Cambridge Judge Business School Centre for Risk Studies 7th Annual Risk Summit

2016 Research Showcase: Special Topics Seminar

Monday 20 June 2016, 09:00 – 14:15 Risk Culture: Challenging Individual Agency

Centre for **Risk Studies**



Cambridge Judge Business School

Centre for Risk Studies 7th Risk Summit Research Showcase

CRS Research Activities in 2016

Dr Andrew Coburn Director of Advisory Board, Cambridge Centre for Risk Studies

20 June 2016 Cambridge, UK

Centre for **Risk Studies**





09:00-14:15 - 2016 Risk Summit Research Showcase

			11:40 – 12:00	Session 3: Modelling and Communicating Risk
09:00 - 09:30	Registration and tea/coffee		1	Financial Catastrophe Research and Stress
				Tests Scenarios
09:30 - 09:50	Session 1: Cambridge Risk Framework			Dr Andy Skelton, Research Associate,
	CRS Research Activities in 2016 Dr Andrew Coburn, Director of Advisory Board,			Cambridge Centre for Risk Studies
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	Cambridge Centre for Risk Studies and Senior		12:00 – 12:20	Financial Risk and Network Analysis
	Vice President, RMS, Inc.			Dr Ali Shaghaghi, Research Assistant,
				Cambridge Centre for Risk Studies
09:50 – 10:10	Recovery and Resilience after Catastrophes			-
	Kristen MacAskill, Risk Researcher, Cambridge		12:20 - 12:40	Putting It All Together: Cambridge Risk
	Centre for Risk Studies			Framework
				Simon Ruffle, Director of Research and
10:10 – 10:30	Session 2: Emerging Risks			Innovation, Cambridge Centre for Risk Studies
	Developing Scenarios for Managing Cyber			-
	Catastrophe Risk		12:40 - 13:30	Lunch at the Judge Business School
	Éireann Leverett, Senior Risk Researcher,			
	Cambridge Centre for Risk Studies		13:30 -13:45	Session 4: Risk Culture and Governance
				Setting a Risk Culture Research Agenda
10:30 - 10:50	Helios: Understanding the Economic Risk of			Professor Daniel Ralph, Academic Director,
	Solar Storms			Cambridge Centre for Risk Studies
	Jennifer Copic, Research Assistant, Cambridge			
	Centre for Risk Studies		13:45 -14:00	Modelling the Interplay between Personal and
				Collective Agencies
10:50 - 11:20	Coffee Break			Dr Michelle Tuveson, Executive Director,
				Cambridge Centre for Risk Studies
11:20 - 11:40	Critical National Infrastructure and Technology			
	Catastrophe Risk		14:00 -14:15	Regulating Risk Culture in the Financial
	Dr Edward Oughton, Research Associate,			Services
	Cambridge Ce	ambridge Centre for Risk Studies		Professor Kern Alexander, Chair for Banking
				and Financial Market Regulation, University of
INVERSITY OF Contro for			Zurich and Risk Fellow, Centre for Risk Studies,	
			University of Cambridge	
VAMBRIDGE Risk Studies			•	

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A Near-Miss

On 23 July 2012 the sun ejected the largest mass of high energy plasma ever recorded

It missed the earth...

How the CME Missed Earth



- The earth was on the other side of the sun at that point of its seasonal orbit
- By chance the Coronal Mass Ejection spat out in the opposite direction
- If it had occurred one week later, the earth would have experienced an event of -1200 Dst



If it Had Hit the Earth: Possible Geomagnetic Storm Footprint





Storm impacts at 05:00 GMT, with short duration

Consequences of a Large Solar Storm

- Electronics and national power grids suffer damage from electromagnetic flux
- 6% of EHV transformers in US power grid are damaged
- 2,300 transformers, 132 fail, 750 trip out
 - Some estimates suggest >360 would fail
- Produces a power outage across United States, taking 8-12 months to fully restore
 - 2 Billion person-days of lost power to population of United States
 - 9 Billion person-days in extreme estimates
 - 5% of the population is out for 5 months
- Costs US economy \$200 Billion (1.4%)
 - Extreme estimate \$1.2 Trillion (8%)
- Costs the global economy \$500 Bn (0.7%)
 - Extreme estimate \$2.7 Trillion (4%)
- Insurance payouts (US only) of \$60-300+ Bn





New York GDP@Risk Impact from Solar Storm





'Catastronomics': Recovery and Resilience

- How do economies react to shocks?
- Which 'resilience' factors speed up recovery?
- How can urban economies be made more resilient?
- Research track on case studies to develop improved models of Catastronomics



Impact of 1995 earthquake on the economy of Kobe, Japan



A Tale of Two Economies

Traditional Economy



Dreyer's

- \$1.5Bn Revenue
- Food manufacturer, 2nd largest frozen foods producer in US
- 8 Manufacturing plants and production centres in NY
- Contributes \$500m to economic output of New York
- Employs 12,000 people in NY

Digital Economy



SalesForce.com

- \$6.6Bn Revenue
- Cloud Service Application, Leading customer relationship management provider in US
- Server farms across US, 3 major datacenters in New York area
- Derives 30% of its revenues from NY customers

Corporate Impact

Traditional Economy

- Manufacturing and distribution centres shut down by power outage
 - large 'supply side shock'
- Economic shrinkage reduces disposable income and translates into decreased consumption
 - modest and time lagged 'demand side shock'

Digital Economy

- Datacenters self-powered but distribution and communications badly impacted by power outage
 - significant 'supply side shock'
- Customers lose access to services and are unable to be productive using technology services
 - Large and immediate 'demand side shock'
- Disruptive to competitive positioning
 - more rapid supplier substitution and brand switching

Dependency on Infrastructure and Interconnectivity



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Disruption of Critical National Infrastructure

- Major cyber attack on power grid distribution system in UK
- Examines the effects of power outage on other CNI layers
 - Telecommunications
 - Transport network
 - Gas supply
 - Water
 - Integrated assessment of power impact on all the different sectors of the economy



Publication launched April 2016



Cyber Attack Threats to Businesses

Cyber attack scenarios developed by Centre for Risk Studies



Software Algorithm Corruption ('Sybil Logic Bomb')



Data Exfiltration ('Leakomania')



Denial of Service Attack ('Mass D-DoS')



Cloud Service Provider Failure ('Cloud Compromise')



Cyber Heist ('Financial Theft')



Ransomware ('Extortion Spree')



Cyber Attack on **US Power Generation** ('Business Blackout')



Cyber Attack on **UK Power Distribution** ('Integrated Infrastructure')



Cyber attack on **Office Buildings** ('UPS fire-induction')



Cyber attack on Aircraft ('Navigation Spoofing Attack')



Cyber Attack on Industrial Chemical Plant ('ICS Attack')



Cyber Attack on Oil Rigs ('Phishing-Triggered Explosions')











Insiness Blackout

Schema

Mak Stades Exposure Data Accumulation Scenarios



UK Cyber

Blackout



Cyber Terrorism

How Can Companies Become More Resilient to Shocks?

Companies face threats to their:

- Operations and activities
- Personnel and workforce
- Supply chains and counterparties

- Critical assets and facilities
- Markets & customer demand
- Financial assets, investments and balance sheets
- Develop a checklist of the threats to each
 - What is the minimum data needed to assess these?
- Strategies for resilience include:
 - Operational risk minimization (e.g. supplier options)
 - Risk culture and risk awareness decision-making
 - Risk transfer and financial risk capital management
 - Strategic planning, incorporating stress test scenarios



What Are the Threats to Worry About? **Cambridge Taxonomy of Threats**









Crash





Natural Catastrophe

Disease Outbreak

Waterborne

Epidemic







Flood



Eruption



Human Epidemi

Windstorm

Tsunami



Animal Epidemic





Epidemic



Dispute

rade

Cartel

atastrophe

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Crisis

Humanitarian

Tornado &

Hail

Pressure

Financial Irregularity

LOSEL

Bank

Run



Refugee Crisis











Heatwave

Storm



ental Catastrophe

LON

Wildfire

Space

Threat







Famine











Conventional War

Asymmetric Wa



Crime

Political Violence

Organized

Assassination Social Unrest



Separatism

Nuclear Meltdown



Industrial Accident



nnological Catastrophe Tech Cyber Catastrophe

Accident

Infrastructure Technological Failure





Event

Space

Collapse

Meteorite



Solar Storm



Satellite System Ozone Layer Failure



Sea Level Rise



















CCRS Research Outputs: Explorations of individual threats





Emerging Risk Scenario

Taxonomy of Threats



Financial Catastrophes



Cyber Accumulation Insurance Risk Report





NatCat FinCats Clash Report



Pandemic Emerging Risk Scenario



Eurozone Meltdown Financial Risk Scenario



Business Blackout Lloyds Emerging Risk Report



Cyber Catastrophe Emerging Risk Scenario



High Inflation Financial Risk Scenario



Climate Change





Social UnrestEbolaEmerging Risk ScenarioEmerging Risk Scenario



Dollar Dethroned Financial Risk Scenario



World City Risk 2025 Lloyds Co-Branded Report



Historical Crises Financial Risk



Solar Storm Emerging Risk Scenario 17

Imposing a Standardized Approach to All Threats





Risk from 22 Threats to the Global Economy



Financial Crises: The Greatest Threat to Economic Output

- Ongoing research into historical financial crises
 - Compiling an authoritative catalogue
- Causes and triggers of market crash, asset bubbles, and sovereign defaults
- Building a model of the modern interconnected financial system
 - Analyzing contagion mechanisms
- Understanding impact on investment portfolios and consequences for economy

Financial Stress Test Scenarios





Global Property Crash Financial Risk Scenario

Eurozone Meltdown Financial Risk Scenario



High Inflation Financial Risk Scenario



Dollar Dethroned Financial Risk Scenario

CCRS – Future Research

- CCRS is pioneering a holistic approach to understanding the full taxonomy of threats
- This continues our work on catastrophic failures of complex systems
- Our primary focus is helping mitigate the risk of business disruption and economic output loss
- We are now working with our supporters to apply these analytics to business problems
- Watch out for... Project Pandora
 - Coming to a conference near you, soon



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