

Solvency Capital Requirements in the Solvency 2 environment

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Insurance (and reinsurance) companies must respect a Solvency 2 ratio, which is looked after, in each country, by a watchdog in charge of financial institutions' supervision.

The solvency ratio which is defined by Own funds / Solvency Capital Requirements (SCR) must be equal or higher than 100%.

For the underwriting activity, the principle is the following one: the premiums received clients are the prices of the commitments that are undertaken by the insurance company towards them. Then, the insurance company must provision the risk to indemnify claims which reduces its net income and therefore its equity accordingly. This provision charge increments a technical provision that is booked in the liabilities side of its balance sheet.

The technical provisions are equal to the sum of a best estimate and a risk margin:

- The best estimate is the sum of the present values of future cash flows weighted by the probably to occur. The cash flows correspond to the required cash inflows (future premiums) and outflows (claims and operating expenses) to face the future commitments of the insurance company during their whole lifetime. The discount rate is the risk-free rate
- The risk margin is calculated so that the technical provisions are equal to the required amount to meet the insurance company's commitments or take over them.

The technical provisions also include 3 items:

- Expenses to meet the company's commitments
- Inflation, including that which is relative to expenses and claims
- Expected payments to policyholders.

The cash corresponding to the technical provision is invested, as a prudent person, in assets the risks of which can be appropriately identified, monitored, managed and disclosed. Moreover, they must guarantee security, quality, liquidity and profitability of the whole portfolio.

Thanks to classical provisions and technical provisions, all potential risks that are undertaken by an insurance company are already provisioned and the corresponding cash is invested in financial products that represent the main part of its balance sheet's assets. If all the anticipated risks were to occur, the insurance would face claims thanks to the sale of its assets.

But damages may imply high claims than expected. This is why the solvency rules include a coverage of possible shocks by the company's equity that defines the Solvency Capital Requirements (SCR). In other terms, if the total estimated possible shocks that are not provisioned are 100, the SCR is 100, meaning that the company's minimum eligible equity has to be 100.

In the Solvency 1 environment, SCR was only taking underwriting risks into account life and non-life businesses. The Solvency 2 environment requires to include all the risk that are borne by the insurance company: life underwriting, non-life underwriting, health underwriting, default of a counterpart, market.

1. Total SCR

Compared to Solvency1, the additional risks in the Solvency 2 framework might have had a negative impact on the ratio but a total SCR is not, in this environment, a simple sum of all the risks.

As all the risks are correlated to each other, the SCR formula is the following one:

$$SCR = \sqrt{\sum_{i=1}^5 corr(i, j). SCR_i . SCR_j}$$

where:

$i = 1$ for default risk

$i = 2$ for market risk

$i = 3$ for life underwriting risk

$i = 4$ for health underwriting risk

$i = 5$ for non-life underwriting risk

Such a formula corresponds to the basic SCR.

It does not include the operational risk which is added to it. This operational risk includes legal risk but does not include risks implied by strategic decisions and reputational risks

The correlation coefficients are given by the following table:

	Market	Default	Life	Health	Non-life
Market	1	0,25	0,25	0,25	0,25
Default	0,25	1	0,25	0,25	0,25
Life	0,25	0,25	1	0,25	0
Health	0,25	0,25	0,25	1	0
Non-Life	0,25	0,25	0	0	1

Unsurprisingly, the correlation coefficient of a risk with itself is equal to 1 and that of life underwriting or health underwriting and non-life underwriting is equal to 0.

Assuming a company has only 2 risks: life and non-life; the its SCR is equal to:

$$= \sqrt{corr(L, L)SCR_L . SCR_L + corr(L, NL)SCR_L . SCR_{NL} + corr(NL, L)SCR_{NL} . SCR_L + corr(NL, NL)SCR_{NL} . SCR_{NL}}$$

As: $corr(L, L) = corr(NL, NL) = 1, corr(L, NL) = corr(NL, L) = 0$:

$$SCR = \sqrt{SCR_L^2 + SCR_{NL}^2} \leq \sqrt{SCR_L^2 + 2SCR_L . SCR_{NL} + SCR_{NL}^2} = \sqrt{(SCR_L + SCR_{NL})^2}$$

$$SCR = \sqrt{SCR_L^2 + SCR_{NL}^2} \leq SCR_L + SCR_{NL}$$

This formula has 2 obvious consequences:

- For an insurance company with 2 uncorrelated risks, the Solvency 2 environment is more favourable than the Solvency 1 environment, assuming there is no other risk, which highly theoretical as the investment of the premiums paid by the policy holders generates a default risk and a market risk
- There is a regulatory incentive for an insurance (or a reinsurance) company to diversify its risks between life and non-life underwriting.

In order to illustrate the formula, the following example presents the detailed calculation of benefits of diversification for an insurance company with the following risks:

Market	100
Default	200
Life	300
Health	400
Non-Life	500

The following tables enable to calculate the SCR in the Solvency 2 environment in order to get, eventually the benefits of diversification:

	Market	Default	Life	Health	Non-life
Market	1	0,25	0,25	0,25	0,25
Default	0,25	1	0,25	0,25	0,25
Life	0,25	0,25	1	0,25	0
Health	0,25	0,25	0,25	1	0
Non-Life	0,25	0,25	0	0	1
	Market	Default	Life	Health	Non-life
Market	100	200	300	400	500
Default	200				
Life	300				
Health	400				
Non-Life	500				
$corr(i, j). SCR_i. SCR_j$	Market	Default	Life	Health	Non-life
Market	10 000	5 000	7 500	10 000	12 500
Default	5 000	40 000	15 000	20 000	25 000
Life	7 500	15 000	90 000	30 000	0
Health	10 000	20 000	30 000	160 000	0
Non-Life	12 500	25 000	0	0	250 000
Total	800 000	$= \sum_{i=1}^5 corr(i, j). SCR_i. SCR_j$			
SCR					
Without benefits of diversification		1 500			
With benefits of diversification		894	= squared root of:		800 000
Benefits of diversification		606			
Presentation in an insurance company's solvency report:					
SCR Market		100			
SCR Default		200			
SCR Life		300			
SCR Health		400			
SCR Non-Life		500			
Benefits of diversification		-606			
Total SCR		894			

Inside each segment of risk, SCR is calculated taking the possible risks and their correlation coefficients into account.

2. SCR for non-life underwriting

$$SCR = \sqrt{\sum_{i=1}^3 corr(i, j). SCR_i . SCR_j}$$

where:

$i = 1$ for Premiums and reserve in non-life

$i = 2$ for Catastrophe in non-life

$i = 3$ for Lapse in non-life

and the following coefficients of correlation:

	Premium and reserve	Catastrophe	Lapse
Premium and reserve	1	0,25	0
Catastrophe	0,25	1	0
Lapse	0	0	1

3. SCR for life underwriting:

$$SCR = \sqrt{\sum_{i=1}^7 corr(i, j). SCR_i . SCR_j}$$

where:

$i = 1$ for Mortality

$i = 2$ for Longevity

$i = 3$ for Invalidity

$i = 4$ for Expenses in life

$i = 5$ for Revision

$i = 6$ for Lapse

$i = 7$ for Catastrophe in life

and the following coefficients of correlation:

	Mortality	Longevity	Invalidity	Expenses in life	Revision	Lapse	Catastrophe in life
Mortality	1	-0,25	0,25	0,25	0	0	0,25
Longevity	-0,25	1	0	0,25	0,25	0,25	0
Invalidity	0,25	0	1	0,5	0	0	0,25
Expenses in life	0,25	0,25	0,5	1	0,5	0,5	0,25
Revision	0	0,25	0	0,5	1	0	0
Lapse	0	0,25	0	0,5	0	1	0,25
Catastrophe in life	0,25	0	0,25	0,25	0	0,25	1