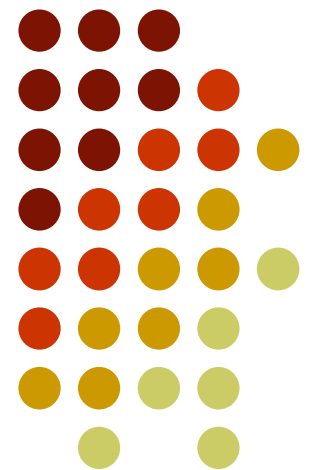


Actuaries as risk managers

Nick Dumbreck

Pacific Rim Actuaries' Club of Toronto

21 February 2008





Agenda

- Financial sector failures and major losses
- Solvency II – a risk-based capital regime for European insurers
- Expanding the role of actuaries in risk management



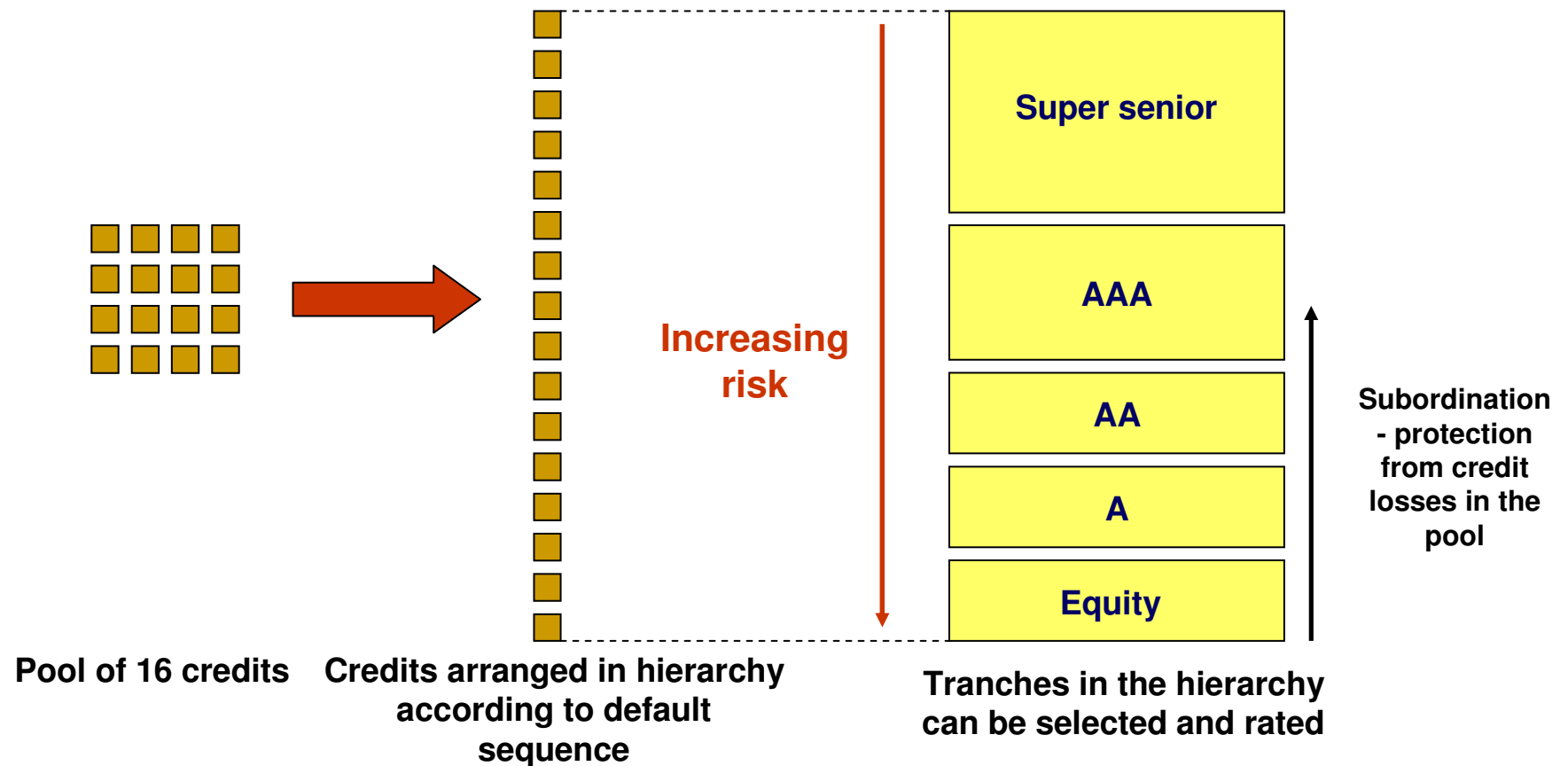
USA: the credit crunch

- Exposure (direct and indirect) to sub-prime mortgages has so far caused \$120bn of losses for banks worldwide, and it is predicted that the total could reach \$400bn
- Many large banks have had to seek additional capital, mainly from SWFs, to maintain ratings
- Over 2,000 rating downgrades of Collateralised Debt Obligations since 1 January 2008





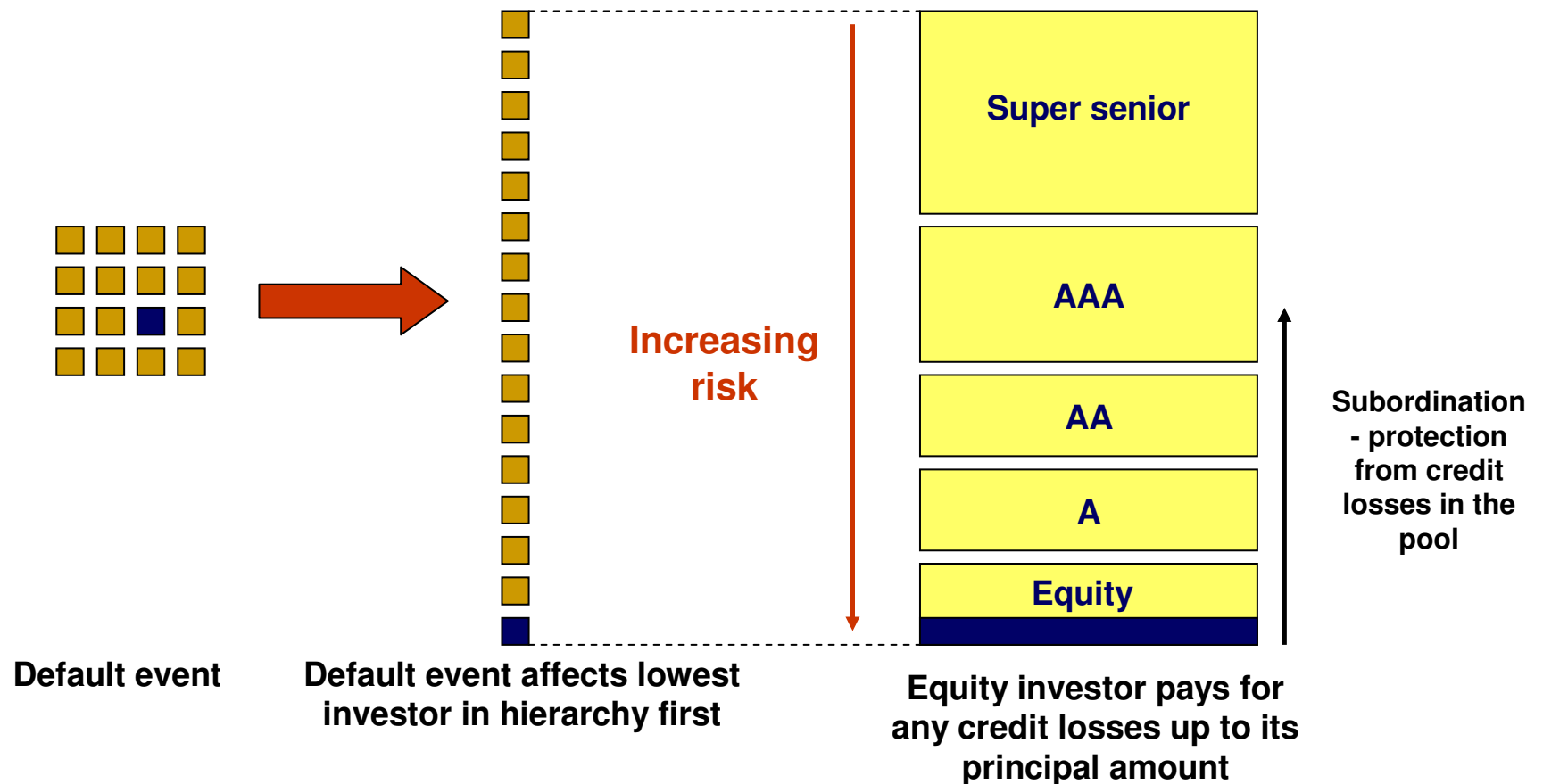
CDOs – how they work (1)



Source: Morgan Stanley



CDOs – how they work (2)



Source: Morgan Stanley



UK: Northern Rock

- Northern Rock is a UK mortgage lender which relied heavily on wholesale markets for funding
- In September 2007 a severe liquidity squeeze caused by the sub-prime crisis led the bank to seek emergency funding from the Bank of England
- News of this caused a run on the bank until the UK government stepped in to guarantee deposits
- The bank is now for sale; the sale terms envisage that the UK government will continue to provide £28bn of funding





USA: Goldman Sachs

- In a rare unplanned investor call, the bank revealed that a flagship global equity fund had lost over 30 per cent of its value in a week because of problems with its trading strategies created by computer models. In particular, the computers had failed to foresee recent market movements to such a degree that they labelled them a “25-standard deviation event” – something that only happens once every 100,000 years or more.
- “We are seeing things that were 25-standard deviation events, several days in a row,” said David Viniar, Goldman’s chief financial officer.
- “People say these are one-in-a-100,000-years events but they seem to happen every year,” says Satyajit Das, a consultant to hedge funds and investment banks. “This episode should make people ask questions about models – I think it could lead to a real reassessment.”

Monoline insurers



- Monolines are insurers which guarantee or “wrap” bonds issued by weaker institutions, to improve their credit rating and thereby reduce borrowing costs
- Exposure to mortgage-backed securities is threatening the AAA credit rating of some monolines, leading to potential downgrades of the bonds they have guaranteed
- Banks are putting together a rescue package to recapitalise the monolines





France: Société Générale

- Futures trader Jérôme Kerviel built up €50bn exposure to world equity markets by creating a fictitious offsetting portfolio and bypassing control systems
- By the time the exposure had been closed out, losses of €4.9bn had been incurred

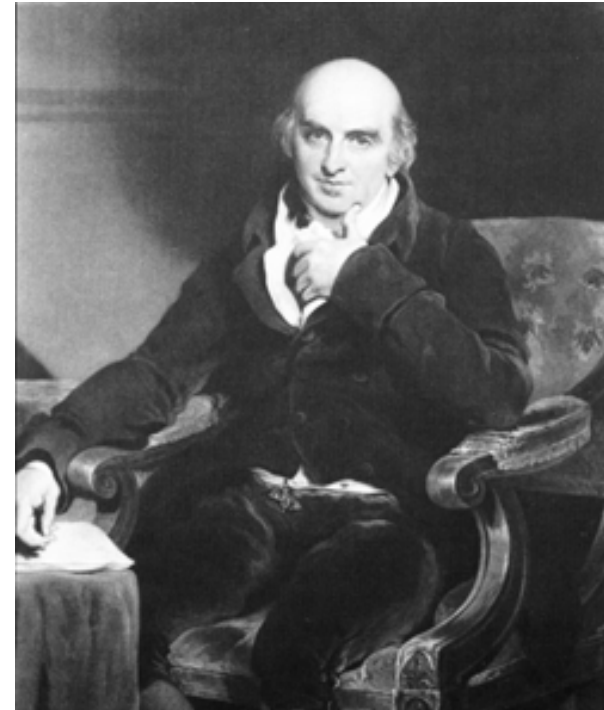
**£3.6bn rogue
'behind crash'**





UK: Equitable Life

- World's oldest mutual life assurer – founded 1762
- Invented participating life insurance
- Ran into serious financial difficulties in 2000 as a result of generous guarantees and falling interest rates, exacerbated by loss of court case
- Closed to new business, but has remained solvent

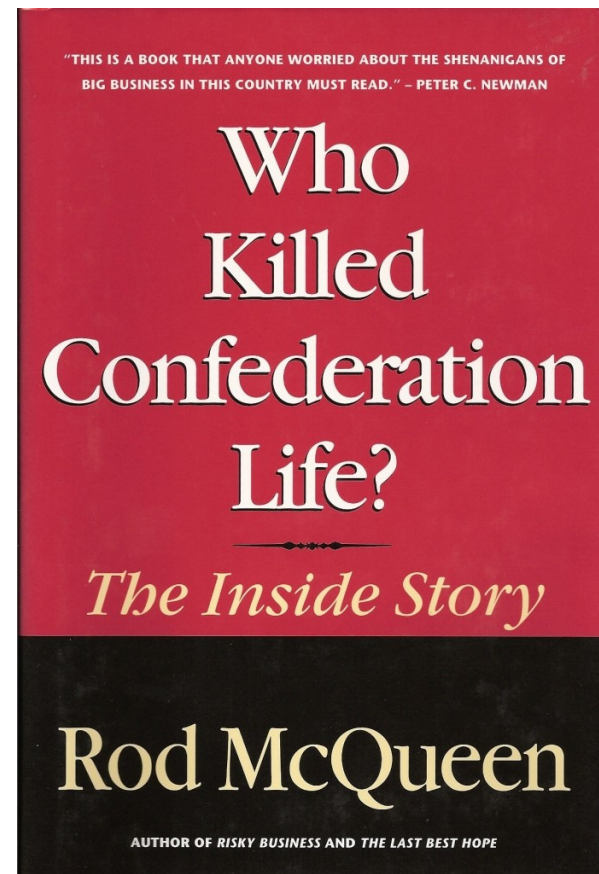


Dr William Morgan
(Chief Actuary 1775 – 1830)



Canada: Confederation Life

- Largest life insurance company failure in North America
- Started 1990s with 75% of assets in real estate and mortgages
- S&P downgraded from A+ to BBB+ one week before liquidators took over in August 1994, having been AAA until January 1992



Australia: HIH



- Australia's second largest P&C insurer
- Became insolvent in March 2001
- Losses up to \$5.3 bn – Australia's largest ever corporate collapse
- Multiple causes including culture/ uncontrolled expansion/ underpricing/ inadequate reserves/ weak auditors
- Directors jailed for fraud/insider dealing



**Former HIH CEO Ray Williams
on his release from jail**



UK: Independent Insurance

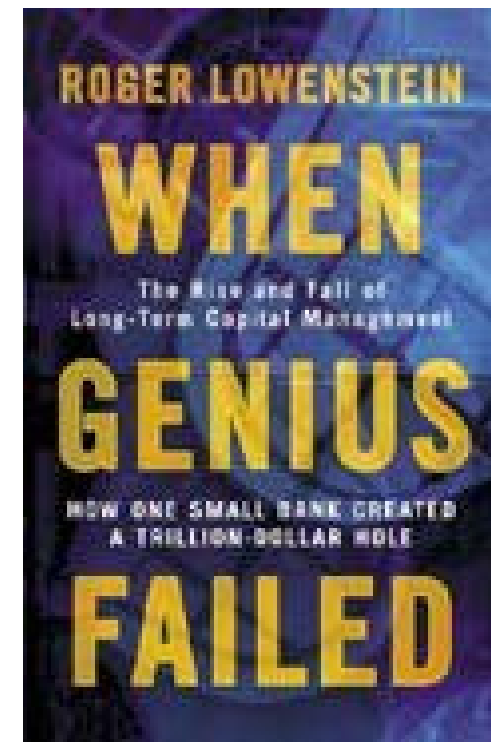
- Major UK P&C insurer
- Grew rapidly after formation in 1986 and was listed in 1993
- Became insolvent in 2001 after company revealed large numbers of claims that had been concealed
- CEO Michael Bright jailed for 7 years in 2007





USA: Long Term Capital Management

- Hedge fund used sophisticated models to exploit expected narrowing of credit spreads between AAA and low grade bonds
- Failed spectacularly when Russian debt crisis caused spreads to widen suddenly



Japan: benefits cut to facilitate restructuring of failing companies



- Between 1976 and 1993, individual life policies typically guaranteed accumulation rates of around 5.5% per annum
- Interest rates fell sharply in late 1990s and exposed guarantees
- Seven life companies became insolvent between 1997 and 2001, but were restructured and sold without ceasing trading





Japan: restructuring approach

- Assets marked to market
- Reserves zillmerised
- Reserve haircut of up to 10%
- Benefits recalculated at lower prospective guaranteed rates
- Moratorium surrender charge imposed

Old name	New name
Nissan Mutual	Aoba Life
Toho Mutual	GE Edison Life
Daihyaku Mutual	Manulife Century
Taisho Life	Azami Life
Chiyoda Mutual	AIG Star Life
Kyōei Life	Gibraltar Life
Tokyo Mutual	T&D Financial

Asia: other problems



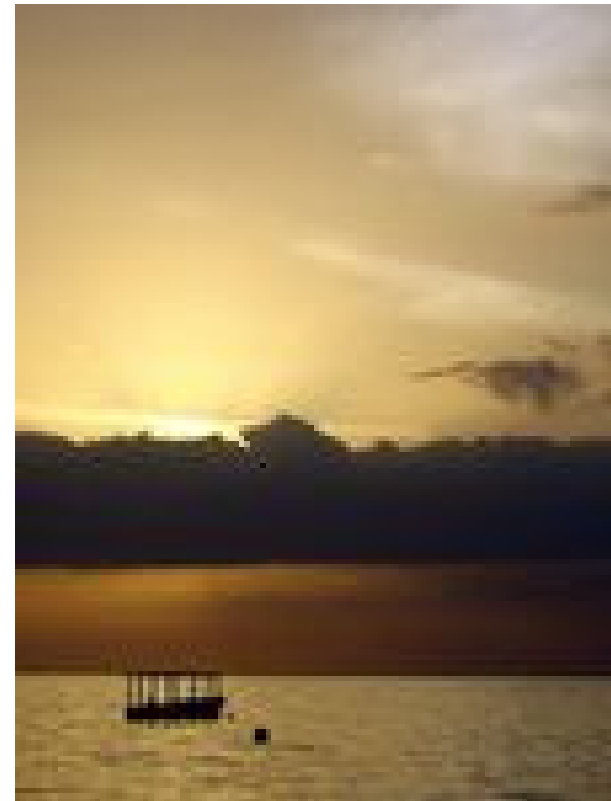
- 6 companies in Korea failed between 1998 and 2000 as a result of high guarantees/ falling interest rates
- Major losses arose in Taiwan on health policies because of rising claim costs
- Concerns over critical illness claims experience
- Guaranteed surrender values may cause problems if stochastic valuation approach required
- China Pacific – high growth/ low margin products/ negative spreads





Jamaica: banks and insurers fail

- In 1995, short term interest rates in Jamaica reached 50% p.a.
- Most bank and insurance products were deposit-like, but funds were invested in illiquid assets, particularly real estate developments
- Companies approached government in 1996 and were bailed out at a cost of 40% of GDP





What went wrong? – a summary

	Market	Credit	Liquidity	Insurance	Operational	Group
Confederation Life						
Equitable Life						
HIH						
Independent						
LTCM						
Northern Rock						
Japan						
Jamaica						



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Solvency II reform in the EU

- Risk-based regulatory framework for all insurers based in EU
- Harmonise standards across the EU to create level playing field
- Moving to a single lead supervisor in Europe for large groups
- Framework Directive finalised in 2007
- Impact studies being used to refine methodology
- Due for implementation in 2012
- Some regulators already adopting risk-based framework in advance, e.g. FSA (UK), BPV (Switzerland), Finansinspektionen (Sweden)

Solvency II will significantly change the insurance solvency system in Europe, and may influence developments elsewhere



Solvency II: 3 Pillar Framework

- Pillar 1: Asset and liability valuation standards; Minimum Capital Requirement; Solvency Capital Requirement
- Pillar 2: Supervisory Review Process
- Pillar 3: enhanced public disclosure and confidential supervisory reporting



Solvency II framework



Best estimate liability

Includes discretionary as well as guaranteed payments

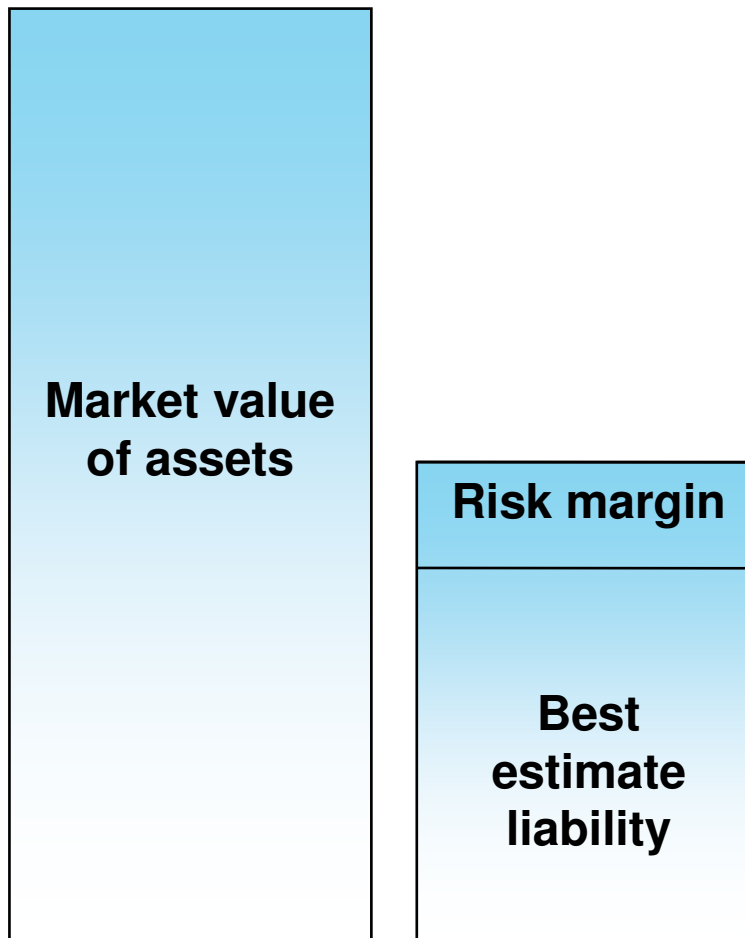
Term structure of discount rates

Management/policyholder actions

Stochastic modelling of options and guarantees/replicating portfolio approach



Solvency II framework

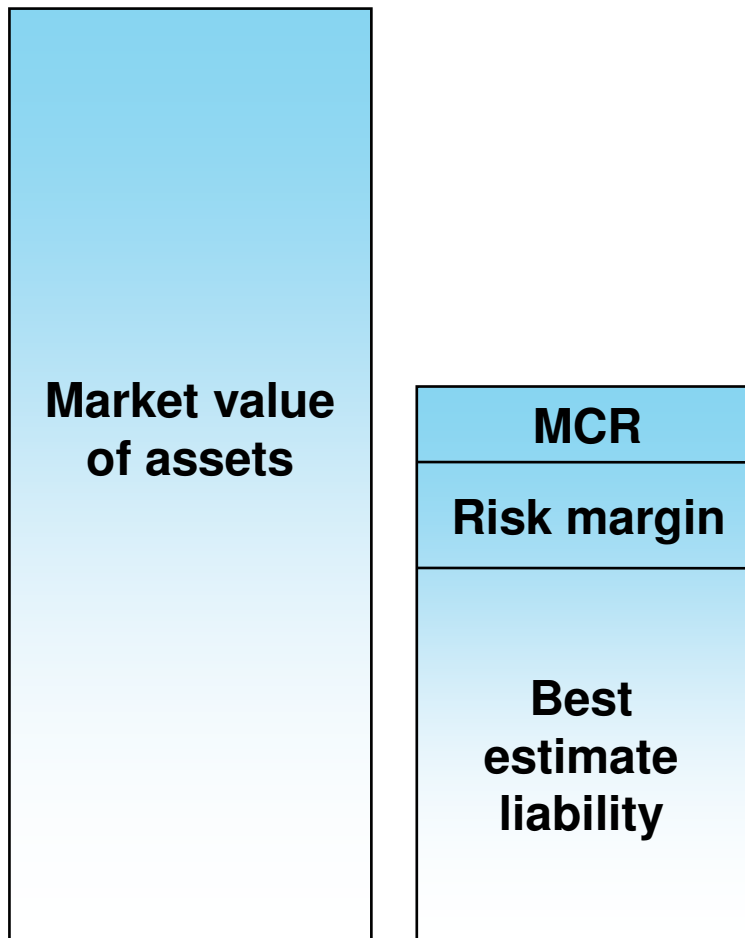


Risk margin (for non-hedgeable risks only)

Cost of capital approach – based on assumption that minimum resources to achieve viable run-off will include the cost to the buyer of holding solvency capital for the business



Solvency II framework



Minimum capital requirement

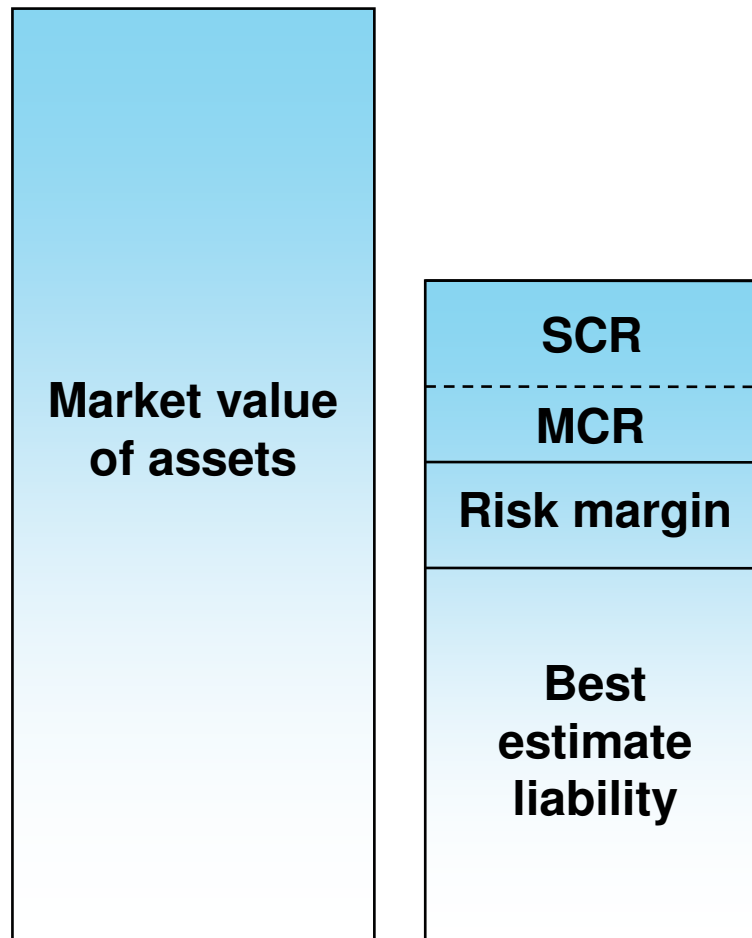
Calculated using simple factor-based approach

Subject to minimum denominated in euros

Minimum resources below which intensive regulatory intervention required



Solvency II framework



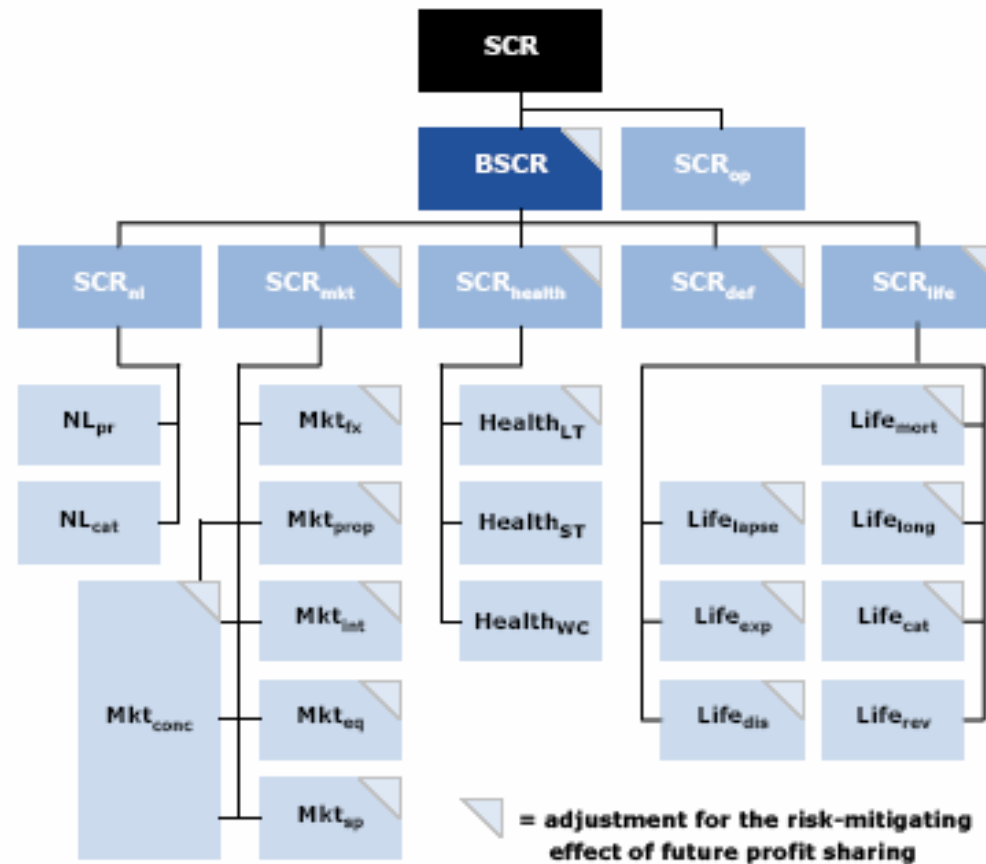
Solvency capital requirement

Standard approach or internal model approach

Aggregation using correlation matrices

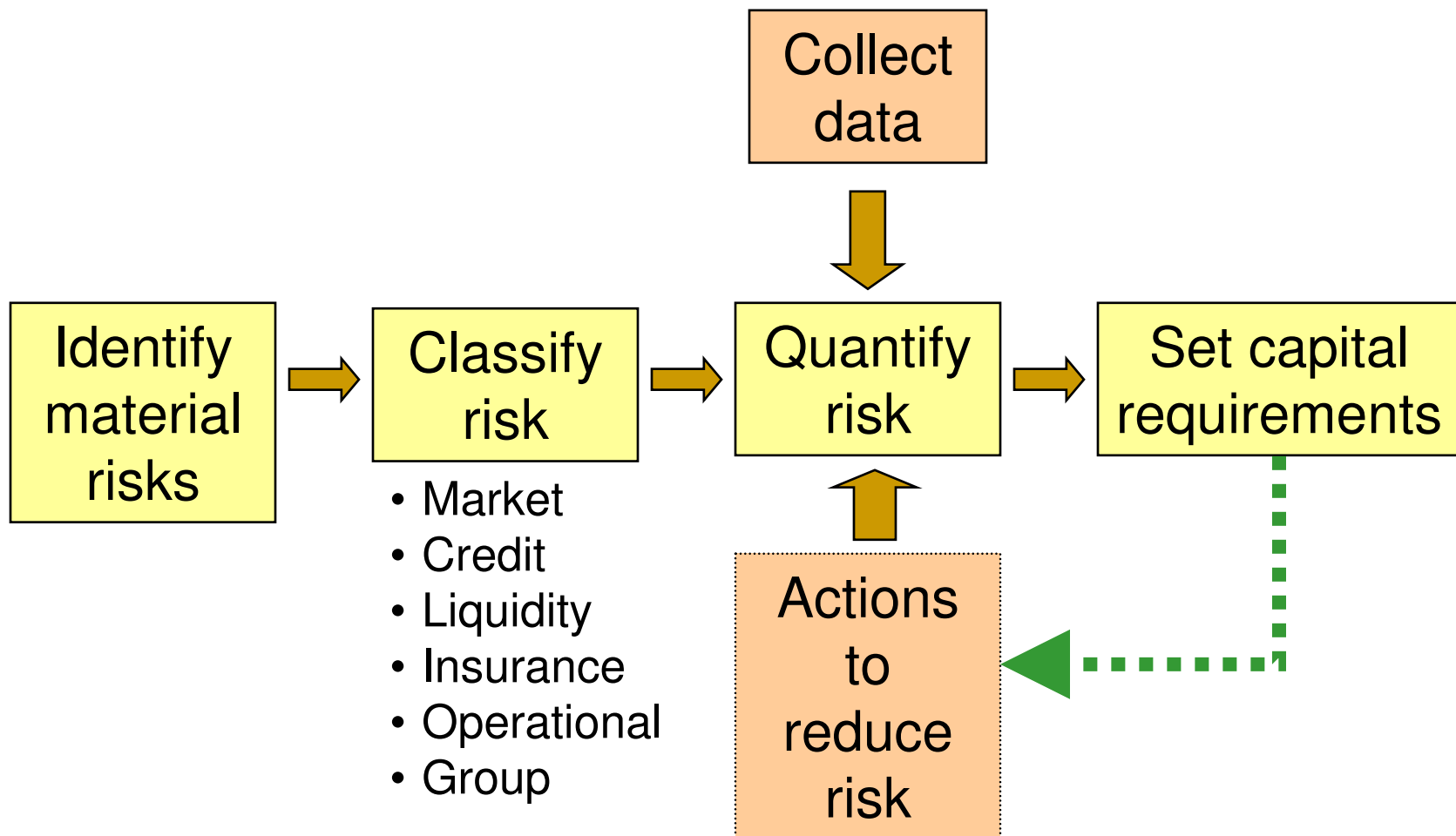


Solvency II: Structure of the SCR





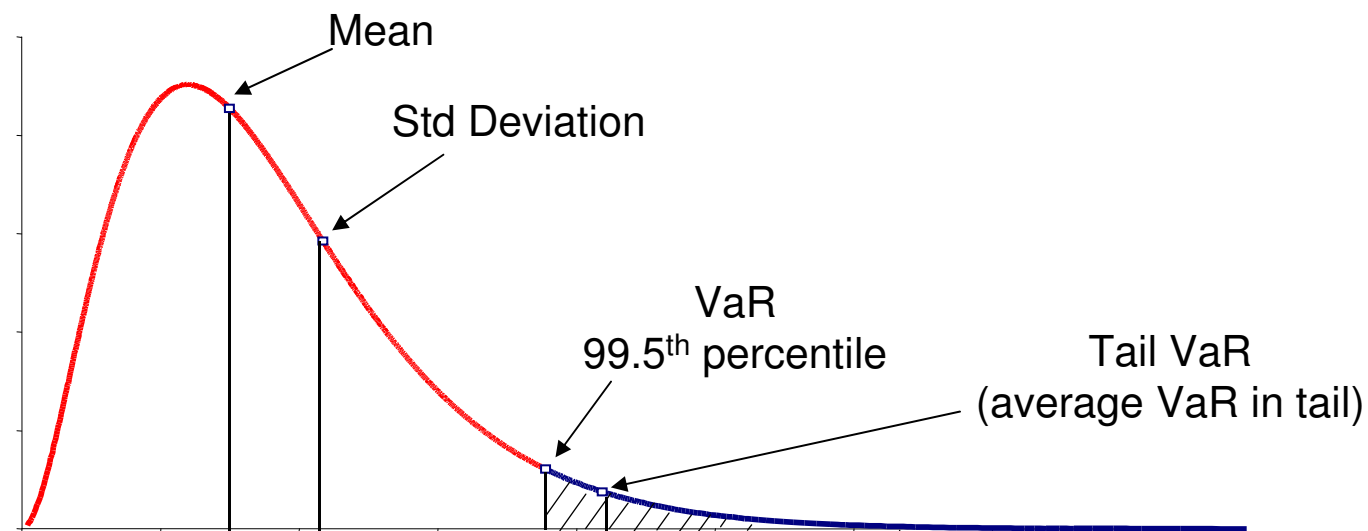
Internal model





Risk based capital requirement

- Based on a **99.5% confidence level over one year** that assets will be equal or greater than liabilities



Calculating risk-based capital requirements



1. Calculate
base
balance
sheet

Base	£m
Assets	1200
Liabilities	1000
Surplus	200

2. Recalculate
base balance
sheet in
scenarios to
get capital
for each risk

Equity down	£m
Assets	1000
Liabilities	840
Surplus	160

3. Apply
aggregation
formula

Correlation Matrix

	Eq	Int.	Prop.	Cred	Eq vl	Mort	Lps	Op
Equity	1.0	-0.2	0.5	0.5	0.7	0.0	-0.5	0.6
Int.	-0.2	1.0	-0.1	0.3	0.0	0.0	0.1	-0.1
Prop	0.5	-0.1	1.0	0.2	0.5	0.0	0.0	0.2
Credit	0.5	0.3	0.2	1.0	0.0	0.0	0.0	0.2
Eq vl	0.7	0.0	0.5	0.0	1.0	0.0	-0.4	0.5
Mort	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Lapse	-0.5	0.1	0.0	0.0	-0.4	0.0	1.0	0.0
Op	0.6	-0.1	0.2	0.2	0.5	0.0	0.0	1.0

$$ICA = \sqrt{\sum C_i^2 + \sum \rho_{ij} C_i C_j}$$

Capital	
Equity	40
Interest	10
Property	5
Credit	5
Equity vol	10
Mortality	5
Lapse	10
Operational	15
Total	100





Risk aggregation

- The most common approach is to:
 - Derive 99.5th percentile stress for each risk
 - Calculate 99.5th percentile capital required for each risk separately
 - Aggregate to derive total capital required using a "correlation matrix formula" approach
 - Adjust as necessary for any weaknesses in approach



The correlation matrix

Capital (C _i)			Equ.	Int.	Prop.	Cred	Eq vl	Mort	Lps	Op
Equity	40	Equity	1.0	-0.2	0.5	0.5	0.7	0.0	-0.5	0.6
Interest	10	Int.	-0.2	1.0	-0.1	0.3	0.0	0.0	0.1	-0.1
Property	5	Prop	0.5	-0.1	1.0	0.2	0.5	0.0	0.0	0.2
Credit	5	Credit	0.5	0.3	0.2	1.0	0.0	0.0	0.0	0.2
Equity imp. vol	10	Eq vol	0.7	0.0	0.5	0.0	1.0	0.0	-0.4	0.5
Mortality	5	Mort	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Lapse	10	Lapse	-0.5	0.1	0.0	0.0	-0.4	0.0	1.0	0.0
Operational	15	Op	0.6	-0.1	0.2	0.2	0.5	0.0	0.0	1.0
Total	100									

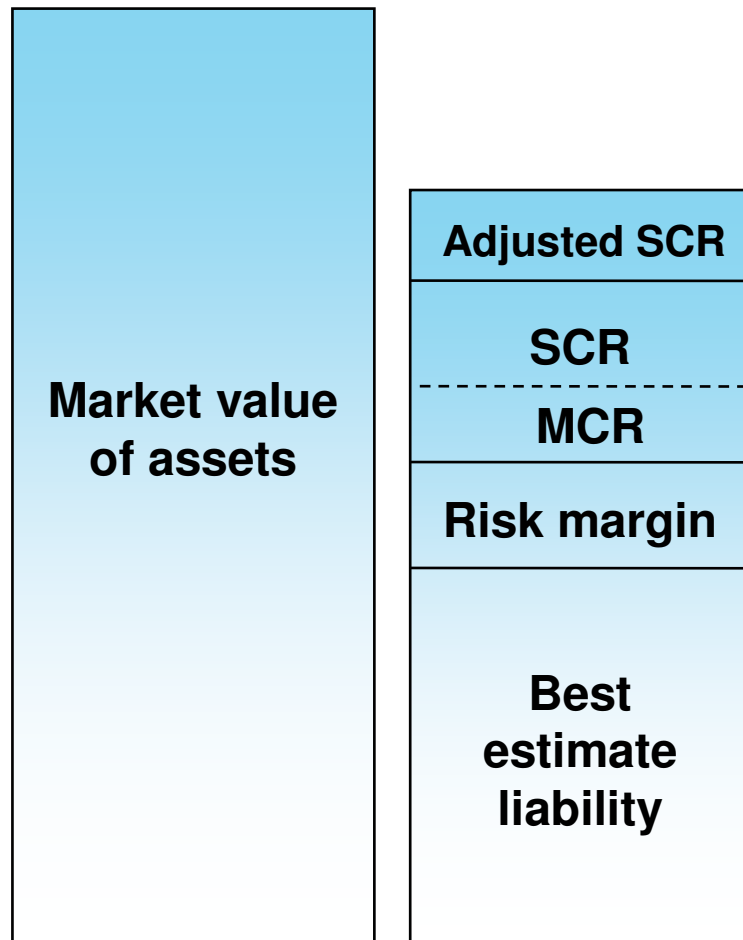
$$\text{Aggregate capital figure} = \sqrt{\sum C_i^2 + \sum \rho_{ij} C_i C_j} = 59$$

$$\text{Square root of sum of squares} = \sqrt{\sum C_i^2} = 47$$

Warning: correlations for example only



Solvency II framework

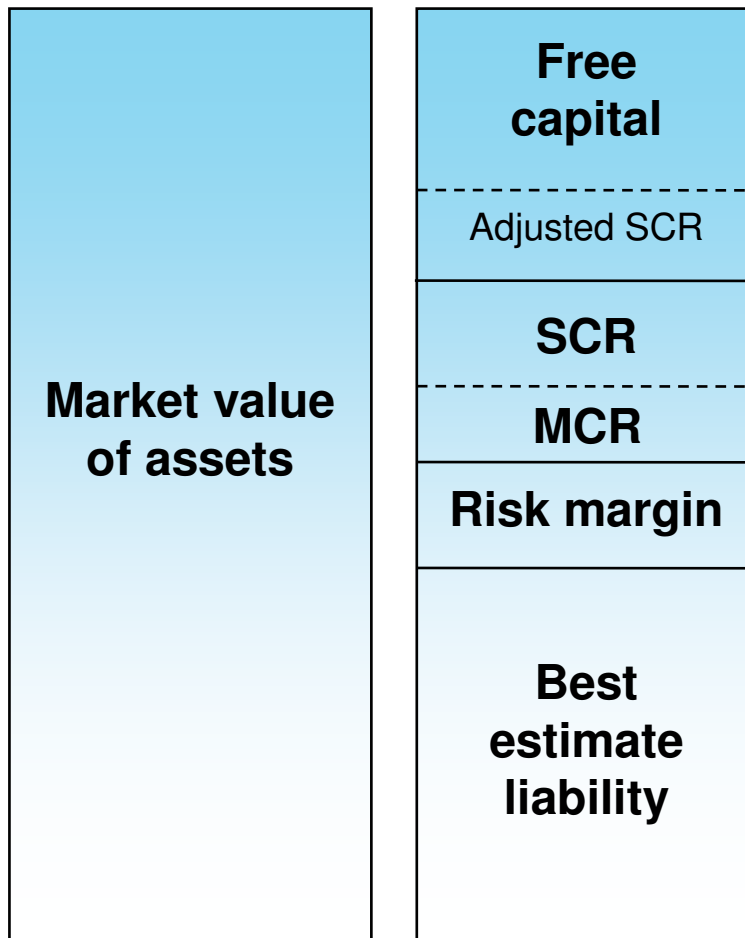


Adjusted SCR

SCR may be increased by regulator if necessary



Solvency II framework



Potential shortcomings of risk-based capital models



- Inadequate data to assess loss distributions
- Wishful thinking/choosing “affordable” assumptions
- Modelling tail behaviour
- Reliance on past as a guide to the future
- Capturing new types of risk
- Results distorted by simplifications





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The role of actuaries

- Rigorous analysis of data
- Improved modelling to understand dynamics of business
- Development of “killer” scenarios and recalibration of correlations in the tails
- Standing back, questioning and challenging
- Clear communication to the decision-makers

Applies to all financial institutions, not just insurance companies



Views of one UK politician

“If we want to avoid these kinds of shocks in the future then we must empower actuaries to ensure that all boards of directors are fully acquainted with the doomsday scenario that could be around the corner”

“Actuaries should not be afraid to speak their minds about the risks being taken within the boardroom. On the contrary. They should be encouraged to make sure that directors are fully aware of the entire risk profile of the business.”

“The only way...is to strengthen stress testing and build effective risk management plans. Actuaries have the skills, experience and expertise to fulfil this critical role.”

**John
Greenway MP**





What is the profession doing to help?

- Developing qualifications in Enterprise Risk Management
 - CERA
 - Planned global qualification
- Greater prominence in education syllabus generally
- Researching new techniques and refining existing ones
- Positioning actuaries as the natural choice for complex risk quantification work



Actuaries as risk managers

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