The Longevity Bond

First International Conference on Longevity Risk and Capital Markets Solutions
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Introduction

- Corporate pensions and insurance company annuities contain significant interest rate, inflation and longevity risks.

- More sophisticated regulation and changes to accounting conventions have highlighted the economic importance of managing these risks.

- The Longevity Bond is the first financial product to offer longevity protection by hedging the trend in longevity.

- Payments under the Longevity Bond are based on the performance of an index constructed from data produced by the Office for National Statistics (ONS, a UK Government Agency). The maximum payment on the whole issue is £50m p.a. for 25 years

- The bond will be issued (and hence all payments “guaranteed”) by the European Investment Bank (EIB), under its EMTN programme.

- Whilst the EIB is rated, the Longevity Bond itself is not
European Investment Bank (EIB)

- The EIB will issue the Longevity Bond as part of its objective to promote economic and social cohesion within the EU.
- The EIB is the EU’s financing institution.
- The shareholders of the European Investment Bank are the 25 Member States of the European Union.
- Each Member State’s share in the EIB’s capital is calculated in accordance with its economic weight within the European Union (expressed in GDP).
- In total, the EIB’s subscribed capital amounts to more than Euro 163.6 billion.
- The EIB is rated AAA by Standard & Poor’s and Aaa1 by Moody.
BNP Paribas In Partnership With PartnerRe

BNP Paribas

- acts as structurer, manager and book-runner for the Longevity Bond
- markets the Longevity Bond
- enters into a swap with EIB to convert its fixed interest, longevity-linked obligations under the bond into the floating obligations, free of longevity risk, that are required by the EIB when raising funding

PartnerRe

- provides the longevity expertise and reinsurance capacity for the Longevity Bond
- this component is key to the structure - longevity risk is essentially a one-way risk and natural takers are difficult to find
<table>
<thead>
<tr>
<th><strong>Issuer</strong></th>
<th>European Investment Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Security</strong></td>
<td>£[550]m Longevity-linked EMTN</td>
</tr>
<tr>
<td><strong>Index</strong></td>
<td>Based on publicly available ONS data of English and Welsh mortality for a cohort of males aged 65 in 2003</td>
</tr>
<tr>
<td><strong>Longevity Risk Period</strong></td>
<td>Calendar years 2003 to 2027 inclusive</td>
</tr>
<tr>
<td><strong>Maturity</strong></td>
<td>25 years</td>
</tr>
<tr>
<td><strong>Bond payoff</strong></td>
<td>£50,000,000 * CSR&lt;sub&gt;t&lt;/sub&gt;</td>
</tr>
<tr>
<td><strong>CSR&lt;sub&gt;t&lt;/sub&gt;</strong></td>
<td>Cumulative Survival Rate (i.e. proportion of survivors) in the cohort at time t</td>
</tr>
<tr>
<td><strong>Index Published</strong></td>
<td>ONS Publication DH1 Mortality Statistics Table 8</td>
</tr>
<tr>
<td><strong>Payment Frequency</strong></td>
<td>Annual</td>
</tr>
<tr>
<td><strong>Pricing</strong></td>
<td>T.B.A.</td>
</tr>
<tr>
<td><strong>Issue Date</strong></td>
<td>T.B.A.</td>
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<tr>
<td><strong>Calculation Agent</strong></td>
<td>BNP Paribas</td>
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</tbody>
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Illustrative cash flows of the Longevity Bond based on the latest Government Actuary’s Department (GAD) projections.
### Annual Pay-off

*Example based on hypothetical mortality data*

<table>
<thead>
<tr>
<th>Fixing date</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality reference year</td>
<td>2003</td>
<td>2004</td>
<td>2005</td>
</tr>
<tr>
<td>Age of the cohort</td>
<td>65y</td>
<td>66y</td>
<td>67y</td>
</tr>
<tr>
<td>Annual mortality rate</td>
<td>1.50%</td>
<td>1.80%</td>
<td>2.10%</td>
</tr>
<tr>
<td>Annual survival rate</td>
<td>98.50%</td>
<td>98.20%</td>
<td>97.90%</td>
</tr>
<tr>
<td>Cumulative survival rate</td>
<td>98.50%</td>
<td>96.73%</td>
<td>[98.50% x 98.20%]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bond pay-off</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Annuity</td>
<td>£1,000</td>
<td>£985</td>
<td>£967.3</td>
</tr>
<tr>
<td></td>
<td>Bond pay-off</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Year 1</td>
<td>Year 2</td>
<td>Year 3</td>
</tr>
</tbody>
</table>

In the current interest rate environment, each £1,000 of Fixed Annuity equates to approximately £11,000 of bond notional.
Longevity Basis Risk

- The Longevity Bond covers 97% of the expected longevity risk for level pensions in payment to the cohort referenced by the bond although there will also be some scheme-specific basis risk.

- Basis risk arises as the difference between a given pension fund population and the cohort of 65 year old males in the English & Welsh population (“Reference Population”)

- Main sources of basis risk:
  - Different trends in longevity among populations of the same age
  - Age distribution of the pension fund different from that of the Reference Population
  - Pension fund population includes males and females whereas the Reference Population is male only
  - The Reference Population weights all lives equally
  - The pension fund may have liabilities for reversionary pensions and escalating payments

- The larger the pension fund the less the basis risk.
Indicative Pricing

- **Longevity Bond**
  - Annuity
  - \* Cumulative survival rate
  - \textit{unknown}

Expected Longevity as defined by the Government Actuary’s Department (GAD)

- **Longevity Bond**
  - Fixed payoff

Pricing vs. swap curve
- EIB funding rate
- Cost of longevity swap
  - \(\Rightarrow\) Approx Libor -35 bp
  - \(\Rightarrow\) Libor - 15 bp
  - \(\Rightarrow\) Approx 20 bp
The cost of the longevity hedge embedded in the Longevity Bond is 0.20% per annum, equivalent to 1.70% upfront. Based on latest projected GAD mortality for the cohort of the population referenced by the Longevity Bond:-

- A 0.20% increase in yield is equivalent to an increase in life expectancy of 0.39 years, relative to the GAD’s projection, during the 25 year period covered by the Longevity Bond.
- An increase in life expectancy of 1 year, relative to the GAD’s projection, during the 25 year period covered by the Longevity Bond is equivalent to a 0.50% increase in yield.
- A decrease in projected mortality of 6.64% at each age, relative to the GAD’s projection, will recover the 0.20% cost of the longevity hedge.
- Similarly, a 1% fall in mortality is equivalent to a 0.03% increase in yield.

The average life of the bond is approximately 8.5 years, therefore if interest rates fall by 0.01% the price of the bond increases by 0.085%.
Key Advantages of the Longevity Bond

- The Longevity Bond
  - embeds a hedge against longevity risk
  - covers virtually all of the longevity risk but is much cheaper than bulk buyouts
  - is much easier to implement and administer than bulk buyouts
  - carries the highest possible issuer credit level (AAA)

- The payoff is similar to a pension in payment

- The longevity index is completely transparent and independent - data are published by the UK Government
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