Managing Mortality and Longevity Risk in Pension Plans



By Minaz H. Lalani, FCIA

Longevity risk is becoming increasingly important, but so far Canadian pension plans have shown little interest in managing it. This article aims to provide pension actuaries (with a focus on defined benefit pension plans) with general information on longevity risk, discuss ideas for managing it and point to interesting background reading.

Background
All pension plans have longevity and mortality risks; specifically, defined benefit (DB) plans have longevity and mortality risks, whereas defined contribution (DC) plans have longevity risk.

In a pension plan, longevity risk is the risk of living longer than the life expectancy on an assumed mortality table for inactive members with pensions in payment.

Mortality risk is the risk of dying earlier than expected for active members who are accruing their pension benefits, or inactive members who have deferred pensions. *(Note: risk is defined as managing the downside and seizing upside opportunities within defined tolerances; there is tendency to view risk as management of downside losses only.)*

Longevity risk is an important and serious risk that needs to be addressed since there is significant uncertainty on longevity projections and because there is a growth of liabilities exposed to longevity risks; death benefits in a pension plan are not material and therefore mortality risk is of lesser importance.

Pension actuaries undertake detailed and sophisticated stochastic projections on economic assumptions for asset liability studies to determine an optimal asset allocation policy. Recently, they have incorporated mortality improvements in these studies by using projection scales with a fixed number of years of improvement, or generational mortality tables; there is a lack of sophistication in use of stochastic mortality, or optimally managing longevity risk.

The lack of sophistication can be attributed to the fact that longevity risk is the "silent" risk. The consequence of longevity creeps up on the pension plan over the longer term, whereas the consequence of asset and investment risks has immediate, short- to medium-term impact. Poor investment performance by an investment manager could increase the short-term solvency contributions, and/or increase the overall pension contributions in the medium term. Also, unlike investment instruments, there is a lack of standardized off-the-shelf instruments that can hedge against longevity risks.

Mortality table and projection improvements
Due to lack of a Canadian pension plan mortality table, Canadian pension actuaries tend to use the Uninsured Pensioner 1994 (UP-94) mortality table and the associated scale AA for mortality

projections.

The UP-94 table was derived from the 1985 to 1989 experience of US Civil Service Retirement System (CSRS), US Social Security, US Military Retirement System, Public Service of Canada, 24 private sector systems and one US state systems. The central year mortality for 1988 was projected using Scale AA to derive the UP-94 table. The Scale AA table was derived from the average of the CSRS and US Social Security mortality trend improvements from 1973 to 1994 with a minimum mortality improvements of 0.5% less than age 85 but no more than 2%; rates over age 85 were graduated to 0.1% to age 100, with no improvements over age 100[1].

The question that needs to be addressed by pension actuaries is: how appropriate is the UP-94 table for valuation of Canadian pension plans?

In view of the fact that the UP-94 table and its associated scale may, or may not, be appropriate for valuation of Canadian pension plans, it may be prudent for pension actuaries to deterministically illustrate the potential financial impact by using mortality tables adjusted for available credible experience, or recently published mortality rates. In addition, mortality improvement projections by *adjusting* Scale AA can be incorporated to demonstrate the financial impact of the increase in longevity. The UK Institute of Actuaries' Continuous Mortality Investigation (CMI) reports provide an excellent source of data on mortality and future improvements.

Stochastic mortality models

A stochastic approach provides a more robust approach to understanding the financial impact of longevity risk as it produces a forecast probability distribution rather than a deterministic point forecast. The quantifying of longevity and mortality risks using stochastic models provides consistency with financial models that also use stochastic methods.

The aggregation of these risks using a consistent approach provides a better understanding of the overall pension risk to plan sponsors. There are a number of stochastic mortality models tested on UK and US data that provide stochastic projections of mortality rates, decomposing mortality improvements into one or more age, period or cohort-related effects. It is clear pension actuaries should understand the limitations of each of these models, ensure goodness of fit with Canadian experience, undertake back testing, and ensure the projected mortality from the model used is statistically valid and appropriate for valuation of Canadian pension plans[2].

Managing longevity risk

In Canada, financial institutions have been slow to provide financial instruments/products that hedge longevity risk; this may be due to the fact there is little interest shown by pension plans in managing longevity risk. A number of capital market solutions have been used, or proposed in managing that risk in the UK. However, the mortality swap (analogous to interest rate swap) solution seems to have some traction.

Mortality swaps at a glance

Mortality swaps (or survivor swaps) is an agreement to exchange cash flows in the future based on a survivor index. The classical approach (proposed in a paper by Blake and Burrows[3]) is a survivor/longevity bond. Such a bond allows the pension plan *(hedger)* to protect against any unanticipated improvement in mortality up to the maturity of the bond. The investment bank or financial intermediary *(issuer)* profits if the mortality based on the survivor index is lower than anticipated. The bond's cash flow must provide a reasonably close match for the payments of the hedger if the bond is to provide an effective hedge; therefore, the choice and derivation of the survivor index is critical to the success of the bond.

Other solutions include: bulk annuity purchases (transfer of longevity risk to insurers); mortality catastrophic bond (more appropriate for mortality risk); bulk buyout of liabilities (this approach eliminates all the plan sponsor risks including longevity risk); buy-ins (transfer of mortality and investment risks to insurer using bond-like instruments), and other complex financially-engineered longevity bonds. The captives approach can also be used to share longevity risk[4].

Conclusion

Longevity risk is an emerging risk that needs to be managed as it directly impacts future funding requirements and accounting disclosures—pension actuaries are in the best position to assist their clients in understanding, quantifying and managing longevity risk. Pension actuaries interested in expanding their knowledge of longevity risk are referred to excellent articles in the *Journal of Risk and Insurance*[5], and J.P. Morgan's technical document on LifeMetrics[6].

References and further reading:

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Minaz Lalani, FCIA, is a member of the Enterprise Risk Management Applications Committee.

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