Taking the long view

Governments are among the few agencies that can help the private sector hedge against the increasing problem of aggregate longevity risk. David Blake, Tom Boardman, Andrew Cairns and Kevin Dowd from the Pensions Institute at Cass Business School urge governments to issue longevity bonds as soon as possible

DRAMATIC INCREASES IN LIFE EXPECTANCY in recent years have left private sector pension funds and annuity providers with massive longevity exposure – and unlike other risks, such as credit or interest-rate risk, there are few options available to hedge this risk on any significant scale within the private sector itself.

In the UK, for example, despite the recent rapid expansion in the number of pension buy-out companies, the buy-out market still only has a turnover of around £5 billion per annum – well short of the £1 trillion of pension-plan liabilities in the country. As individuals and companies switch to defined contribution (DC) plans, an efficient annuity market becomes more important than ever. At the same time, governments are looking to broaden their sources of funding in a time of economic uncertainty and large fiscal deficits.

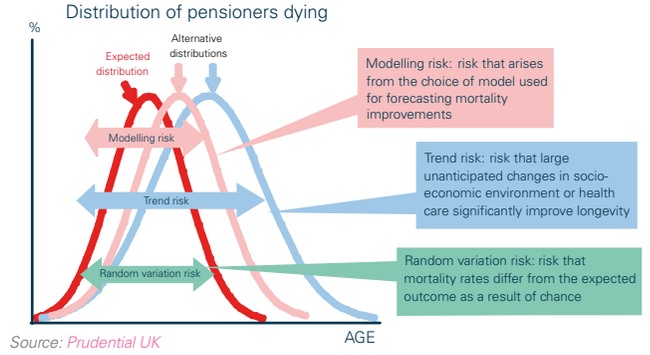
Against this economic backdrop, the UK government and, indeed, governments across the world, should consider issuing longevity bonds to help pension funds and annuity providers hedge the aggregate longevity risk they face. In this way, they would gain access to a new source of long-term funding that, by widening the investor base, lowers the cost of government issuance. In addition, the longevity risk premium attached to such issues will further reduce the expected cost of the long-term national debt. Governments would also be able to issue bonds with a deferred payment structure to help their current funding programmes.

But it is not just governments that will benefit. Insurers would be able to use a market-determined mortality term structure to help them establish an optimal level of capital in a Solvency II world. Longevity bonds will help insurers grow their annuity businesses, as well as continue their role of aggregating the longevity risk in pension plans, while being able to pass on a proportion of this risk to the capital markets. This would reduce their longevity concentration risk and distribute it around global capital markets.

The capital markets would be able to establish a liquid longevity derivatives market once the cash market in government-issued longevity bonds – and the associated strips market – had established key price points along the mortality term structure. At the same time, regulators would be able to use the mortality term structure to help validate insurers' economic capital, thereby making regulation more robust.

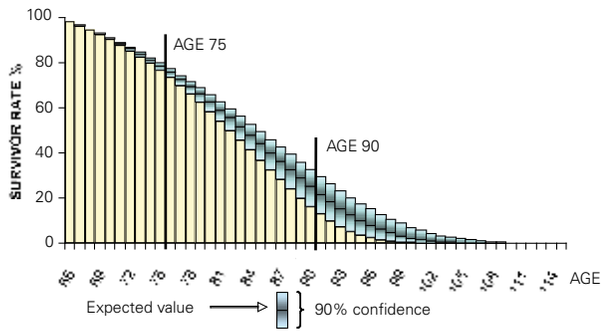
As Figure 1 shows, longevity risk for pension plans is driven by three underlying risks: modelling risk, trend risk and random variation risk. The first and last of these are specific risks that private sector institutions can deal with by pooling and relying on the law of large numbers to reduce. Trend risk, on the other hand, is – like inflation risk – an aggregate risk that cannot be diversified away and the private sector is unable to hedge this risk effectively without a suitable instrument. This is where governments can step in and provide such an instrument in the form of longevity bonds. There are four main reasons why the government should agree to share longevity risk in this way.

Figure 1. Longevity risk is driven by three underlying risks



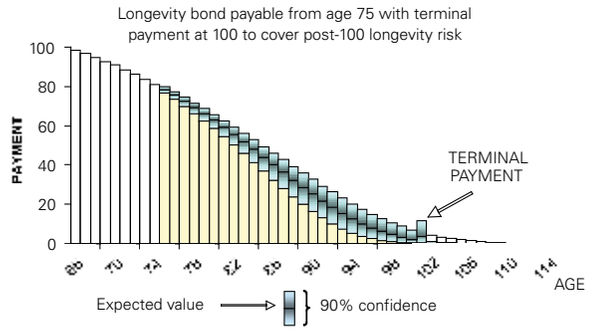
Source: Prudential UK

Figure 2. Survivor fan chart – males aged 65 in 2010



Source: Authors' own analysis using CBD model

Figure 3 Longevity bond for male aged 65 with 10-year deferment



Source: Authors' own analysis using CBD model

First, the government has an interest in ensuring there is an efficient annuity market, given its desire to encourage retirement savings in DC pension plans that rely on annuities to turn savings into guaranteed lifetime retirement income.

A number of factors are driving the growth in the annuity market:

- the overall growth in both the number and size of DC pension funds
- the associated growth in the number of pensioners with DC funds reaching retirement
- the increasing demand from defined benefit (DB) plans to use annuities to back their pensions in payment
- the growing demand from DB plans for bulk buy-outs.

Insurance companies will inevitably need to play a big role in aggregating longevity risk and providing DB pension plans with indemnity solutions. There is, however, a danger that this could result in an unhealthy concentration of risk among a small number of insurance companies. Further, there is insufficient capital in the insurance/reinsurance industry to deal with the total private sector longevity risk (which in the UK alone amounts to £1 trillion with DB plans and £125 billion with insurance companies). The only realistic way of dealing with these two issues, at least for accrued pension liabilities, is to pass some of the risk onto the capital markets.

Second, if the private sector is unable to hedge aggregate longevity risk, it increases the likelihood that:

- more companies withdraw from DB pension provision
- more plans end up in the Pension Protection Fund
- insurance companies stop selling annuities or increase annuity prices, which would reduce pensioner income in retirement

As a consequence of the above, the next generation of workers might be obliged to subsidise pensioner incomes even more than happens at present through additional government taxation.

Third, it could be argued that the government has an interest in ensuring there is an efficient capital market for longevity risk transfers. Capital markets have a key role to play in reducing concentration risk and facilitating price discovery. But because longevity risk is not actively traded in the capital markets, we do not have a good estimate of its market price, that is, the longevity risk premium or the mortality term structure. The government could help the capital markets establish the riskless term structure for future mortality rates by issuing longevity bonds in the same way that government-issued fixed-income and index-linked bonds help to establish the riskless interest rate and inflation premium term structures. This helped establish the inflation swaps market by using market information on inflation expectations rather than actuarial projections. Government-issued longevity bonds would therefore provide the basis for the growth of a private-sector longevity derivatives market.

Fourth, the government is one of the few agencies in society that can engage in intergenerational risk sharing on a large scale and enforce intergenerational contracts. This is important, given that longevity risk is a risk that crosses a number of generations.

What type of longevity bonds should the government issue? To answer this question, we need to know where longevity risk is concentrated. Figure 2 presents a survivor fan chart derived using the Cairns-Blake-Dowd stochastic mortality model. This shows the uncertainty attached to the distribution of survivors from English and Welsh males who will be 65 in 2010: the bars indicate the 90% confidence interval on the survivor rate for each age out to 114. The Figure shows that there is little uncertainty to age 75: we can be fairly confident that approximately 23% will have died by 75. The uncertainty peaks at age 90. The best estimate is that 25% will survive to age 90, but it could be anywhere between 16% and 33%. This is a very large range. The chart also shows the extent of the tail risk after age 90.

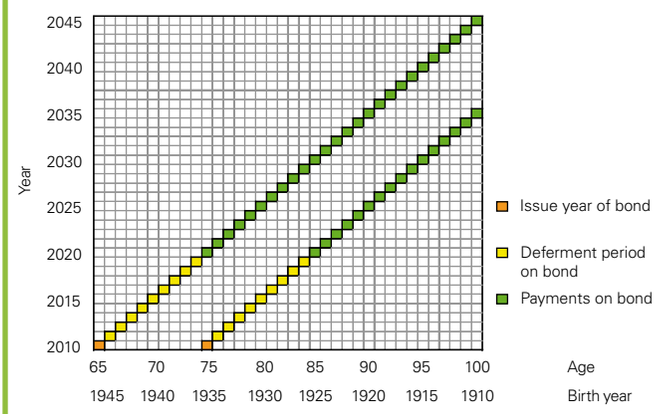
What would be most beneficial to the private sector would be for the government to provide tail-risk protection. At the same time, the government should also offer some initial assistance to the capital market solutions that are beginning to emerge to transfer longevity risk between ages 75 and 90. This would help establish a market price for longevity risk ahead of Solvency II. The current Solvency II proposals, if adopted, could require insurers to hold significant additional

capital to back their annuity liabilities if longevity risk cannot be marked to market, since insurers might have to charge a 6% cost of capital above the risk-free rate. This extra cost of capital would have to be passed on to customers and the money's worth of annuities could fall by around 5%.

Figure 3 illustrates the optimal structure for longevity bonds in the set-up stage of the market. The Figure shows the cash flows on a deferred longevity bond of newly retired 65 year olds. Cash flows will be based on the proportions surviving to each age. We recommend that the government issues four bonds initially: two bonds based on male lives aged 65 and 75 and two bonds based on female lives aged 65 and 75. If four bonds were thought to be too many for a new and untried market, then two bonds based on female lives – given their greater life expectancy – might work. The bonds would be issued with a 10-year deferment period and payments would cease at age 100 with a terminal payment equal to the discounted value of the sum of the post-100 survivor rates (thereby avoiding the payment of trivial sums). The bonds would be purchased to hedge the aggregate longevity risk of pension plans and insurers. To the extent that a pension plan has members typical of the national population of England and Wales, a combination of these bonds could provide a good hedge of the members' aggregate longevity risk. If, on the other hand, the members have a mortality profile that is not consistent with that of the national population, this will introduce basis risk.[1]

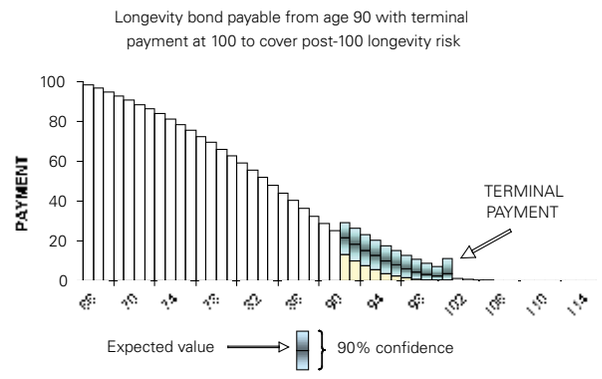
Figure 4 shows how longevity bonds help 'kick start the market' in the sense of providing an adequate coverage against aggregate longevity risk across both ages and time. The four bonds – one each for males and females at age 65 and one each for males and females at age 75 – will help to establish and maintain the market-clearing 'price points' for longevity risk at key ages and future dates. In other words, the bonds help to establish the riskless term structure for mortality rates for ages above 65 for future years.[2]

Figure 4: Longevity bond cash flows across ages and time



Source: Authors' own analysis

Figure 5: Deferred tail longevity bond for male aged 65



Source: Authors' own analysis using CBD model

> "Everyone should benefit from having a market price for longevity risk and the ability to hedge aggregate longevity risk"

Once the market for longevity bonds has matured, in the sense of producing stable and reliable price points in the age range 65-90, the capital markets can take over responsibility for providing the necessary hedging capacity in this age range using longevity derivatives. All that will then be needed will be for the government to provide a continuous supply of deferred tail longevity bonds with payments starting from age 90 in order to allow pension plans and insurers to hedge their tail risk. Figure 5 illustrates the cash flows on such a bond.

Who benefits from the optimal sharing of longevity risk? The simple answer is everyone! Everyone should benefit from having a market price for longevity risk and the ability to hedge aggregate longevity risk, and, in particular, insurers will be able to hold optimal levels of capital in a Solvency II world, thereby maximising the value of annuities to individuals in both DC and DB pension plans.

We therefore strongly urge the UK government and other governments across the world with mature pension funds and annuity markets to issue longevity bonds as soon as is practically feasible to do so. An ideal introduction date would be 2010, as this would give the market a couple of years to settle before Solvency II comes into effect in 2012. L&P

1 This is the risk that the 'underlying' – in this case, the survivor rates of the population being hedged –does not move in line with the hedging instrument – which, in this case, depends on the survivor rates of the national population of England and Wales. Basis risk can be minimised by scaling up or down the number of bonds held to maximise the effectiveness of the hedge.

2 Each bond is specified by four dates: the birth year (eg. 1945), the issue date (eg. 2010), the first payment date (eg. 2020) and the last payment date (eg. 2045). Each bond also has a gender (M or F).