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Författare **Bengt von Bahr**

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Finansinspektionen
P.O. Box 6750
SE-113 85 Stockholm
[Sveavägen 167]
Tel +46 8 787 80 00
Fax +46 8 24 13 35
finansinspektionen@fi.se
www.fi.se

A model for reduction of the SCR taking into account

risk absorbing capital

Background

The liability side of the balance sheet consists mainly of the following items:

TPG = technical provisions for guaranteed liabilities

TPN = Technical provisions for non-guaranteed liabilities

EQ = Owners' equity

The technical provisions TP is the sum of both TPG and TPN. According to conditions in the insurance contracts, the company can decrease the TPN, and thus reduce the solvency capital requirement (SCR) on EQ. TPN is a basis for future bonuses to policy holders. Decrease of TPN implies of course decrease of future bonuses.

Example 1 The risk factor R_1 is the decrease in values in the stock market. X_1 is the decrease of the company's assets. 95 % of the losses because of decrease of asset values are covered by reducing TPN, as long it is non-negative.

Example 2 The risk factor R_2 is the decrease in rates of interest in the market. X_2 is the increase in technical life provisions minus the increase in the values of the bond portfolio. TPN increases by 95 % of the increase in the values of the bonds.

Example 3 The risk factor R_3 is the insurance risk business in life insurance. X_3 is the corresponding loss, and the 50 % of the loss is covered by reducing TPN, as long it is non-negative.

In this note we propose an alternative model to define the SCR in the presence of TPN.

Mathematical model

We denote different risks by R_i and the stress on the balance sheet, that is the increase in the difference between liabilities and assets because of R_i , by X_i . The X_i 's, $i = 1, 2, \dots, n$ are considered as random variables with zero mean,

standard deviations σ_i and correlation coefficients ρ_{ij} between different X_i and X_j . For each X_i we also define the 99,5 % -percentile w_i , and under assumptions of normal distributions, $w_i = 2,58 \cdot \sigma_i$. The assumption of mean zero is a consequence of the fact that all items in the balance sheet shall be valued according to “the prudent person principle”, from which follows that they are unbiased. Thus deviations all have mean zero. The total stress on the balance sheet because of the risks R_i is the sum $S = \sum_i X_i$ with standard deviation σ given by the formula

$$\sigma = \sqrt{\sum_i \sigma_i^2 + 2 \cdot \sum_{i < j} \rho_{ij} \sigma_i \sigma_j}$$

The capital requirement for the company is the 99,5 % -percentile w of S , and so, under assumptions of normal distributions

$$w = 2,58 \cdot \sigma = \sqrt{\sum_i w_i^2 + 2 \cdot \sum_{i < j} \rho_{ij} w_i w_j}$$

One part of this capital requirement is taken by the TPN and the rest by EQ. The SCR is defined as the EQ-part. We will now define stress values x_i to the different risks so that their combined effect $x = \sum_i x_i$ equals w . This is achieved by choosing $x_i = c \cdot w_i$, where the constant c has the value

$$c = \frac{\sqrt{\sum_i \sigma_i^2 + 2 \cdot \sum_{i < j} \rho_{ij} \sigma_i \sigma_j}}{\sum_i w_i}$$

Then

$$\sum_i x_i = c \cdot \sum_i w_i = \sqrt{\sum_i w_i^2 + 2 \cdot \sum_{i < j} \rho_{ij} w_i w_j} = w$$

The stress values x_i are the reduced stress values, in contrast to the original values w_i .

Given the reduced stress values, the company must calculate, taking into account the conditions in the insurance contracts, how much of the x_i 's could be covered by TPN if the latter were big enough, and how much must - as a consequence - be covered by EQ. We denote that notional TPN-part by y_i and the EQ-part by $z_i = x_i - y_i$. We put $y = \sum_i y_i$ and $z = \sum_i z_i$. The sum z is a direct capital requirement on EQ, whatever the size of TPN. If y is smaller than the available overall value of TPN, which we denote by TPN_0 , then TPN can absorb the whole sum y , which leaves the net total requirement on EQ to the sum z . On the other hand, If y is greater than TPN_0 , EQ must also absorb the difference $y - TPN_0$. Thus the total solvency net capital requirement on EQ is defined as

$$SCR = z + \text{MAX}(0; y - TPN_0).$$

Summary

1. Determine the gross capital requirements w_i at the 99,5 % level for each risk factor R_i .
2. Calculate the square-root-sum of the capital requirements w_i using the relevant correlation matrix. Also calculate the direct sum of these capital requirements. The ratio c between these sums is the reduction ratio.
3. Determine for each risk factor R_i the reduced capital requirements x_i by multiplying the w_i by c .
4. For each risk factor R_i decide, using the appropriate policy conditions and other relevant information, how much of the reduced capital requirements x_i that could be covered by the TPN, if it were big enough. This part is denoted y_i .
5. The part of the reduced capital requirements x_i which can not be covered by TPN - whatever the size - becomes a direct capital requirement on EQ. These requirements are denoted z_i and their sum is z .

The sum of the capital requirements y_i that might be covered by TPN is denoted y . Compare this sum with the available value of TPN, which is denoted TPN_0 . If the sum is smaller than TPN_0 , then TPN can cover all capital requirements y_i , and the total net capital requirement on EQ is z . On the other hand, if the sum is greater than TPN_0 , then the net capital requirements on EQ is z plus the excess of y over