Hedging Longevity Risk for Pension Plans

By Vincent Francom, CFA, CAIA
Senior Consulting Associate

Introduction

Many pension plan risks, such as those related to investments, interest rates and inflation are well-known to plan sponsors. Longevity risk, however, tends to be more esoteric. Very simply, longevity risk is the risk of people living longer than expected. To illustrate this concept, let us first turn to a curious transaction involving a French attorney, an elderly widow, and a coveted Provençal apartment.

In 1965, André-François Raffray signed a contract with Jeanne Calment, agreeing to pay the widow a life annuity of 2,500 francs per month contingent on Mrs. Calment bequeathing her apartment to Mr. Raffray upon her death. While this agreement may sound peculiar or even distasteful, en viager (meaning “for life”) transactions are not unusual in France. Such sales allow a property owner to remain in his or her home while drawing a monthly income from the buyer, who hopes to secure a desirable property at a discounted price. Given that Mrs. Calment was 90-years old at the time of their agreement, Mr. Raffray, then 47, likely thought he was landing a grand bargain. He was not.

“[P]eople always live for ever when there is an annuity to be paid them ....”

The preceding quote is from Jane Austen’s nineteenth-century novel, Sense and Sensibility, but it nearly describes the predicament of Mr. Raffray. In 1995, 30 years and the equivalent of $184,000 later (an amount greater than twice the apartment’s market value), it was Mr. Raffray – not Mrs. Calment – who was the first to pass away. As for Mrs. Calment, she continued to receive her monthly stipend, as Mr. Raffray’s widow was obligated to fulfill, until she died in 1997 – at the age of 122.

Granted, the above example is an extreme one. Mr. Raffray was extraordinarily unlucky to enter into a “for life” agreement with a woman who would ultimately claim the world record for the longest confirmed human lifespan. It does, however, highlight the impact of longevity risk from both sides of the ledger. Like Mr. Raffray, in the defined benefit world, pension plans are “short” longevity as their liabilities rise with longevity. That is, if a pension plan’s members live materially longer than expected, the pension is responsible for the extra benefit payments. In contrast, the life insurance industry, for
instance, is “long” longevity as life insurance policy liabilities are inversely correlated to longevity (i.e., declining mortality means longer premium payments and delayed payouts).

**What is Driving Longevity Improvements?**

Over the last 100-plus years, advances in medicine, health care, and technology have contributed to a substantial improvement in life expectancy. As shown in the top-right chart, at first, this improvement was mainly due to reduced infant and child mortality. From the beginning of the twentieth century (dark blue line) to the late 1950s (maroon line), the percentage of newborns surviving to at least five climbed from 82% to 97%. While this improvement is clearly laudable, increased life expectancy stemming from reduced infant mortality does not impact longevity risk. For longevity risk, what matters is improving life expectancy at older ages, especially after retirement age. Here again, the gains have been substantial, especially over the past several decades. As depicted in the bottom-right chart, in 1970, an average 65-year-old U.S. male was expected to live an additional 13 years; by 2007, an average 65-year-old U.S. male was expected to live an additional 17 years – a 34% increase. The trend is similar for U.S. women, although the rate of improvement has been less-pronounced – up 20% from 1970.

**Sources of Longevity Risk**

Longevity risk is a systematic risk; it is inherent to the entire market and, therefore, cannot be diversified. As illustrated below, longevity risk is driven by three underlying risks: trend risk, basis risk, and random variation risk.
Trend risk is equal for all plans, while basis risk is more relevant to plans with concentrated exposures to specific demographic segments of the general population. The final source of longevity risk, random variation risk, is more relevant to plans that lack diversification, such as those with small memberships. Of the three, trend risk is the primary source of longevity risk, as forecasters have consistently underestimated actual improvements in life expectancy.\(^2\)

Related to trend risk is the instability of mortality rates. Although mortality has declined across the board for more than a century, the rate of decline has fluctuated over shorter time periods. This lack of stability further complicates attempts to estimate future declines in mortality. In addition, there is no guarantee that lifespans will continue to grow as factors including increasing obesity, global conflicts, natural disasters, and pandemics could constrain or halt longevity improvements.

**Is Longevity Risk Significant?**

According to the International Monetary Fund, each additional year of life expectancy increases the present value of the typical pension plan’s liabilities by 3%.\(^3\) In addition, low interest rates, which have prevailed in the U.S. for years, exacerbate the impact of longevity risk on pension plans as lower discount rates result in higher present values for pension liabilities. Overall, Swiss Re estimates the global exposure to longevity risk to be $23 trillion.\(^4\)

In contrast to more prominent pension risk exposures, longevity risk lacks volatility. Unlike investment and interest rate risk, which can have a much more immediate impact on a plan’s funding ratio, longevity risk is a gradual, cumulative risk.

**Longevity Risk Transfer Options**

The shift by plan sponsors over the past few decades from defined benefit to defined contribution plans has transferred longevity risk from the sponsor to the participant. For plan sponsors with existing pension liabilities, the options for hedging longevity risk fall into three main categories:

- **Buy-out transaction (see left diagram below)**

  In a buy-out, all of a pension plan’s liabilities and associated assets are irrevocably transferred to an insurance company in exchange for an up-front premium paid by the plan. The plan’s liabilities and corresponding assets are removed from the sponsor’s balance sheet, and the insurer assumes full responsibility for all future plan obligations. As a result, a traditional buy-
out transfers all of the risks associated with the plan – including investment, interest rate, inflation, and longevity – from the plan sponsor to the insurer. Over the years, variations of buy-outs have emerged, such as transactions where liabilities are off-loaded in stages (known as “phased” buy-outs).

- **Buy-in transaction (see right diagram above)**

A buy-in is a relatively new arrangement for hedging longevity risk where a plan sponsor pays an up-front premium to an insurer in exchange for a group annuity contract. Unlike a buy-out transaction, the plan’s liabilities remain on the plan sponsor’s balance sheet. A buy-in is essentially an insurance contract, held as an asset of the plan, the terms of which obligate the insurer to make periodic payments to the plan sponsor in an amount equal to those paid by the sponsor to its members. The buy-in arrangement guarantees benefit payments to the plan’s retirees regardless of how long they live, thus transferring longevity risk from the sponsor to the insurer.

Unlike a buy-out, a buy-in is only a partial de-risking solution since it only hedges a plan’s exposure to longevity risk. Also, in contrast to a buy-out, a buy-in is revocable – a feature that provides the plan sponsor the option of converting to a buy-out at a later date.

- **Longevity swaps (see diagram below)**

Longevity swaps are derivative contracts that are similar in structure to interest rates swaps, which are used by counterparties to exchange interest rate cash flows on a predetermined schedule. With a longevity swap, a plan sponsor hedges longevity risk by making periodic fixed payments (equal to the expected benefit payments at the outset of the contract, plus a risk premium) to a swap provider. In exchange for a risk premium, the swap provider (usually an insurance company or an investment bank) pays the plan sponsor an amount equal to the actual periodic benefit payments.
As illustrated in the diagram to the left, the “fixed leg” is the sponsor’s payments, while the “floating leg” is the swap provider’s. If the plan’s members live longer than expected (as reflected in the pricing of the fixed leg), the swap provider is responsible for making the additional benefit payments. Thus, for the plan sponsor, a longevity swap eliminates an element of uncertainty – all future benefit payments made by the sponsor are fixed and known when the swap is executed. While longevity risk is transferred with a longevity swap, other financial risks, such as investment and interest rate risk, remain with the plan.

Which Option for Transferring Longevity Risk is Preferred?

Of course, deciding on the preferred longevity hedging option depends on the specifics of each pension plan. Buy-outs are the classical approach; however, for underfunded plans, a buy-out can be prohibitively expensive since the plan’s unfunded liabilities must be recognized and immediately remedied in order to complete the transaction. This immediate recognition of the asset-liability gap is not required for buy-in and longevity swap transactions as the plan’s liabilities are not transferred. Consequently, buy-ins and longevity swaps may be preferable to buy-outs for underfunded plans. Buy-ins and swaps can also be attractive for sponsors looking to hedge longevity risk relating to specific segments of the plan’s membership. Sponsors wishing to retain exposure to investment risk may also look to longevity swaps as longevity risk can be isolated and hedged without ceding control of the plan’s underlying assets. In contrast, buy-out and buy-in transactions usually transfer investment risk along with longevity risk.

Other options for hedging longevity risk include a potential capital market solution known as a longevity bond. A longevity bond is structured such that its payout is linked to an index that tracks the survival rate of a given population, known as a cohort. The payout on a longevity bond is proportional to the number of survivors in the cohort; therefore, the bond issuer pays more to the bond investor when longevity is higher. Unfortunately for plan sponsors intrigued by this capital market approach, actual longevity bond issuance has been trivial to date, including several false starts.

Alternatively, a plan sponsor could choose to manage its longevity risk internally through self-insurance (i.e., reserves). If the hurdle rate for self-insurance is sufficiently low enough, it might make sense for the plan sponsor to reserve prudently, periodically update assumptions based on predicted longevity improvements, and manage the risk in-house.
A Closer Look at Longevity Swaps

Longevity swaps are a recent entrant into the longevity hedging market, with 2009 marking the first swap transaction involving a pension plan. As described above, a longevity swap is an unfunded transaction that is executed without the transfer or sale of plan assets. As a result, the plan sponsor can continue to invest the plan’s assets and potentially benefit from the retention of investment risk. Retaining control of assets and the lack of an up-front premium are two main reasons why longevity swaps have appealed to plan sponsors.

Below is a look at known longevity swap transactions to date:

<table>
<thead>
<tr>
<th>Date</th>
<th>Longevity Hedger</th>
<th>Longevity Swap Provider</th>
<th>Approx. Size Local Currency (millions)</th>
<th>Approx. Size U.S. Dollars (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May-13</td>
<td>Bentley</td>
<td>Deutsche Bank / Abbey Life</td>
<td>£400</td>
<td>$600</td>
</tr>
<tr>
<td>Feb-13</td>
<td>BAE Systems</td>
<td>Legal &amp; General</td>
<td>£3,200</td>
<td>$4,900</td>
</tr>
<tr>
<td>Dec-12</td>
<td>LV</td>
<td>Swiss Re</td>
<td>£800</td>
<td>$1,200</td>
</tr>
<tr>
<td>May-12</td>
<td>Akzo Nobel</td>
<td>Swiss Re</td>
<td>£1,400</td>
<td>$2,100</td>
</tr>
<tr>
<td>Feb-12</td>
<td>AEGON*</td>
<td>Deutsche Bank</td>
<td>€12,000</td>
<td>$15,900</td>
</tr>
<tr>
<td>Jan-12</td>
<td>Pilkington</td>
<td>Legal &amp; General</td>
<td>£1,000</td>
<td>$1,500</td>
</tr>
<tr>
<td>Dec-11</td>
<td>British Airways</td>
<td>Goldman Sachs / Rothesay Life</td>
<td>£1,300</td>
<td>$2,000</td>
</tr>
<tr>
<td>Nov-11</td>
<td>Rolls-Royce</td>
<td>Deutsche Bank</td>
<td>£3,000</td>
<td>$4,600</td>
</tr>
<tr>
<td>Aug-11</td>
<td>ITV</td>
<td>Credit Suisse</td>
<td>£1,700</td>
<td>$2,600</td>
</tr>
<tr>
<td>Feb-11</td>
<td>Pall</td>
<td>JP Morgan</td>
<td>£70</td>
<td>$110</td>
</tr>
<tr>
<td>Jul-10</td>
<td>British Airways</td>
<td>Goldman Sachs / Rothesay Life</td>
<td>£1,300</td>
<td>$2,000</td>
</tr>
<tr>
<td>Feb-10</td>
<td>BMW</td>
<td>Deutsche Bank / Abbey Life</td>
<td>£3,000</td>
<td>$4,600</td>
</tr>
<tr>
<td>Nov-09</td>
<td>Royal County of Berkshire</td>
<td>Swiss Re</td>
<td>£1,000</td>
<td>$1,500</td>
</tr>
<tr>
<td>Jul-09</td>
<td>RSA Insurance Group</td>
<td>Goldman Sachs / Rothesay Life</td>
<td>£1,900</td>
<td>$2,900</td>
</tr>
<tr>
<td>May-09</td>
<td>Babcock International</td>
<td>Credit Suisse</td>
<td>£1,500</td>
<td>$2,300</td>
</tr>
<tr>
<td>Mar-09</td>
<td>Aviva*</td>
<td>RBS / PartnerRe</td>
<td>£475</td>
<td>$700</td>
</tr>
<tr>
<td>Feb-09</td>
<td>Abbey Life*</td>
<td>Deutsche Bank</td>
<td>£1,500</td>
<td>$2,300</td>
</tr>
<tr>
<td>Jul-08</td>
<td>Canada Life*</td>
<td>JP Morgan</td>
<td>£500</td>
<td>$800</td>
</tr>
<tr>
<td>Jan-08</td>
<td>Lucida*</td>
<td>JP Morgan</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Source: Aon Hewitt, Pension & Investments, Pensions Institute, AEGON, Investment & Pensions Europe
*Longevity swap transaction involving an insurance company’s book (i.e., not a pension plan)

A few things stand out from the list of transactions above: (1) the longevity swap market is a fledgling one with fewer than 20 transactions completed — all in Europe, (2) U.K. plan sponsors and insurers have dominated the longevity swap market,6 (3) swap providers have been limited to a handful of insurers, reinsurers, and investment banks, and (4) with few exceptions, longevity swap transactions involving pension funds have been confined to larger plans.

Two Types of Longevity Swaps: Indemnity-based and Index-based

Longevity swaps fall into two general categories: indemnity-based and index-based. Indemnity-based swaps are also known as customized or “bespoke” swaps since they are based on the actual population of the pension plan being hedged. An indemnity-based swap entails the plan sponsor making a series of
fixed payments (the “fixed leg”), based on a customized longevity assumption, in exchange for the actual pension payments (the “floating leg”) that the plan pays its members. As a result of this customization feature, indemnity-based swaps are highly effective in hedging longevity risk.

In contrast to an indemnity-based longevity swap, the payments of an index-based swap are tied to a mortality index rather than the actual population of the plan. The effectiveness of an index-based swap is contingent on the actual mortality experience of the plan’s population tracking the selected index. As a result, an index-based swap introduces basis risk, which reflects the potential mismatch between the plan’s actual longevity experience and that of the mortality index. Keep in mind that the mere presence of basis risk does not necessarily negate the effectiveness of an index-based swap; however, the imperfect nature of the hedge introduces an element of uncertainty which is absent with an indemnity-based swap.

Despite the added exposure to basis risk, index-based longevity swaps offer plan sponsors several advantages relative to indemnity-based swaps. For instance, index-based hedges may be more cost effective for smaller plans since indemnity-based hedges are generally only feasible for plans with liabilities of at least £300 million ($480 million). This is because of the relatively high structuring costs associated with the custom tailoring of an indemnity-based swap – costs that are difficult for smaller plans to absorb. In contrast, since index-based swaps are based on general population statistics, it is not necessary for the swap provider to account for the actual longevity experience of the plan’s membership. Thus, index-based longevity swaps are, at least in theory, easier for the provider to price.

Although a recently announced deal may change this perception, index-based swaps have also been viewed as a more viable swap alternative for plan sponsors looking to hedge the longevity risk of non-pensioners (i.e., active and deferred members). For most pension plans, the majority of longevity risk lies not with retirees, but with non-pensioners. The rationale behind this aspect is fairly straightforward: with their longer life expectancies (relative to older retirees), non-pensioners expose pension plans to greater uncertainty regarding future longevity trends. In the past, this increased uncertainty made indemnity-based swaps too expensive for sponsors seeking to hedge non-pensioner longevity risk. Since index-based longevity swaps are typically easier to price (as discussed above), and are designed for shorter durations (typically 10 years), they are perceived to be more suitable than indemnity-based swaps for plan sponsors with significant deferred and active members.

Further Longevity Swap Considerations

- **Nascent, non-standardized market:** As summarized above, the actual number of longevity swap transactions completed to date is quite small, with none involving a pension plan outside of Europe. Furthermore, despite several attempts to jump-start broad capital market interest, the market for longevity swaps remains private, illiquid, and non-standardized. Also, with scant pricing details available in the public domain, it is difficult to discern whether or not a “first mover” advantage exists.

- **Few counterparties:** As shown earlier, swap providers have been limited to a handful of insurers, reinsurers, and investment banks. Since insurance and reinsurance companies are exposed to mortality risk (the risk of people dying ahead of expectations) through life insurance
policies, they are viewed as natural counterparties for longevity risk. Unfortunately, insurers do not possess sufficient capacity to meet potential demand. In addition, due to increased capital reserving requirements under Basel III, several investment banks (i.e., UBS, Credit Suisse, and Nomura) exited the longevity swap market in 2012. Finally, although asset managers, sovereign wealth funds, and hedge funds are frequently mentioned as potential longevity swap counterparties, they have remained on the sidelines to date.

- **No transparent way to price longevity risk:** A fundamental problem facing the longevity swap market is the difficulty in accurately predicting life expectancy improvements. Without this, longevity risk is burdensome to price. A rule of thumb for longevity swaps is for the swap provider to assign a 4-7% risk premium to the revised best estimate of a pension plan’s cash flows (based on the most recent actuarial longevity assumptions, plus estimates of future longevity improvements). However, this method is inexact at best and, as a senior expert at the International Monetary Fund points out, the absence of a generally accepted “Black-Scholes” pricing model for longevity risk complicates the modeling of collateral posting requirements.

- **Counterparty credit risk:** In a longevity swap transaction, both the hedger and the swap provider face counterparty credit risk, which is traditionally addressed through collateral agreements.

- **Highly complex and time consuming transaction:** Estimates vary, but plan sponsors contemplating longevity swaps would be wise to budget between a year and 18 months in order to complete a transaction. The main steps in the process include ongoing trustee education, studies of feasibility, counterparty selection, structuring (including collateral arrangements), and implementation. Especially in the case of an indemnity-based transaction, data cleansing by the plan sponsor is paramount as the swap provider requires credible membership data in order to customize and price the swap. Poor or insufficient data may result in higher pricing by the swap provider or, if the information is too questionable, the entire transaction could be abandoned.

- **Fewer hedging options available for smaller plans:** As described above, with a few exceptions, longevity swap transactions have been limited to larger pension plans.

- **Termination of a swap is likely difficult:** While unwinding a longevity swap is feasible in theory, we have found no literature to indicate a successful termination. Furthermore, a swap holder looking to close out a longevity position prior to maturity would likely incur a significant haircut, given the illiquid nature of the market. Therefore, we would caution that the early termination of a swap could be financially painful. Given this backdrop, plan sponsors need to be cognizant of the potential ramifications associated with an agreement that spans several decades.

**Conclusion**

The primary objective of a pension plan is to ensure that sufficient funds are available to pay promised benefits as they become due. While we would agree that longevity risk can hinder a plan’s ability to achieve its primary objective, we would argue that the potential impact of the exposure is subordinate
to the three more traditionally known pension risks (i.e., investment risk, interest rate risk, and inflation risk). Unlike investment and interest rate risk, which both have the potential to harm a plan’s funded status in short order, longevity risk is a gradual, cumulative risk – it cannot damage a pension plan overnight.

For plan sponsors interested in pension de-risking, in order to prioritize hedging activities, it is important to estimate the level of longevity risk specific to the plan, and rank this risk relative to the plan’s other exposures. Given that very deep, liquid, and established markets exist to hedge all three primary pension risks, we believe plan sponsors should focus their de-risking efforts in these markets before tackling longevity risk.

For plans with significant pension de-risking programs already in place, hedging longevity risk might be the next logical step. Of course, deciding on the preferred hedging option depends on the specifics of each plan. We would point out, however, that given the fledgling state of the longevity swap market, it might be prudent for plan sponsors to exercise patience and explore self-insurance as an alternative strategy for managing longevity risk.

Notes

1In 1965, 2,500 francs was equivalent to about $500.
3Ibid.
5Assuming the utilization of an indemnity-based or “bespoke” longevity swap (as discussed on pages 6 & 7), as an index-based swap introduces basis risk.
6Differences in statutory and regulatory requirements between Europe and the United States, which are beyond the scope of this paper, provide some explanation as to why longevity swap transactions involving pension funds have been confined to the United Kingdom.
8In December 2012, LV= and Swiss Re completed the first-ever indemnity-based longevity swap transaction involving pensioners and members over age 55 (i.e., including active and deferred members). The deal covered pension liabilities totaling £800 million ($1,200 million) and 5,000 lives. No details regarding swap pricing were made public.
9While the shorter duration of index-based swaps helps to facilitate the hedging of longevity risk related to non-pensioners (i.e., providers are willing to assume the risk of a shorter-term liability), it does expose the plan to reinvestment risk. That is, given that index-based swaps are typically only 10 years in length, in order to continue with a long duration longevity hedging program, a plan sponsor would have to buy a series of similar swaps in the future, which could potentially be more expensive due to changes in the underlying mortality index.
10Life insurers also have the option of internally managing or hedging mortality risk (by writing annuities, which carry longevity risk).
14Counterparty credit risk exists since longevity swaps are privately negotiated transactions – either the hedger or the swap provider could potentially default on their end of the agreement.