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# Return Smoothing and Risk Sharing Elements in Life Insurance from a Client Perspective

(based on joint work with Jochen Ruß)

Risk and Statistics - 2nd ISM-UUlm Joint Workshop |
Stefan Schelling | 10.10.2019

# Motivation

- **Traditional participating life insurance** (TPLI) contracts have been the core business of life insurers for many years.
  - typical components of TPLI contracts:
    - provide a year-to-year (cliquet) guarantee
    - receive additionally a surplus participation
  - main difference to individual retirement savings products:
    - life insurers pool assets and liabilities of a heterogeneous portfolio of TPLI contracts which allows for return smoothing and risk sharing

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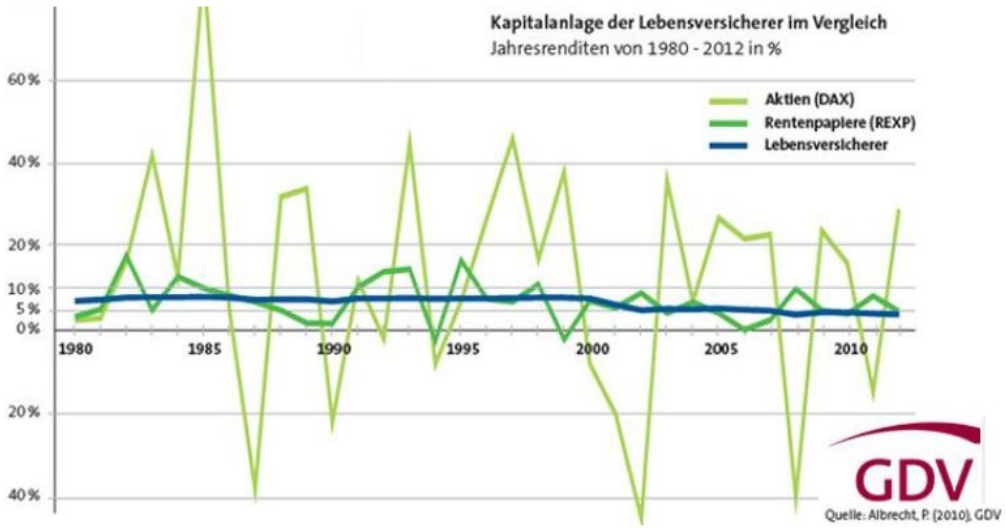
      $\Rightarrow$ results in rather stable investment returns



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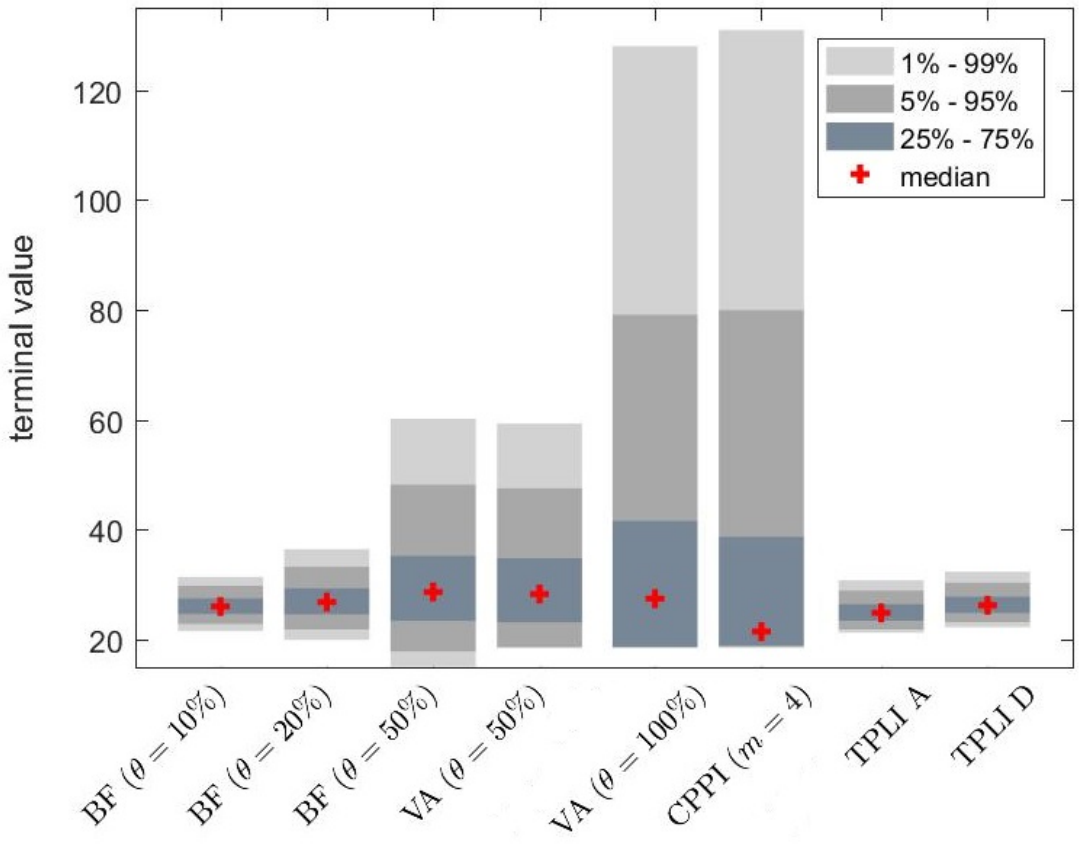
But that comes at a price, cf. exemplary representation of the distribution (as percentiles) of the terminal value of different retirement savings products:

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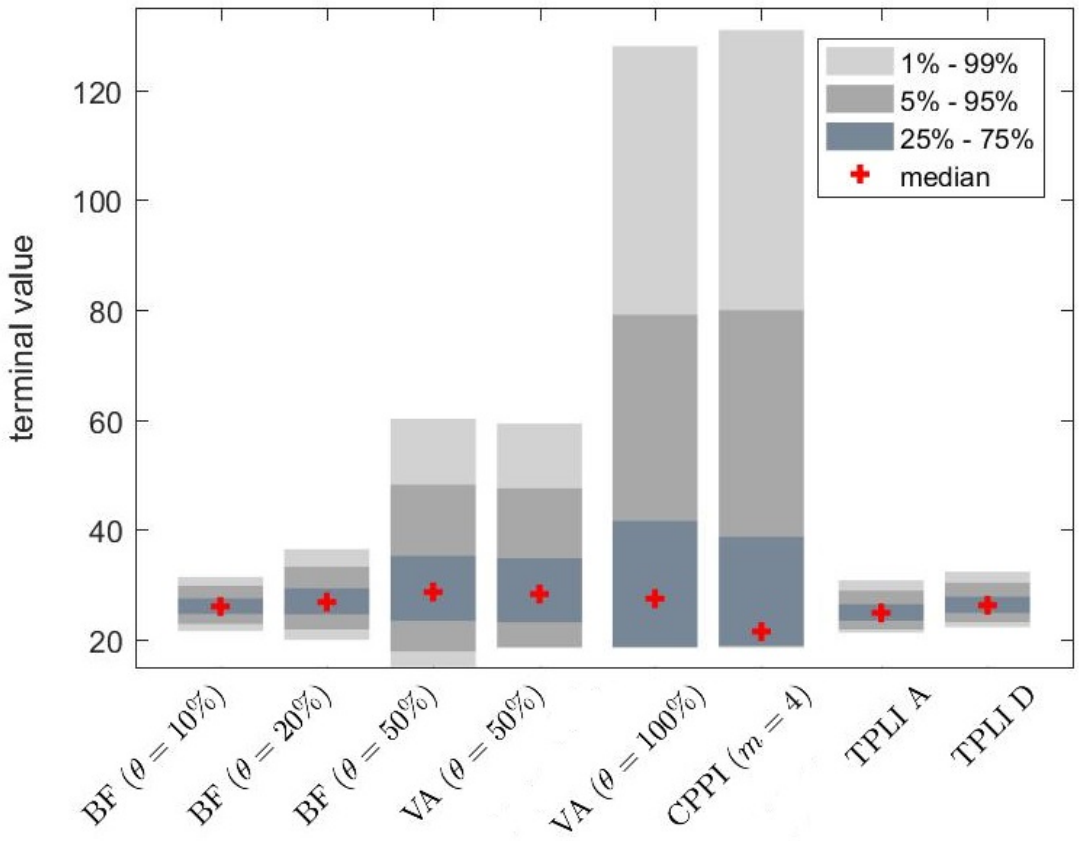


- Yet, versions of TPLI contracts are still very popular

# Motivation

**Q: Why are TPLI contracts so popular?**

- How do clients perceive and evaluate TPLI contracts?
- Which features make TPLI contracts attractive?
  - role of smoothing and risk sharing elements
  - role of (cliquet-style) guarantee

# Decision Making of Long-term Investors

**How do clients perceive and evaluate TPLI contracts?**

- Decision making of humans (often) depends on heuristics which can lead to cognitive biases and systematic deviations from rational decisions.
- A popular descriptive model of decision making is **Cumulative Prospect Theory (CPT)**:
  - introduced by Tversky and Kahneman (1992)
  - descriptive model that tries to give a more accurate description of actual decision making
  - models several cognitive biases
  - consideration of gains and losses with respect to a reference point instead of the total wealth

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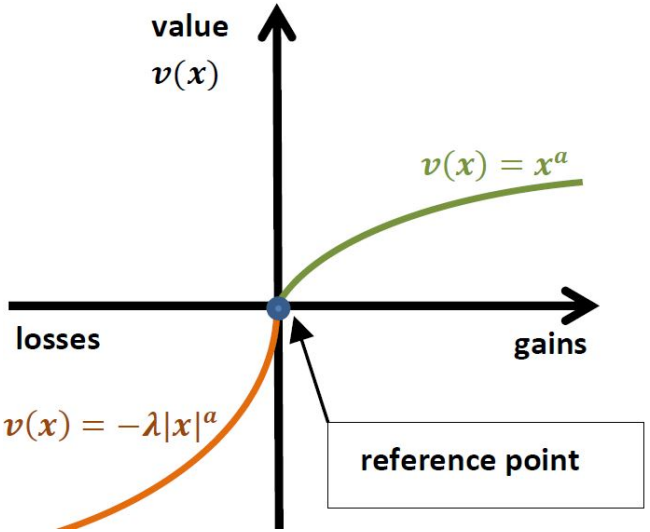
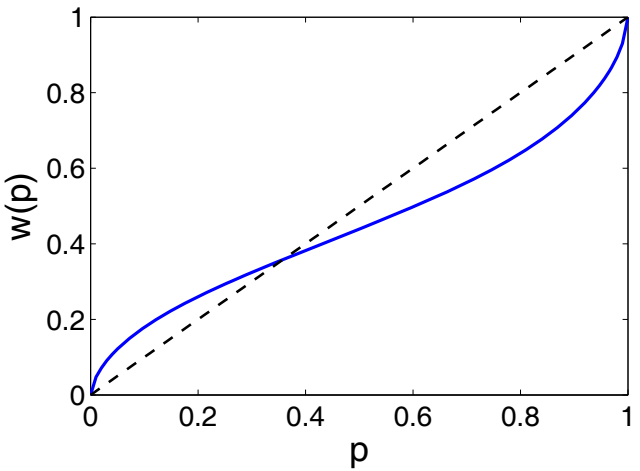
# Decision Making of Long-term Investors

## Main components of CPT:

- S-shaped value function ($v$)
- different treatment of gains (concave) and losses (convex) ($\alpha$)
- loss aversion w.r.t. a reference point ($\lambda$)
- probability distortion function ($w$)
- tail events with small prob. are overweighted ($\gamma$)



# Decision Making of Long-term Investors

**Common approach in this context:**

- Consideration of the distribution of the total change in wealth, i.e.,

$$X := P_T - P_0$$

  with $P_t$ denoting the level of wealth at time $t$.

- The CPT (subjective) utility is then defined as

$$CPT(X) := \int_{-\infty}^{0} v(x) d\left(w\left(F(x)\right)\right) + \int_{0}^{\infty} v(x) d\left(-w\left(1 - F(x)\right)\right)$$

  with $F(s) = \mathbb{P}(X \leq s) = \int_{-\infty}^{s} d\mu_X$.

- Now, several studies (e.g., Benartzi and Thaler, 1995) indicate that long-term investors tend to take into account future annual value changes already when making the investment decision.

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# Decision Making of Long-term Investors

- Ruß and Schelling (2018) propose a model (MCPT) that considers a long-term investor whose investment decision is based on the distributions of all future annual value changes rather than solely on the distribution of the terminal outcome.
- Studies (Ruß and Schelling, 2018; Graf et al., 2019) indicate that MCPT describes long-term decision making more accurately.

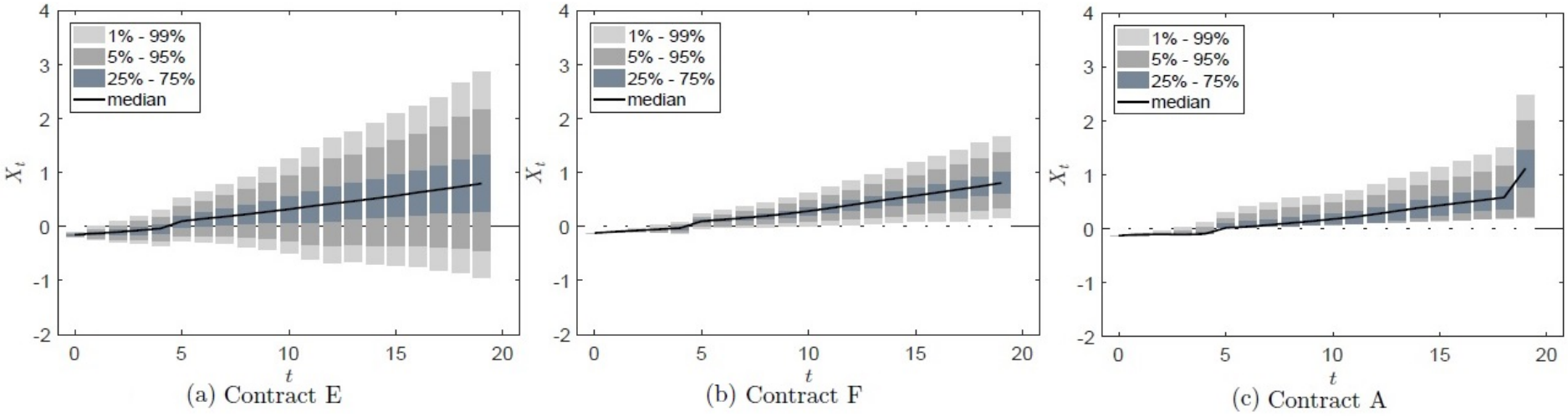
The MCPT value at $t_0 = 0$ of investment $A$ with maturity $T$ and annual value changes $\{X_t\}_{t=1}^{T}$ with $F_t(x) = \mathbb{P}(X_t \leq x)$ is defined by

$$MCPT(A) := \sum_{t=1}^{T} CPT(X_t),$$

where $CPT(X_t) = \int_{-\infty}^{0} v(x)\,\mathrm{d}\big(w\left(F_t(x)\right)\big) + \int_{0}^{\infty} v(x)\,\mathrm{d}\big(-w\left(1-F_t(x)\right)\big)$.

# Selected Results

Percentiles of the annual changes $X_t$:




(a) Contract E (b) Contract F (c) Contract A

(a) contract E: unsmoothed investment

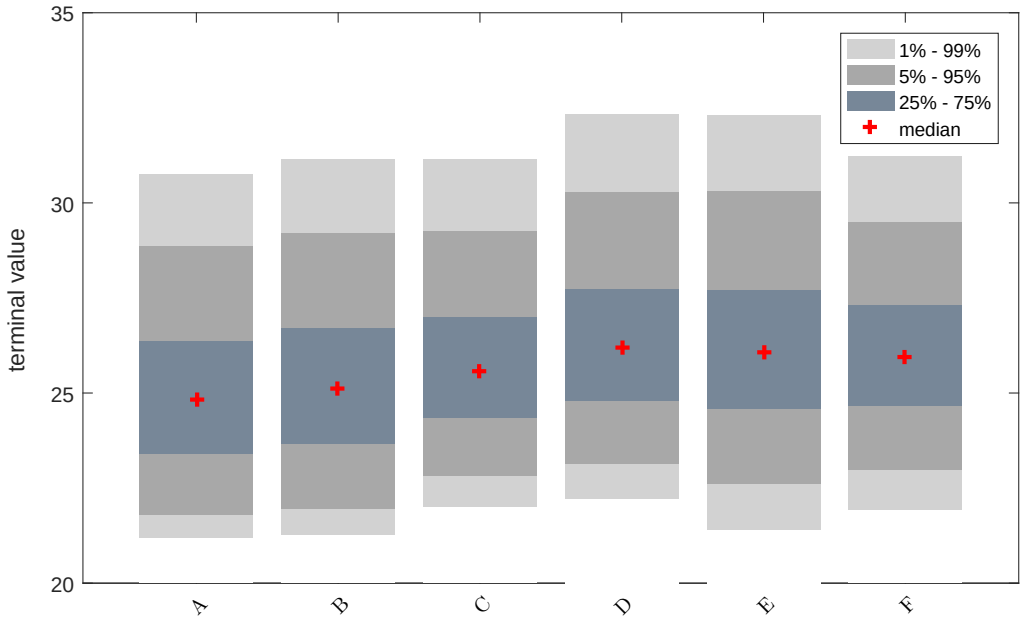
(b) contract F: smoothed investment returns but w/o guarantee

(c) contract A: TPLI (smoothed returns and year-to-year guarantee)

- Insurance company serves as buffer between capital market and policyholder.

# Selected Results

## Percentiles of the terminal value:




A-D: TPLI contracts with different initial situations

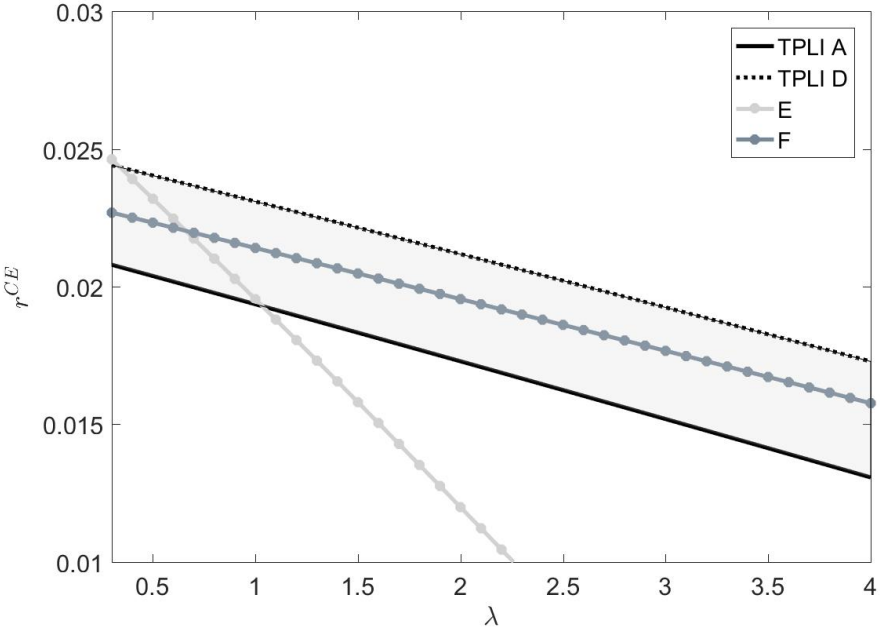
E: unsmoothed investment

F: smoothed investment returns but w/o guarantee

- Collective investment can heavily stabilize annual changes without significantly changing the risk-return characteristics of the terminal value

# Selected Results

## Results for an MCPT-investor:




| contract setting | return smooth. | annual guarantee |
|---|---|---|
| TPLI A | ✓ | ✓(1.25%) |
| TPLI D | ✓ | ✓(1.25%) |
| E | ✗ | ✗ |
| F | ✓ | ✗ |

$r^{CE}$ describes the guaranteed annual return that an investor would regard equally desirable as the considered contract. $\lambda$ denotes degree of loss aversion.

- Results for contract F compared with contract E show that collective smoothing elements heavily increases attractiveness (even w/o guarantee).

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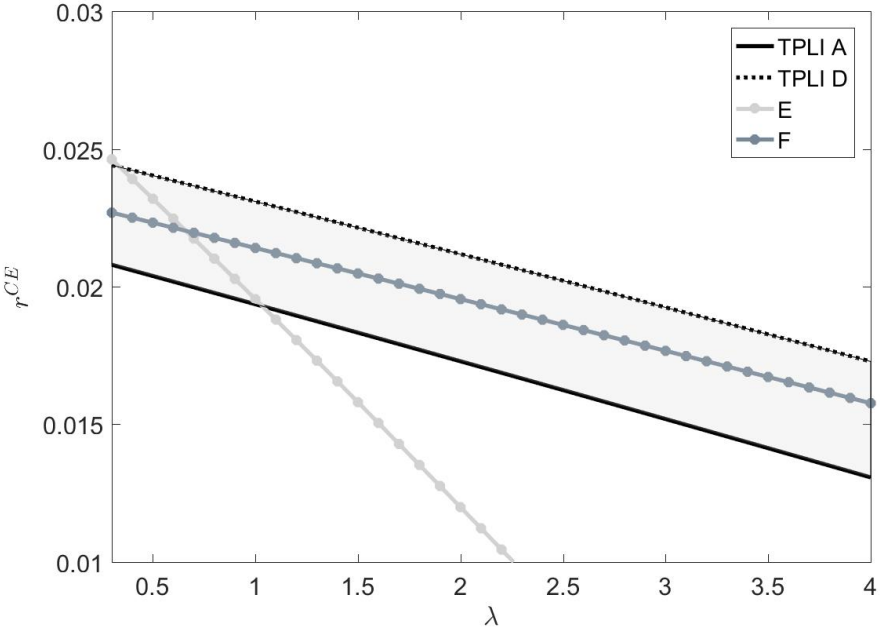


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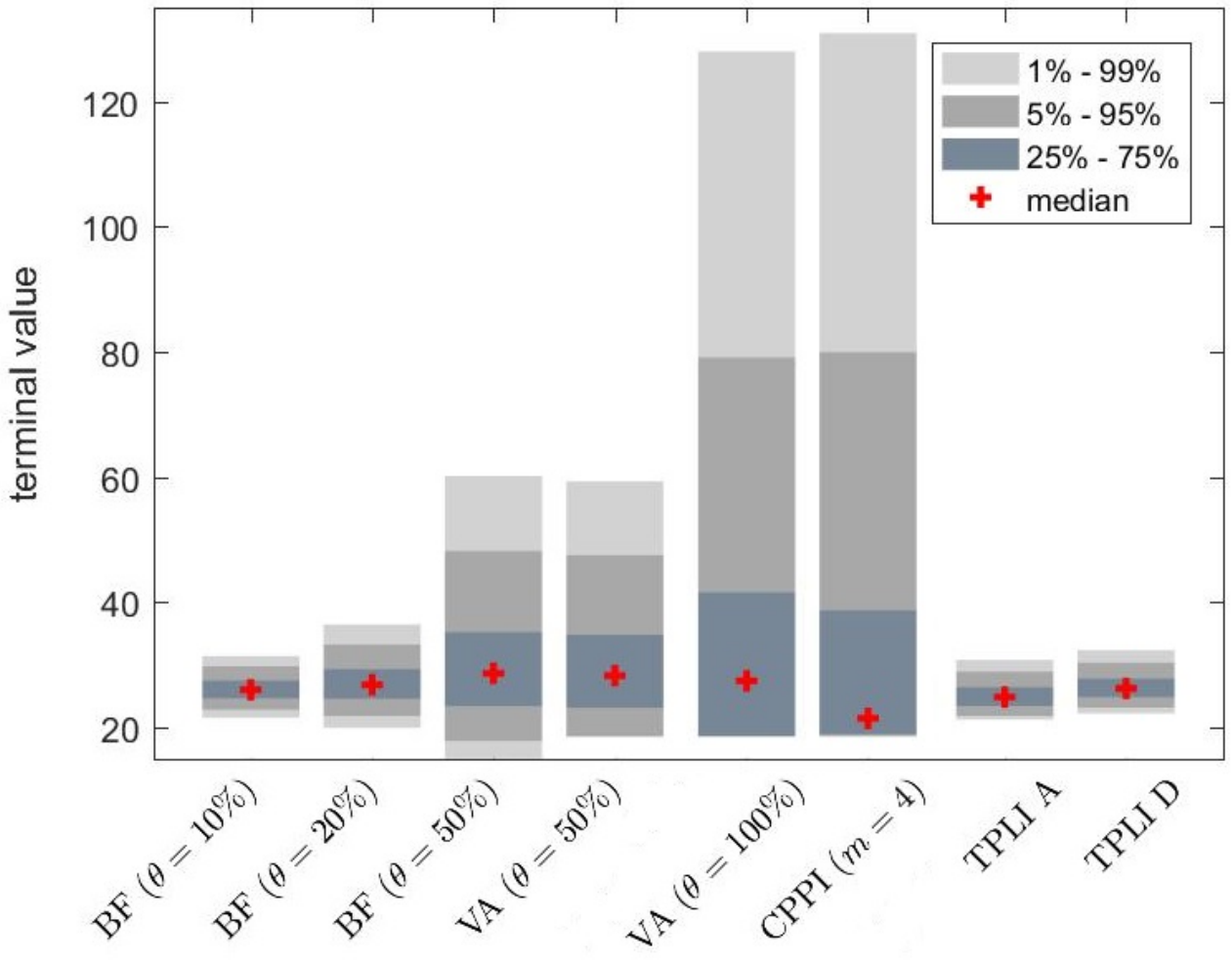
Now, we come back to figure from the beginning:



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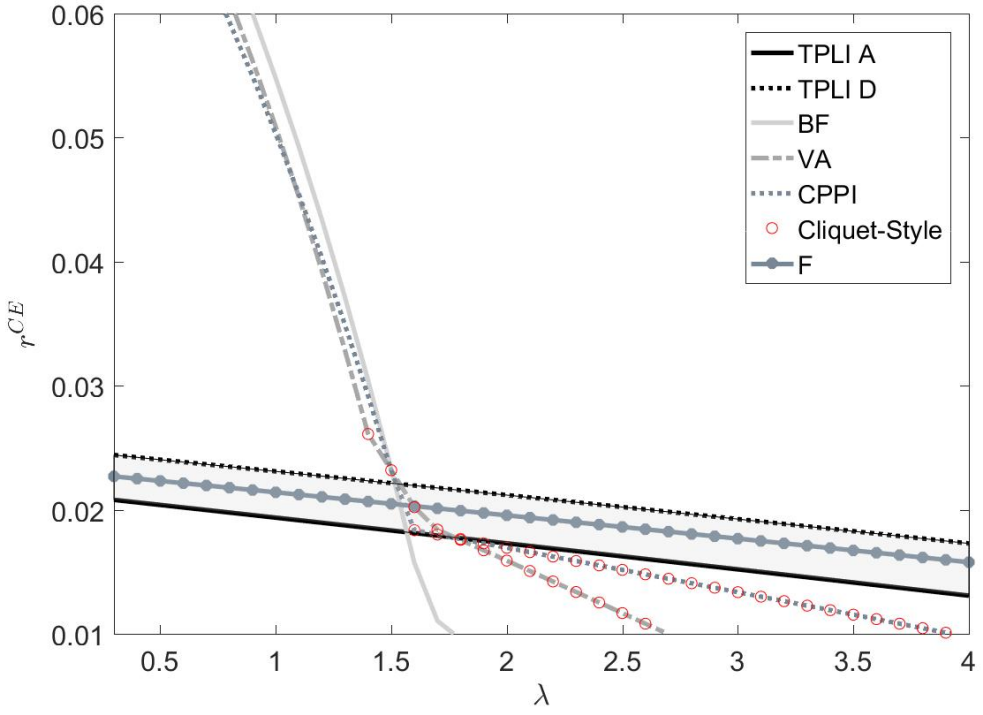
Results for an MCPT-investor:




- TPLI contracts are preferred over other products for typical degrees of loss aversion ($\approx 2$)
  $\rightarrow$ this is even true for other products with (year-to-year) guarantee features!

# Summary

- The **results show**:
  - collective investment can heavily stabilize annual returns without significantly changing the risk-return characteristics of terminal value
  - For an MCPT-investor:
    - Smoothing elements significantly increase attractiveness
    - TPLI products are preferred over common unit-linked products
- In the context of **product design**:

  Results indicate that products ...
  - which make use of smoothing elements of a collective investment and
  - with weaker guarantee features ...

  seem promising in ...
  - providing an objectively superior distribution of terminal value ...
  - while at the same subjectively being attractive for the customer.

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# Thank you for your attention!

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# Selected References


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