Behavioral Aspects of Product Design and Demand in Retirement Savings

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Motivation

▶ German pension system consists of three pillars:

1. mandatory state pension
2. occupational pension insurance
3. private pension insurance

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3. private pension insurance

▶ In face of an aging society, occupational and private pension insurance become increasingly important to maintain a desired standard of living in old age.

  ▶ more choices but also higher complexity and self-responsibility

▶ Individuals are typically confronted with two fundamental decisions:

  D1. How to invest in the accumulation phase?
  D2. How to decumulate savings after approaching retirement age to maintain a desired standard of living?

Motivation

▶ Both questions have been analyzed by numerous authors:
  ▶ There is vast literature on optimal investment allocation and consumption (over the lifecycle) ...
    ▶ seminal papers: Markowitz (1952), Yaari (1965), Merton (1969, 1971), etc.
  ▶ and the optimal design of pension insurance products.
    ▶ e.g., Cairns et al. (2006), Branger et al. (2010), Chen & Delong (2015), etc.

▶ Common assumption in this stream of literature:
  ▶ economic agents are utility maximizing rational decision makers (in a normative fashion)

▶ Results provide insights on how economic agents should make decisions in order to maximize their well-being (utility) from a rational point of view.

Motivation

▶ However, there exists a high discrepancy between theoretical optimal and observed behavior.

▶ Examples for observed behavior in the context of retirement savings:[1]

    ▶ preference for very safe investments (savings account, bonds, etc.)

    ▶ avoidance of short-term losses (Benartzi & Thaler, 1995),

    ▶ preference for various types of guarantees

    ▶ very low voluntary annuitization rates

"I visualized my grief if the stock market went way up and I wasn't in it – or if it went way down and I was completely in it. So I split my contributions 50/50 between stocks and bonds." – Harry M. Markowitz

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[1] E.g., Benartzi & Thaler (1995), Mitchell et al. (2009), Benartzi et al. (2011), Ebert et al. (2012).

Motivation

▶ **Cumulative Prospect Theory** (CPT) by Tversky & Kahneman (1992):
  ▶ S-shaped value function (v)
    ▶ different treatment of gains (concave) and losses (convex)
    ▶ loss aversion w.r.t. a reference point (λ)
  ▶ probability distortion function (w)
    ▶ tail events with small probabilities are overweighted (γ)

▶ Several authors have analyzed retirement savings products under CPT:
  ▶ CPT can explain the demand for terminal guarantees,
    ▶ e.g., Døskeland & Nordahl (2008) and Dichtl & Drobetz (2011).
  ▶ But, CPT (in its standard form) cannot explain the popularity of many common retirement savings products, e.g.,
    ▶ products with year-to-year guarantee features (Ebert et al., 2012),
    ▶ funds with decreasing risk exposure towards maturity (Graf, 2017),

Objectives and Research Questions

Therefore, this thesis covers the following research questions concerning D1 (accumulation phase):

Q1. How do investors perceive and evaluate long-term investments?

- ▶ How can we appropriately model the impact of potential interim changes in the account value on the decisions of long-term investors?
  → Research paper 1
- ▶ Is the consideration of potential interim value changes able to explain the observed demand for common retirement savings products?
  → Research paper 1, 2, and 3
- ▶ How attractive are return smoothing and risk sharing elements provided by life insurers for such long-term investors?
  → Research paper 3

Objectives and Research Questions

► Behavioral aspects seem also important to understand the **very low voluntary annuitization rates**.

  ► Studies indicate that framing is crucial (Brown et al., 2008).
  ► The drivers of this result, the role of different cognitive biases as well as their interaction are not yet fully clear.

Therefore, this thesis also analyzes the following research questions concerning D2 (decumulation phase):

Q2. How can we explain the strong impact of framing on the annuitization decision?

  ► How can we model actual decision making under the different frames?
  ► What are the impacts of different behavioral aspects under these frames?

  → Research paper 4

Selected Research Results

Research Paper 1:

Multi Cumulative Prospect Theory and the Demand for Cliquet-Style Guarantees

joint work with J. Ruß

Journal of Risk and Insurance 85(4): 1103–1125, (2018).

Motivation

Q1: How do investors perceive and evaluate long-term investments?

▶ Mental Accounting implies that investors tend to reevaluate their investment decision on short evaluation periods.

  ▶ Long-term investors typically receive annually a financial statement.
  ⇒ adaptation of the reference point (→annual changes)

▶ Myopic Loss Aversion (Benartzi & Thaler, 1995): Combination of loss aversion and short investment evaluation periods.

  ▶ can explain the popularity of very safe investments

⇒ These findings strongly indicate that long-term investors tend to take into account future annual value changes already when making the investment decision.

Multi Cumulative Prospect Theory

▶ Based on this, we propose a model that considers a long-term investor whose investment decision is based on the distributions of all future annual value changes rather than on the distribution of the terminal outcome.

Multi Cumulative Prospect Theory (MCPT) Preference

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

First Application of MCPT

Can MCPT explain the popularity of year-to-year guarantee features?

▶ Consideration of different unit-linked products:
- ▶ without guarantee (constant mix)
- ▶ with terminal guarantee (roll-up)
- ▶ with year-to-year guarantee (ratch-up / cliquet)

Summary of the Results of Research Paper 1

▶ Risk free asset is preferred among products without guarantee.

  ▶ consistent with the popularity of very safe assets

▶ Year-to-year guaranteed products (cliquet, ratch-up) are preferred over other products.

  ▶ consistent with the popularity of year-to-year (cliquet) guaranteed products

Overall, research paper 1 answers several aspects of Q1:

▶ We motivate and describe a descriptive model (MCPT) which attempts to approximate actual decision making of long-term investors more accurately.

▶ We show that MCPT is able to explain the popularity of year-to-year (cliquet) guaranteed products.

Selected Research Results

Research Paper 2:

As You like It: Explaining the Popularity of Life-Cycle Funds with Multi Cumulative Prospect Theory

joint work with S. Graf & J. Ruß
Risk Management and Insurance Review 22(2): 221-238, (2019).

Second Application of MCPT

Can MCPT explain the popularity of life-cycle funds?

- ▶ Life-cycle funds:
    - ▶ decrease risk exposure towards maturity
    - ▶ For any given life-cycle fund there exists a matching balanced fund with an (almost) identical distribution of the terminal outcome (Graf, 2017).
- ▶ Main result under MCPT:
    - ▶ Life-cycle funds are preferred for typical degrees of loss aversion ($\lambda \approx 2$).

Overall, research paper 2 contributes to Q1:

- ▶ We show that MCPT is able to explain the popularity of life-cycle funds (in contrast to EUT and CPT).
- ▶ We provide further evidence that MCPT describes actual long-term investment decision making more accurately.

Selected Research Results

Research Paper 3:

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

joint work with J. Ruß
submitted and under review

Third Application of MCPT

How attractive are return smoothing and risk sharing elements provided by life insurers for MCPT investors?

▶ A detailed presentation can be found on actuview (2nd Ulm Actuarial Day):
`https://www.actuview.com/return-smoothing-and-risk-sharing-elements`
`-in-life-insurance-from-a-client-perspective_c37adc27d.html`

Overall, research paper 3 contributes to Q1:

▶ We show that return smoothing and risk sharing elements heavily increase the attractiveness of retirement savings products (in the sense of MCPT).

▶ We show that MCPT is able to explain the popularity of traditional participating life insurance contracts and provide further evidence on the descriptive power of MCPT.

Selected Research Results

Research Paper 4:

When and How Framing Makes Annuitization Appealing:
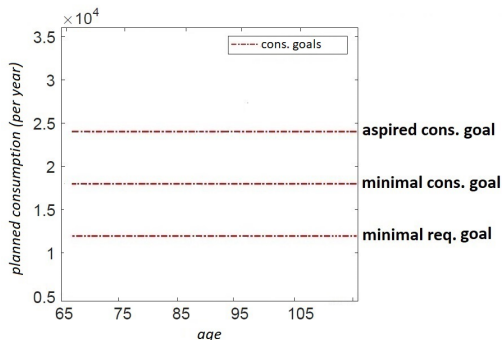A Model-Based Analysis

working paper

Motivation

Q2: How can we explain the strong impact of framing on the annuitization decision?

▶ **Framing:** Perception and evaluation depends on representation.

- ▶ Investment frame:
  - ▶ individuals focus solely on the investment return
  - ▶ investment frame provides an explanation for very low annuitization rates (Hu & Scott, 2007, and Brown et al., 2008)

- ▶ Consumption frame:
  - ▶ focus on maintaining an aspired standard of living
  - ▶ annuities are perceived as much more appealing (Brown et al., 2008)
  - ▶ but choices still deviate from utility maximizing choices under traditional life-cycle models (Brown et al., 2013)

Model Approach

How can we model actual decision making under the different frames?
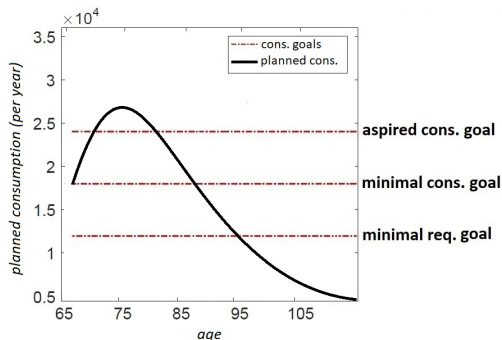
▶ We assume that individuals consider multiple consumption goals and that planned consumption is based on these goals.

Model Approach

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Model Approach

How can we model actual decision making under the different frames?

► We assume that individuals consider multiple consumption goals and that planned consumption is based on these goals.

► This suggests a double S-shaped value function (v).
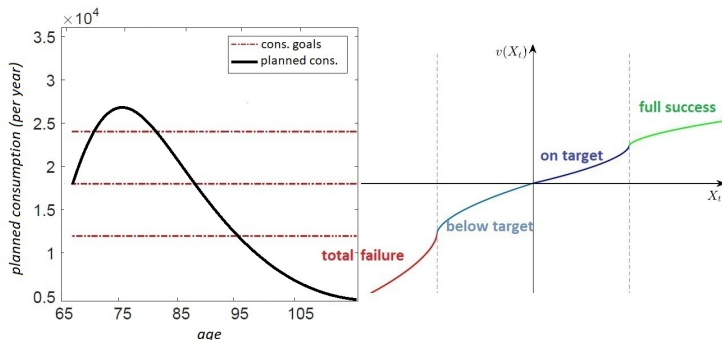
Selected Results

What are the impacts of different behavioral aspects?

- ▶ Investment frame:
    - ▶ cognitive biases make annuitization even less appealing
        - ▶ loss aversion with respect to the annuitized wealth
        - ▶ overweighting of proverbial "hit by the bus" events
- ▶ Consumption frame:
    - ▶ main driver of the high annuitization rates are the different reference points
    - ▶ other aspects like cognitive biases can have diverse impacts
        - ▶ loss aversion, probability distortion, subjective life expectancy, etc.

Overall, research paper 4 contributes to Q2:

- ▶ We motivate and describe descriptive models for the different frames.

- ▶ We are able to disentangle the impact of different behavioral aspects on the decision.

Summary

Q1: How do investors perceive and evaluate long-term investments?

- We have motivated and introduced a descriptive model (MCPT) for long-term investment decision making.

- We have shown that MCPT is able to explain the popularity of various common retirement savings products (year-to-year guarantees, life-cycle funds, TPLI).

- We have shown how return smoothing and risk sharing elements can heavily increase the attractiveness of retirement savings products.

- Overall, the results provide strong evidence that MCPT describes actual long-term investment decision making more accurately than existing approaches.

Q2: How can we explain the strong impact of framing on the annuitization decision?

- We have motivated and described models for the decision making under the different frames.

- We are able to disentangle the impact of different behavioral aspects on the decision.

Thank you for your attention!

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Behavioral Aspects of Product Design and Demand in Retirement Savings

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