

Reinsurance of longevity : risk transfer and capital management solutions

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Plan

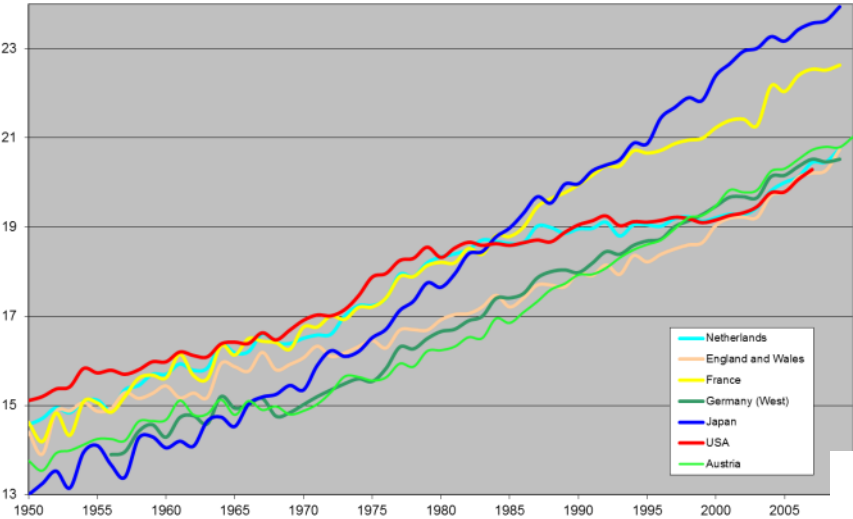
1 Longevity risk. Where reinsurance can help?

2 Ways to cover longevity risk: depending on your needs..

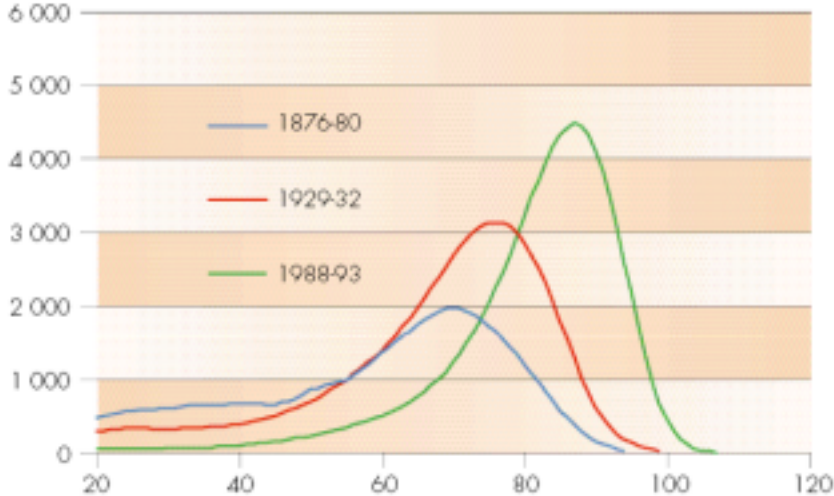
3 Reinsurance solutions: some examples and where the price come from.

Longevity risk: insured living longer than expected by pension/annuity provider

Female life expectancy at age 65



Switzerland:
Age at death distribution



Mortality evolution: changing drivers



A new stage? (mid 80-s +)

- Mortality reductions at increasingly older ages
- Treatment and prevention of cerebrovascular diseases
- Greater attention paid to the health of the elderly

Cardio-vascular revolution (Europe : from 1970s)

- Reduction infectious diseases contribute little to the increase of life expectancy
- Cardio-vascular diseases become the main driver of mortality decrease
- Society diseases make less deaths

Receding of infectious pandemics (Europe : mid-XVIII century – beg.

- The epidemics become rare
- Infectious diseases back off
- Mortality declines, fluctuations decrease

Historical demographic regimes (Europe up to mid- XVIII century)

- Prevalence of infectious diseases
- Significant fluctuations due to epidemics, famines (bubonic plague - mid. XIV century)
 - High mortality

Longevity risk components

Random fluctuations

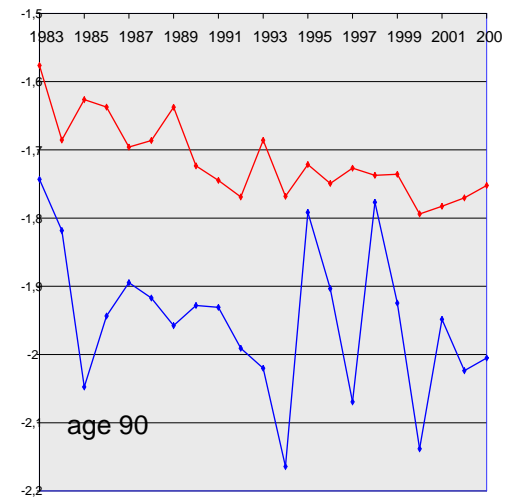
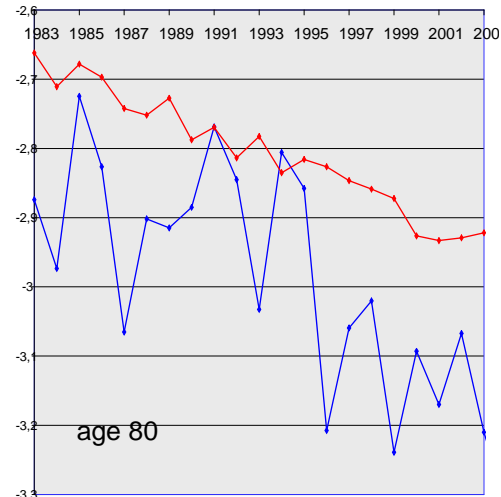
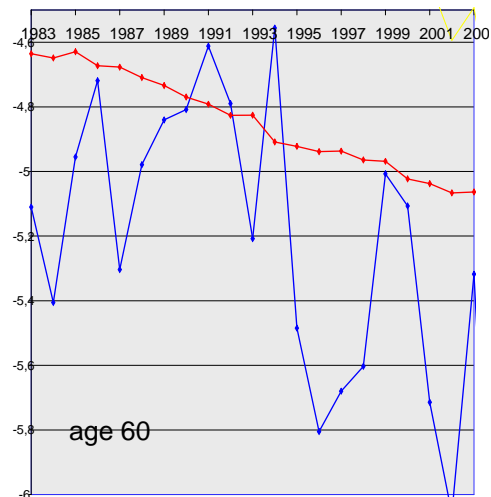
RF1: intrinsic - volatility due to the oscillations around the trend:

Year to year variation in mortality around a mean that is due to irregular trends in epidemics, weather etc.

RF2: sampling risk - volatility due to portfolio's size and heterogeneity:

A small portfolio does not allow for a good mutualisation. Moreover, if annuity amounts are very heterogeneous, survival of a few particular annuitants can significantly change future cash flows

Death rates for the general population (ONS - red) and for pensioners (CMI - blue) on the log scale, females :



Longevity risk components

T: Trend

The mortality improvement is not a diversifiable risk: it affects the whole portfolio and thus cannot be managed using the law of large numbers

L: Current mortality level estimation

Estimation error based on observed mortality experience: the error is larger for small populations (or for poorly represented age groups)

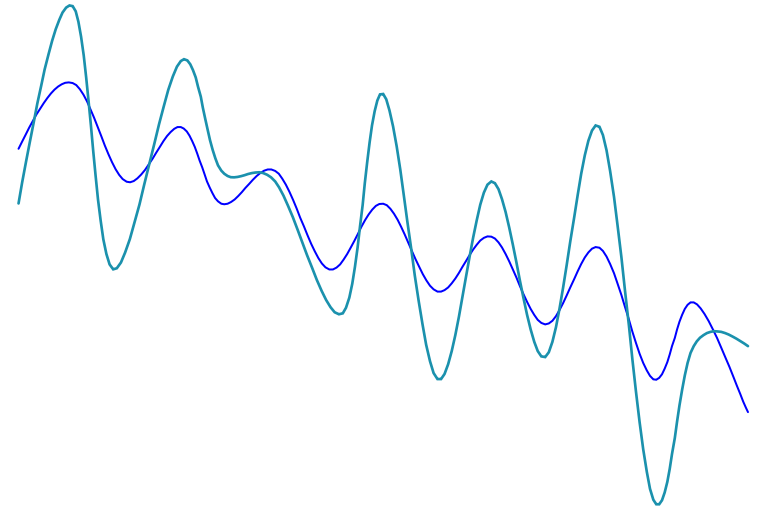
Increase in pension value due to the level or trend misestimation and additional investment return on the reserves needed to compensate for it

(example based on the French table TGH05/TGF05 with flat interest rate of 3%):

	females				males			
	Doubled improvements		Mortality level at 80% of the expected (SCR shock)		Doubled improvements		Mortality level at 80% of the expected (SCR shock)	
	pension value	interest rate	pension value	interest rate	pension value	interest rate	pension value	interest rate
65	+5.7%	+43bp	+4.7%	+36bp	+7%	+57bp	+5.7%	+48bp
75	+5.2%	+55bp	+7.6%	+80bp	+6.3%	+74bp	+9.1%	+107bp
85	+3.6%	+60bp	+13.2%	+207bp	+4.3%	+84bp	+15.4%	+281bp

Longevity risk components

- Longevity risk components:
 - RF random fluctuations
 - RF1 intrinsic
 - RF2 sampling risk



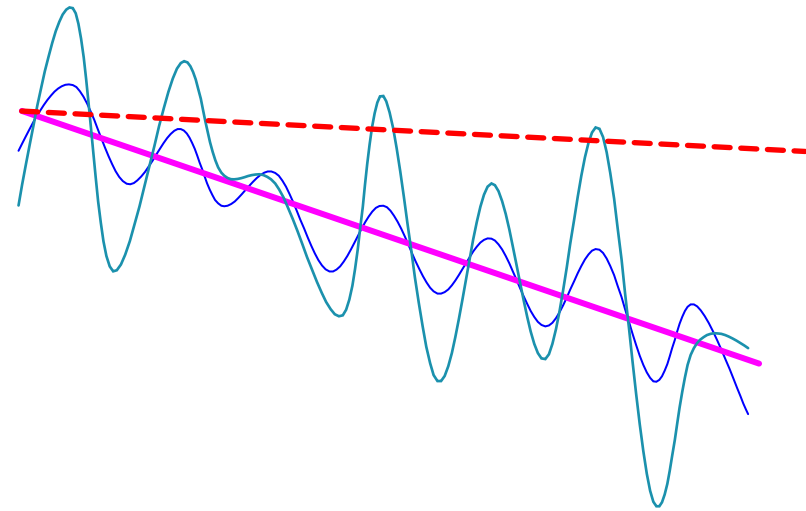
Intrinsic fluctuations
Sampling fluctuations

Longevity risk components

□ Longevity risk components:

- RF random fluctuations
 - RF1 intrinsic
 - RF2 sampling risk

- T trend
 - selected model
 - selected calibration period



Intrinsic fluctuations

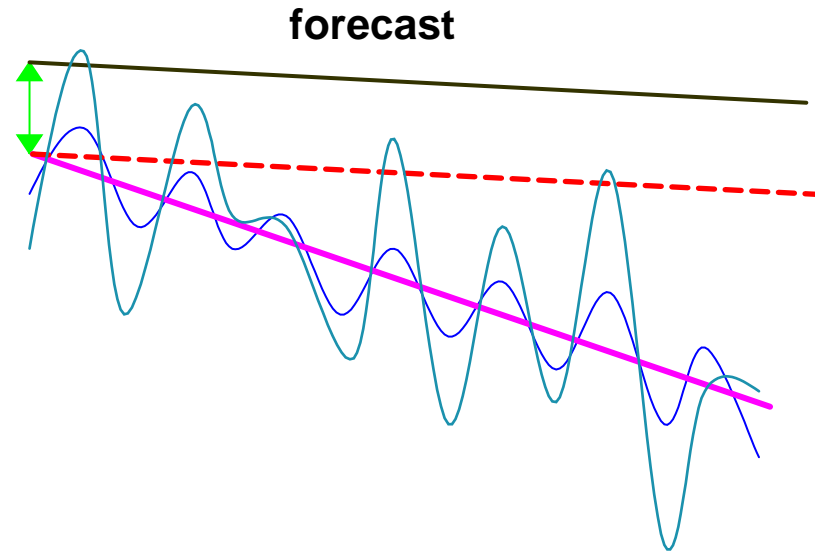
Sampling fluctuations

Real trend

Error in trend estimation

Longevity risk components

- Longevity risk components:
 - RF random fluctuations
 - RF1 intrinsic
 - RF2 sampling risk
 - T trend
 - selected model
 - selected calibration period
 - L current level estimation



Intrinsic fluctuations

Sampling fluctuations

Real trend

Error in trend estimation

Error in current level estimation

Longevity risk: forecast uncertainty

□ Impact of each risk component

Short term forecast

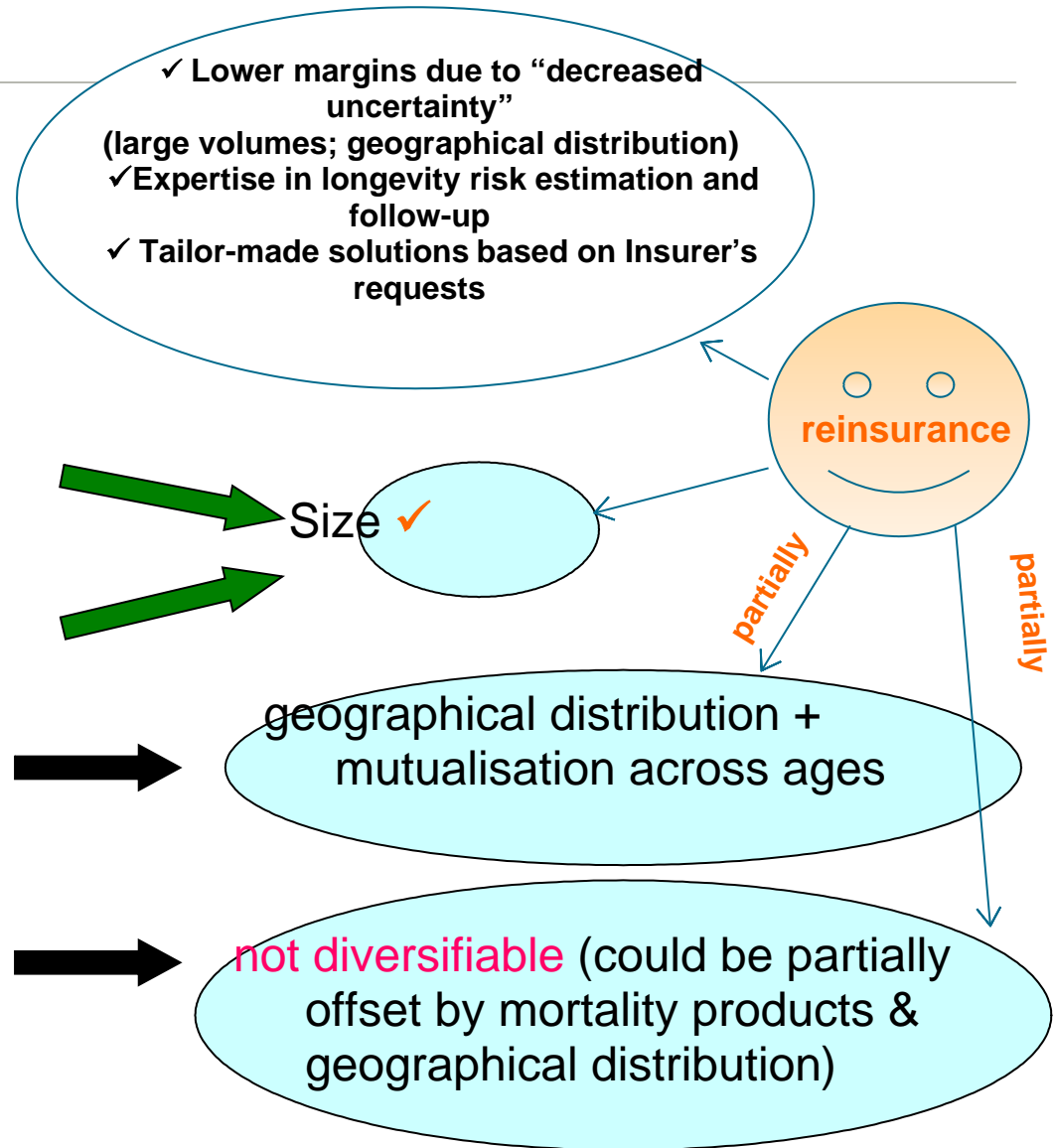
- *RF - random fluctuations*
- *L - current level estimation*

Long term forecast

- *T – trend risk*
- *RF2 - sampling risk (for small portfolios)*

How to decrease uncertainty?

- ✓ L - level estimation
- ✓ RF2 - sampling fluctuations
- ✓ RF1 - yearly variations in national mortality
- ✓ T - trend risk



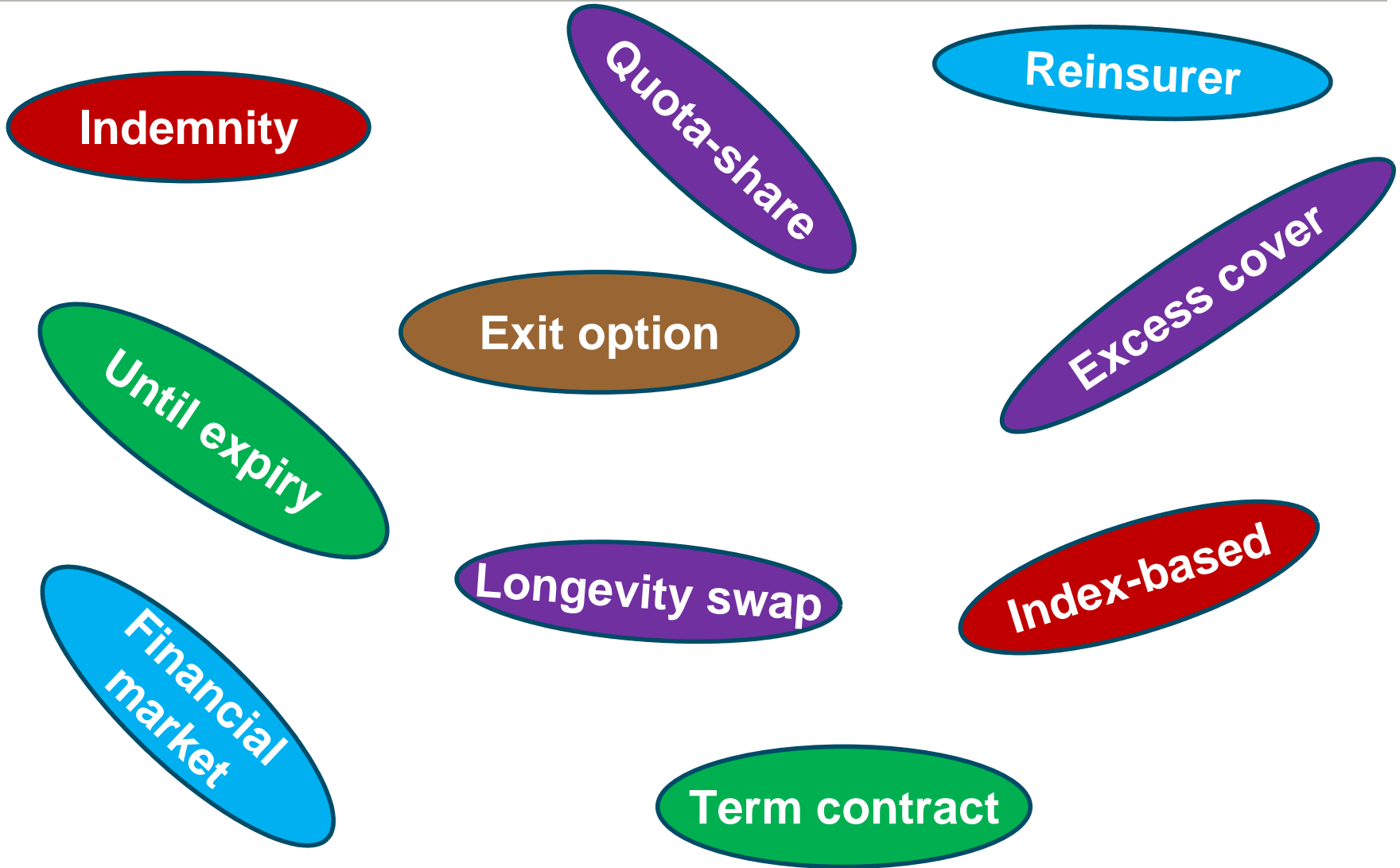
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Ways to cover longevity risk



What impacts the choice of cover?

- Reserving level (Best Estimate or regulatory table ? Assets ?)
- Portfolio characteristics (size? in payment ? part of deferred? ...)
- Administration system
- Internal model / Solvency regime
- Diversification

Two categories of longevity hedge:



Indemnity

- reflects actual longevity experience of the insured portfolio –

Based on actual payments made to annuitants!



Choosing your type of hedge

Index based



- cost effective as less due-diligence required
- no charge on the administration system: no exchange of seriatim data, death certificates, etc.
- straightforward calculation of parties' liabilities
- capital release
- exit option and recalibration sometimes possible
- more potential counterparties



- basis risk stays with the insurer: not a PERFECT hedge
- maturity: fixed (ex. 10 or 20 years)
- reliance on index availability

Indemnity



- PERFECT hedge as reflects actual longevity experience of the insured portfolio
- maturity: until the last member dies; but could be fixed
- capital release
- traditional counterparties and treaty wordings
- risk completely out of the balance sheet

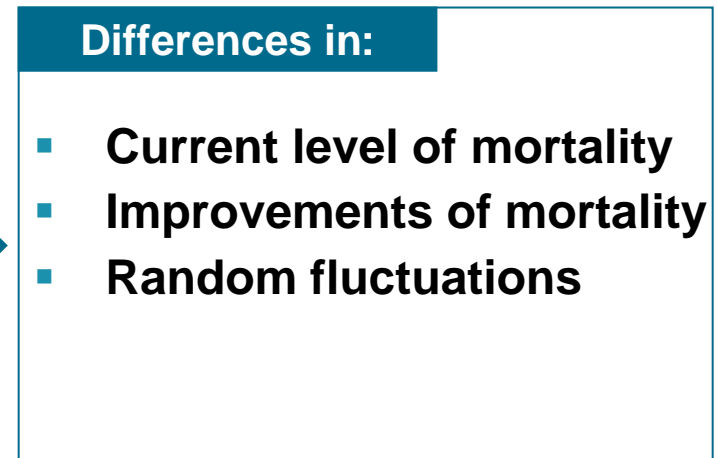
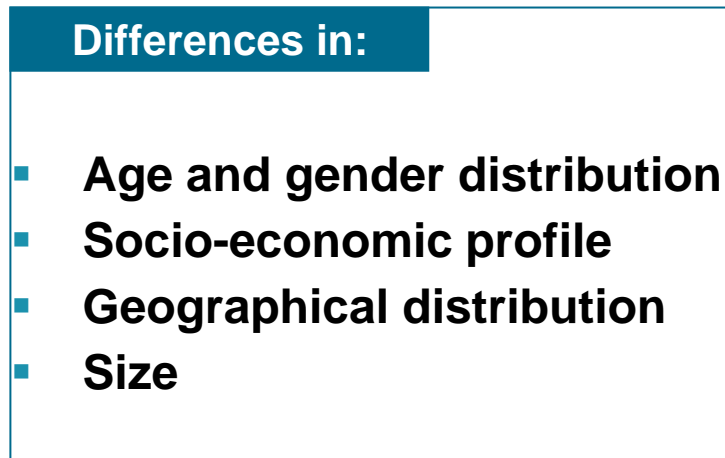


- higher due diligence and monitoring cost
- generally no exit option
- less transparent for the investors

Longevity index & basis risk

□ Population basis risk

Underlying portfolio population National population



Carefully constructing and rebalancing the hedge

Choosing a type of cover

Longevity swap

- Only biometric risk is transferred
- Annual predetermined cash flows are swapped for actual annuity payments
- Could be indemnity or index based
- Credit risk limited to longevity deviation

Quota - share

- Both longevity and asset risks are transferred (eventually split between different risk takers)
- Indemnity cover
- Higher credit risk

Excess cover

- Only biometric risk is transferred
- Extreme deviations are covered
- Solution mainly for capital relief

Choosing a counterparty/type of contract

Financial market

Potentially liquid!



More counterparties

Collateral requirement more stringent



Short maturity

Execution risk

Why not
both?

Reinsurer

Traditional counterparty

Maturity



Collateral cost

Less liquid



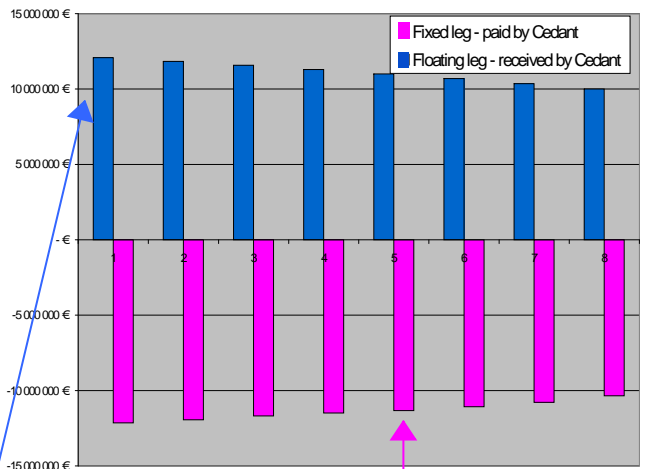
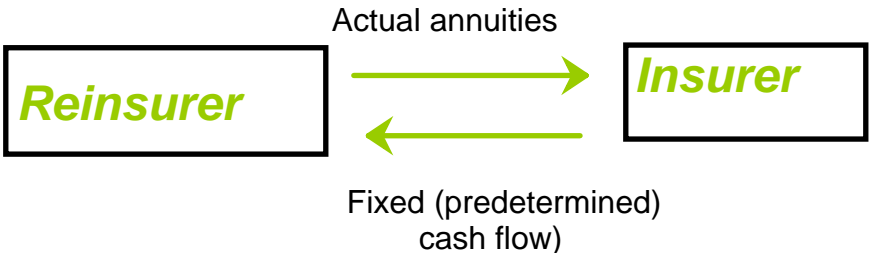
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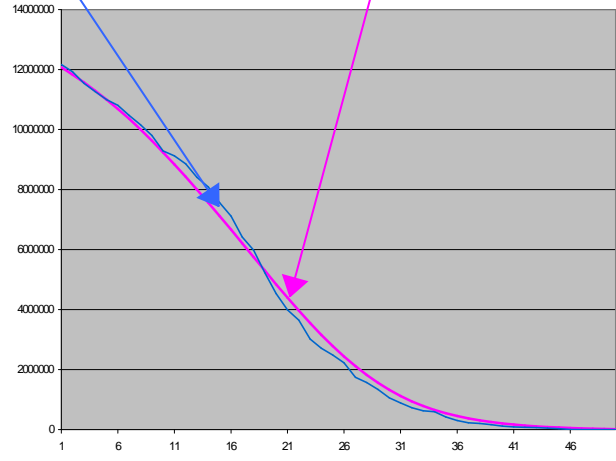
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Example 1: Classical longevity swap

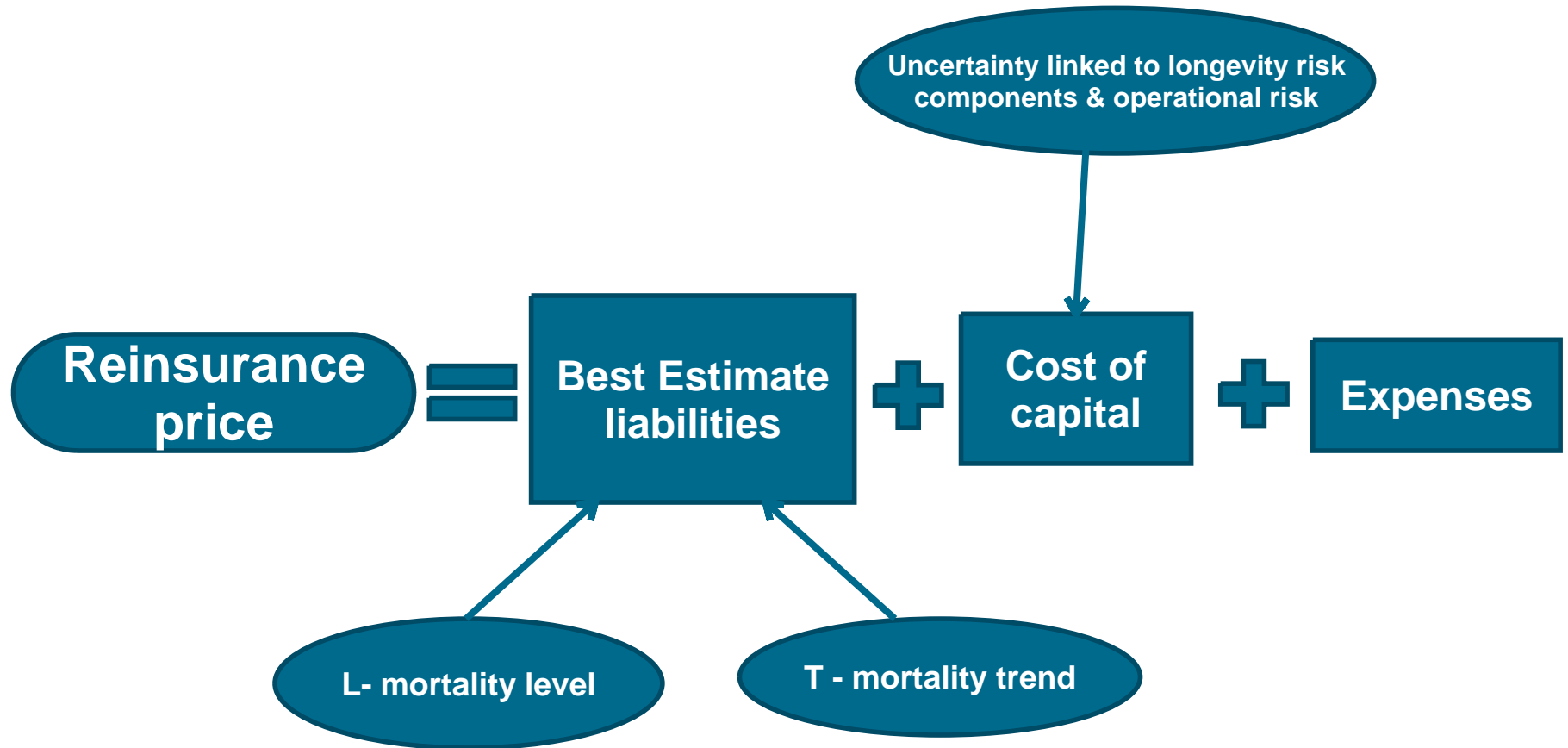


Realised cash flows

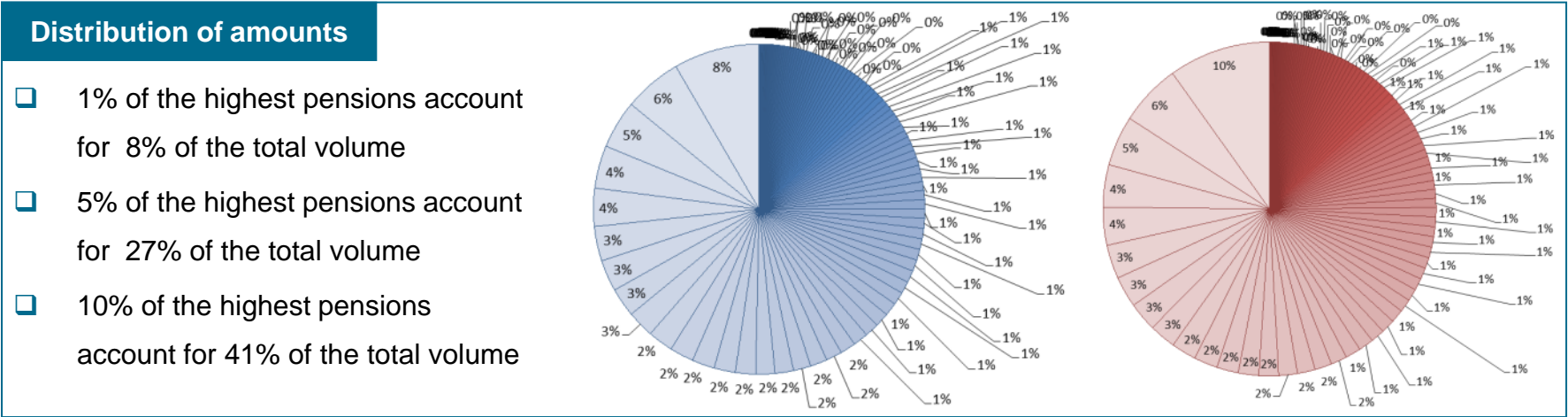
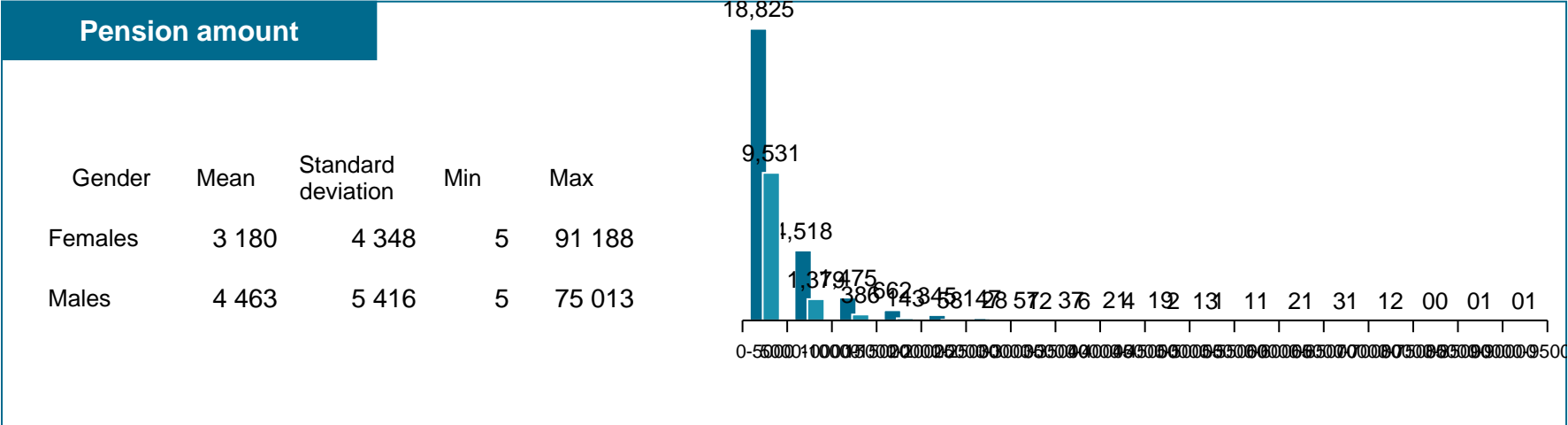
Fixed cash flow



Reinsurance pricing



RF – random fluctuation components : influence of portfolio heterogeneity



L - mortality level component: influence of portfolio heterogeneity

- ❑ Split the portfolio into homogeneous sub-groups :
 - Generally pension size is a good proxy to social class,
 - Keep the number of subgroups limited in order to maintain results significant,
 - Check against external datasets (ex. mortality by postcode).

- ❑ Example: 5 subgroups based on pension size . A/E ratio in lives and in amounts

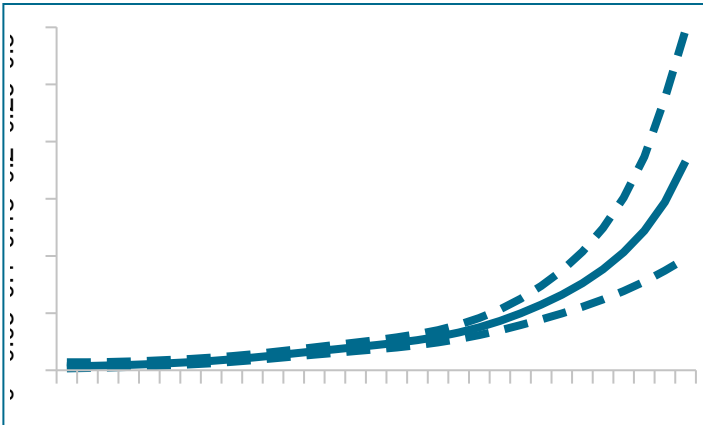
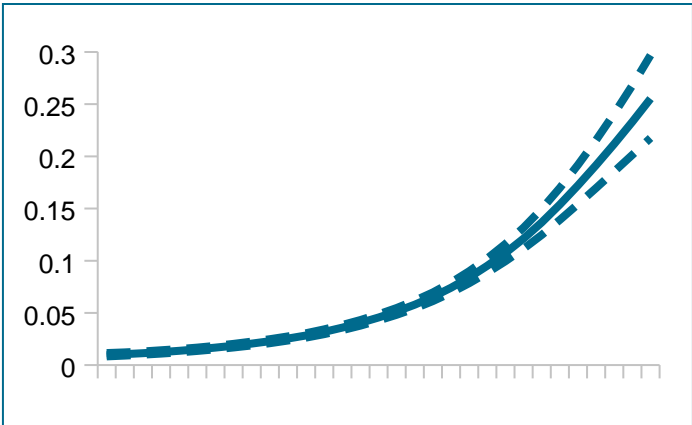
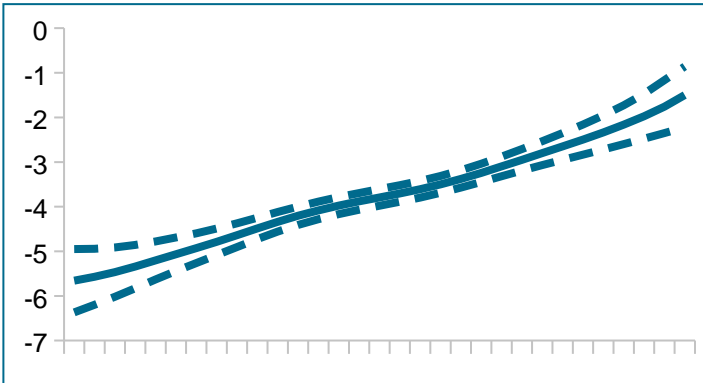
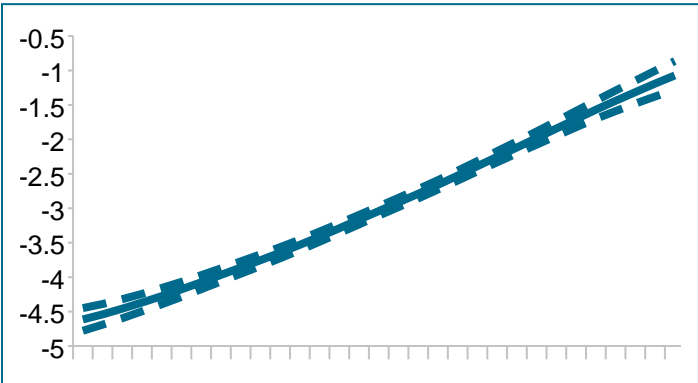
Pension size	A/E (lives)	A/E (amount)	Nb of deaths	Exposure (lives)	Exposure (amount)	% total (lives)	% total (amount)
0 – 3 749	114%	112%	1 812	56 189	85 mln	67%	26%
3 750 – 7 499	98%	98%	263	15 220	81 mln	18%	24%
7 500 +	88%	85%	158	11 891	165 mln	14%	50%

Pension size	A/E (lives)	A/E (amount)	Nb of deaths	Exposure (lives)	Exposure (amount)	% total (lives)	% total (amount)
0 – 2 999	101%	102%	665	26 978	31 mln	73%	31%
3 000 +	86%	72%	115	9 879	70 mln	27%	69%

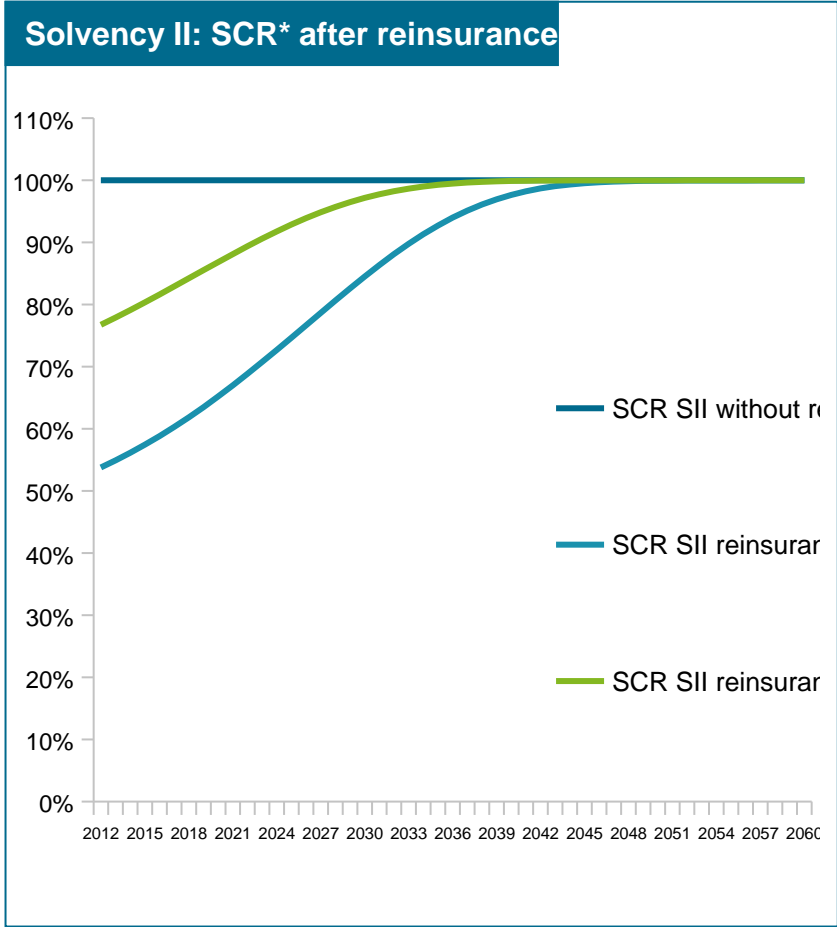
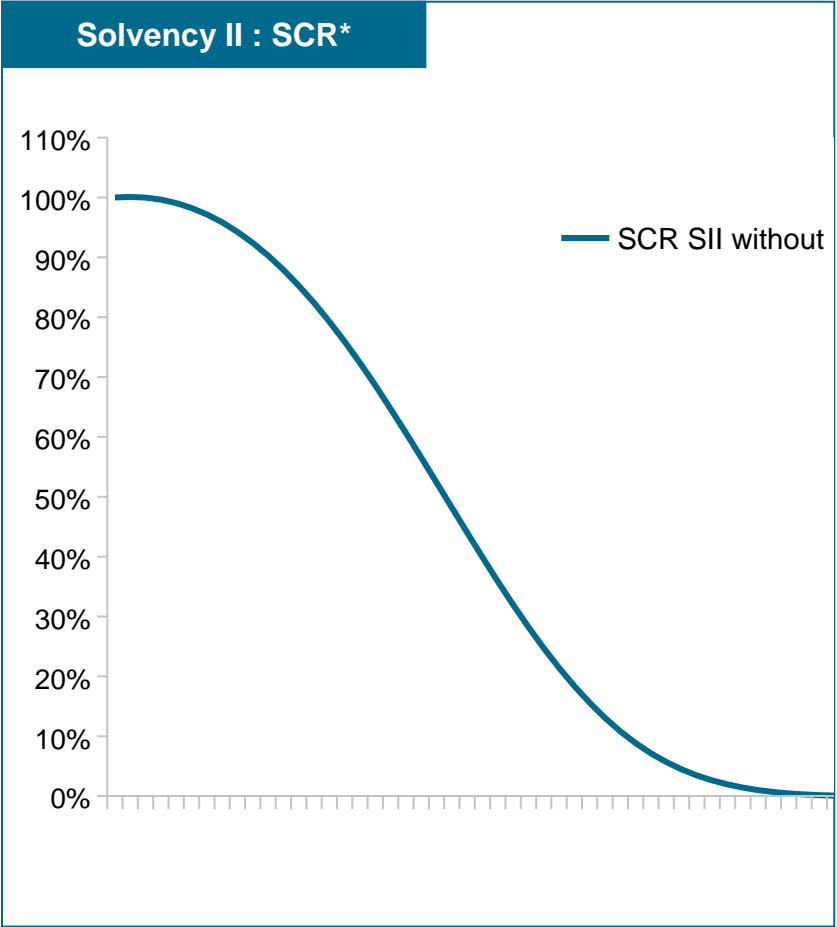
Cost of capital

- Cost of capital is lower if good volume / high quality mortality experience provided by Client.

Example: Cost of capital linked to uncertainty in L - level estimation is 2.5 times higher for mortality experience based on 2000 deaths compared to that based on 300 deaths



Capital Solvency II : impact of reinsurance



(*) SCR estimated by standard formula

Insurer's obligations

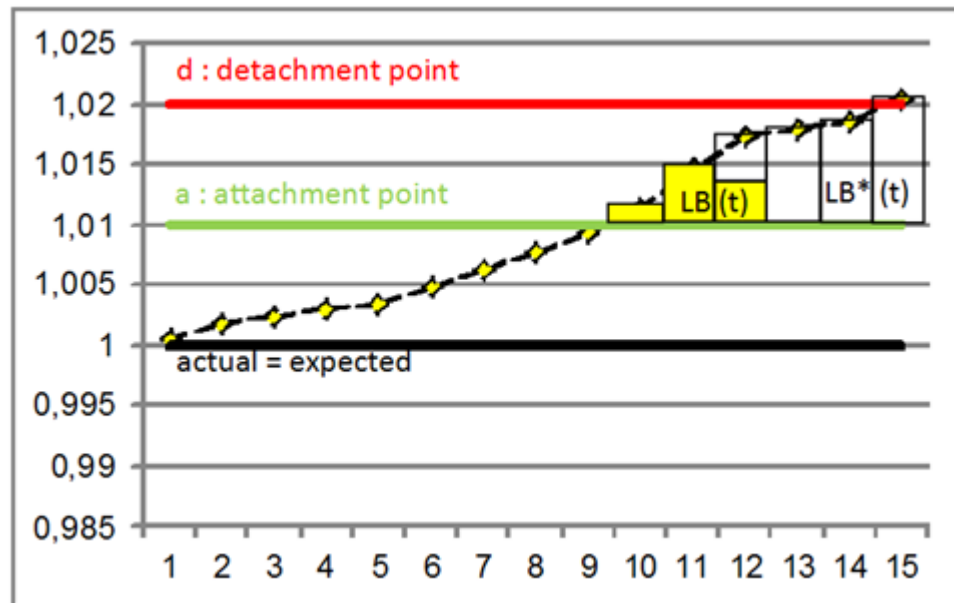
In order to propose the best price through limiting the operational risk for the reinsurer :
strict requirements on the administration (especially if insurer keeps a very small retention)

- Certificates of existence and death certificates**
- Financial penalties**
- Right to audit**
- List of data provided to SGL at outset and monthly**
- Control of payments**
- Termination rights due to persistent administrative breaches**
-

Example 2: Index based solution for capital optimisation

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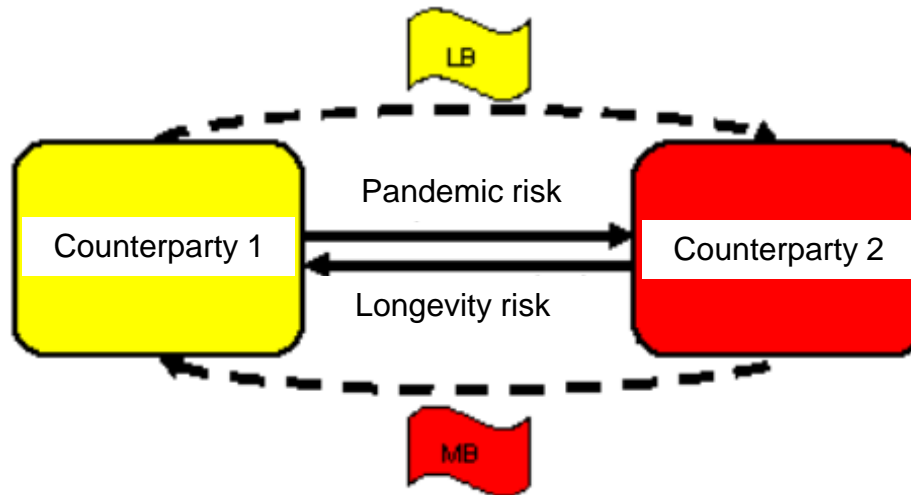
- Scenario: longevity is higher than expected and breaks the attachment point ; Reinsurer makes a payment to the cedent.



- Possibility: exit option after 5 years to recalibrate the index and optimise the economy of capital.

Example 3: Index-based solution for optimising capital through diversification

- Two counterparties, one overweight on longevity, another on pandemic risk : exchange of exposures



- Attachment points sufficiently far away to optimise capital release on both sides and minimise premium exchange: a win-win situation.

Scor Global Life added value

- Solutions tailored to your specific requirements
- Mortality analysis and forecasting
- Advise on claims payment monitoring
- High level expertise thanks to our R&D Centre on Longevity & Mortality

Insurance

Thank you for your attention !