Analysis of objective oriented perspectives for the calculation of Solvency Capital Requirement for pension funds considering Solvency II and IORP II

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Pension funds in Germany

- contract
  - increases in contributions (risks explicitly assumed, recovery plans)
  - reduction of benefits in case of sponsor default

- pension protection schemes
  - PSV

- national social, labour and supervision law
  - subsidiary liability of employer

- employer
  - beneficiary
  - pension fund
  - PSV
  - insolvency
  - pension commitment
  - subsidiary liability
  - subscription right

Motivation

Pension funds in Germany

- contract
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Problem

- How to measure the risks and calculate Solvency Capital Requirement (SCR) for a pension fund?
- Which security mechanisms should be considered in the calculations at all? How can these security mechanisms be taken into account?
  - conditional benefits
  - risks explicitly assumed by employer
  - recovery plans
  - subsidiary liability
  - PSV
- How should reasonable supervision rules for pension funds be designed?
Literature review

Literature on risk measurement, security mechanisms and supervision of IORPs

- [Queisser 1998]
- [Brunner, Hinz, Rocha 2008]
- [van Gaalen 2003], [Mihr 2004], [Gisler 2010]
- [Haberman, Butt, Megaloudi 2000]
- [Broeders, Chen 2010]

Discussion on IORP II

- [CEA 2009]
- [GCAE 2010], [Hügelschäffer 2011], [Reuss 2008], [Velten 2008], [Wiesner 2009]
- [EIOPA 2012]
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Who should be protected?

Protection ...

- ... of contractual partner?
- ... of beneficiary within the system?
- ... of stability of the system?
- ... from regulatory arbitrage?
Perspective 1: objectives

- protection of beneficiary within the system
Perspective 1: consequences

- consider **contractual arrangements** like risks explicitly assumed and recovery plans
- consider **national law** like subsidiary liability
- consider **pension protection schemes** like PSV
- consider **maximum value** of sponsor support and pension protection scheme
Perspective 1: assessment

- in line with technical specifications of first QIS
- not consistent with Solvency II
- no protection of employer
- risk for pension fund from financial situation of employer/PSV
- systemic risk
Perspective 2: objectives

- protection of stability of the system
- protection of contractual partner
- protection from regulatory arbitrage
Perspective 2: consequences

- consider **contractual arrangements** like risks explicitly assumed and recovery plans
Perspective 2: assessment

- consistent with Solvency II
- adequate protection of employer
- no risk for pension fund from financial situation of employer/PSV
- adequate protection of beneficiary and stability of the system (within pension fund’s area of responsibility)
- control of employer’s risks?
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Stress scenarios

\[ \Delta \text{NAV} = \text{NAV}_{\text{normal}} - \text{NAV}_{\text{stress}} \]
### The model - basic idea (without security mechanisms)

The model consists of several risk factors, each contributing to different types of risk. These factors are:

- **Interest rate and inflation**: $mkt_{int}$
- **Equity**: $mkt_{equ}$
- **Salary increase**: $mkt_{sal}$
- **Mortality**: $pension_{mort}$
- **Longevity**: $pension_{long}$
- **Disability**: $pension_{dis}$

#### Aggregation to Market Risk

The market risk is calculated by aggregating the correlations and variances of different factors:

\[
SCR_{mkt} = \sqrt{\sum_{r,c} Corrmkt_{r,c} \cdot mkt_r \cdot mkt_c}
\]

#### Aggregation to Pension Liability Risk

The pension liability risk is calculated similarly:

\[
SCR_{pension} = \sqrt{\sum_{r,c} Corrpension_{r,c} \cdot pension_r \cdot pension_c}
\]

#### Aggregation to SCR

Finally, the SCR is aggregated by considering the correlations and variances of the risk factors:

\[
SCR = \sqrt{\sum_{i,j} Corr_{i,j} \cdot SCR_i \cdot SCR_j}
\]
The model with adjustment for security mechanisms

BSCR
considered sec. mech.: –
The model with adjustment for security mechanisms

- **BSCR**: Considered sec. mech.: –

- **n1BSCR**: Considered sec. mech.: 1

control maximum effect after aggregation

**sec. mech. 1**: conditional benefits
The model with adjustment for security mechanisms

- **BSCR**
  - considered sec. mech.: –

- **n1BSCR**
  - considered sec. mech.: 1

- **n2BSCR**
  - considered sec. mech.: 1, 2

- Control maximum effect after aggregation

- **sec. mech. 1:**
  - conditional benefits

- **sec. mech. 2:**
  - risks explicitly assumed by employer
The model with adjustment for security mechanisms

- **BSCR**
  - considered sec. mech.: –

- **n1BSCR**
  - considered sec. mech.: 1

- **n2BSCR**
  - considered sec. mech.: 1, 2

- **SCR_P2 = n3BSCR**
  - considered sec. mech.: sec. mech.: 1, 2, 3

Control maximum effect after aggregation

- **sec. mech. 1:**
  - conditional benefits

- **sec. mech. 2:**
  - risks explicitly assumed by employer

- **sec. mech. 3:**
  - recovery plan
The model with adjustment for security mechanisms

- **BSCR**
  - considered sec. mech.: –

- **n1BSCR**
  - considered sec. mech.: 1

- **n2BSCR**
  - considered sec. mech.: 1, 2

- **SCR_P2 = n3BSCR**
  - considered sec. mech.: sec. mech.: 1, 2, 3

- **SCR_P1 = n4BSCR**
  - considered sec. mech. 1, 2, 3, 4

- control maximum effect after aggregation

- sec. mech. 1: conditional benefits
- sec. mech. 2: risks explicitly assumed by employer
- sec. mech. 3: recovery plan
- sec. mech. 4: subsidiary liability
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Example for Analysis

beneficiary

- retired male beneficiary of age 70
- annuity payment of 1000 EUR / survivorship annuity of 600 EUR per month
- no contractually specified pension dynamics

possible contractual risk sharing with employer

- market risks
- biometric risks
- recovery plan

pension fund

- assets: varying coverage ratio of pension account, additional own funds 5 %
- investment of assets: 35 % in shares, 65 % in fixed interest bearing securities
- calculatory interest rate: 4.0 % or 1.75 %
- calculatory mortality tables: Heubeck 2005 G or DAV 2004 R
Employer bearing market risk (1)
**Employer bearing market risk (2)**
Insurance type

coverage ratio (market value)

coverage ratio (calculatory)

support employer / market value liab.

free surplus in Euro

0,9 0,95 1 1,05 1,1 1,15 1,2 1,25 1,3
1,28 1,38 1,48 1,58 1,68 1,78
0,00
0,05
0,10
0,15
0,20
0,25
0,30

P_2
P_1_min
P_1_max

0,9
0,95
1
1,05
1,1
1,15
1,2
1,25
1,3

1,28
1,38
1,48
1,58
1,68
1,78

0,00
0,05
0,10
0,15
0,20
0,25
0,30

0
50.000
100.000
150.000

-100.000
-50.000
0
50.000
100.000
150.000

P_2
P_1_min
P_1_max

Employer bearing biometric risk
Employer bearing both market and biometric risk
Conclusions

▶ The answer to the question, which security mechanisms should be taken into account for the calculation of the SCR, depends on the supervisory objectives assumed.

▶ A general statement about which perspective delivers a higher SCR and therefore is the more stringent one, is not possible. The result strongly depends on the constellation of risk sharing, the coverage ratio and the limitation of additional support from security mechanisms.

▶ On the subject of systemic risk further research is needed.
Thank you for your attention!
Literature I


Literature II

Gisler T.: *Solvency Tests for Pension Funds: An International Analysis with a Standard Model*, Books on Demand, Norderstedt, 2010

Haberman S., Butt Z., Megaloudi C.: *Contribution and solvency risk in a defined benefit pension scheme*, Insurance: Mathematics and Economics 17, S. 237–259


Mihr E.: *Vorschlag zur Bestimmung der Solvabilität bei Pensionskassen*, Diplomarbeit (Swiss Pension Actuary Course)


Reuss A.: *Die Auswirkung risikobasierter Eigenmittelanforderungen auf Pension Funds*, in: BetrAV 63 (2008), S. 655–659
Literature III


Wiesner B.: *Der Weg nach Europa*, in: BetrAV 64 (2009), S. 179–180