

Box 14

HEDGING LONGEVITY RISK

Providers of annuities, such as life insurance companies and pension funds, face the risk that the duration of their assets can become mismatched from that of their liabilities, and that the mortality rates of policyholders could fall at a faster rate than anticipated in their pricing and reserving calculations. As profit margins in the provision of annuities tend to be low, reflecting competition, the profit margin of annuity providers will be squeezed if the mortality assumptions built into the prices of annuities turn out to be overestimated. Indeed, some life insurance companies have been claiming that their annuity businesses have been producing losses because annuitants have been living longer than expected. Some companies have sought to cover themselves against this longevity risk by only quoting prices for annuities on uncompetitive

terms. This Box discusses the challenges posed by longevity risk, and examines ways in which life insurers can manage their exposure to this risk.

With pension reforms in many countries shifting the standard formulae of pension plans away from defined benefit to defined contribution plans, longevity risk in pensions is being gradually shifted to individuals. Since individuals may not want to bear this risk, this shift has been creating greater demand for individual annuities sold by life insurance companies. Hence, while the pension fund industry may be facing less longevity risk, the mirror of this is increasing longevity risk being borne by life insurers. Practically, two options are available to life insurers to mitigate this risk: using new mortality tables,¹ or hedging longevity risk with risk management tools.

Longevity risk is difficult to diversify, thus life insurers turn to the financial markets as an alternative for institutional risk-pooling. For instance, Swiss Re² decided to issue mortality-linked securities to manage adverse mortality risk, with products known as Vita I and Vita II. In December 2003, a three-year bond worth USD 400 million was issued by Swiss Re and Vita Capital in the form of a floating-rate bond linked to a mortality index. The repayment of principal was linked to a mortality index of mortality rates experienced in five countries (France, Italy, Switzerland, the UK and the US). The spread was set at 135 basis points over LIBOR, and the bond effectively covered catastrophic mortality risk such as a severe pandemic, a major terrorist attack or a natural catastrophe.

Blake and Burrows (2001) suggest that the potentially most effective and appropriate way of addressing longevity risk would be for governments to issue “survivor bonds” or “longevity bonds”.³ The role of governments in providing such bonds is however still debated.⁴ For instance, King (2004) notes that members of a particular cohort cannot insure themselves against the risk of an unexpected rise in the overall level of life expectancy for that cohort.⁵ Only governments can spread risk across future generations: whereas no financial company can sell instruments to the unborn, governments can run up debts to be paid by future taxpayers.

In 2004, the European Investment Bank (EIB) took the initiative of creating a new capital instrument to assist life insurance companies and pension funds in addressing the challenges of ageing populations. Although the EIB was the issuer of the proposed bond, the ultimate recipient of the longevity risk embedded in the bond was PartnerRe, a Bermuda-based reinsurance company. The EIB undertook a swap with BNP Paribas, with the EIB receiving floating-rate sterling funding. In turn, BNP Paribas reinsured the longevity risk with PartnerRe, leaving BNP Paribas with the interest rate exposure and PartnerRe insuring the longevity risk. The payments on the latter bond were linked to a survivor index based on UK males aged 65. The total value of the issue was to be GBP 540 million, and it was primarily intended for

1 For instance, the German life insurers introduced new tables and made significant adjustments to their reserves for the annuity contracts they had already sold. A similar development also took place in the UK. Source: H. Grundl, T. Post and R. N. Schulze (2006), “To Hedge or Not Hedge: Managing Demographic Risk in Life Insurance Companies”, *Journal of Risk & Insurance*, 73/1, pp. 19-41.

2 See O. S. Mitchell, J. Piggott, M. Sherris and S. Yow (2006), “Financial Innovation for an Aging World”, Reserve Bank of Australia, G20 meetings.

3 See J. R. Brown and P. R. Orszag (2006), “The Political Economy of Government-issued Longevity Bonds”, *Journal of Risk & Insurance*, forthcoming and D. Blake and W. Burrows (2001), “Survivor Bonds: Helping to Hedge Mortality Risk”, *Journal of Risk and Insurance*, 68/2, pp. 339-348.

4 See D. Miles and M. Capleton (2005), “Funding Issues and Debt Management”, in: R. Chote, C. Emmerson, D. Miles and Z. Oldfield (eds) (2006), *The Green Budget*, produced by the IFS/Morgan Stanley, Chapter 5.

5 See M. King (2004), “What Fates Impose: Facing up to Uncertainty”, Eighth British Academy Annual Lecture.

purchase by UK pension funds. The issue was announced in November 2004, but it was subsequently withdrawn in late 2005 without ever being issued. Precisely why the pension funds and life insurers were reluctant to subscribe for this bond remains unclear, but many possible reasons can be advanced. For example, one problem with the EIB/BNP bond was that it was capital-intensive, requiring a high degree of upfront capital commitment for the degree of protection it offered. Another problem was related to basis risk, in that the bond seemed to provide a relatively poor hedge for a typical annuity book as its reference population was insufficiently correlated with the population underlying a typical annuity book. Furthermore, the mortality experience of life insurers may be different from that of the reference UK population. On top of this, the bond only provided a hedge for the longevity of males, even though pension funds and life insurers are also exposed to significant longevity risk from females too.

The key determinant regarding the future issue of longevity bonds is the availability of sufficient reinsurance capacity. It should be underlined that neither a UK-based nor an EU-based reinsurer was willing to provide cover for the bond. Furthermore, Partner Re was not prepared to offer cover above the issue size of GBP 540 million. This raises the question of whether sufficient reinsurance capacity really exists. A further issue is whether this capacity problem might be related to the EU's solvency requirements, which make reinsurance cover within the EU prohibitively expensive.⁶

There is another aspect that is relevant for financial stability. In the case of the EIB longevity bond, the investors' main credit risk was borne by the EIB itself. However, as the EIB is AAA rated, it might not have been felt necessary for the contract to include a credit-enhancement agreement. Nevertheless, with other mortality-linked securities, the first point of contact for the investor might be with a lower-rated institution. In such circumstances, it would presumably be essential that a credit-enhancement agreement be put in place: without such an agreement, potential investors might be discouraged from subscribing to the issue. It should be recalled that the primary role of longevity bonds and other mortality-linked securities is to provide holders with the opportunity to hedge their systematic longevity risks.⁷

The failure of the EIB bond draws attention to the fact that new initiatives and capital market solutions are needed. Broadly speaking, there are several theoretical options including mortality swaps, mortality futures or mortality options.

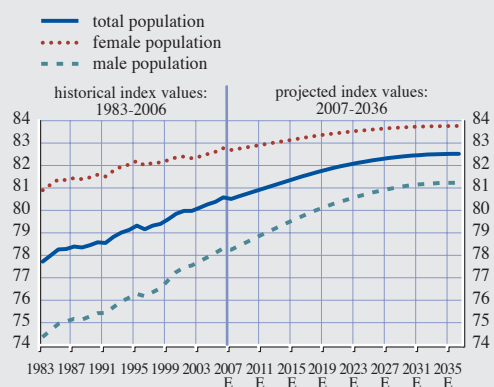
In recent years, a market for mortality swaps has been developing. A mortality swap is an agreement to exchange one or more cash flows in the future based on the outcome of at least one (random) survivor or mortality index. Mortality swaps appear to have certain advantages over longevity bonds. They can be arranged at a lower transaction cost than bond issues, and are more easily cancelled. They are in addition more flexible and can be tailor-made to suit diverse circumstances. They do not require the existence of a liquid market, simply the willingness of counterparties to exploit their comparative advantages or trade views on the development of mortality over time. Mortality swaps may also have advantages against traditional insurance arrangements as they entail lower transaction costs and are more flexible than reinsurance treaties.

⁶ See Barnett Waddingham LLP (2005), "Longevity Bond to be Issued by the EIB", February.

⁷ See D. Blake, A. J. G. Cairns and K. Dowd (2006), "Living with Mortality: Longevity Bonds and Other Mortality-linked Securities", paper presented to the Faculty of Actuaries, January.

Chart 14.1 Expected average lifetime by gender

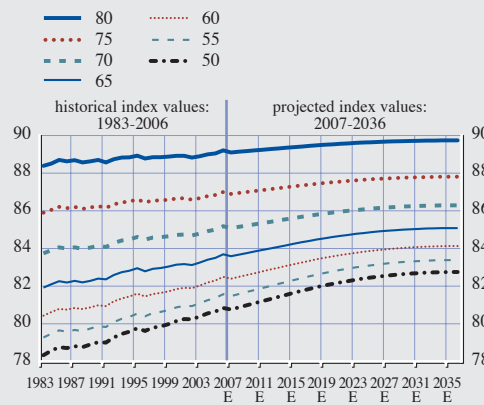
(historical and projected index values, genders)



Source: Credit Suisse (Credit Suisse Longevity Index).
Note: Historical index values for 1983 through 2006 are derived using the respective reference years (1980 through 2003) mortality and population weighting by gender. Projected index values for 2007 through 2036 are derived using the projected mortality data for 2004 through 2033, and the 2003 population weightings by gender in each of those years.

Chart 14.2 Expected average lifetime by age

(historical and projected index values, ages)



Source: Credit Suisse (Credit Suisse Longevity Index).
Note: Historical index values for 1983 through 2006 are derived using the respective reference years (1980 through 2003) mortality and population weighting by gender. Projected index values for 2007 through 2036 are derived using the projected mortality data for 2004 through 2033, and the 2003 population weightings by gender in each of those years.

In December 2005, Credit Suisse announced the launch of the CS Longevity Index⁸, which provides an objective mortality and longevity index for investors and institutions exposed to longevity risk (see Charts B14.1 and B14.2). However, basis risk remains an issue for insurers and pension plans. Securities to offset longevity risk based on such an index have lower overall longevity risk. These developments notwithstanding, the hedging of longevity risk remains a challenge for the foreseeable future.

⁸ Concerning details, this index is a standardised measure of the expected average lifetime for general populations based on publicly available statistics. It includes both historical and forward values, and will be released annually. At present, the index only references US population data, but data on other selected countries will be forthcoming. In addition to the Composite Index representing the total population, there are also gender and age-specific sub-indices. The calculation is made and updated annually by Milliman, a leading global actuarial firm. The index is available at http://www.csfb.com/institutional/life_finance/assets/EAL_Data_Graphs.pdf or from Bloomberg terminals: LIFF GO.