The Investment Implications of Solvency II

André van Vliet, Ortec Finance, Insurance Risk Management
Anthony Brown, FSA

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Outline

Introduction – Solvency II

- New European Solvency II regulation for insurance companies is expected around 2012 based on trends such as:
  - 1. Total balance sheet approach
  - 2. Economic (market) value
  - 3. Value at Risk (VaR) approach to determine capital requirements
  - 4. Wide range of risks
  - 5. Capital requirements based on a confidence level on a one year basis
  - 6. Standard versus internal models

- In the perspective of Solvency II (and the deficiencies of Solvency I), various countries developed additional reporting models such as:
  - Dutch Financieel ToetsingsKader (FTK)
  - Swedish Traffic-light model
  - Danish model
  - UK model (ICA)
  - Swiss Solvency Test (SST)

Introduction – Solvency II Principles

Risk based supervision:

- Policies containing more risk are 'punished' by an increase in the required capital.
- Broad consensus that this is the right direction.
- Fits nicely with concepts of Economic Capital.

Apart from all the technical issues in computing the QIS results, the definition of SCR is very compact.

Solvency Capital Requirement (SCR):

- With 99.5% certainty → seems OK
- Condition Surplus>0 → not very strong
- On a 1-year horizon → too myopic?

For strategic decision making one should play with these 3 ingredients.

Introduction – Strategic decision making

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Implementation of Solvency II

- We are able to compute SCR → Done
- But: "How does Solvency II change strategic decision making?"

The standard to meet

- Available capital > Solvency Capital Requirement
- This implies a Solvency Ratio > 100%

Are we happy with SR = 100%?

- What is the probability that one year later still SR >= 100%?
- Unless we have a very strong P&L, this probability is approx. 50%.

Introduction – Strategic decision making

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Actions when SR < 100%

- Do nothing
  - → Supervisor will require action
  - → Rating will suffer
- Reduce risks
  - → Sell stocks when they are low
  - → Hedge interest rate risk on low interest rates
  - → Buy reinsurance (lower retention) in stressful times
  - → Ask shareholders to supply extra capital
- **Both kind of alternatives are unattractive**

Therefore:

- The ALM policy should be robust
- The insurance company should minimize the risk that it is forced to change the chosen strategy.
- **What is a good target level for the SR?**

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  - Solvency II
  - Strategic Decision Making
- Impact of investment decisions
  - Solvency Testing
  - Strategic Asset Allocation
  - Alternative Investments
- Beyond the standard formula
- Dynamic Asset Allocation
  - Motivation
  - Implementation of the SAA
  - Risk budgeting example
  - Further improvements
- Wrap-up

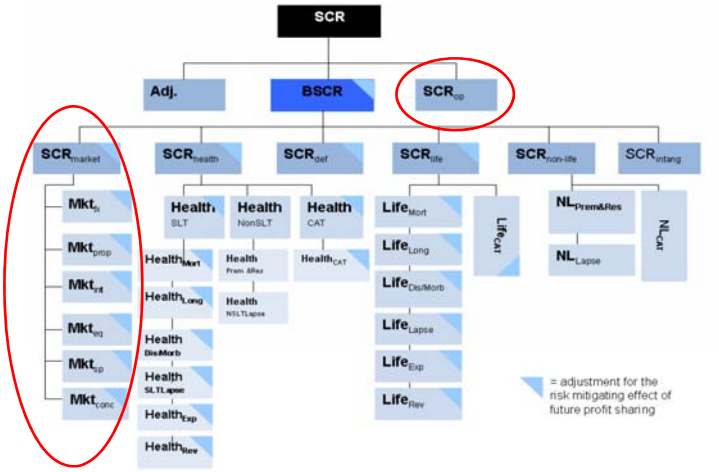
Case of Life Insurance Company – Balance sheet

- Consider the following (simplified) market-value balance sheet of an insurance company:

Activa		**Passiva**	
Investment portfolio	€ 266,629,000	Surplus	€ 75,894,000
		Traditional liabilities	
		1) Fixed cash flow product	€ 97,767,000
		2) Profit sharing product	€ 92,968,000
Total	**€ 266,629,000**	**Total**	**€ 266,629,000**

- Currently the investment portfolio is invested as follows:
  - Equity (50% Europe, 50% US) 30.0%
  - Fixed income (Gov. bonds Europe) 70.0%
- Initial Solvency I ratio: 364% (on book-value)
- Duration liabilities: 21
- Duration fixed income: 15 (duration of assets 10.5)
- No dividend payments

Case of Life Insurance Company – Solvency II capital



- In analysing investment decisions, the required capital for both the market risk and the operational risk is taken into account (other risks unchanged)

Solvency Testing – Results current policy

Solvency Testing	Current policy
Market value assets	€ 266,629,000
Market value liabilities	€ 190,735,000
Available capital (surplus) [1]	37.6%
Required capital (SCR)	28.5%
Operational risk	6.5%
BSCR	22.0%
- Interest rate risk	14.7%
- Equity risk (Global)	13.4%
- Equity risk (Other)	0.0%
- Credit risk	3.7%
- Currency risk	0.0%
- Property risk	0.0%
- Diversification benefit	-9.8%
Solvency ratio	132%

[1] All values are stated as a percentage of the market value of the liabilities.

- Solvency ratio lowered from 364% to 132%.
- Additional available capital is required to compensate for risk.
- Interest rate risk and equity risk dominate the required capital.
- NB: Can be completely different in other cases.

Solvency Testing – Impact of investment policy

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Behaviour of SCR

- The SCR is highly dependent on the choice of investment policy.
- How large is the impact of the investment policy?

Variations on the investment policy:

- **Asset allocation**: The percentage of equity in the investment portfolio will be varied according to the following scheme:
  0%, 10%, 20%, 30%, 40%
- **Duration of total assets**: The duration of total assets will be varied as follows: 5, 10, 15 , 20, 25

Solvency Testing – Solvency Required Capital

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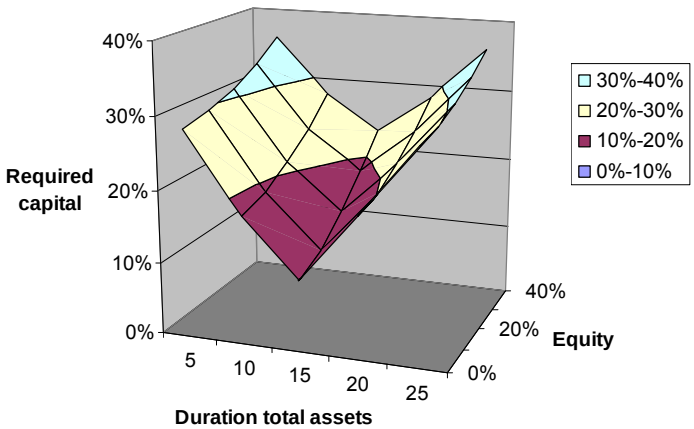
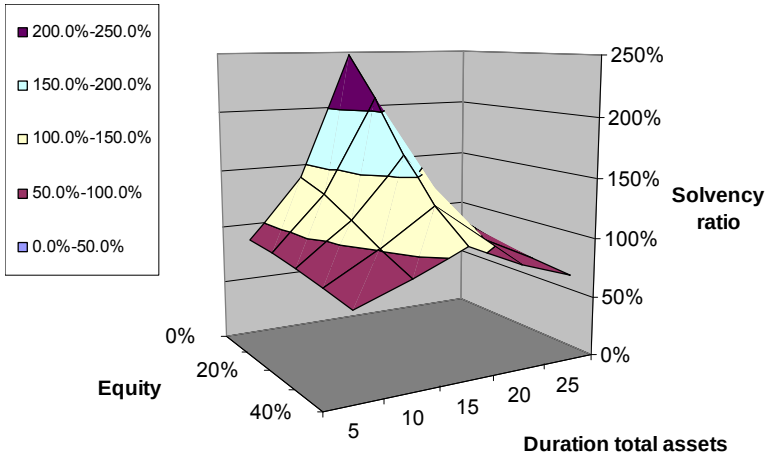


Lower required capital through:

(a) better matching of interest rate sensitivity; and/or

(b) less equity

Solvency Testing – Solvency Ratio



Impact of the investment decision:

- **Huge!!**

Solvency Testing – Observations

Better matching of assets and liabilities is rewarded

- Through a lower required capital.
- Optimal duration of total assets: approx. 15.
- Should we reduce equity to 0%?

Short term view : Yes

- Straightforward optimization of SR

Long term view : No

- Further matching will also reduce the expected return.
- An optimal **multi-period risk-return tradeoff** is required to determine the optimal strategic policy.
  → "Dynamic solvency testing"

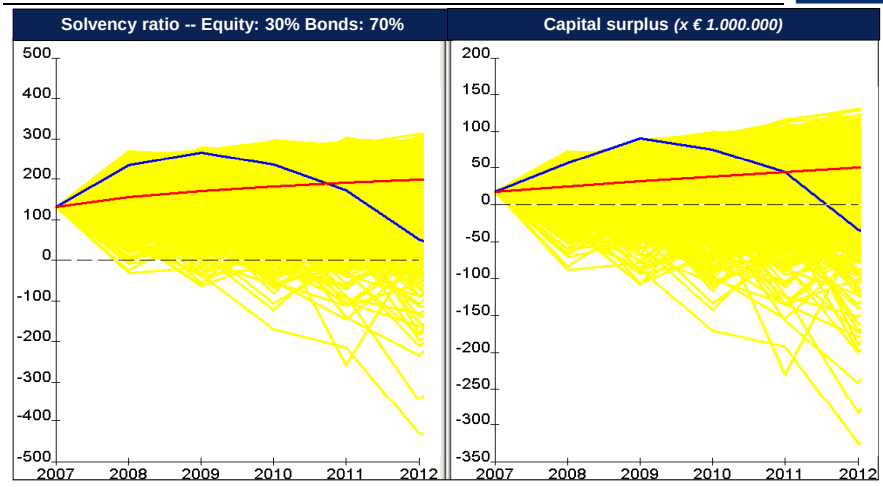
Dynamic Solvency Testing – Evaluation of Policy effects

- Calculate risk and return of
  - Current policy
  - Others asset allocations (% equity)
  - Alternative investments (Hedge Funds)

- Monte Carlo simulation context
  - 2000 real world economic scenarios with a horizon of 5 years
  - Going concern: including new business, taxes, etc…
  - Solvency I : SR = 100% * Available capital / WSM
  - Solvency II : SR = 100% * Available capital / SCR

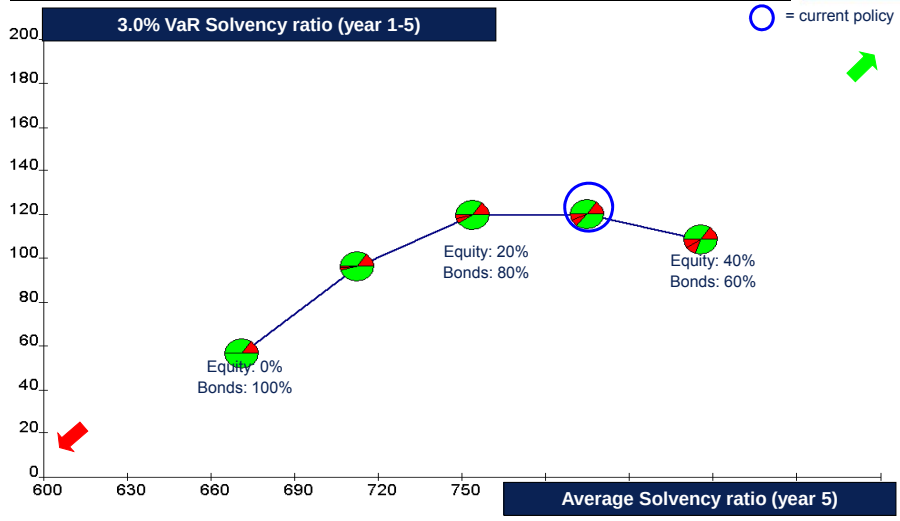
- How to evaluate?
  - Risk measure : 3% Value-at-Risk of Solvency Ratio
  - Return measure : Expected Solvency Ratio at the end of year 5

Dynamic Solvency Testing – Example for Solvency II



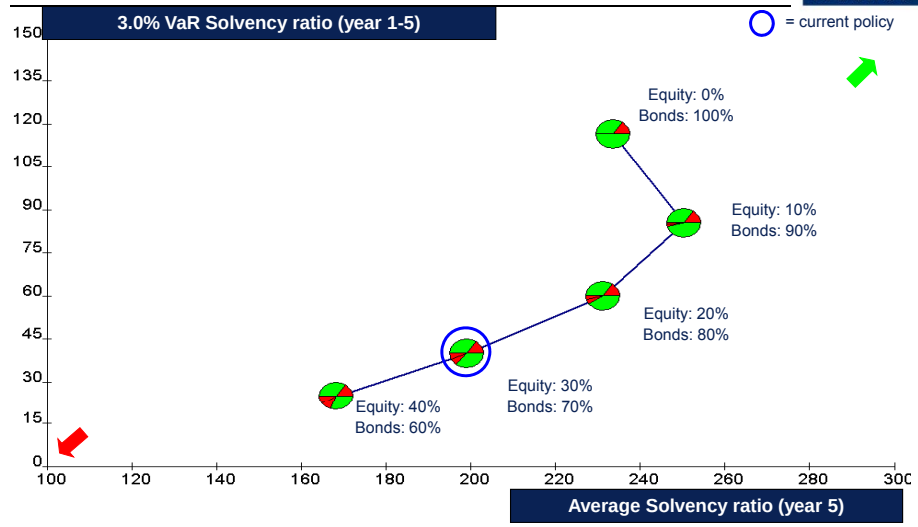
- Figure to the left : development over time of the solvency ratio given the Solvency II framework.
- Figure to the right : **capital surplus** is defined as the difference between available capital and required capital.

Other Asset Allocations – under Solvency I



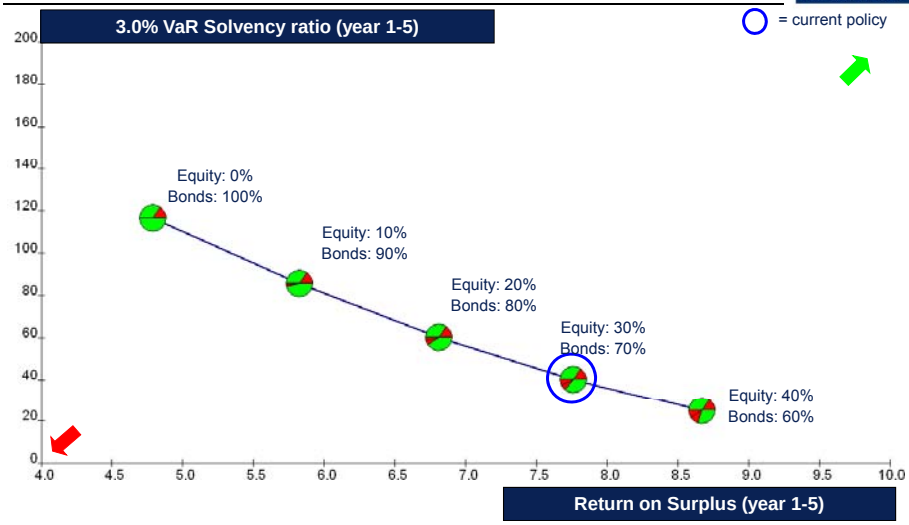
Typical risk-return trade-off

Other Asset Allocations – under Solvency II



- More equity results in a higher SCR and therefore more risk.
- Average SR decreases when equity increases above 10%, in spite of the higher asset return.
- **Average SR is not such a good return measure.**

Other Asset Allocations – under Solvency II



- More equity results in a higher SCR and therefore more risk.
- More equity results in a higher Return on Surplus

Alternative investments

Solvency I framework:

- Addition of alternative investments (e.g. Hedge Funds) to the asset allocation leads to an improvement in both risk and return of the investment portfolio.

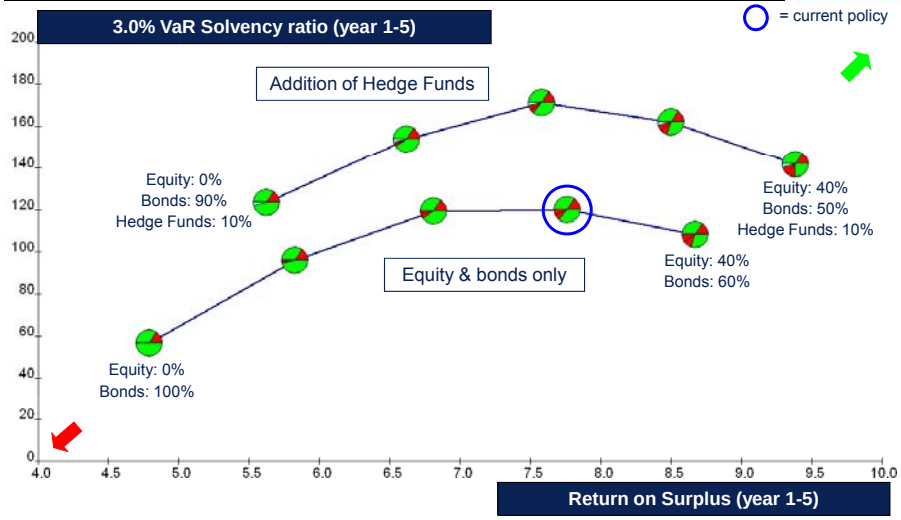
Solvency II framework:

- Risks are reduced by excluding alternative investments from the investment portfolio.
- Loss of possible additional return of the portfolio is offset by reduction of the required capital.

This effect is due to the following trade-off:

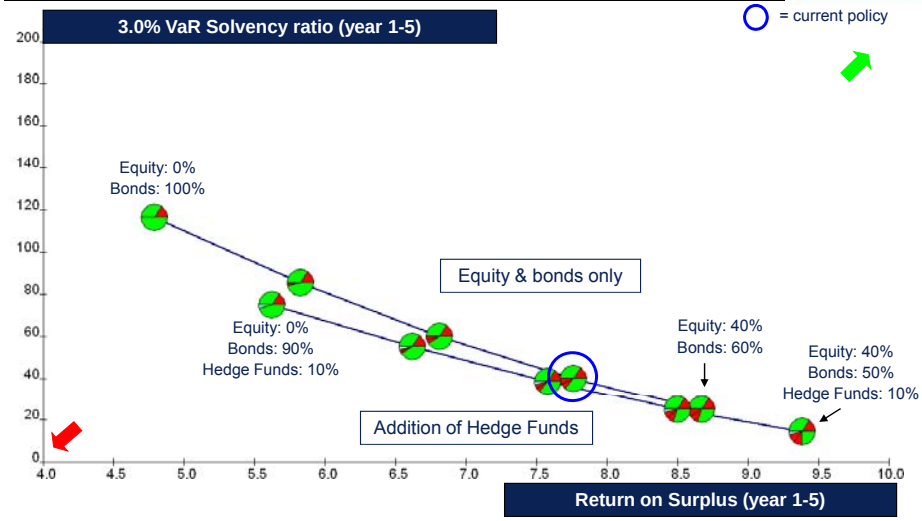
	Hedge Funds	Equity (mature markets)
Return/Risk (ALM)	μ: 7.0% σ: 8.4%	μ: 8.25% σ: 20.1%
Solvency Requirement	45%	32%

Alternative investments – under Solvency I



- In the Solvency I framework, expanding the asset allocation with Hedge Funds increases return and reduces risk.
- Due to: (a) Favourable characteristics of Hedge Funds in comparison to equity and (b) Diversification benefits.

Alternative investments – under Solvency II



- In spite of the favourable characteristics, adding Hedge Funds to the investment portfolio has a negative impact on the risk profile.

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Beyond The Standard Formula: Internal Models

What sort of suit is your model??

M&S

Beyond The Standard Formula: Internal Models

- Internal models should bring economic capital and regulatory capital into closer alignment.
- SCR may be higher or lower than under standard formula.
- FSA do not see full benchmarking to standard formula as appropriate
- 100 firms in the UK are considering internal models
- Risk metric: Equivalent but not identical

Beyond The Standard Formula: Pillar V

Pillar II: Governance + Pillar III: Disclosure = Pillar V

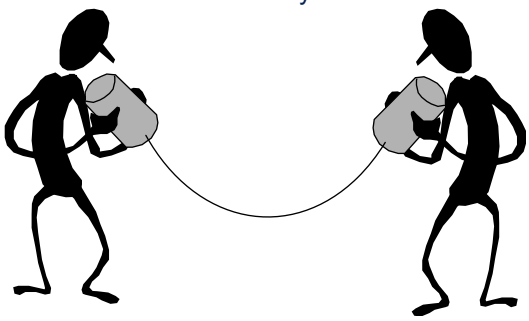
Pillar V introduces a number of considerations:

- Prudent person principle (don't forget ALM)
- Own Risk and Solvency Assessment (ORSA)
- Extension of the recovery period
- Target solvency ratio: is 100% enough?

Beyond The Standard Formula: Communicating

The people we communicate to are incredibly important

- Solvency Ratios: Take care in comparing
- Holding assets to match liabilities: Very important
- Prudent Person: Match liabilities
  Invest sensibly otherwise



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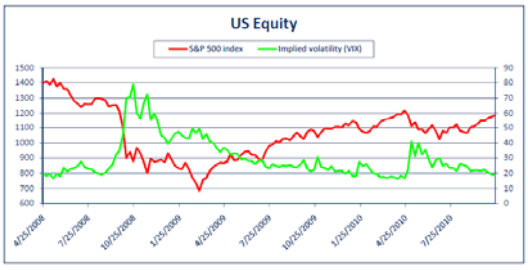
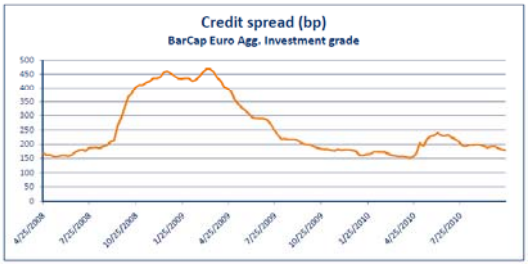
Motivation for dynamic strategies

- Restrictions on “risk budget“
  - limit on funding ratio of pension fund
  - Limit on solvency ratio of insurance company
- Changes in cash flows of liabilities
- Markets may be over/under-valued
  - Mean reversion
    (however, this presentation is **not** about TAA)
- Changing risk environment
  - Volatilities are not constant

Motivation : changing risk environment

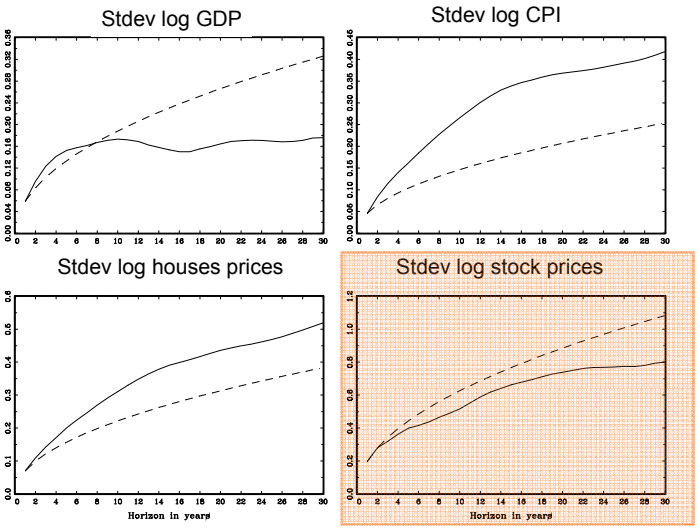


- Volatility is not constant ... but typically increases when stock prices go down



- Credit spread (the perceived risk of credit bonds) is not constant either
- Mean reversion in credit spreads

Motivation : mean-reversion



- Term structures of volatilities, US 1900-2009 (cumulative log returns)
- Volatilities increase with investment horizon, but typically not following a simple random walk (dotted line)

Implementation of SAA – Introduction

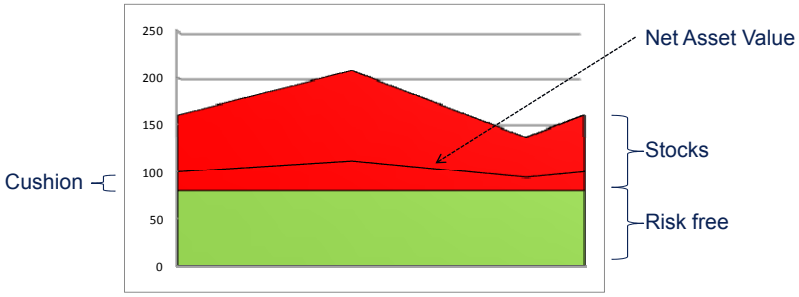
- The Strategic Asset Allocation (SAA) is an important output of many ALM studies
  - Anchor for asset allocation in the coming years (“target allocation”)
  - Question : how static or dynamic do we implement the strategic asset allocation? (apart from a TAA strategy that may be present)
- Different ways for implementing the SAA
  1. Static approach
  2. Buy-and-hold approach
  3. SAA only on the return portfolio (liabilities matched)
  4. Risk budgeting approach (similar to Economic Capital / Solvency II)
- We will zoom in on the 4th : the risk budgeting approach

Implementation of SAA – Risk budgeting approach

- Take market risk dynamically, based on the ability to bear risks
- Example:
  - Satisfy market risk budget from Economic Capital models
  - Increase/decrease market risk in order to keep Solvency II ratio high enough
- Pro:
  - Optimization of return within explicit risk constraints
  - Optimal (maximal) usage of available capital
- Con:
  - Risk of buying high and selling low
  - Big changes in portfolio can be needed
- Similarities with CPPI?
  - Remember the 1987 krach

Implementation of SAA – CPPI Example

- Constant Proportion Portfolio Insurance (CPPI)
- Dynamic trading strategy that provides a minimum capital guarantee (at the end).
  - Minimum end capital guaranteed by zero-coupon bond
  - The *cushion* (net asset value -/- zero coupon bond) is invested in risky assets
  - Leveraged with a multiplier (typically 4 to 5), depending on the assumed crash size (typically 20% to 25%) that is insured against.



- Risk budget is always fully used.
- Strong pro-cyclical effects.

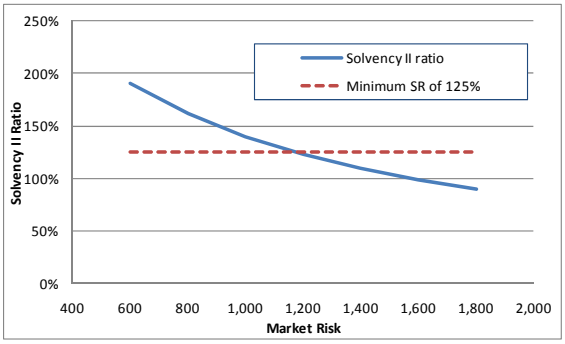
Risk Budgeting Example

- All risks have to be taken into account
  - SCR often dominated by insurance risk and (financial) market risk
  - Investment decisions can change the solvency II ratio instantaneously
- New solvency regulation will impact how much insurance companies can invest in risky assets
  - (dynamic) asset allocations have to satisfy solvency constraints.
- Example:

Available Capital (own funds)	**1,400**
Market risk	1,000
Insurance risk	547
Diversification	-237
Operational risk	34
Tax Adjustment	-343
Solvency Capital Requirement	**1,002**
Solvency II ratio	**140%**

Risk Budgeting Example – Impact of asset allocation

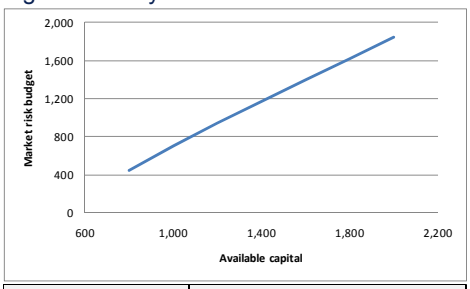
- A higher budget for market risk (the asset allocation decision), lowers the Solvency II ratio



- Minimum solvency ratio can be required for rating purposes
  - Approximately 125% required for single-A rating
- "Greedy" strategy for dynamic asset allocation:
  - Allocate budget for market risk such that current solvency ratio equals 125%.

Risk Budgeting Example – dynamic market risk budget

- Relation between available capital and market risk budget, assuming a target Solvency II ratio of 125%



Available Capital	800	1,000	1,200	1,400	1,600	1,800	2,000
Market Risk Budget	443	699	939	1,170	1,397	1,621	1,843
Corresponding Equity exposure	*1,135*	*1,793*	*2,407*	*3,000*	*3,582*	*4,156*	*4,725*

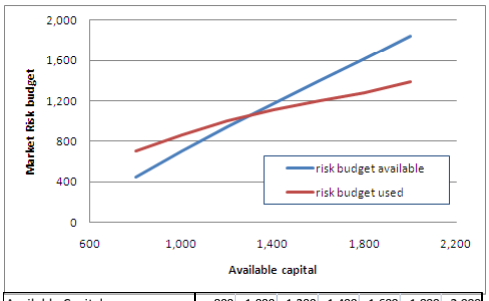
- For this greedy strategy, the Market Risk Budget is very sensitive to Available Capital
- When market risk is solely allocated to equity (risk charge 39%), then 1 euro decrease in available capital will result in a decrease of 3 euro invested in equity → This looks pretty much like CPPI

Risk Budgeting Example – a less dynamic strategy

- This greedy strategy can be regarded as “too dynamic”
  - Huge adjustments in asset allocation required. Can this be done quick enough?
  - Low liquidity of credits and real estate may result in additional losses.
  - De-risking at low market prices is something you typically want to avoid.
- In high solvency situations the investment results will be dominating the insurance results
  - The insurance company has become an investment company
  - Perhaps better pay excess capital as dividend to the shareholders
- In low solvency situations the investment returns may be too low, which makes it difficult to recover to a better solvency situation.
  - Solution: prevent low solvency situations by taking less risk in the high solvency situation.
  - This boils down to leaving part of the market risk budget unused in high solvency situations

Risk Budgeting Example – a less dynamic strategy

- At high solvency positions, not the full available market risk budget is used
- At low solvency positions, more than the available market risk budget is used, thus accepting a solvency ratio below the target of 125%.



Available Capital	800	1,000	1,200	1,400	1,600	1,800	2,000
Market Risk Budget Available	443	699	939	1,170	1,397	1,621	1,843
Market Risk Budget Used	699	863	997	1,108	1,202	1,283	1,391
Solvency II ratio	100%	110%	120%	130%	140%	150%	160%

- This "semi-dynamic" strategy more than halves the changes in the asset allocation that need to be made
  - Part of the required change may already be realized by changes in market prices
- Can be implemented without the drawbacks of the greedy strategy.

Further improvements – are the risk charges constant?

- **Equity dampener** in Solvency II
  - Base risk charge for global equity of 39%
  - Risk charge is increased by at most +10% after increase in equity prices
  - Risk charge is decreased by at most -10% after decrease in equity prices
  - (based on current price compared to average price in preceding 3 years)
  - This reduces the impact of equity prices on equity exposure allowed → reduction of pro-cyclical effects of Solvency II
- Economic Capital models (or internal model approach)
  - Fall in equity prices often results in higher implied volatilities
  - Double whammy
    - Lower available capital
    - Higher risk charges
  - High impact of equity prices on equity exposure allowed → stronger pro-cyclical effects when taking into account higher implied volatilities.
  - Suggested approach
  - In an internal model approach, both dynamic volatility and mean reversion can (should) be addressed in the economic scenarios that are used
- And don't forget the counter-cyclical **liquidity premium** and **Pillar V**

Further improvements – forward looking arguments

- In the risk budgeting approach sofar, the changes in the asset allocation have been motivated by changes in the available capital.
  - This is a rather backward looking principle.
- However, there is structure (e.g. business cycles) in economic time series that can be exploited in the economic scenarios for risk monitoring and dynamic asset allocation.
  - It is possible to value markets or understand dislocations.
  - Risk is not static, i.e. yesterday‘s tail is not tomorrow‘s tail.
  - The history does repeat itself, although imperfectly.
- Suggested (forward looking) approach
  - Periodically update the Economic Scenarios used
  - Incorporate current market conditions (e.g. volatilities, forward curves)
  - Model business cycle behaviour (e.g. financial markets that are out of equilibrium).
  - Apply the economic scenarios in an internal model approach for ECAP / Solvency II calculations.

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Wrap-up

- The required capital (SCR) can be volatile under Solvency II. We can change the SCR with our investment decisions.
- The attractiveness of asset categories will change, when going from Solvency I to Solvency II.
- As the risk-return pictures are changing, we have to rethink our risk limits and our return objectives.
- Insurance companies will have to take into account solvency II constraints on their asset allocation.
- A dynamic asset allocation strategy that uses the total available market risk budget, will result in too aggressive changes in the investment portfolio.
- The proposed approach is to let part of the available risk budget unused in high solvency situations, thus reducing the probability of arriving in low solvency situations.
- The risk budgeting approach can be further developed into dynamic ALM that is periodically applied.