Maximizing the Return on Risk-Adjusted Capital: A Performance Perspective Under Solvency II

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August 2015
Overview – Research Question & Procedure

Research Question

- How does Solvency II influence asset management decisions?
- Which influences have the Solvency II capital requirements on the common performance measure “Return on Risk-Adjusted Capital (RoRAC)”?

Procedure

1. Starting Point: Construction of a large number of asset portfolios
2. Calculation of the associated capital charges under the Standard Formula
3. Calculation of the insurer’s profit and the resulting RoRAC
# Empirical Data

## Three asset classes

- Discrete returns for 25-year period from 07/1990 until 12/2014

<table>
<thead>
<tr>
<th>Stocks</th>
<th>• EURO STOXX 50 Total Return Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Bonds</td>
<td>• German Stock Exchange REX Performance Index (REXP)</td>
</tr>
<tr>
<td>Real Estate</td>
<td>• Real Estate “Grundbesitz” Europa Fund (adjusted for dividends)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stocks</th>
<th>Expected Return (percent): 8.67</th>
<th>Standard Deviation (percent): 18.48</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Estate</td>
<td>Expected Return (percent): 5.03</td>
<td>Standard Deviation (percent): 1.67</td>
</tr>
</tbody>
</table>
Investment Limits under the German Investment Regulation (AnlV)

*Investment Limits:
- Stocks: 20%
- Government Bonds: none
- Real Estate: 25%
Construction of Asset Portfolios (1/2)

Criteria

- Budget Constraint (portfolio)
- Short-Sale Constraints (asset class)
- Investment Limits Constraint according to AnIV (asset class)

Procedure

- Discrete increment of 0.1 percent (fixed)
- Open up tree with government bonds
- Insert stocks and real estate sub-portfolios
Construction of Asset Portfolios (2/2)

<table>
<thead>
<tr>
<th>Government Bonds</th>
<th>Stocks</th>
<th>Real Estate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
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<tr>
<td>0.001</td>
<td>0.001</td>
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<tr>
<td>⋮</td>
<td>⋮</td>
<td>⋮</td>
</tr>
<tr>
<td>1.000</td>
<td>0.200</td>
<td>0.250</td>
</tr>
</tbody>
</table>

- Max. # of possible combinations: 50,501,451 portfolios
- Reduce matrix to fulfill the budget constraint
- Final # of portfolios: 50,451
Portfolios in Mean-Variance Space
Overview – Solvency II

- Solvency II (01/2016) as new regulatory framework for European insurers:
  - Protection of the policyholders
  - Uniform standards within European insurance landscape
  - Uniform supervisory practice in Europe
- Three-Pillar approach (as Basel II)
- “Two level approach”
  - Definition of minimum capital requirement
  - Definition of Solvency capital requirement (standard formula)
Solvency II Standard Formula – Market Risk Module

- Divided into modules (market, health, default, life, non-life, intangibles)
- Market risk accounts for approx. 70 percent of life insurer’s capital charges (Fitch, 2011)
- Market risk divided into seven sub-modules: interest rate, equity, property, spread, currency, concentration, illiquidity

**Interest Rate Risk**

**Equity**

**Property**

- In respect to the modelling setup of the standard model, please cf. the paper version
Simplified Insurance Company (1/2)

Assets

Aggregated portfolio return: \[ \tilde{r}_p = (w_1, w_2, w_3) \begin{pmatrix} \tilde{r}_1 \\ \tilde{r}_2 \\ \tilde{r}_3 \end{pmatrix} = \mathbf{w}' \mathbf{R} \]

Assets at the end of the period: \[ \tilde{A}_1 = A_0 \cdot (1 + \tilde{r}_p) \]

Liabilities

Liabilities at the end of the period: \[ \tilde{L}_1 = L_0 \cdot (1 + \tilde{r}_l) \]
Simplified Insurance Company (2/2)

Equity Capital

Equity capital at the end of the period: \[ \overline{EC}_1 = (\bar{A}_1 - \bar{L}_1, 0)^+ \]

Profit

Change in the equity capital:
\[
\tilde{P} = \overline{EC}_1 - EC_0 \\
= \bar{A}_1 - \bar{L}_1 - (A_0 - L_0) \\
= A_0 \cdot \tilde{r}_p - L_0 \cdot \hat{r}_l \\
= (\overline{EC}_1 - EC_0, -EC_0)^+ 
\]

- Balance sheet total: **EUR 10 bn**, equity: **12 percent**, \( D_L: 10 \), \( \hat{r}_l: 1.75 \) percent
Risk-Adjusted Performance Measurement

- Business activities associated with risks
- ROE as well as ROI, however, based on book values
- The higher the risk of a business activity, the higher the SCR as demanded by Solvency II
- Return on Risk-Adjusted Capital (RoRAC) defined as:

\[
RoRAC = \frac{E(\tilde{P})}{SCR_0}
\]

- Insurer can influence the RoRAC by changing the asset allocation
- Process:

  Asset-Portfolio  ➙ insert in standard model  ➙ calculate SCR, E(P) and RoRAC

(for all 50,451 portfolios)
Results (1/6) – Expected Profit vs. Standard Deviation

![Graph showing expected profit vs. standard deviation](image-url)
Results (2/6) – SCR vs. Standard Deviation
Results (3/6) – RoRAC vs. Expected Profit
Results (4/6) RoRAC vs. SCR
Results (5/6) – RoRAC vs. Standard Deviation
Results (6/6) – RoRAC vs. Standard Deviation vs. Expected Return
Preliminary Conclusion

- Profit-maximizing portfolio does not result in the maximum RoRAC
- Portfolio with the lowest SCR achieves the highest RoRAC
- Diversified portfolios lead to low RoRAC figures => SCR as main driver of the RoRAC (increased systemic risk?)

Next steps in the paper (to do’s)

- Extend the # of asset classes in the portfolio to six and run different scenarios (time horizon)
- More detailed analyses of the portfolios: Compare the optimal RoRAC in the standard model with an internal model given $\varepsilon = 0.5\%$

=> What are differences in RoRAC and in the portfolio structure / level of SCR?