on other members of a given member's failure.*"

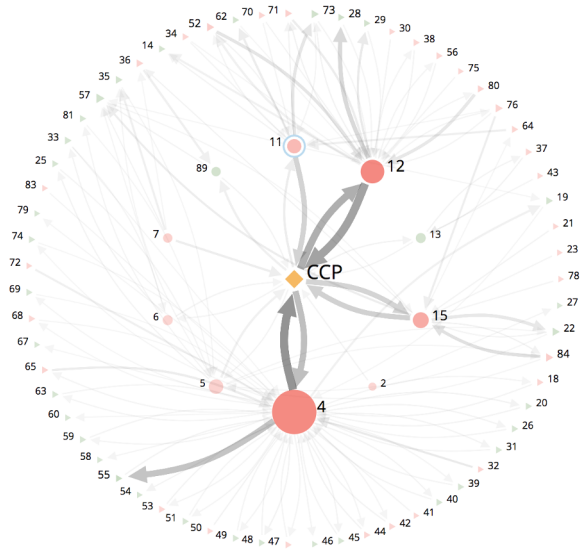
Cox & Steigerwald (2018)

Agenda

1) Interconnectedness **across** CCPs **within** a CCP



2) Interconnectedness



3) Simulation & Stress Testing

FNA

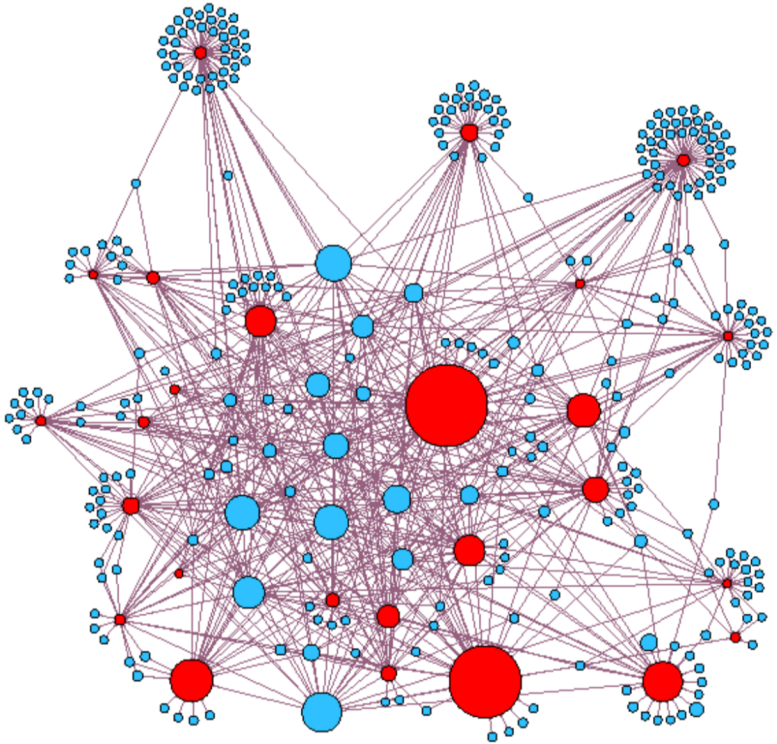
Interconnectedness in the
Global System of CCPs

Scope of Analysis

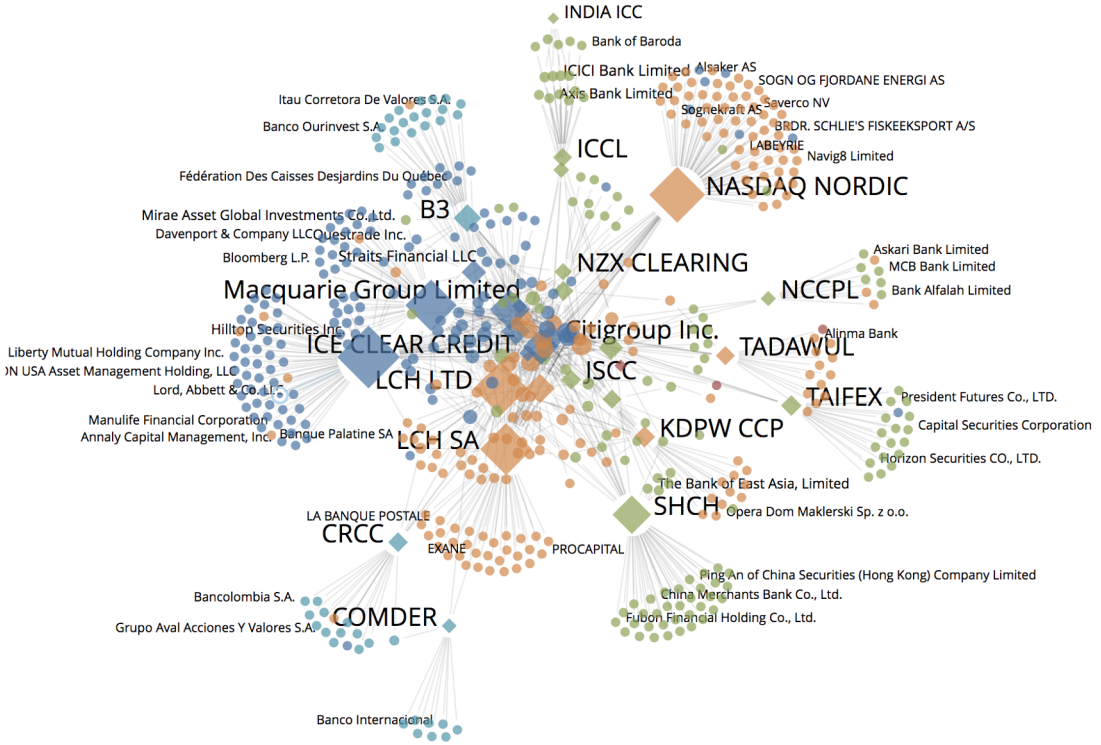
Comparison with BIS "Analysis of Central Clearing Interdependencies" (2018)

	BIS (2018)	**FNA (2018)**
CCPs	26	29
Clearing Members	n/a	813
Parent Organizations	306	495
Roles	7 (member, settlement, LOC, ...)	1 (member)

Private vs Public Data



BIS (2018)



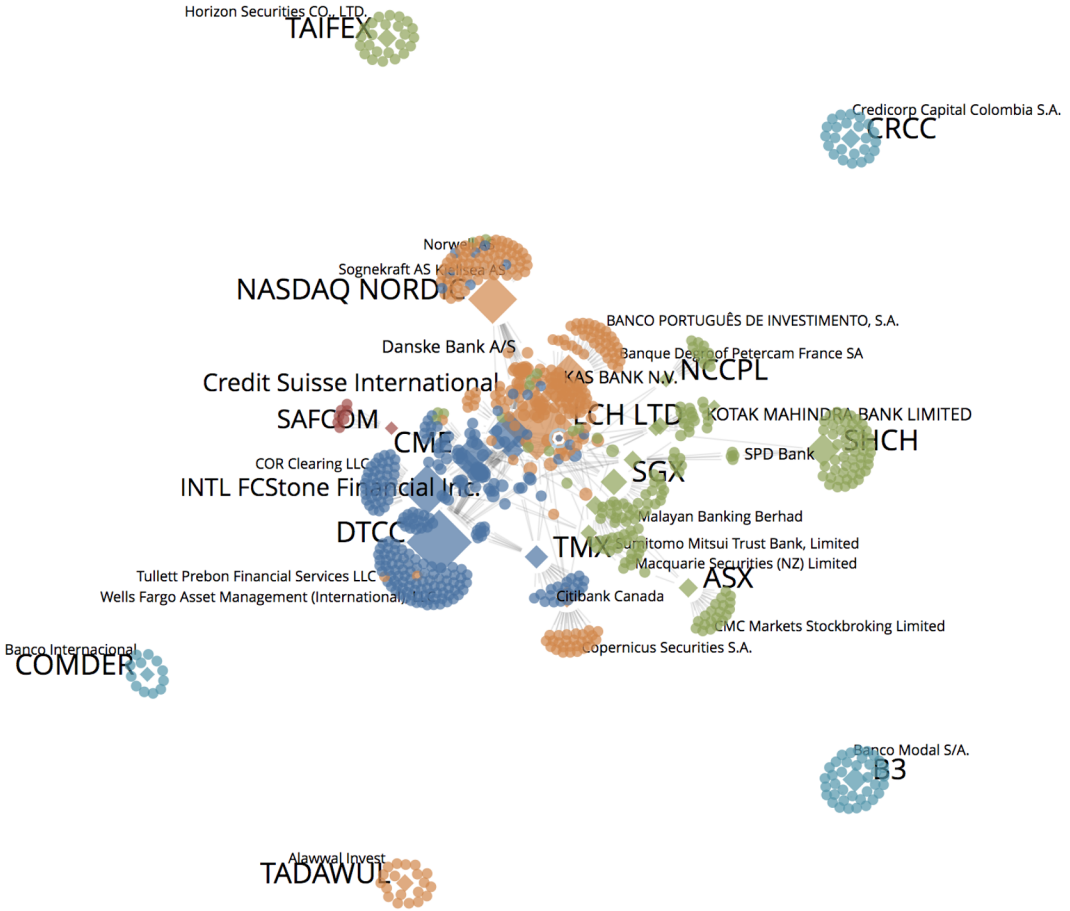
FNA (2018)

CCP Interconnectedness - Subsidiary Level

We see CCPs (diamonds) and their members (circles) from different regions:

- North America (blue)
- Europe and Middle East (orange)
- Asia and Pacific (green)
- Latin America (light blue)
- Africa (red)

On subsidiary level, we see a tight core with peripheral CCPs and a number of completely disconnected CCPs from Latin America and Middle East.

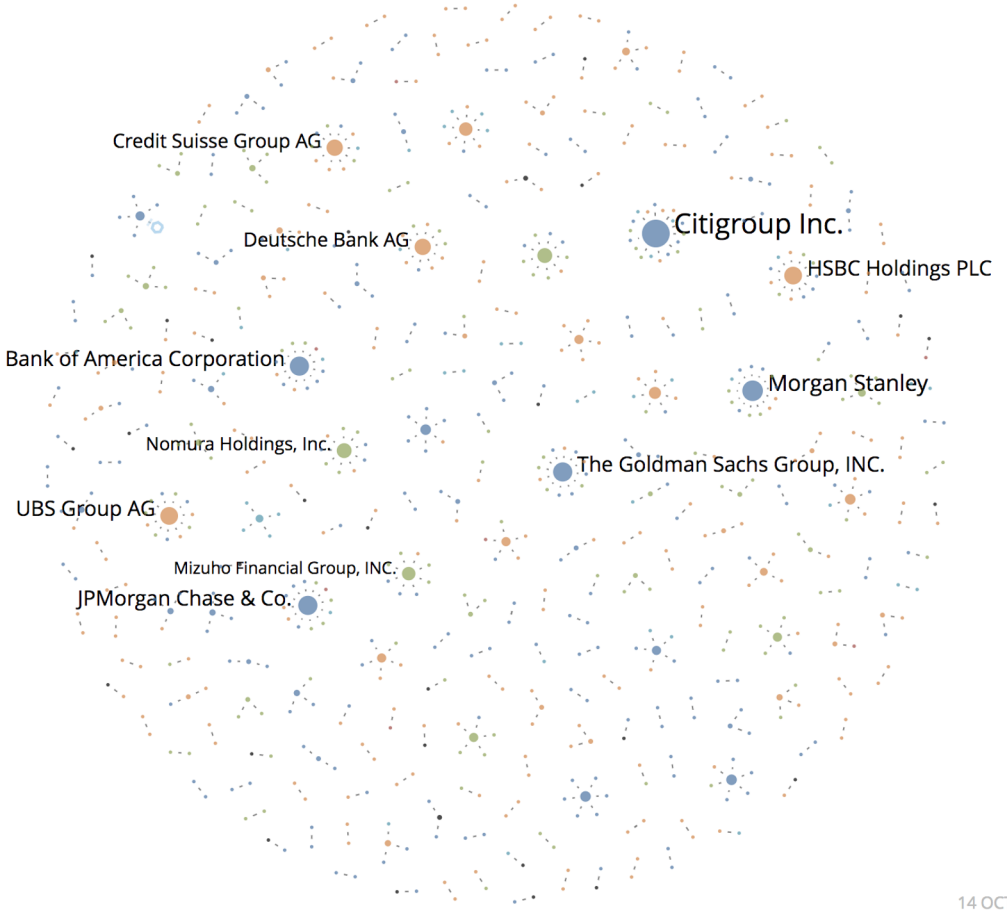


Banking Groups

210 Banking Groups

Largest (# of entities):

1. Citigroup (18)
2. Morgan Stanley (13)
3. Goldman Sachs (12)
4. JPMorgan Chase (12)
5. Bank of America (12)
6. HSBC (11)
7. UBS (11)
8. Deutsche Bank (10)
9. Credit Suisse (10)
10. Nomura Holdings (9)

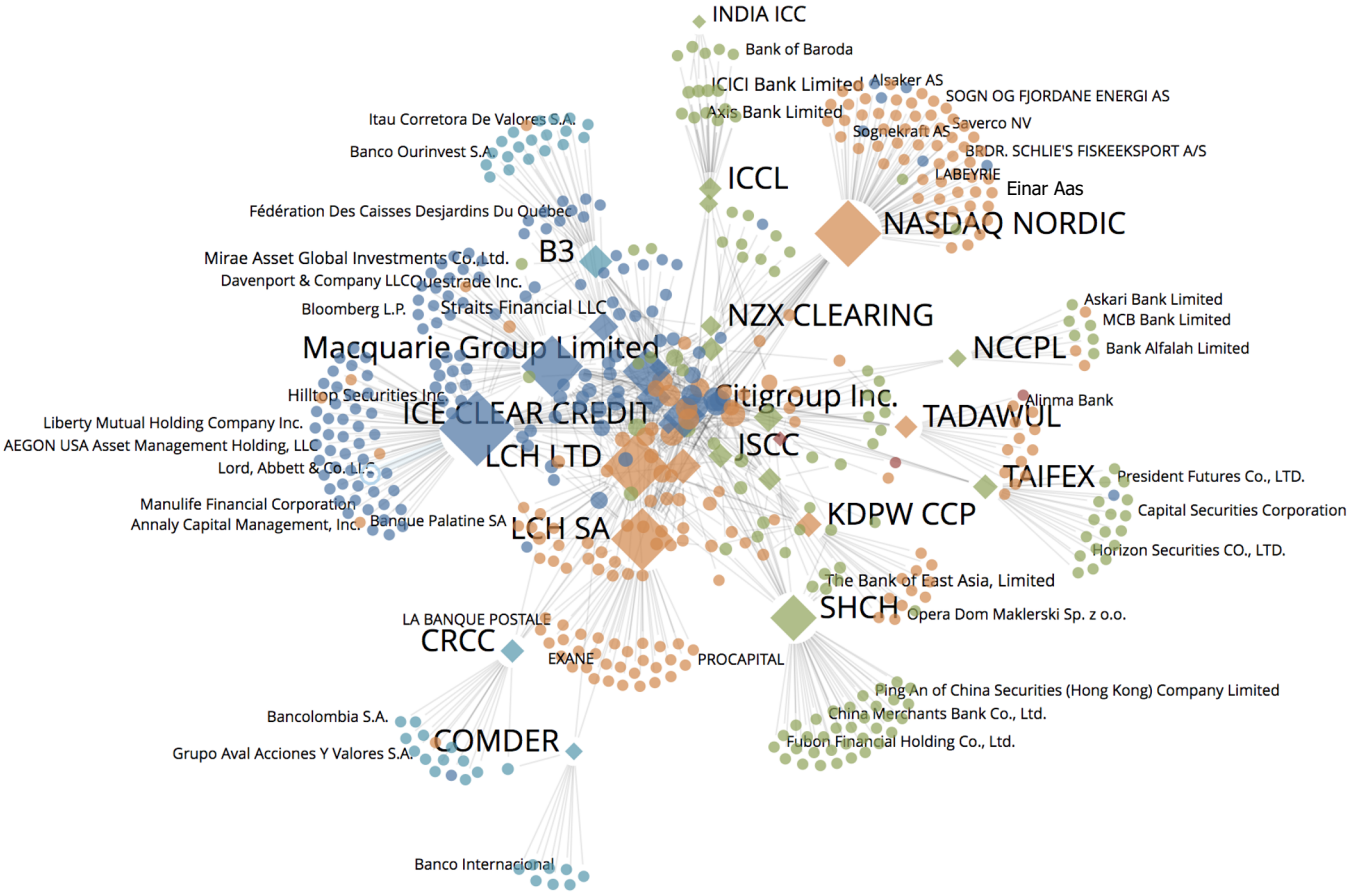


CCP Interconnectedness on Parent Level

We see CCPs (diamonds) and their members (circles) from different regions:

- North America (blue)
- Europe and Middle East (orange)
- Asia and Pacific (green)
- Latin America (light blue)
- Africa (red)

On parent level we see a completely connected network dominated by a core consisting of CCPs from North America and Europe and global banks.

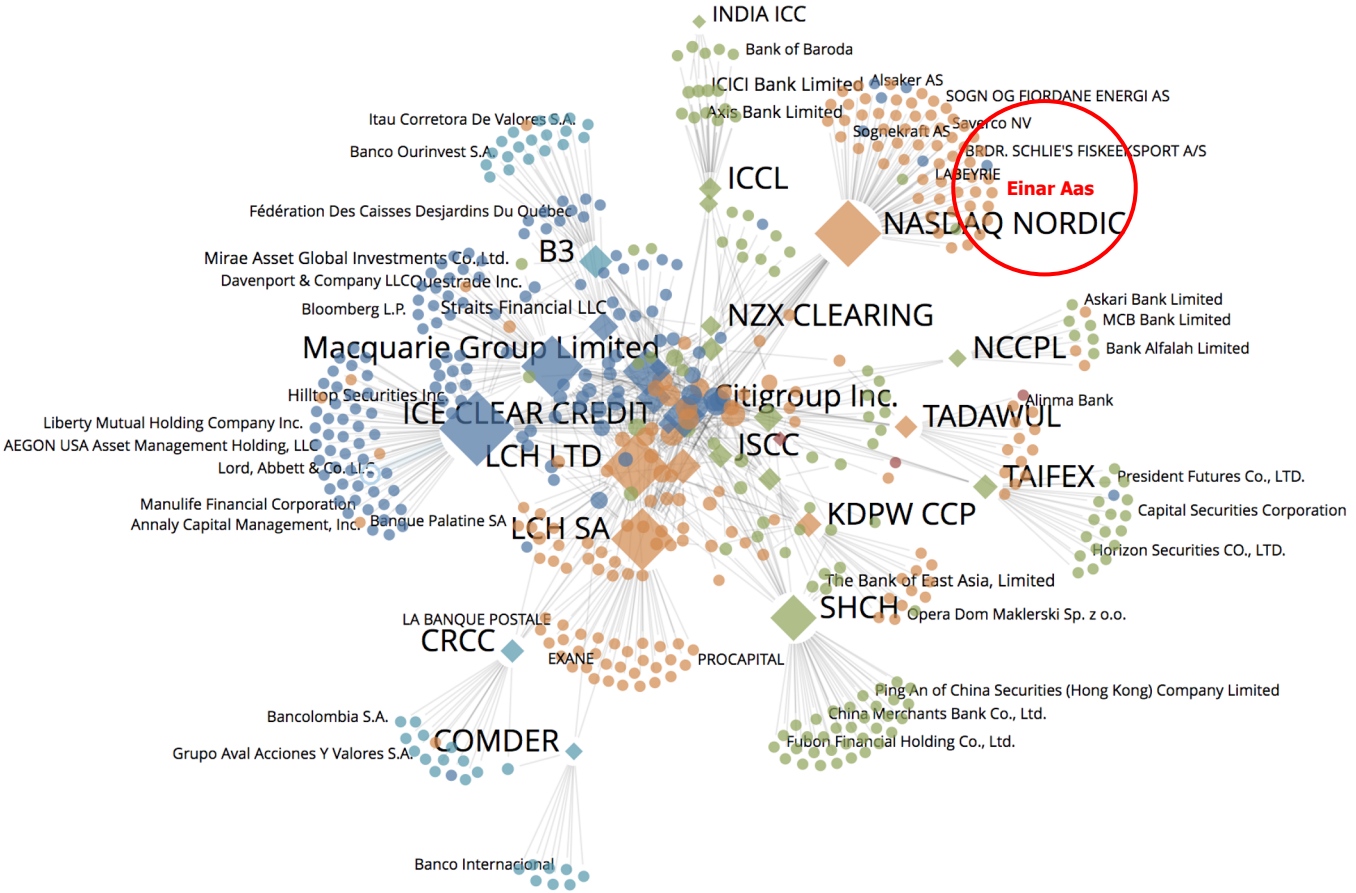


CCP Interconnectedness on Parent Level

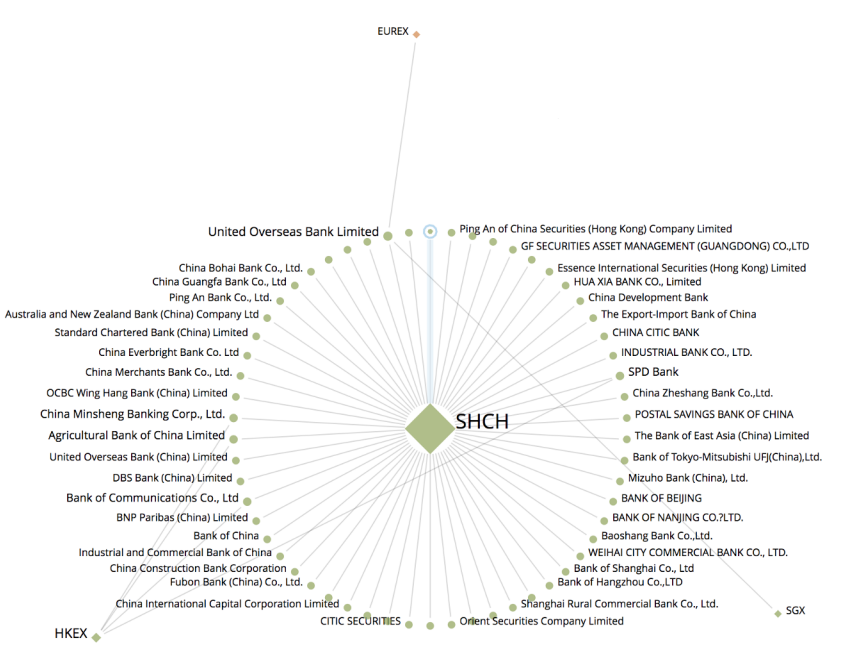
We see CCPs (diamonds) and their members (circles) from different regions:

- North America (blue)
- Europe and Middle East (orange)
- Asia and Pacific (green)
- Latin America (light blue)
- Africa (red)

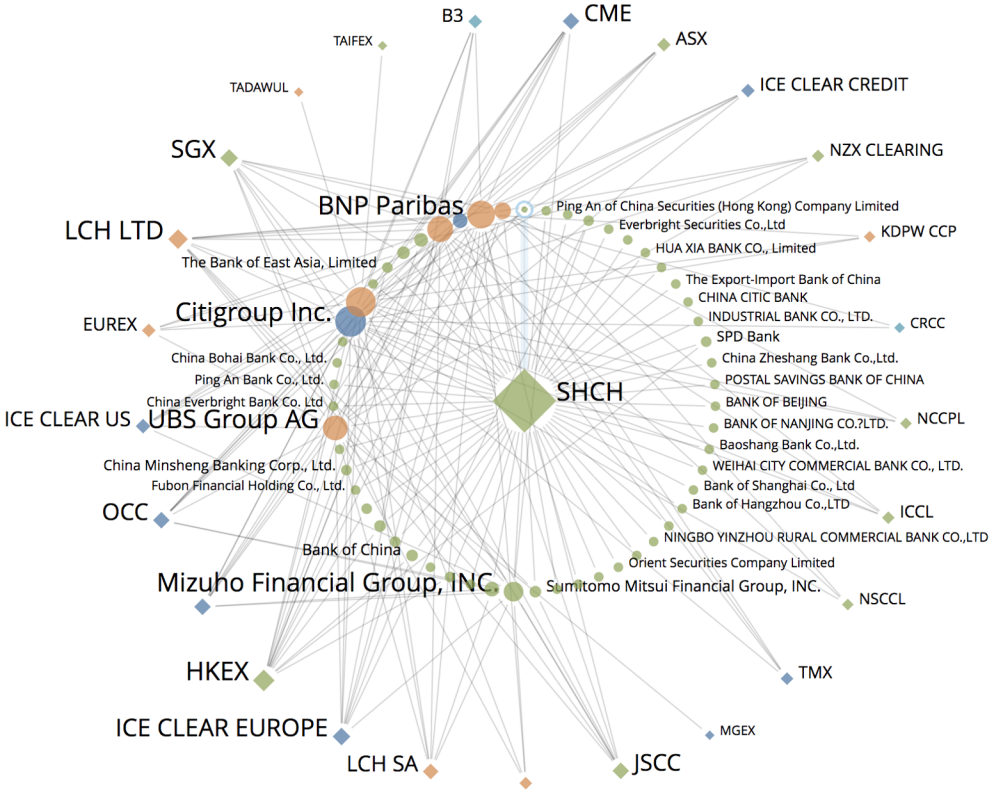
On parent level we see a completely connected network dominated by a core consisting of CCPs from North America and Europe and global banks.



CCP Interconnectedness on Subsidiary vs Parent Level - Example



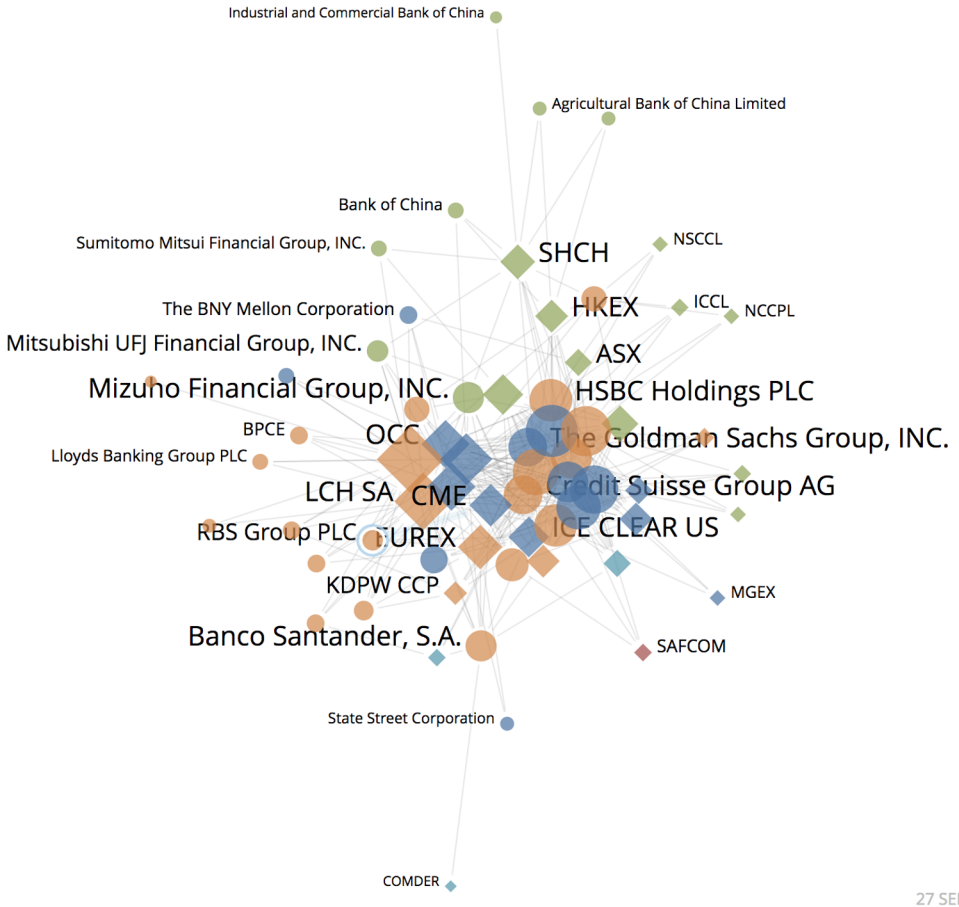
Subsidiary Level
(Connected to 3 CCPs)



Parent Level
(Connected to 25 CCPs)

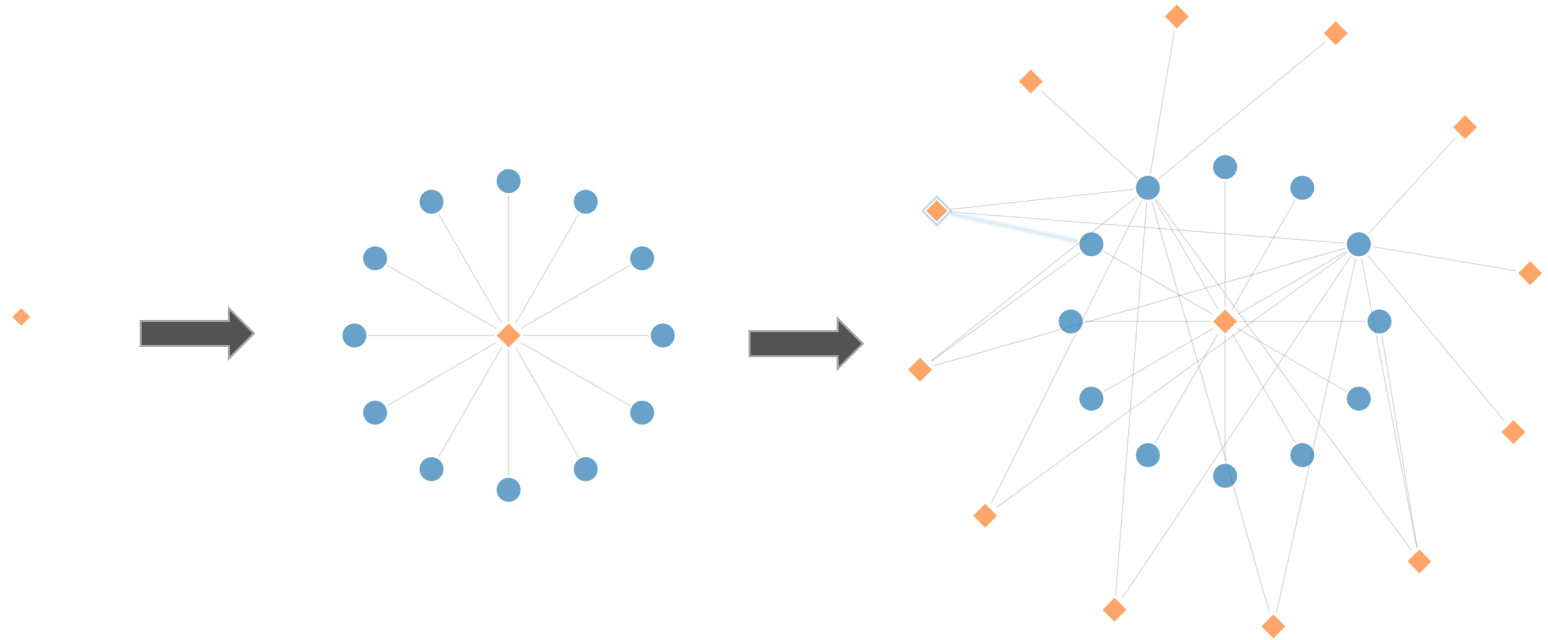
CCP Interconnectedness on GSIB Level

Bank (Parent)	# of CCPs
Citigroup	22
Deutsche Bank	21
JPMorgan Chase & Co.	20
BNP Paribas	19
Bank of America	18
HSBC	17
Societe Generale	17
UBS	16
Morgan Stanley	16
Credit Suisse	15



Contagion - CCP Disruption

A disruption in a CCP would affect all of that CCP's clearing members, thereby affecting the other CCP's to which the affected CCP's members belong, possibly creating a cascading cycle as disruption is propagated across members and CCPs



CCP disruption

Propagates to all members

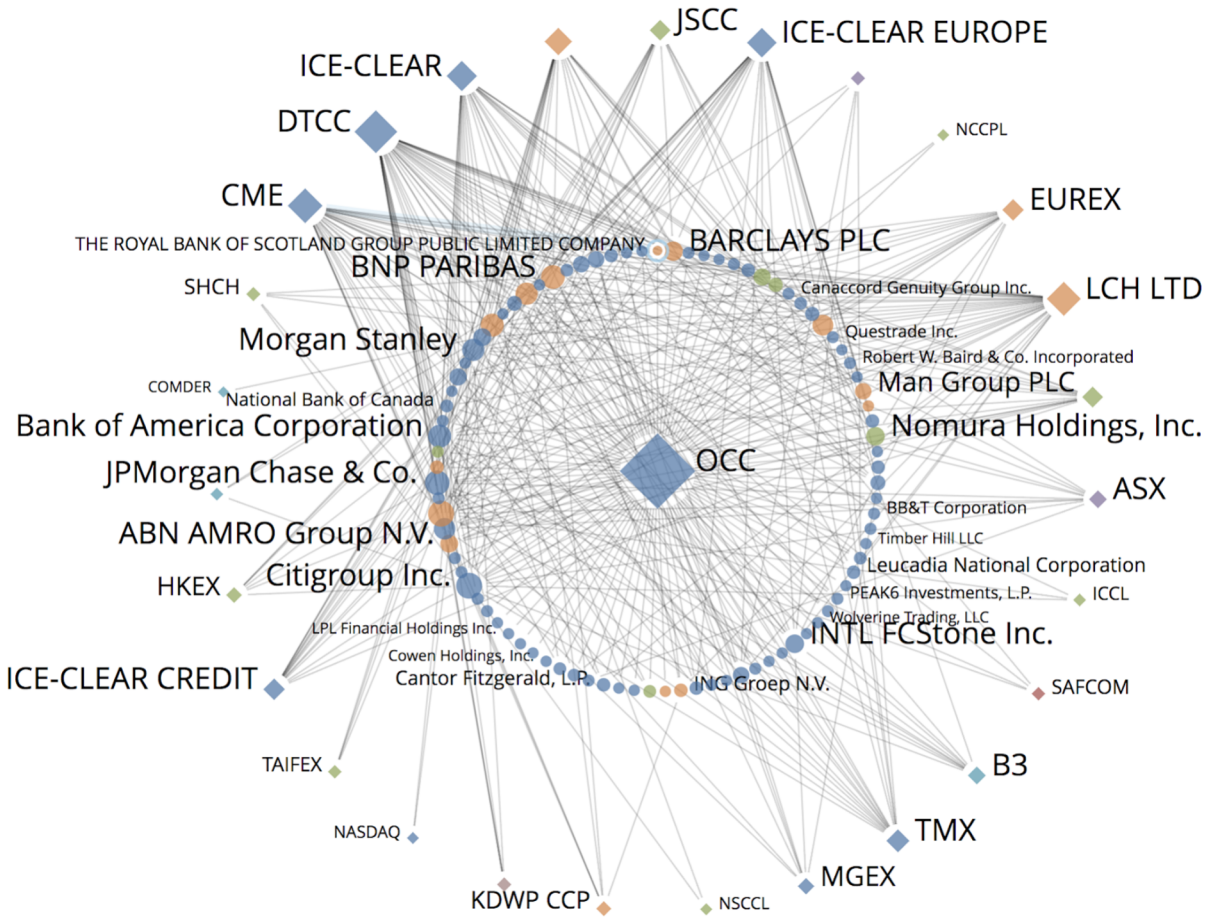
Propagates to other CCPs

Footprint of CCPs - OCC

OCC's 79 members are connected to 27 other CCPs

The membership is mostly US with a significant EU base.

The most connected CCP's are DTCC and CME.

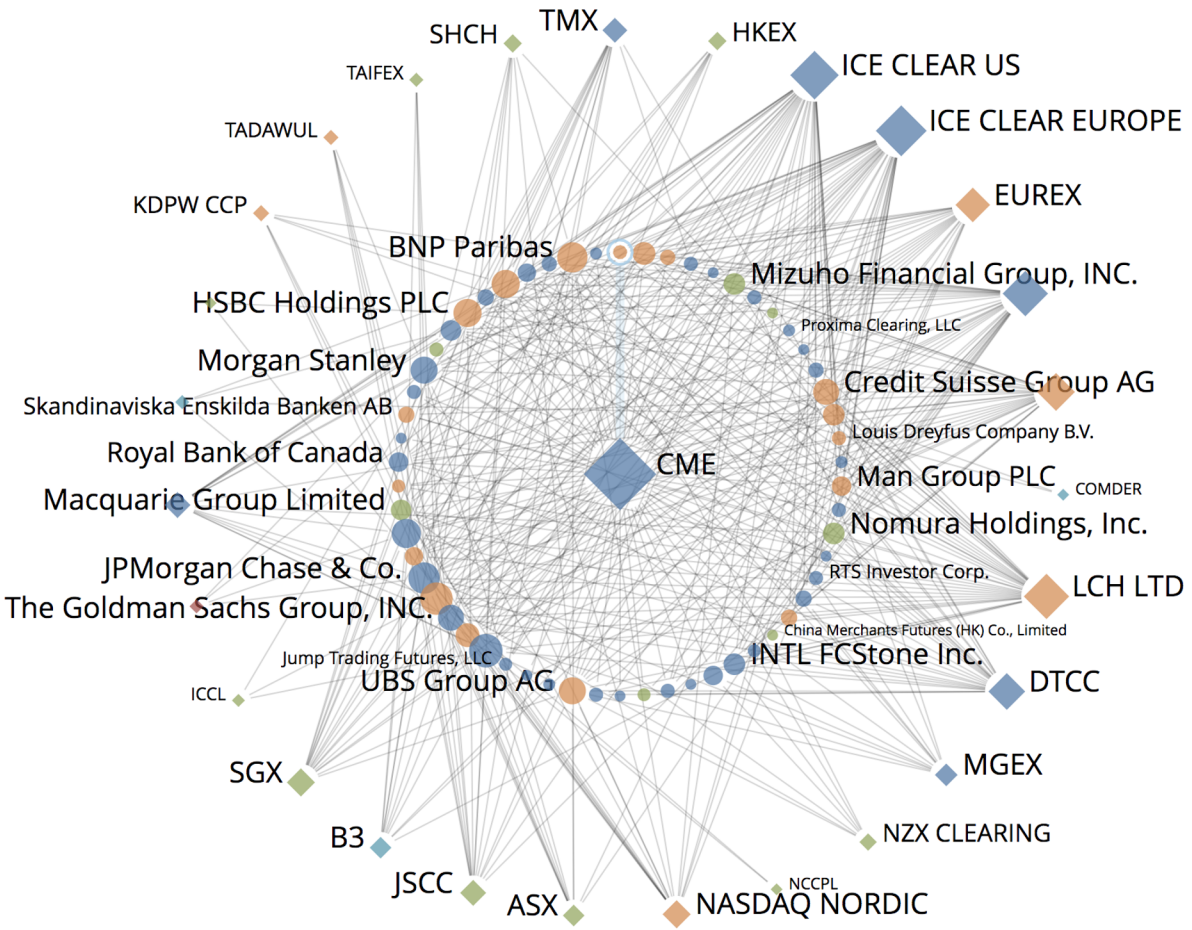


Footprint of CCPs - CME

CME's 58 members are connected to 27 other CCPs

The membership is mostly US with few entries from Europe and Asia

The most connected CCP are ICE US, ICE Europe, LCH Ltd. and OCC

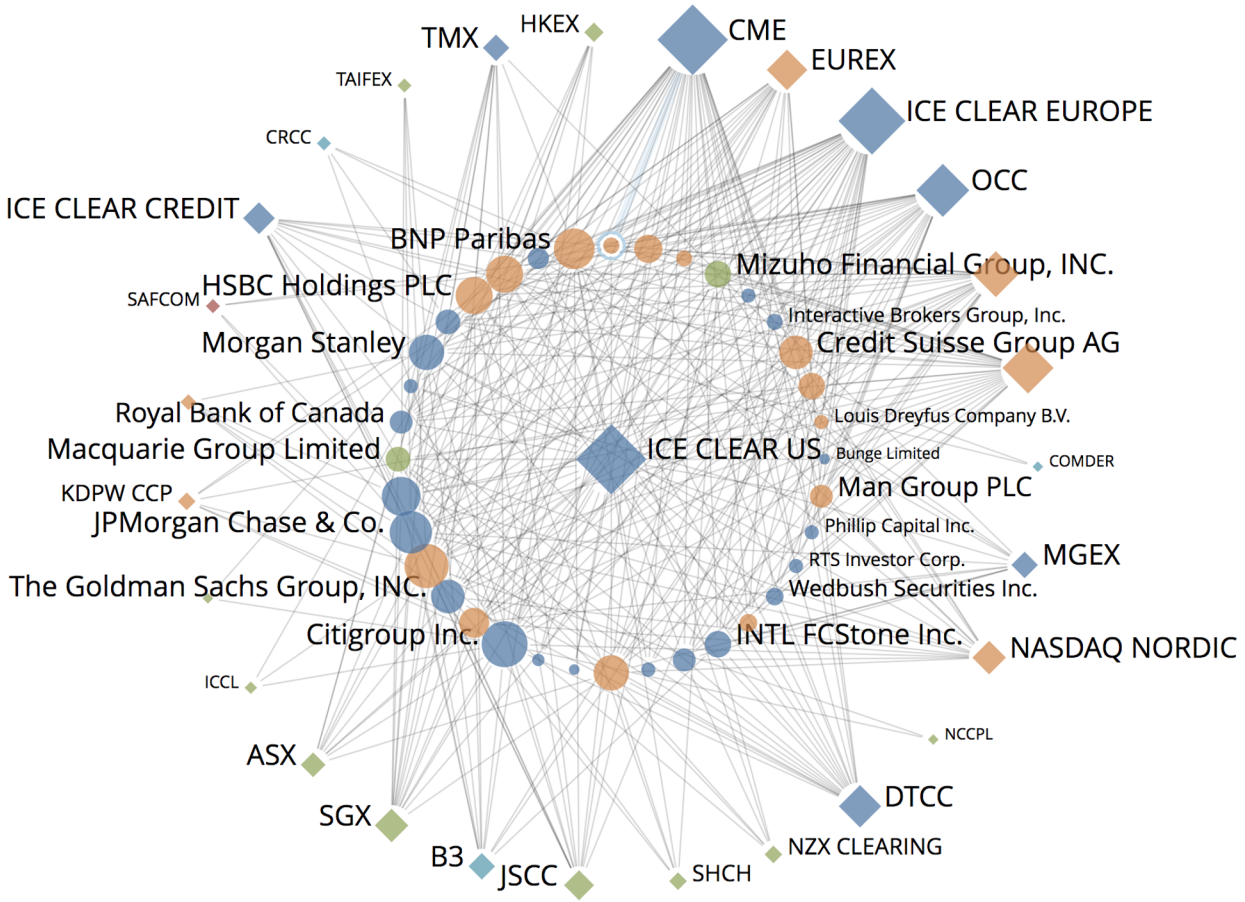


Footprint of CCPs - ICE

ICE's 36 members are connected to 27 other CCPs

The membership is mostly US with a significant European base.

The most connected CCPs are CME, ICE EUROPE and OCC



Contagion – Member Disruption

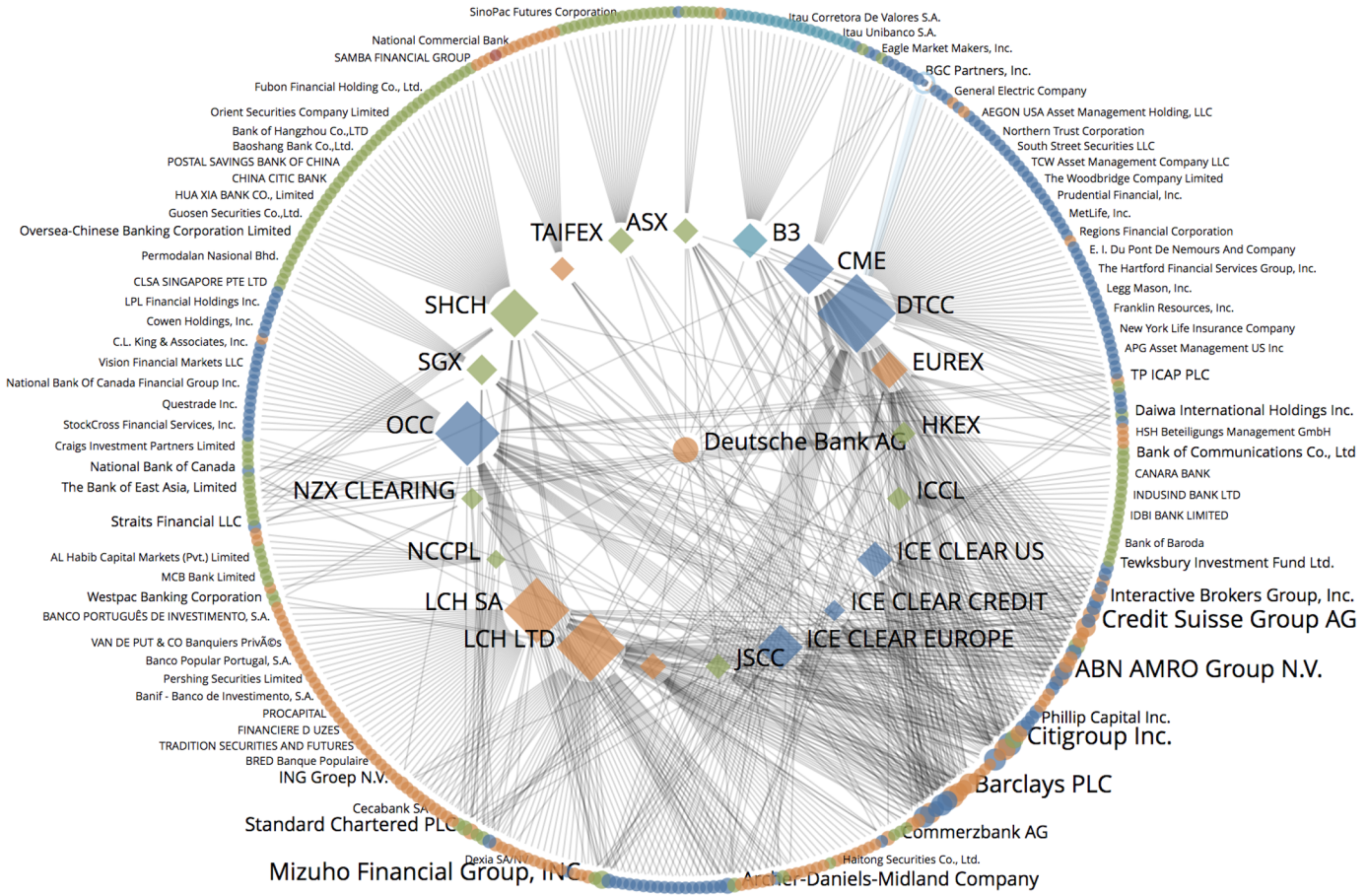
A member disruption could be felt by up to **448** banking groups or banks (of total of 495, or 90%) that are members of the same CCP as the stricken group.

Banking Group	# banking groups connected via a CCP
Citigroup	448
BNP Paribas	426
JPMorgan Chase	396
Deutsche Bank	392
Bank of America	391
Morgan Stanley	378
Credit Suisse	357
Société Générale	351
Goldman Sachs	349
HSBC Holdings	339

Contagion – Member Disruption

Deutsche Bank Group participates in 21 CCPs (of 29 mapped).

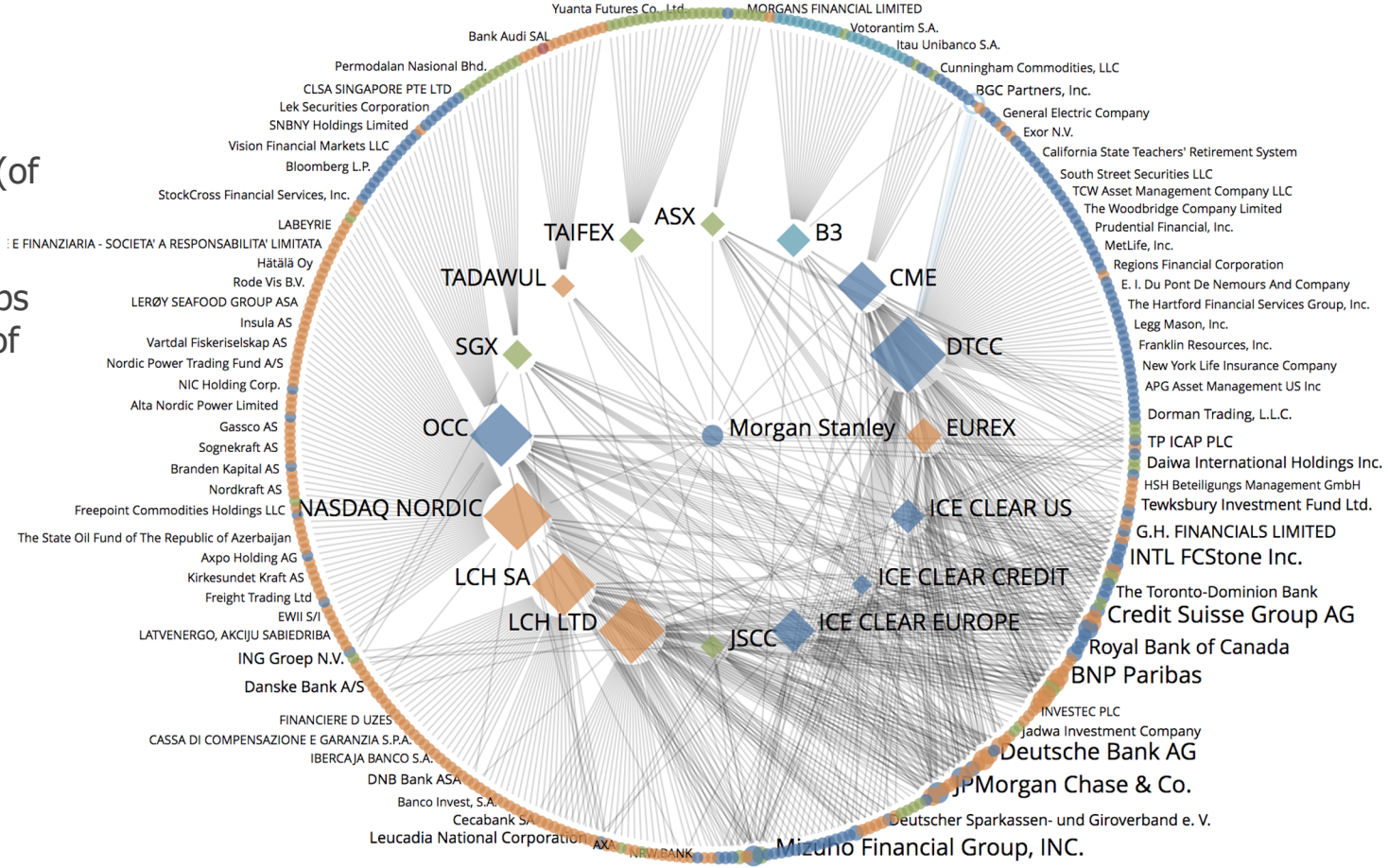
392 other banking groups or banks are members of these CCPs.



Contagion – Member Disruption

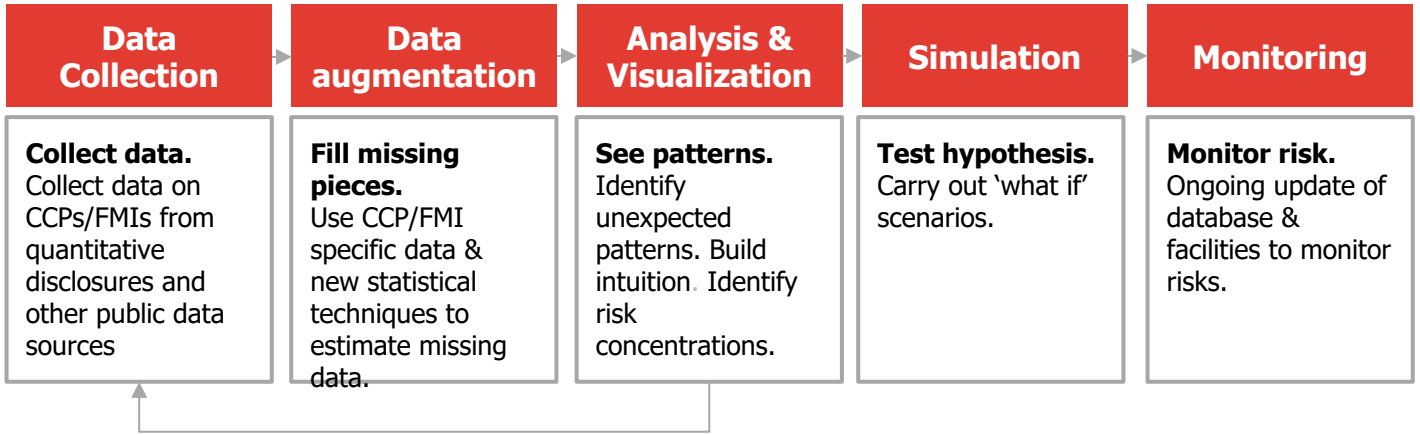
Morgan Stanley participates in 16 CCPs (of 29 mapped).

378 other banking groups or banks are members of these CCPs.



Objective & Roadmap

Objective: Develop a global database and the methods to measure risk concentrations and simulate failures and stress scenarios of interconnected FMIs and markets. This will allow regulators, FMIs and members develop risk mitigation strategies to address this new and global systemic risk.



Short History of Payment System Simulations

1997 : Bank of Finland

Evaluate liquidity needs of banks when Finland's RTGS system was joining TARGET

First general purpose payment systems simulator

2000 : Bank of Japan and FRBNY

Test liquidity saving mechanisms (LSM) for BoJ-Net & Fedwire

2001 - : CLS approval process and ongoing oversight

Test CLS risk management

Evaluate settlement' members capacity for pay-ins

Understand how the system works

Since then: Bank of Canada, Banque de France, Nederlandsche Bank, Norges Bank, TARGET2, and many others

2018 : Exact replicas of LVTS, CHAPS and 4 other FMIs in FNA

Three main use cases:

- Liquidity optimization
- Liquidity stress testing
- What-if Analysis

FNA

Interconnectedness within a CCP

Concept: Operational Failure of a Settlement Member

Mapping
This network shows settlement relationships between the:

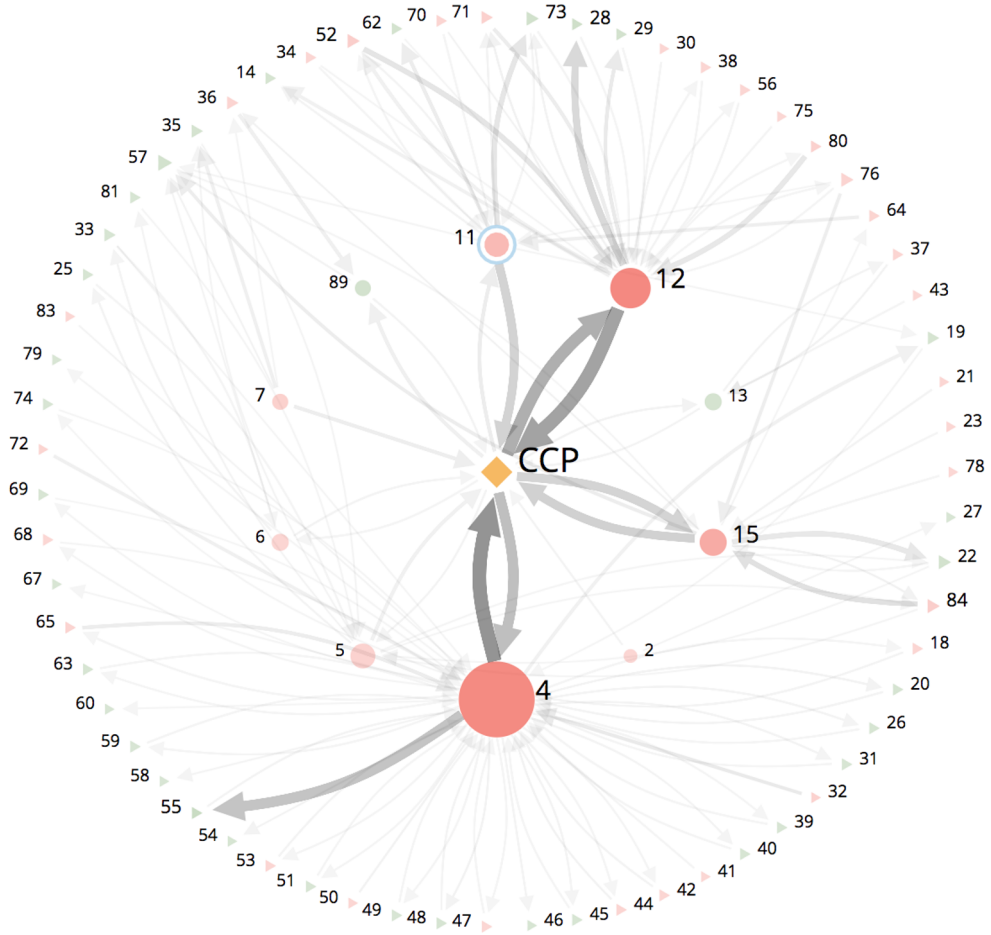
- CCP (center)
- Settlement members (inner circle) and
- Clearing members (outer circle)

Note: Data is representative, not real

Size of node shows value of multilateral position

Width of lines shows value of bilateral positions

Question
What would happen if member 4 had an operational failure?



Backup Relationships

Map

Shows Clearing Members on the left, and Settlement Members on the right.

The lines denote which settlement member the clearing member can use for settlement (ie its main and its backups)

Concept: Operational Failure of a Settlement Member

Mapping
This network shows settlement relationships between the:

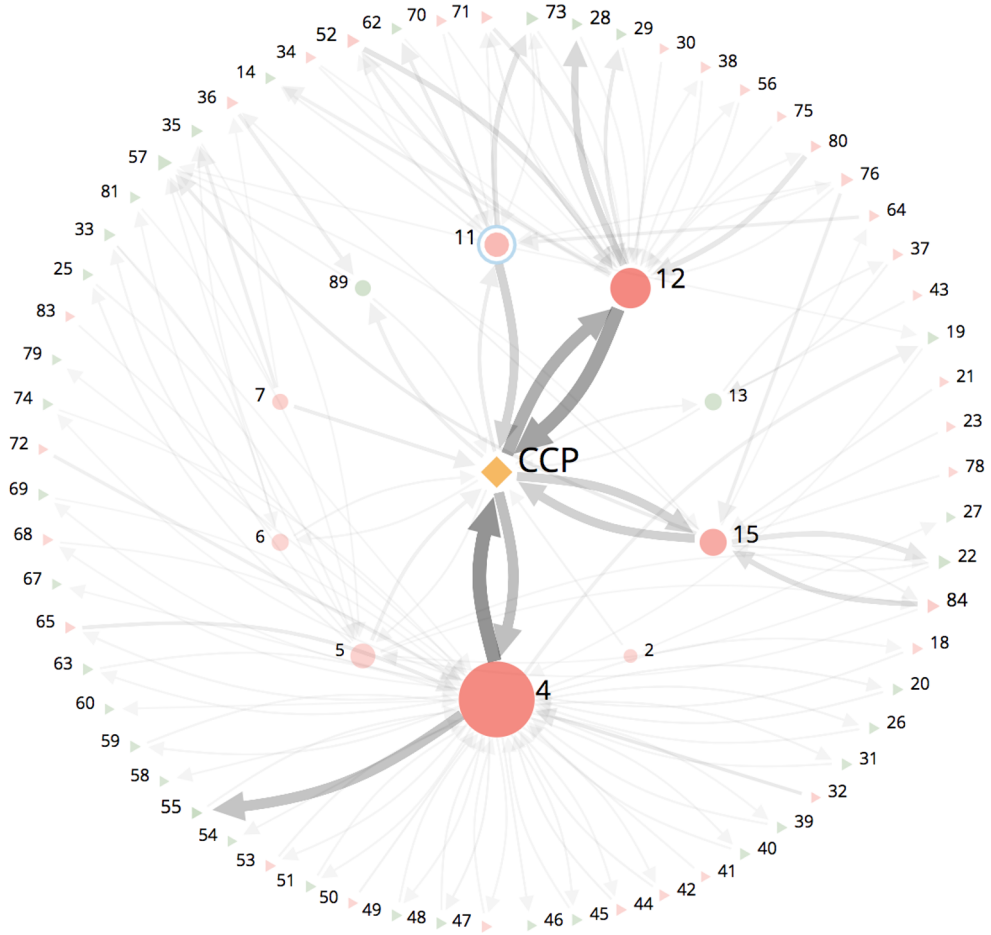
- CCP (center)
- Settlement members (inner circle) and
- Clearing members (outer circle)

Note: Data is representative, not real

Size of node shows value of multilateral position

Width of lines shows value of bilateral positions

Question
What would happen if member 4 had an operational failure?

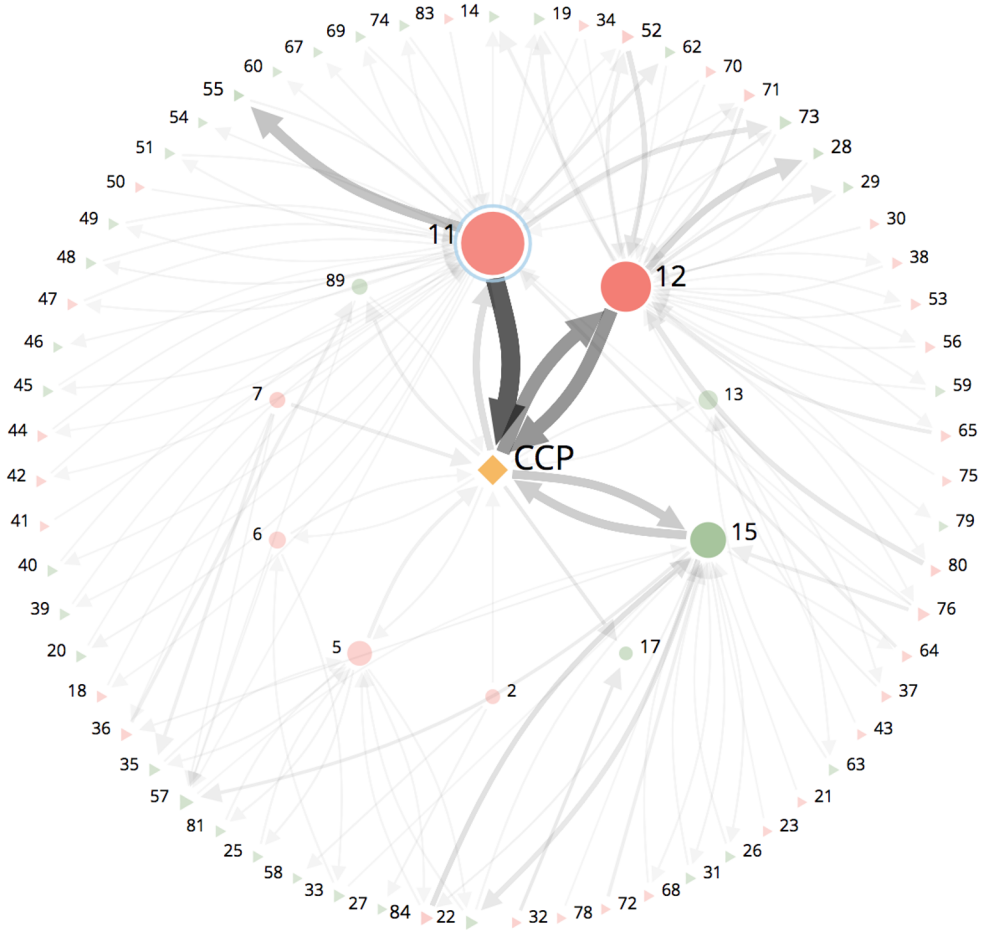


Rewiring for Maximum Concentration

Each clearing member using Bank 4 must now effect settlement through one of its backup relationships.

Findings
Simulation shows that settlement flows could be concentrated on a few participants, e.g.
causing operational challenges for Bank 11.

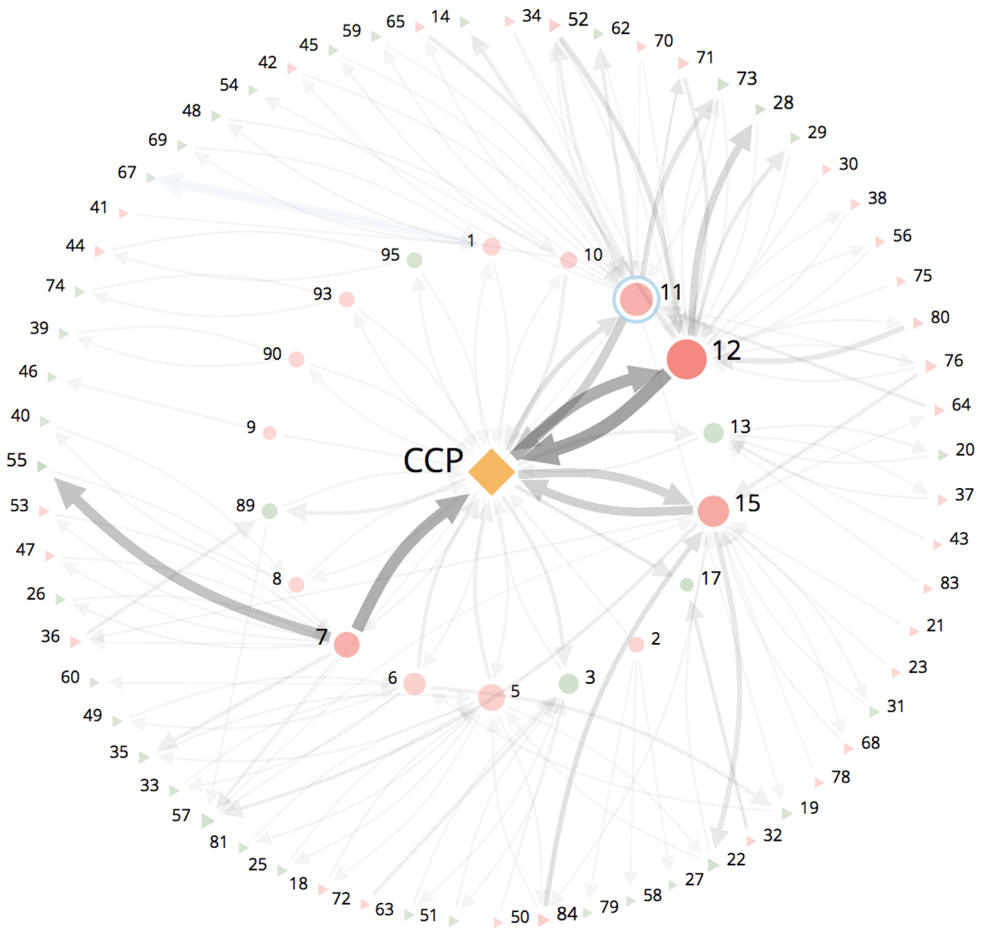
Insight
Bank 11 was not among the most active settlement members on a normal day, but might need to build operational capacity to cover for rare failure days.



Rewiring for Minimum Concentration

Findings
... or clearing members might use different settlement members resulting in a much higher number (18 instead of 10) of settlement members for the day.

Insight
The CCP may need to build operational capacity to be able to complete settlement.



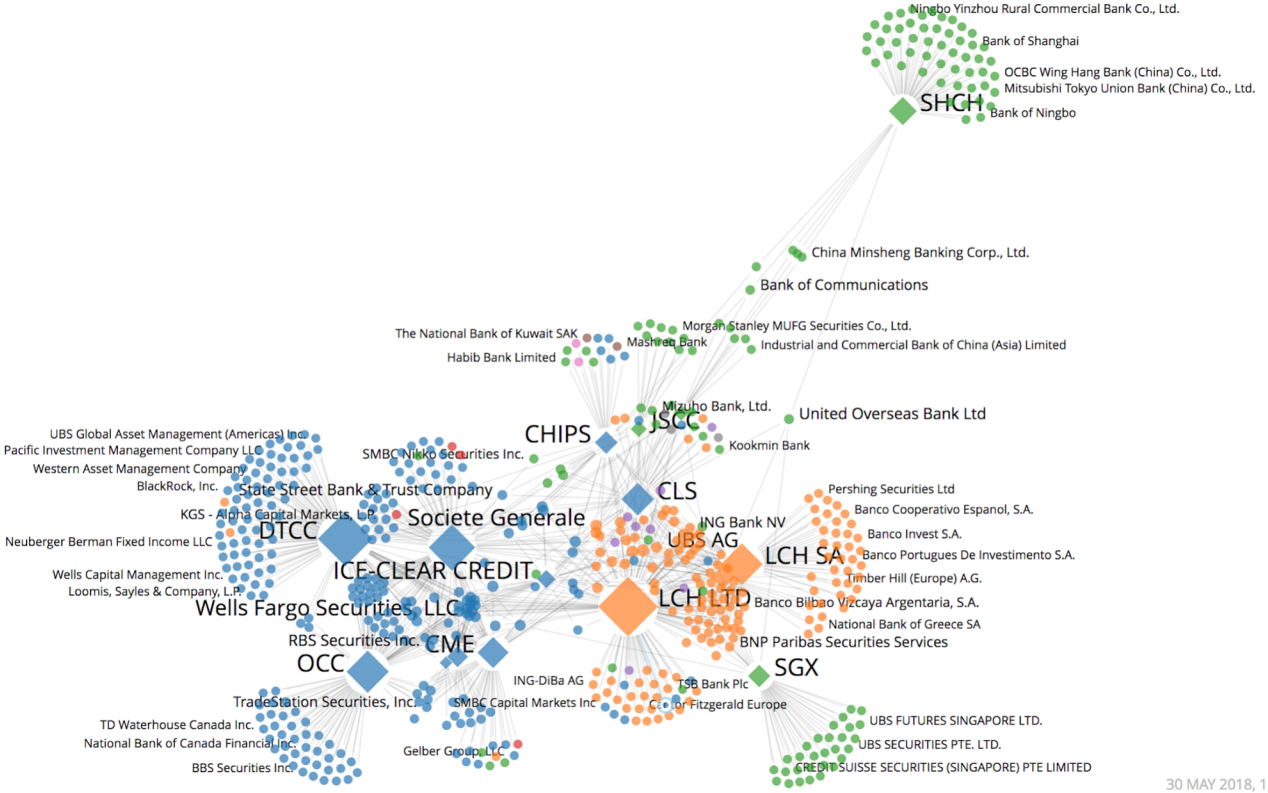
The Vision - Simulate System of FMIs

Stress testing in practice means simulation.

For realistic scenarios, we need to understand how everything is interconnected within and across FMIs.

This means CCPs, Payment Systems, CLS, ICSDs, etc.

FMI Simulators are valuable alone, and more valuable when connected.

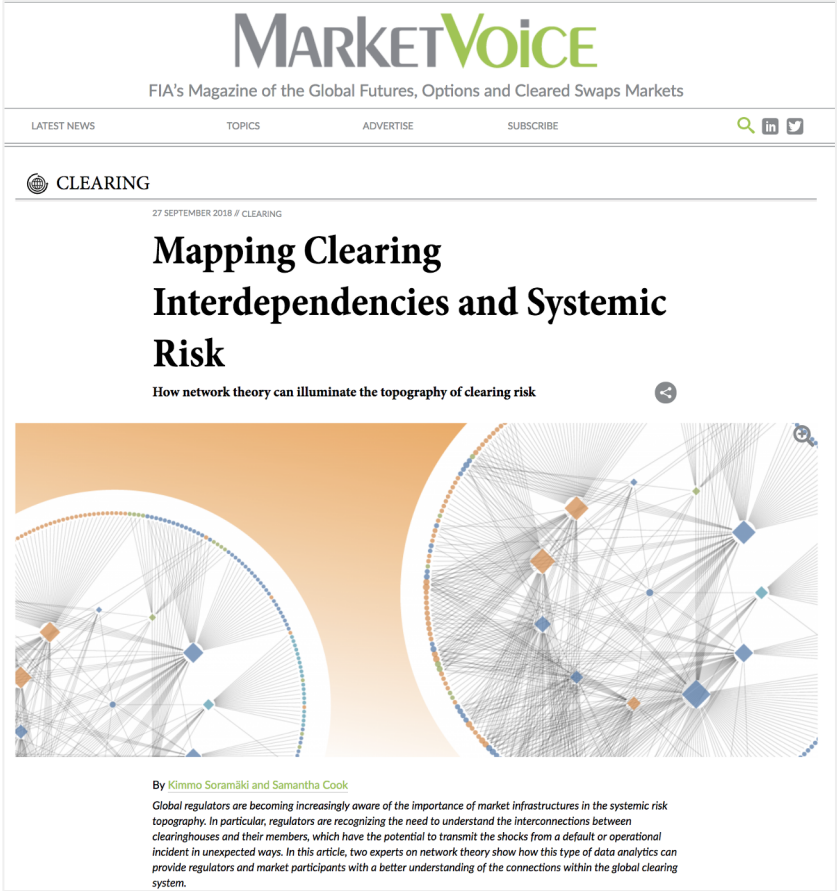


Visualizations

The visualizations were created for FIA MarketVoice article :

"Mapping Clearing Interdependencies and Systemic Risk: How network theory can illuminate the topography of clearing risk"

Links to interactive versions are available on FNA Website and in the following slides.



MARKETVOICE

FIA's Magazine of the Global Futures, Options and Cleared Swaps Markets

LATEST NEWS TOPICS ADVERTISE SUBSCRIBE

CLEARING

27 SEPTEMBER 2018 // CLEARING

Mapping Clearing Interdependencies and Systemic Risk

How network theory can illuminate the topography of clearing risk

By Kimmo Soramäki and Samantha Cook

Global regulators are becoming increasingly aware of the importance of market infrastructures in the systemic risk topography. In particular, regulators are recognizing the need to understand the interconnections between clearinghouses and their members, which have the potential to transmit the shocks from a default or operational incident in unexpected ways. In this article, two experts on network theory show how this type of data analytics can provide regulators and market participants with a better understanding of the connections within the global clearing system.

FNA

Dr. Kimmo Soramäki
Founder & CEO
FNA - Financial Network Analysis Ltd.

kimmo@fna.fi
tel. +44 203 538 6505

Address
4-8 Crown Place
London EC2A 4BT
United Kingdom