Risk Margins in Loss Reserves

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Ancient History

- Historically US has not allowed discounting for casualty loss reserves.
  - Conservative/Implicit risk margin
  - Exception for workers compensation
- Mid 1980's – Committee on the Theory or Risk explored the idea of discounting reserves with an explicit risk margin.
- I wrote a paper "Risk Theoretic Issues in Loss Reserving – The Case of Workers Compensation Loss Reserves" *PCAS* 1989.

http://www.casact.org/pubs/proceed/proceed89/89171.pdf

Outline of Paper

- Calculated risk margins using utility theory
- Tuned the utility function so that it obtained risk margins on new business roughly equal to profit margins on new business.
- Applied the “tuned” utility function to Workers’ Compensation pension reserves.

Compare Risk Margins

Expected Value @6% = 29,903,273

Utility Theory		Conservative Discount Rate	
Utility Parameter	Risk Margin	Discount Rate	Risk Margin
0.5.	348,034	3.5%	9,225,608
0.6	376,560	0.0%	34,522,501
0.7	402,100		
0.8	425,562		
0.9	447,068		
1.0	466,740		

Note the substantial disagreement between the risk margin implied by utility theory and the implicit risk margin implied by not discounting.

Subsequently

- Moved on to risk margins in new business
  - Over the years my (and others) thinking moved into a financial view of risk margins.
  - Risk margins as the cost of capital.
- The issue of risk margins in loss reserves lied dormant in the US P/C circles.
- But it was alive in pensions.

Context of Risk Margins

- Risk-based capital and Solvency II
  - Awaits passage by European Parliament
  - If passed, it is expected to be implemented in 2012.
- Many organizations have been analyzing and commenting on Solvency II.
  - CEA, CEIOPS, Groupe Consultatif, CRO, Joint Forum, IAIS, IAA, IFRS.
  - These organization turn out lots of analyses that when printed out is best measured units of cubic meters of paper.

Solvency II and the IAA

- International Association of Insurance Supervisors (IAIS) requested help from the International Actuarial Association (IAA) to work on the issues of risk based capital and risk margins for loss reserves.
- Most recent (November 1) draft of risk margin report has 220 pages.
- Refer to risk margin as Market Value Margin (MVM)

IAIS – Properties of Risk Margins

1. The less that is known about the current estimate and its trend; the higher the risk margins should be.
2. Risks with low frequency and high severity will have higher risk margins than risks with high frequency and low severity.
3. For similar risks, contracts that persist over a longer timeframe will have higher risk margins than those of shorter duration.
4. Risks with a wide probability distribution will have higher risk margins than those risks with a narrower distribution.
5. To the extent that emerging experience reduces uncertainty, risk margins will decrease, and vice versa.

Possibilities

- Undiscounted reserves
  - Only satisfy Property 3
- Percentile method
  - Does not satisfy Property 3
- Cost of Capital Method
  - Satisfies all properties
- So – What is the Cost of Capital Method?

Version 1 – Capital Cash Flow (CCF)

- C_t = capital required to support liability at time *t.*
- i = risk-free rate of return
- r = risky rate of return due to insurer's investors
- $MVM_{CCF} = C_0 -$ PV(Released Capital @ rate r)

$$MVM_{CCF} = C_0 - \sum_{t=0}^{\infty} \frac{C_t \cdot (1+i) - C_{t+1}}{(1+r)^{t+1}}$$

$$MVM_{CCF} = (r-i) \cdot \sum_{t=0}^{\infty} \frac{C_t}{(1+r)^{t+1}}$$

After some algebra

Versions 2 and 3

- Capital Cash Flow (CCF)

$$MVM_{CCF} = (r - i) \cdot \sum_{t=0}^{\infty} \frac{C_t}{(1+r)^{t+1}}$$

- Swiss Solvency Test (SST)
  - Starts at $t = 1$. Ignores capital raised in first year.
  - Discounts at rate i instead of rate r.

$$MVM_{SST} = (r - i) \cdot \sum_{t=1}^{\infty} \frac{C_t}{(1+i)^{t+1}}$$

- Solvency II/QIS4 (SII)
  - Starts at $t = 0$

$$MVM_{SII} = (r - i) \cdot \sum_{t=0}^{\infty} \frac{C_t}{(1+i)^{t+1}}$$

All three versions satisfy the IAIS criteria.

Rationale Behind MVM_{SST} and MVM_{SII}

$$MVM_{SST} = (r - i) \cdot \sum_{t=1}^{\infty} \frac{C_t}{(1+i)^{t+1}}$$

"The risk margin can be expressed as the expected present value of the cost of capital necessary to buffer the nonhedgeable risk of insurance liabilities during the entire lifetime of the insurance liabilities."

$$MVM_{SII} = (r - i) \cdot \sum_{t=0}^{\infty} \frac{C_t}{(1+i)^{t+1}}$$

Both Solvency II and SST require capital to cover risk over a one year time horizon. SST says that you don't need a risk margin to cover the first year. Solvency II says you do.

Sample MVM Calculations

Hold Liability Until Maturity

i = 6.0%			r = 10.0%	r - i = 4.0%				
Nominal Liability	Difference Liability	Discounted Liability	Nominal TVaR	Difference TVaR	Discounted TVaR	Capital	MVM	MVM %
67,183	27,103	61,224	80,126	28,503	72,015	10,791	CCF	
40,080	18,847	36,993	51,623	21,737	46,990	9,997	1,292	2.1%
21,233	11,391	19,809	29,886	13,909	27,430	7,621		
9,843	5,978	9,270	15,978	8,025	14,756	5,486	SST	
3,864	2,653	3,671	7,953	4,195	7,379	3,708	1,084	1.8%
1,211	940	1,160	3,757	2,020	3,502	2,343		
271	237	261	1,737	836	1,632	1,371	SII	
34	33	33	901	799	869	837	1,938	3.2%
1	1	1	102	102	99	98		

Reference – Stochastic Loss Reserving with the Collective Risk Model

http://www.casact.org/pubs/forum/08fforum/

Accounting Standards
Hold to Maturity vs. Exit Value

- Calculations above assume that the liability was held to maturity.
  - Generally the case for illiquid liabilities such as general insurance loss reserves
- An alternate accounting standard would be post a risk margin appropriate for the exit value.
  - Exit to who? Since in most cases the exit will not occur we have to make up a reference company
- Example below assumes a “large” copy of the same insurer. By “large” I mean no process risk, only parameter risk.

Sample MVM Calculations

Exit Value

i = 6.0%			r = 10.0%	r - i = 4.0%				
Nominal Liability	Difference Liability	Discounted Liability	Nominal TVaR	Difference TVaR	Discounted TVaR	Capital	MVM	MVM %
67,183	27,103	61,224	75,833	29,606	68,892	7,668	CCF	
40,080	18,847	36,993	46,228	21,022	42,544	5,551	669	1.1%
21,233	11,391	19,809	25,206	13,119	23,454	3,645		
9,843	5,978	9,270	12,086	7,091	11,354	2,084	SST	
3,864	2,653	3,671	4,996	3,305	4,735	1,064	461	0.8%
1,211	940	1,160	1,691	1,276	1,616	457		
271	237	261	414	356	399	138	SII	
34	33	33	59	57	57	24	1,003	1.6%
1	1	1	2	2	2	1		

Reference – Stochastic Loss Reserving with the Collective Risk Model
http://www.casact.org/pubs/forum/08fforum/

Sample MVM Calculations

Hold Liability Until Maturity

i = 6.0%			r = 10.0%	r - i = 4.0%				
Nominal Liability	Difference Liability	Discounted Liability	Nominal TVaR	Difference TVaR	Discounted TVaR	Capital	MVM	MVM %
67,183	27,103	61,224	80,126	28,503	72,015	10,791	CCF	
40,080	18,847	36,993	51,623	21,737	46,990	9,997	1,292	2.1%
21,233	11,391	19,809	29,886	13,909	27,430	7,621		
9,843	5,978	9,270	15,978	8,025	14,756	5,486	SST	
3,864	2,653	3,671	7,953	4,195	7,379	3,708	1,084	1.8%
1,211	940	1,160	3,757	2,020	3,502	2,343		
271	237	261	1,737	836	1,632	1,371	SII	
34	33	33	901	799	869	837	1,938	3.2%
1	1	1	102	102	99	98		

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What is the Appropriate Cost of Capital Rate?

- The cost of capital rate, *r*, should take the following into account.
  - Market sentiment: risk aversion in the market leads to a higher *r*.
  - Financial distress cost (especially for exit value accounting)
  - Agency costs (i.e. insurer management incentives)
  - Corporate income tax rates

Amount of Capital

- TVaR, VaR etc
- Aggregation level of liability
  - Total liability of insurer?
  - By line of business?
    - Allocate capital?
  - Insurer groups?
- Does this apply to exit value accounting?

Reference

"The Meaning of Market Consistency in Europe"

- Published by Ernst & Young
- Contact philipp.keller@ch.ey.com