

Calculation of the solvency capital for German hybrid products

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via|dico

Motivation

The partial internal model

Numerical results

Conclusions and further research

Capital requirement for modern life insurance products

current status

- ▶ neither the technical specifications nor the GDV standard formula provide insurance companies with guidelines on how to calculate the solvency capital requirement for hybrid products
- ▶ calculations with the GDV standard formula appear to be unreasonable

research objectives

- ▶ develop and analyze a methodology for calculating the solvency capital requirement for hybrid products
- ▶ develop a partial internal model for stochastic solvency capital requirement calculations
- ▶ identify and quantify main risks of hybrid products

Hybrid products

framework

- ▶ mix of traditional German and unit-linked deferred annuity insurance
- ▶ high degree of security for the policyholder
- ▶ potential of high returns
- ▶ insurance benefits dependent on assets
- ▶ substantial guarantees (products are nonlinear)
- ▶ therefore: need of stochastic calculations

types of hybrid products

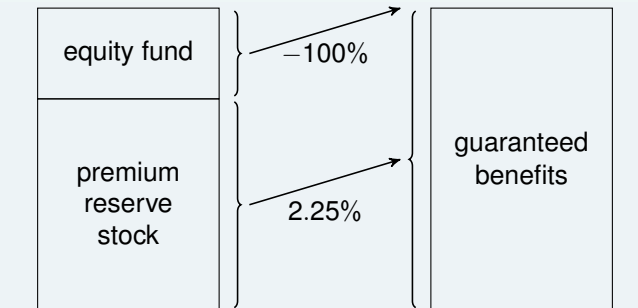
- ▶ static hybrids
- ▶ dynamic hybrids
 - ▶ 2-pot dynamic hybrids
 - ▶ 3-pot dynamic hybrids

Static hybrid products

hedge of guarantees

- ▶ investment in a conventional premium reserve stock (with guaranteed annual interest rate)
- ▶ investment of free premiums in equity funds

worst case

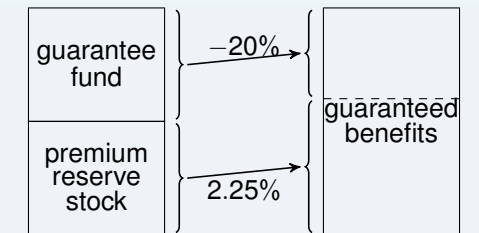


2-pot dynamic hybrid products

hedge of guarantees

- ▶ investment in a conventional premium reserve stock (with guaranteed annual interest rate) and guarantee funds (with guaranteed minimum return)
- ▶ rebalanced monthly
- ▶ purpose: high returns through maximum investment in guarantee funds

worst case

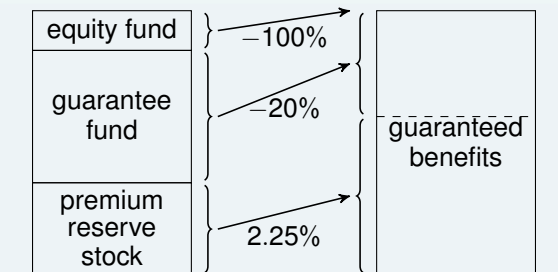


3-pot dynamic hybrid products

hedge of guarantees

- ▶ extension of 2-pot dynamic hybrids
- ▶ investment in equity funds possible
- ▶ in scenarios with strong developments of the equity it is possible to only invest in guarantee funds and equity funds

worst case



Other product features

accumulation period

- ▶ single premium policies
- ▶ death benefits, surrender option (with surrender fee)
- ▶ guaranteed accumulation benefits
- ▶ surplus reinvested

pension period

- ▶ lump-sum option
- ▶ guaranteed annuity factor
- ▶ conventional annuity benefits
- ▶ surplus disbursed as bonuses

Literature

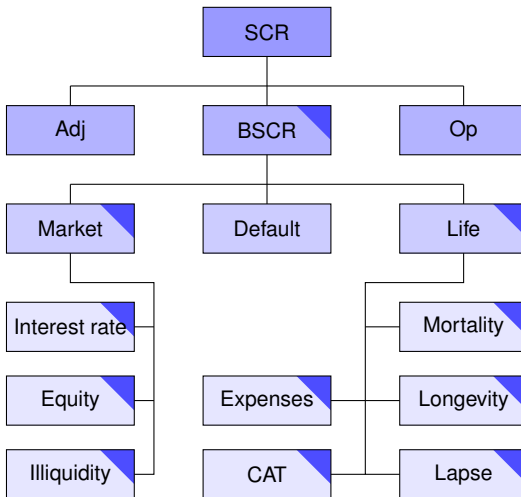
calculation of solvency capital requirement

- ▶ QIS5 Technical Specifications (2010); CEIOPS (EIOPA)
- ▶ QIS5 LV Rst (2010); GDV
- ▶ Market Consistent Embedded Value Principles (2009); CFO Forum

hybrid products

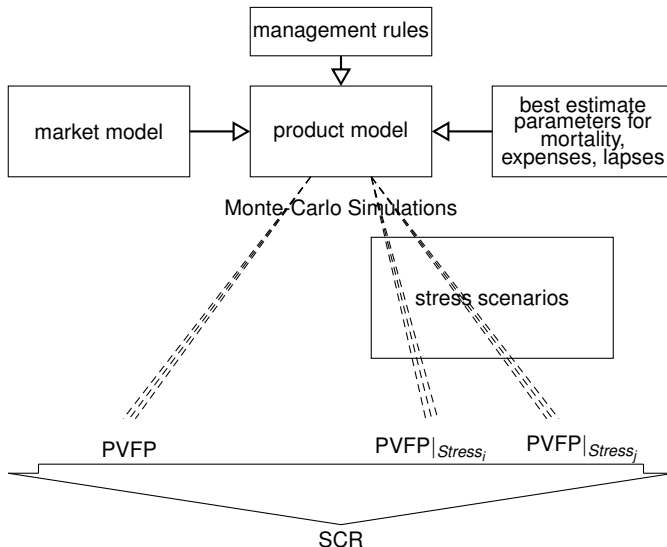
- ▶ Vorteile innovativer Lebensversicherungsprodukte und ihre Risiken unter Solvency II (2010); Reuß, Ruß
- ▶ Produkte für die An- und Entsparphase (2009); Kling
- ▶ Dynamische Hybridprodukte - eine neue Produktfamilie mit viel Potential (2008); Fix, Käfer
- ▶ Planbarkeit, Sicherheit und Rendite (2008); Deichl

SCR - modular structure



= included in Adj

The partial internal model



Economic balance sheet

- ▶ stochastic balance sheet
- ▶ risk neutral valuation

premium reserve stock	PVFP
	O&G

	FDB

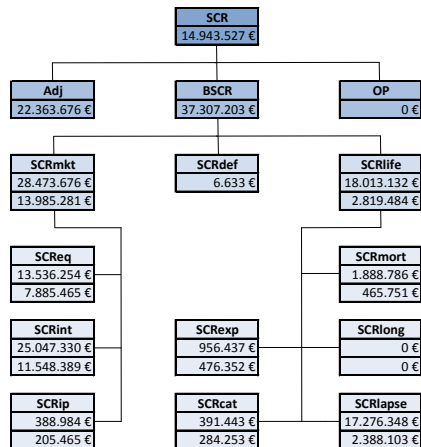
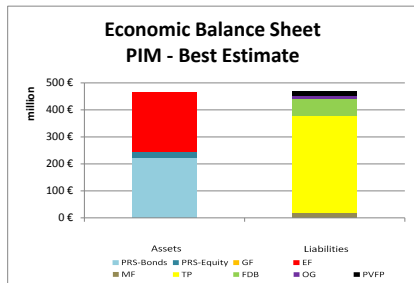
guarantee fund	insurance benefits
equity fund	management fees

- ▶ PVFP - present value of future profits
- ▶ present value of insurance benefits
- ▶ present value of management fees

- ▶ FDB - present value of future discretionary benefits
- ▶ O&G - time value of options and guarantees
 - ▶ $O\&G = PVFP^{\text{certainty equivalent scenario}} - PVFP^{\text{stochastic}}$

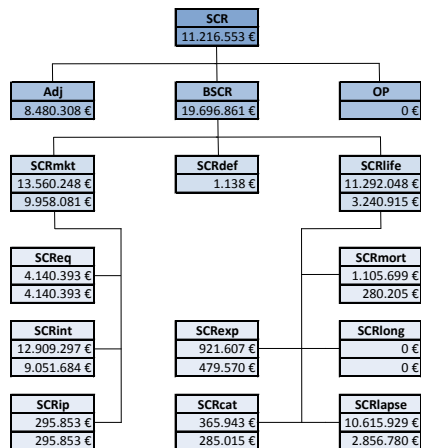
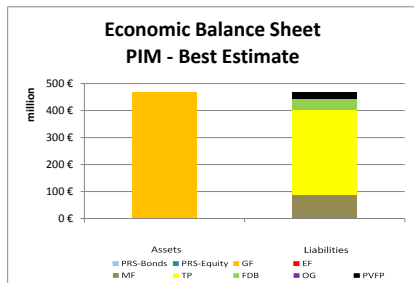
static hybrid product - new business

SP 0 w/o PP	
PVFP	16,966,252 €
O&G	7,740,421 €
SCR	14,943,527 €
SCR ratio	1.14
SCReq	7,885,465 €
SCRint	11,548,389 €
SCRlapse	2,388,103 €



2-pot dynamic hybrid product - new business

SP 0 w/o PP	
PVFP	23,584,281 €
O&G	1,007,563 €
SCR	11,216,553 €
SCR ratio	2.10
SCReq	4,140,393 €
SCRint	9,051,684 €
SCRlapse	2,856,780 €

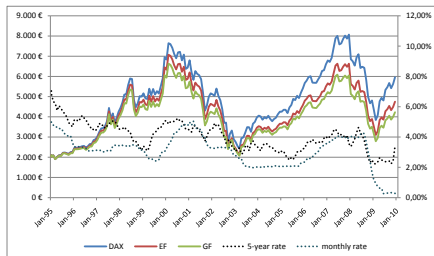


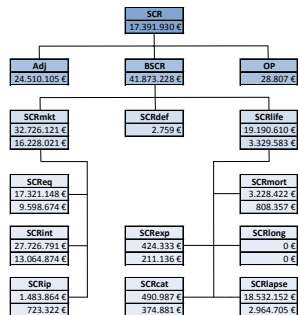
almost identical results for the 3-pot dynamic hybrid

Generating a sample portfolio

motivation

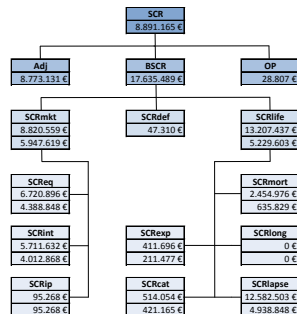
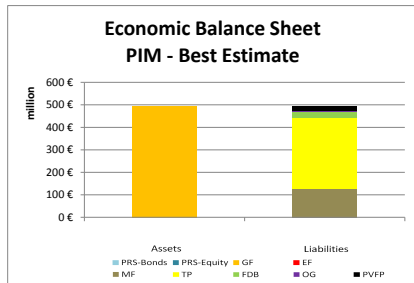
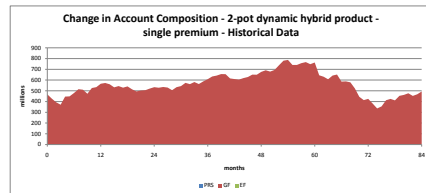
- ▶ solvency capital requirement calculation for business in force
- ▶ using real financial historical data (up to 15 years)
 - ▶ short term interest rates (SU0101, Bundesbank)
 - ▶ long term interest rates (GDBR5-Index, synthetic German zero-coupon bonds, Bloomberg)
 - ▶ risky assets (DAX-Index, Bloomberg)
- ▶ equity fund and guarantee fund modeled based on historical data





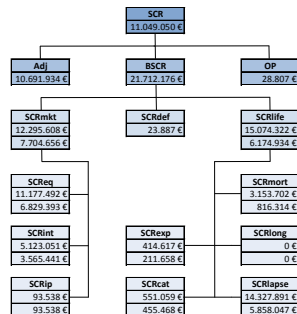
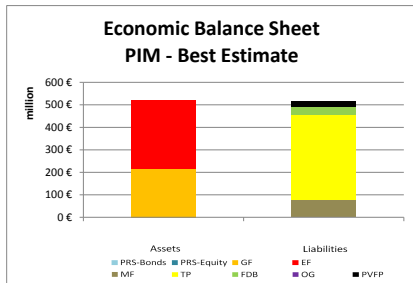
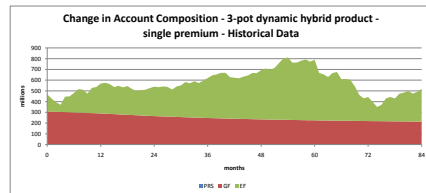
2-pot dynamic hybrid product - 7 years in force

	SP 0 w/o PP	SP 7 w/o PP
PVFP	23,584,281 €	21,705,679 €
O&G	1,007,563 €	341,354 €
SCR	11,216,553 €	8,891,165 €
SCR ratio	2.10	2.44
SCReq	4,140,393 €	4,388,848 €
SCRint	9,051,684 €	4,012,868 €
SCRlapse	2,856,780 €	4,938,848 €



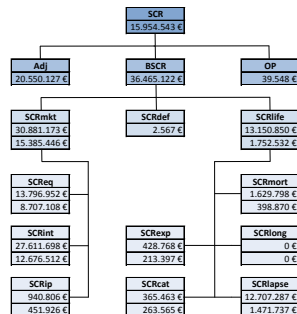
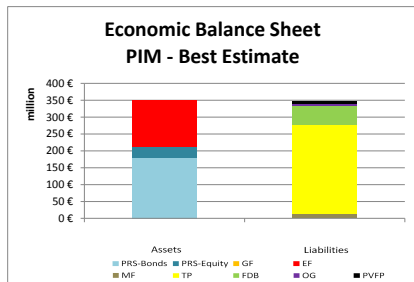
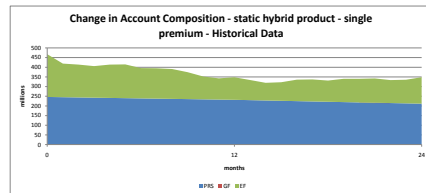
3-pot dynamic hybrid product - 7 years in force

	SP 0 w/o PP	SP 7 w/o PP
PVFP	24,660,943 €	24,824,010 €
O&G	752,245 €	245,431 €
SCR	11,922,609 €	11,049,050 €
SCR ratio	2.07	2.24
SCReq	5,545,696 €	6,829,393 €
SCRint	8,935,632 €	3,565,441 €
SCRlapse	3,174,968 €	5,858,047 €



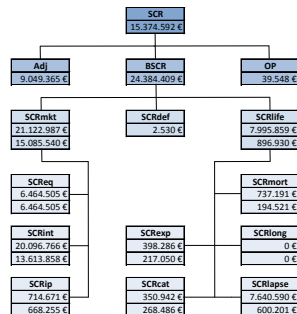
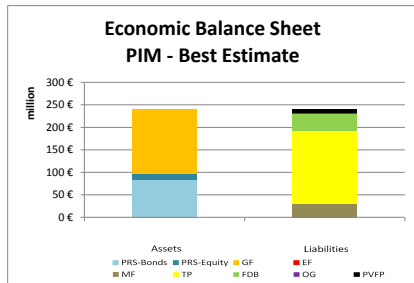
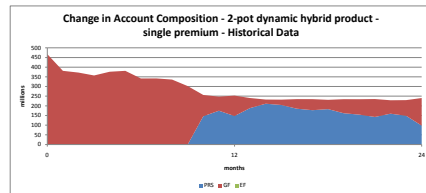
static hybrid product - 2 years in force

	SP 0 w/o PP	SP 2 w/o PP
PVFP	16,966,252 €	8,662,752 €
O&G	7,740,421 €	5,821,079 €
SCR	14,943,527 €	15,954,543 €
SCR ratio	1.14	0.54
SCReq	7,885,465 €	8,707,108 €
SCRint	11,548,389 €	12,676,512 €
SCRlapse	2,388,103 €	1,471,737 €



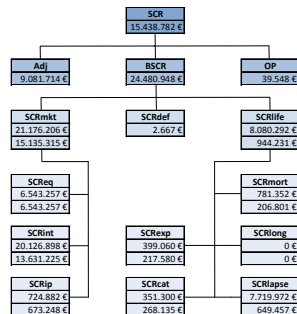
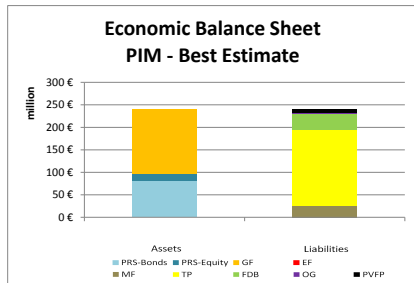
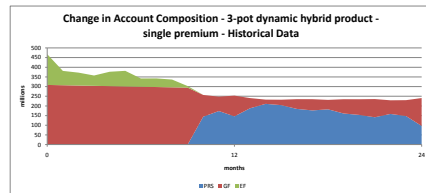
2-pot dynamic hybrid product - 2 years in force

	SP 0 w/o PP	SP 2 w/o PP
PVFP	23,584,281 €	8,098,390 €
O&G	1,007,563 €	2,545,772 €
SCR	11,216,553 €	15,374,592 €
SCR ratio	2.10	0.53
SCReq	4,140,393 €	6,464,505 €
SCRint	9,051,684 €	13,613,858 €
SCRlapse	2,856,780 €	600,201 €



3-pot dynamic hybrid product - 2 years in force

	SP 0 w/o PP	SP 2 w/o PP
PVFP	24,660,943 €	8,300,824 €
O&G	752,245 €	2,375,729 €
SCR	11,922,609 €	15,438,782 €
SCR ratio	2.07	0.54
SCReq	5,545,696 €	6,543,257 €
SCRint	8,935,632 €	13,631,225 €
SCRlapse	3,174,968 €	649,457 €



conclusions

static hybrid products

- ▶ main risks are interest rate, equity and lapse risk
- ▶ SCR is high, product strongly non-linear
- ▶ after good scenario: small increase of SCR
- ▶ after bad scenario: small increase of SCR

dynamic hybrid products

- ▶ main risks are interest rate, equity and lapse risk
- ▶ SCR is low, product almost linear
- ▶ after good scenario: SCR decreases
- ▶ after bad scenario: SCR increases strongly

further research

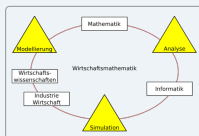
extensions of the model

- ▶ regular premiums
- ▶ dynamic pension period
- ▶ "intelligent" asset management rules for premium reserve stock

further research

- ▶ mixed portfolio of traditional insurance and dynamic hybrid products
- ▶ approximation formulas for O&G

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Thank you for your attention!