The Impact of Inflation Risk on Financial Planning and Risk-Return Profiles

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Motivation

• Government-run pay-as-you-go systems suffer from demographic changes
  → demand for private old age provision increases

• How to choose “optimal” products?
  – Vast body of literature on determining optimal (often dynamic) asset allocations mostly using expected utility approaches
  – Really practicable for “typical” client?
  – Graf et al. (2012) introduce risk-return profiles of old age provision products by means of stochastic modelling focussing on nominal returns
  – But: **Purchasing power of benefits more relevant than nominal returns.**
Products under consideration

„Standard“ products

– Equity Fund
– Zero-Bond
– Different products with nominal guarantee
  • Option based
  • Zero plus Underlying
  • iCPPI
Nominal risk-return profile

Contribution

- Extend the model of Graf et al. (2012) by including stochastic modelling of inflation
- Quantitative analysis of real returns especially focussing on (existing) products equipped with nominal investment guarantees
- Proposal of product modifications taking inflation risk into account
Products under consideration

„Modified“ Products („Inflation-linked“ products)

– Inflation-linked bond

– Modified versions of Zero plus Underlying and iCPPI
  • Adjustment of floor based on realized inflation
  • Market based adjustment of floor
  • Inflation-linked bond as a safe asset
Risk-return profiles

Assess product’s risk-return profile by estimating the probability distribution of (nominal and real) maturity benefits (or returns)

Derive maturity benefit by generating equity, interest rate and inflation scenarios, modelling fund management decisions, and modelling products investing in various funds

Stochastic modelling of Equity (Heston, 1993), nominal interest rates (Cox et al. 1985), and inflation (Vasiček, 1977)

• In the paper, we analyze the risk-return profiles of all considered products for single and regular premium payment and perform a large number of sensitivity analyses.
• In this presentation, we look at single premiums and a „base case“ scenario only.
Nominal vs real risk-return profiles of standard products

Single premium with 30y investment horizon

- Popular products with nominal guarantees often have a significant probability mass at the guaranteed amount
- This results in a high probability of negative real returns
- Product designs with an investment strategy that takes inflation into account are desirable
Real risk-return profiles of modified products

Single premium with 30y investment horizon

- Product modifications significantly reduce the risk of negative real returns
- Using a market based floor adjustment appears to yield better results (changes are picked up more quickly)
- The Zero plus Underlying products are more conservative, the iCPPI products yield more upside potential but also more risk.
- This products and „combinations in between“ might provide a good starting point for offering products with some form of inflation protection.
Conclusion and further research

Conclusion

– Inflation risk has significant impact on existing old age provision products, in particular products that are perceived as safe due to nominal guarantees.
– Proposed product modifications reduce inflation risk significantly.
– We constructed different modified products for clients with different risk aversion.

Further research

– Measure and manage inflation risk in the payout phase of different types of annuities.
– Derive policy implications and educate governments, regulators, financial advisors and clients about inflation risk.

• E.g. the German case: Government provides certain tax benefits only for products with nominal guarantees + intended legal obligation to show nominal risk return profiles.
Thank you very much for your attention

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Backup – Model and parameters

\[ r(t) = \kappa_r (\theta_r - r(t)) dt + \sigma_r \sqrt{r(t)} dW^r(t) \]
\[ di(t) = \kappa_i (\theta_i - i(t)) dt + \sigma_i dW^i(t) \]
\[ dS(t) = S(t) \left( (r(t) + \lambda_S) dt + \sqrt{V(t)} dW^S(t) \right) \]
\[ dV(t) = \kappa_V (\theta_V - V(t)) dt + \sigma_V dW^V(t) \]

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