Idiosyncratic Mortality Risk  
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Introduction

Idiosyncratic risk

- Idiosyncratic (or non-systematic) mortality risk arises through random fluctuations in a population
- Even if we know the ‘correct’ mortality distribution for a particular population, we do not know when each individual will die
- Though this risk can be diversified away through pooling, this is not possible for many pension schemes or for individuals
Pension scheme size
Scheme size by number of members

- 21% Fewer than 100 members
- 11% 100 to 499 members
- 34% 500 to 999 members
- 24% 1,000 members or more

Source: The Pensions Regulator, Scheme funding statistics 2017 appendix

Distribution of average age at death
Male age 60 – 1 Member

Source: JLT calculations

Distribution of average age at death
Male age 60 – 5 Members

Source: JLT calculations
Distribution of average age at death
Male age 60 – 10 Members

Source: JLT calculations
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Distribution of average age at death
Male age 60 – 20 Members

Source: JLT calculations
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Distribution of average age at death
Male age 60 – 50 Members

Source: JLT calculations
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Distribution of average age at death

Male age 60 – 100 Members

Source: JLT calculations

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Example of simulation output

Source: JLT calculations

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Mortality assumptions

“the mortality tables used and the demographic assumptions made must be based on prudent principles, having regard to the main characteristics of the members as a group and expected changes in the risks to the scheme”

Occupational Pension Schemes (Scheme Funding) Regulations 2005
Regulation 5(4)(c)

Mortality assumptions

Life expectancy assumption (years)

• Mortality assumptions adopted do not vary by scheme size
• No evidence that more prudent life expectancy assumptions are being adopted for smaller pension schemes

Source: The Pensions Regulator, Scheme funding statistics 2017, appendix

The problem

• Idiosyncratic mortality risk is a real and material risk for a large number of defined benefit pension schemes
• The problem is exacerbated by concentration risk where the majority of the liability sits with a small number of members
• For an individual member or a small pension scheme, the only standalone ‘solution’ is through an annuity
• A possible future solution is through some of the different forms of aggregation being considered, but not all involve pooling of mortality risks
A proposal

- In the absence of a ‘solution’, the key is to help trustees (and their advisors) understand and quantify the risk being run
- This will help improve decision making, and highlight the true value of different strategies
- It is reasonably straightforward to carry out simulations for a pension scheme to allow the risk to be quantified and understood
- However, smaller pension schemes will often be the ones who do not have the resources or support available to help them to do this
- We have developed a simplified approach to help

The goal

- The goal is to be able to quantify idiosyncratic mortality risk on an approximate basis without the need to carry out scheme specific simulations
- The output will identify a range of possible liabilities, or average life expectations, with different levels of confidence
- This will allow pension scheme trustees to
  - consider the amount of idiosyncratic mortality risk the pension scheme is exposed to; and / or
  - incorporate explicit margins for prudence in actuarial valuations if required

Variance of life expectancy

- Use variance as our initial risk measure
- The variance of any individual mortality distribution can be calculated analytically
- Consider what factors drive the variance to allow us to produce a parsimonious model
- For example, sex is not a material factor even at higher ages
Key factors

- Key factors are
  - Age
  - Contingent spouse proportion
  - ‘Shape’ of mortality distribution

- For this analysis we ignore shape by simply referring to the ‘S2’ Series mortality tables

- 92% of defined benefit pension schemes currently use SAPS

Loadings applied to base mortality tables

- No loading
- Rating by age
- Percentage adjustment to q(x)
- SAPS series light / heavy
- Combination of others

Source: The Pensions Regulator, Scheme funding statistics 2017: appendix

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Approximating variance of (joint) life expectancy

Variance by age

Source: JLT calculations

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Applying to data

- We require the following member data for each member \( i = 1 \ldots n \)
  - Age (\( A_i \))
  - Amount of pension (\( P_i \))

- We calculate the variance for each member (\( V_i \)) by reference to age and a simple linear approximation, for example
  \( V_i = 150 - 1.5 x A_i \)

- The variance for each member is weighted by the amount of pension

  Weighted average variance
  \[
  \sum_{i=1}^{n} \left( \frac{P_i^2 V_i}{\sum_{i=1}^{n} P_i} \right)
  \]

Source: The Pensions Regulator, Scheme funding statistics 2017: appendix

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Using the variance

- We can then use the weighted average variance to produce scheme specific confidence intervals
- For example, assume the weighted average life expectancy is 20 years
- The average variance is calculated to be 5
- We can calculate a confidence interval by reference to a normal distribution, so for example with 95% confidence average life expectancy for the population will be no more than

\[ 20 \pm 1.6445 \times \sqrt{5} = 23.7 \text{ years} \]

Our model compared to a full simulation

Impact on small scheme funding

- Consider aggregate funding position of schemes with less than 100 members
- Assume these schemes will need to eventually target self-sufficiency if they do not buyout
- Apply 90% confidence level as need to allow for idiosyncratic risk
- Almost doubles the funding shortfall

<table>
<thead>
<tr>
<th>Scheme</th>
<th>No allowance for idiosyncratic risk</th>
<th>90% allowance for idiosyncratic risk (90% confidence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets</td>
<td>£16.1bn</td>
<td>£16.1bn</td>
</tr>
<tr>
<td>Liabilities</td>
<td>£17.0bn</td>
<td>£19.0bn</td>
</tr>
<tr>
<td>Surplus / (Deficit)</td>
<td>£1.8bn</td>
<td>(£3.4bn)</td>
</tr>
<tr>
<td>Funding level</td>
<td>50%</td>
<td>83%</td>
</tr>
</tbody>
</table>

Source: The Pensions Regulator, Scheme Funding statistics 2017: appendix; The Purple Book 2017; JLT calculations

No allowance for idiosyncratic risk

With allowance for idiosyncratic risk (90% confidence)
Outcome

- We have arrived at a quick and straightforward method for calculating the value of idiosyncratic mortality risk for a pension scheme
- The impact of this risk can then be communicated to trustees and employers and included in funding reserves if desired
- This provides support for long-term strategy discussions. For example:
  - What value does a scheme buy-in / buyout provide?
  - If we target self-sufficiency how do we allow for this risk?
  - How could annuity top slicing benefit the pension scheme?
- This could also be used by financial advisors to help model this risk when providing advice to individuals

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