Swedbank

Aggregation of capital requirements in Solvency II standard formula

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Magnus Carlehed, Head of Risk,
Swedbank Group Savings

Swedbank

- Retail bank
  - Four home markets (Sweden, Estonia, Latvia, Lithuania)
  - 7.2 million private customers, 0.6 million corporate customers
  - 13 900 employees
  - Also has asset management and insurance companies as subsidaries
- Swedbank’s insurance business
  - Swedbank Försäkring AB, Life insurance, Sweden, AUM 170bn SEK
  - Swedbank Life Insurance SE, Baltics, AUM 5bn SEK
  - Swedbank P&C Insurance SA, Non-Life Insurance, Baltics

Solvency Capital Requirement (SCR)

Solvency II: The three pillars

Pillar I – Solvency Capital Requirements (SCR)
Pillar 2 – Governance
Pillar 3 – Reporting

Solvency II

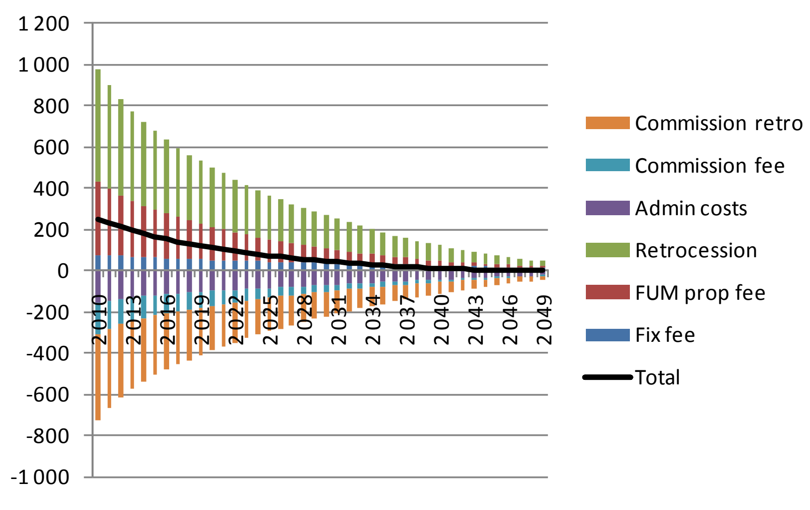
Pillar I
Solvency Capital Requirements
- Minimal Capital Requirements (MCR)
- Solvency Capital Requirements (SCR)
- Standard model or Internal model
- Capital structure
- Mark to market/model

Pillar II
Governance and Risk Management
- System for:
  - Governance
  - Risk Management
  - Internal Control
- Own Risk and Solvency Assessment

Pillar III
External and Internal Reporting
- IT-system support
- Data Quality
- Reporting structure and procedures

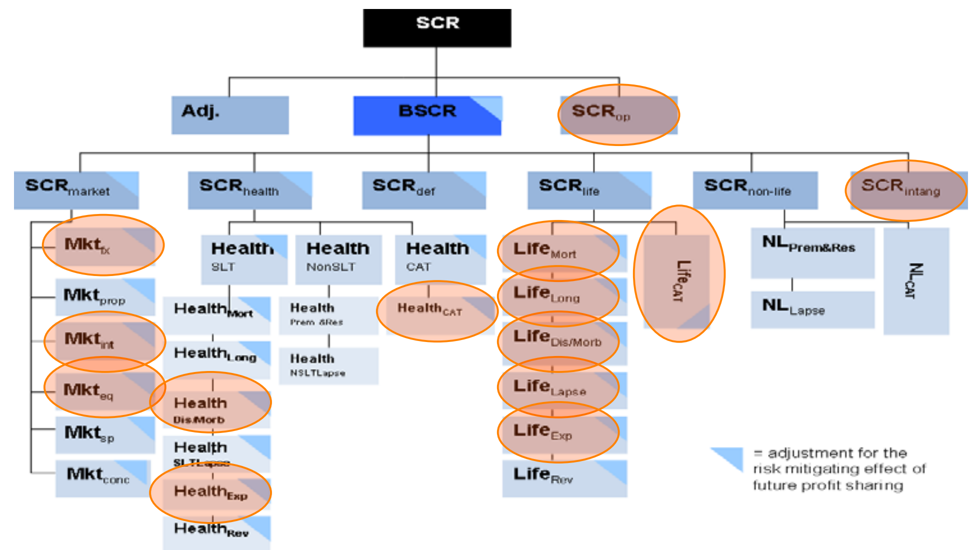
Identify risk exposures (example from life insurance)

Identifying risk exposure to future profits



- Future cash flows are exposed to a number of risks that, if crystallized, may have an adverse affect on Own Funds.

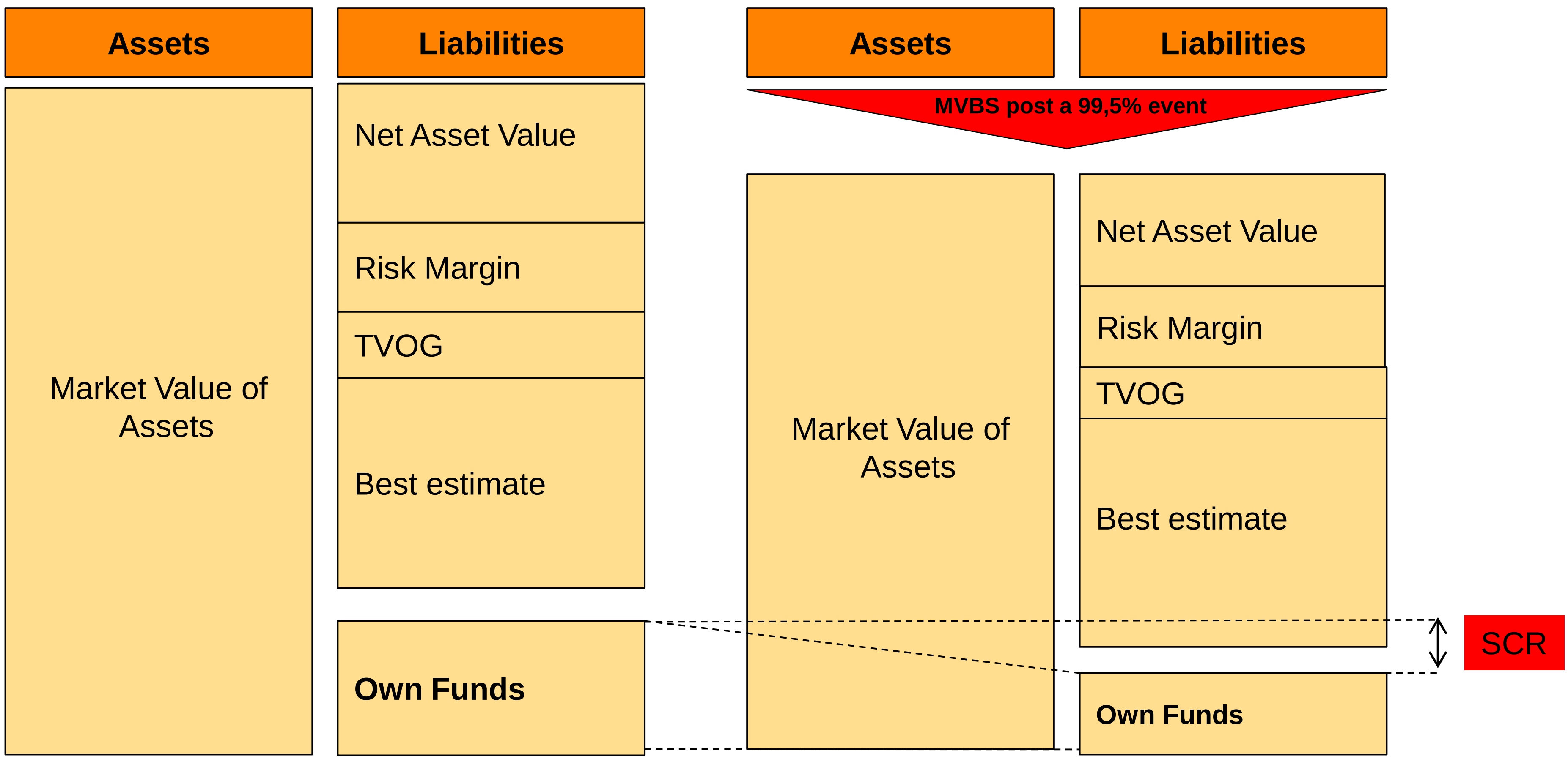
SII risk taxonomy



- The main exposures applicable to SFAB business is highlighted above

Shocking Market Valued Balance Sheet (MVBS)

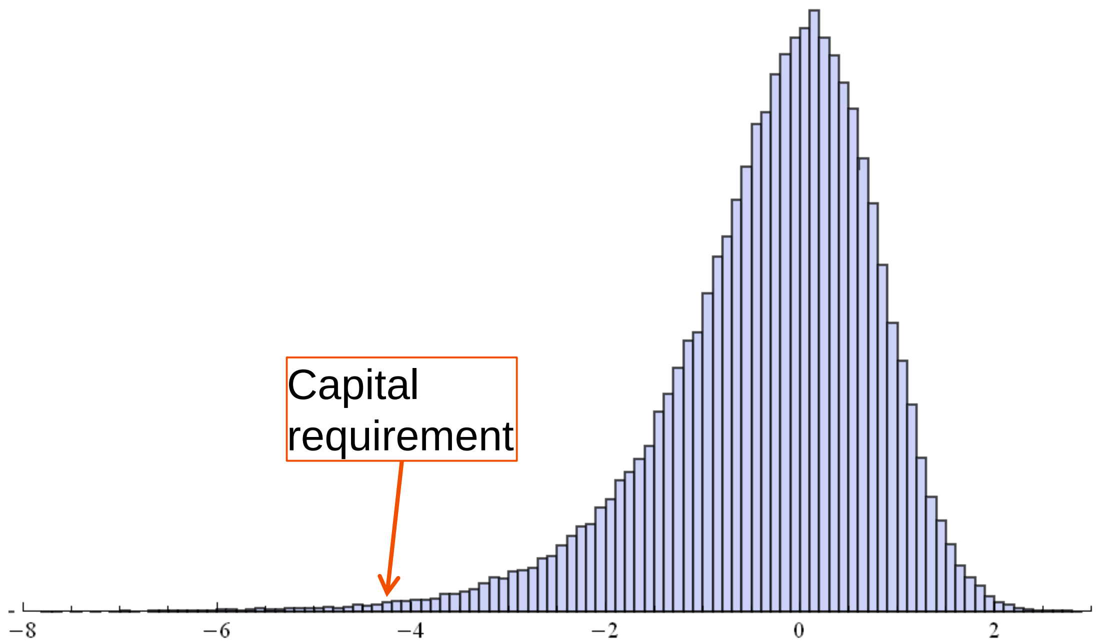
- VAR approach calibrated to a 99,5% confidence level



Solvency Capital Requirements Aggregation

Two risk factors

- In all examples we will look at two risk types *X* and *Y*, e.g. Equity and Lapse
- In principle, the correct capital requirement is the 99.5% quantile of the value distribution, when we simulate both *X* and *Y* simultaneously → difficult



The standard formula is a simplification (1)

In the Standard Formula, we stress one risk factor at the time, by a prescribed stress.

X	*Y*	Value *f(X,Y)*	Capital requirement
0	0	0	N/A
q_X = -0.5	0	-75	C_X = 75
0	q_Y = -0.3	-300	C_Y = 300

- $C_X = -f(q_X, 0)$, $C_Y = -f(0, q_Y)$, where q_X and q_Y are quantiles of *X* and *Y*, and *f* is the "value function".
- The value function *f* describes how the value of our portfolio varies with *X* and *Y*, and is obviously very important for the outcome

The standard formula is a simplification (2)

In the Standard Formula, we then aggregate the individual capital requirements C_X and C_Y using a prescribed “correlation” α.

- $SCR = SCR(\alpha) := \sqrt{C_X^2 + 2\alpha C_X\, C_Y\ + C_X^2}$

Example: Two risks, each with a capital requirement of 100

α	Capital requirement (SCR)
1.0	200
0.75	187
0.5	173
0.25	158
0	141
- 0.25	122

- What is the correct α?
  - That depends on f, but also on the underlying joint distribution of X and Y.
- What is a prudent α?
  - For Life Risks and Market Risks, Solvency II has α=0.25.

Everything is normal…

- Solvency II does not assume any specific joint distribution for the risk factors.
- We will assume bivariate normal distribution of X and Y, with mean 0, variance 1 and correlation ρ.
- The theme of my work is:

> Given ρ, if we want SCR(α) to equal the correct capital requirement (from the joint distribution), how shall we choose α?

- Naive conclusion: $\alpha = \rho$

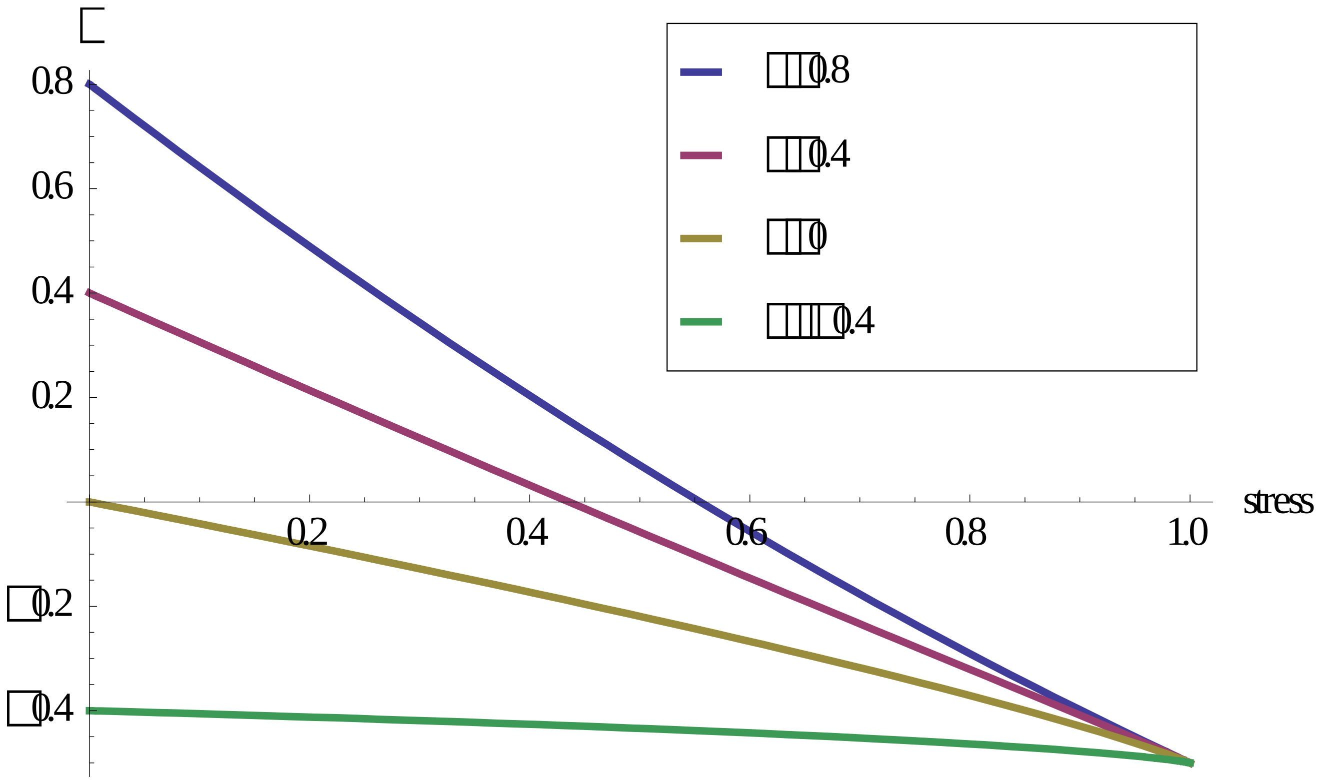
Special case:
The “volume dependent” situation in a life portfolio

Volume dependent case in life insurance

- A portfolio of unit-linked contracts. The company receives fees that are proportional to the Assets Under Management (AUM).
- After expenses, this gives rise to a number of cash flows that are discounted to today with a (hopefully) positive net sum = Own Funds (OF). Statically, the Own Funds are approximately proportional to AUM.
- Losing AUM "over-night", due to e.g. mass lapse or equity crash, means losing OF overnight in a proportional way.

Surprisingly, if the stresses are not too small, the correct α is negative, even for highly positive ρ.
"A lapsed portfolio can't crash."

Plot of how α depends on the stress and on ρ



1. Small stress and high correlation gives positive α.
2. Large stress gives negative α.
3. Zero or negative correlation gives negative α, regardless of stress.

Case study: Three portfolios in a life insurance company

Three portfolios of a life insurance company

- P1, unit-linked
- P2 and P3, guarantees
- Equity stress: Full stress of EQ Type 1 as -39% (no stress of Type 2 or Fixed Income instruments). Half stress -19.5%.
- Lapse: Full stress: Mass lapse, 40%. Half stress 20%.

Risk matrices (a small number of simultaneous stresses for each portfolio)

$P1$	0	$\frac{1}{2}$	1
0	0	946	1893
$\frac{1}{2}$	823	1593	2364
1	1647	2240	2835

$P3$	0	$\frac{1}{2}$	1
0	0	66	143
$\frac{1}{2}$	92	147	210
1	185	228	285

Individual capital requirements

$P2$	0	$\frac{1}{2}$	1
0	0	29	60
$\frac{1}{2}$	25	48	74
1	58	68	91

Rows = Lapse
Columns = EQ
(Each cell requires a large stochastic simulation)

Simulation approach ("internal model")

- Distribution assumptions:
  - EQ: Student-t distributed
  - Lapse: another heavy-tailed distribution
  - Independence between EQ and Lapse
- Draw a large number of scenarios (EQ,Lapse) from the assumed distribution.
- Use the risk matrices to calculate the value (OF) of the portfolio given each scenario ("value response function")
- Find the correct quantile of the OF value changes, and compare with $SCR(\alpha)$; the latter is found analytically.
- Back out α.

Results and conclusion

	EQ	Lapse	Sum	Both	Standard Formula, $\alpha = 0.25$	Simulation, $\rho = 0$
P1	1893	1647	3540	2835	2802	2288
P2	60	58	118	91	87	72
P3	143	185	328	285	260	223

The found α are -0.19, -0.19, -0.12, for the three portfolios, respectively. Here ρ = 0. However, some analysis shows that we are in the area where α is negative for all ρ.

The prescribed α=0.25 is too large!

Thank you!

magnus.carlehed@swedbank.com