

P R O M E M O R I A



Datum June 2009
Författare **Bengt von Bahr, Younes Elonq and Erik Elvers**

Finansinspektionen
P.O. Box 7821
SE-103 97 Stockholm, Sweden
[Brunnsgatan 3]
Tel +46 8 787 80 00
Fax +46 8 24 13 35
finansinspektionen@fi.se
www.fi.se

Stress test for measuring insurance risks in non-life insurance

Summary

This memo describes stress testing of insurance risks and expense risk for non-life insurance in the traffic light model.

Background and purpose

Finansinspektionen's (FI) intention with the new expansion of the traffic-light model for non-life insurance is to stress items in the company's balance sheet including both the asset and the liability. The size of the changes will be chosen such that it approximately represents the 99.5 percent quantile of possible deviations in one year. This document describes how assumptions for insurance risks for non-life insurance are chosen.

Changed assumptions for non-life insurance

The changed assumptions for the provisions in non-life insurance companies include

- A best estimate in accordance with the Prudent Person Principle
- Capital requirements for increase of provisions for unearned premiums and unexpired risks
- Capital requirements for increase of provisions for outstanding claims
- Capital requirements for catastrophe risk
- Capital requirements for expense risk

Best estimate in accordance with the Prudent Person Principle

A "best estimate according to the Prudent Person Principle" shall correspond to the expected value of the amounts which the company needs to fulfill the commitments which can reasonably be expected. Discounting of the future payments shall be done with a risk-free interest rate. The calculations shall be made with appropriate actuarial methods and refer to business gross of reinsurance.

Capital requirements for increased provisions for unearned premiums and unexpired risks KPR

The risk factors for these provisions are of two types: Parameter risk and Volatility risk.

Parameter risk

The Parameter risk lies primarily within claim inflation and claim frequency. The average duration of the remaining period of risk is often about six months. The increase in claim frequency is assumed to be 10% per year and the increase in inflation 2% per year, both above those that have been used in the best estimates. The total increase in the company's provisions for unearned premiums and unexpired risks because of uncertainty in parameters is therefore $(10\% + 2\%) \cdot 6/12 = 6\%$ of the company's provisions for unearned premiums and unexpired risks (*AEIPKR*), i.e.

$$KPRPAR = 6\% \cdot AEIPKR$$

Volatility risk

The volatility risk describes uncertainty about the outcome of the insurance business during the period which unearned premiums are supposed to cover. The capital requirement for branch number i is determined from the numbers

n_i = expected number of claims, nil-claims excluded, during the following 12-month-period for branch number i , net reinsurance

m_i = expected claim size, nil-claims excluded, for branch i , net reinsurance

v_i = coefficient of variation in the claims distribution, nil-claims excluded, for branch number i , net reinsurance

The capital requirement is determined by the formula

$$KPRSLUMP_i = 2,58 \cdot \sqrt{\frac{n_i}{2}} \cdot m_i \cdot \sqrt{1 + v_i^2}$$

The total capital requirement for volatility risk is determined by a square root summation over branches by

$$KPRSLUMP = \sqrt{\sum_i KPRSLUMP_i^2}$$

The capital requirement for unearned premiums and unexpired risks is

$$KPR = \sqrt{KPRPAR^2 + KPRSLUMP^2}$$

Capital requirement for increased provisions for outstanding claims KOS

The risk factors for these provisions are primarily claim amounts, claim inflation and payment patterns. FI has estimated the uncertainty in made provisions by studying the variation in the supplementary payment factor, i.e. the ratio be-

tween total compensation and paid compensation to date. In order to more accurately estimate the standard deviations, the companies have been divided into three more homogenous groups:

- AFA Health and Sickness
- National companies except AFA Health and Sickness
- Large local companies.

The standard deviation is a measure for uncertainty. Let $\sigma(\cdot)$ be a notation for standard deviation and denote the supplementary payment factor by SPF . Then the following holds:

$$SPF = \frac{\text{Total compensation}}{\text{Paid to date}}$$

$$\text{Provisions} = \text{Total compensation} - \text{Paid to date} = \text{Paid to date} \cdot (SPF - 1)$$

$$\sigma(\text{Provisions}) = \text{Paid to date} \cdot \sigma(SPFF)$$

FI has estimated the standard deviation σ_{iD} for the supplementary payment factor for the total payments within the company groups by insurance branch i and development year D .

The estimations of the standard deviations for the three groups are given in Table 1 and Table 2.

Table 1. Standard deviations σ_{iD} for National companies

Development year D	Accident and health except AFA	Accident and health AFA	Employer's no-fault insurance	Householder's and home-owner's	Business and house-owner's	Motor vehicle	Motor third party insurance	Marine insurance	Transportation	Credit insurance	Discharge insurance	Livestock insurance
0	1,20	2,50	4,30	0,10	0,55	0,06	0,25	1,45	0,40	0,85	1,20	0,03
1	0,55	0,70	0,60	0,07	0,15	0,06	0,17	0,60	0,10	0,40	0,45	0,02
2	0,35	0,30	0,35	0,05	0,10	0,05	0,15	0,50	0,07	0,25	0,40	0,02
3	0,35	0,20	0,25		0,10		0,15	0,35	0,06	0,15	0,20	
4	0,35	0,10	0,20		0,10		0,15	0,10	0,04	0,15	0,10	
5	0,30	0,06			0,08		0,13					
6	0,25	0,04			0,08		0,13					
7	0,15	0,04			0,06		0,13					
8	0,05	0,04			0,06		0,13					
9	0,02	0,01			0,03		0,13					
10							0,13					
11							0,13					

Table 2. Standard deviations σ_{iD} for Large local companies

Development year D	Accident and health	Householder's and homeowner's	Business and homeowner's	Motor vehicle	Motor third party insurance
0	1,25	0,08	0,30	0,03	0,25
1	0,55	0,02	0,06	0,01	0,17
2	0,35	0,01	0,02	0,005	0,15
3	0,25		0,02		0,15
4	0,15		0,02		0,15
5	0,15		0,02		
6	0,15		0,02		
7	0,05		0,02		
8	0,05		0,02		
9	0,05		0,005		

The standard deviations σ_{iD} for the supplementary payment factor shall thus be applied to the claim years $t = R - D$ for $D = 0, 1, 2, \dots$

For an individual company B , the standard deviation s_{Bit} for the provisions for branch i and claim year t is calculated as

$$s_{Bit} = \max \left[1 - 2 \cdot c_{Bit}; 0, 7 \cdot (1 - c_{Bit}) \right] \cdot \min \left(u_{Bit} \cdot \frac{\sigma_{iD}}{\sqrt{a_{Bit}}}; 0, 5 \cdot f_{Bit} \right)$$

where

c_{Bit} = the company's estimated share of reinsurance ceded for insurance branch i and year t

u_{Bit} = the company's payments to date for insurance branch i and claim year t

σ_{iD} = the standard deviation according to the table above, where $D = R - t$

a_{Bit} = the company's market share in its group for insurance branch i and claim year t

f_{Bit} = the company's provisions for outstanding claims for insurance branch i and claim year t

The share of ceded reinsurance can be estimated by the ratio between the premiums for ceded reinsurance and the total premium or the ratio between compensations from reinsurance companies and total compensations.

The market share is measured with the aid of the premium share in the company group as

$$a_{Bit} = \max\left(\frac{p_{Bit}}{P_{it}}; \frac{1}{9}\right)$$

where

p_{Bit} = the company's premium for insurance branch i and year t

P_{it} = total premium in the company group for insurance branch i and year t

AFA has the share 1 in its company group.

The total premiums P_{it} are presented in Table 3 and Table 4.

Table 3. Total premium P_{it} in kSEK for National companies except AFA

Accident year t	Accident and health	Employer's no-fault insurance	Householder's and homeowner's	Business and homeowner's	Motor vehicle	Motor third party insurance	Marine insurance	Transportation	Credit insurance	Discharge insurance	Livestock insurance
R	4 939 783	648 665	7 703 198	7 938 261	9 462 377	6 673 812	175 944	783 078	654 496	208 736	1 913 028
R-1	4 473 948	650 007	7 597 479	7 729 741	8 894 998	7 244 479	248 096	774 062	651 722	282 508	1 698 801
R-2	3 773 008	701 192	7 123 434	7 308 165	8 326 275	7 472 829	229 052	776 443	569 912	146 374	1 343 658
R-3	3 493 675	674 535		7 577 030		8 278 276	226 210	887 301	712 996	94 637	
R-4	3 373 154	81 088		7 590 779		9 084 890	258 695	857 567	771 708	56 937	
R-5	3 070 025			6 281 233		7 493 577					
R-6	3 238 379			5 464 591		6 459 562					
R-7	3 138 320			5 249 781		5 471 569					
R-8	2 706 059			4 848 379		5 091 614					
R-9	2 687 800			5 703 208		4 602 290					
R-10						4 372 219					
R-11						4 326 881					

Table 4. Total premium P_{it} in kSEK for Large local companies

Accident year R	Accident and health	Householder's and homeowner's	Business and homeowner's	Motor vehicle	Motor third party insurance
R	380 384	3 642 186	4 940 656	3 324 835	3 090 279
R-1	370 186	3 523 984	4 724 290	3 248 064	3 189 741
R-2	321 490	3 450 103	4 735 526	3 216 655	3 227 217
R-3	299 405		4 499 341		3 244 623
R-4	265 163		3 942 694		1 910 641
R-5	231 540		3 212 698		
R-6	210 083		2 494 372		
R-7	202 906		2 319 798		
R-8	187 063		2 143 423		
R-9	158 085		1 812 731		

The standard deviation $s_{Bi(yngre)}$ for the company's provisions for outstanding claims for insurance branch i is calculated by the square root formula:

$$s_{Bi(yngre)} = \sqrt{\sum_t s_{Bit}^2}$$

where the sum is calculated for the more recent claim years for which the standard deviations are calculated as above. These years do not represent the entire provisions for outstanding claims, rather in terms of experience, there are minor provisions for claim years older than those reported separately. These older claim years represent the following shares b_i of the total provisions:

Table 5. Percentage for older claim years b_i

	Accident and health	Employer's no-fault insurance	Householder's and homeowner's	Business and homeowner's	Motor vehicle	Motor third party insurance	Marine insurance	Transportation	Credit insurance	Discharge insurance	Livestock insurance
National companies except AFA	0,12	0,50	0,13	0,15	0,03	0,12	0,17	0,10	0,16	0,02	0,02
AFA	0,01										
Large local companies	0,12		0,14	0,04	0,04	0,00					

Under the assumption that the relative standard deviation for uncertainty in the provisions for the older claim years is the same as the more recent claim years,

$$s_{Bi(\text{aldre})} = s_{Bi(\text{yngre})} \cdot \frac{b_i}{1 - b_i}$$

The total standard deviation then becomes

$$s_{Bi} = \sqrt{s_{Bi(\text{yngre})}^2 + s_{Bi(\text{aldre})}^2}$$

The above calculations can only be completed for those insurance branches where Finansinspektionen has access to reliable statistics. For the branches

- Direct foreign insurance
- Reinsurance received from Swedish companies
- Reinsurance received from foreign companies

the following standard amounts shall be applied:

$$s_{B,util} = 0.06 \cdot \text{the provisions for outstanding claims}$$

$$s_{B,mott\ sv\ \grave{a}f} = 0.15 \cdot \text{the provisions for outstanding claims}$$

$$s_{B,mott\ utl\ \grave{a}f} = 0.20 \cdot \text{the provisions for outstanding claims}$$

The standard deviation s_B for the company's total provisions for outstanding claims is also calculated with the square root formula

$$s_B = \sqrt{\sum_i s_{Bi}^2 + s_{B,util}^2 + s_{B,mott\ sv\ \grave{a}f}^2 + s_{B,mott\ utl\ \grave{a}f}^2}$$

Capital requirements for provisions for outstanding claims

The capital requirements in the company's provisions for outstanding claims (*KOS*) is calculated as

$$KOS = 2,58 \cdot s_B$$

Capital requirements for catastrophe risk

The company shall estimate the costs net of reinsurance from the following three catastrophes. The costs shall be valued as the best estimate of the effect on the company if the catastrophe occurs where the company is active. A catastrophe, the effect of which is less than 25 % of the largest, need not be valued and can be neglected.

- Catastrophe 1 A storm resulting in a total loss in the Swedish market of SEK 15 billion, affecting insurance class Property (Commercial and property, homeowners).
- Catastrophe 2 A financial crisis resulting in a market loss of SEK 2 billion, affecting insurance class Credit insurance.
- Catastrophe 3 An epidemic resulting in a market loss of SEK 1 billion affecting insurance class Personal accident and sickness.

The capital requirement is determined as follows:

$$KKAT = \sqrt{\sum_i KAT_i^2}$$

where KAT_i , $i = 1,2,3$, is the net cost for catastrophe 1 (storm), catastrophe 2 (financial crisis) and catastrophe 3 (epidemic).

Capital requirements for non life insurance risk KS

$$KS = \sqrt{KOS^2 + KPR^2 + 2 \cdot 0,5 \cdot KOS \cdot KPR + KKAT^2}$$

Expense risk

The purpose for testing expense risk is that the company must be able to cover an increase of the fixed expenses for different reasons by 10 %. It is assumed that the company can reduce this increase of costs and/or increase the income within a period of 12 months. The stressing is thus assumed to have only a temporary effect.

This risk shall be reported separately and shall not be included under the term “insurance risk”.

The expense risk is measured by

K = the company’s annual fixed costs, defined as operating expenses plus claims adjustment costs minus acquisition costs.

The capital requirement for expense risk is calculated as $0.1 \cdot K$.

Expense risk and insurance risk are assumed to have a correlation coefficient of 50 % when calculating the total risk.