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HOW TO PRICE A LONGEVITY SWAP

PENSION SCHEMES ARE INCREASINGLY SEEKING TO HEDGE LONGEVITY RISK USING LONGEVITY SWAPS. A KEY QUESTION IS HOW SUCH TRANSACTIONS ARE PRICED. THIS PAPER OUTLINES THE FACTORS REINSURERS CONSIDER WHEN PRICING A LONGEVITY SWAP AND HOW COVID-19 MAY IMPACT THIS.

When a pension scheme enters into a longevity swap it must pay a series of fixed cashflows to a reinsurer (via an insurer). These fixed cashflows are effectively the price that the scheme is paying to remove its longevity risk. They will reflect two factors:

1. a **best estimate projection of the cashflows** likely to be payable to surviving scheme members for the next 50 to 60 years, and
2. a **risk fee** that reflects the level of risk to which the reinsurer is exposing itself by entering into the swap and taking on the scheme's longevity risk.

In this short paper we outline how a reinsurer determines the best estimate cashflows and an appropriate risk fee. We also consider how COVID-19 might impact both in future.

Notably, reinsurers tell us they remain keen to take on longevity risk. In the short term at least, they do not expect to materially alter their pricing approach or levels.

BEST ESTIMATE CASHFLOW PROJECTION

The best estimate cashflow projection is the reinsurer's best guess of the aggregate monthly pension amount that will be paid to the individuals underlying the longevity swap during the remainder of their lives. As such, the projection will take account of the following information:

- Member details
- Current pension amounts
- Benefit structure (e.g. pension increase types and contingent spouses benefits)

In order to generate a projection of the future, this information must be combined with an estimate of the life expectancy of each individual. This view of individuals' life expectancy is determined by considering current mortality rates (i.e. the probability of death at each age over the next 12 months) and how those rates might evolve in future (e.g. in response to medical developments or anticipated lifestyle changes).

Rather than use generic, population-wide mortality rates, the reinsurer must clearly use mortality rates that are appropriate to the individuals. There are two main ways that this can be done:

- **Socio-economic models:** Much like when pricing car insurance or life insurance, the reinsurer feeds member-specific data (e.g. age, gender, postcode, occupation) into its socio-economic model, which generates a mortality table. The socio-economic model will have typically been pre-populated with vast amounts of historical mortality data, which is then used to determine the likely mortality for our individual given their specific characteristics.
- **Scheme-specific analysis:** For larger schemes with more members and a substantial amount of historical deaths data, the reinsurer will typically carry out a scheme-specific mortality analysis, placing no reliance on external data. In this case the reinsurer will use the historical scheme data to derive mortality rates for member sub-groups (e.g. females with pensions of more than £5,000 pa). The mortality rates for current scheme members will then simply be a function of which sub-group they belong to.

Although the current mortality rates will be member-specific, the longevity improvement assumptions that determine how those rates evolve through time typically won't be. They will often be derived from an analysis of population-wide data (e.g. the England and Wales data published by the Office for National Statistics).

This reflects the fact that you need a large body of data with a long history in order to produce a credible projection of the future. For example, five years of mortality data for a large pension scheme may be sufficient to determine suitable current mortality rates, but it would be of little use in determining how those rates might develop over the next 50 years.

As such, most reinsurers will use an approach similar to that underlying the model produced on an annual basis by the Continuous Mortality Investigation (CMI). The CMI model, which is used by most pension schemes, takes in historical England and Wales mortality data and combines it with a range of parameters to derive future longevity improvement rates. Reinsurers would then vary the parameters to reflect their view of factors such as the very long-term improvement rate and how quickly we might reach those rates. More sophisticated reinsurers might use different sets of parameters for various socio-economic groups.

LONGEVITY RISK FEE

The longevity risk fee is the amount that the pension scheme must pay above the best estimate projection for the reinsurer to take on the longevity risk. If the reinsurer sets the fee too low they will have a significant probability of making a loss, but if they set it too high it will be unattractive to potential clients. Reinsurers must therefore find the right balance between generating a sufficient return on their capital while at the same time offering a commercially attractive price.

The key factors a reinsurer will consider are:

- **Average age:** The younger the members, the greater the probability of their longevity deviating from initial expectations; they will typically have a greater probability of benefitting from future medical advances and more time to develop healthier lifestyles. As such, the younger the average age, the higher the risk fee is likely to be.
- **Benefit structure:** Higher pension increases magnify the impact of an individual living longer than expected. For example, extending life expectancy by one year in the case of a non-increasing pension might increase the current value by 4%. In the case of a pension linked to the inflation, the increase would be closer to 6%. As such, the more generous the pension increases, the higher the risk fee is likely to be.

IMPACT OF COVID-19

The COVID-19 pandemic clearly has implications for the way in which reinsurers price future longevity swaps.

At the very simplest level, mortality data from 2020 will be of little use in projecting next year's likely mortality rates, unless you think the virus is here to stay. Reinsurers could try to strip out the COVID-19 deaths and analyse trends within the non-COVID-19 data, but this is unlikely to be straightforward as it is unclear how accurately deaths are being categorised as being due to the virus or other factors.

When trying to determine how COVID-19 might affect mortality rates further into the future, reinsurers must take into account a wide range of factors. For example:

- On the basis that the individuals most affected by COVID-19 had pre-existing medical conditions, will the population post-pandemic be healthier on average than the pre-pandemic population?
- How might the life expectancy of individuals who survived the virus be impacted by the damage it caused?
- Will increased awareness of the importance of hand washing reduce the impact of seasonal flu and other viruses in future?
- Might reduced air pollution during the crisis have long-lasting benefits?
- How will the effective closure of many parts of the health service during the crisis, resulting in many cancers and other life-threatening illnesses going undiagnosed for longer, affect future life expectancy?
- To what extent will the financial crisis arising from the pandemic affect individuals' health?

It may be years before we are able answer these questions with any certainty, so in the meantime the reinsurer must carefully analyse the data they do have and take a sensible approach.

IMPORTANT INFORMATION

RISK DISCLOSURES

Investment in any strategy involves a risk of loss which may partly be due to exchange rate fluctuations.

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