Schnieper's method revisited

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Agenda

The reason for this presentation

Schnieper's method

An application

More on Schnieper's method (if time)

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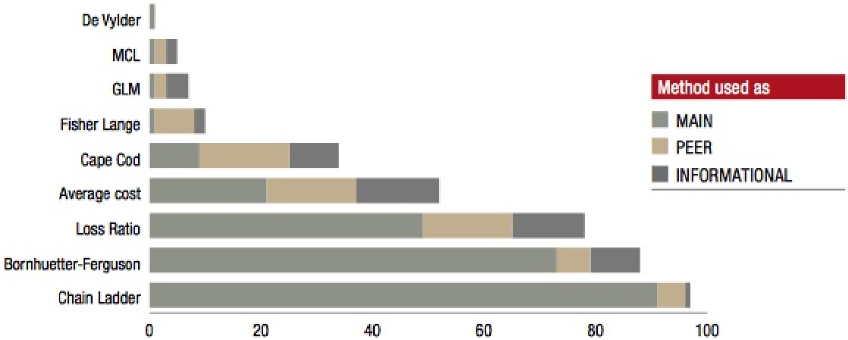
ASTIN "WPNLReserving Survey" 2016 Report: Non-life reserving practices



Schnieper's method is not even mentioned in the report

The reason for this talk

- So Schnieper's method is (seemingly) not used to any extent
- This talk aims at showing that the method deserves a place in the actuarys toolbox, by looking at it from a (perhaps) somewhat new angle
- I will give a example from Länsförsäkringar that illustrates the kind of situation where it is superior to Chain Ladder

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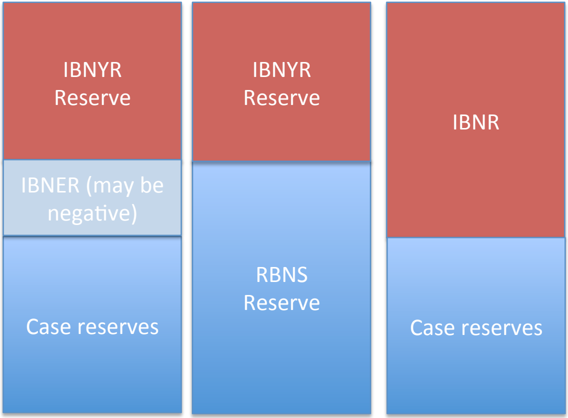
The idea of Schnieper is to estimate IBNYR and IBNER separately



Here IBNER is the adjustment to the case reserve

The method uses incurred claims

Accident year	*Development year* 0	1	2	$\cdots$	$J-2$	$J-1$
1	$C_{1,0}$	$C_{1,1}$	$C_{1,2}$	$\cdots$	$C_{1,J-2}$	$C_{1,J-1}$
2	$C_{2,0}$	$C_{2,1}$	$C_{2,2}$	$\cdots$	$C_{2,J-2}$	
$\vdots$	$\vdots$	$\vdots$	$\vdots$			
$I-1$	$C_{I-1,0}$	$C_{I-1,1}$				
I	$C_{I,0}$					

This is just the standard cumulative incurred claims triangle

Schnieper (1991) in ASTIN Bulletin: "Separating true IBNR and IBNER claims"

- The separation of IBNYR and IBNER calls for new data
- We first look at the cost for claims reported in different years:

  For claims incurred in accident year i, and reported during development year j, we let N_{ij} be the incurred claim cost as recorded by the end of development year j

The New claims triangle (N triangle)

Accident year	*Development year* 0	1	2	$\cdots$	$J-2$	$J-1$
1	$N_{1,0}$	$N_{1,1}$	$N_{1,2}$	$\cdots$	$N_{1,J-2}$	$N_{1,J-1}$
2	$N_{2,0}$	$N_{2,1}$	$N_{2,2}$	$\cdots$	$N_{2,J-2}$	
$\vdots$	$\vdots$	$\vdots$	$\vdots$			
$I-1$	$N_{I-1,0}$	$N_{I-1,1}$				
I	$N_{I,0}$					

This is an incremental triangle. Note that $N_{i,0} = C_{i,0}$, for all i.

One more triangle

- Next we follow up the development of reported claims
- This is done by looking at a triangle of:
  D_{ij} = the incremental change in incurred claim cost for existing claims
- If we have two triangles, the third is given by

$$C_{ij} = C_{i,j-1} + D_{ij} + N_{ij}$$

The Development triangle triangle (D triangle)

Accident year	*Development year* 0	1	2	$\cdots$	$J-2$	$J-1$
1	$D_{1,0}$	$D_{1,1}$	$D_{1,2}$	$\cdots$	$D_{1,J-2}$	$D_{1,J-1}$
2	$D_{2,0}$	$D_{2,1}$	$D_{2,2}$	$\cdots$	$D_{2,J-2}$	
$\vdots$	$\vdots$	$\vdots$	$\vdots$			
$I-1$	$D_{I-1,0}$	$D_{I-1,1}$				
I	$D_{I,0}$					

This is an incremental triangle. Note that $D_{i,0} = 0$, for all i.

The ideas behind the methods

- The CL idea: $C_{ij} \approx C_{i,j-1}\, f_j$
- Now let $E_i > 0$ be an exposure measure for IBNYR
- We may think of E_i as earned premium, but any known quantity is OK
- Schnieper's idea for new claims:

$$N_{ij} \approx E_i\, \lambda_j$$

  Development of previous claims:

$$C_{i,j-1} + D_{ij} \approx C_{i,j-1}\, \delta_j$$

Chain Ladder vs. Schnieper

- So in the CL

$$C_{ij} = C_{i,j-1} + D_{ij} + N_{ij} \approx C_{i,j-1}\, f_j$$

- This means (implicitly) that both the run-off development D and the new reported claims N are proportional to the observed C
- Schnieper, on the other hand, allows us to use any available exposure measure for new reported claims

$$C_{i,j-1} + D_{ij} + N_{ij} \approx C_{i,j-1}\, \delta_j + E_i \lambda_j$$

- While it is reasonable that the IBNER is proportional $C_{i,j-1}$, it is less obvious that the IBNYR should be so

Choice of exposure for IBNYR

- If the amount of incurred claims is greatly influenced by background factors, such as wheather conditions, then we expect substantial correlation between last years incurred claims $C_{i,j-1}$ and next years reported new claims N_{ij}
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- If that is not the case, we expect the new reported claims to be more or less independent of last years incurred claims
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- Typically, we have a mix of the two above cases, but often the background factors are less important

When to use Schnieper's method

In our experience, Schnieper should be considered:

- when data is readily available; *and*
- when there are no strong background factors affecting many claims; *and*
- when there is a large amount of IBNYR.

If the development is long-tailed, it is more likely that using Schnieper pays off, than in a short-tailed reserve

The estimators are simple CL look-alikes

- The CL estimators:

$$\hat{f}_j = \frac{\sum_i C_{ij}}{\sum_i C_{i,j-1}} = \frac{\sum_i C_{i,j-1} f_{ij}}{\sum_i C_{i,j-1}} \qquad f_{ij} = \frac{C_{ij}}{C_{i,j-1}}$$

- The Schnieper estimators:

$$\hat{\delta}_j = \frac{\sum_i (C_{i,j-1} + D_{ij})}{\sum_i C_{i,j-1}} = \frac{\sum_i C_{i,j-1}\, \delta_{ij}}{\sum_i C_{i,j-1}} \qquad \delta_{ij} = \frac{C_{i,j-1} + D_{ij}}{C_{i,j-1}}$$

- $$\hat{\lambda}_j = \frac{\sum_i N_{ij}}{\sum_i E_i} = \frac{\sum_i E_i\, \lambda_{ij}}{\sum_i E_i} \qquad \lambda_{ij} = \frac{N_{ij}}{E_i}$$

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More on Schnieper's method (if time)

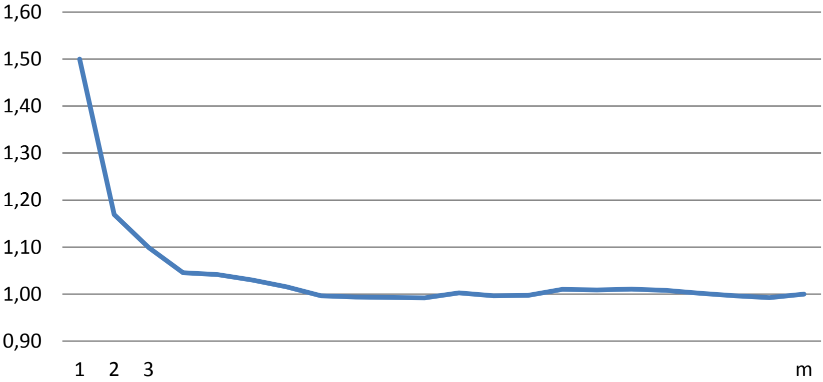
Example: Personal accident insurance

From the master thesis Flodström (2013)[1](in Swedish)

- Limited details on the data is given, due to confidentiality reasons
- In case of disability, income protection is given in form of a limited (but sometimes large) lump-sum
- Accidents may cause disability later in life
- This results in a substantial amount of late reported claims, up to 20-30 years, unrelated to the claims reported earlier
- Schnieper's method seems taylor-made for this situation (though it was designed for XL reinsurance)

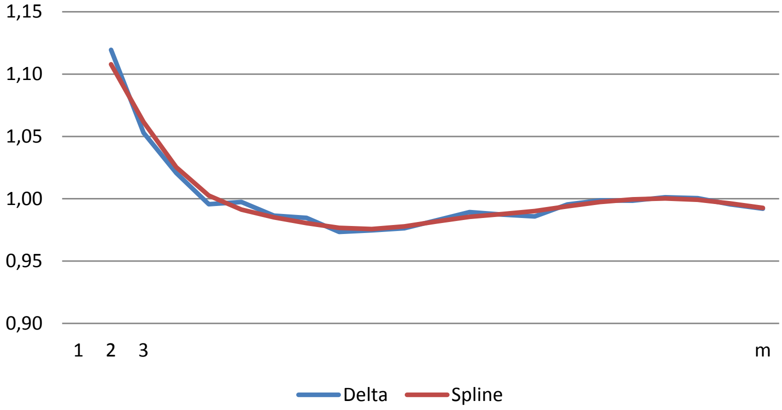
[1] Anna Flodström has now changed her surname to Wettebrandt

Chain Ladder development factors "Volume 7"



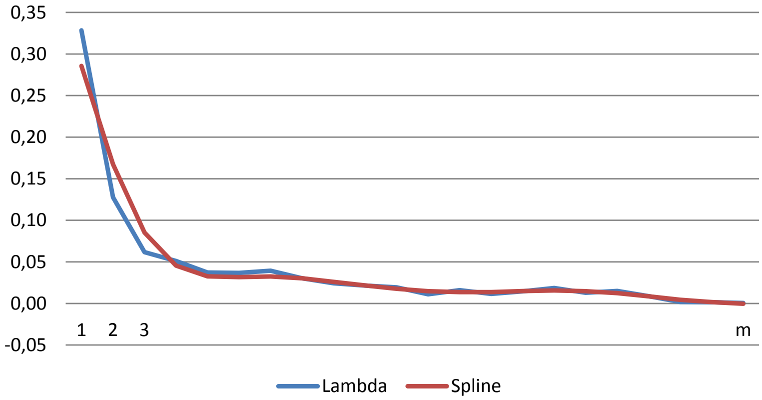
- m is the last observed development year
- It is hard to see any reasons for a tail beyond m

Schnieper development factors δ "Volume 7"



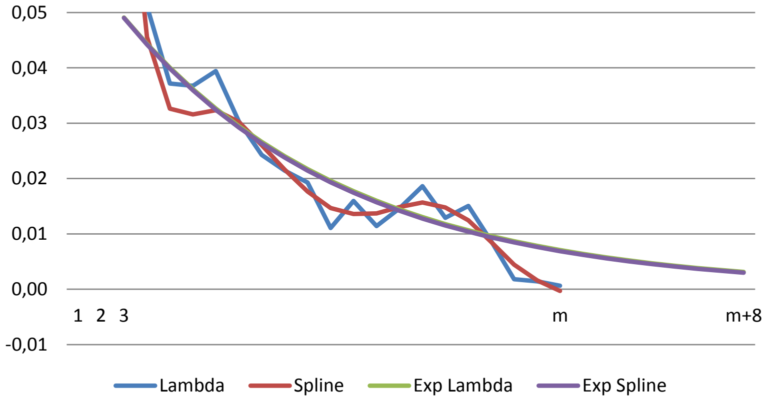
- The case reserves underestimates at start and overestimate later

Schnieper new claims factors λ "Volume 7"



- Very late IBNYR is seen here, but this is blurred by negative IBNER in the CL

A closer look at the tail of λ



- A need for a tail was identified (last observations are volatile)

More figures from the thesis

- The CL gave 25% less reserv than Schnieper with tail and 14% without
- In the case without tail, the one-year risk was estimated to $\sigma = 11,5\%$ for Schnieper and $\sigma = 14,0\%$ for the Chain Ladder
- So in this case, Schnieper's method is both more efficient and more informative than CL
- The (rather low) price is having to gather the data and do two triangulations

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Schnieper's paper in the literature

- Mack (1993) acknowledges that for his famous result on the MSE of the Chain Ladder: "The decisive step towards this formula was made by Schnieper (1991)"
- Liu and Verrall (2009) gave a bootstrap method for Schnieper's method
- For a good exposition of the theory on the method, see Ch. 10.2 in *Stochastic claims reserving methods in insurance* by Wüthrich and Merz (2008). In particular, they derive formulas for the MSEP.
- So Schnieper's method is not forgotten, but as we have seen it its not widespread among practicioners

Separation of IBNYR and IBNER

- We believe that Schnieper's method does not give a strict separation of the two parts
- That would require an additional assumption (A4) that the incurred claims of accident year i that are reported in development year j, N_{ij}, have *the same expected further development* from $j+1$ and onward as the incurred claims reported earlier, $C_{i,j-1}$, have.
- In most cases, it is not likely that late reported claims have the same development as those reported much earlier

Separation. . . contd.

- However, the overall unbiasedness of the IBNR is not conditional on (A4)
- It is only the separation of IBNR into IBNYR and IBNER that is not *strictly* achieved when (A4) is not fulfilled – but we still get an indication of the impact of these two parts
- To get a strict separation, we would need 3D-reserving (accident year, reporting year, development year)
  – As explained by Neuhaus (2004), this is quite complicated and at risk of giving over-parameterised models
- In our opinion, the great advantage of Schnieper's method is not this separation, but the possibility to use a more relevant exposure for the unknown claims
  – This is, of course, not affected by the above discussion

Schnieper and Bornheutter-Ferguson

- Note that Bornheutter-Ferguson (BF) assumes that the entire claim cost is proportional to the premium (or other exposure measure)

Schnieper offers a middle way

- CL: entire IBNR proportional to reported claim cost
- Schnieper: IBNER proportional to reported claim cost, IBNYR proportional to the premium
- BF: entire IBNR proportional to the premium

Conclusion

- Schnieper's method is a powerful reserving tool, due to the possibility to choose a more relevant exposure for unknown claims than is used in the Chain Ladder
- Schnieper's method offers a middle way between
  CL (all proportional to reported), and
  Bornheutter-Ferguson (all proportional to the premium)
- The separation into IBNYR and IBNER is not strict (not unbiased) but still informative and the IBNR is nevertheless unbiased
- In our experience, Schnieper's method deserves a prominent place in the actuary's toolbox

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The end!