

13 January 2016

# Cambridge Centre for Risk Studies Research Showcase

Centre for  
**Risk Studies**



UNIVERSITY OF  
CAMBRIDGE  
Judge Business School

# Research Showcase Agenda

- 9.30-10.10      **Session I - Cambridge Risk Framework**      Lecture Theatre 2
- Review of Research Activities in 2015      Professor Danny Ralph, Academic Director
  - Catastronomics in World Cities Risk      Jaclyn Zhiyi Yeo, Research Assistant
- 10.10-10.30      **Session II - Technical Catastrophes - “TechCat”**      Lecture Theatre 2
- Technological Catastrophe Research and the Cambridge Risk Framework  
Simon Ruffle, Director of Technology Research & Innovation
- 10.30-11.00 Coffee Break      Common Room
- 11.00-12.00      Lecture Theatre 2
- Proactive Cyber Risk Management      Éireann Leverett, Senior Risk Researcher
  - Solar Storm Helios Scenario      Jennifer Copic, Risk Assistant
  - Critical Infrastructure Interdependencies      Dr Edward Oughton, Senior Risk Researcher
- 12.00-13.00      **Session III - Financial Catastrophes - “FinCat”**      Lecture Theatre 2
- Financial Catastrophe Research and Stress Test Scenarios      Dr Andrew Skelton, Research Associate
  - Financial Risk and Network Analysis      Dr Ali Rais Shaghaghi, Risk Researcher
  - Research Objectives for 2016      Dr Andrew Coburn, Director of External Advisory Board
- 13.00 Buffet Lunch at CJBS
- 14.00-18.00      **Advisory Board**      Castle Teaching Room





13 January 2015  
Advisory Board Meeting

# Overview of 2015 Research at the Cambridge Centre for Risk Studies

Centre for  
**Risk Studies**



**Prof Danny Ralph**  
Academic Director  
Centre for Risk Studies



# Centre for Risk Studies Mission

**To be the world's leading academic centre  
for research into systemic risk  
in business, the economy, and society**



# University of Cambridge Centre for Risk Studies



We Welcome the Representatives of our Research Supporters to the Advisory Board Meeting:

McKinsey&Company

HSBC

LOCKHEED MARTIN



TALBOT  
VALIDUS GROUP

AIG



LLOYD'S

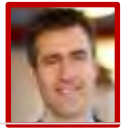
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E·S·R·C  
ECONOMIC  
& SOCIAL  
RESEARCH  
COUNCIL

UNIVERSITY OF  
CAMBRIDGE

# Cambridge Centre for Risk Studies Research Team

## Centre for Risk Studies Executive Team



**Prof Danny Ralph**  
*Academic Director*



**Dr Michelle Tuveson**  
*Executive Director*

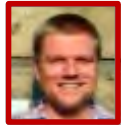


**Dr Andrew Coburn**  
*Director of Advisory Board*



**Simon Ruffle**  
*Director of Research & Innovation*

## Centre for Risk Studies Research Team



**Dr Scott Kelly**  
*Senior Research Associate*



**Dr Olaf Bochmann**  
*Research Associate*



**Dr Andy Skelton**  
*Research Associate*



**Dr Duncan Needham**  
*Risk Researcher*



**Dr Ali Shaghaghi**  
*Research Assistant*



**Dr Andrew Chaplin**  
*Risk Researcher*



**Jaclyn Zhiyi Yeo**  
*Research Assistant*



**Eugene Neduv**  
*Risk Researcher*



**Dr Jay Jung**  
*Risk Researcher*



**Tamara Evan**  
*Editorial Associate*



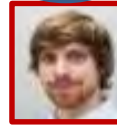
**Jennifer Copic**  
*Research Assistant*



**Viktorija Kesaite**  
*Research Assistant, Economics*



**Eireann Leverett**  
*Senior Risk Researcher*



**Dr Edward Oughton**  
*Risk Researcher*



**Siobhan Sweeney**  
*Legal Risk Researcher*



**Dr Louise Pryor**  
*Senior Risk Researcher*



**Lee Coppack**  
*Senior Advisor, Risk Communication*



**Crystal Mbanefo**  
*Events & Operations Manager*

# Catastrophe Modelling in Complex Systems

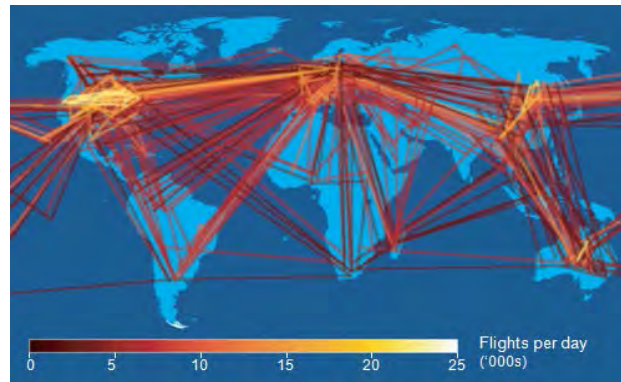
- The Centre for Risk Studies arises from shared interests by the participants in exploring areas of intersection between
  - Catastrophe modelling and extreme risk analytics
  - Failure of complex systems and networks
- Advance the scientific understanding of how systems can be made more resilient to the threat of catastrophic failures

To answer questions such as: 'What would be the impact of a [War in China] on [Trade Networks] and how would this impact the [Global Economy]?'

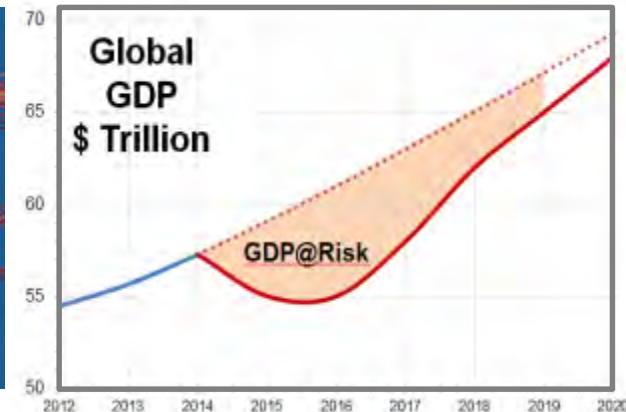
Regional Conflict



Air Travel Network







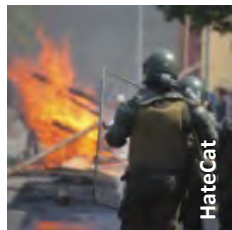





















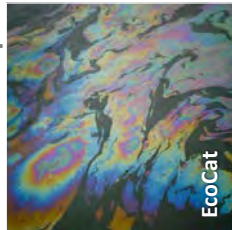



















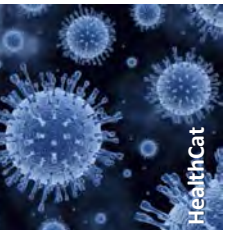

























Global Economy





# 2010-12 Cambridge Taxonomy of Threats

Financial Shock	 FinCat	 Asset Bubble	Trade Dispute	 TradeCat	 Labour Dispute	Geopolitical Conflict	 WarCat	 Conventional War	Political Violence	 HateCat	 Terrorism
	 Market Crash	 Sovereign Default		 Bank Run	 Cartel Pressure		 Trade Sanctions	 Asymmetric War		 Organized Crime	 Assassination
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Natural Catastrophe	 NatCat	 Earthquake	Climatic Catastrophe	 WeatherCat	 Drought	Environmental Catastrophe	 EcoCat	 Sea Level Rise	Technological Catastrophe	 TechCat	 Nuclear Meltdown
	 Volcanic Eruption	 Flood		 Tornado & Hail	 Freeze		 Wildfire	 Ocean System Change		 Cyber Catastrophe	 Industrial Accident
	 Volcanic Eruption	 Flood		 Tornado & Hail	 Freeze		 Wildfire	 Ocean System Change		 Cyber Catastrophe	 Industrial Accident
Disease Outbreak	 HealthCat	 Human Epidemic	Humanitarian Crisis	 AidCat	 Famine	Externality	 SpaceCat	 Meteorite	Other	 NextCat	 Infrastructure Failure
	 Waterborne Epidemic	 Zoonosis		 Child Poverty	 Water Supply Failure		 Space Threat	 Solar Storm		 Technological Accident	 Infrastructure Failure
	 Waterborne Epidemic	 Zoonosis		 Child Poverty	 Water Supply Failure		 Space Threat	 Solar Storm		 Technological Accident	 Infrastructure Failure



# 2015: Year of Modelling for Aggregating and Cascading Threats

## ■ Multi-Threat: World Cities at Risk 2025

- 21 threat models applied to 300 cities
- AKA Lloyd's City Risk 2015

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## ■ Integrating multiple infrastructure impacts

- Cyber/Power disaster in north east USA / Lloyd's
- Cyber/Power disaster in south east UK
- ⇒ Telecomms, Water, Rail

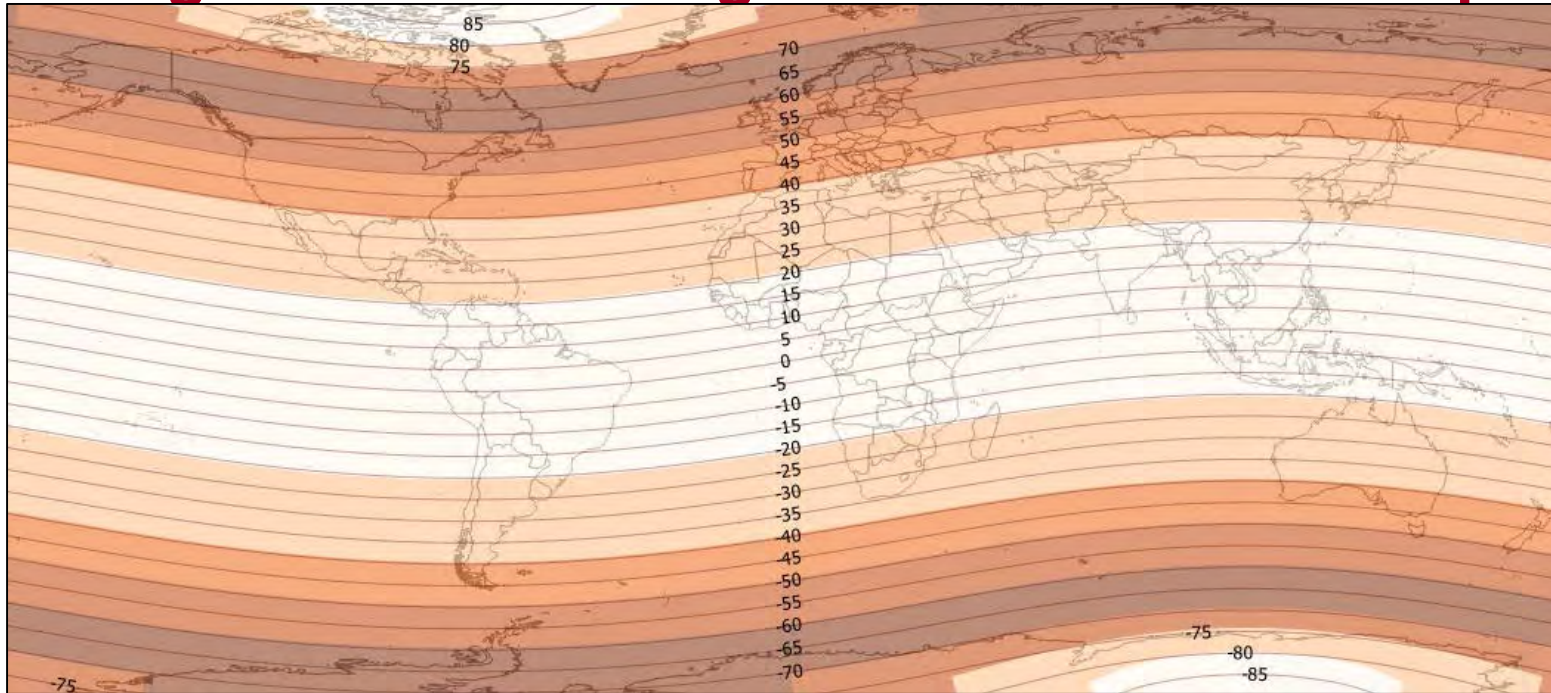
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## ■ Foundations of multi-threat for Financial Catastrophes



# Example of Threat Model: Cambridge Global Geomagnetic Storm Threat Map

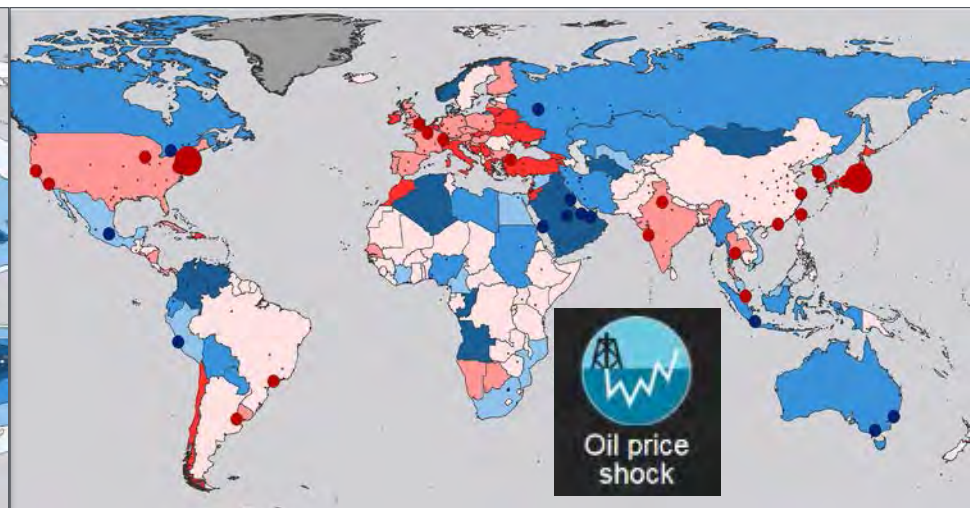
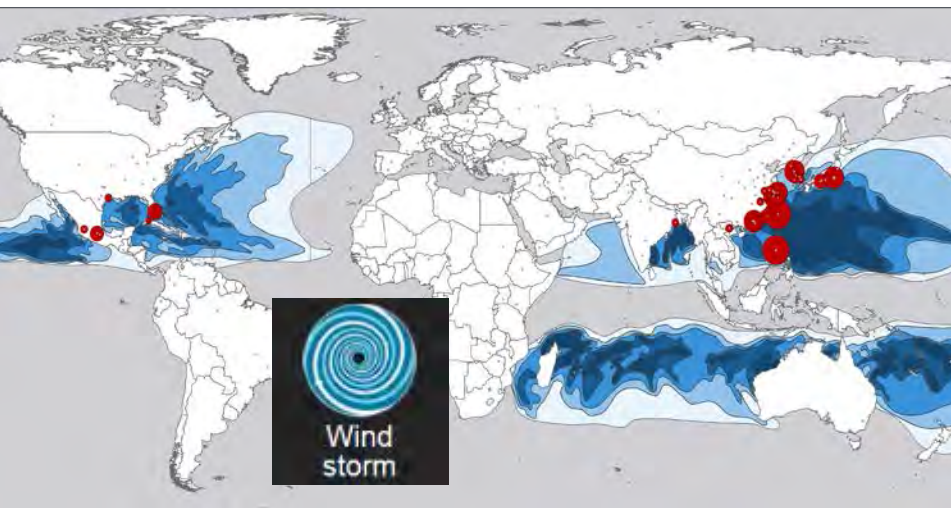
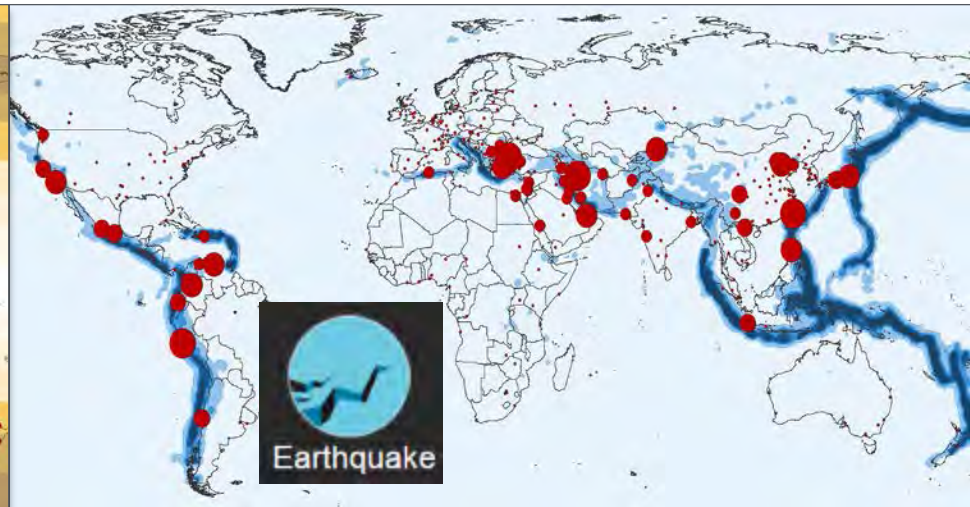
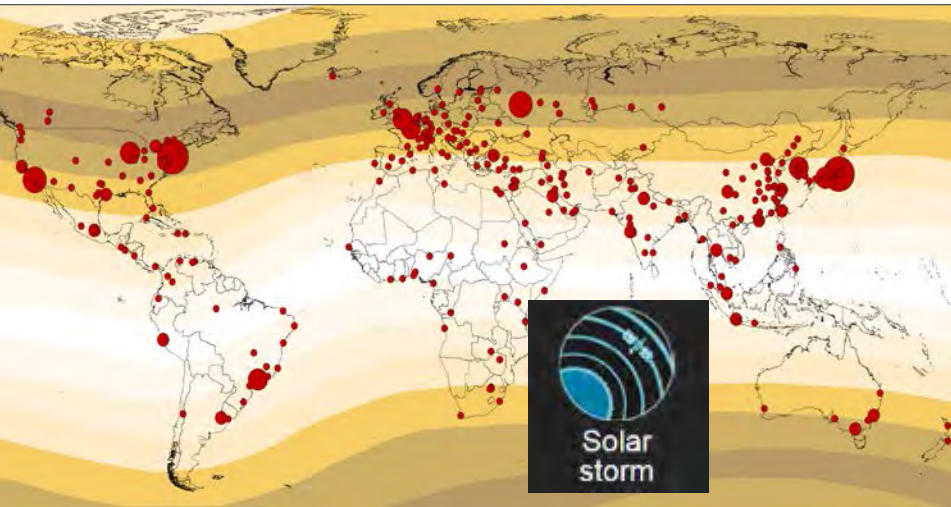


World population	S1	S2	X1
Exposed to storm	11%	22%	62%
Not exposed to storm	89%	78%	38%

- 38% of the world population is not exposed to the storm in any scenario variant



# World Cities at Risk: Mapping 21 Threats to 300 Cities



# Cyber threat as a continuing exploration in 2015

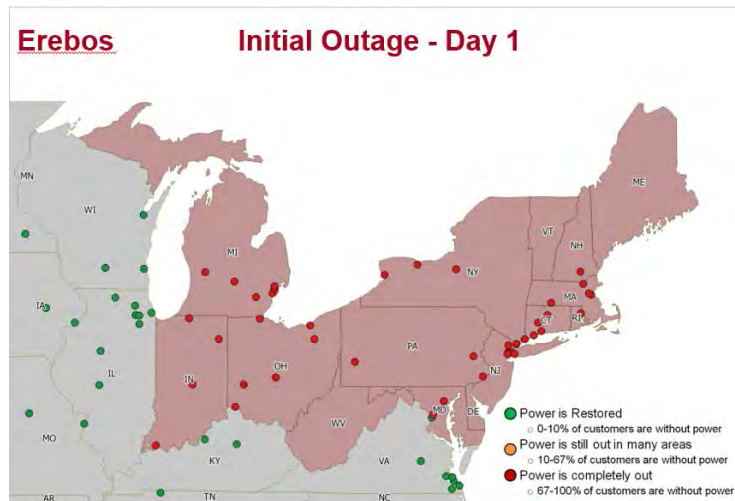
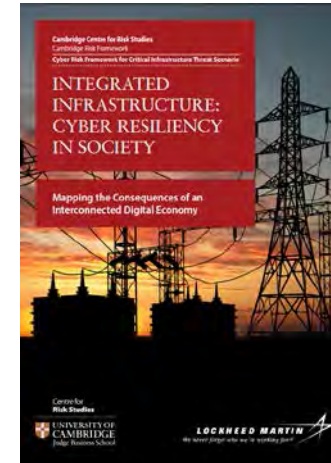


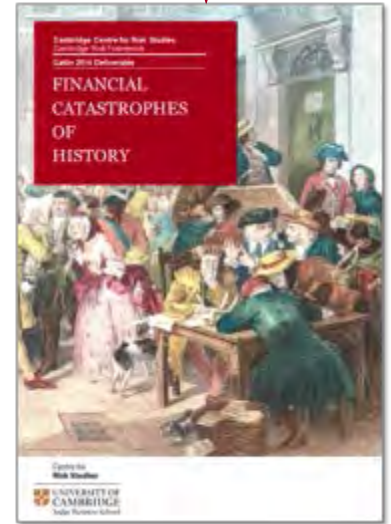
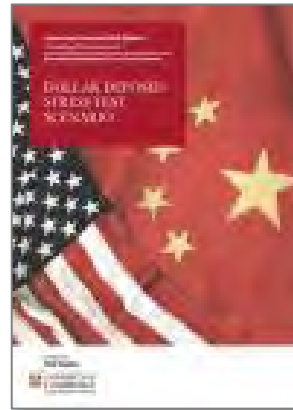
Figure 15: Peak digital communications, fresh water and waste water customers disrupted

Infrastructure modelling in collaboration with  
Infrastructure Transitions Research Consortium  
University of Oxford, [www.itrc.org.uk](http://www.itrc.org.uk)

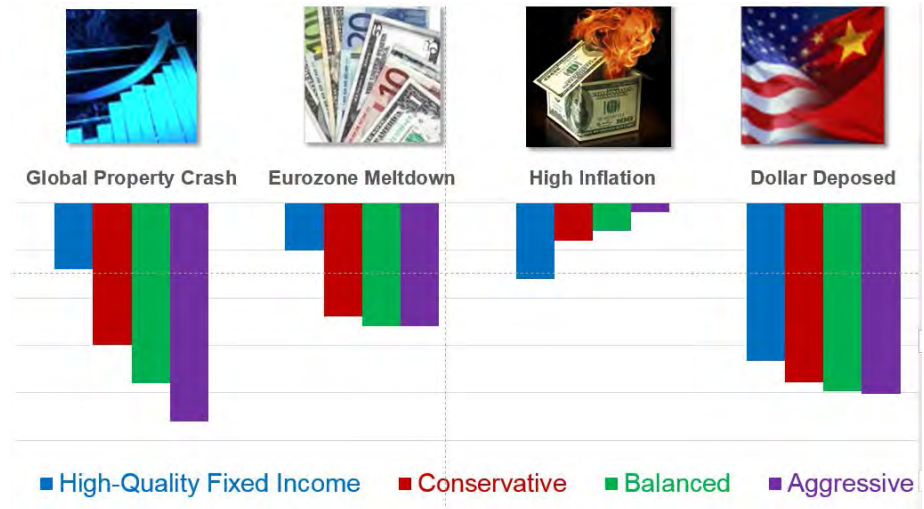


# Financial Catastrophe Research

1. Catalogue of historical financial events
2. Development of stress-test scenarios

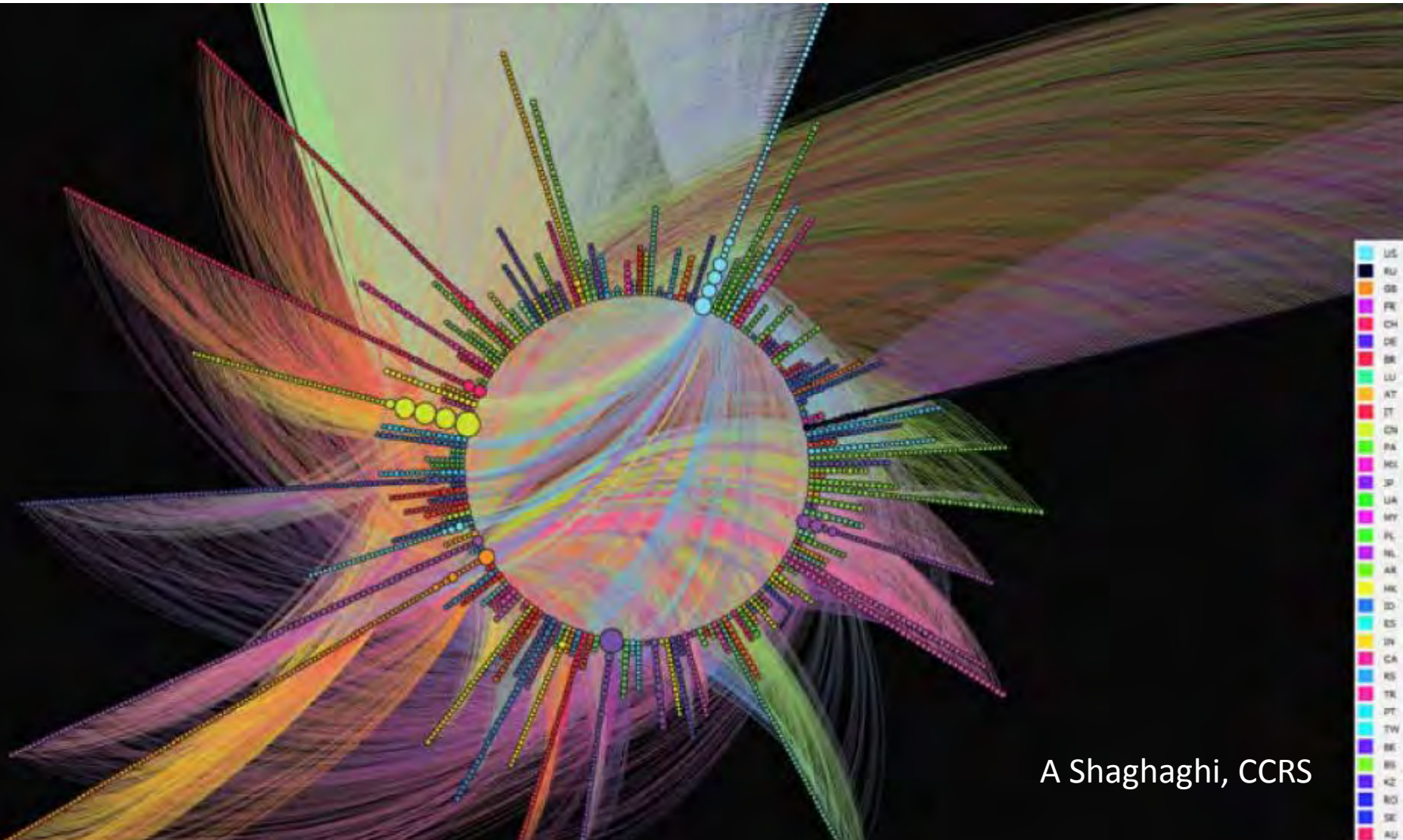


Macroeconomic Impacts  
Financial Market Impacts



# Understanding contagion in global banking system

- 5,074 banks (vertices)
- 31,587 inter-bank lending / borrowing relationships (links)

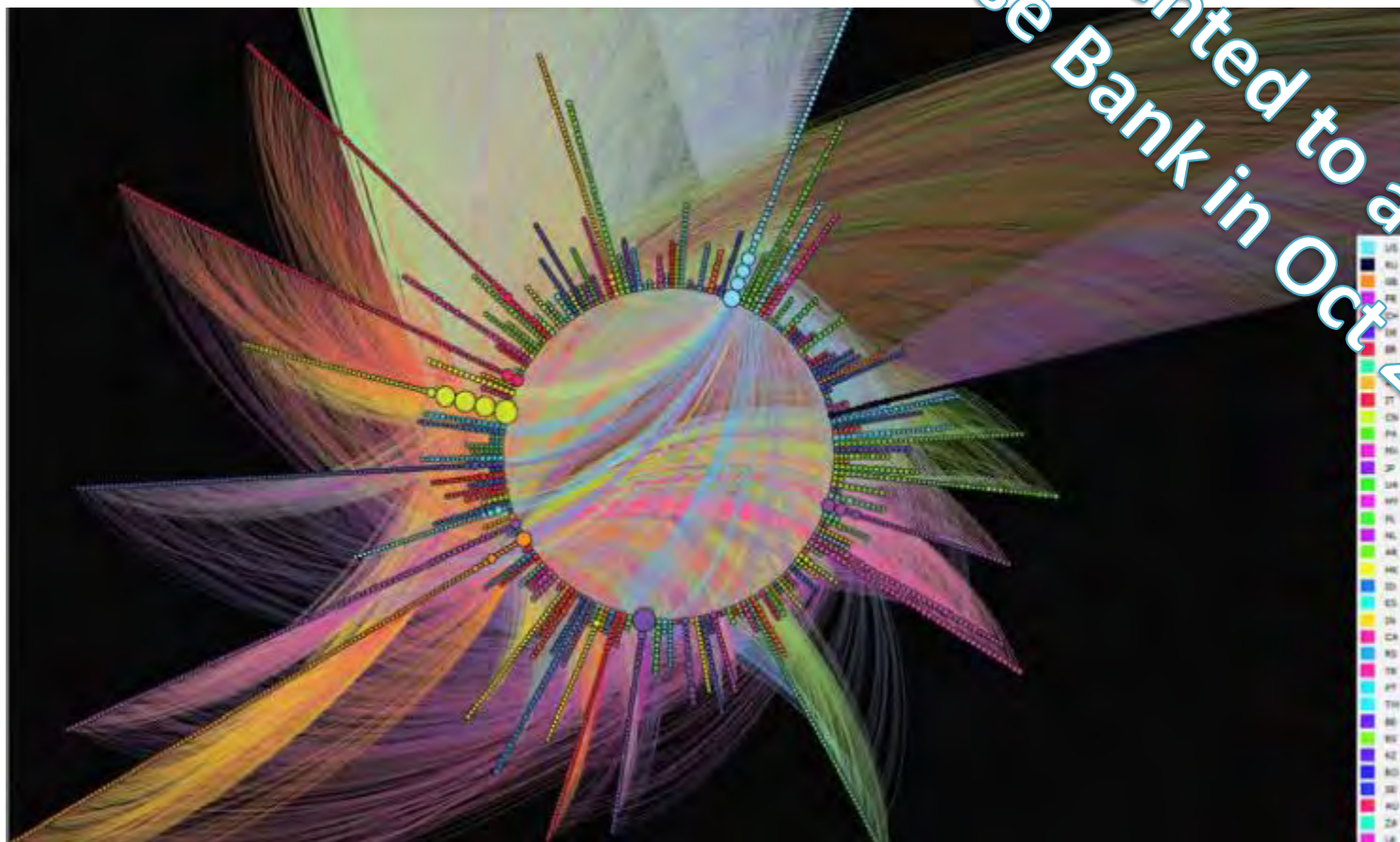


A Shaghaghi, CCRS



## 全球银行体系改造举例：

- （最高时）5074家银行
- 31587道银行间借贷关系（联系）



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