Longevity Market
in the UK and in the World

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hannover **re**®

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Introducing Hannover Re

- Established in **1966**, initially: Non-life
  - **since 1990: Life and health** as strategic growth segment
- **Initial Public Offering 1994** (second P.O. 2003), majority shareholder: **Talanx**
- About **2200 employees** in more than 100 subsidiaries, branches and representative offices on all 5 continents
- More than **5000 insurance clients** in about 150 countries
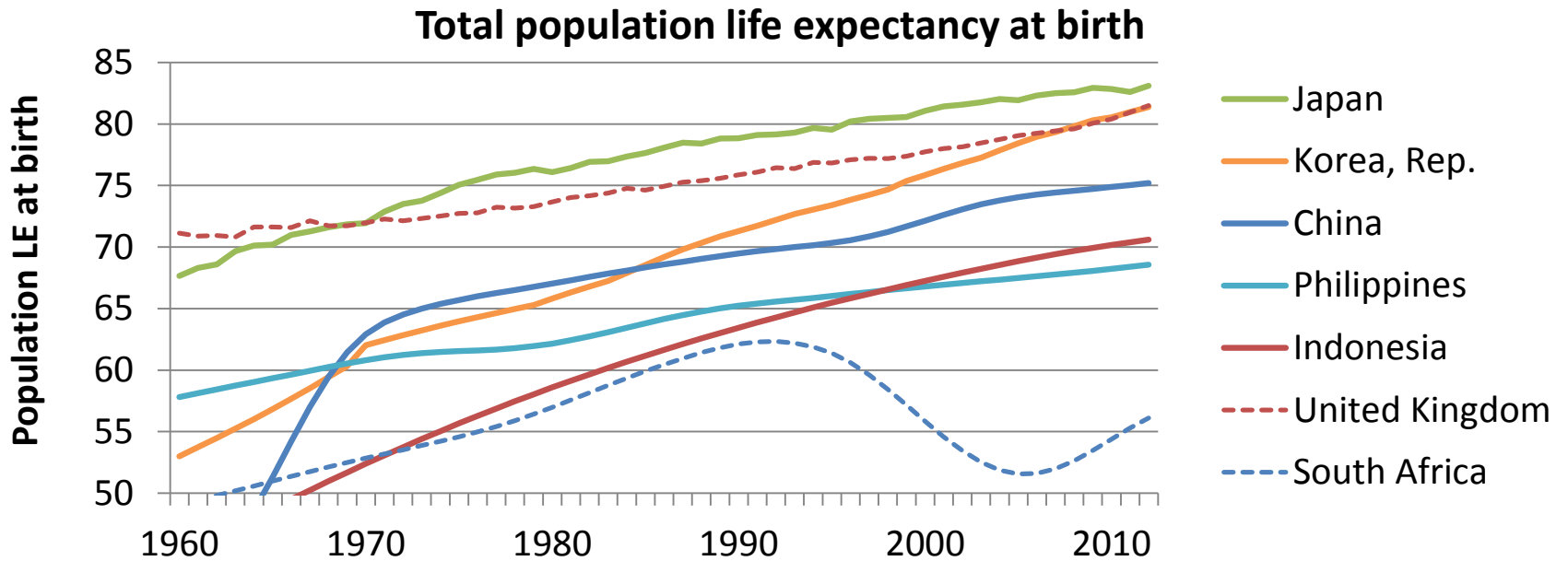
Introducing Hannover Re

- Five branches in Asia: **Hong Kong**, Kuala Lumpur, Manama, Seoul, Shanghai
- Strong **growth** in Asia

Gross Premium Written	2012 (Euro m)	2013 (Euro m)	Growth
L&H	6 058	6 145	+ 1.4%
Asia	584	750	+ 28.4%

The Challenge

Total population life expectancy at birth

Data Source: World Bank: *World Data Bank*, http://data.worldbank.org/indicator/SP.DYN.LE00.IN/

The challenge: Secure life-long income after age 65

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Agenda: Some solution approaches

- **Block transactions** of pension liabilities

- Individual annuities, e.g. **enhanced annuities**

- **Index solutions** for longevity risk

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Block Transactions

- Initial situation: **Occupational pensions**

  - **Defined Benefit:** Employer's pension fund has longevity risk

  - **Defined Contribution:** Longevity risk (for pensions in payment) lies with direct insurer

Block Transactions

- **Buy-out:** Pension fund assets and liabilities are transferred to insurance company
  - Insurance company assumes responsibility for all risks
  - Pension fund ceases to exist

- **Buy-in:** Pension fund buys insurance policy from assets
  - Pension fund continues to exist, fulfills the liabilities
  - Only partial risks transferred to insurance company (e.g.: longevity risk, partial investment and inflation risk)
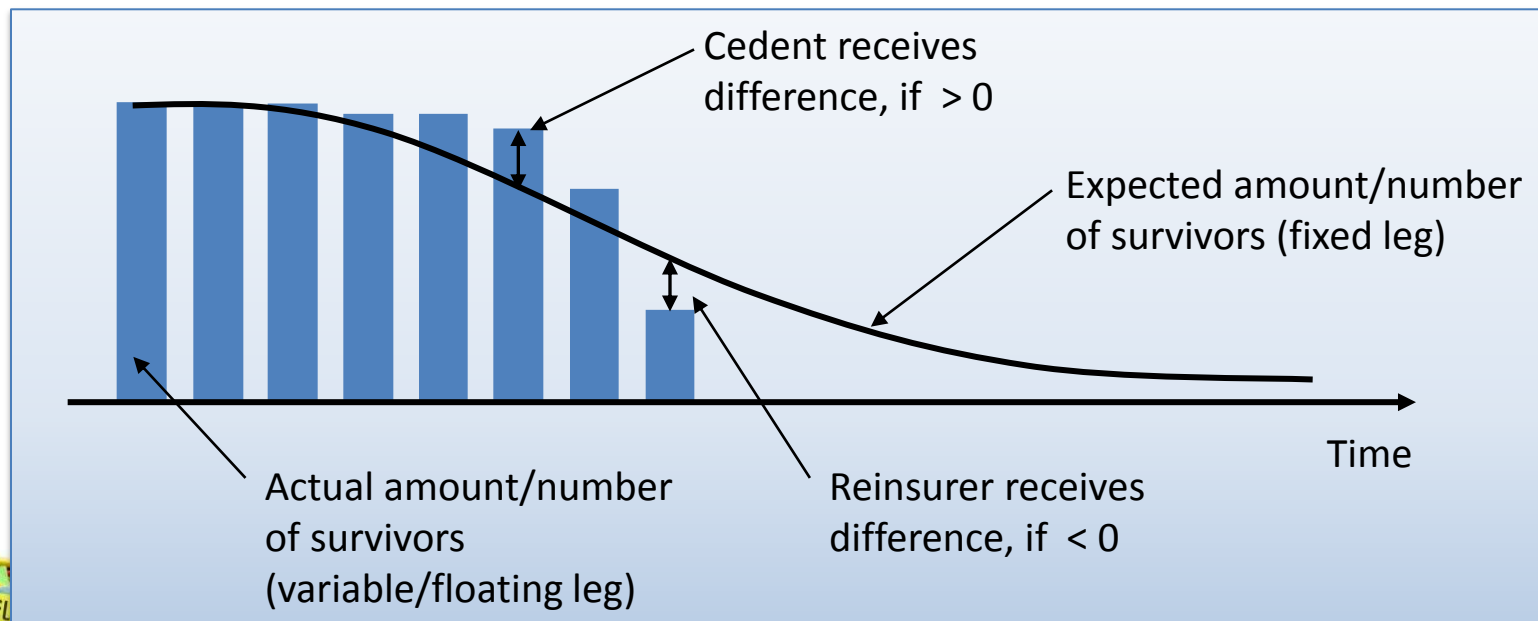
Block Transactions

- **Regular Premium Annuity Treaty (RPAT):** Pension fund keeps assets – or: reinsurance scheme for Buy-In:
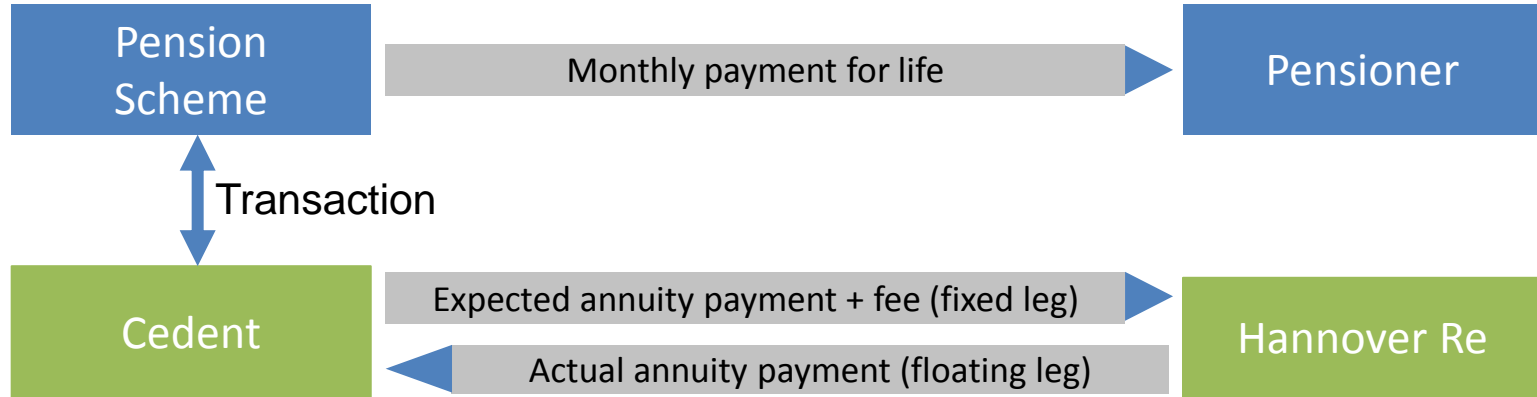 - Regular exchange of premiums and claims

Cedent receives difference, if > 0

Expected amount/number of survivors (fixed leg)

Actual amount/number of survivors (variable/floating leg)

Reinsurer receives difference, if < 0

Time

Block Transactions: RPAT

Diagram: Pension Scheme → "Monthly payment for life" → Pensioner. Pension Scheme ↕ "Transaction" ↔ Cedent. Cedent → "Expected annuity payment + fee (fixed leg)" → Hannover Re. Cedent ← "Actual annuity payment (floating leg)" ← Hannover Re.

- Proportional reassurance (typically **quota share**)
- Hannover Re **pays actual annuity** benefits for reassured business
- Hannover Re **receives** regular reinsurance premium equal to **expected annuity** benefits plus fee, fixed at inception based on best estimate mortality and mortality improvements
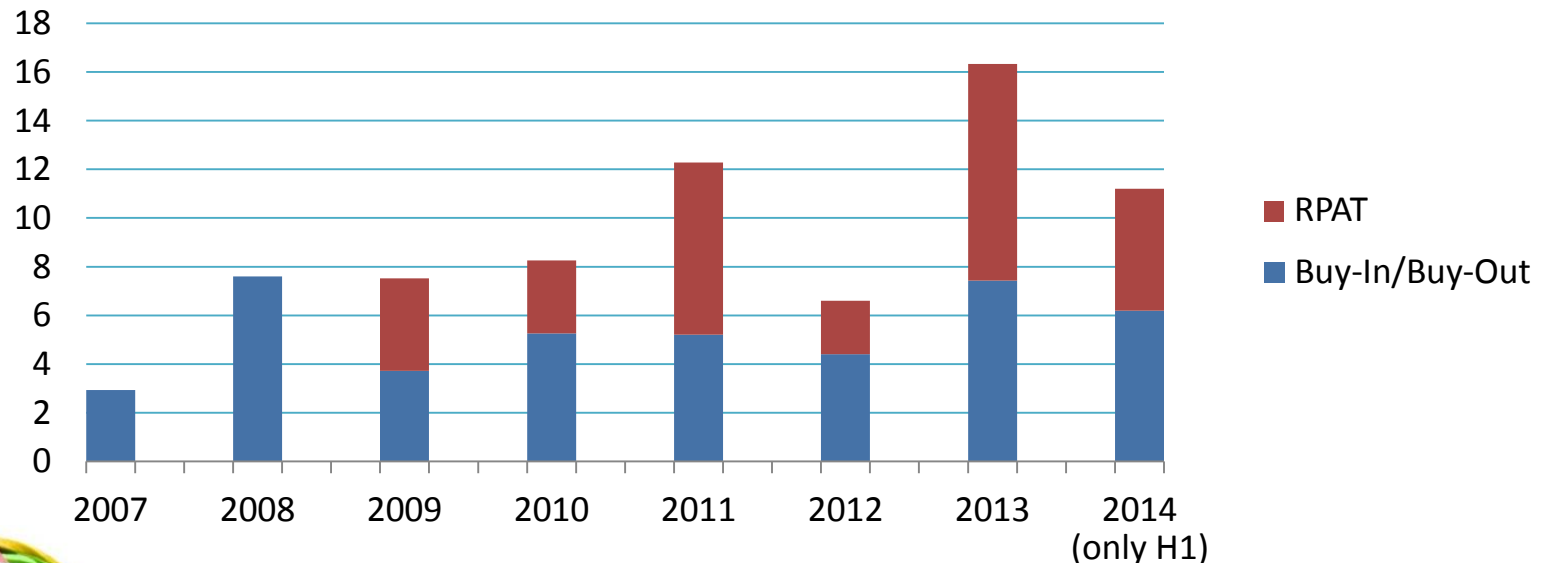- **Net settlement** of cash flows

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Block Transactions

- More markets developing:
  - **France** (AXA and Hannover Re, 750mEUR)
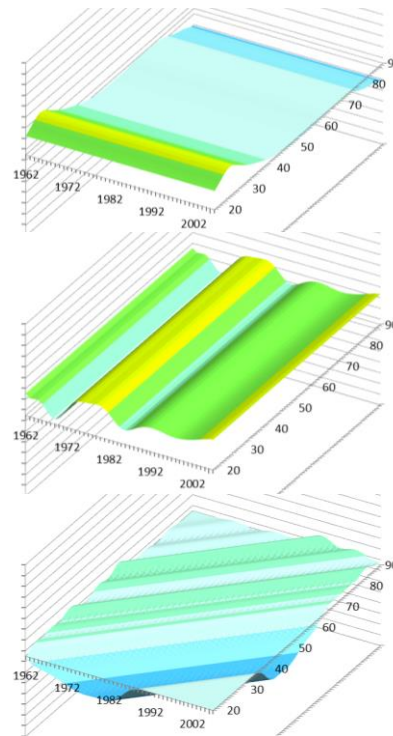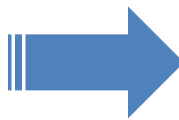- Market volumes in the UK (bn. GBP):

Legend: RPAT, Buy-In/Buy-Out
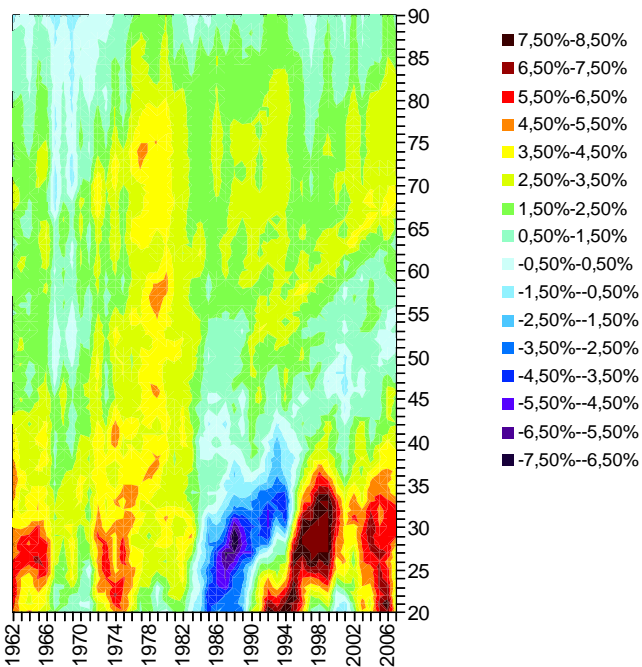
Data Source: LCP Pension Buy-Ins, Buy-Outs and RPATs 2008 – 2013, current market data for 2014 from www.artemis.bm

Mortality Improvements

- Statistical approach to projection of mortality

Age component

Period component
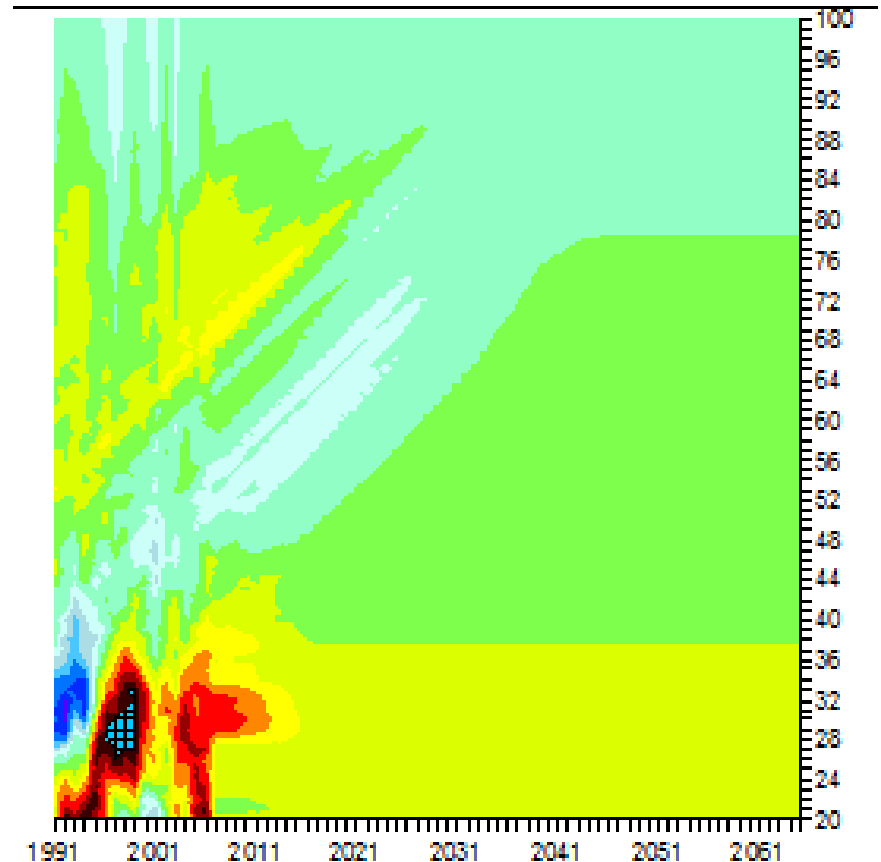
Cohort component

Mortality Improvements

- Projection approach developed by **CMI** (Continuous Mortality Investigation), UK

- **Widely used** as one perspective on mortality dynamics

- Requires significant **historical mortality data**

Block Transactions

- Some **drivers** of new markets
  - **Awareness:** International Accounting Standards unify the **regular, market consistent valuation of pension liabilities**
  - **Demand:** Different parties (rating agencies, investors, etc.) require **appropriate risk management**
  - **Technical Framework:** Regulation, taxation, long-term collateral mechanisms, data and/or methods for projections of future dynamics

Agenda: Some solution approaches

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- **Index solutions** for longevity risk

Enhanced Annuities

- UK situation: Occupational and private **pensions savings are supported by tax advantages**
  - Pensioners **have to buy annuity to keep taxation benefits** (until now)
  - **Traditionally: Standard annuity rates** for everyone
  - Pensioners with severe diseases were disadvantaged

- New product line: **Enhanced Annuities**
  - Higher annuity payments for applicants with reduced life expectancy

Enhanced Annuities

Health Statement

Height * [164] cm   Weight * [74] kg

1. Do you smoke? *   [No ▼]

2. Do you have raised blood pressure? *   [No ▼]

3. Do you have raised cholesterol? *   [No ▼]

4. Have you had or do you currently have any of the following heart conditions or surgical interventions: heart attack, heart bypass or angioplasty, angina (recurrent chest pain), enlarged heart or heart failure, irregular heart beat (arrhythmia), problem with heart valve (valvular heart disease) or any other heart problem? *   [No ▼]
   If yes, please specify and indicate relevant question with its number.

5. Have you had any form of stroke or brain haemorrhage? *   [No ▼]

6. Have you experienced any form of cancer, leukaemia, hodgkins disease, lymphoma, brain or spinal tumour? *   [No ▼]
   If yes, please specify and indicate relevant question with its number.

7. Are you diabetic? *   [No ▼]

8. Do you have any of the following medical condition: alzheimers, parkinsons, multiple sclerosis, kidney failure, liver complaint, chronic respiratory conditions or any other condition? *   [No ▼]
   If yes, please specify and indicate relevant question with its number.

Enhanced Annuities

- Example: 65yo man, 50,000 GBP pension fund

Condition	Healthy	PMA 100%	Heavy smoker (25/day), overweight	Diabetes, diagnosed 15 years ago, treated with insulin and tablets, retinopathy	Lung cancer, lymph node metastases, currently treated with chemotherapy
Monthly annuity	306	313	330	363	535
Increase in % relative to healthy		3%	8%	18%	76%

Enhanced Annuities

- In-house medical expert team
  - **Derives system** parameters from professional experience and medical research
  - Handles **individual cases** (e.g., high premiums)

- Actuarial
  - Provide **reference survival projections** (population, healthy)
  - **Translate** between medical expertise and survival projections for impaired applicants
  - Compare **experience** with system output

Enhanced Annuities

- **1995**: First introduction of underwritten Impaired Life Annuities (PAFS and Hannover Re)
  - **Manual underwriting**, targeting significantly impaired applicants

- **Today**: Many standard annuity providers offer EA's
  - Standardized questionnaire: **eCQRF**
  - 2011: EA's represent 15% of single premium market: 3 bn. GBP, **increasing**

Enhanced Annuities

- **Outlook**: Underwriting to become standard for all individual annuities
  - "Underwritten" concepts for **small defined benefit schemes**
  - About **50% of individual annuitants qualify** for "enhancements"
  - **Roll-out** of the concept to other countries
  - **UK future open:** no compulsory annuitization any more
  - **Australia** may require purchase of annuity from pensions savings
  - **Germany** has individual "Riester" savings to be annuitized

Enhanced Annuities

- **Challenges** (not only) in new markets
  - **"Longevity protection"** is difficult to grasp for non-actuaries: **communication** and **new product ideas** needed
  - Major **socio-economic differences** vs. (often) **lack of reliable data**
  - Very long-term insurance concepts are still quite new to some market participants
  - **Regulatory uncertainties** (mandatory annuitization? taxation? individual UW and non-discrimination laws?)

Agenda: Some solution approaches

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- **Index solutions** for longevity risk

Index Solutions

- In the market **since about 2005**
- Often set up by banks, insurers and reinsurers together
- Hedging tools for (e.g.)
  - **Longevity portfolio** development
  - **Population mortality** development
  - Development of **correlations** between mortality of different groups ("young US males vs. older UK males", etc.)
  - Originally UK-focused, increasingly targeting other populations

Index Solutions

- Core problem: Stochastic mortality projections
  - Understanding the probabilities for certain payout events

- Huge academic literature on stochastic mortality models
  - Identify the right model, fit to historical data
  - Projection(s)

Index Solutions

- E.g., Renshaw-Haberman model
$$\log \mu_{x,t} = \beta_x^{(1)} + \beta_x^{(2)} \kappa_t^{(2)} + \beta_x^{(3)} \gamma_{t-x}^{(3)} + \text{noise}$$
  – Fit model to data (e.g.: GLM, cf. [Currie, 2014])
  – Project **component time-series**
  – Derive **distribution** of
    - future mortalities
    - projected portfolio values
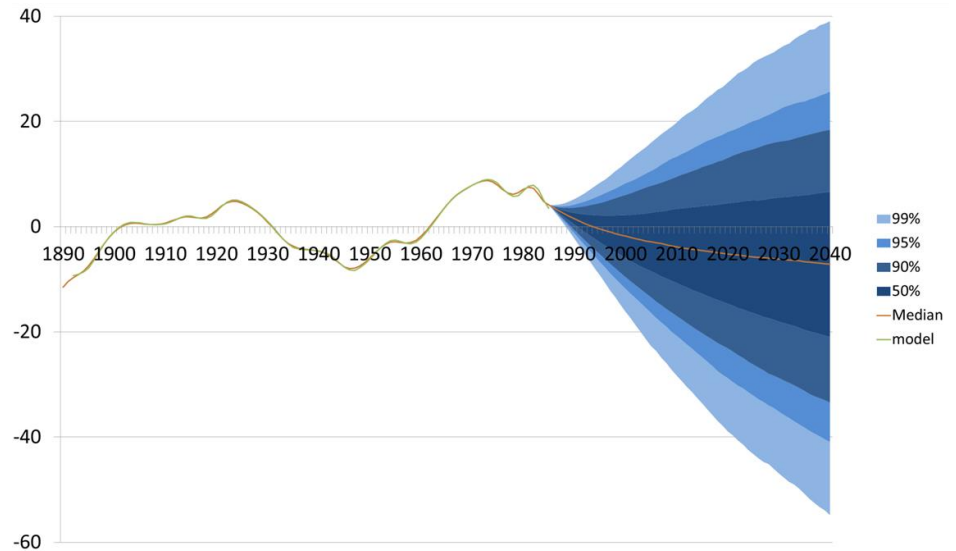   - …

Illustration: Cohort component γ for UK Males from RH model: Data, model and stochastic projection

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Hannover Re's Profile

- Combine **worldwide experience** and **local competence**
- E.g.: **Underwriting support**
  - POS UW **systems** (not only for annuities)
  - Online UW **manual**
  - Medical **advice** and UW **support** from our medical director
  - Annual overseas UW **training**, tailor-made training for individual markets and companies
- Joint **product development** with clients
- **Flexible** reinsurance solutions, high local authority
- Dedicated to **long-term partnerships**

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