Longevity and Mortality risk transfer in the capital markets through the LifeMetrics platform

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Capital markets solutions for longevity and mortality risk transfer

– Insurance-based solutions
  • Annuities
  • Buy-out
  • Longevity insurance

– Capital markets-based solutions
  • Customised longevity hedges
    – Longevity cash flow swap
  • Standardised (Index) longevity hedges
    – q-Forward
  • Extreme mortality structures
The market for longevity & mortality risk involves a broader set of players and exposure types

- **The Players**
  - Insurers & reinsurers
  - Pension trustees/fiduciaries
  - Pension sponsors
  - Banks
  - Investors

- **Exposures**
  - Life settlements
  - Life insurance portfolios
  - Mortality cat exposure
  - Annuity portfolios
  - Pension plans
  - Equity release mortgages

More than just longevity: This is the Life Market
Capital markets can transfer longevity risk to financial investors in return for a risk premium

- **Investors**
  - Earn a risk premium
  - Gain exposure to an uncorrelated risk

- **Banks intermediate**
  - Provide liquidity
  - Credit intermediation
  - Structuring

**Defined Benefit Pension Plan or Insurance Portfolio** → **Longevity or Mortality Risk Hedge** → **Banks** → **Investors**

**Longevity or Mortality Risk Investment**

Trades have been done
Overview of hedging and investment opportunities

– Fully-funded (bond) and Leveraged (derivative)
– Mortality and Longevity exposure
– At-the-money and Out-of-the-money risk structures
  • Essentially the difference between a Swap and Catastrophe Structure
– Customised and standardised index exposure
There are two kinds of longevity risk hedges, both of which have been transacted:

<table>
<thead>
<tr>
<th>Customised Hedge:</th>
<th>Standardised Index Hedge:</th>
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<tbody>
<tr>
<td>- Copy reinsurance</td>
<td></td>
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<tr>
<td>• Indemnification paradigm</td>
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<tr>
<td>- Hedge is tailored to reflect actual longevity experience of the pension members</td>
<td></td>
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<tr>
<td>- Structured as a cash flow hedge</td>
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<tr>
<td>=&gt; Exact hedge</td>
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</tbody>
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| => Cheaper, simpler, more liquid |
| Each provides different advantages to hedgers |

- New approach
  • Risk management paradigm
  - Hedge is standardised to reflect national longevity index
  - But calibrated to the mortality sensitivity of the pension
  - Can be structured as a value hedge
  - Can be shorter maturity
Investor perspective on longevity risk transfer formats

- Challenges for investors in customised longevity investments
  - Very long maturity
  - Customised longevity risk complicated and unique
  - Very illiquid
  - Uncapped downside risk
  ➔ *Require additional risk premium*

- Standardised index products more appealing
  - Can be short maturity
  - Standardised population longevity risk
  - Potentially more liquid
  ➔ *A larger investor base, lower required risk premium*

Investors will buy both, but tend to prefer standardised products
Example of customised hedge: GBP 500mm capital markets longevity swap for a UK life insurer

- Collateral margin requirements
- Fixed payments
- Payments based on actual mortality experience of pool of annuitants
Customised longevity cash flow swap

- Exchanges fixed longevity for realised longevity over 40 years
- Insurer pays fixed leg:
  - The fixed leg is a series of defined payments payable by the insurer
- Insurer receives floating leg:
  - The floating leg corresponds to actual payments made to annuitants and is paid to the insurer by the hedge provider

- Result: Fixed liability payments are “locked in”

*Longevity cash flow swap payments*

Insurer makes fixed payments reflecting fixed longevity

Insurer receives actual annuitant payments reflecting realised longevity
LifeMetrics provides a toolkit for longevity risk transfer

- **Launched by JPMorgan in March 2007 – free to all**
  - **Longevity Index**
    - Longevity and mortality indices – national population
    - England & Wales, US, the Netherlands and Germany
  - **Framework**
    - Documents and analytics for risk management
  - **Software**
    - Tools for modelling and forecasting mortality

- **Features**
  - Open-source, transparent, non-proprietary and free
  - Independent Calculation Agent
  - Independent Advisory Committee
  - Advisors: The Pensions Institute, Watson Wyatt, Heubeck
Example of Index longevity hedge: q-Forward

- Hedge of liability **value**
- Mortality on specified population
  - Single exchange at maturity
  - Fully collateralised

Lower realised mortality results in a payout to offset the increase in liabilities.
Standardised longevity Index derivatives can be combined to create a tailored hedge for a pension plan or insurance portfolio.

- Hedge is based on standardised index “building blocks”
  - “q-Forwards”
- Match mortality sensitivity of the liability value with the mortality sensitivity of the hedge
- Basis risk can be measured and managed

<table>
<thead>
<tr>
<th>Member Data</th>
<th>Match mortality sensitivity</th>
</tr>
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<tbody>
<tr>
<td>Age profile</td>
<td></td>
</tr>
<tr>
<td>Gender profile</td>
<td></td>
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<tr>
<td>Benefit structure</td>
<td></td>
</tr>
<tr>
<td>Specific mortality table</td>
<td></td>
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</table>

**q-Forward Building Blocks**

- Age 40-49 Males
- Age 50-59 Males
- Age 60-69 Males
- Age 70-79 Males
- Age 80-89 Males

- Age 40-49 Females
- Age 50-59 Females
- Age 60-69 Females
- Age 70-79 Females
- Age 80-89 Females

Provides an effective hedge of liability value
The basis risk associated with standardised hedges can be measured and managed

- Basis risk can be managed
  - Short term movements in mortality rates have a low correlations
  - But movements in the value of pensions for different populations are correlated over the long term

- Example
  - Pension for cohort of males with the same demographics as CMI
  - Hedge based on LifeMetrics
  - Values track very closely over the long term

Source: CMI and LifeMetrics
Hedge effectiveness can also be measured stochastically

– Hedge effectiveness is about risk reduction
  • Quantifying how hedge reduces potential for monetary loss
  • Need to measure residual risk
– Example
  • Risk reduction = 86%
  • Residual risk = 14%
– Residual risk mainly reflects basis risk between pension population and the national population

Distribution of liability value in 2019: Before and after hedging

Unhedged liability value 2019
Hedged liability value 2019
How much does it cost?

Mortality rates

- "Best estimate" or "expected" mortality curve
- Forward mortality curve

Risk premium
Economic cost

Offer bid

Summary

- Longevity risk transfer via the capital markets is now possible
  - Hedges have been traded
  - Investments have been made

- Customised Hedges
  - Mimic reinsurance but in capital markets format

- Standardised Index Hedges
  - A new paradigm based on risk management rather than indemnification
  - Basis risk can be managed