

Commentary

BUFFIN PARTNERS INC.

ECONOMIC INVESTMENT AND ACTUARIAL RESEARCH

Longevity Risk Management

Two of the major categories of risk from an actuarial perspective in an asset-liability context are interest rate risk and mortality or longevity risk. The theory and practice of interest rate risk management has been well developed over the years, but by contrast, the theory and practice of longevity risk management is in the early stages of research and development. Pension plans and the institutions that sponsor them have become increasingly aware in recent years of the challenges posed by secular improvements in mortality rates as reflected in increasing longevity for each successive cohort of pensioners. The actuarial profession has an excellent reputation for the measurement of mortality and the production of various mortality tables. However, it is only in recent years that the techniques of financial risk theory and financial engineering have been applied to mortality risk to produce specific products that are designed to hedge or to mitigate to some extent the effects of mortality risk due to increasing longevity.

Longevity bonds are a good example of the type of financial instrument that are helpful in longevity risk management. The design of a longevity bond is relatively simple. The concept is to provide a bond with a periodic stream of cash payments that are linked to a survivorship index of a defined population cohort over a specified period. These features may be illustrated by describing the European Investment Bank (EIB) and Banque Nationale de Paris (BNP) longevity bond that was announced in November 2004. The EIB-BNP longevity bond was designed with a 25-year maturity feature and provided floating coupon payments directly linked to a cohort survivor index of UK males age 65 in 2002 as published by the UK Office of National Statistics. The EIB-BNP longevity bond was priced

by means of discounting the expected cash flow payments at the London Interbank Offered Rate (LIBOR) minus 35 basis points. Although these basic features adequately describe the design of the EIB-BNP longevity bond, the actual design involved other complexities including a cross-currency rate swap between EIB and BNP and a mortality swap between EIB and PartnerRe to hedge the mortality exposure.

The EIB-BNP longevity bond represents a prototype for further research and development of this class of security and other mortality-linked securities. In a paper presented to the Institute of Actuaries in London on February 27, 2006 titled *Living with Mortality: Longevity Bonds and Other Mortality-linked Securities*, authors Blake, Cairns and Dowd explore a universe of hypothetical mortality-linked securities. Conceptually at least, it is possible to develop an array of mortality-linked securities including longevity bonds, mortality swaps, mortality futures and mortality options.

Of particular interest to pension plan sponsors and their advisers is the category of coupon-based longevity bonds. When designed as hedge instruments, these bonds take the form of annuity bonds with no terminal repayment of principal. A classical longevity bond is the "survivor bond" whose coupon payments vary in proportion to the actual experience of the survivorship ratio of a specified reference population until the death of the last surviving member. Just as zero-coupon treasury securities in the US or zero-coupon gilts in the UK may be issued or financially engineered by stripping the principal and coupon payments to produce Separately Traded Interest and Principal Securities (STRIPS), so too it would be possible to strip standard longevity bonds to produce a series of specific target

longevity bonds that would provide the ideal matching security for hedging a pension plan's longevity risk provided such securities were available in sufficient quantity for the full spectrum of maturity dates and reference population cohorts.

We envisage an ideal opportunity for research and development efforts to produce a spectrum of longevity bonds based on appropriate mortality and survivorship scenarios for various reference population cohorts and sub-groups. From a practical standpoint there are a number of issues that would present challenges to potential issuers and purchasers of longevity bonds. The selection of the appropriate reference population cohorts and the construction of the survivorship index would not necessarily fit the exact requirements of a potential purchaser and would expose the purchaser to "basis risk" in respect of the difference in mortality experience of the reference cohort population used in the index construction and the actual population cohort for which it is desired to hedge the longevity risk. Another potential area of concern would be the credit risk associated with the issuer of the longevity bonds. But perhaps the most important challenge that requires further research and development work is in the actual pricing of the bonds and the establishment of a fair market value that will encourage institutions to issue longevity bonds and will represent an efficient use of capital for pension plan sponsors.

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