The one-year non-life insurance risk

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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 = \text{reserve estimate at the beginning of the year}
- C^\infty = \text{payments over the remaining run-off period}
- R^0 - C^\infty = \text{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.

- $R^0 = \text{opening reserve estimate (beginning of the year)}$
- $C^1 = \text{amount paid during the year}$
- $R^1 = \text{closing reserve estimate (end of the year)}$
- 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 \( T = R^0 - C^1 - R^1 \).

\( D_t \) = random variables observed up to time \( t \)

\( D_0 \) = known random variables, beginning of the year

\( E(T|D_0) = 0 \) if the reserve estimate is unbiased

Risk is measured in the distribution of \( T \) given \( D_0 \),
say by \( \text{VaR}(-T|D_0) \)

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

- $E(\tilde{T}|D_0)$ is expected profit
- Risk is measured in the distribution of $\tilde{T}$ given $D_0$, say by $\text{VaR}(-\tilde{T}|D_0)$
- 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
\[ \tilde{T} = \tilde{U}^0 + P - E - (\tilde{C}^1 + \tilde{R}^1) - \tilde{U}^1. \]

- \( E(\tilde{T}|D_0) \) is one year's worth of expected profit.
- Risk is again measured as \( \text{VaR}(-\tilde{T}|D_0) \).
- Here \( P \) and \( E \) are considered non-stochastic.
- When we condition on \( D_0 \), \( \tilde{U}^0 \) becomes non-stochastic, while \( \tilde{U}^1 \) is stochastic.
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Finally: adding risk margins and discounting

- Let $M^t_d; t = 0, 1$ 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 reevaluating the replicating portfolio
- The entire technical result is then, $C^1$ denoting all payments during the year

$$T_d = (U^0_d + R^0_d + M^0_d) + P + I - E - C^1 - (U^1_d + R^1_d + \tilde{R}^1_d + M^1_d)$$
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!