The Policy Maker's Tale

Stress testing policy and business plans for extreme
events – hope for the best, plan for the worst

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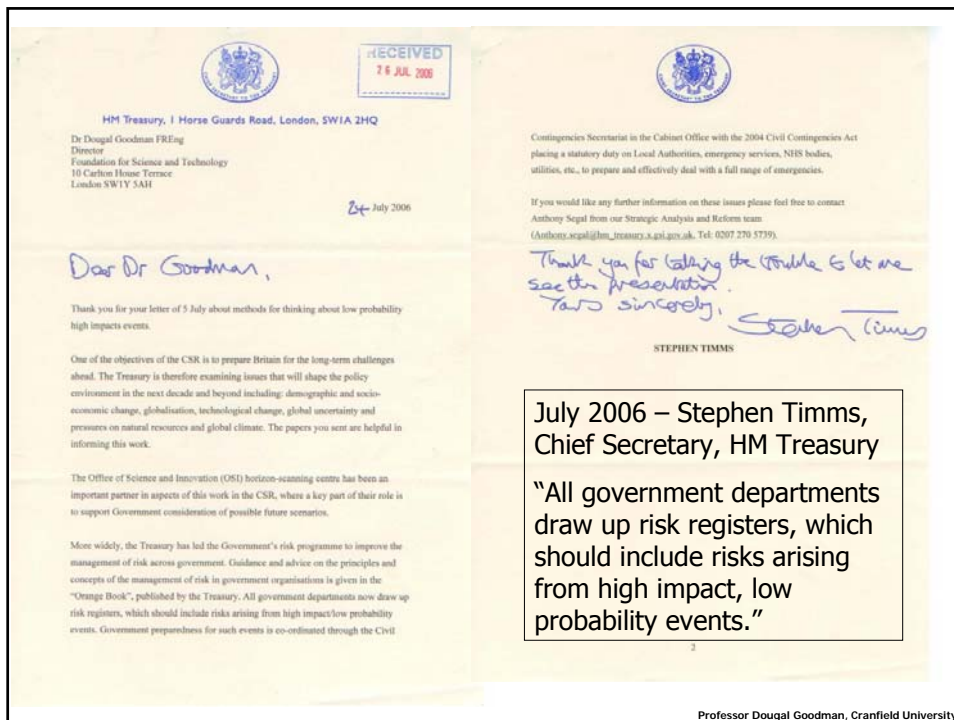

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- Simon Pollard and Sophie Rocks, Cranfield

  www.cranfield.ac.uk/sas/risk

  www.stat.unc.edu/faculty/rsmith.html

  www.math.ethz.ch/~embrechts/

July 2006 – Stephen Timms, Chief Secretary, HM Treasury

"All government departments draw up risk registers, which should include risks arising from high impact, low probability events."
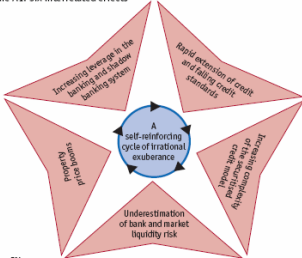

FSA Outlook 2009

1 Increased leverage in the banking and shadow banking system

2 Property price booms

3 Rapid extension of credit and falling credit standards

4 Increasing complexity of the securities credit model

5 Underestimation of bank and market liquidity risk

"A self-reinforcing cycle of exuberance"

New processes are required for the better management of risk

Figure A1: Six interrelated effects

Source: FSA

The UK Corporate Governance Code
Financial Reporting Council July 2010

C.2 Risk Management and Internal Control

Main Principle

The board is responsible for determining the nature and extent of the significant risks it is willing to take in achieving its strategic objectives. The board should maintain sound risk management and internal control systems.

Code Provision

C.2.1 The board should, at least annually, conduct a review of the effectiveness of the company's risk management and internal control systems ……

Solvency II – Regulation of Insurers

New regime for the regulation of insurers from 2012

Pillar I -   Companies will have to show regulators that they have appropriate internal models for evaluating their capital requirements or use a standardised approach

Pillar II –   Demonstrate that they have an effective risk management process and a risk identification process

Pillar III –   Public disclosure and reporting requirements

UK GDP

£1,470 billion

What could destroy 5% of UK GDP or 5% of the value of a company?

A Banker?

A Cyber Attack?

An accident - Macondo Well Failure

Damage to BP brand in US and elsewhere

Combination of events led to low probability, high severity event

Challenge to client contractor relationships

Significant loss of value to the company

A natural catastrophe?

Plate 1: Flash flooding – Abingdon, July 2007

Plate 2: Surface runoff – South Croxton, Leicestershire, July 2007

Plate 3: Red Brook – Shrewsbury, July 2007

Plate 4: River Severn – Tewkesbury, July 2007

The threat to electricity and waste water treatment infrastructure was very high.

There could have been widespread business disruption.

The summer 2007 floods in England & Wales – a hydrological appraisal, Terry Marsh and Jamie Hannaford, CEH and BGS, 2007
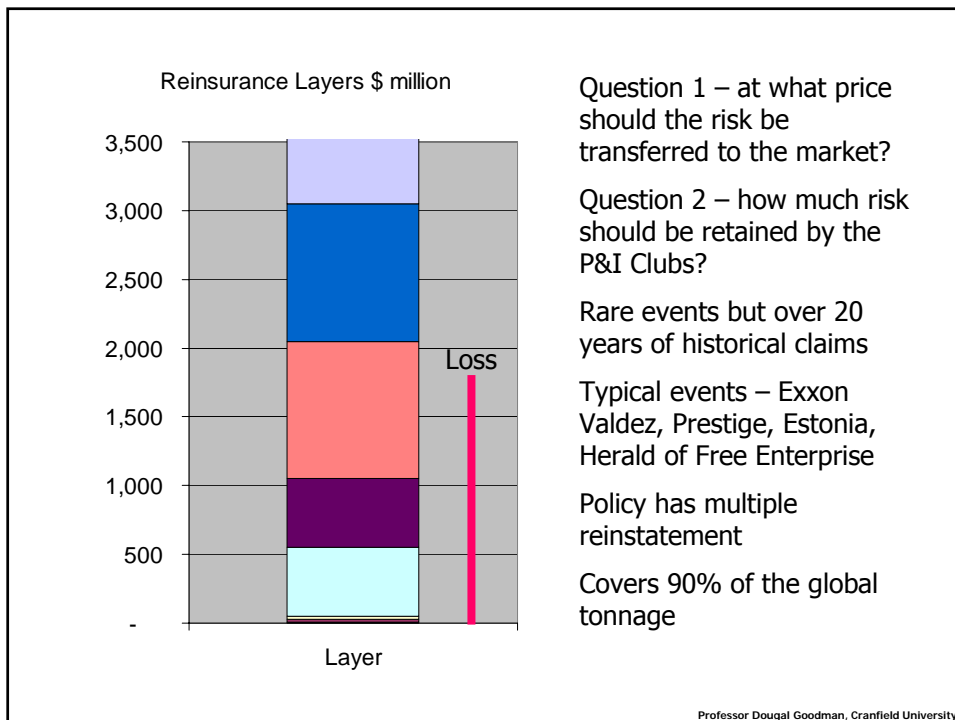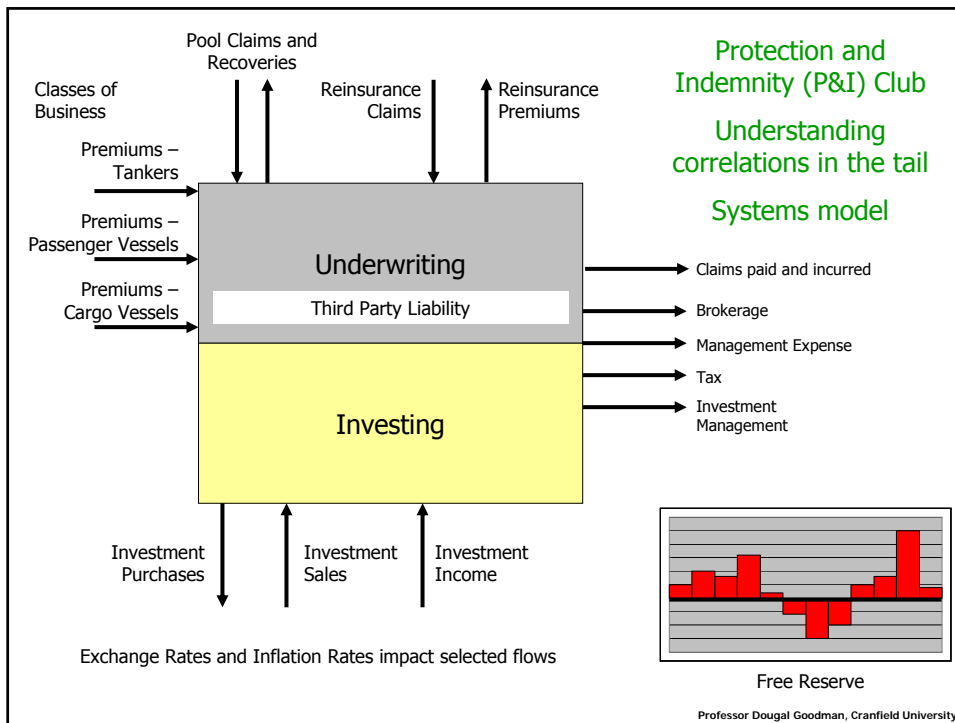
Deep downsides – only some can be quantified

- Sudden product price or margin fall
- Customers do not pay for goods or services
- Liability claim
- Loss of trust of employees
- Outrage of the public
- Projects fail to complete on time and within budget
- Cyber attack

- Business interruption from natural catastrophes
- Fire or explosion at a facility
- Fraud, accounting or trading failure
- Collapse of a supplier
- Regulatory or tax step change
- Loss of utilities
- and so on…

Risk level controlled by elimination, management or transfer

Senior management should review risk registers more than once a year

Slide 1

Pool Claims and Recoveries

Classes of Business

Reinsurance Claims

Reinsurance Premiums

Premiums – Tankers

Premiums – Passenger Vessels

Premiums – Cargo Vessels

Underwriting

Third Party Liability

Investing

Claims paid and incurred

Brokerage

Management Expense

Tax

Investment Management

Investment Purchases

Investment Sales

Investment Income

Exchange Rates and Inflation Rates impact selected flows

Free Reserve

Protection and Indemnity (P&I) Club

Understanding correlations in the tail

Systems model

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Slide 2

Reinsurance Layers $ million

3,500
3,000
2,500
2,000
1,500
1,000
500
-

Loss

Layer

Question 1 – at what price should the risk be transferred to the market?

Question 2 – how much risk should be retained by the P&I Clubs?

Rare events but over 20 years of historical claims

Typical events – Exxon Valdez, Prestige, Estonia, Herald of Free Enterprise

Policy has multiple reinstatement

Covers 90% of the global tonnage

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The toolkit

Extreme Value Analysis

FTSE 100
Steady growth or decline with occasional abrupt falls – extreme events
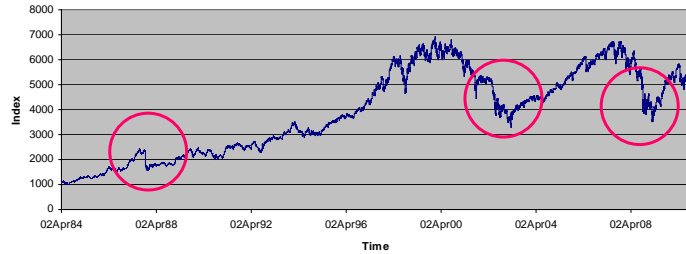
Daily Rate of Change of FTSE100
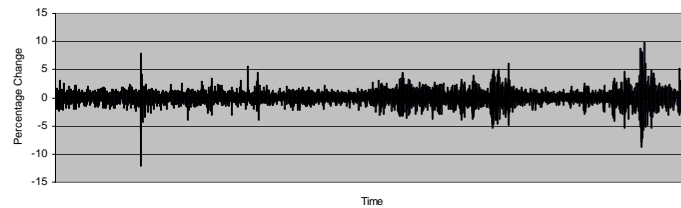
January 1984 to October 2010
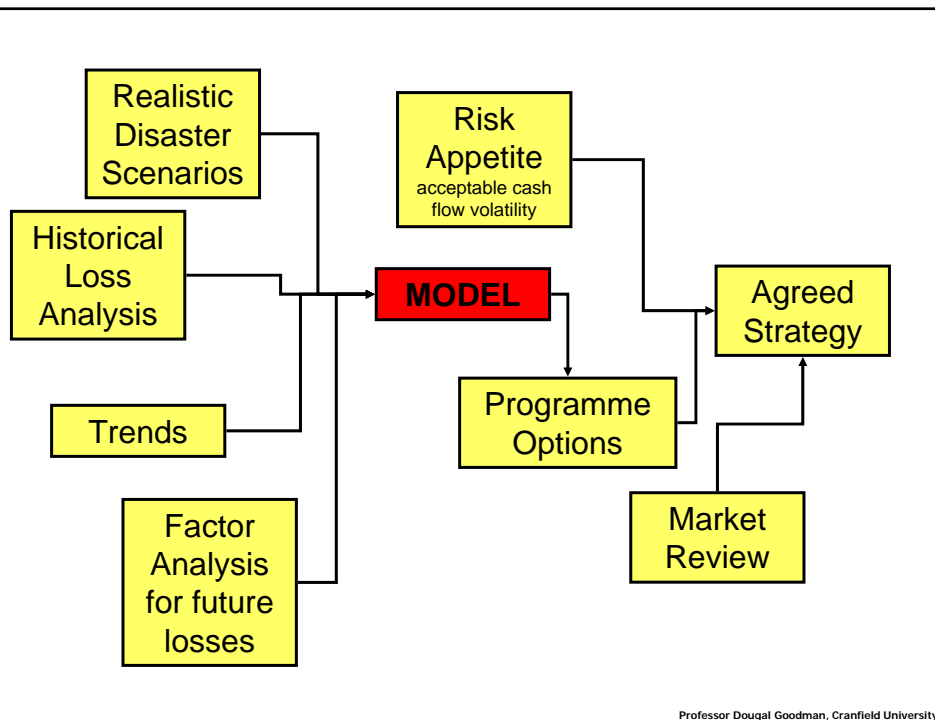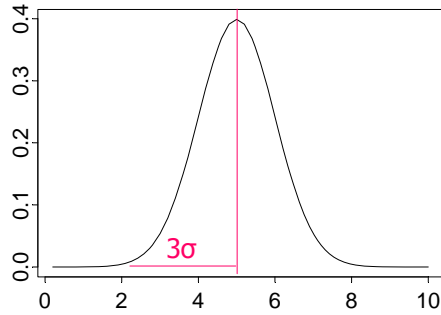
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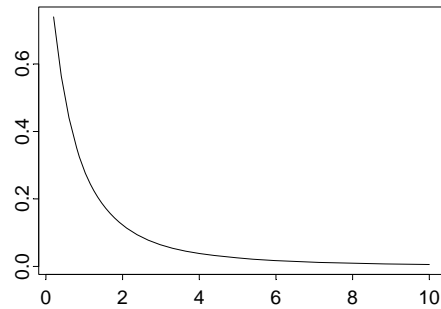Professor Dougal Goodman, Cranfield University

THE TAIL

Gaussian

Mean of 5, standard deviation 1
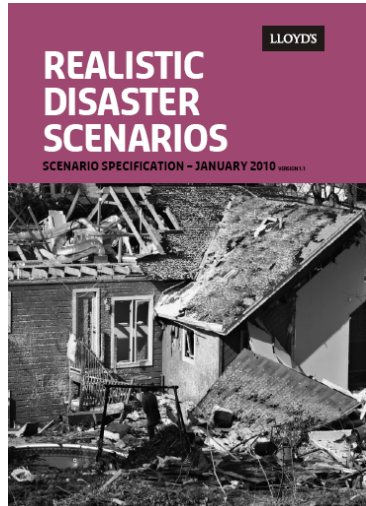
Generalised Pareto

Shape parameter is 0.6, beta is 1

Break out of thinking that all distributions are normal distributions.
Tail events may, however, be driven by a different process.

Stress testing and
what ifs?

Lloyd's Market Process

Lloyd's Realistic Disaster Scenarios

1. Two events – North East US hurricane and a Carolinas windstorm event
2. Florida windstorm
3. Gulf of Mexico windstorm
4. European windstorm
5. Japanese windstorm
6. California earthquake
7. New Madrid earthquake
8. Japanese earthquake
9. UK flood
10. Terrorist event
11. Marine
12. Loss of major complex
13. Aviation loss
14. Satellite risk
15. Liability exposure
16. Political risk

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UK Flood Event – Scenario 9

Residential	£4.5 bn
Commercial/industrial	£1.6 bn
Agriculture	£0.05 bn
Motor	£0.05 bn
TOTAL	£6.2 bn

To estimate the loss a knowledge of precipitation, surface flooding, river flow, terrain heights, land use and the social aspects of how people react to flood warnings is required.

London flood model

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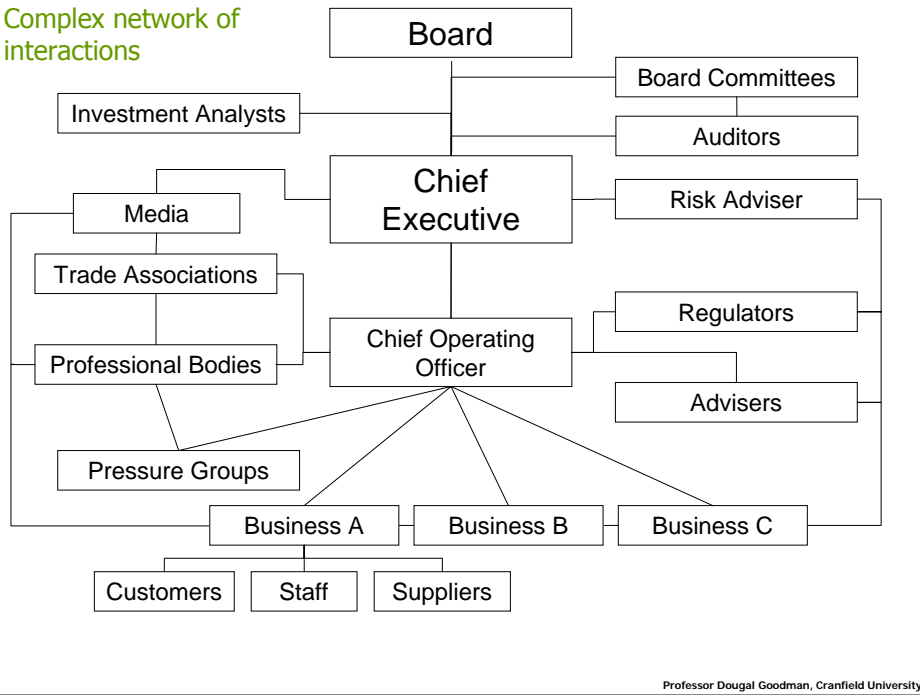
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Communication and Triage

What is acceptable?

A board decision

As Low As Reasonably Practicable

Risk = Consequences * Likelihood

Risk = How big? * How often?

Harm per unit time

Complex network of interactions

Board

Board Committees

Investment Analysts

Auditors

Chief Executive

Risk Adviser

Media

Trade Associations

Regulators

Professional Bodies

Chief Operating Officer

Advisers

Pressure Groups

Business A   Business B   Business C

Customers   Staff   Suppliers

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European Commission

Select Committees

Council for Science and Technology

Parliament

Minister

Media

Chief Scientific Adviser

Trade Associations

Agencies

Officials

Businesses

Advisers

Pressure Groups

Research Councils

Professional Societies

Scientists

Dougal Goodman FST Sep06

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THE ANALYST

The capital requirement at a 99.5% quantile (1 in 200) is $x million.

We can build a model and do some more sensitivities.

The model may have some missing elements.

I will ask an expert for advice.

Distributions of outcomes

THE MANAGER

Should I buy the company – yes or no?

Do I commit resources to this project – yes or no?

Should I respond to this threat – yes or no?
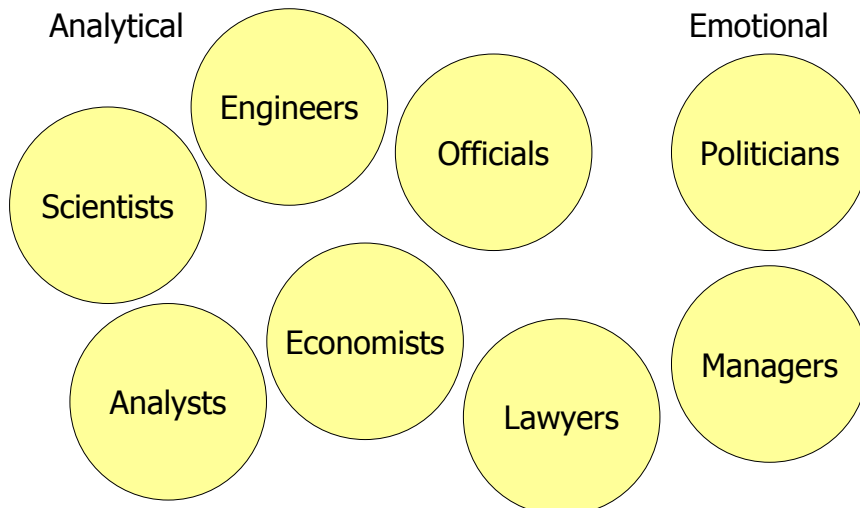
Is the structure safe – yes or no?

Binary choices

Analytical

Emotional

Engineers

Officials

Politicians

Scientists

Economists

Managers

Analysts

Lawyers

Intermediaries are needed to translate....

Summary

- Government and industry should share best practice in assessing low probability, high severity events

- Senior managers should stand back from day to day operations and think about the deep downsides that could destroy their businesses

- Communication of extreme value analysis is not straightforward – a new language for communicating risk in business is required

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