Understanding Longevity Risk
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Pension schemes are increasingly focusing on understanding and managing longevity risk. This might be as part of the regular valuation cycle to understand the risks relating to the accuracy of life expectancy assumptions or when assessing the value for money of a longevity hedging deal.

In this summary note, we set out some background on why this is important, how longevity risk is very different to asset risk and some guidelines on how to assess longevity risk.

Longevity risk in context

It is easy to overstate the reliability of current longevity estimates. The chart below shows how wrong past longevity estimates have been (for national mortality). Not only have they been inaccurate, but they have consistently understated life expectancy, possibly because:

- Of a general conviction that there is a maximum human life span;
- They accounted only for known driving factors, which automatically results in predictions of longevity improvement tailing off in the future.

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### Actual and projected period life expectancy at birth for England and Wales males

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Source: Office for National Statistics, Population Trends 128
Predicting longevity is difficult. Even simply extrapolating past trends is not straightforward. For instance, the chart below shows how male and female life expectancy at age 65 has varied since 1900.

This shows that while female life expectancy has experienced relatively stable improvements over the period, male life expectancy:

- Failed to improve in the two decades following the Second World War;
- But since 1975 the rate of improvement for males has been higher than for females.

The prediction problem is that the data alone does not tell you whether male longevity is simply catching up with female mortality (which is what most experts think) or whether it will continue to improve after it has caught up female longevity (which is what many models assume). A similar issue (but one that is less visible and less commented upon) is that longevity improvement varies by socio-economic types.

Given that the liability-weighted socio-economic profile of the scheme is unlikely to match that of the national population upon which the standard longevity projections tables are based, this means that there is additional longevity improvement risk (simply because the data to measure past longevity by socio-economic type is much less accessible).

### Period life expectancy at age 65 for England and Wales for males and females

![Life expectancy graph](source: Office for National Statistics (Aon Hewitt calculations))

In the 1980s and 1990s, when UK final salary pension schemes were in their prime, these large prediction errors would have seemed less financially significant because long-dated discount rates were higher. In turn, this meant that getting longer term mortality predictions wrong had relatively less impact on liabilities.

**With the fall in discount rates over the last decade or so, this is no longer the case: longevity risk is material.**
Our approach to measuring longevity risk

Our risk analysis has three primary objectives:

To place a quantum on the longevity risk faced by the Fund

To allow you to determine whether the risk is of sufficient magnitude to merit investigation into potential hedging strategies

To provide a measure for assessing the effectiveness of different hedging strategies

There is no single best measure of longevity risk and so we advise clients to use a variety of methods to assess longevity risk and to understand the relative merits of the different approaches.

However, we believe that a suitable risk measure should meet the following requirements:

• It should measure risk relative to a single and as objective as possible best estimate view of future longevity;

• It should be framed so that it can be understood by all interested parties and be consistent with measures used for the other risks facing the schemes;

• It should capture the nature of the risk; longevity risk behaves differently compared to traditional asset price risk;

• It typically looks low during the first few years of any projection, but over medium time frames (say 5 to 10 years) longevity improvement is ‘serially correlated’. This means that if it is higher than expected in the first 5 years, it is also likely to be higher than expected in the following 5 years. This is illustrated below, and can be viewed as ‘when longevity risk moves against you, it is likely to continue to do so’.

Our approach to determining a statistical measure of longevity risk is to project a variety of outcomes (measured as the impact on liabilities), with the more extreme outcomes being less likely:

• For assessing improvement risk, we use a stochastic longevity state model that allows us to project stochastically into the future up to a particular point in time and the run best estimate mortality taking account of that specific scenario into the future;

• We measure base table risk using statistical analysis of the scheme’s experience combined with validation tests on our postcode model;

• We measure per member risk using simulations (with grouping techniques to ensure that the calculations are scalable for very large datasets).
Defining longevity risk

We can define longevity risk in relation to, say, the 1 in 20th worst case outcome. Common measures are either:

- The 1 in 20th worst case outcome, sometimes called ‘value at risk’ (VaR);
- There is then a 1 in 20 probability of the outcome being that bad, or worse; or
- If we are specifically interested in tail risk, the average outcome in the 1 in 20 worst outcomes, known as ‘tail VaR’.

A sample range of outcomes is shown below.

The blue coloured area represents the worst 5% of outcomes, and lines indicate the conventional VaR and the more extreme tail VaR.

Distribution of longevity risk (typical impact on liabilities)
The chart below shows the magnitude of risks (measured as conventional VaR) for a typical medium to large scheme’s pensioner liabilities. It shows that the total risk is dominated by the improvement risk. (It also shows that because the risk components are largely independent, there is some diversification benefit when they are added together.)

It is well known that investment risks are fat tailed, at least in the short term. In other words, the likelihood of an extreme outcome is higher than implied by a normal distribution calibrated to observed volatility. Moreover correlations between asset classes under normal circumstances may change radically in extremis.

Illustrative examples of these two effects in relation to longevity risk are:

- If there is a change in the standard mortality projection tables then it is possible that general actuarial opinion may jump from the ‘old’ to the ‘new’ view in a short space of time. (This is not speculation; this happened with the introduction of the CMI short, medium and long cohort projections, and then later the CMI Projections Model.)
- Although it is often stated that longevity risk is independent of non-longevity based assets, this is not true in terms of impact on liabilities; if longevity improves and yields fall, the combined impact on liabilities is greater than the sum of the individual impacts.
- Again this is not speculation; this positive correlation is one of the reasons why funding levels of most UK pension schemes have suffered over the last 10 years.
Contact

If you would like to discuss longevity risk and/or possible hedging opportunities for your scheme, or if you would like any further information, please contact one of our longevity specialists:

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