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Threshold Portfolio Return for Swiss pension funds based on nested stochastic modelling

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About the speaker

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- Head of IT & Software Tools
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Company/Institution

- Comprehensive Actuarial and Pension Fund Consulting
- International Accounting
- Pension Fund Administration

Agenda

- Definition of threshold portfolio return (TPR)
- Objectives of this study
- Approach & Results

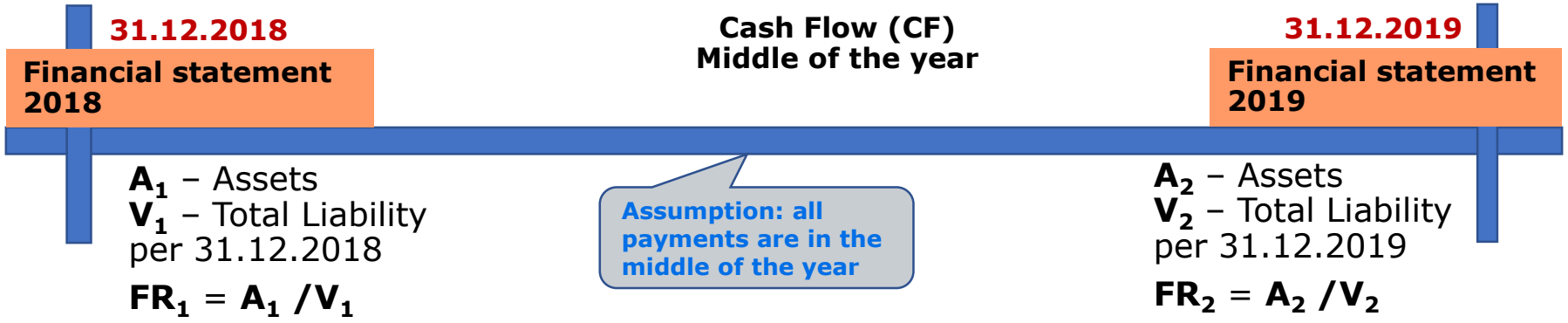
Definition of threshold portfolio return (TPR)

Based on the FRP 5 Guidelines of the Swiss expert chamber (SKPE)

FRP5 Guidelines (SKPE)

- **TPR** is a portfolio return necessary to keep the funding ratio on the same level like the year before
- Swiss Chamber of Pension Fund Experts (**SKPE**) sets up minimum requirements for the verification of a pension fund according to Art. 52e Abs. 1 BVG/LPP (the law of the second pillar in Switzerland)
  - The definition of the threshold portfolio return, **TPR** (*rendement nécessaire*), belongs to these guidelines
  - **FRP5** requests that the pension fund expert gives a feedback to the **TPR** size compared to the portfolio return

Formula for TPR used by actuaries



To ensure that the funding ratio (FR) over one year stay constant **(i.e. $FR_1 = FR_2$)** it is necessary that the asset value at the year end (A_2) amounts to **$A_2 = A_1 * (V_2 / V_1)$**

$$A_2 = A_1 * (V_2 / V_1) = A_1 * (1 + R^{Liab})$$
$$= A_1 * (1+R^{TPR}) + CF * (1+ R^{TPR} / 2)$$

CF = Cash-In – Cash-out; **$CF^{\%(A1)} = CF/A_1$** (i.e. Cash flow divided by the asset value at the former year)
R^{TPR} -> Threshold Portfolio Return; **R^{Liab} - > Total liability change rate** = **$V_2 / V_1 - 1$**

$$R^{TPR} \approx R^{Liab} - CF^{\%(A1)} + \dots$$

TPR Role in Riskmanagement „rule of thumb with TPR“

$$R^{TPR} \approx R^{Liab} - CF\ \%(A1) + \ldots$$

Portfolio return - $R^{TPR} \approx$ FR (EoY)/FR (BoY) -1

(Portfolio return - R^{TPR}) * FR(BoY) ≈ FR (EoY) - FR (BoY)

- **If the funding ratio at the beginning of the year FR(BoY) is ca. 100% then the change of the funding ratio over the year is ca. the difference between the portfolio perfomance and the TPR for this year**
- **If the FR(BoY) < 100% (>100%) then the funding ratio change is smaller (bigger) than the difference between the portfolio return and TPR**

Objectives of this study

Objectives of this study

- New approach to forecast the Threshold Portfolio Return (**TPR**)
  - based on nested stochastic simulations of liabilities
- Analysis of Impact on forecasted TPR
  - of the pension fund size,
  - proportion of the total pensioner liability to active membership liability
  - Development of active membership (growth of salary and head count)
- Impact on TPR of
  - the cash flow sign, CF
  - the level of the funding ratio at BoY, FR(BoY)
- Comparison with TPR forecast results based on the similar approach widely used by board of trustees

Forecast of Threshold Portfolio Return

- **TPR** does not depend on the portfolio return
- Due to this fact this analysis is done without using a ESG (Economic Scenario Generator) – model for the asset allocation
- The impact of the stochastic discount rate (so called technical interest rate) will be investigated

Fund population impact and its development

- Modelling of active membership
  - Stochastic simulations of leavers, death and disability cases, retirement and new enters
  - The impact of stable and growing population is investigated

- Modelling of pensioner population
  - The pensioner population is open due to the fact that every year new potential retirees, spouses and disabled could enter into the pensioner population
  - Only in case of death all kind of pensioners will quit from the pensioner population
  - Disability annuity is paid up to the retirement age and after the retirement age the disabled will be converted into the retiree state

- Child pensions (orphan, child pension for disabled and child pension for retiree if child younger than 25) will be modelled as a capital payment

Impact of cash flow sign and FR level

- Based on **TPR** definition the level of the funding ratio, **FR**, has an impact on **TPR** depending on the sign of the total cash flow
  - Total Cash Flow = *Cash-Inflow – Cash-Outflow*
- The total cash flow is negative
  - TPR (FR < 100%) > TPR (FR = 100%)
  - TPR (FR > 100%) < TPR (FR = 100%)
  - This is the case of pension funds with a big pensioner liability
- The total cash flow is positive
  - TPR (FR < 100%) < TPR (FR = 100%)
  - TPR (FR > 100%) > TPR (FR = 100%)
  - This is the case of growing pension funds with smaller part of pensioner liability

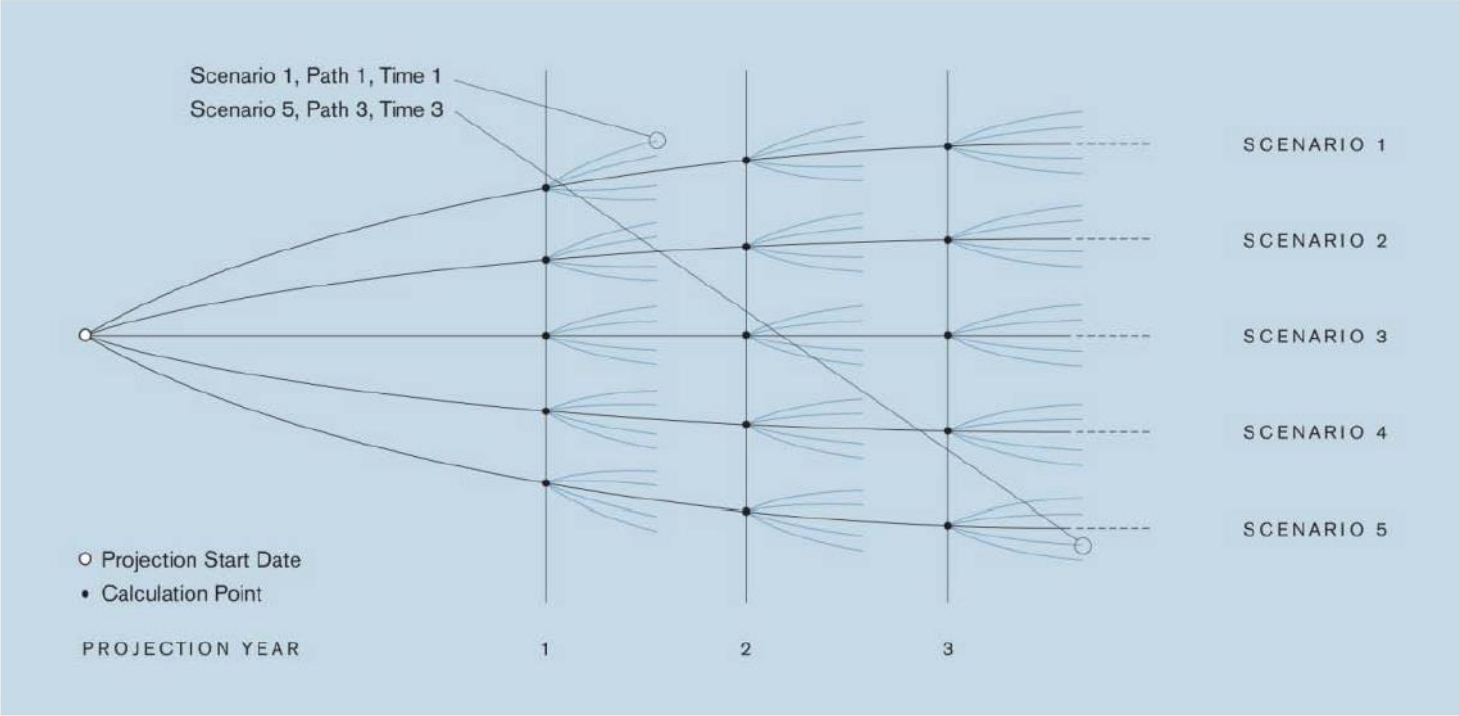
Approach & Results

Nested stochastic simulations of pension fund memberhsip mutations and future discount rates

General Information on Pension Funds

Key metrics	Big pension fund PF1	Medium pension fund PF2
Total head count	ca. 4‘500	Ca. 1‘500
% head count active membership	82%	49.5%
% pensioner liability % total liability	1/3	2/3
Benefit plan: ▪ Saving policy for retirement ▪ Risk benefits (Death & Disability)	 Cash Balance Plan (IC 1.5%) Defined Benefit	 The same plan The same plan
Reserving actuarial basis: Additional actuatial provisions	BVG2015 Gener.Table, 1.5% Typical rules	The same basis The same rules
Start Funding Ratio	100%	100%
Gross Salary development	ca. 4%	ca. 1%
Development active membership	Head count growth rate ca. 1.4%	Head count constant (i.e. growth rate 0%)

Liability Stochastic Simulations based on Nested Stochastic Projections

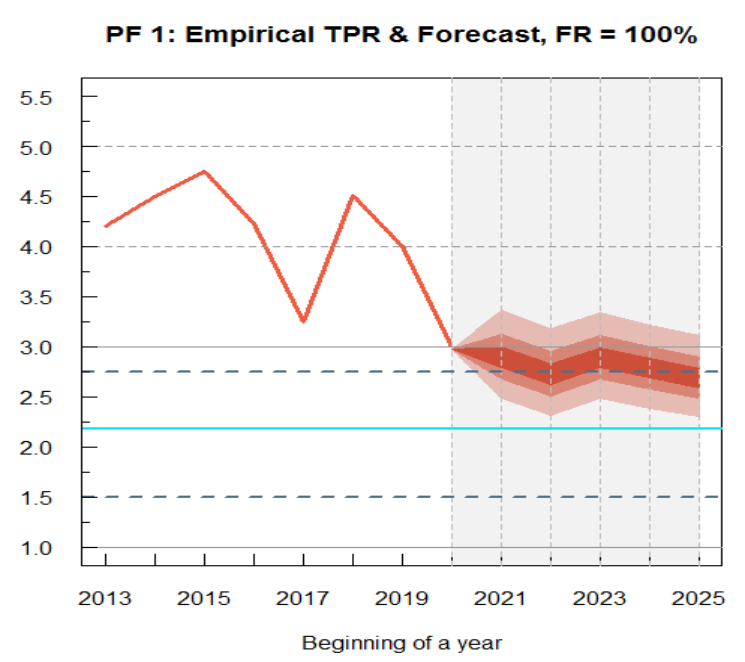
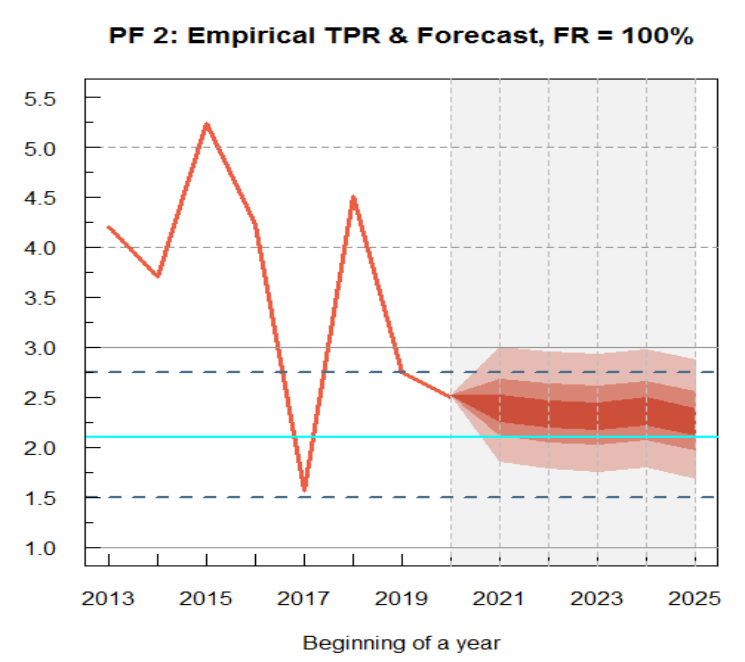


Excerpted from "The Future of Capital Modeling," by Pat Renzi, Milliman Insight, Issue 2, 2006.

- Book „Stochastic Modeling: Theory and Reality from an Actuarial Perspective", ISBN 978-0-9813968-2-8, www.actuaries.org (Milliman)

Comparison of results:

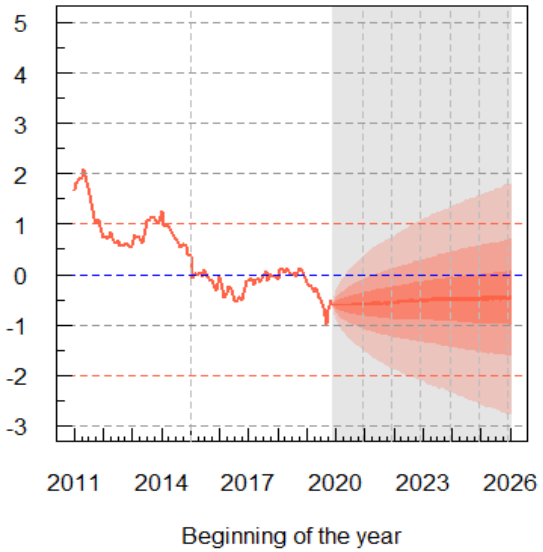
Forecast of TPR for PF 1 and PF 2 based only on mutations (no changes of discount rate)

Nominal growth rate of insured payroll 0.9% Head count active membersip growth rate Zero	Nominal growth rate of insured payroll 0.9% Head count active membersip growth rate Zero
	

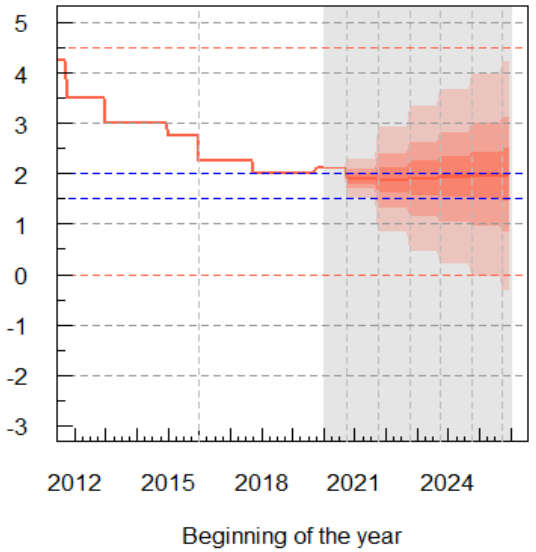
- The forecasts for PF 1 and PF 2 are based on assumptions that no plan changes and parameter changes will be implemented in the coming 6 years
- The light blue line shows the value of the expected TPR estimated based on the simple approach used by boards of trustees and actuaries

Impact of discount rate reduction

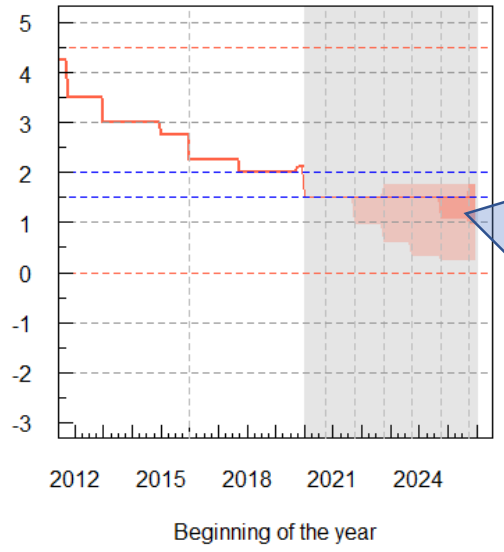
10-year government bond yields (%)



FRP4: discount rate upper limit (%)



Local discount rate based on FRP4 limit (%)



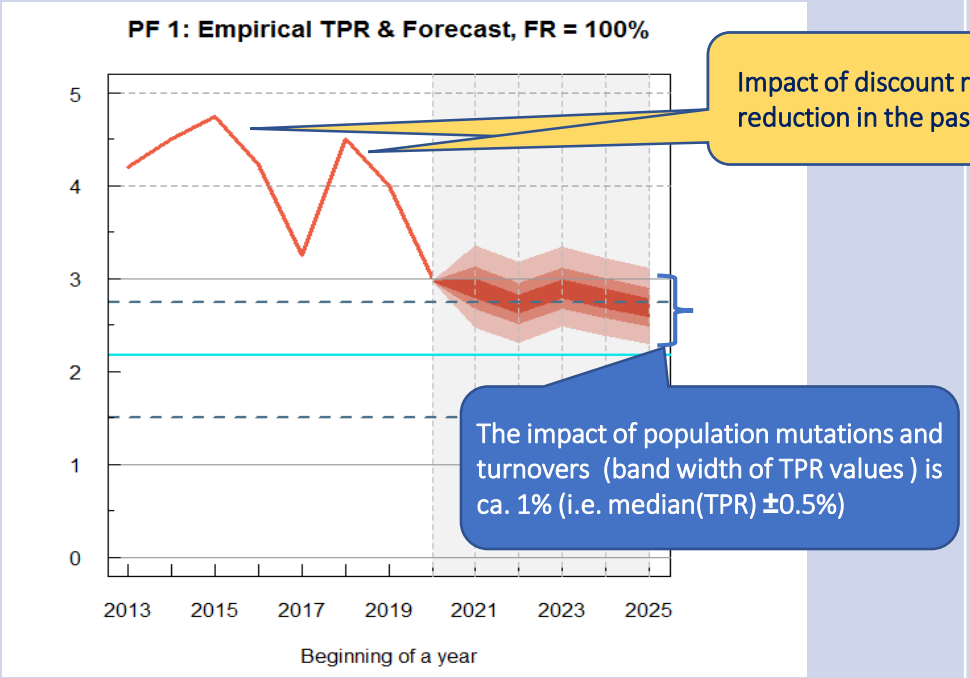
The impact of discount rate reduction from 1.5% to 1.0% is in the 2nd year, from 1.0.% to 0.75% in the 3rd year and from 0.75% to 0.5% in 4th year and from 0.5% to 0.25% in the 6th year are between 5th- 20th percentiles
The increase from 1.5% to 1.75% in 3d year are between 80th-95th percentiles

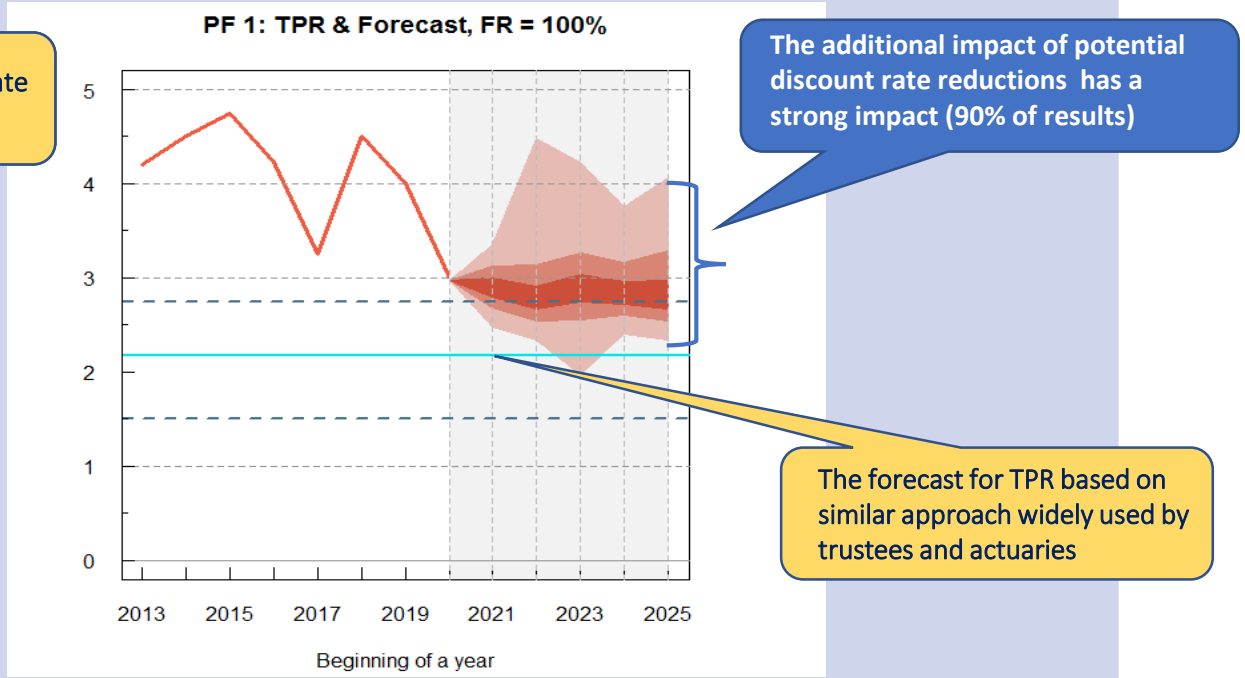
- The upper limit for the local discount rate is set up in FRP4 Guidelines SKPE (Swiss Chamber of pension fund experts/ actuaries)
- The upper limit is an average value of 10-year government bond yields over the last 12 months (measured at the end of September) plus 2.5% (maximum value <= 4.5%)
- **As a rule the current discount rate will be not substantially increased (here from 1.5% up to 1.75%) but decreased in steps by 0.25% or 0.5%**

Comparison of forecast results PF1:

TPR for PF 1 based on mutations and potential discount rate reduction

Nominal growth rate of insured payroll 0.9% Head count active membership growth rate Zero Local discount rate 1.5%	Nominal growth rate of insured payroll 0.9% Head count active membership growth rate Zero Local discount rate will be reduced based on stochastic forecast FRP4





- The forecast for PF 1 (left) is based on the constant DR = 1.5% / the forecast for PF1 (right) is based on stochastic discount rate
- **The reduction of discount rate by 0.5% increases the TPR by ca. 1.7% (=0.5%*10/3) one-time (Duration 10 years, pensioner liability 1/3 of total liability)**
- The median of stochastic discount rate is 1.5%
  - The discount rate decrease implemented between 5th and 20th percentiles und its increase between 80th and 95th percentiles

Summary: value added by this approach

- The nested stochastic projections of liabilities produce more realistic forecast for the threshold portfolio return
- The results are pension fund specific and depend on the size of active membership and pensioner population, on development scenarios as well as on the benefit plan scope
- Modeling liabilities based on nested stochastic approach could be used as well for reserving and pricing of all types of actuarial products in pension funds and in insurance companies
- As a nest step it would be useful to include a stochastic mortality model (esp. for pensioner population) to verify potential costs for the Treshold Portfolio Return for longevity risk

Thank you for your attention

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