Longevity risk transfer

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Introduction
Longevity and pension markets

Assets in the pension market

Source: Towers Watson: Global Pensions Asset Study 2013

Global pension assets now amount to 78.3% of the GDP of above economies
Longevity risks
Different kinds of longevity risk

- **Today’s mortality**
  - Experience analyses give an indication of today’s mortality for a specific portfolio.
  - Detailed analyses are only possible where enough data is available; hence, socioeconomic patterns might be overlooked for smaller portfolios.

- **Future mortality: improvements are very volatile and there are many different opinions on how mortality improvements will develop in the future.**

- **Ancillary benefits: spouse pension, escalations, commutations, transfers, fixed duration vs. life long etc.**

- **Systematic longevity risk: longevity risk that cannot be diversified away even in large portfolios of longevity risks (e.g. population’s mortality improvement, seasonal mortality).**

- **Unsystematic longevity risk: longevity risk that can be diversified away when more and large portfolios of longevity risks are added (e.g. mortality due to accident, randomness).**
Who can manage which risks?

**Pension schemes**
- Regulatory changes
- Data

**Mortality risk**
- Systematic
- Unsystematic

**Investment risk**
- Ancillary benefit

**Insurer / Reinsurer**
- Level
- Shape
- Stochastic
- Spouses
- Special benefits

**Capital Market/ Investor**
- Asset risks
- Benefit inflation
  - Improvement
  - Seasonality
Holders of longevity risks

Many developed countries have a pension system consisting of:

- State pension → Government/Communities
- Occupational pension → Employers/Corporates
- Private pension → Life Insurers

Insurers and pension funds hold risks inherent in the liabilities.

P&C insurers hold longevity risk from structured settlements.

Investors hold longevity risk from life settlements.

Substantial longevity risks currently held outside the insurance industry.
Regular Premium Annuity Treaty (RPAT)
**Regular Premium Annuity Treaty (RPAT) - The technical model**

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

**Protection from the financial impact if pensioners live longer than expected**
Regular premium annuity treaty (RPAT)
Exchanging expected and actual cash flows

Sample cash-flows for RPATs

- Actual payments
- Expected payments
- Premium + fee (fixed leg + fee)
Regular premium annuity treaty (RPAT)
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Sample cash-flows for RPATs

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- Expected payments
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Cedant receives difference, if >0
Reinsurer receives difference, if >0
Contractual agreement
Important considerations

- Exact definition of the covered benefits and the price
  - Structured fee versus flat fee

- Treatment of data errors
  - Recalculation of fixed leg, price adjustments

- Initial data cleaning

- Administration and minimum standard requirements

- Provisions and minimum standard requirements

- Termination provisions
Market volume for pension block transactions in UK
Closed treaties: primary insurance market and Hannover Re

Present Value of liabilities

<table>
<thead>
<tr>
<th>Year</th>
<th>Buy-In/Buy-Out</th>
<th>RPAT</th>
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<tbody>
<tr>
<td>2007</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>2009</td>
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<td>2011</td>
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<td>2012</td>
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<tr>
<td>2013</td>
<td>16.2</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>29.5</td>
<td></td>
</tr>
</tbody>
</table>


Substantial growth in the market
Derivatives
Value hedge versus cash-flow hedge
Direct and indirect hedges

- **Value hedge:**
  hedge against an asset/liability with a fixed value that changes according to market value or model value

- **Cash-flow hedge:**
  hedge derived from cash flows received from two or more financial products

  ➡ Both hedges are used to hedge against changes in the value of the asset

  ➡ The cash-flow hedge is linked to an asset/liability that provides regular payments to/from the holder

- **Direct hedge:**
  hedge in which the cash market instrument being hedged is hedged by derivatives contract on the same underlying instrument

- **Indirect hedge:**
  hedge based on a parameter influencing index that should actually be covered
Index solutions
Forwards

- **q-forward**: capital market instrument for transferring longevity or mortality risk
  - Involves the exchange of realized mortality rate of a population at some future date, in return for a fixed mortality rate agreed at inception
  - q-forwards form the basis from which many other more complex derivatives can be constructed

- **S-forward**: cash settled contract linked to survival rates of a given population
  - Basic building-block for RPATs used by pension funds and (re)insurers
  - RPATs essentially comprise a stream of S-forwards with different maturity dates
  - Also referred to as the tpx-forward
Index solution
Example: mortality forward

Ceding company (Seller)

Floating
Notional x Realised mortality rate

Fix
Notional x Strike rate

Reassurer (Buyer)

Net settlement at end of tenor

Buyer pays

strike rate

Realised index mortality

cap

floor

Seller pays

Realisation of mortality index
Mortality forward
Typically indirect value hedge

Pay-out structure mortality forward

- Pay-out (strike rate less realised mortality rate) mortality
- No basis risk transferred, only systematic risk
- During the lifetime of the contract an index is published
- Fixed limited duration of trade
- Might be attractive due to savings in the cost of capital
Past activities in the market

- **EIB / BNP Longevity Bond (never sold)**
  - Announced in 11/2004, GBP 540 million, 25 year maturity (may be too short)
  - Required upfront payment by hedgers, cost to hedge ~20 basis points

- **Kortis (2010)**
  - USD 50 million, duration 8 years
  - Covers improvements experienced by older UK males against younger US males

- **Pall UK Pension Fund (2011)**
  - GBP 70 million, 10-year term in which the fund’s trustees can adjust size or structure
  - If life expectancy improves at a greater rate than specified the fund receives a payout

- **Pandemic Bonds (Vita Cat Bonds (2003, 2005, 2006), Nathan (2008))**

- **AEGON / Deutsche Bank longevity transaction (2012), based on Dutch data**

- **Delta Lloyd in EUR 12 billion (?) index-based RPAT with Reinsurer (2014)**

- **UK Macro Longevity Transaction**
  - S-forward based on ONS data, 1bn GBP, risk period 15 years
Possible index solution to hedge future value

- Hedge PV for a synthetic portfolio – matched to an actual portfolio – by fixing
  - mortality relative to population
  - discount factors and maturity

- For fixed predetermined attachment and detachment point determined upfront, the pay-out is

  $Payout = \max(0, \min(PV, Detachment) - Attachment)$,

  whereas PV is the Present Value at the time of pay-out with the data available and the projection method agreed (for example automated Lee-Carter)

- Direct value hedge

- Potentially cheaper than RPAT, but longevity risk for a concrete portfolio is not covered completely
Advantages and Disadvantages
Reinsurance vs. Derivative

- Indemnity cover, essentially all risks covered
- Cover until natural expiry
- Termination only by mutual agreement
- Theoretically higher fees
- Insurance accounting
- Direct impact on solvency through proven methods

- Significant basis risk retained/unhedged
- Shorter in duration
- Potentially easier to close (once a liquid market exists)
- Price only for systematic longevity risk
- Mark-to-market or mark-to-model, rules for hedge accounting
- Impact on solvency subject to discussion with regulator

Currently reinsurance offers more valuable benefits
Wrap up
Wrap up

- Volume of Longevity market increases steadily over time

- Pensions/annuities:
  - New hedging products emerge, partially requiring a very detailed understanding of the key drivers of mortality
  - RPAT is standard reinsurance products in the UK:
    - Direct cash flow hedge covering all risks (systematic and unsystematic)
  - Some index solutions have already been signed and many more are currently in development

- Solvency II:
  - Introduction of Solvency II likely to lead to structural innovation around transferring longevity risks
  - Cost of holding longevity risk significant for some players