IFRS 17

‘Risk Adjustment’ and other related topics

August 2017

Eric Dal Moro / Yuriy Krvavych / Glenn Meyers

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IFRS 17 – The current situation

- IFRS 17 standard has been published in May 2017
- Exposure Draft of IAA monograph on Risk Margin accepted in May 2017
  - ASTIN working party commented on the ED

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Why an IAA monograph on risk margin under IFRS 17 ?

IFRS

INTERNATIONAL ACTUARIAL ASSOCIATION
ASSOCIATION ACTUARIELLE INTERNATIONALE

- Discussions between IAA and IASB are on-going
  - Collaboration in Insurance, Pensions and Discounting
  - IAA is a frequent commenter on IASB's EDs
  - Latest topic was on IFRS 17 (= IFRS 4 phase 2)
  - IAA Monograph on Risk Adjustment supports Risk Adjustment Margin Calculations under IFRS 17
  - Also, the confidence level disclosure related to the presence of the risk margin is part of the monograph

- In the IAA, the Insurance Accounting Committee and its subcommittee, the Education and Practice subcommittee are involved in these discussions.

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The IAA Sections

INTERNATIONAL ACTUARIAL ASSOCIATION
ASSOCIATION ACTUARIELLE INTERNATIONALE

- promote actuarial role in specific areas of practice
- sponsor **research** of section's field of activity
- organize **events** of interest to individual actuaries

  - ASTIN
  - AFIR/ERM
  - IACA

  - AWB
  - PBSS
  - IAAHS
  - IAALS

SECTIONS

AFIR/ERM
Financial Risks and ERM

ASTIN
Non-Life Insurance

AWB
Actuaries Without Borders®

IAAHS
Health

IAALS
Life Insurance

IACA
Consulting

PBSS
Pensions, Benefits and Social Security

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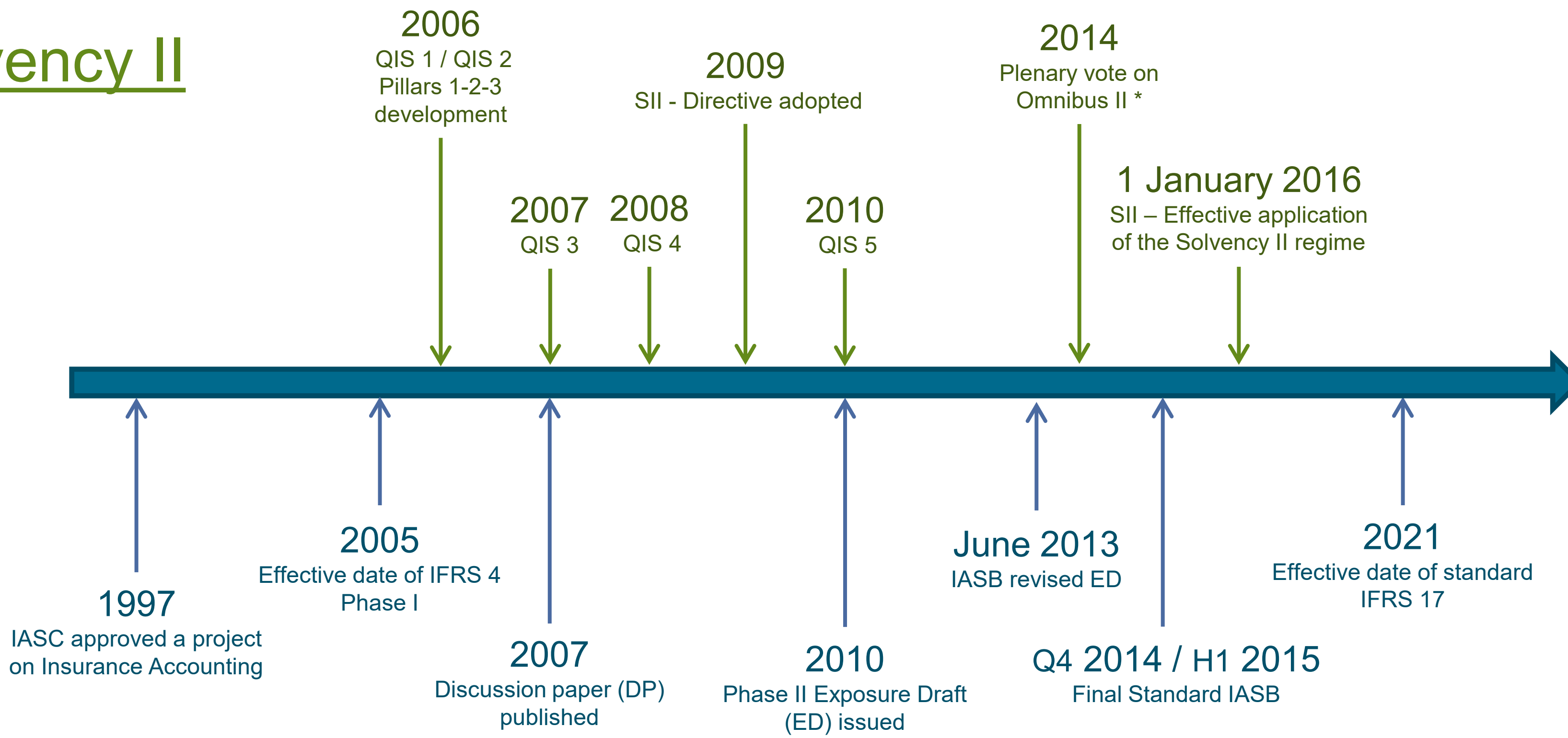
Timelines comparison for both Solvency II and IFRS 17

Solvency II



IFRS 17

* Omnibus II is the legislation to amend Solvency II

Timeline for the publication of the monograph

- End August

  Send the revised monograph to IAA Oversight Group with track changes for review

- Tuesday Oct 3rd – IAA meeting in Chicago

  Accounting committee to discuss the monograph

- November

  Publication by IAA

Financial reporting for insurance contracts
A journey from Phase 1 to Phase 2

- Because it was not feasible to complete the project in time for many entities that would adopt IFRS in 2005, the IASB split the project into two phases.

IFRS 4 Phase 1

Limited improvements

- an **interim standard**
- continue to **allow various current and local accounting principles**
- no **cash flow projections**
- **limited** comparability and transparency

IFRS 4 Phase 2 (IFRS 17)

A comprehensive standard

- **Market-consistent measurement**:
  Building block approach
  Premium allocation approach as a proxy
- **Precise recognition, presentation, disclosure**
  Income statement based on deposit accounting
- **Transparency, comparability, financial reporting**

Building Block Approach (BBA)

- This approach is relevant for insurance contracts with a coverage period equal or more than one year
- Entities required to measure their insurance contracts using the current measurement model, where current estimates are re-estimated every reporting period

Best estimate	Expected future cash flows	• An **explicit** and **unbiased** estimate of the current value of expected future cashflows • From premiums, claims and benefits
	Discounted at risk free rate	• Future cashflows adjusted to take into account the **time value of money**
Margins	Risk Adjustment Margin	• Explicit adjustment to reflect **uncertainty** in the amount and timing of the future cashflows
	Contractual Service Margin	• The expected contract profit which eliminates any gain at inception of the contract

New Format of Insurance Companies' Income Statement

- **Components of insurance contract revenue (top line):**
  - prospective current estimate of claims and services (ex investment comp)
  - change in the risk adjustment
  - amortization of the CSM
  - allocation to reporting period of acquisition expenses spread out over the coverage period

- **Other items in the Profit and Loss Statement**
  - effective claims and service expenses (ex investment components)
  - changes in estimates of future cash flows that don't adjust the CSM (claim reserves, onerous contracts)
  - interest expense (locked-in yield curve)

- **Other Comprehensive Income**
  - movements in liability due to yield curve change

Contractual Service Margin

- Locked-in yield curve
  - allows splitting of earnings into investment and underwriting income
- Adjustment of the CSM for changes in expected cash flows for future coverage (this excludes changes in expected claim reserve cash flows)
- CSM to be determined according to 3 groups
  - Onerous contracts: Immediate loss recognition
  - Profitable contracts: Recognition of profit according to patterns
  - Profitable contracts that may become onerous

Risk allowance

- Risk margins reflect all risks associated with the insurance contract except those reflected through the use of market consistent inputs.

Solvency II

- Risk margin

Prescribed approach: Cost of Capital using 6% cost of capital

- Depict the risk and uncertainty

To ensure that the **technical provisions are equivalent to the expected amount** required by another insurer to take over and meet the insurance obligations.

- Allowance for diversification benefit

IFRS 4 phase 2

- Risk adjustment

No prescribed technique

Some Risk Adjustment Techniques examples

1. Confidence Interval;
2. Conditional Tail Expectation (CTE);
3. Cost of Capital.

- Depict the risk and uncertainty

An explicit allowance to **reflect the compensation that the insurer requires for bearing the uncertainty** surrounding the amount and timing of the cash flows that arise as the insurer fulfils the insurance contracts.

- Allowance for diversification benefit based on an entity's own view of risk

Risk Adjustment

- An **explicit** measurement of the effects of uncertainty about future cash flows is required with **re-measurement at each reporting period**

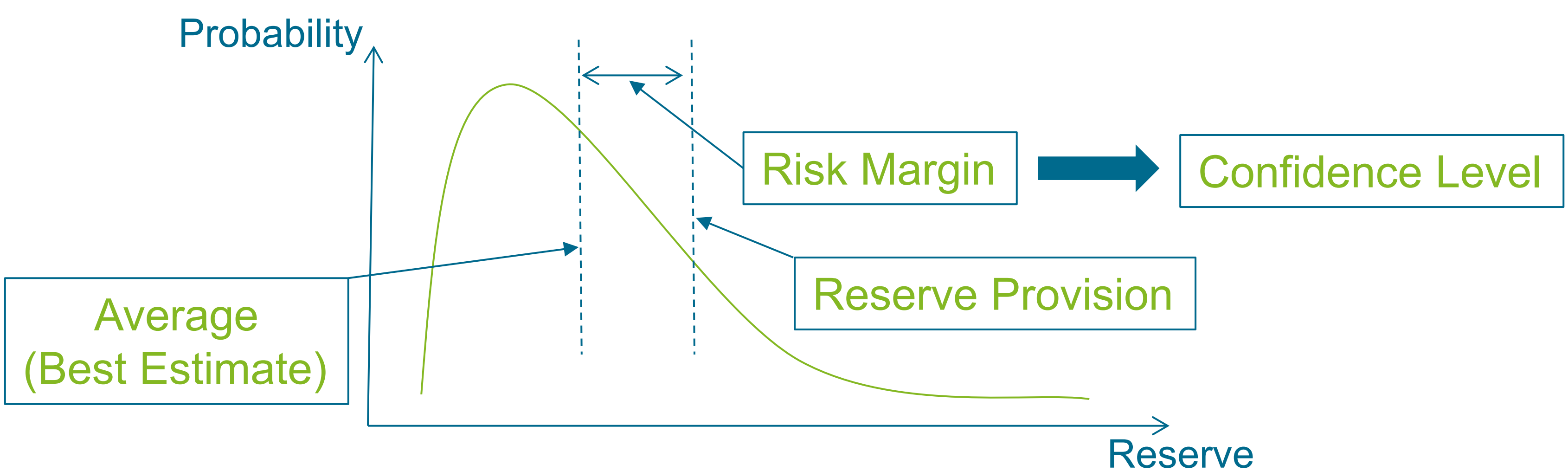
- There are only a small number of well-established methodologies currently available
  - The International Actuarial Association (IAA) published a monograph on recommended methods
    - The working party commented on the Exposure Draft of this monograph. The main comments related to:
      - The disclosure requirements
      - The examples

Disclosure of Risk Margin Confidence Level

- In Europe, the basis of calculation for the risk margin is likely to be calculated using the Cost of Capital approach:

$$\text{MVM} = \text{CoC x} \sum_{i=1}^{m} \frac{E[SCR(i)]}{[1+r_0(i+1)]^{i+1}}$$

- How to "convert" a Cost of Capital risk margin, or any form of Solvency II risk margin, into its implied 'Confidence Level' defined as the 'Probability of Sufficiency'?



Confidence Level of Risk Margin – definition

- Let X be the reserve value with distribution F_X, best estimate BE_X, and variability measured via coefficient of variation CoV_X
- The confidence level of reserve risk margin per unit of best estimate, η_X, (often pre-calculated and provided by reserving/capital actuaries) is defined by the probability level of provision set at $(1+\eta_X)\cdot BE_X$ on the reserve risk profile F_X. It is called *Probability of Sufficiency (PoS)* and equal to:

$$PoS = F_X[(1+\eta_X)\cdot BE_X] = P[X \leq (1+\eta_X)\cdot BE_X].$$

- Examples of PoS use: in Australia the non-life technical provisions are required by APRA to be set at the minimum level which is the greater of the two values:
  1. *75th percentile of the reserve distribution providing 75% of PoS; and*
  2. *best estimate plus one half of a standard deviation of the reserve.*

Confidence Level of Risk Margin – features

- PoS itself is a measure of prudence in liability valuation:
  - **PoS below 50%** indicates the technical provisions are set below the central estimate **(under-reserved position)**;
  - **PoS of 50% to 60%** indicates the technical provisions are set approximately at the level of central estimate **(weak prudence)**;
  - **PoS of around 75%** indicates that technical provisions are set so that likely (i.e. up to 1-in-4 years) reserve deteriorations above the central estimate are fully absorbed by the technical provisions **(adequate prudence)**; and
  - **PoS above 75%** indicates that the technical provisions could also absorb some of unlikely reserve deteriorations above the central estimate **(strong prudence)**.

PoS in the 'log-normality' bubble (1)

- What if the reserve is log-normally distributed? …

  That is, $X \sim LN(\mu, \sigma^2)$, and thus $BE_X = e^{\mu+\frac{1}{2}\sigma^2}$, $\sigma^2 = \ln(1 + CoV_X^2)$ and $\frac{X}{BE_X} \sim LN\left(-\frac{1}{2}\sigma^2, \sigma^2\right)$:

  - $$PoS = P[X \leq (1+\eta_X) \cdot BE_X] = P\left[\frac{X}{BE_X} \leq (1+\eta_X)\right]$$
    $$= \Phi\left(\frac{\ln(1+\eta_X) + \frac{1}{2}\sigma^2}{\sigma}\right)$$
    $$= \Phi\left(\frac{\ln\left((1+\eta_X) \cdot \sqrt{1+CoV_X^2}\right)}{\sqrt{\ln(1+CoV_X^2)}}\right)$$

- … and the problem is solved, but …

PoS in the 'log-normality' bubble (2)

- **Log-normality does not cover the whole range of practically feasible reserve risk profiles**, i.e. for $CoV_X \leq 50\%$ and disproportionally higher(lower) skewness
  - e.g. how about $CoV_X = 20\%$ and skewness γ_X of 1.0 (or 0.4) or equivalently 5 (or 2), when expressed per unit of CoV_X (i.e. Skewness-to-CoV (SC) ratio)?
  - **with log-normality we could only achieve the SC ratio in the range of 3 to 3.25 for** $CoV_X \leq 50\%$
- Is there a way of **estimating PoS using only** the reserve risk profile's characteristics like **CoV and skewness** without knowing the parametric structure of reserve distribution?

PoS approximations – distribution-free approach (1)

- **Insight into unknown PoS level,** α, of the technical provision set at $(1+\eta_X)\cdot BE_X$ of the reserve risk X, defined as

$$PoS = P[X \leq (1+\eta_X)\cdot BE_X] = \alpha,$$

can be gained by using the centralised and normalised copy of X, $\tilde{X} = \frac{X-BE_X}{BE_X\cdot CoV_X}$, for which

- $VaR_\alpha(\tilde{X}) = \frac{\eta_X}{CoV_X} = q$, i.e. it is neutral w.r.t. reserve risk location (volume);

- Distribution (or any quantile) of $\tilde{X}$ can be approximated using cumulants of the original reserve risk copy X of third order and higher (skewness and kurtosis are invariant w.r.t. linear transformations).

PoS approximations – distribution-free approach (2)

- **Two particular practical approximations:**

  - **Bohman-Esscher (B-E)** based on transformed Gamma distribution

$$\hat{\alpha} \approx Gamma_{s,1}(s + \sqrt{s} \cdot q),$$

where $s = \frac{4}{\gamma_X^2}$, $\gamma_X = SC_X \cdot CoV_X$ and $q = \frac{\eta_X}{CoV_X}$

  - **Cornish-Fisher (C-F) approximations** including the Normal-Power (N-P) case ($C_1 = C_2 = 0$), based on C-F expansion of F_X into the series of powers of the normal quantile z_α using cumulants of X like skewness γ_X and kurtosis ι_X

$$VaR_\alpha(\tilde{X}) \approx z_\alpha + \gamma_X \cdot \frac{z_\alpha^2 - 1}{6} + C_1 \cdot \left(\iota_X \cdot \frac{z_\alpha^3 - 3z_\alpha}{24} - \gamma_X^2 \cdot \frac{2z_\alpha^3 - 5z_\alpha}{36} \right)$$

$$+ C_2 \left(-\gamma_X \cdot \iota_X \cdot \frac{z_\alpha^4 - 5z_\alpha^2 + 2}{24} + \gamma_X^3 \cdot \frac{12z_\alpha^4 - 53z_\alpha^2 + 17}{324} \right)$$

PoS approximations – distribution-free approach (3)

- As was shown in Dal Moro and Krvavych (2017), **the quality of both B-E and N-P approximations is generally quite good** when compared to other alternative approximations of distribution's VaR like *higher-order Cornish-Fisher approximations, Haldane method, Wilson-Hilferty method* and *GPD/Hill method*.

- **When compared to the N-P approximation, in most practical cases the B-E approximation is of the same or better quality.**

- However, in some rare extreme situations (i.e. for excessively high CoV and/or SC ratio) the N-P approximation is of better quality.

- **The two approximations can be easily implemented in Excel environment**. Specifically, the Bohman-Esscher approximation can be computed using Excel's Gamma distribution function `GAMMA.DIST (x, alpha, beta, cumulative)`, i.e. using the following formulaic expression

$$\mathrm{GAMMA.DIST}(s + \sqrt{s} \cdot q, s, 1, 1)$$

PoS approximations – further refinement and implementation (1)

- Using four parametric distributions of *Single Shape Parameter (SSP)* type to define the domain of attraction of a wide range of distribution-free reserve risk profiles characterised by their CoV and skewness (SC ratio)

  - Characteristics of the four parametric distributions of SSP type

$\mathcal{PD}$ distribution	SC ratio as a function of CoV
Gamma	2
Inverse-Gaussian (Wald)	3
Log-Normal	$3 + CoV^2 \in (3, 4),\ CoV < 100\%$
Inverse-Gamma (Vinci)	$\frac{4}{1-CoV^2} > 4,\ CoV < 100\%$

  - Reserve risk profile categorisation

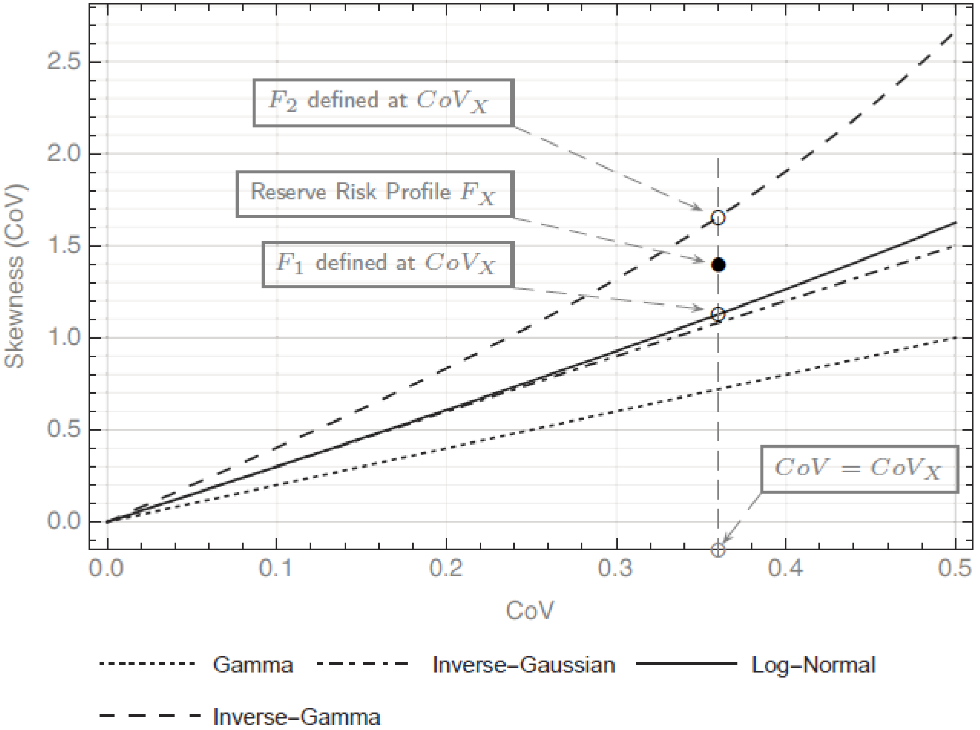
Type of reserving class				
Duration	**CoV range**	**Skewness (SC ratio)**	**$\mathcal{PD}$ induced DoA**	**Example of reserving class**
Short tail	6%-12%	1.9 to 2.1	Gamma	Motor (ex Bodily Injury)
Short tail	10%-16%	2.0 to 3.0	Gamma, Inverse-Gaussian (Wald)	Home
Short tail	10%-18%	2.9 to 3.1	Inverse-Gaussian (Wald), Log-Normal	Comm Property/Fire, Comm Accident
Long tail	12%-25%	3.0 to 3.5	Log-Normal	Motor Bodily Injury, Marine
Long tail	18%-50%	3.0 to 4.0	Log-Normal, Inverse-Gamma (Vinci)	Workers Comp, Prof Liab, Comm Liab
Long tail	25%-70%	> 4	Inverse-Gamma (Vinci)	Asbestos and other long tail books

PoS approximations – further refinement and implementation (2)

- When the reserve risk profile is ideally one of the four parametric SSP distributions, then one can get the exact PoS value as well as the corresponding correction factor (ratio of exact-to-approximate).

- In reality, any reserve risk profile can be located in the system of CoV-Skew coordinates between two adjacent (closest) SSP curves, …

- and the ultimate correction factor is then calculated using linear interpolation of the correction factors from the adjacent SSP curves.



Example

Insurer #353 - Commercial Auto
from the CAS Loss Reserve Database

w\d	1	2	3	4	5	6	7	8	9	10
1	952	1529	2813	3647	3724	3832	3899	3907	3911	3912
2	849	1564	2202	2432	2468	2487	2513	2526	2531	
3	983	2211	2830	3832	4039	4065	4102	4155		
4	1657	2685	3169	3600	3900	4320	4332			
5	932	1940	2626	3332	3368	3491				
6	1162	2402	2799	2996	3034					
7	1478	2980	3945	4714						
8	1240	2080	2607							
9	1326	2412								
10	1413									

Example

- Key Assumption - The output parameters of a Bayesian MCMC model and "data" simulated from these parameters represents the set of all possible outcomes.
- Fit a Bayesian MCMC model to the triangle. The output will contain 10,000 equally likely (vector-valued) parameters, $\{\theta_j\}_{j=1}^{10,000}$.
  - The parameter, θ_j could consist of the accident year level parameters, development year parameters, and possibly other parameters.
- For each parameter, θ_j, calculate the "statistics of interest" associated with the parameter.
  - Estimate of ultimate loss, U_j
  - Present value of future cash flows, B_j

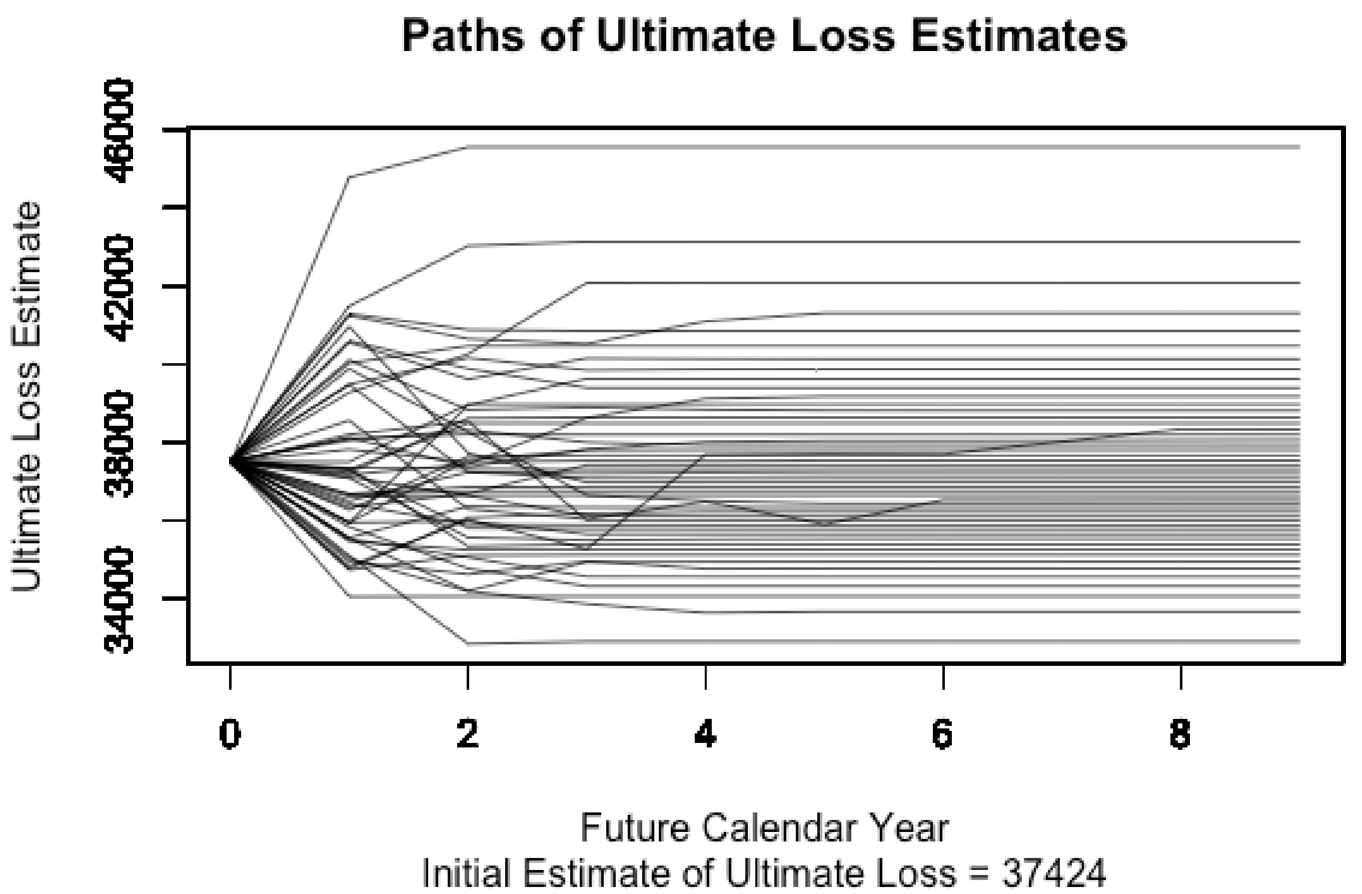
Example

- For a selected k, simulate t future calendar years of data using the parameter θ_k for $t = 1, \ldots, 9$. Call the loss trapezoid with t future calendar years of loss, T_t^k.
- Using Bayes' theorem, calculate $Pr\{J = j | T_t^k\}_{j=1}^{10{,}000}$.
- Repeat for other all other $k = 1, \ldots 10{,}000$.
- Doing the above gives us is the probability of every parameter, $Pr\{J = j | T_t^k\}_{j=1}^{10{,}000}$, given the data T_t^k, for $k = 1, \ldots, 10{,}000$. From these sets of parameters and probabilities, we can calculate the quantities we need for a cost of capital risk margin.

Example

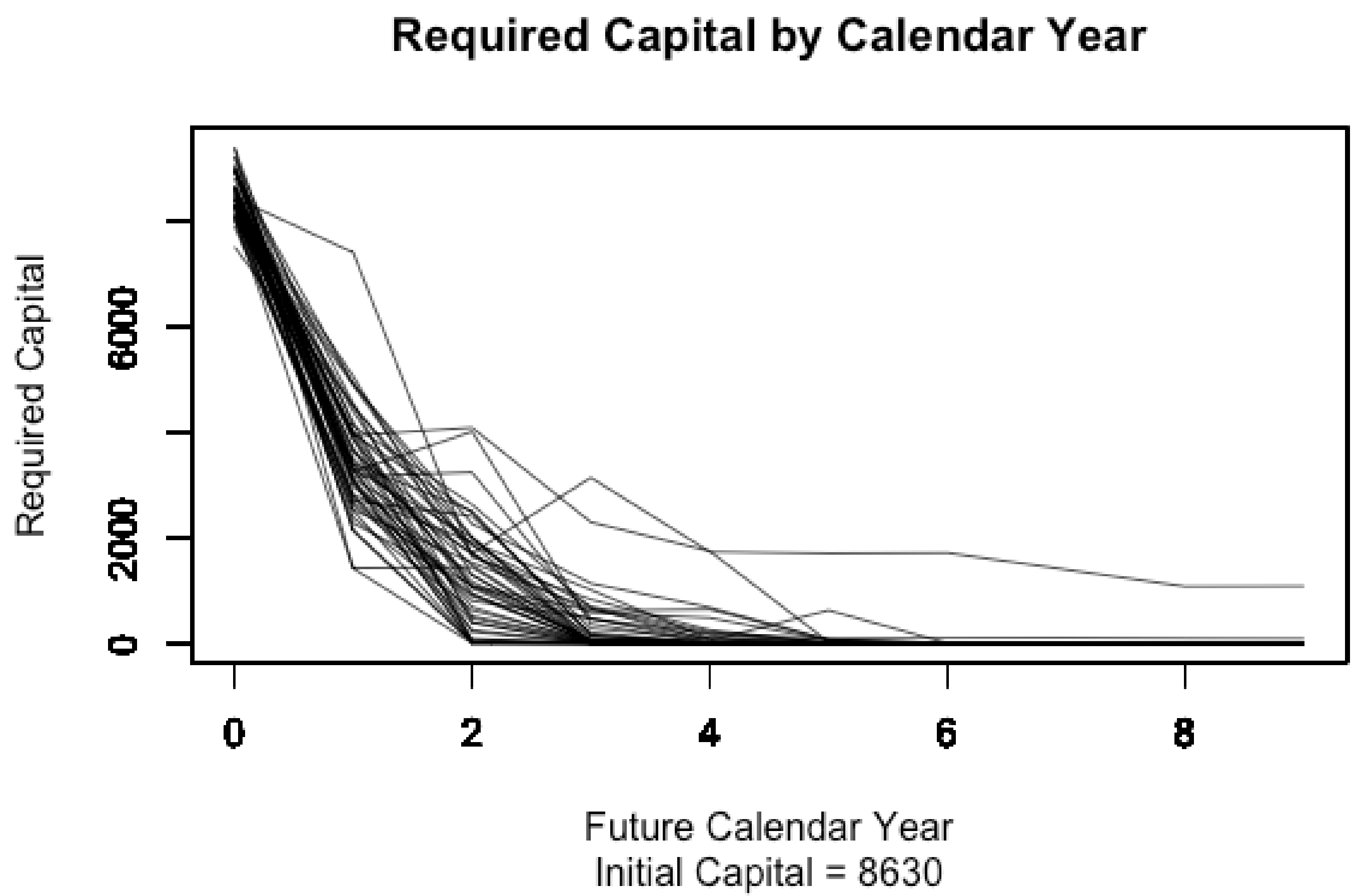
- Required — An explicit measurement of the effects of uncertainty about future cash flows is required with re-measurement at each reporting period.
- For each $k = 1, \ldots, 10,000$
  - For each $t = 0, \ldots, 9$
    - Take a random sample, S_t^k, with replacement, of $\{U_j\}_{j=1}^{10,000}$ with sampling probabilities, $Pr\{J = j | T_t^k\}_{j=1}^{10,000}$.
    - Set the expected outcome, $E_t^k \equiv \text{mean}[S_t^k]$.
    - Set the required assets, $A_t^k \equiv \text{TVaR}_\alpha[S_t^k]$ =mean of the largest $10,000 \cdot (1 - \alpha)$ elements of S_t^k.
    - Set the required capital, $C_t^k \equiv A_t^k - E_t^k$.

Example



Paths of Ultimate Loss Estimates
Ultimate Loss Estimate
46000
42000
38000
34000
0
2
4
6
8
Future Calendar Year
Initial Estimate of Ultimate Loss = 37424

Example



Required Capital by Calendar Year
Required Capital
0
2000
6000
0
2
4
6
8
Future Calendar Year
Initial Capital = 8630

Example

For a given path k

1. At the end of the current calendar year (call this time $t = 0$), the insurer posts its best estimate of the liability. The insurer also posts the amount of capital, C_0^k, needed to contain the uncertainty in this estimate. It invests C_0^k in a fund that earns income at the risk-free interest rate i.
2. At the end of the next calendar year, at time $t = 1$, the insurer uses its next year of loss experience to reevaluate its liability. It then posts its updated estimate of the liability and the capital, C_1^k, needed to contain the uncertainty in this estimate. The difference between $C_0^k \cdot (1 + i)$ and C_1^k is returned to the investor.

Example

For a given path k

3. The process continues for future calendar years, t, with the amount,
$$C_{t-1}^k \cdot (1+i) - C_t^k,$$
being returned to (or being contributed by) the investor.
4. At time $t = 9$, the loss is deemed to at ultimate. So we set $C_t^k = 0$ for $t > 9$.
5. The present value, discounted at the risky rate r, of the amount returned is equal to
$$\sum_{t=1}^{9} \frac{C_{t-1}^k \cdot (1+i) - C_t^k}{(1+r)^t}.$$

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Example

- Since $r > i$, this present value will be less than the initial capital investment of C_0^k. To adequately compensate the investor for taking on the risk of insuring policyholder losses, the difference can be made up at time $t = 0$ by what we now define as the cost of capital risk margin, R_{COC}^k.

$$R_{COC}^k \equiv C_0^k - \sum_{t=1}^{9} \frac{C_{t-1}^k \cdot (1+i) - C_t^k}{(1+r)^t} = (r-i) \cdot \sum_{t=0}^{9} \frac{C_t^k}{(1+r)^t}$$

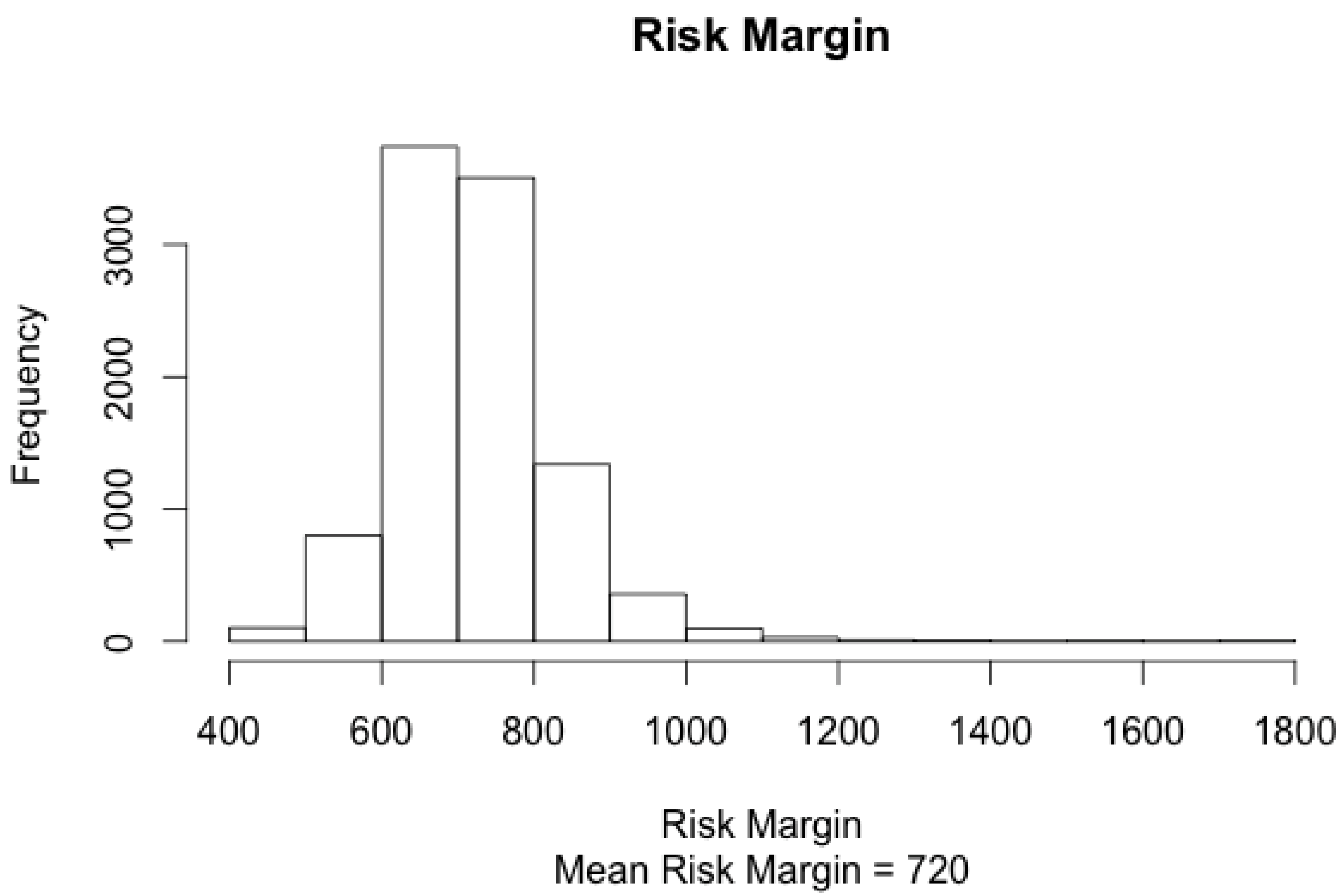
Then the overall risk margin, R_{COC}, is equal to

$$\text{mean}\left[\{R_{COC}^k\}_{k=1}^{10{,}000}\right]$$

Example

- Use the Changing Settlement Rate (CSR) Bayesian MCMC Model
- Input parameters
  - $i = 4\%$, $r = 10\%$, $\alpha = 97\%$
- Key summary outputs
  - Estimated Ultimate Loss $= 37{,}424$
  - Best Estimate of Liability $= 4{,}485$
  - Initial Capital $= 8{,}630$
  - Risk Margin $= 720$

Example


Risk Margin
Frequency
0
1000
2000
3000
400
600
800
1000
1200
1400
1600
1800
Risk Margin
Mean Risk Margin = 720

Conclusion

- Bad news
  - More work for actuaries
  - More complexity to deal with
  - More data to be delivered by actuaries

- Good news
  - We have (a lot of) work as a profession for the next few years