Design and Demand of Retirement Products in the Accumulation Phase - An Analysis of the Policyholders' Perspective

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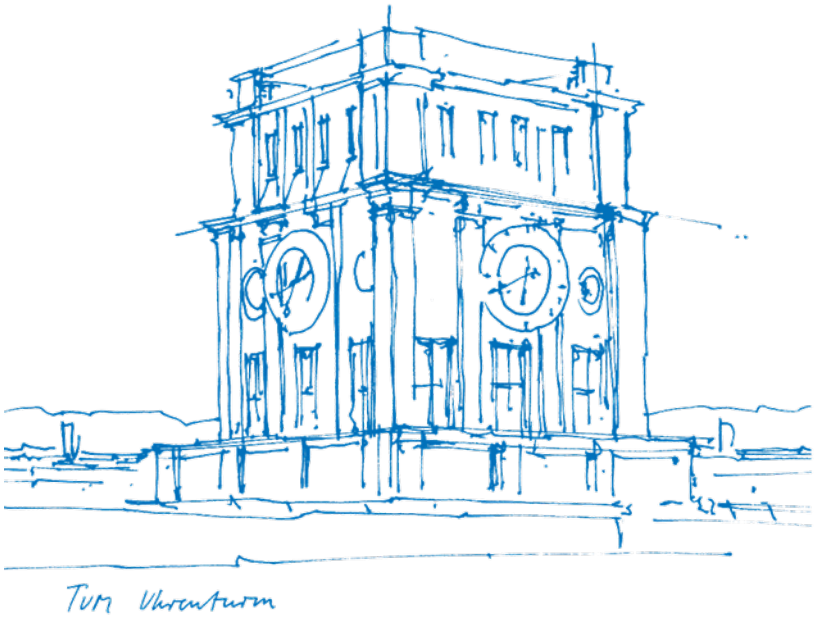
October 14, 2021



Introduction

- Macroeconomic problems and challenges for pension systems.
- Regulation of insurance markets.
- Tailor-made product design, wishes and needs of customers.
- Biases and heuristics in human decision-making.

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Behavioral insurance

Actuarial modeling

Introduction

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- Regulation of insurance markets.
- Tailor-made product design, wishes and needs of customers.
- Biases and heuristics in human decision-making.

Aim of the presentation

- Comprehensive connection of behavioral insurance and actuarial modeling.
- Comparison and combination of the various approaches evaluating the policyholders' perspective, contribute a more holistic model.
- Application of multi cumulative prospect theory and comparison with results from classic methodologies, provide use cases for this recent theory.
- Extensive analysis of behavioral theories, deliver insights in particular for the German insurance market.
- Further development of the basic modeling: take solvency, terminal bonus payment and equityholder fairness into account. Implement legally prescribed minimum participation restriction together with a reserve-dependent surplus distribution mechanism.

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Model framework

Modeling of the insurance company - overview

Table: Balance sheet of the life insurer at time t.

Assets	Liabilities
A_t	AR_t BR_t } P_t B_t
A_t	A_t

A_t asset base
AR_t actuarial reserve (guaranteed benefit)
BR_t bonus reserve (surplus account)
P_t policy reserve
B_t buffer

Model framework

Modeling the liability side: Considered products

Products with same guaranteed maturity benefit...

- Annually paid premium.
- Prospective actuarial reserve.
- Smoothing scheme.
- Minimum surplus participation restriction.
- Buffer payback to equityholders with fair (risk-adequate) buffer interest.
- Terminal bonus payment to policyholders.

... but different type of guarantee

- **Traditional participating life insurance contract:** $r^G = 1.75\%$ minimum guaranteed interest rate, cliquet-style guarantee.
- **Alternative product 1:** $r^G = 0\%$, account value cannot decrease.
- **Alternative product 2:** $r^G = -100\%$, no year-to-year guarantee.

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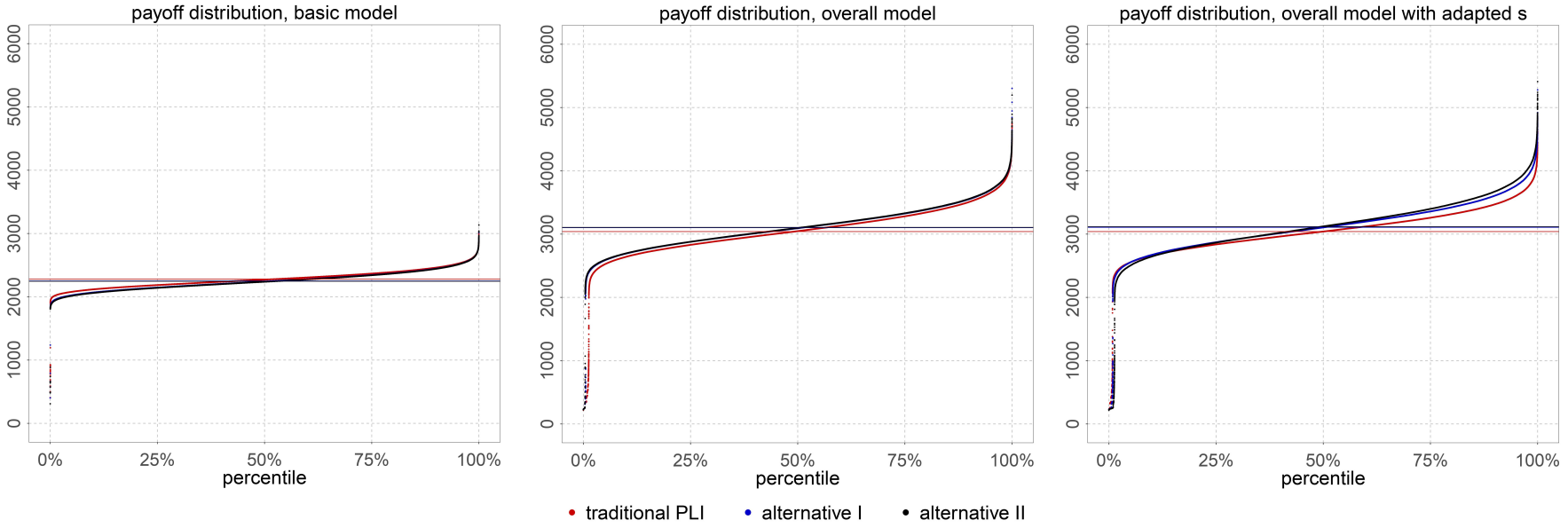
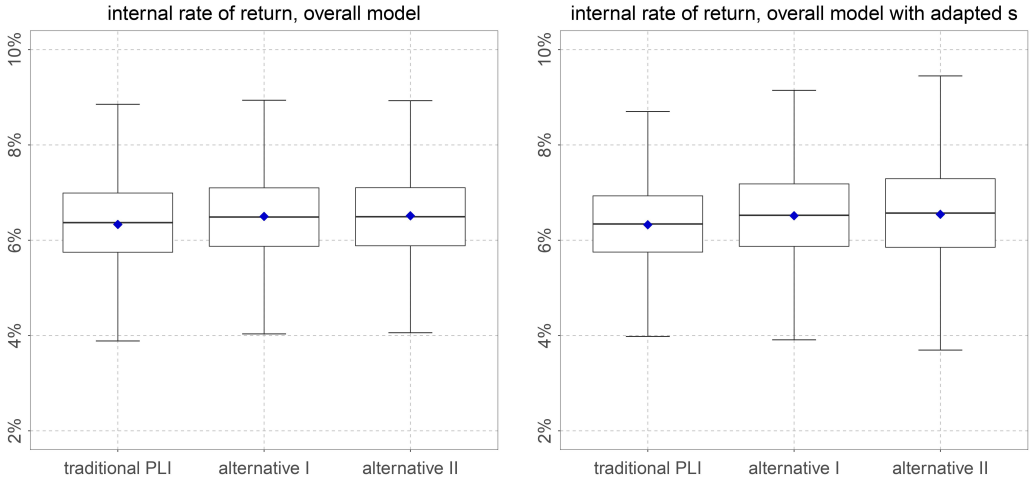
Numerical analysis of the customer perspective

Payoffs and terminal distributions



Numerical analysis of the customer perspective

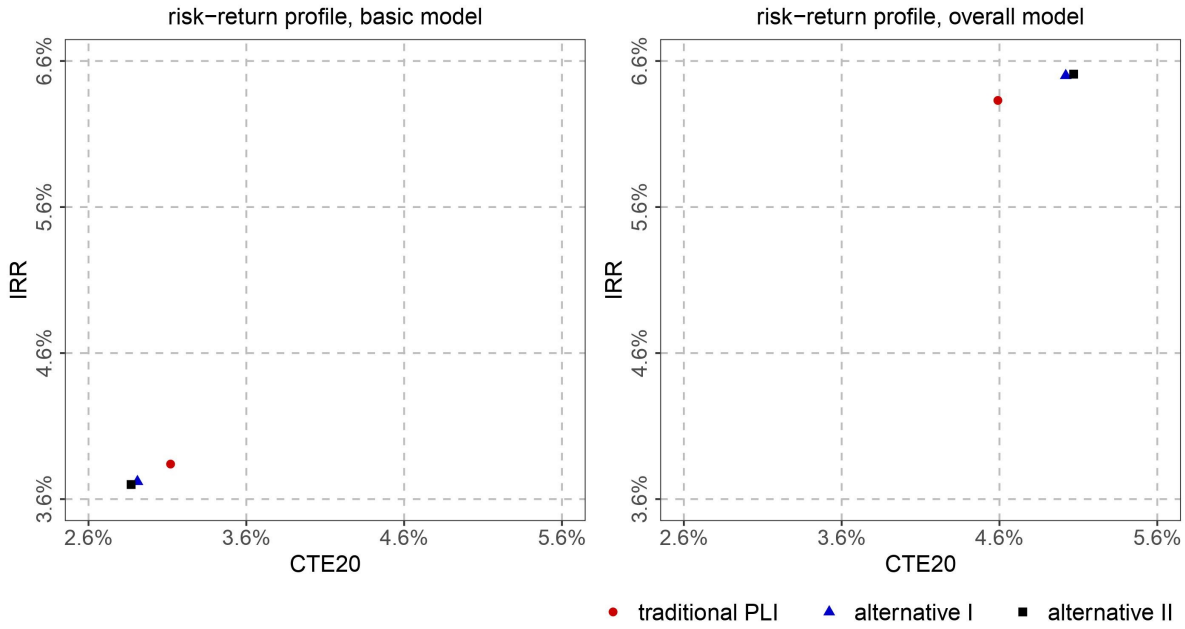
Risk-return profiles (1)



- The spread around the IRR of the expected payoff is equal and does not exhibit skews for all products in the overall model.
- The spread decreases for the traditional product and increases for the alternatives when considering adapted stock proportions.

Numerical analysis of the customer perspective

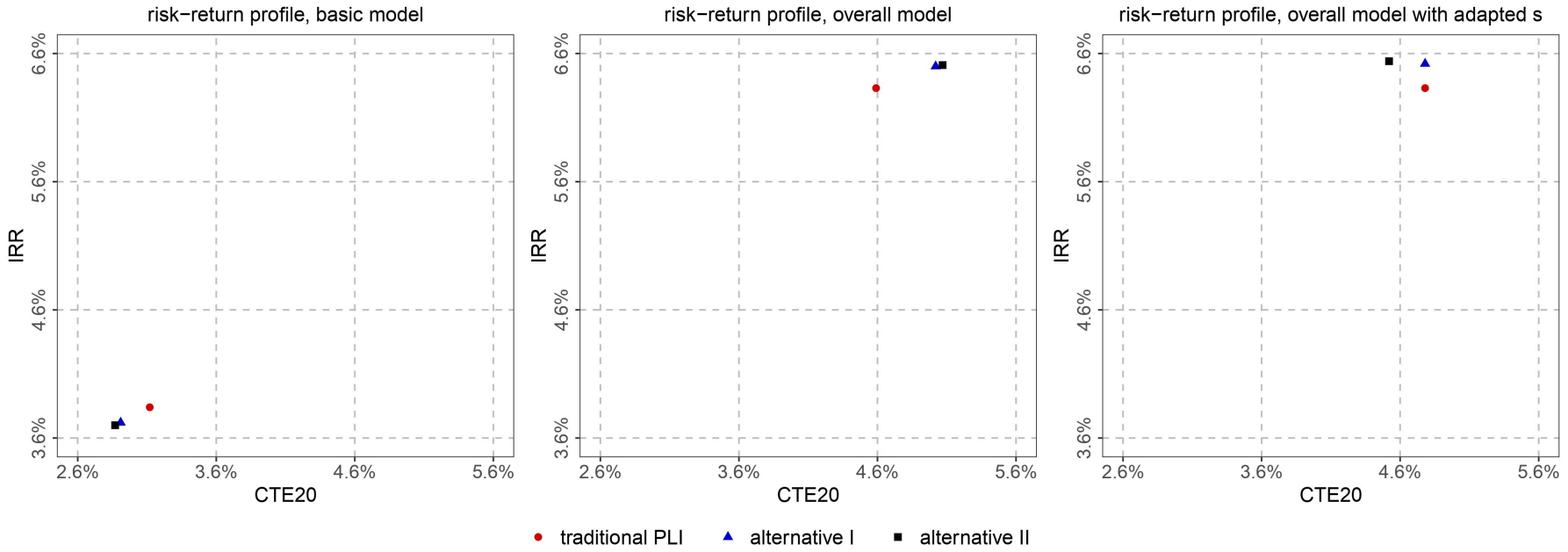
Risk-return profiles (2)



- Moreover, the downside risk increases with rising stock proportion in the basic and overall model.

Numerical analysis of the customer perspective

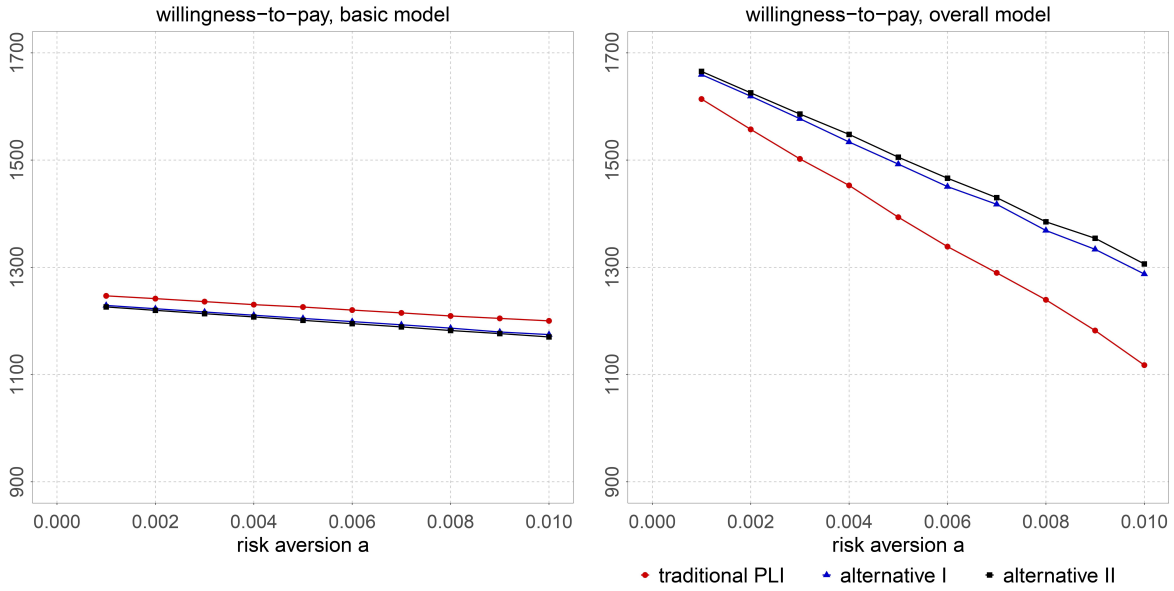
Risk-return profiles (3)



- With adapted stock proportions the return (measured by the IRR) only slightly increases, while the downside risk (measured by the CTE20) of the traditional product decreases and of the modern ones increases.

Numerical analysis of the customer perspective

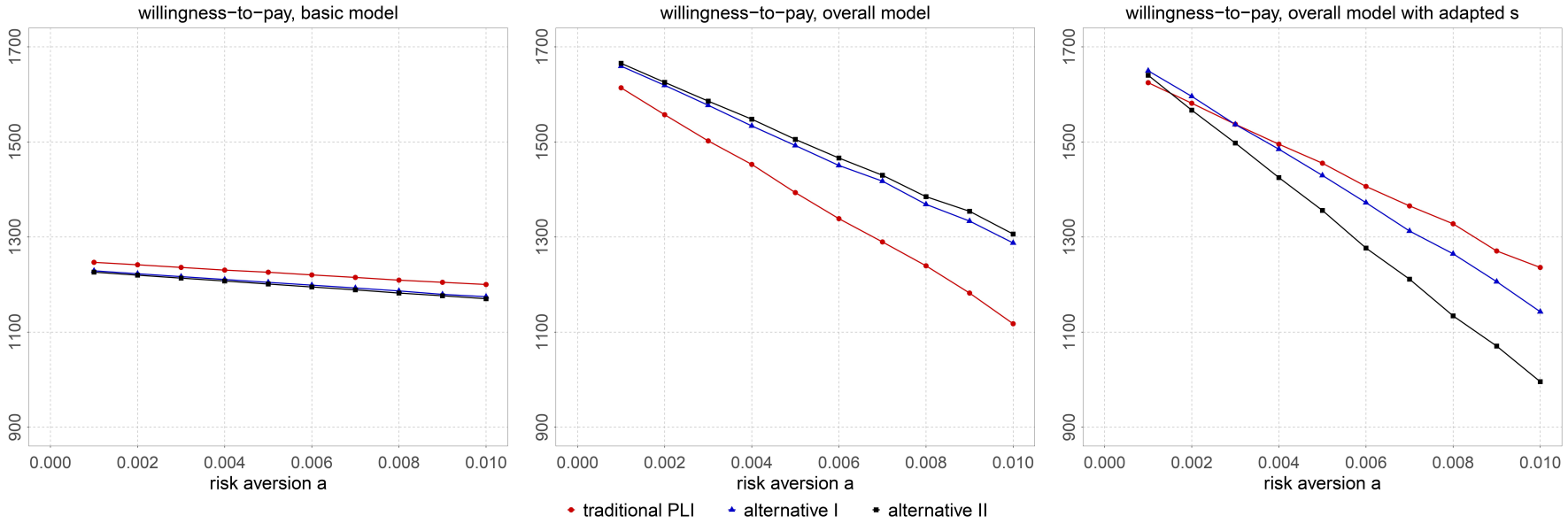
Willingness-to-pay (1)



- $P_{single} = 1278$.
- The WTP does not exceed the single premium for any of the contracts in the basic model.
- Decrease of the WTP in the overall model for increasing risk aversion, more risk averse customers would just be willing to purchase a modern product.

Numerical analysis of the customer perspective

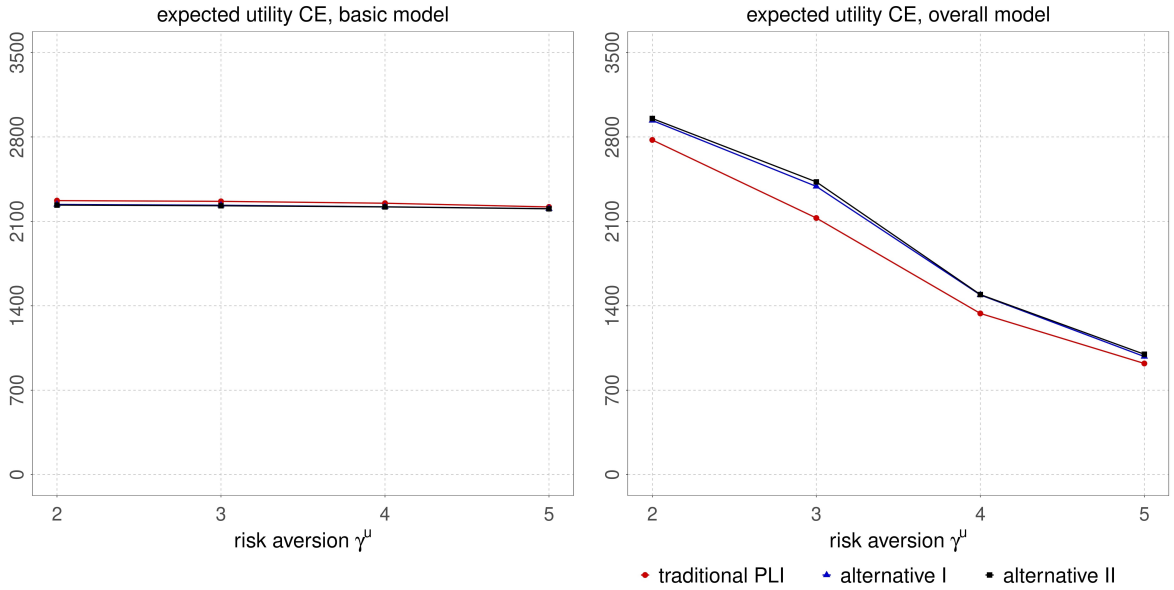
Willingness-to-pay (2)



- With adjusted stock ratios, less risk averse individuals are willing to pay slightly more for alternative 1.
- From a degree of risk aversion below the medium level, the willingness-to-pay is the highest for the traditional product.

Numerical analysis of the customer perspective

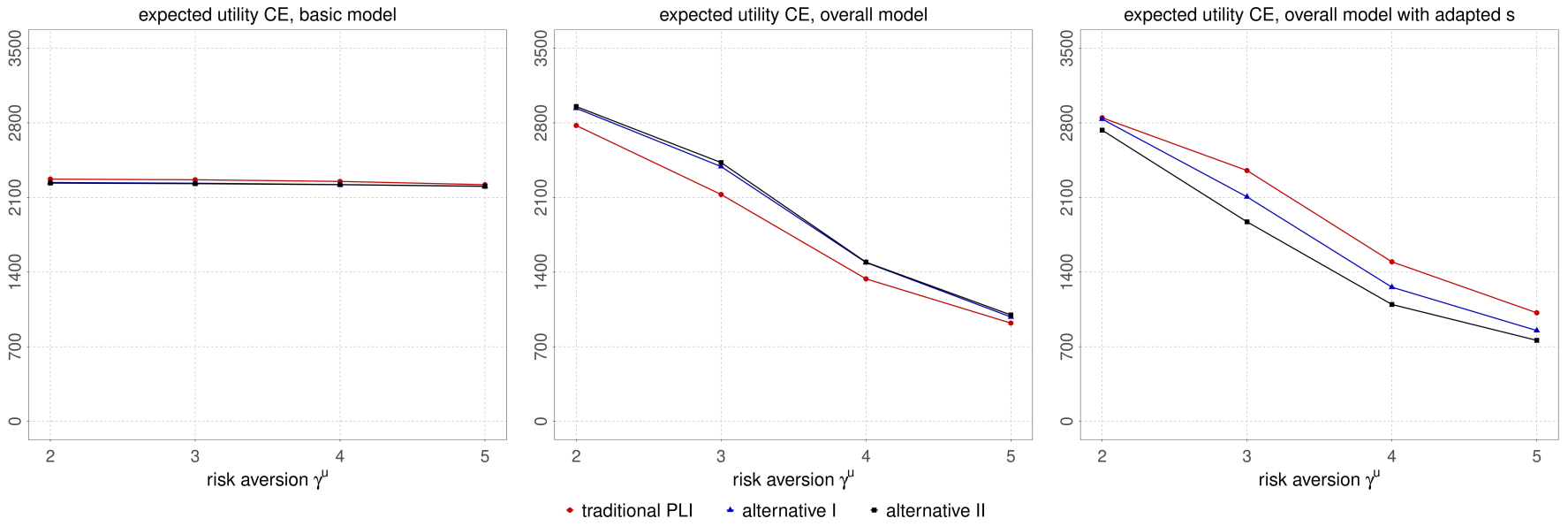
Expected utility theory (1)



- Under expected utility no significant differences between the products and different degrees of risk aversion in the basic model.
- Decreasing utility for an increasing degree of loss aversion, with a higher expected utility of the modern alternatives in the overall model.

Numerical analysis of the customer perspective

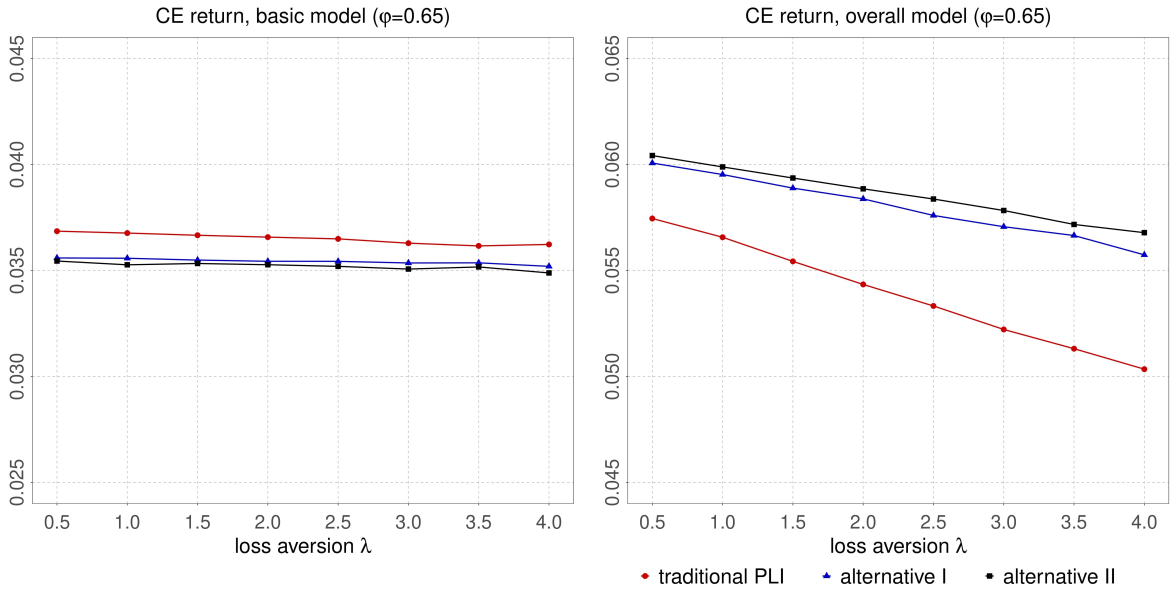
Expected utility theory (2)



- With adapted asset allocation, the traditional product is preferred by any degree of risk averse customer.

Numerical analysis of the customer perspective

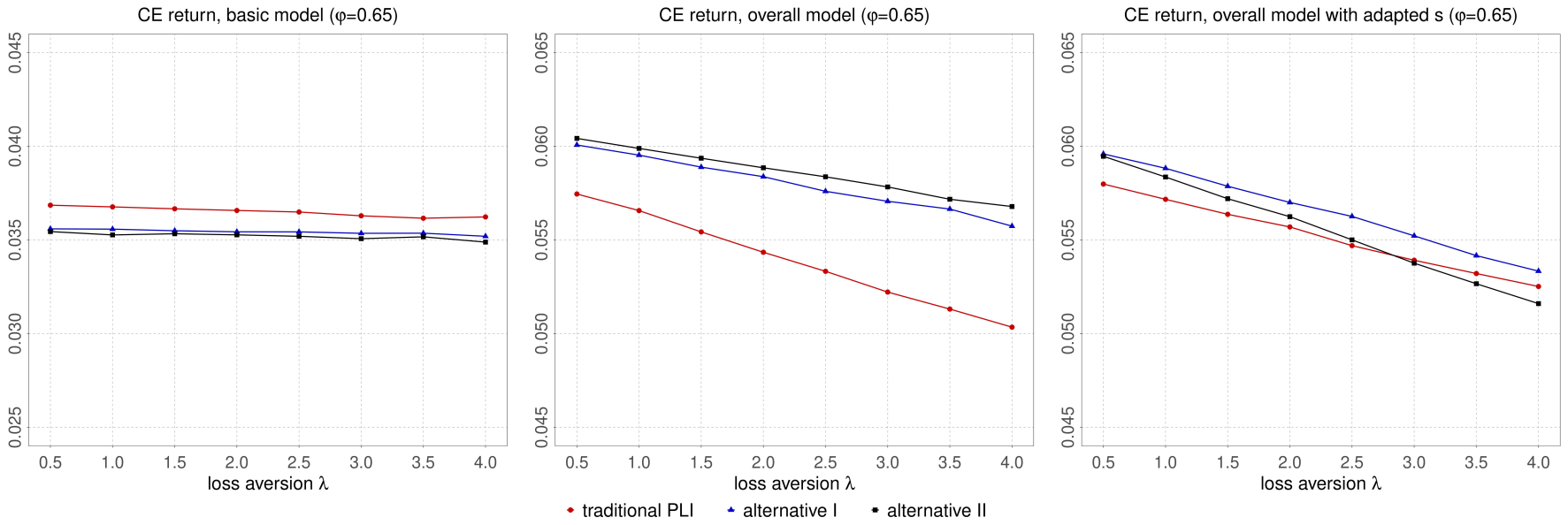
Cumulative prospect theory (1)



- Utility under CPT is independent of the loss aversion in the basic model. The traditional product is favored.
- Decreasing certainty equivalent returns for increasing loss aversion in the overall model. The modern alternatives are clearly favored.

Numerical analysis of the customer perspective

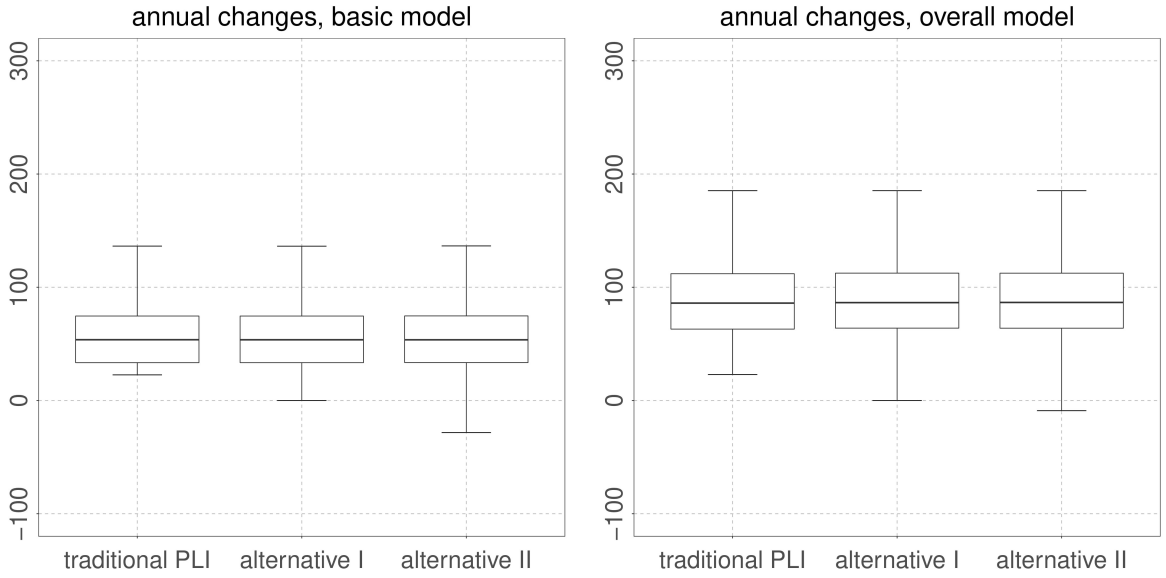
Cumulative prospect theory (2)



- Alternative 1 leads to the highest certainty equivalent return after adapting the respective stock shares.
- Below average loss averse individuals prefer alternative 2 over the traditional product.

Numerical analysis of the customer perspective

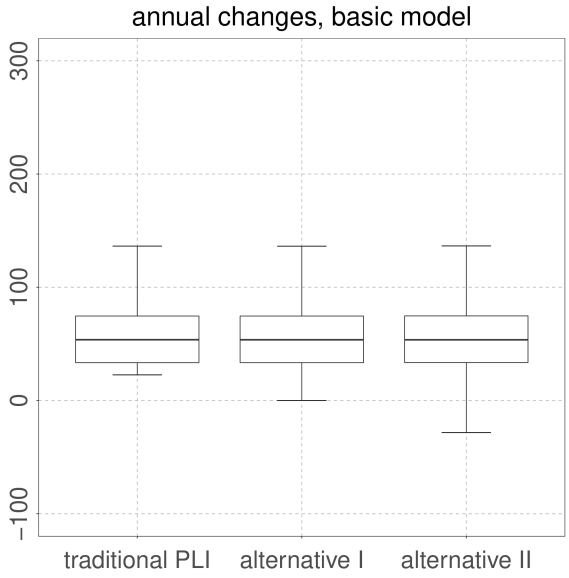
Annual price changes (1)

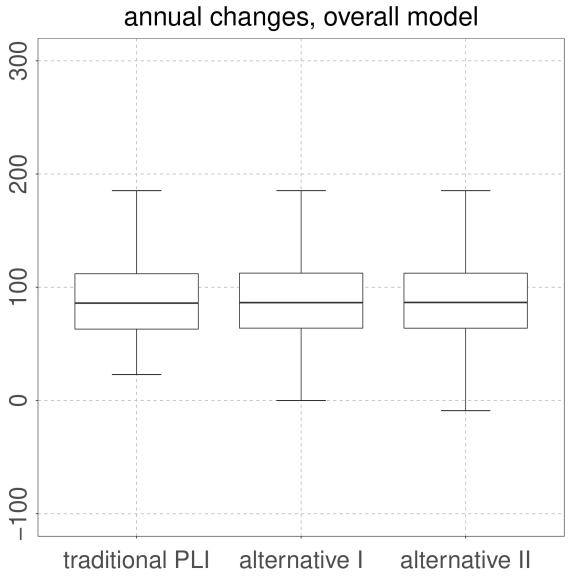


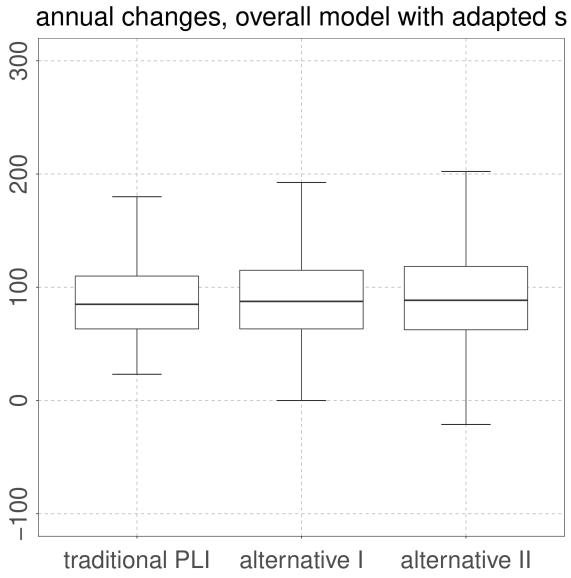
- The traditional PLI product has a positive skew for all models.
- Annual price changes are shifted upward and the possible range of values is larger in the overall model.

Numerical analysis of the customer perspective

Annual price changes (2)



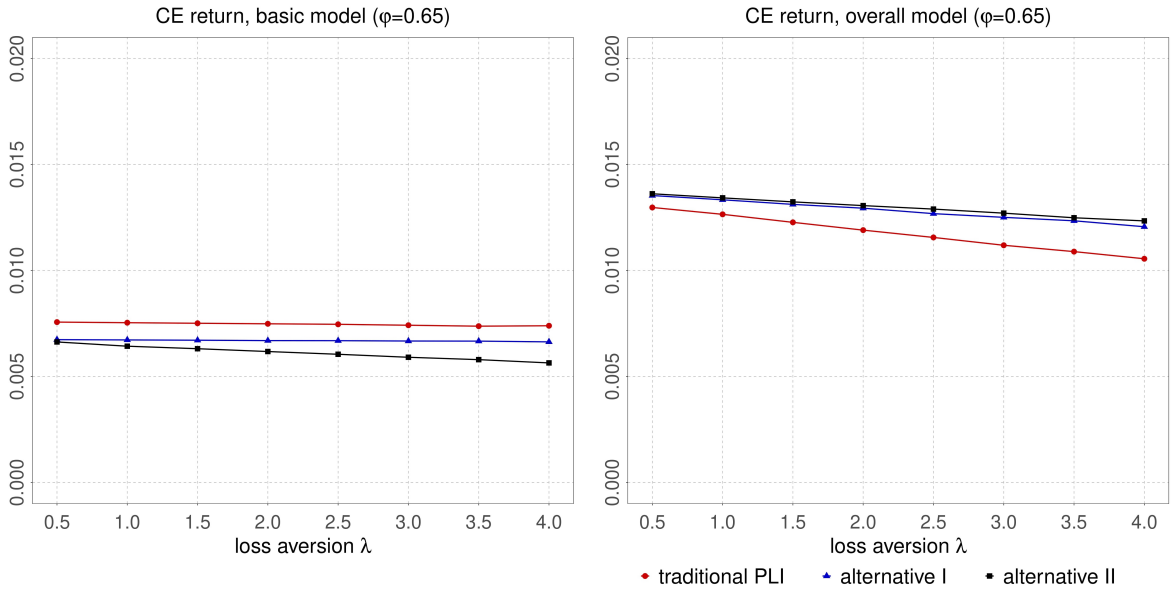




- Compared to the overall model, the range of values is larger with adjusted stock ratios.

Numerical analysis of the customer perspective

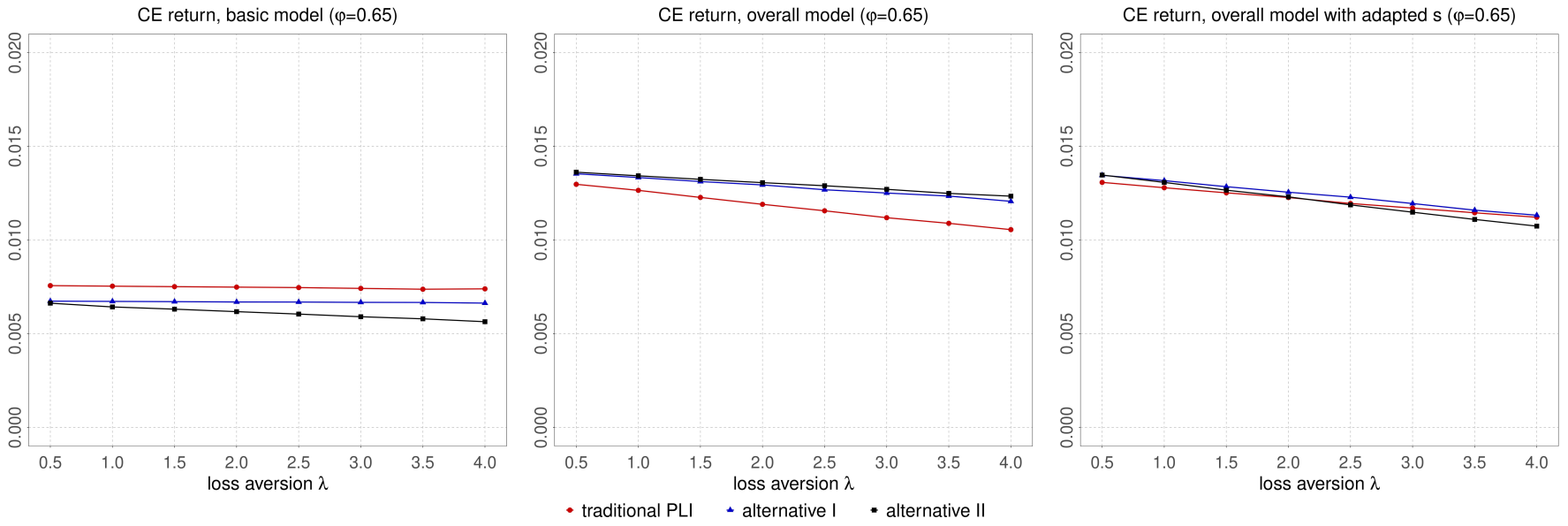
Multi cumulative prospect theory (1)



- The results are qualitatively in line with CPT.

Numerical analysis of the customer perspective

Multi cumulative prospect theory (2)



- Customers are practically indifferent between the contracts under MCPT in the overall model with respectively adapted asset allocations.

Contents

Conclusion and outlook

- Combination of behavioral insurance and actuarial modeling: comprehensive approach of assessing perspective of customers and insights into characteristics that different product designs entail.
- More holistic approach and modeling.
- No “optimal” product. Preferences and differences between products depend on underlying methodology, as well as modeling.
- Certain information and key figures might be misleading and may raise wrong expectations.
- Underlines importance of taking policyholders’ perspective into account for future pension product designs, and that it might be important for actuaries to be aware of it.
- Potential extensions of the modeling: e.g. inclusion of mortality, adaption of parameters to current market environment, analysis and comparison of other products.

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Thank you for your attention!