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Runoff or Redesign? Alternative Guarantees and New Business Strategies for Participating Life Insurance

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Contents

Introduction

Motivation

- **Participating life insurance products** play a major role in old-age provision.
- **Key problem**: significant financial risk due to year-to-year guarantees
  - impact of low interest rates and volatile asset returns
  - capital requirements under risk based solvency frameworks (e.g. **Solvency II**)

- Reuß, Ruß, Wieland [2015] "Participating Life Insurance Contracts under Risk Based Solvency Frameworks: How to increase **Capital Efficiency** by Product Design"
  - **Alternative product designs** can significantly **enhance "Capital Efficiency"**,
  - and reduce the insurer's risk and increase profitability.
  - analysis for one-product portfolios (technical interest rate **1.75%;** flat yield curve of **3.0%** while building up portfolio)

- **Focus of this presentation:**
  1. **value** and **compare** "typical" insurer's books of business built up in the past with traditional, but also alternative and mixed product history
  2. **analyze new business** strategies with alternative products

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Products and modeling

3 considered product designs

- **Considered products** with identical **guaranteed benefit** *G* at maturity:
  - annual premium payments (based on a **constant interest rate** i, e.g. $i = 1.75\%$)
  - **prospective actuarial reserves** for guaranteed benefit *G* (also based on i)
  - **yearly surplus** (e.g. 90% of book value returns), credited to a bonus reserve
  - (policyholder's) **account value** consisting of **actuarial reserve and bonus reserve**

- Products come with the **same guarantee at maturity**, but **different year-to-year guarantee**:
  - **Traditional product:** i is also a **year-to-year minimum guaranteed interest rate** (cliquet-style guarantee)
    - at least this rate has to be earned each year on the assets backing the account value
  - **Alternative I product: year-to-year minimum guaranteed interest rate = 0%**
  - **Alternative II product:** no additional guarantee on the account value

- Advantage of the **alternative** products (cf. Reuß, Ruß, Wieland [2015]) :
  - minimum **required yield** often **lower than** i (in case of previously earned surpluses),
  - but (total) benefit for policyholder only reduced in very adverse scenarios

Products and modeling

History of the portfolio

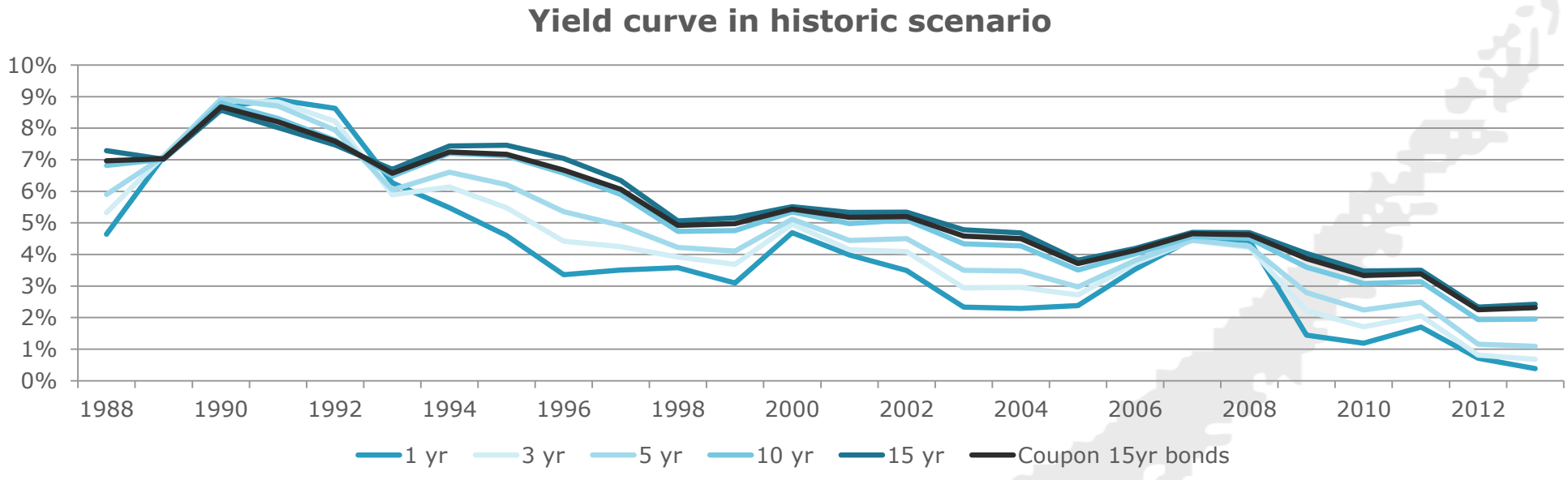
- Business starting in **1988**
- Constant new business volume of **1,000 contracts every year** until 2013
  - all policyholders are 40 years old at inception of the respective contract, maturity **20 years**
  - German standard mortality table, no surrender
  - **technical interest rates** for the contracts (maximum rate allowed by German regulation):

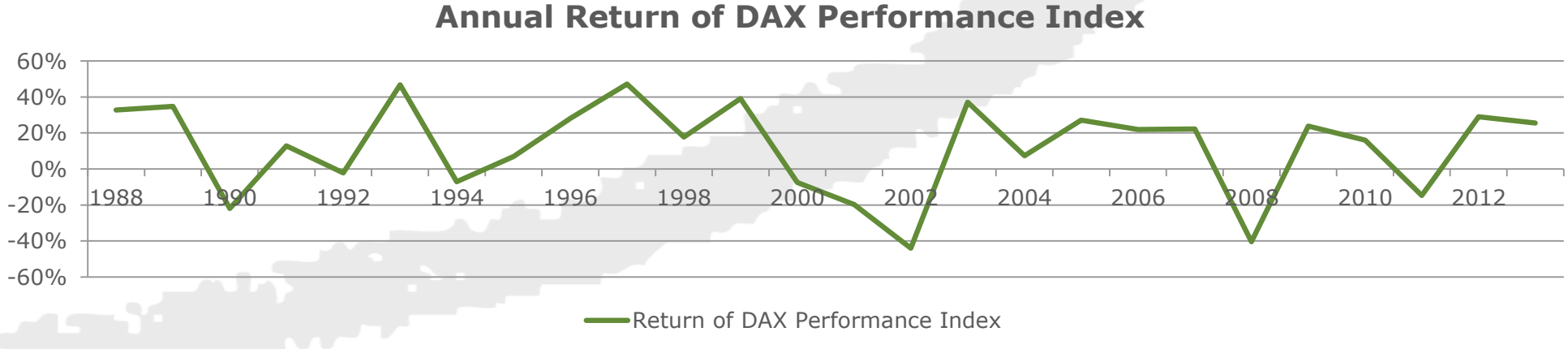
Underwriting year	1988 - 1994	1995 - 2000	2001 - 2003	2004 - 2006	2007 - 2011	2012 - 2014	from 2015
i	3.50%	4.00%	3.25%	2.75%	2.25%	1.75%	1.25%

- Financial market:
  - insurer's assets invested in a portfolio consisting of **stocks** and **coupon bonds**
  - **coupon rates** derived from **yield curves of the German treasury bonds** (until 2001) and **zero-coupon Euro swap curves** (from 2002 to 2013)
    - maturity of coupon bonds: **15 years**
  - **equity returns** derived from **DAX performance index**

Products and modeling

History of the portfolio





Products and modeling

The asset-liability model

- Simplified balance sheet:

Assets	Liabilities
book value of stocks BV_t^S	shareholders‘ profit or loss X_t
book value of coupon bonds BV_t^B	sum of account values AV_t

- **rebalancing** strategy with a **constant equity ratio** $\boldsymbol{q = 5\%}$
- **portion of total asset return credited to the policyholders:** participation rate $\boldsymbol{p = 90\%}$
- surplus distribution such that total yield is the same for all policyholders
  - but at least the required yield
- **Book-value accounting rules** following German GAAP are applied.
- further management rules regarding asset allocation (reinvestment, rebalancing) and handling of **unrealized gains or losses** etc.

Products and modeling

The financial market model for the projections

- asset portfolio consisting of **stocks** and **coupon bonds**
- Short rate process follows a Vasicek model, stock market follows a geometric Brownian motion.
- risk-neutral ($\mathbb{Q}$) valuation framework

short rate process	$dr_t = \kappa(\theta - r_t)dt + \sigma_r dW_t^{(1)}$
stock market process	$\frac{dS_t}{S_t} = r_t dt + \rho\sigma_S dW_t^{(1)} + \sqrt{1-\rho^2}\sigma_S dW_t^{(2)}$

- Bank account given by $B_t = \exp\left(\int_0^t r_u du\right)$, and used for investment of cash flows during the year.
- parameter values for projections:

	r_0	θ	κ	σ_r	σ_S	ρ
basic	1.5%	3.0%	30.0%	2.0%	20.0%	15.0%
stress	0.5%	2.0%				

  - (Source of parameters: r_0, θ take yield curves for current Solvency II calculations into account; other parameters: Graf et al. [2011])
- **Monte Carlo** projection of sample book of business until maturity of last contract

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Analyses and results

Valuation measures

- **Measure for profit:** Present Value of Future Profits $\boldsymbol{PVFP}$
  - and $\boldsymbol{PVFP_{stress}}$ (i.e. under parameters from stress level)
- **Measure for financial relief:** Average required yield of portfolio $\boldsymbol{ARY_t}$ (in year t)
  - required yields of all contracts in t weighted with the account values
- **Measures for asymmetry and risk:**
  - Time Value of Options and Guarantees: $\boldsymbol{TVOG = PVFP_{CE} - PVFP}$
    - $PVFP_{CE}$ from a so-called "certainty equivalent" scenario
  - Solvency capital requirement for interest rate risk $\boldsymbol{SCR_{int}}$ (approx.): $\boldsymbol{\Delta PVFP = PVFP - PVFP_{stress}}$
- **Measure for capital efficiency:** $\boldsymbol{CapEff} := \frac{\boldsymbol{PVFP}}{\boldsymbol{\Delta PVFP}} \cong \frac{\boldsymbol{PVFP}}{\boldsymbol{SCR_{int}}}$
- **Measure for new business profitability:** New business margin $\boldsymbol{NBM}$
  - and $\boldsymbol{NBM_{stress}}$ accordingly

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Analyses and results

Analysis of portfolios in force in 2014

- Setting: Insurer has sold the **traditional / alternative I / alternative II** product **since starting business** in 1988.

	Traditional	Alternative I	Alternative II
$PVFP$	3.05%	5.16%	5.23%
ARY_{2013}	3.46%	0.02%	-3.39%
$TVOG$	2.14%	0.07%	0.05%
$PVFP_{stress}$	-1.26%	3.22%	3.40%
$\Delta PVFP\ (\cong SCR_{int})$	4.31%	1.94%	1.83%
$CapEff$	0.71	2.67	2.87

- $PVFP$ about 70% higher, and **average required yield** close to zero with Alternative I and even remarkably below zero with Alternative II.
- SCR_{int} could have been reduced by 55 to 58% by selling alternative guarantees.

➔ **Capital efficiency** multiple times larger with alternative products

Analyses and results

Analysis of portfolios in force in 2014

- Setting: Insurer started with the **traditional** product, and switched to selling **alternative I / alternative II** in the respective year.

In…	2004		2008		2012		No switch
switch to…	Alt. I	Alt. II	Alt. I	Alt. II	Alt. I	Alt. II	
$PVFP$	4.74%	4.75%	4.07%	4.11%	3.40%	3.46%	3.05%
ARY_{2013}	2.88%	2.20%	3.28%	3.18%	3.45%	3.45%	3.46%
$TVOG$	0.45%	0.44%	1.12%	1.08%	1.79%	1.73%	2.14%
$\Delta PVFP\ (\cong SCR_{int})$	2.99%	2.99%	3.86%	3.89%	4.25%	4.30%	4.31%
$CapEff$	1.59	1.59	1.05	1.06	0.80	0.81	0.71

- **The earlier** the insurer has **switched to alternatives**, **the stronger** are the effects towards **capital efficiency**:
  - e.g. **0.71** if staying with the traditional product, **0.80** if switch to Alt. I in 2012, **1.59** if switch in 2004.
- **Measures** show **different speed** of adjustment: $TVOG$ and $PVFP$ with significant effects shortly after switch; SCR_{int} and ARY need more time to adjust.

➔ **What** will be the **effects in the future** if **switching now**?

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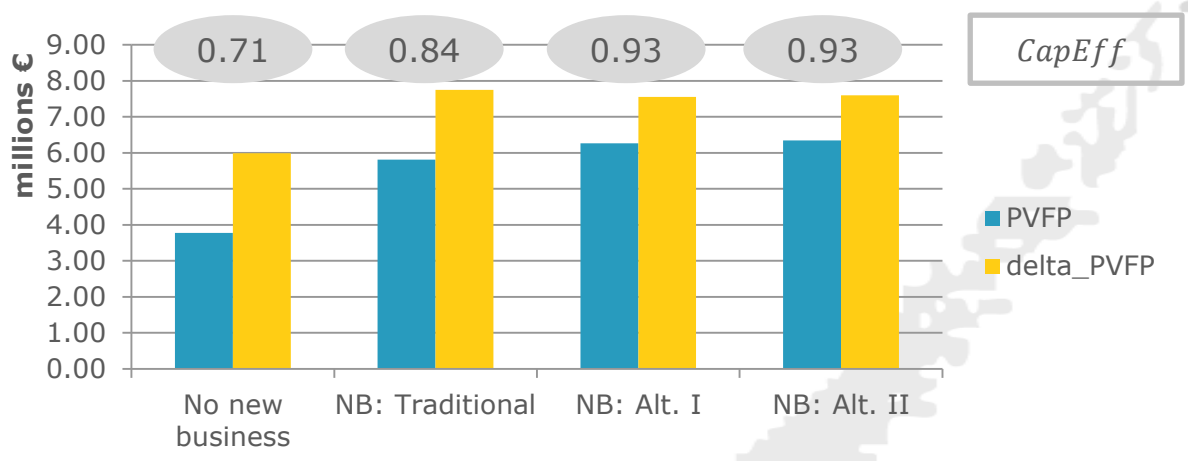
Analyses and results

Analysis of new business strategy

- Setting: Insurer sold **traditional** product **in the past**, and sells for the upcoming **5 years** (2014-18; 1,000 contracts per yr) either
  - **no new business,**
  - **traditional contracts,** or
  - **alternative (I/II) contracts.**



- With selling new business, $PVFP$ **as well as capital requirement** (measured by $\Delta PVFP$) **grow.**
  - However, **relation of $PVFP$ to $\Delta PVFP$ improves,** particularly with **alternative guarantees.**
    ➔ Stopping new business not beneficial.

	In-force business
$PVFP$	3.05%
$PVFP_{stress}$	-1.26%

	Traditional	Alternative I	Alternative II
NBM	3.01%	3.63%	3.74%
NBM_{stress}	0.67%	1.53%	1.58%

- **New business margin** (NBM) of **alternative** new business **clearly larger** than profitability of (traditional) **in-force business** (especially in more adverse capital market).

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Analyses and results

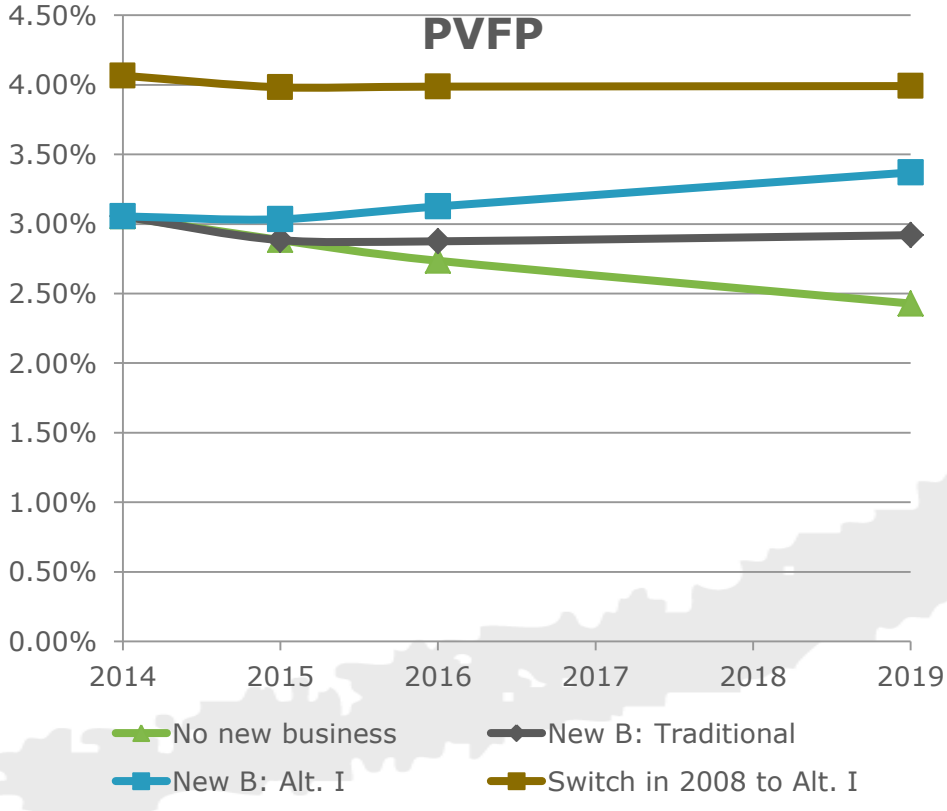
Development of risk exposure in the future (ORSA)

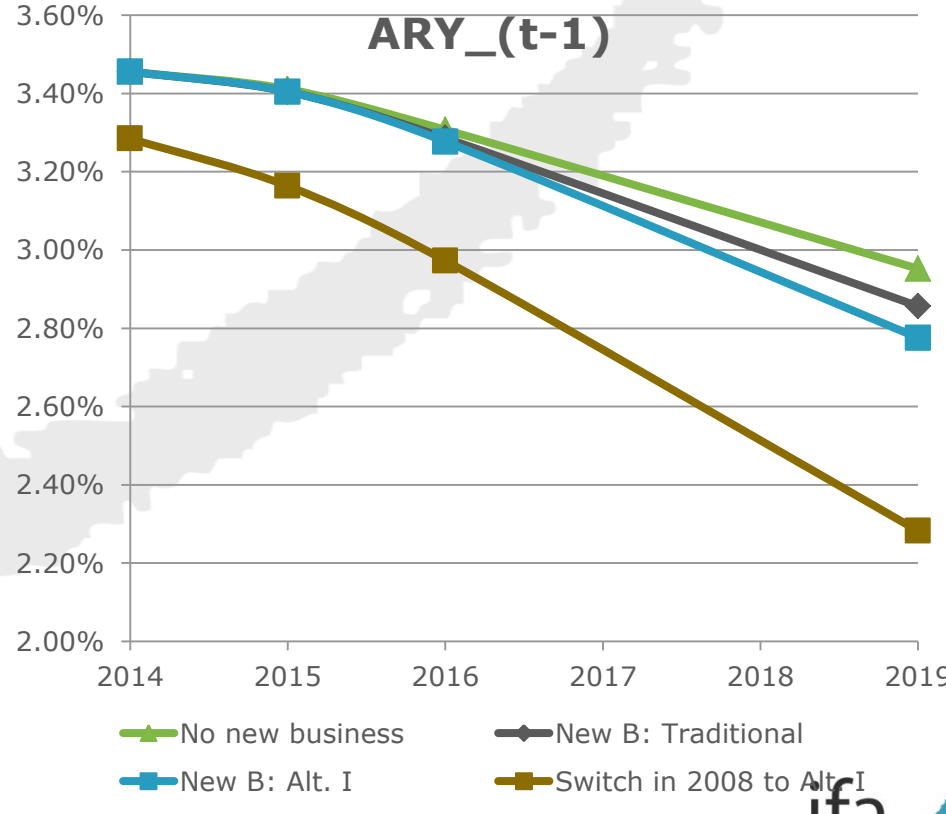
- **Own risk and solvency assessment** (ORSA) with respect to the company's strategic planning and projected risk profile required in Solvency II framework
- In a planning scenario, we assume the following market conditions in the **next 5 years** (from 2014 on):
  - 15 yr bonds with coupons of **2.604%** (derived from the risk-neutral return in the CE-scenario of the projections),
  - equity returns of **5.604%** (i.e. a risk premium of 3 perc. points)
- 4 settings:
  1) Insurer sold **traditional contracts in the past**, **and stops new business** from 2014 on.
  2) Insurer sold and **continues** selling **traditional contracts**.
  3) Insurer sold **traditional contracts in the past**, but **sells Alternative I product from 2014** on.
  4) Insurer already **switched from Traditional to Alternative I in 2008**, and continues selling Alternative I.
  - new business: **1,000** contracts **per year**

Analyses and results

Development of risk exposure in the future (ORSA): Planning scenario

- ***PVFP*** increases by approx. 11% over 5 years if insurer switches to Alt. I for new business
  - constant on a higher level if he already switched in 2008
- As before, ***ARY*** needs more time to adjust, i.e. **decreases stronger** with a **longer history** of alternative contracts in the portfolio.



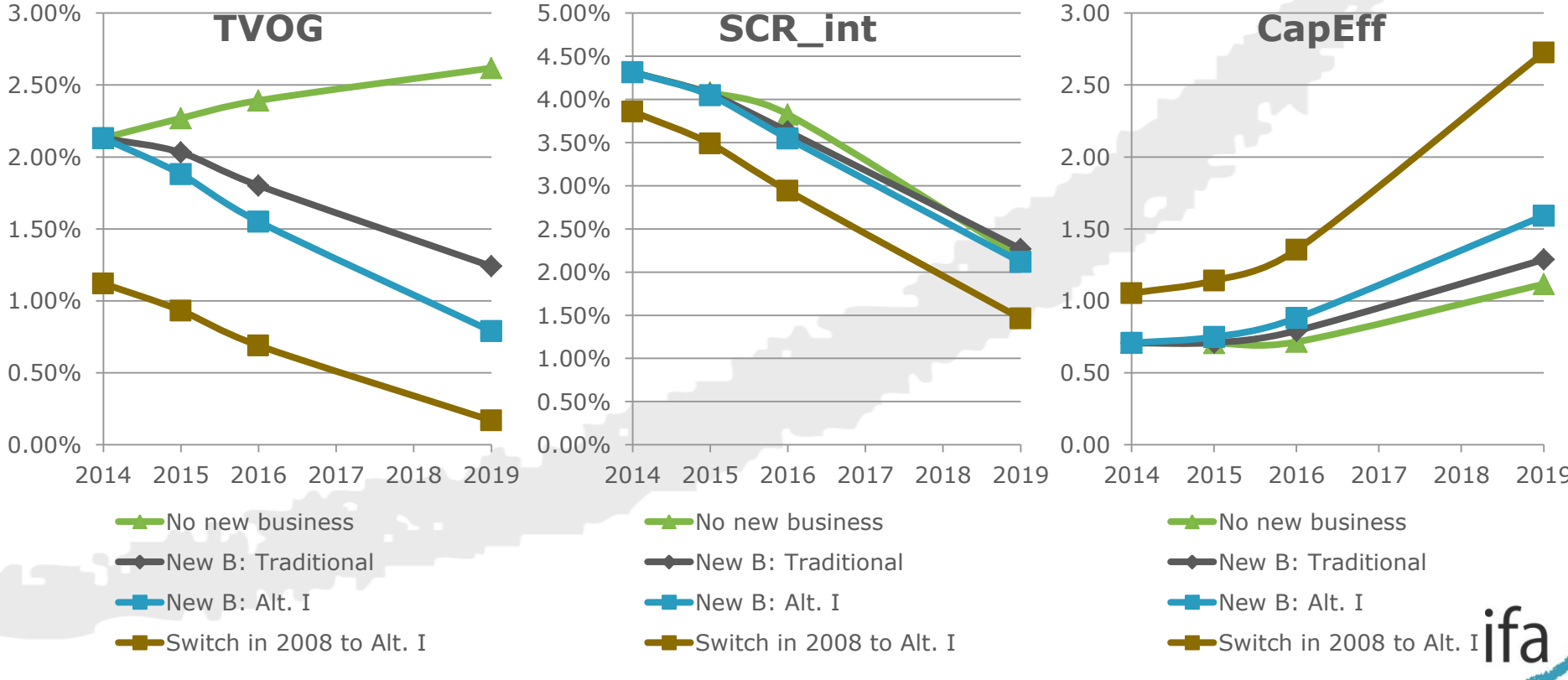


Analyses and results

Development of risk exposure in the future (ORSA): Planning scenario

- $TVOG$: decreases **stronger with alternative guarantees** in new business; increases without new business (run-off portfolio)
- SCR_{int}: **parallely decreasing** due to **decreasing guarantee** levels; **lower risk level** if **already alternative** contracts in the portfolio

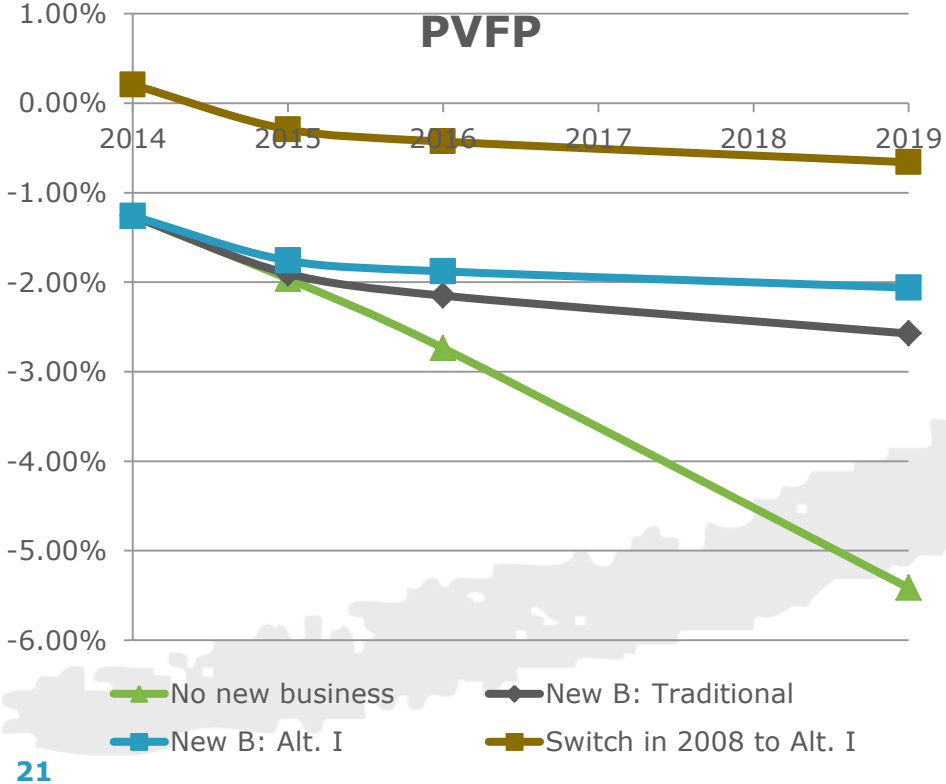
➔ **Capital efficiency** of portfolios with alternative products **strong** after few years.

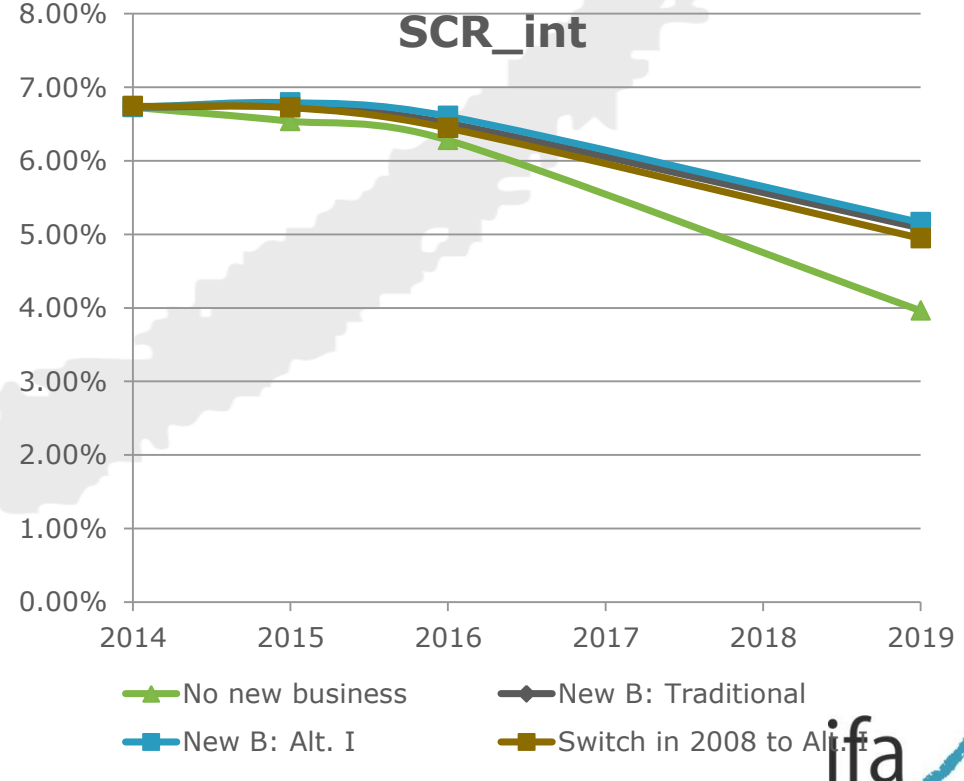


Analyses and results

Development of risk exposure in the future (ORSA): Stressed scenario

- consider a **stressed** planning scenario with coupons of **1.592%** and equity returns of **4.592%**
  - **No profitability** in **stressed** scenario for **all settings**, but **projected loss** developping **worst** in case of **no new business** and **least severe** if switching **early to alternatives.**
  - SCR_{int} decreasing slightly stronger in run-off portfolio
  - ➔ **no advantage**, however, considering the **increasing loss**





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Conclusion

Importance of alternative product design and new business strategy

- **Impact** of **alternative products** on existing **"traditional" portfolio**:
  - **Strong relief** in **financial risk** for insurer (→ required yield moving to zero); **improving capital efficiency.**
  - **Early switch** to alternatives **amplifies the effects** a lot.

- **New business strategy**:
  - Considering profit **and** capital requirement, new business is beneficial **and improves capital efficiency.**
  - **New business margin** of **alternative** new business clearly larger.
  - **Positive development** of risk exposure in the **planning scenario** with alternative contracts (→ important for ORSA).

- Areas for **additional research**:
  - product design for the annuity payout phase

Thank you for your attention!

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