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Capital Management at Lloyd's and the risk horizon

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Agenda

- Lloyd’s Capital Structure
- ICAS vs Solvency II
- Test Modelling Framework and Results
- One year Versus Ultimate Parameters
- Capital setting under Solvency II
- Questions

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Section 1: Lloyd's capital structure

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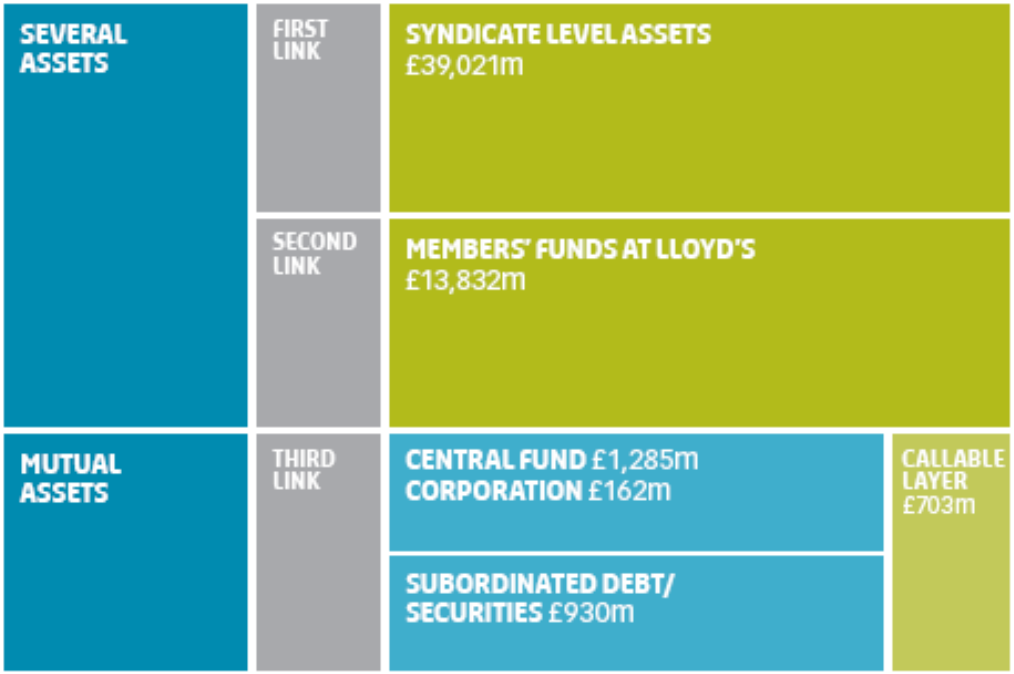
Chain of security – What is it?

- Policyholder protection provided by combination of mutual and several assets
- Members deposit several capital at Lloyd's held in trust (Funds at Lloyd's)
- Members contribute to a mutual layer of capital known as the Central Fund



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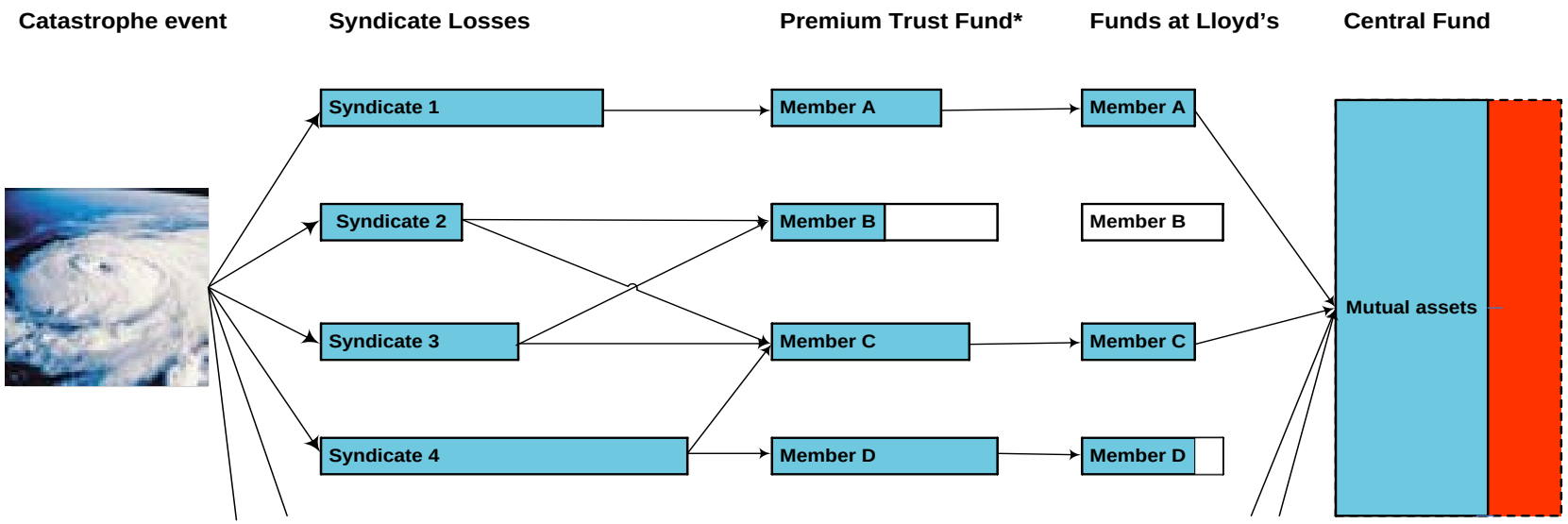
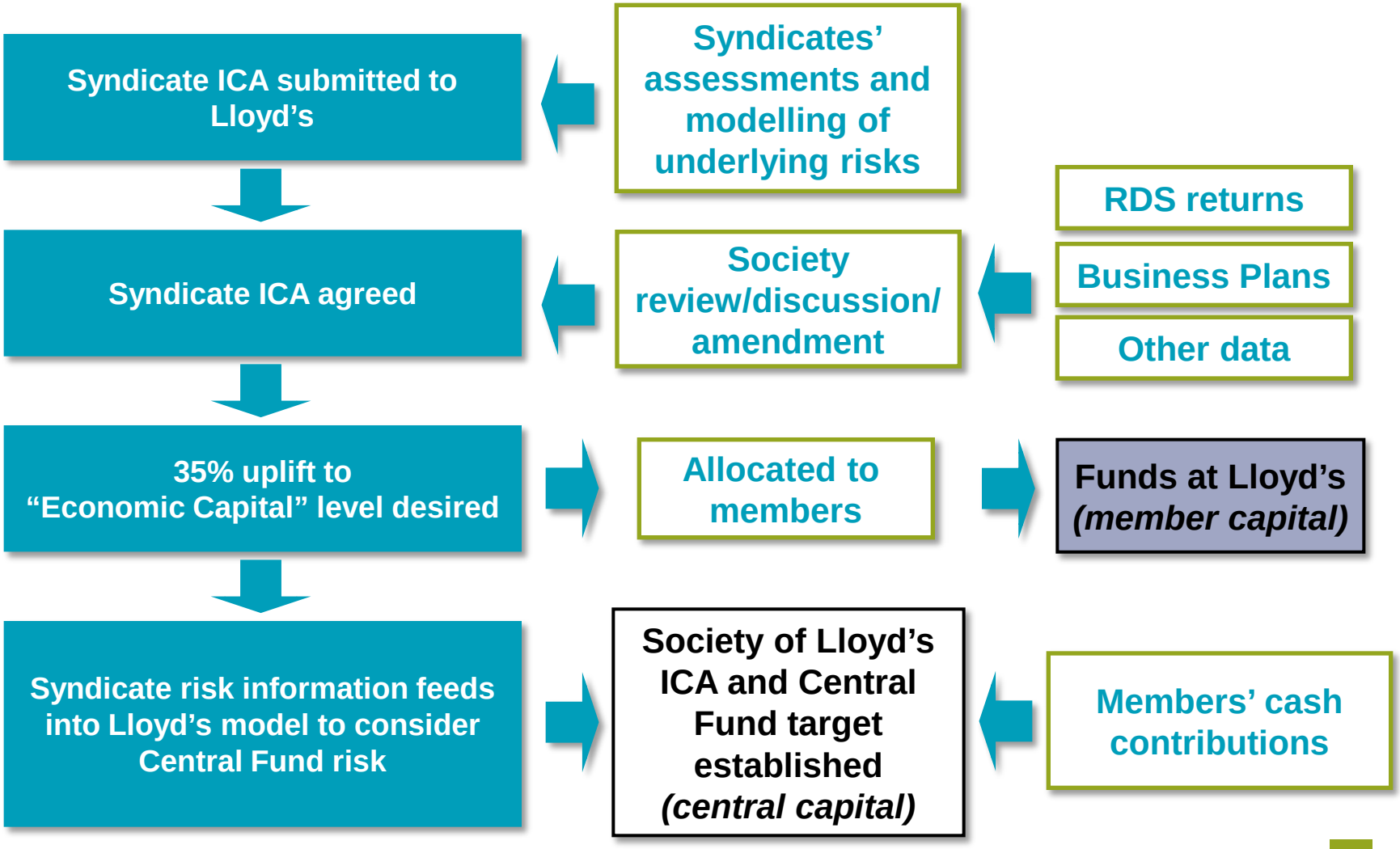
Chain of security – How does it work?

- Capital efficiency for members driven by mutuality of risks
- Diversity of risk and capital providers makes Lloyd's commercially attractive
- Equity in member FAL important, members should receive same benefit from central fund per unit of exposure



* In practice, Premium Trust Fund assets are held at syndicate level. This illustration shows assets held at member level to highlight how losses flow through the chain of security from a member perspective (for example member B makes a profit in this scenario).

Capital setting process at Lloyd's



So what about Solvency II?

- Capital setting process driven by ICAS requirements
- Solvency II supersedes ICAS
- Need to revise capital setting process
- Solvency II introduces SCR risk measure
  - Can SCR be used for Member capital setting?
  - Is it equitable between members?
  - What about balance between mutual and several capital? Is there a need to reconsider the economic uplift?

How does the SCR differ from the ICA risk measure?

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Section 2: ICAS versus Solvency II

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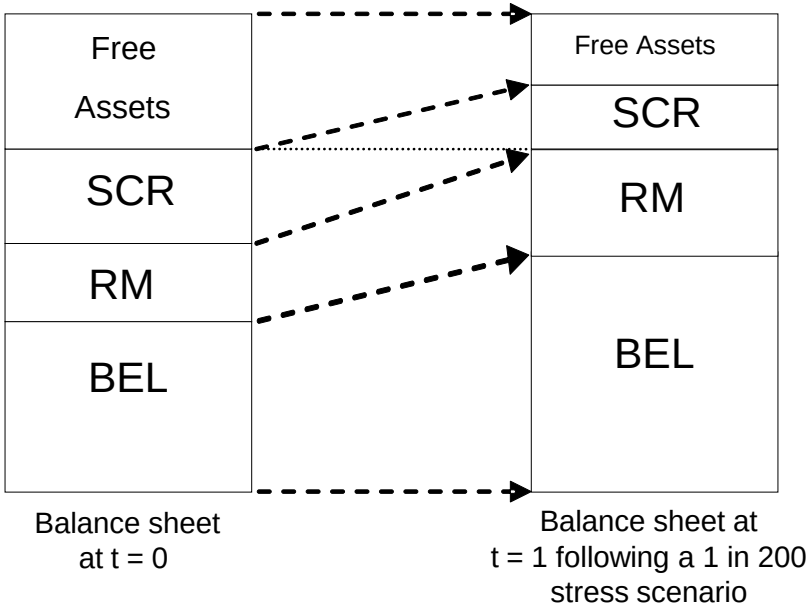
Solvency II: Capital Requirement

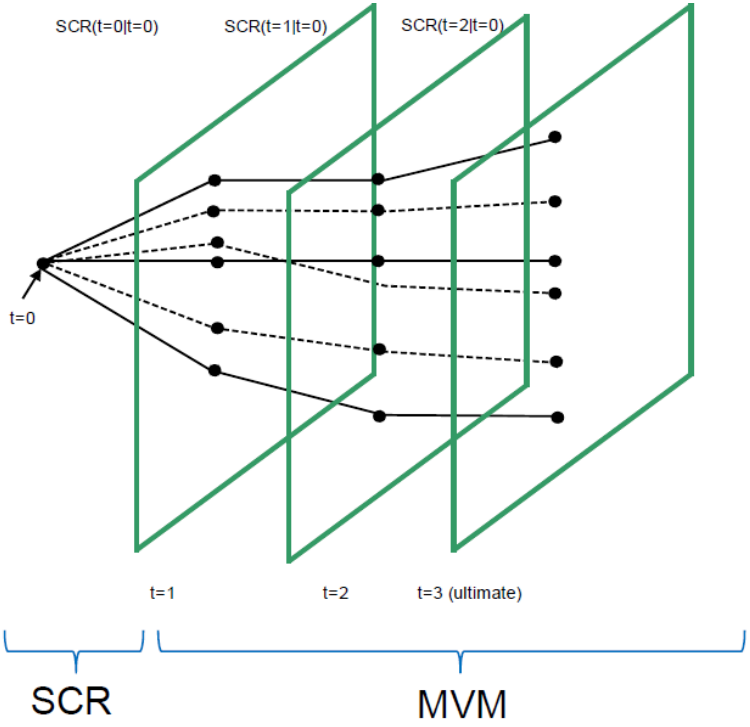
- Idea of Solvency II is to hold risk capital sufficient to survive adverse scenarios over the next year and then transfer liabilities to a third party
- For simplicity we will ignore asset and credit risk and focus on insurance risk
- The SCR at time zero is calculated as the potential increase in technical provisions over the next year including claims paid with probability 0.5%



- Note that QIS 5 assumes that the risk margin will not change over time

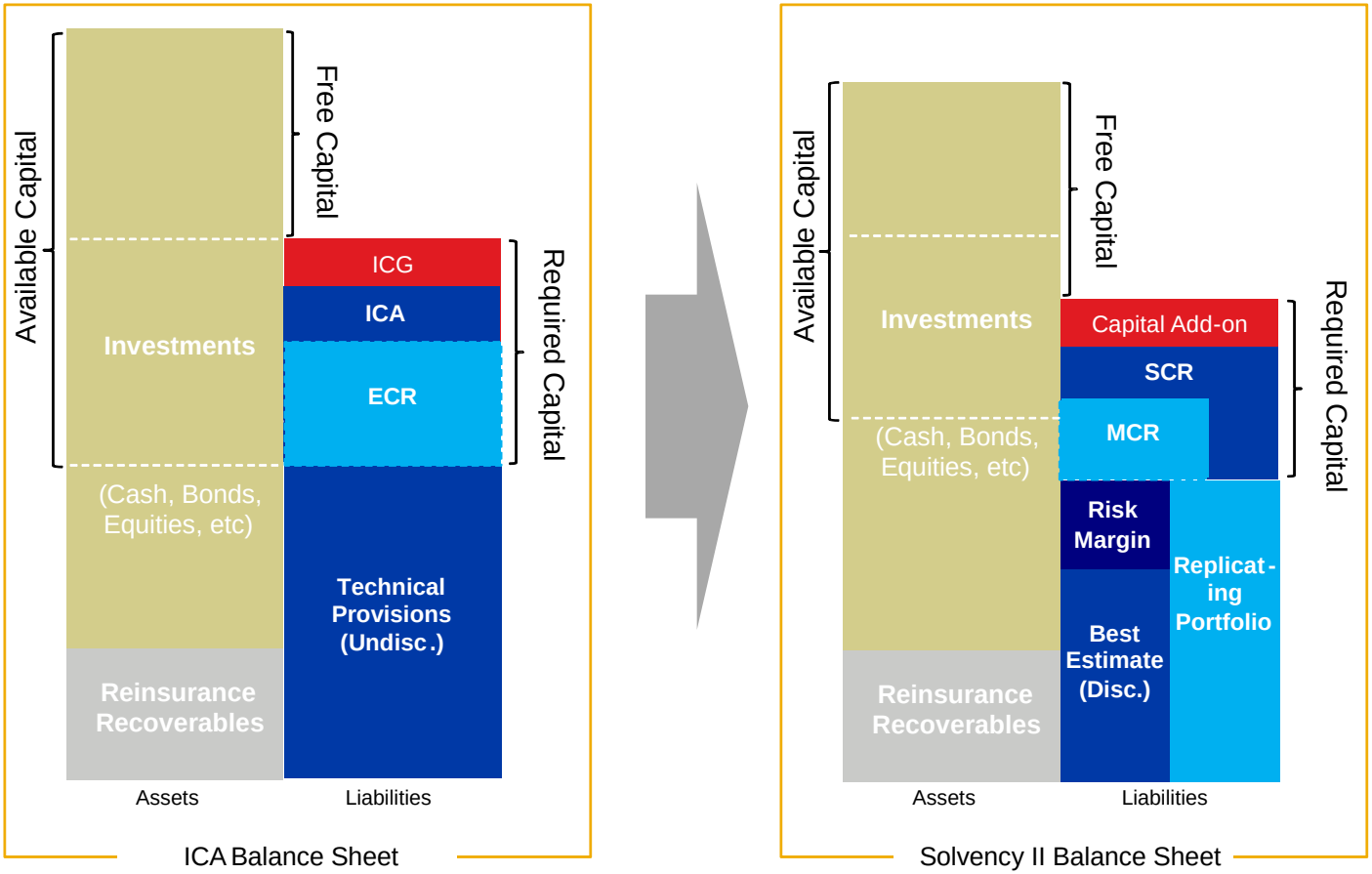
Solvency II: Fair Value of Liabilities

- How does Solvency II measure fair value?
  - For liabilities that can be replicated by exchange listed securities, the fair value is taken as the replication cost
  - However, for the majority of non-life insurance liabilities, such securities do not exist ... different approach needed
- For non-hedgeable risks, the fair value is broken down into two components
  - The discounted Best Estimate of the liability
  - The Risk Margin
- The Risk Margin is an additional loading on top of the Best Estimate that is required to reach the fair value of the liability
  - It is calculated in QIS 5 using the "Cost of Capital" method
  - Note reinsurers have tended to assess risk margin using percentile based methods (e.g. for Part VII transfers)



ICAS versus Solvency II: Balance Sheet

- Significant changes moving from UK ICA to Solvency II for both valuation and capital
- Unclear on the overall effect on the ratio of available to required capital



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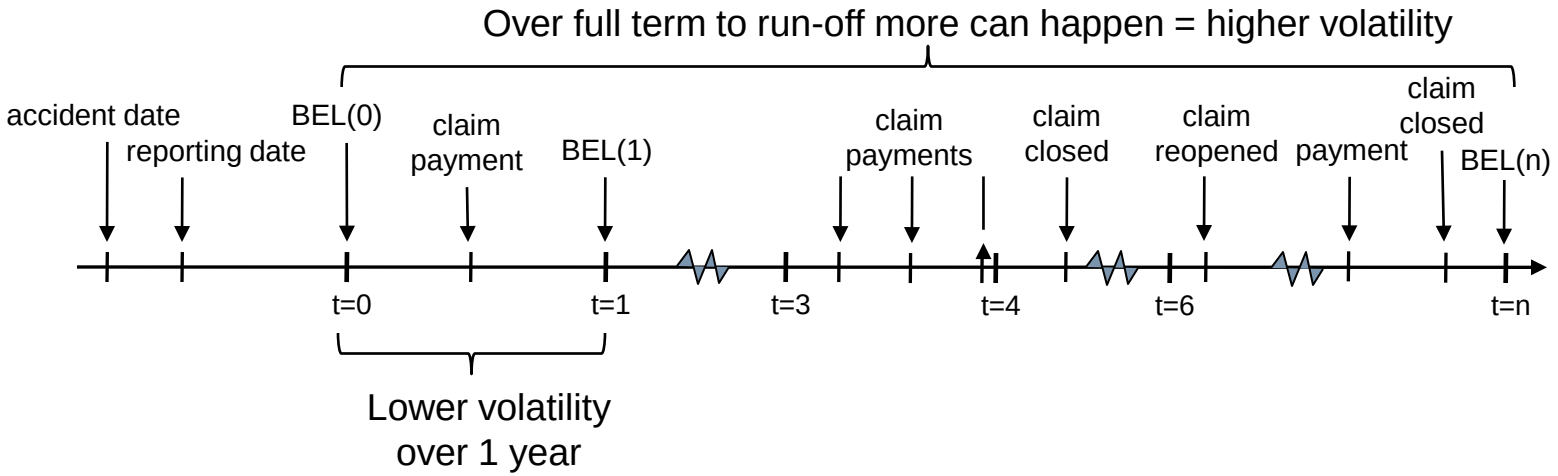
ICAS versus Solvency II: Capital Requirement

- Both have 99.5% confidence level
- Both have a “1 year time horizon” (more or less)
- Key difference is the meaning of “time horizon”
  - For ICAS time horizon refers to how many years of new business is modelled
  - Under Solvency II (and SST), time horizon is concerned with the evolution of the balance sheet
    – i.e. 1 year time horizon means evolving assets and liabilities for 1 year
  - ICAS requires liabilities to be fully run-off – and therefore has an ultimate time horizon in the Solvency II sense



Total Resource Requirements

- To compare the existing ICAS regime to Solvency II we consider the total resource requirements under each regulatory system
- This is the sum of the **Technical Provisions** and the **Capital Requirements**

Item	ICAS	Solvency II
Technical Provisions	Undiscounted	Discounted Fair value risk margin
Capital Requirements	1 in 200 Ultimate	1 in 200 on 1 year time horizon

- The ICA capital level after one year is calculated as the level required to support the existing reserves and business written over the next year to run-off such that the probability the assets will not be sufficient is 0.5%.
- Under Solvency II the SCR is defined as the potential decrease in the net asset value following a 1 in 200 year event, over a 1 year time horizon

Drivers of Total Resource Requirements

- Comparing the two regimes, it is clear that there are several key drivers of total resource requirements
  - Payment pattern
  - Level of underwriting and reserve volatility
  - Recognition of ultimate volatility over 1 year
  - Correlation between development over the first year and the remaining period to ultimate
- These will impact the total resource requirements in a number of ways:
  - Discounted vs. undiscounted reserves
  - Risk margin
  - Risk capital
- The overall effect will also depend on internal model implementation approach

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Section 3: Test Modelling Framework and Results

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Overall Framework

- To quantify the impact of the different factors that drive differences between ICAS and Solvency II a simplified partial internal model was constructed
  - Covering reserve and underwriting risk (excl. cat)
  - No allowance has been made for market risk on the assets backing the reserves
  - No allowance for catastrophe risk, reinsurance, expenses, unexpired risk or unincepted obligations.
- We considered the following input “levers” of total resource requirements:
  - Payment pattern (short, medium and long)
  - Volatility (low, medium and high) – for Reserve and Underwriting separately
  - Solvency II one-year recognition assumption (low, medium, high, full)
  - Correlation (negative, none, positive)
- We ran the model on all combinations (324!)

Payment pattern (short, medium and long)

Short		Medium		Long	
Time	Pattern	Time	Pattern	Time	Pattern
0.5	45.0%	0.5	10.0%	0.5	2.0%
1.5	25.0%	1.5	25.0%	1.5	10.0%
2.5	15.0%	2.5	20.0%	2.5	15.0%
3.5	10.0%	3.5	15.0%	3.5	15.0%
4.5	5.0%	4.5	10.0%	4.5	15.0%
5.5	0.0%	5.5	8.0%	5.5	10.0%
6.5	0.0%	6.5	5.0%	6.5	9.0%
7.5	0.0%	7.5	3.0%	7.5	7.0%
8.5	0.0%	8.5	2.0%	8.5	5.0%
9.5	0.0%	9.5	1.0%	9.5	4.0%
10.5	0.0%	10.5	1.0%	10.5	3.0%
11.5	0.0%	11.5	0.0%	11.5	2.0%
12.5	0.0%	12.5	0.0%	12.5	1.0%
13.5	0.0%	13.5	0.0%	13.5	1.0%
14.5	0.0%	14.5	0.0%	14.5	1.0%

Solvency II one-year recognition assumption

Low	Medium	High	Full
25%	50%	75%	100%

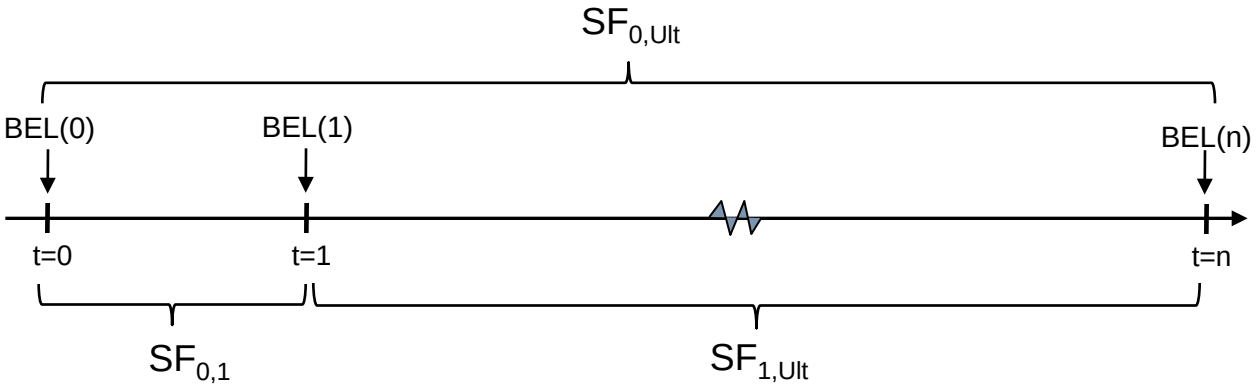
Ultimate Underwriting Volatility			Ultimate Reserve Volatility		
Low	Medium	High	Low	Medium	High
10%	30%	50%	5%	15%	25%

Correlation (negative, none, positive)

Negative	None	Positive
-50%	0%	50%

The Model: Reserve Risk

- Simple model is applied for projecting the evolution of reserves:
  - Uncertainty in the initial best estimate over the period to next year [0, 1] is modelled using a stochastic scaling factor $SF_{0,1}$
  - Similarly, uncertainty in the initial best estimate over the full period of run-off [0, Ult] is modelled using a second stochastic scaling factor SF_{Ult}
  - We assume that the volatility over a 1-year time horizon versus the total reserve volatility can be modelled using the "recognition percentage":
    - $\sigma_{0,1} = \sigma_{ult} *$ recognition percentage
  - The distribution from time 1 to ultimate $SF_{1,Ult}$ is derived from the 1 year and ultimate under a correlation assumption



The Model: Underwriting Risk

- Similarly we model ultimate loss ratio volatility under the underwriting model using two log-normal distributions, describing the risk over a one-year time horizon, and describing risk from time 1 to ultimate
- The parameterisation methodology is the same as for the Reserve Risk Model; in the Underwriting Risk model
- It is assumed that the ultimate combined ratio is 100%
- Under ICAS the capital level incorporates the ultimate loss ratio volatility for the entire period
- Under Solvency II we also use the “recognition percentage” to reflect the percentage of the total ultimate loss “known” after one-year versus the total ultimate loss

The Model: Implementation

- Stochastic model implemented in ReMetrica using Monte Carlo simulation
- For each scenario from the parameter matrix, we consider initial best estimate reserves of £100 and a premium volume of £100
- Simulation run for 50,000 scenarios which was tested for statistical convergence
- Results for each parameter combination recorded for ICAS and Solvency II total resource requirements
- Discounting will be carried out using a single discount rate instead of a yield curve. We have used a 4% discount rate
  - This will not have a material impact on the questions posed in respect of the project of Solvency II
  - However the use of a different discount rate may impact the ratio between the total resource requirements under the two regimes

Overall Results

- The volatility recognition pattern has the most significant impact on the ratio of total resource requirements between Solvency II and ICAS
- Secondary factors are the overall level of volatility and payment pattern which drive the level of risk margin

Ranking of Parameter Influence on Total Resource Requirements

ICA	SII	Ratio
1. Underwriting volatility	1. Recognition percentage	1. Recognition percentage
2. Reserve volatility	2. Underwriting volatility	2. Underwriting volatility
3. Payment pattern	3. Reserve volatility	3. Payment pattern
4. Recognition percentage	4. Payment pattern	4. Reserve volatility

Overall Results

- Risk emergence is the key driver of total resource requirements between ICAS and Solvency II
  - Impacts both the risk capital level and the technical provisions through the risk margin
  - Reducing recognition percentage will reduce both the SCR and risk margin under Solvency II
- For classes that have low recognition percentages Solvency II requires significantly less total resource requirement than ICAS

Recognition Percentage	Total Resource Requirements		
	ICA	SII	Ratio
Low	206.5	110.7	57%
Medium	206.5	143.5	72%
High	206.5	182.0	90%

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Section 4: One year Versus Ultimate Parameters

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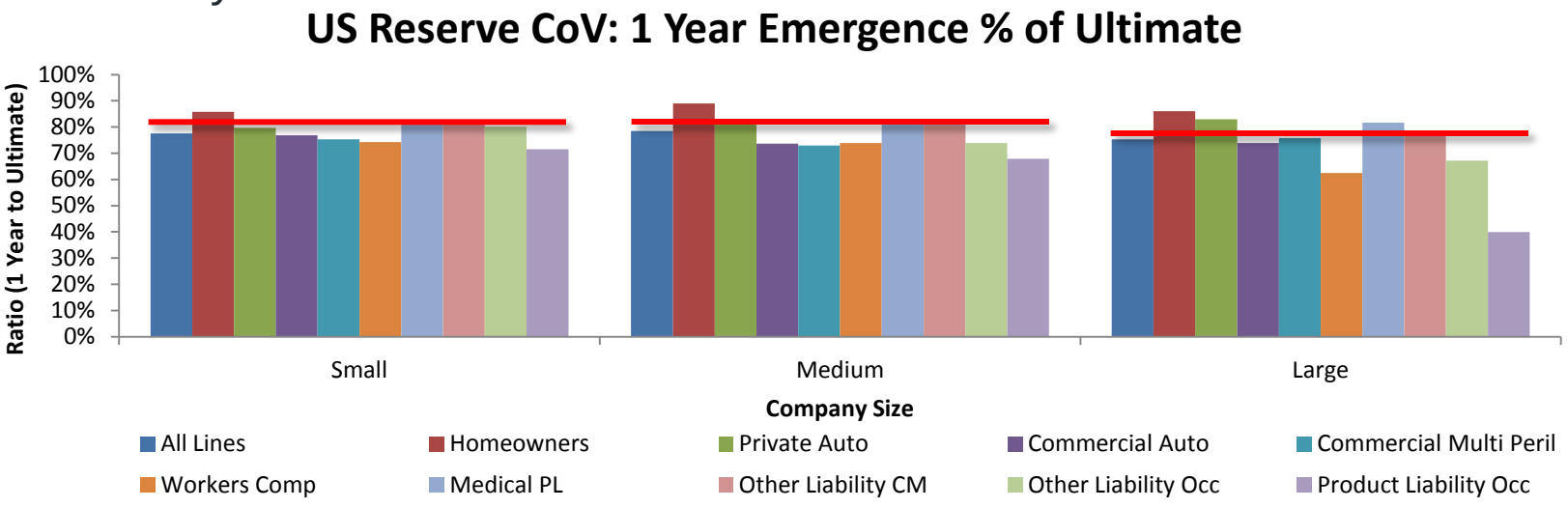
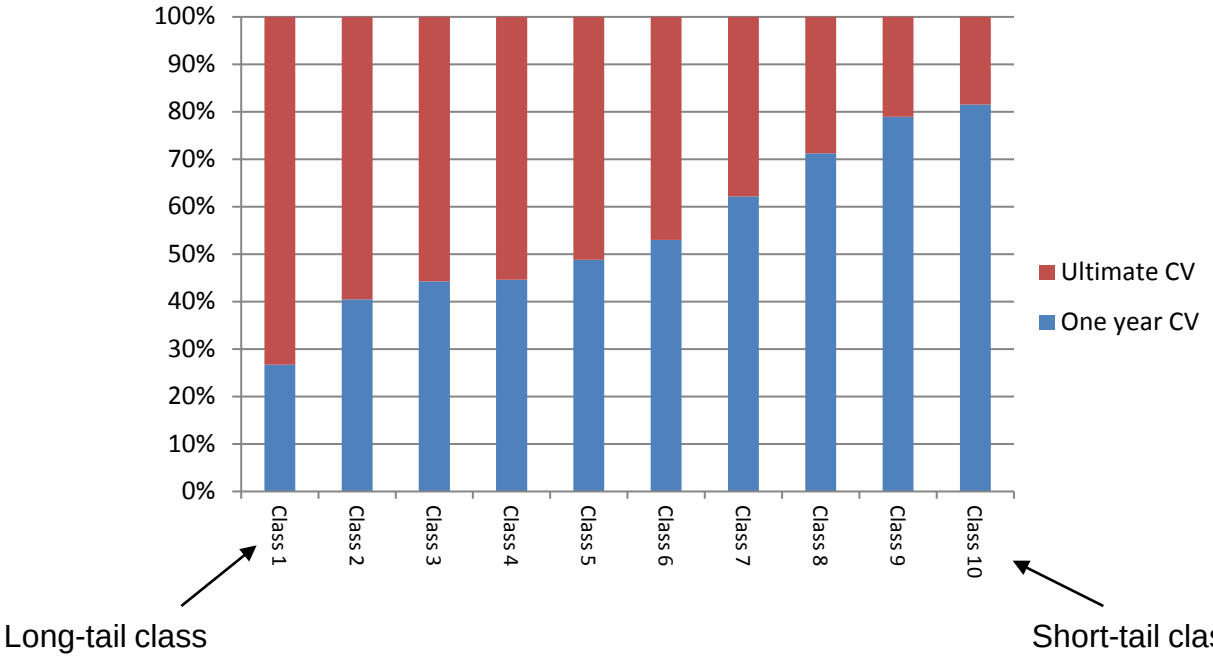
Reserve Risk and Time Horizon

- Aon Benfield Insurance Risk Study 2011 compares the one year and ultimate view of reserve risk
- Ultimate reserve CV computed using average of Mack and Over Dispersed Poisson (ODP) Bootstrap methods (paid losses)
- One-year reserve CV uses average of the Merz-Wuthrich and ODP Bootstrap methods
- All methods adjusted to account for tail factor volatility and reserves more than 10 years old



New Business risk and Time Horizon

- Lloyd's has analysed market experience on a One year and Ultimate basis between 1993-2010
- What does the history tell us for Lloyd's 'high-level 10' classes? Chart below shows One year CVs expressed as a % of Ultimate CVs. No expert judgement used … probably for the best!



What is New Business risk under Solvency II?

- Need to consider risk from inception of policy to 12 months time (not one year of risk)
- So what?
- Let's consider SCR calculation as-at 01/01 20XX

Inception month	Class A	Class B	Class C	Class D	Class E	Class F	Class G	Class H	Class I	Class J	Lloyd's average
January	39%	22%	27%	61%	18%	31%	58%	26%	52%	30%	33%
February	5%	2%	3%	0%	2%	11%	2%	4%	1%	6%	4%
March	4%	5%	6%	1%	8%	4%	1%	9%	2%	7%	6%
April	10%	10%	9%	9%	12%	9%	3%	14%	12%	11%	11%
May	4%	5%	7%	3%	14%	5%	4%	8%	6%	5%	7%
June	7%	4%	9%	3%	17%	7%	4%	10%	12%	7%	10%
July	9%	12%	12%	13%	14%	8%	6%	9%	11%	9%	10%
August	4%	4%	4%	2%	3%	3%	8%	3%	0%	5%	3%
September	6%	3%	5%	0%	3%	5%	1%	4%	0%	6%	3%
October	4%	5%	8%	5%	4%	6%	6%	4%	1%	6%	5%
November	4%	14%	6%	0%	3%	4%	2%	3%	1%	6%	4%
December	5%	14%	5%	1%	3%	6%	6%	5%	1%	4%	5%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Weighted average inception month	April	June	May	March	May	April	March	April	March	April	April
Weighted average 'time horizon' under SII	8 months	6 months	7 months	9 months	7 months	8 months	9 months	8 months	9 months	8 months	8 months

New Business risk is very (very) different under Solvency II!

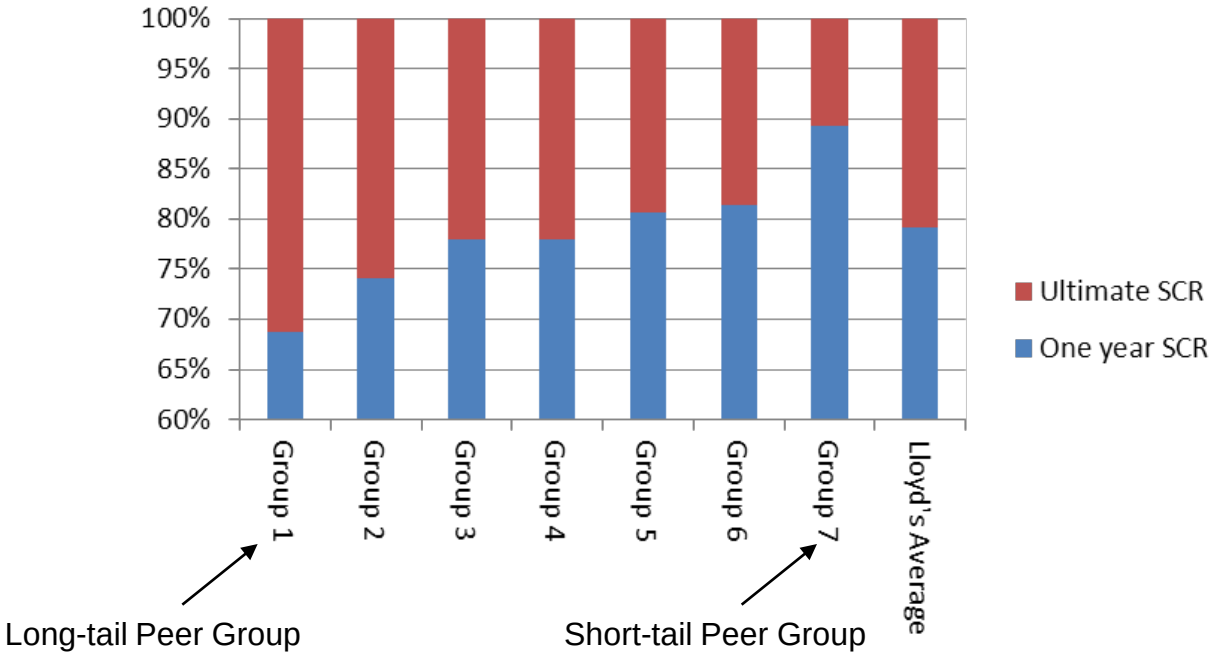
- For Class B, average policy will recognise six months risk in 01/01 SCR calculation
- Lloyd's capitalise members based on **underwriting year of account exposures**. Capital for a year of account will vary based on classes written and their inception dates.

- Lets be silly and take this to the extreme!
  - … consider a syndicate which prices and incepts all of its new business on 31/12/2012, what happens to the 2012 SCR?
    - (a) At time 1 (31/12/2012) the syndicate may take credit for the economic value of this new business
    - (b) No risk recognised and a risk margin set up on 31/12/2012 to fund future SCRs
    - (a) – (b) typically positive for business written to a profitable target. Hence new business helps reduce capital! This implies a negative capital requirement for the 2012 underwriting year of account.

- Very different under ICAS!

So what does this mean for capital? 16/09 LCR submissions provide an insight

- Syndicates have submitted their view of One year and Ultimate capital
- 82 syndicates believe Ultimate>One year, 7 believe One year>Ultimate.
- Chart below shows an aggregated comparison of the 82 syndicates for each Lloyd's Peer Group. One year SCR is expressed as % of ultimate SCR.



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Section 5: Capital setting under Solvency II

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Lloyd's is unique!

- Philosophy behind SCR calculation may be considered economically more efficient than ICA

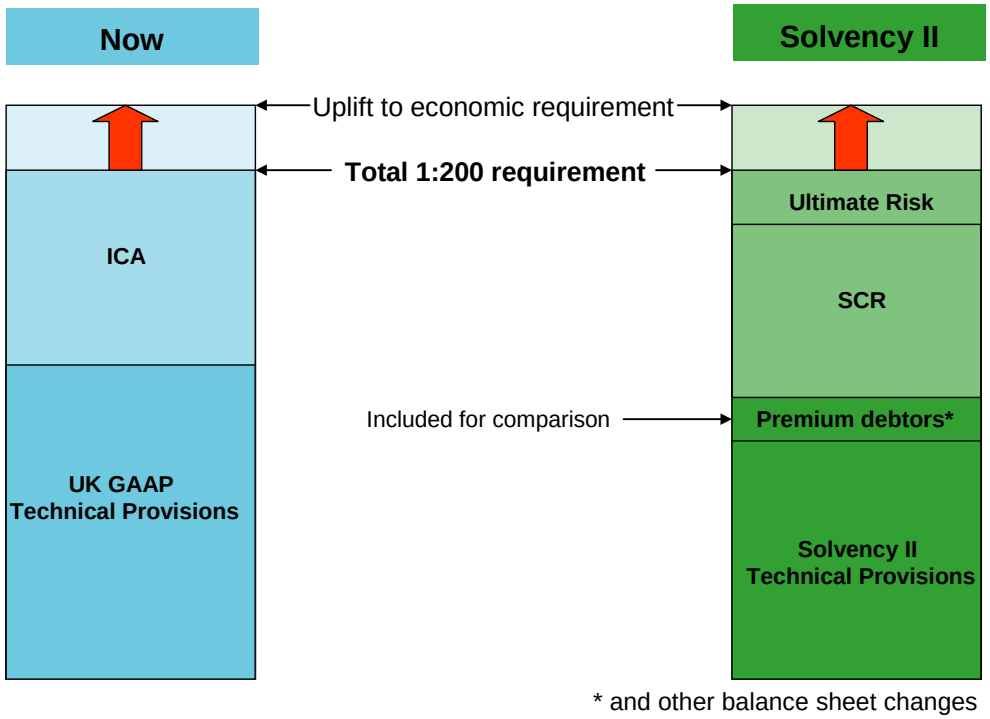
- Lloyd's business model
  - Coming Into Line process (members may exit market)
  - Member equity (consider members who underwrite different classes)
  - Economic uplift/Mutuality within the market
  - Setting capital on u/w year basis (inception dates, unincepted legal obligations)

So what does this mean for member capital setting?

- Following internal discussion, consultation with the LMA and key modelling companies, Lloyd's Franchise Board agree 'in principle' the following;
  - Member capital should aim to preserve current level of member assets
  - Capital set using Ultimate calculation (Ultimate SCR)
  - Uplift applied to Ultimate SCR to determine economic capital requirements (FAL)
  - Technical provisions should be consistent with Solvency II balance sheet and allocated to u/w year

How this may look at Lloyd's?

- Move to an economic balance sheet
- Comparison of balance sheets requires adjustment for SII premium debtors
- Uplift will be set to preserve the same amount of member capital at Lloyd's



But what is the Ultimate SCR?

- 1:200 net cost to ultimate for all years of account combined LESS the projected net liabilities on the balance sheet at t0 (Dec 2011 for now) on a solvency II basis and one year of new business premiums
- ‘Ultimate’ is defined as the final realised position – not the most prudent time step to ultimate
- Lloyd’s expects syndicates to capture Insurance and Reinsurance Credit risk to ultimate while other risk categories may be modelled over one year
- Agents may model market risk (and associated returns) on assets held over one year and then discount liabilities from t1 to ultimate using the risk-free rate
- Includes release of risk margin (profit offset)
- Ignore exposures relating to underwriting years beyond t1

Questions or comments?

- The views expressed in this presentation are the presenters and may not represent the views of their prospective employers.

Appendix: Aon Benfield Insurance Risk Study Reserve Risk Parameters (2011)

U.S. Reserve Volatility by Line, by Carried Reserve Size

	One Year Reserve CV			Ultimate Reserve CV		
Line	Small USD10M–USD100M	Medium USD100M–USD500M	Large > USD500M	Small USD10M–USD100M	Medium USD100M–USD500M	Large > USD500M
All Lines	10.4%	8.4%	5.5%	13.4%	10.7%	7.3%
Homeowners	14.5%	12.2%	10.5%	16.9%	13.7%	12.2%
Private Passenger Auto	10.2%	6.4%	3.4%	12.8%	7.8%	4.1%
Commercial Auto	12.3%	7.0%	4.8%	16.0%	9.5%	6.5%
Commercial Multi Peril	12.8%	10.0%	6.9%	17.0%	13.7%	9.1%
Workers Compensation	7.5%	4.8%	4.0%	10.1%	6.5%	6.4%
Medical PL—CM	14.4%	13.7%	11.6%	17.6%	16.8%	14.2%
Other Liability—CM	14.2%	13.2%	15.1%	17.4%	16.0%	19.2%
Other Liability—Occ	14.9%	11.6%	8.2%	18.6%	15.7%	12.2%
Products Liability—Occ	17.9%	11.2%	7.5%	25.0%	16.5%	18.8%

Ultimate reserve CV calculated using average of Mack and Over Dispersed Poisson (ODP) Bootstrap methods applied to paid loss triangles by line. One-year reserve CV uses average of the Merz-Wuthrich and ODP Bootstrap methods. All methods adjusted to account for fail factor volatility and reserves more than 10 years old.