The one-year non-life insurance risk

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Agenda

1. Introduction
2. The one-year reserve risk
3. The one-year premium risk
4. Influence of risk margins and discounting
5. Conclusions

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Non-life insurance risk

- Insurance risk = reserve risk + premium risk
- Reserve risk = risk associated with historical years
- Premium risk = risk associated with (the) future year(s)
- Solvency II and other models take a one-year perspective
- Measures risks in the annual profit/loss report

The ultimo reserve risk

- R^0 = reserve estimate at the beginning of the year
- C^∞ = payments over the remaining run-off period
- $R^0 - C^\infty$ = profit/loss for the remaining run-off period
- The *ultimo reserve risk* is the risk in this technical result
- This is the approach of standard *stochastic claims reserving*: Mack (1993), England-Verall (2002) and many others
- Only part of this profit/loss will affect the next annual report
- Not consistent with a one-year approach

AISAM-ACME study (2007):

”Only a few members were aware of the inconsistency between their assessment on the ultimate costs and the Solvency II framework which uses a one-year horizon”.

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The one-year run-off result

Consider the claims reserve R during one year.

- R^0 = opening reserve estimate (beginning of the year)
- C^1 = amount paid during the year
- R^1 = closing reserve estimate (end of the year)
- The run-off result is then

$$T = R^0 - C^1 - R^1$$

The one-year reserve risk

—the risk in the run-off result $T = R^0 - C^1 - R^1$.

- $\mathcal{D}_t$ = random variables observed up to time t
- $\mathcal{D}_0$ = known random variables, beginning of the year
- $E(T|\mathcal{D}_0) = 0$ if the reserve estimate is unbiased
- Risk is measured in the distribution of T given $\mathcal{D}_0$, say by VaR$(-T|\mathcal{D}_0)$

VaR(L) = Value-at-Risk for the loss L at some chosen level,

say 99.5%

The one-year reserve risk, comments

- Merz & Wütrich (2008, paper at this conference) give analytic formulas for Mack-type MSEP for the ”claims development result” (=the run-off result)
- Our paper discusses the simulation approach (first presented to us by Peter England, EMB)
- AISAM-ACME (2007) study on long-tailed liabilities: ultimo (”full run-off”) risk is 2-3 times higher than the one-year risk
- Merz & Wütrich find some 25% larger MSEP for the ultimo perspective in a short-tailed example

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The first year result

Here the premium reserve is *pro rata temporis*.

- $\tilde{P}$ = earned premium next origin year (expected)
- E = operating expenses
- $\tilde{C}^1$ = first years payments
- $\tilde{R}^1$ = claims reserve estimate (end of the year)
- The first year result (profit/loss) is then

$$\tilde{T} = \tilde{P} - E - (\tilde{C}^1 + \tilde{R}^1)$$

The one-year premium risk

—the risk in the first year result $\tilde{T} = \tilde{P} - E - (\tilde{C}^1 + \tilde{R}^1)$

- $E(\tilde{T}|\mathcal{D}_0)$ is expected profit
- Risk is measured in the distribution of $\tilde{T}$ given $\mathcal{D}_0$, say by VaR$(-\tilde{T}|\mathcal{D}_0)$
- This is consistent with the QIS4 calculation of undertaking-specific parameters based on

$$\frac{\tilde{C}^1 + \tilde{R}^1}{\tilde{P}}$$

The volume for premium risk

QIS4 Technical specifications:

”TS.XIII.B.4 Premium risk relates to policies to be written (including renewals) during the period, and to unexpired risks on existing contracts. ”

This means that the exposure volume is

- The opening premium reserve $\tilde{U}^0$, plus
- the premium written during the year P

The one-year profit/loss—economic value

Moving from *pro rata temporis* to economic value, we must take both the opening and closing premium reserve into consideration.

- $\tilde{U}^t; t = 0, 1$ is the opening and closing premium reserve
- Valued as best estimates of claims covered but not incurred
- The premium result (due to premium reserves plus written premium) is

$$\tilde{T} = \tilde{U}^0 + P - E - (\tilde{C}^1 + \tilde{R}^1) - \tilde{U}^1$$

The one-year premium risk—economic value

—the risk in the result $\tilde{T} = \tilde{U}^0 + P - E - (\tilde{C}^1 + \tilde{R}^1) - \tilde{U}^1$.

- $E(\tilde{T}|\mathcal{D}_0)$ is one years worth of expected profit
- Risk is again measured as VaR$(-\tilde{T}|\mathcal{D}_0)$
- Here P and E are considered non-stochastic
- When we condition on $\mathcal{D}_0$, $\tilde{U}^0$ becomes non-stochastic, while $\tilde{U}^1$ is stochastic

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Finally: adding risk margins and discounting

- Let $M_d^t; t = 0, 1$ be the risk margin for a combined premium and claims reserve
- Combine the run-off result and the premium result
- Discount by some yield-curve, stochastic at time $t = 1$
- Subscript d denotes discounted value
- Add I = investment income transferred from financial operations
- Calculate I by revaluating the replicating portfolio
- The entire technical result is then, C^1 denoting *all* payments during the year

$$T_d = (U_d^0 + R_d^0 + M_d^0) + P + I - E - C^1 - (U_d^1 + R_d^1 + \tilde{R}_d^1 + M_d^1)$$

The rest of the paper...

The risk margin computed by the CoC method requires the solvency capital, while the solvency capital requires the risk margin. Circular reference?

- We show that there is no circular reference, by recursion from the ultimate year and backwards
- The calculations are impractical though, even with simulation
- The usual simplification, with risk margin proportional to expected run-off of the reserve, means that risk margins can be left out of the SCR calculation
- The simplified SCR is just the duration of the reserve times the initial SCR

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Conclusions

- We have tried to make clear the difference between the one-year and the ultimate risk
- Premium risk has a new interpretation under economic value accounting
- Risk margins do affect the risk, but not under the simplified CoC method
- More discussion/research is needed!

The end!