Institute of Insurance Economics

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Minimum Standards for Investment Performance: A New Perspective on Non-Life Insurer Solvency

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Outline

1. Introduction

- New RBC standards in the EU (Solvency II):

- Minimum Capital Requirements (MCR)

- Target Capital Requirements (TCR), derived via a standard model or an internal model

- Proposal for a standard model

- New perspective: Instead of deriving a certain amount of capital, minimum standards for the investment performance are obtained ("solvency line")

- Literature

2. Model Framework

- $U_1 = A_1 - L_1 = A_0 \cdot R - L_1 = \left(U_0 + L_0\right) \cdot R - (S_1 + B_1)$

- U = Risk-bearing capital
  A = Assets
  L = Liabilities
  R = 1 + r = Rate of return
  S = Market value of net claims
  B = Operating expenses

Solvency

- For the distribution of the risk-bearing capital in t = 1, U_1, a Normal-Power-Approximation is used

  Skewness of the distribution can be taken into account

  Analytical expressions for different risk measures can be derived

- <u>Ruin Probability (RP)</u>:

$$RP = P(U_1 \leq 0) = P(A_1 \leq L_1) = \varepsilon$$

$$0 = E(U_1) + z_\varepsilon \cdot \sigma(U_1) + \frac{z_\varepsilon^2 - 1}{6} \cdot \gamma(U_1) \cdot \sigma(U_1)$$

Solvency

- Expected Policyholder Deficit (EPD):

$$EPD = E\left(\max\left(0 - U_1, 0\right)\right)$$

$$EPD = -E\left(U_1\right) \cdot \Phi\left(-v\left(0\right)\right) + \left(\sigma\left(U_1\right) + \frac{\gamma\left(U_1\right) \cdot \sigma\left(U_1\right)}{6} \cdot v\left(0\right)\right) \cdot \varphi\left(v\left(0\right)\right)$$

- Tail Value at Risk (TVaR):

$$TVaR_\alpha\left(U_1\right) = E\left(-U_1 \mid U_1 \le q_\alpha\right) \qquad VaR_\alpha\left(U_1\right) = q_\alpha$$

$$TVaR_\alpha\left(U_1\right) = \frac{-E\left(U_1\right) \cdot \Phi\left(v\left(q_\alpha\right)\right)}{\alpha} + \frac{\left(\sigma\left(U_1\right) + \frac{\gamma\left(U_1\right) \cdot \sigma\left(U_1\right)}{6} \cdot v\left(q_\alpha\right)\right) \cdot \varphi\left(v\left(q_\alpha\right)\right)}{\alpha} + q_\alpha\left(1 - \alpha\right)$$

3. Numerical Example Based on Empirical Data

- Given a fixed safety level, a risk-bearing capital U_0, and the insurer's liabilities, minimum requirements for the investment portfolio in an $E(r)–\sigma(r)$ relationship can be derived

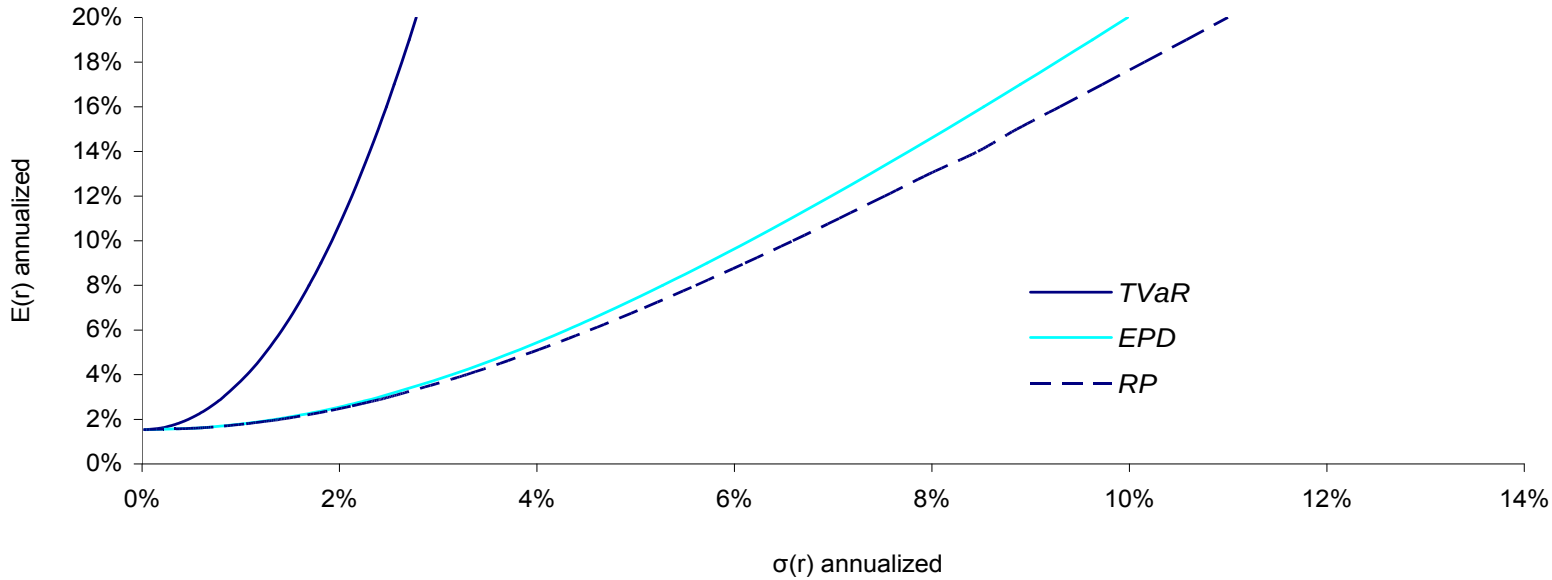
- Data: Medium-size German non-life insurer

$A_0 = U_0 + L_0 =$ € 1.582 billion
$E(S_1) =$ € 1.171 billion
$\sigma(S_1) =$ € 66 billion
$\gamma(S_1) = 0.3$
$B_1 =$ € 245 billion

Solvency

- RP: $\varepsilon = 0.5\%$ (Solvency II safety level)
- TVaR: $\alpha = 1\%$ (Swiss Solvency Test safety level)
- $TVAR_{1\%}(U_1) =$ € 25.72 billion; EPD = € 122 million

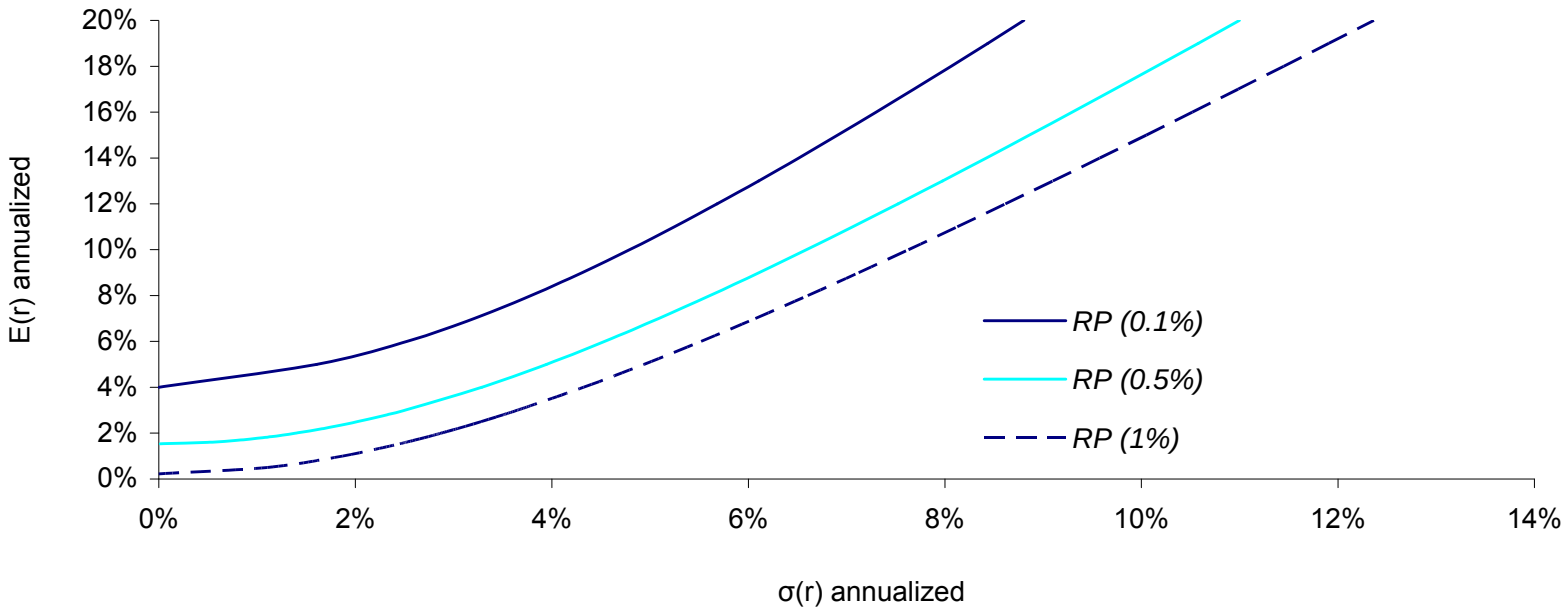
Figure 1



Solvency

- RP: ε = 0.1%, 1%, 0.5% (Solvency II)

Figure 2



- Solvency Line and Capital Market Line

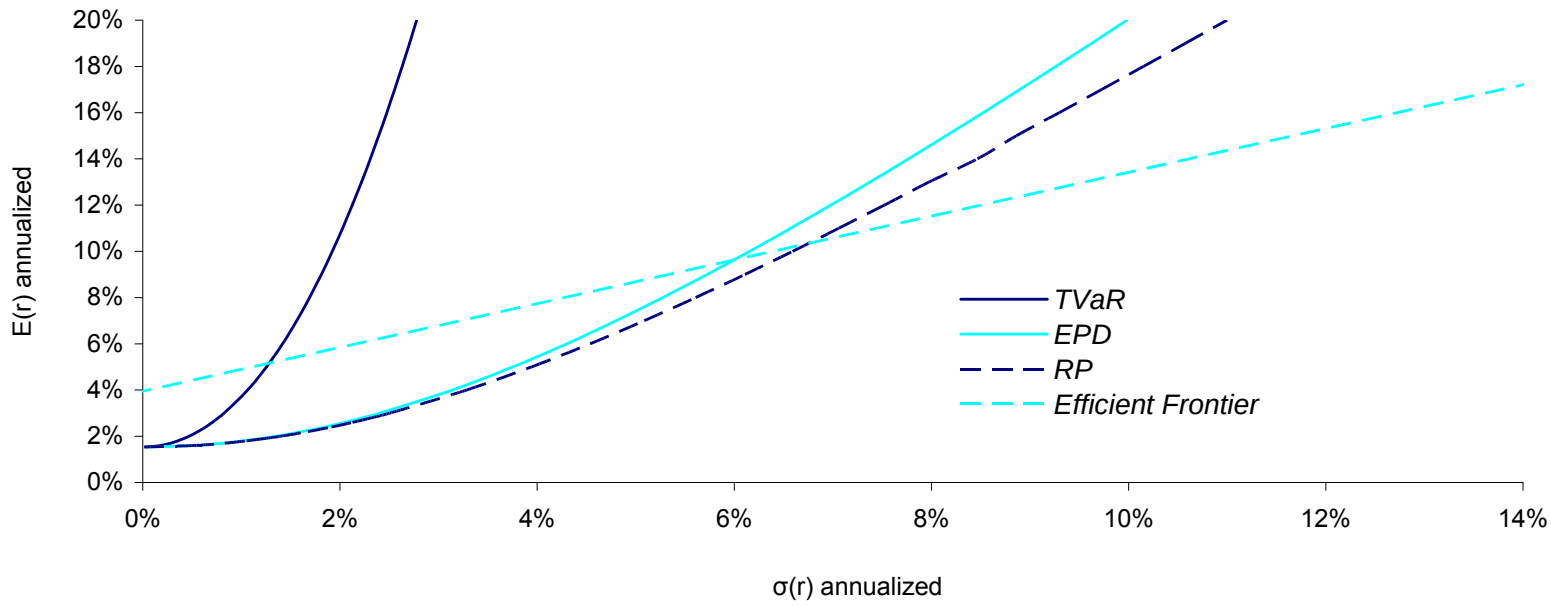
Benchmark indices

Asset class	Index	Illustration	E(r) annualized	σ(r) annualized
Money	JPM Euro Cash 3 Month	Money market in the EMU = r_f	3.95%	0.00%
Stocks	MSCI World ex EMU	Worldwide stocks without the EMU	8.92%	13.41%
	MSCI EMU ex Germany	Stocks from the EMU without Germany	12.16%	17.86%
	MSCI Germany	Stocks from Germany	10.46%	22.12%
Bonds	MSCI SDI World ex EMU	Worldwide government bonds without the EMU	4.84%	5.78%
	MSCI SDI EMU ex Germany	Gov. bonds from the EMU without Germany	6.54%	3.82%
	MSCI SDI Germany	Government bonds from Germany	5.59%	3.46%
	MSCI Euro Credit Corporate	Corporate bonds from the EMU	5.84%	3.41%
Real	GPR General PSI Global	Real estate worldwide	8.45%	11.37%
estate	GPR General PSI Europe	Real estate in Europe	8.19%	7.16%
	DIMAX	Real estate in Germany	7.65%	13.15%

JPM: J.P. Morgan; MSCI: Morgan Stanley Capital International; EMU: European Monetary Union; SDI: Sovereign Debt Index; GPR: Global Property Research; PSI: Property Share Index; DIMAX: Deutscher Immobilien Aktienindex

- Solvency Lines from Figure 1 and Capital Market Line

Figure 3



- # Asset Allocation and RP

Examples of asset allocation

Asset class	Index	Asset allocation Example 1	Asset allocation Example 2	Asset allocation Example 3	Asset allocation Example 4
Money	JPM Euro Cash 3 Month	100%	0%	0%	0%
Stocks	MSCI World ex EMU	0%	5%	10%	20%
	MSCI EMU ex Germany	0%	5%	10%	20%
	MSCI Germany	0%	5%	10%	20%
Bonds	MSCI SDI World ex EMU	0%	15%	10%	0%
	MSCI SDI EMU ex Germany	0%	15%	10%	0%
	MSCI SDI Germany	0%	15%	10%	0%
	MSCI Euro Credit Corporate	0%	10%	10%	0%
Real	GPR General PSI Global	0%	10%	10%	0%
estate	GPR General PSI Europe	0%	10%	10%	20%
	DIMAX	0%	10%	10%	20%
E(r) annualized		3.95%	7.14%	7.86%	9.48%
σ(r) annualized		0%	4.58%	6.64%	11.96%
Corresponding *RP* of the insurer		0.12%	0.31%	1.07%	5.80%

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4. Summary

- Proposal for a standard model under Solvency II
- Applicability is tested using data from a German non-life insurer
- Consequences of the framework:

- One regulatory framework instead of two separate regulatory tool for assets and equity capital
- Insurer's do have different degrees of freedom in how to choose their asset allocation