



## Is longevity risk a one-way market?

**The first international conference on longevity risk and capital market solutions took place on 18 February 2005, at Cass Business School, London. Alistair Byrne and Debbie Harrison of the Pensions Institute at Cass report on the key issues raised. The conference was sponsored by Lehman Brothers Europe Ltd, ABN AMRO, the American Risk and Insurance Association, the Centre for Risk and Insurance at Nottingham University Business School, and the Pensions Institute.**

Longevity risk is a critical issue for organisations that provide pensions, and this includes the government, private sector employers, and insurance companies that write immediate and deferred annuity business. ‘Ownership’ of the longevity risk inherent in a defined benefit (DB) scheme or in an insurance company’s pool of annuitants is an increasingly controversial issue that can have a detrimental affect on share prices and corporate activity – adding to the woes of employers with a funding deficit. At present there is no obvious single solution to such problems but the urgency of the situation demands a clear and open discussion of the issues.

The first international conference set out to achieve just this, drawing delegates from academia, government, and the banking, insurance and pension industries. Speakers quantified the scale of the problem, explained why traditional capital market instruments are inadequate as longevity risk hedges, considered whether new instruments can provide more robust solutions, and identified key areas of research.

### **‘UK Plc’ liabilities**

Farooq Hanif of Lehman Brothers opened the conference by providing a UK equity analyst’s perspective. He explained that the UK economy has over £1000bn of liabilities exposed to longevity risk – an amount equivalent to one year’s gross domestic product (GDP). Private sector DB pensions, at £760bn, account for the bulk of this, while unfunded public sector pension liabilities amount to at least another £350bn (and possibly as much as £700bn according to recent research from Watson Wyatt), while UK life assurers have annuity liabilities of about £70bn. The greatest perceived risk lies with the sponsoring employers of

DB schemes, due to the comparatively young age of many members and the associated length of the risk tail.

The scale of the liabilities – and, in the case of employer-sponsored DB schemes, the level of deficits – are partly a result of dramatic increases in mortality experience. As Michael Johnson (Tillinghast Towers Perrin), explained: ‘Longevity risk materialises when mortality expectations are not met.’ Indeed actual experience has far outstripped predicted improvements in longevity. Over the course of the 20<sup>th</sup> century, life expectancy rose, on average, by about 3 months per annum. More recently, the rate of improvement has accelerated. In particular, the cohort born between the two world wars – who are today’s pensioners – are living significantly longer. Better diets, changes in smoking habits and improving healthcare all appear to be contributing to this trend. To put this in perspective, life expectancy for a man aged 65 in 1980 was 13 years; by 2000 male life expectancy at 65 had risen to 16 years – an increase of over 20%.

### **Uncertain future mortality trends**

These significant and unanticipated improvements are already having a major impact on the required funding to meet pension promises. Equally, if not more worrying, is the uncertainty over future trends. All the speakers were in agreement: we simply do not know whether there is a natural physiological limit to the extent to which medical technology can extend our lives, neither do we know whether modern lifestyle issues, such as rising rates of obesity, will slow the trend towards longer life. The traditional approach to the prediction of future mortality assumptions is to rely on historical patterns but this is no longer sufficient. Simon Carne, an independent consultant, argued that actuaries must now begin to look forward, working with medics and demographers to construct a better picture of likely future trends.

### **Impact on share prices**

The inability of companies to hedge their exposure to longevity risk, or, in the case of corporate pension funds, to transfer it to other parties such as insurance companies, ‘is moving share prices’, Farooq Hanif said. Institutional investors are now scrutinising the longevity risk inherent in a DB scheme as well as scheme deficits. These two factors combined are forcing companies to increase reserves against future liabilities and to reduce profits distributed to shareholders.

In practice, therefore, DB deficits and the uncertainty over longevity risk are restricting the way companies do business and this may have an impact on the economy as a whole unless we find ways to quantify longevity risk more accurately and to manage this risk.

Farooq Hanif (Lehman) and Eugene Dimitriou (Morgan Stanley) both noted that the risk in DB pensions was blocking corporate merger and acquisition activity, as has been seen with the W H Smiths and Marks & Spencer deals in 2004, and, more recently, the Allders case. While FRS17 has improved disclosure on many aspects of pension funds – in particular the deficit is now explicit in the annual report – companies do not have to disclose the mortality assumptions used. The use of modern mortality tables – which may still be too conservative – would add some £20bn to the existing £60bn total deficit for FTSE 100 company DB schemes.

An important point, noted by Farooq Hanif, is that longevity risk is largely systemic in that it affects all parties concerned in broadly equivalent ways. This makes diversification across different sponsors of pension schemes virtually impossible. Risk reduction can only be achieved, therefore, through the involvement of a range of counter-parties, each tackling a specific portion of the risk, which they can underwrite with confidence. At present the appetite of reinsurers to take on further longevity risk is very limited. Non-traditional underwriters such as investment banks are an essential component for the solution but for such institutions to enter the market we need an objective index for mortality.

Adrian Gallop of the Government Actuary's Department (GAD) outlined some of the problems with constructing a mortality index in terms of the availability of data, the timeliness of data, and the definitions used. He was one of several speakers who asked whether such a mortality index, based on the population as a whole, would be appropriate for pension funds, which often have specific membership profiles that affect actual mortality experience. Francis Fernandes (ABN AMRO) warned that this basis risk – the difference between the mortality experience of the population used to construct an index for a bond and that of the actual scheme membership – could easily be of the order of 20% because of the parts of the country where the scheme members lived. Gavin Jones (Swiss Re) illustrated this point by referring to the very significant differences in life expectancy at age 65 depending on sex, employment history, income and region. Life expectancy at 65 for a female, who has held high status / high-income jobs, and who lives in the South-east of England is approximately 22 years. The comparable figure for a male, living in the North, who has held low status / low incomes jobs is just under 13 years.

### **Traditional risk management techniques inadequate**

Historically there have been few obvious ways for pension funds and life assurance companies to hedge the longevity risk they face. A pension fund could ask a life assurance company to 'buy out' the liabilities, but the conversion of DB benefits to annuities is

expensive and insurance capacity is limited, particularly where deferred annuities are involved.

The capital reserving requirements for deferred annuities are extremely tough. At the same time, annuity innovations, such as the trend towards enhanced rates for impaired lives, are restricting the capacity for cross-subsidy and creating anti-selection issues for conventional annuity writers. In recent years the buy-out market has shrunk with Prudential and Legal & General the only two major providers still active. Moreover, the cost of full buy out of DB scheme liabilities is prohibitive due to the increasing cost of annuities. Few UK schemes can afford this option – a problem exacerbated by the widespread deficit situation. Francis Fernandes pointed out that since the UK government's announcement on 11<sup>th</sup> June 2003, a solvent employer is not allowed to walk away from an underfunded DB scheme unless it first tops up the fund assets to the value required on a full insurance company buy-out assessment. This means that most employers are now locked into delivering on these pension promises. Even where a scheme is closed to all future accrual, the residual risk remains with the employer until the last DB member and his/her beneficiaries has died – a tail that could extend 40-60 years.

### **The Swiss Re mortality bond**

In terms of capital market innovations that can be used to hedge mortality and longevity risk, the first significant development was the Swiss Re mortality bond of December 2003. According to reports, the \$400m bond has a three-year maturity and was priced at LIBOR + 1.35%.

Ronnie Klein (Swiss Re) explained that this bond was designed to de-risk the company's exposure to an extreme mortality event such as a flu epidemic or nuclear attack. The bond shares many characteristics with the 'catastrophe' bonds that have been issued by general insurers to hedge against risks such as earthquakes or other natural disasters. With a catastrophe bond structure, principal repayments are reduced if the trigger event occurs. In this case, should an extreme mortality event take place, once mortality reaches a predetermined level in excess of normal experience, the amount of principal that Swiss Re has to pay back to bond holders is reduced on a sliding scale to zero. Swiss Re's mortality index was based on mortality experience in five major countries.

The mortality hedge in the structure allows the company to release capital that would otherwise need to be held to cover its life and health insurance liabilities in the event of a major mortality event.

Other institutions – particularly pension funds and annuity writers – face risks that are in effect the opposite of those to which Swiss Re is exposed. While Swiss Re is concerned about high mortality rates, pension schemes and annuity providers recognise that they will suffer financially if people live longer than expected. These organisations require capital market instruments that are linked to longevity experience – in other words instruments that pay more the longer people live.

Philip Roberts (Tillinghast Towers Perrin) explained that annuity writers and pension funds face similar liabilities but have different perspectives. Life insurers are used to risk taking and operate in tightly regulated markets. Pension funds tend to be more risk averse and more loosely regulated. Life insurers are most concerned about potential catastrophic losses, whereas pension funds are concerned about incremental losses.

### **BNP Paribas / EIB survivor bond**

Mark Azzopardi (BNP Paribas) described the 25-year European Investment Bank / BNP Paribas survivor bond of November 2004, where coupon payments are linked to the proportion of the population who were age 65 in 2003 who are still alive at the coupon date. The base coupon is £50m per annum and each year this is scaled by the percentage of the reference group who are still alive (actually, were alive two years ago due to the time lag in gathering the data.)

The bond – in effect a group annuity – should be an attractive hedging investment to pension funds, particularly as the EIB is a supranational institution that is triple-A rated. The longevity risk in this structure is ultimately borne by Partner Re – a Bermuda-based reinsurance company. However innovative, the scale of this bond is small in comparison with the market's appetite (£550m of bond vs. £760bn of DB pension liabilities), while the hedge is potentially expensive. If mortality evolves in line with current projections by the GAD the bond trades at approximately 20 basis points below EIB bonds of comparable duration – the cost of the longevity hedge. For the record, Partner Re appears to have made it clear that it has little appetite for additional deals.

### **Technical issues for mortality and longevity bonds**

Both the Swiss Re and EIB/Paribas bonds present important technical issues. Philip Roberts (Tillinghast Towers Perrin) observed that stochastic mortality models are required to price these instruments, as are reliable mortality indices. Academic research is proving crucial to finding market solutions. Sam Cox and Shaun Wang (Georgia State University) and Andrew Cairns (Heriot-Watt University) discussed models that can be used to price the bonds once

the mortality index has been determined (for further detail, see the speaker slides on the Pensions Institute website [www.pensions-institute.org](http://www.pensions-institute.org)).

In the case of Cox and Wang, the pricing model is a modification of the ‘Wang Transform’ approach they have used to price insurance catastrophe bonds. For the Swiss Re bond, the model produces results close to the observed pricing. In the case of Cairns, a stochastic mortality term structure model is developed using the same techniques used to model the term structure of interest rates, in order to form a basis for pricing longevity bonds such as the EIB structure.

Given the concerns over basis risk it follows that the mortality profile of a scheme could be quite different from that used to price the bond. Furthermore, most of the hedges run for a fixed number of years – 25 in the case of the EIB bond – which means there is ‘tail risk’ in that there is currently no way to hedge the cost of pensions to members who survive more than 25 years after retirement. The alternative – suggested by Francis Fernandes – is that pension schemes assess the best estimate of the longevity of their own scheme members and try to match the pension cashflows implied by this as best as possible using traditional investment instruments. Cash flow swaps might provide an alternative to longevity bonds for DB schemes, he said, but trustee understanding of these instruments currently is low and this acts as a barrier to usage.

### **Issues for the market**

Philip Roberts (Tillinghast Towers Perrin) suggested that companies with longevity risk could either attempt to sell the risk, or buy an asset that will hedge the risk. Chris Hatry (Legal & General) echoed Francis Fernandes’ opinion when he pointed out that while there was a clear demand for longevity risk hedges, the market understanding, particularly among DB scheme trustees, is poor. Moreover, Chris Hatry questioned how such a market would operate given the potential liquidity issues that would arise where buyers were holding longevity bonds for the full term. The potential lack of a liquid secondary market, therefore, must be taken into account.

Designing appropriate hedges is an important first step in producing solutions to longevity risk, but an active market for these hedges requires both buyers and sellers. The sellers of longevity risk are clear – pension funds and annuity providers – but identifying the buyers is problematic. Reinsurers have typically been prepared to accept some longevity risk through bulk purchase of annuity contracts, but, as mentioned, their capacity is limited. The government is a possible issuer of longevity bonds, but Arnaud Mares (Debt Management Office) noted that while the DMO had been consulting the market on the possibility of issuing

ultra-long (50 year) gilts, which could be attractive to pension funds, it was not currently planning to issue longevity bonds, not least because to do so would result in a significant risk transfer to the government, which would require consideration of broader policy issues.

In this context it is important to remember that the UK government is already significantly exposed to longevity risk through state benefits and unfunded public sector pension schemes. However, Arnaud Mares said that the Treasury is keeping ‘an open mind’ on the issue, that the DMO has had informal discussions with asset managers, trustees, consultants and actuaries, and that it may revisit the longevity bond issue at a later date. He pointed out that the DMO’s objective as a debt manager is to be able to demonstrate to the Treasury that it can achieve a reduction in financing costs and/or risk for the government if it issues a new instrument. It also needs to be confident that there is a sustainable and sufficiently liquid market for any new instrument. A week after the conference the Government asked Adair Turner’s Pension Commission to consider the case for the Treasury issuing longevity bonds.

Several speakers suggested that pharmaceutical and long-term care companies were potential private sector issuers of longevity bonds, as these companies’ profits are linked to longevity. However, to date these potential counter-parties appear to have shown no interest in the subject. Eugene Dimitriou (Morgan Stanley) suggested that overseas life assurers (for whom longevity risk is less of a concern), hedge funds and private equity funds are potential longevity risk takers. There have been constructive discussions in the past with these parties but no trades yet. At present, therefore, it would seem that longevity risk is largely a one-way market.

## **Conclusion**

The debate at this first conference on managing longevity risk was wide ranging and the high level of interest was evident in the significant turnout and the continuing research being carried out by academics. It is clear that the lack of institutions prepared to underwrite longevity risk presents complex challenges to those involved in the development of capital market instruments. This in turn reflects the high level of uncertainty over future longevity, which makes it very difficult to assess the fair price of these instruments. The inherent basis risk in using these instruments will also remain an important concern for buyers, in particular DB scheme trustees.

Despite these problems, the conference speakers agreed that solutions must be found. Without an appropriate response to longevity risk it is likely that corporate sponsors will be forced to default on some or all of the pensions promises made to employees and their

dependants. Michael Johnson (Tillinghast Towers Perrin) argued that the current crisis of large deficiencies in company pension plans arising from longevity risk has close parallels with the LDC (less developed countries) debt crisis in the 1980s. In both cases the problem is large and it emerged rapidly before regulators realised what was happening. In both cases, creditors found themselves locked in. In both cases the same solution is being applied, namely to cut deals with creditors, and in the case of the pension crisis, this means pensioners and employees. Just as the Brady Plan led to massive debt relief, will the same thing happen here, with trustees agreeing to reduce employee benefits?

In the short- to medium-term, trustees will find themselves under increasing regulatory and legal pressure, following the implementation of the Pensions Act 2004, which requires them to exert greater influence over the solvency position of their schemes. Where trustees fail to improve solvency and to manage longevity risk, the impact of defaults on the fledgling Pension Protection Fund (PPF) could be disastrous. Moreover, the social consequences of mis-management of these issues could be dramatic and far-reaching, forcing impoverished pensioners to fall back on the state and on the tax payer. As Simon Carne succinctly put it: 'longevity risk is simply code language for the very real risk of pensioner poverty.'

*There will be a Second International Conference on Longevity Risk and Capital Market Solutions in Atlanta, USA, on April 17<sup>th</sup>, 2006 (hosted again by Professors Richard MacMinn and David Blake under the auspices of the Bowles Chair held by Professor Sam Cox of Georgia State University). Details will be posted on the Pensions Institute web site in due course. Selected papers from that conference will be published in a special issue of the Journal of Risk and Insurance, a Journal of the American Risk and Insurance Association, in 2007.*

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