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Solvency II and Technical Provisions

Dealing with the risk margin

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Risk Margin

Topics to cover:

- Introduction
- What is a risk margin?
- Issues to consider when calculating the SCR
- Simplifications
- A practical example of how to calculate the risk margin
- What actuaries should be doing now
- Next steps

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Introduction to the risk margin

Under Solvency II

- The current reserves used for solvency purposes will be replaced with a true best estimate stripping out any implicit margins, plus an explicit market value margin called the risk margin
- The risk margin will be held in addition to the discounted best estimate liability
- The risk margin is calculated by estimating the capital required to support the current business until it runs off and then calculating the cost of holding this capital
- The requirement to use a cost of capital approach means much closer interaction between the reserving and capital teams
- When calculating the risk margin, some simplifications may be used where appropriate.
- The risk margin is not discretionary and is calculated using a fixed formula where the discount and cost of capital are fixed.

What is the risk margin

Definition

- This is defined as the amount required to ensure the value of the technical provisions is increased from the discounted best estimate to an amount equivalent to the theoretical level required to transfer the obligations to another insurance undertaking.
- Where the best estimate and risk margins are calculated separately, risk margins should be calculated using a cost of capital approach.
- This is a new concept compared to current practice and it is envisaged that the risk margin will be calculated to some extent using suitable simplifications

The risks included

The following risks are included until all claims are run-off

- Underwriting risks (Reserve, Premium, Lapse and Catastrophe risks)
- Counterparty default risk
- Operational risk
- Unavoidable market risk

- It is unlikely that reserving actuaries will have responsibility for understanding and modelling all of the above risks. This raises an interesting question of where the calculation of the risk margin will sit.
- The Reserve and Premium risks are likely to be determined by a mixture of the reserving, capital and underwriting teams.
- The remaining risks could be determined by the capital team and other business functions.

SCR calculation for the risk margin

Definition

- SCR is the solvency capital requirement
- The SCR is defined in guidance as the 99.5th percentile value at risk of the 'basic own funds' of an (re)insurance undertaking over a 1 year time period
- Basic own funds are excess assets over liabilities + subordinated liabilities
- The SCR needs to be calculated for all future time periods until run-off

Level of granularity

- The latest QIS5 guidance allows companies to calculate the SCR at a total business level allowing for diversification between lines of business
- The total SCR can then be allocated to the lines of business according to each line's contribution to the overall SCR

Calculation of the risk margin

Calculation

- Calculate the SCR for each future time period (t>=0) until business is run off
- Formulae; SCR = Basic SCR + Partial SCR – Adjust. (loss absorbing capacity)
  - Basic SCR covers underwriting and counterparty risks
  - Partial SCR covers operational risk
- Discount the SCR to time zero using a risk free yield curve for maturity t
- Multiply the total discounted SCRs for by Cost of Capital rate
- The cost of capital rate in QIS5 is 6%.

Modelling SCR

- Companies will need to determine whether they are using a Standard formula, full internal model or a hybrid (partial internal model) to calculate the SCR

Increasing credibility

Approach	Pros	Cons
Standard Formula	• Simple process • Relatively quick to apply	• May not match firms' view of risk at all
Undertaking specific parameters	• Makes use of own data • So better reflection of true "economic" value	• Limited scope for methodologies are any of the permitted methodologies appropriate for some classes?
Model one-year reserve risk	• Can drive the parameterisation of the internal model • A robust process can deliver a single firm-wide view of risk	• Proxies required for credit risk, operational risk, and "unavoidable" market risk • sufficient knowledge to apply / review / accept results
Internal Model result	• One firm-wide view of risk • Approval should give stakeholders confidence in result • Best reflection of "economic" value	• Needs additional functionality built into internal model calculation kernel • Who is responsible for producing these results? Capital or reserving team?

Increasing ease of calculation

Simplifications of the risk margin

- CEIOPS have set out a range of potential simplifications.
- It is envisaged that most firms would use some form of simplifications.
- Simplifications provides different answers depending on which simplification is used.
- Firms will need to justify their choice of simplification and some simplifications may not be valid for all firms.
- CEIOPS has provided a helper tab for QIS5 which is available on the website.
- Helper tab enables firms to apply simplifications by use of simple formulae.

Simplifications of the risk margin

- These simplifications are listed below, ranging from the most complex to the simplest approach are:

  1. Make a full calculation of all future SCRs without simplification
  2. Approximate the individual risks or sub risks to be used within some or all modules for future SCRs
  3. Approximate the whole SCR for each future time period using proportional approach
  4. Estimate all future SCR at once using an approximation based on duration approach
  5. Approximate the risk margin as a % of the best estimate

- In this hierarchy of simplifications the calculation gets simpler step by step.

Simplification 3 (TP 5.41) – Simplified calculation of future SCRs

- This is based on the assumption that the future SCRs are proportional to the best estimate technical provisions.
- SCR (t=0) = £100m
- BE (t=0) = £117.6m
- BE (t =1) = £80m
- CoC = 6%
- Risk Free Interest Rate = 1.5%
- SCR (t=1) = (SCR (t=0)) / ((BE(t=0)/BE(t=1))
- Therefore, SCR (t=1) = £68m
- **Risk Margin = £10m**

Simplification 4 (TP 5.49)
Simplified calculation of future SCRs at once

- This is using the modified duration of the liabilities in order to calculate the present and all future SCRs in one step.
- Simplification takes account of maturity and run-off pattern of the obligations.
- Makes simplified assumptions on the composition of risks over time.
- Assumes average credit rating of reinsurers remains the same over time.
- SCR(t=0) = £100m
- Modified Duration = 2 years
- CoC = 6%
- Risk Free Rate = 1.5%
- **Risk Margin =6%x2x100/(1.015) = £11.8m**

Simplification 5 (TP5.53)
Percentage of Best estimates

- The risk margin is a fixed % depending on the line of business.
- Intended for monoline insurers or where one line of business is dominant.
- Fixed % are specified in QIS5 for non-life undertakings intending to use the fixed percentage approach
- Examples:
- **Motor vehicle liability**
  - Best Estimate = £117.6m
  - QIS 5 Risk Margin Percent = 8.0%
  - **Risk Margin = (£117.6m) x (8%) = £9.4m**

A practical example - reserve risk

Outline

- This example is intended to demonstrate a simple approach to calculating the risk margin under Solvency II.
- In the example we will only consider the SCR contribution from reserving risk (i.e. ignoring counterparty, operational and unavoidable market risks).

Data

- We have paid, net of reinsurance development triangles by underwriting year origin period, for a “short-tail” class.
- This triangle is representative of actual London Market claims data.

A practical example - reserve risk

Approach

1. Use the chainladder method to project the undiscounted best-estimate reserves at time zero, BE0.
2. Project the best-estimate reserves at each future time period, BE1, BE2, BE3,... until the reserves are run off.
3. Apply a paid bootstrap to both triangles to obtain a distribution of reserve run-off to ultimate. We will run 10,000 simulations in our example.
4. Record the first calendar year diagonal projected by the bootstrap for each of the 10,000 simulations.
5. Add the new diagonal to our original triangle, to obtain a set of 10,000 new paid triangles.
6. Use a paid chainladder to project each of the 10,000 updated triangle to ultimate.
7. Use these 10,000 projections to obtain a distribution of reserve risk over one year.
8. Calculate SCR0 - i.e. the 99.5th percentile of this distribution, and calculate the ratio of SCR0 : BE0.
9. Apply this ratio to the projected best estimates BE1, BE2, BE3,... to obtain estimates of SCR1, SCR2, SCR3,... – the one year SCR at each future time period – until the reserves are run off.
10. Apply the risk margin formula to calculate the risk margin required at time zero.

A practical example - reserve risk

This is our “short tail” triangle

Underwriting year net paid data

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	28,246	92,510	116,202	120,156	121,378	122,884	123,339	123,522	123,822	123,440	123,472	123,516	123,502	123,502	123,561
2	96,123	175,031	196,781	206,981	208,356	209,593	209,700	210,025	210,293	210,325	210,342	210,335	210,352	210,329	
3	49,130	153,777	181,056	187,904	187,056	187,372	188,209	188,475	188,649	188,752	188,755	188,960	189,003		
4	65,631	154,719	178,581	185,362	188,321	190,538	190,961	191,238	191,624	191,965	192,115	192,027			
5	30,515	180,262	219,547	236,087	240,767	242,463	252,449	253,129	256,573	256,196	255,969				
6	113,792	260,796	320,066	337,558	346,351	353,263	351,564	380,785	382,572	382,926					
7	100,154	245,359	314,204	341,091	358,102	393,443	399,564	401,450	402,876						
8	64,289	303,619	399,155	462,663	514,806	522,808	527,004	532,299							
9	70,778	325,568	394,184	457,553	471,090	473,600	476,375								
10	37,510	203,799	245,415	260,419	266,749	268,524									
11	40,280	169,379	238,196	257,859	262,911										
12	47,864	231,933	355,896	401,307											
13	89,940	339,494	462,205												
14	38,889	146,753													
15	79,066														

A practical example - reserve risk

1. Projecting the triangle to ultimate using a weighted all periods chainladder gave the following results

The total reserve is 572,640

Year of Account	Paid Claims	Selected Percentage Developed	Total Claims Reserve	Ultimate Claims
1	123,561	100.00%	0	123,561
2	210,329	99.95%	100	210,429
3	189,003	99.96%	77	189,081
4	192,027	99.95%	95	192,123
5	255,969	99.93%	183	256,151
6	382,926	99.93%	263	383,189
7	402,876	99.93%	298	403,175
8	532,299	99.48%	2,766	535,065
9	476,375	97.82%	10,617	486,992
10	268,524	96.99%	8,347	276,871
11	262,911	94.97%	13,916	276,828
12	401,307	91.61%	36,775	438,083
13	462,205	83.77%	89,575	551,780
14	146,753	65.60%	76,944	223,697
15	79,066	19.20%	332,684	411,750
Total	4,386,133		572,640	4,958,773

A practical example - reserve risk

2. Projecting the future cash flows gave the following result

Time	Best Estimate Reserves
0	572,640
1	264,425
2	135,433
3	74,825
4	43,091
5	21,506
6	11,630
7	3,467
8	1,314
9	1,027
10	839
11	558
12	275
13	196
14	0

That is:

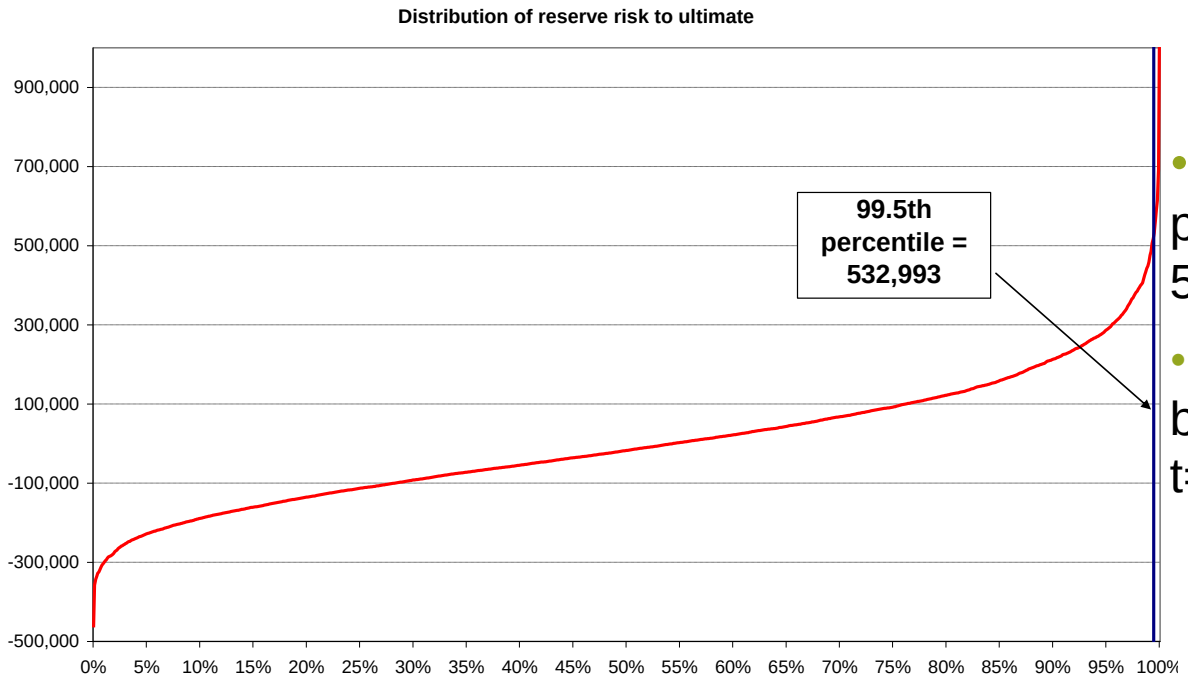
- Applying the chainladder development factors to each origin period, we estimated the future cashflows in each future calendar year.
- Using these we generated the following projections of best estimate reserves at each future time period

A practical example - reserve risk

3. We then ran a bootstrap on the triangle to measure reserve risk to ultimate.

… We used a standard Mack bootstrap to obtain 10,000 simulations of ultimate claims

… The distribution of interest to us is the deviation from expected reserves



- As noted in the chart, the 99.5th percentile of this distribution is 532,993.
- I.E. in the 9,950th simulation, the best estimate reserves required at t=0 deteriorated by 532,993.

A practical example - reserve risk

4. For each bootstrap simulation, we recorded the new diagonal projected…

5. …and used this information to create a new triangle. For example, one such triangle was as follows:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1995	28,246	92,510	116,202	120,156	121,378	122,884	123,339	123,522	123,822	123,440	123,472	123,516	123,502	123,502	123,561	123,561
1996	96,123	175,031	196,781	206,981	208,356	209,593	209,700	210,025	210,293	210,325	210,342	210,335	210,352	210,329	210,376	
1997	49,130	153,777	181,056	187,904	187,056	187,372	188,209	188,475	188,649	188,752	188,755	188,960	189,003	188,934		
1998	65,631	154,719	178,581	185,362	188,321	190,538	190,961	191,238	191,624	191,965	192,115	192,027	192,092			
1999	30,515	180,262	219,547	236,087	240,767	242,463	252,449	253,129	256,573	256,196	255,969	256,095				
2000	113,792	260,796	320,066	337,558	346,351	353,263	351,564	380,785	382,572	382,926	382,838					
2001	100,154	245,359	314,204	341,091	358,102	393,443	399,564	401,450	402,876	402,921						
2002	64,289	303,619	399,155	462,663	514,806	522,808	527,004	532,299	538,881							
2003	70,778	325,568	394,184	457,553	471,090	473,600	476,375	468,430								
2004	37,510	203,799	245,415	260,419	266,749	268,524	269,487									
2005	40,280	169,379	238,196	257,859	262,911	267,095										
2006	47,864	231,933	355,896	401,307	399,700											
2007	89,940	339,494	462,205	510,855												
2008	38,889	146,753	150,834													
2009	79,066	209,534														

- We have generated 10,000 new triangles each with one new diagonal

A practical example - reserve risk

6. Projecting this triangle to ultimate using a weighted all-periods chainladder, and calculating the change in reserves over the year gave the following results:

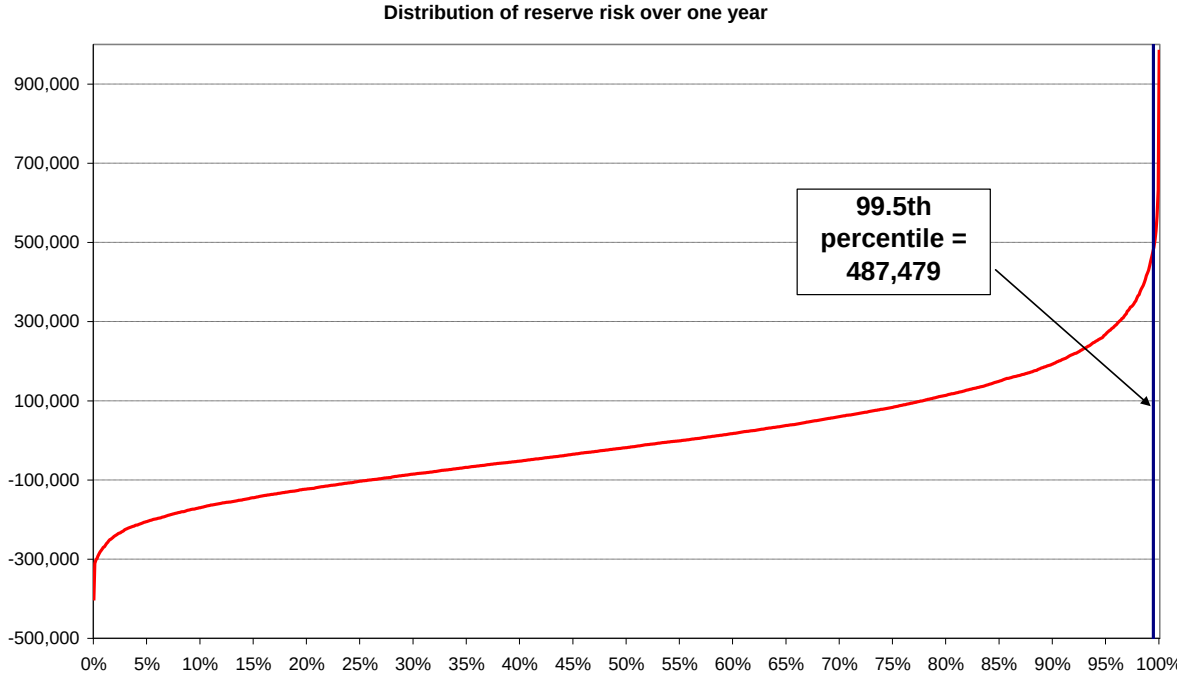
Year of Account	Original Paid Claims	Original Claims Reserve	Claims Paid in Year 1	Claims Reserve At time 1	Claims Result
1	123,561	0	0	0	0
2	210,329	100	46	0	-54
3	189,003	77	-70	59	-88
4	192,027	95	65	27	-4
5	255,969	183	127	75	19
6	382,926	263	-88	224	-127
7	402,876	298	45	201	-53
8	532,299	2,766	6,582	305	4,122
9	476,375	10,617	-7,945	3,218	-15,344
10	268,524	8,347	962	4,863	-2,521
11	262,911	13,916	4,184	7,037	-2,695
12	401,307	36,775	-1,608	19,043	-19,340
13	462,205	89,575	48,649	41,479	553
14	146,753	76,944	4,082	27,752	-45,111
15	79,066	332,684	130,468	104,197	-98,018
Total	4,386,133	572,640	185,500	208,479	-178,660

- So in this simulation, the original projected best estimate reserves required at t=0 reduced by 178,660 (i.e change in reserves plus claims paid in the year) as a result adding the new diagonal to the triangle.

A practical example - reserve risk

7. Repeating the process (described in 6) for each of the simulated new diagonals from the bootstrap gave a distribution for the claims result.

8. This distribution is the one-year reserve risk distribution used to obtain SCR0



- As noted in the chart, the 99.5th percentile of this distribution is 487,479.
- So SCR0 is 91.5% of the reserve risk to ultimate. Since this is a short tailed class, it is not surprising that a large proportion of the reserving risk emerges in the first year

A practical example - reserve risk

9. We now apply the ratio of SCR0 : BE0 of 85.1% and estimate the future SCRs

10. Finally, we discount these SCRs and apply the cost of capital. We have used a discount rate of 1.5% and a CoC of 6%.

Time	Best Estimate Reserve	SCRt	Ratio of SCR0: BE0
0	572,640	487,479	85.1%
1	264,425	225,101	85.1%
2	135,433	115,292	85.1%
3	74,825	63,697	85.1%
4	43,091	36,683	85.1%
5	21,506	18,307	85.1%
6	11,630	9,900	85.1%
7	3,467	2,951	85.1%
8	1,314	1,118	85.1%
9	1,027	874	85.1%
10	839	714	85.1%
11	558	475	85.1%
12	275	234	85.1%
13	196	167	85.1%
14	0	0	85.1%

Time	SCRt	Discounted SCRt	Cost of Capital
0	487,479	487,479	29,249
1	225,101	221,774	13,306
2	115,292	111,910	6,715
3	63,697	60,915	3,655
4	36,683	34,562	2,074
5	18,307	16,994	1,020
6	9,900	9,054	543
7	2,951	2,659	160
8	1,118	993	60
9	874	764	46
10	714	615	37
11	475	403	24
12	234	196	12
13	167	137	8
14	0	0	0
Total			56,907
Best estimate reserves			572,640
As % of B.E reserves			9.9%

In this example the risk margin is 9.9% of the best estimate reserve.

What actuaries should be doing now

- The reserving actuary should be consulted when firms are deciding whether they are applying for internal model approval or using the standard formula.
- Reserving actuaries should fully engage in QIS5 as this will give the best indication to the capital required by the standard formula.
- Assuming a company has decided to apply for internal model approval then reserving actuaries should be working with the capital modelling teams to understand how SCRs and risk margins will be calculated.
- Actuaries and the business should consider how the other risks within the risk margin, notably counterparty, operational and unavoidable market risks, would be allowed for.
- The reserving actuary should begin communicating the changes on reserving to all the key stakeholders within their organisation.
- The concept of technical provisions set equal to discounted best estimate reserves plus a ‘market value’ margin will be very different to the existing process.

Next steps

Next steps for working party to investigate, if any

- Output from QIS5
- Survey of what approach companies intend to use for the risk margin calculation

Questions or comments?

Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.

The views expressed in this presentation are those of the presenter.