



# **Living with mortality: Longevity bonds and other mortality-linked securities**

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# Introduction

- Longevity risk = risk that aggregate survival rates are higher than anticipated.
- Now accepted as a key risk factor for many life insurers and pension funds  
→ perceived need for solutions to tackle longevity risk

# Range of responses

- Accept longevity risk as legitimate business risk
- Reinsurance
- Participating annuities with survival credits
- Securitisation
- Manage risk with mortality-linked securities

# Stakeholders

- Hedgers
- General investors seeking low-beta securities for diversified portfolios
- Speculators:
  - ◆ Essential for providing liquidity
- Arbitrageurs:
  - ◆ Need well-defined pricing relationships between related securities
- Government:
  - ◆ Insurer of last resort
  - ◆ Encouragement of market stability

# Existing mortality-linked securities

- Swiss Re mortality catastrophe bond 2003
  - ◆ 3 years
  - ◆ Reduces exposure to catastrophic mortality
  - ◆ Oversubscribed, second tranche issued 2005
- EIB/BNP longevity bond 2004
  - ◆ 25 years
  - ◆ 65-year old English and Welsh males
  - ◆ 2005: Withdrawn due to insufficient investor interest
- *Can we learn from these experiences?*

# New mortality-linked securities

- Longevity bonds:
  - ◆ Classical LBs
  - ◆ Geared LBs to reduce capital outlay
    - ☞  $S(t) \in [S_l(t), S_u(t)]$
  - ◆ Deferred LBs to focus on longer-term, more-risky cashflows
  - ◆ Principal-at-risk LBs
    - ☞ Reductions if survivorship above threshold

# New mortality-linked securities

- Mortality swaps (OTC):
  - ◆ Swap fixed for floating survivor index
  - ◆ Flexible and tailor-made
  - ◆ Swap embedded in EIB/BNP bond

# New mortality-linked securities

- Mortality futures:
  - ◆  $F(t, T)$  = futures price at  $t$  for delivery of  $X(t)$  at  $T$
  - ◆ *E.g.*  $X(t)$  = longevity bond or survivor index
- AFPEN (France)
  - ◆ Annuity futures
  - ◆  $X(t)$  based on UK market annuity rates



# New mortality-linked securities

- Factors making for success of futures:
  - ◆ Liquid spot market
  - ◆ Spot prices must be sufficiently volatile to create both hedging needs and speculative interest
  - ◆ Underlying must be homogeneous or have well-defined grading system
  - ◆ Requires active participation of both hedgers and speculators

# New mortality-linked securities

- Mortality options:
  - ◆ Survivor caps
    - ☞ Payout =  $\max\{S(t,x) - s_c(t), 0\}$
  - ◆ Survivor floors
    - ☞ Payout =  $\max\{s_f(t) - S(t,x), 0\}$
  - ◆ Annuity futures options

# Which mortality index?

- Choice of reference population critical
  - ◆ Basis risk
  - ◆ Integrity / Moral hazard
    - ☞ E.g. Swiss Re bond uses population mortality
- Choice of mortality table:
  - ◆ Population tables?
  - ◆ CMI tables?
  - ◆ Hedger's own mortality experience?

# Credit risk

- Hedgers need to be confident that the counterparty will deliver
- Solutions:
  - ◆ Credit enhancement
  - ◆ Credit derivatives
  - ◆ Securitisation tied to Special Purpose Vehicle

# Barriers to development

- What needs to be done to establish both a spot and a derivatives market in longevity-linked securities?
- EIB longevity bond did not generate sufficient demand to be launched.
- Instructive to look at possible reasons:
  - ◆ design issues
  - ◆ pricing issues
  - ◆ institutional issues

# Barriers to development

- Design issues:
  - ◆ Capital outlay too high relative to hedging capacity
    - ☞ No capital left over e.g. for hedging inflation
  - ◆ Basis risk too high??
    - ☞ Population        versus        Own mortality
    - ☞ Age 65            versus        Range of cohorts
    - ☞ Males             versus        Females

# Barriers to development

- Pricing issues:
  - ◆ Longevity risk premium built into initial price of bond set at 20 basis points.
  - ◆ Demand versus supply
  - ◆ Need here for more research and education?
  - ◆ Impact of basis risk on price

# Barriers to development

- Institutional issues:
  - ◆ Issue size too small to create liquid market.
  - ◆ Consultants reluctant to recommend it to trustees:
    - ☞ unwilling to be the first to leap.
  - ◆ Fund managers do not currently have mandate to manage longevity risk
  - ◆ Insufficient reinsurance capacity:
    - ☞ EIB/BNP could not find UK/EU reinsurer
    - ☞ Partner Re would not cover > £540m



# Barriers to development

- Futures and options market needs:
  - ◆ Liquid spot market
  - ◆ Underlying mortality index must be fair and trustworthy
  - ◆ Underlying survivor indices must be few in number, but also appropriately graded:
    - ☞ A small number of contracts helps to increase liquidity, but also leads to basis risk
    - ☞ Basis risk can be reduced with suitably graded contracts

# Conclusions

- Mortality-linked securities are potentially very useful tools for managing longevity risk.
- Once teething problems are overcome, way will be clear for markets in these securities to develop and mature.
- We would then be on cusp of completely new global financial market in mortality-linked securities.

# Discussion themes:

- What prospects for market development?
- How much appetite is there for hedging?
- Views on good/bad contract design
- Is basis risk perceived as a problem?
- Your experiences in security design
- Your views as an adviser
- Your views as a hedger
  - ◆ Pension fund
  - ◆ Life office
  - ◆ Reinsurer