Institution: City University London

Unit of Assessment: 19 Business and Management Studies

Title of case study: The introduction of the Life Market, a global capital market for transferring longevity risk

1. Summary of the impact

The Life Market is a major new global capital market for transferring longevity risk from corporate pension plans and annuity providers to long-term capital market investors, such as sovereign wealth funds and endowments, in exchange for a longevity risk premium (paid to the investors by the institutions laying off their longevity risk). Previously, the only source of longevity risk hedging was the insurance industry which, given that so many people are living much longer than anticipated, now has insufficient capacity to deal with this risk (estimated at $25trillion) on a global basis. The size of their future pension liabilities now present serious threats to the solvency of many companies. The longevity bonds and swaps designed by Professor David Blake at the Pensions Institute at Cass Business School, City University London, were integral to the creation and operation of the Life Market. The adoption of these bonds and swaps by investors has served to establish a global capital market investor base contributing towards the long-term availability of longevity solutions, benefiting the insurance and pensions industries, employers and, in turn, employees through greater security of their pensions in retirement.

2. Underpinning research

People are living much longer than anticipated and as a result, many companies face significant future unanticipated pension liabilities which threaten the sustainability of their businesses. However, the insurance industry is not large enough to insure, on a global basis, the longevity risk of all affected companies. Blake and Burrows (2001) introduced the idea of longevity (or survivor) bonds (LBs) to hedge systematic or aggregate longevity risk. The systematic component of longevity risk is a slowly developing trend risk (unlike most other risks in finance which tend to be cyclical) and it is very difficult to project with any reliability this trend improvement in life expectancy many years ahead. Blake and Burrows formed the idea of issuing LBs with coupons (in each year after the issue date) linked to the number of survivors from a cohort of, for example, 65-year-old males alive in the year the bond was issued. This research suggested that, by holding such a bond, pension plans and annuity providers could hedge the systematic longevity risk they face. Detailed research on the design of LBs was published in Blake *et al.* (2006).

The failure of the first attempt to issue a LB in November 2004 by BNP Paribas on behalf of the European Investment Bank bond prompted further research initiatives by the Pensions Institute that was established at Cass Business School in 2004 under the leadership of Professor Blake (at City since 2004). This work was carried out with Pensions Institute Fellows Andrew Cairns, Professor of Actuarial Science, Herriot-Watt University and Kevin Dowd, Professor of Economics and Finance, University of Durham; often in association with teams of industry practitioners from JP Morgan, led by Guy Coughlan, and the Prudential UK, led by Tom Boardman, now Visiting Professor at the Pensions Institute. The first of these five initiatives was to examine alternatives to LBs as hedging instruments. The most obvious course of action was to consider longevity (or survivor, or 'S') swaps as less capital-intensive alternatives. This was carried out by Dowd *et al* (2006).

A programme of theoretical academic work designed to support the practical development of the Life Market formed the basis of the second research initiative. The key outcomes were the recognition of the role a national population mortality index could play in (a) the pricing and securitisation of longevity risk (Cairns *et al.* 2006) and (b) index-based longevity hedges that minimise basis risk (in this context, the difference in mortality experience between the population underlying the index and the population of lives being hedged) (Coughlan *et al.* 2011). Previous experience showed that an important prerequisite for traded derivatives markets to succeed is a well-defined, homogeneous 'underlying' asset or index. This problem complicates the Life Market, where the 'underlying' consists of the lives of different pension plan members and annuitants from

different companies, regions, and socio-economic groups (i.e., it is neither well-defined nor homogenous). Pensions Institute researchers suggested that the only effective way of creating a liquid traded Life Market was to build the market around national population mortality rate indices that were calculated by an independent agent.

The third initiative was the creation of the LifeMetrics Indices, designed to facilitate the Life Market's development. These were jointly designed between 2007 and 2009 by Blake and JP Morgan and are national population mortality rate indices constructed using official mortality data based on the populations for England and Wales, the USA, Holland and Germany, with Towers Watson appointed as the independent calculation agent.

The fourth research stream aimed to initiate a debate on whether there is a role for government in helping to support the development of the Life Market by directly issuing LBs. This would help to establish a market price for longevity risk in the same way that governments help create a market price for inflation risk by issuing inflation-index-linked bonds. This was first mentioned as a possibility in Blake and Burrows (2001) and the arguments were more formally laid out in Blake *et al.* (2010).

The final initiative was to help educate the market further by increasing awareness of longevity risk and the role of the capital markets in providing potential solutions. This was achieved through the International Longevity Risk and Capital Markets Solutions Conference series which was launched by Blake, with the first one held at Cass in 2005. These are held annually at varying global venues and bring together academics, industry practitioners and policy makers, providing an environment conducive to research collaboration and learning (www.longevity-risk.org/).

3. References to the research

Blake D. & Burrows W. (2001). Survivor Bonds: Helping to Hedge Mortality Risk. *Journal of Risk and Insurance,* 68(2), 339-348. (winner, 2011 Robert I. Mehr Award*,* the annual prize of the American Risk and Insurance Association for the paper published ten years ago in The *Journal of Risk and Insurance* that has best stood the test of time).

Blake D., Cairns A.J.G., Dowd K., & MacMinn R. (2006). Longevity Bonds: Financial Engineering, Valuation and Hedging. *Journal of Risk and Insurance*, 73(4), 647-672.

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Cairns A.J.G., Blake D., & Dowd K. (2006). Pricing Death: Frameworks for the Valuation and Securitization of Mortality Risk. *ASTIN Bulletin*, 36(1), 79-120. (winner, 2007 the International Actuarial Association's (IAA) Bob Alting von Geusau Memorial Prize for the best contribution to the *ASTIN Bulletin* on a subject related to Actuarial Approach for Financial Risks; winner, 2008 The US Society of Actuaries David Garrick Halmstad Prize for the best published paper on actuarial research).

Coughlan G.D., Khalaf-Allah M., Ye Y., Kumar S., Cairns A.J.G., Blake D., & Dowd K. (2011). Longevity Hedging 101: A Framework for Longevity Basis Risk Analysis and Hedge Effectiveness. *North American Actuarial Journal*, 15(2), 150-176.

Dowd K., Blake D., Cairns A.J.G., & Dawson P. (2006). Survivor Swaps. *Journal of Risk and Insurance*, 73(1), 1-17.

Journal of Risk and Insurance is the flagship journal of the American Risk and Insurance Association and is the highest ranked journal in the field of academic risk management and insurance. It applies a rigorous peer review process.

4. Details of the impact

Blake's research and its adoption into the introduction of LifeMetrics Indices in March 2007 demonstrate how academic ideas can translate into sustainable market applications by creating new products, services and market standards [1]. The research led to the world's first longevity swap executed in April 2007 between Swiss Re and the UK annuity provider Friends Provident.

This was a pure longevity risk transfer, although it was structured as an insurance contract rather than a capital market instrument. It was tailor-made and hence illiquid and difficult to unwind. The swap involved Friends Provident's £1.7billion book of 78,000 pension annuity contracts written between July 2001 and December 2006.

The first longevity swap exclusively based on the LifeMetrics Index (for England and Wales) was then executed in January 2008 between JP Morgan and Lucida (a UK insurance company focused on the annuity and longevity risk transfer business which was bought by Legal & General in 2013) [2]. The deal, in the region of £100M in size, had a 10-year maturity and provided a partial hedge for the longevity exposure acquired by Lucida when it reinsured more than €100M of Bank of Ireland Life's annuity business. The swap was structured by JP Morgan so that Lucida would receive money if more of its policy holders survived for longer than was originally anticipated, but would pay JP Morgan if the opposite happened.

The first index-based longevity swap to apply basis-risk-minimising hedging techniques was executed in February 2011 between JP Morgan and the Pension Fund of Pall (UK) [3]. This was a particular type of longevity swap called a q-(or mortality) forward since it was based on future realised mortality rates [4]. Andrew Thomson, Chairman of the Pension Fund's Trustees, said: "*Like other pension plans, our Fund has been hit by significant life expectancy rises over the past decade. This flexible and innovative arrangement helps us manage the key risk of longevity*" [3]. Gordon Fletcher, risk consultant at Mercer (a leading global provider of consulting, outsourcing and investment services) and lead adviser to the Trustees, said: "*In general, the uncertain life expectancies of people still yet to retire pose a far greater risk to pension plans than those who have retired. Current practice has been to focus on mitigating pensioner risk, so this new transaction marks a huge advance in the longevity risk market place. It is flexible with minimal cash implications on day one and is, therefore, likely to be of interest to many occupational pension plans that are actively de-risking*" [3].

In April 2011, ownership of the LifeMetrics Indices was transferred to the new Life and Longevity Markets Association (LLMA), a membership body which comprises the principal investment banks and insurance companies operating in the market [5]. Additionally the S-(or survivor) forward swap based on survival rates rather than mortality rates, as proposed in Dowd *et al* (2006), was adopted by the LLMA and is offered by its members [6]. These are global companies such as Aviva, AXA, Deutsche Bank, JP Morgan, Morgan Stanley, Legal & General, Munich Re, Pension Corporation, Prudential (UK), RBS, Swiss Re and UBS, ensuring that the Indices have become the global standard for hedging and trading longevity risk. At the time of the transfer, David Epstein, Executive Director at JP Morgan, said: "*We are proud of what we have achieved with LifeMetrics and are delighted that it will now officially form the backbone of an industry standard through the transfer to the LLMA*" [5].

The impact of Blake's work has had further global reach. Building on the research in Blake *et al* (2006), the world's first successful LB (the Kortis Bond) was issued by Swiss Re in December 2010 [7]. This is an 8-year bond worth $50M which triggers payments to Swiss Re in the event of a large divergence in the mortality improvements experienced between male lives aged 75 to 85 in England and Wales and male lives aged 55 to 65 in the US. The first international longevity swap (value €12billion) then took place in January 2012 between the Dutch insurer Aegon and Deutsche Bank [8].

There is growing support for the government issuance of LBs of the type designed by the Pensions Institute. The World Economic Forum, in its 2009 Report 'Transforming Pensions and Healthcare in a Rapidly Ageing World', argued that: "*Given the on-going shift towards defined contribution pension arrangements, there will be a growing need for annuities to enhance the security of retirement income. Longevity-Indexed Bonds and markets for hedging longevity risk would therefore play a critical role in ensuring an adequate provision of annuities*" [9].

The International Monetary Fund, in its Global Financial Stability Report published in 2012, stated that: "*Although the private sector will further develop market-based transfer mechanisms for longevity risk if it recognises the benefits of doing so, the government has a potential role in supporting this market. Measures could include provision of better longevity data, better regulation and supervision, and education to promote awareness of longevity risk. Those governments that*

are able to limit their own longevity risk could consider issuing a limited quantity of longevity bonds to jumpstart the market" [10].

The impact of Blake's research and of the annual International Longevity Conference series has received numerous endorsements from market participants. The following examples come from three practitioners, all of whom have participated in the annual Conference series. Edward Giera, Managing Director at JP Morgan in London, said: "*The Pensions Institute has made a valuable and influential impact on the pension and insurance markets over the past several years*" [11]. Amy Kessler, head of longevity reassurance at the Prudential Insurance Corporation (US) said: "*We often appreciate your [Blake's] excellent, common sense quotes in the pension and financial press…you are sharing your thought leadership with a market that has long needed a good, common sense approach to risk*" [11]. Alan Rubenstein, CEO of the Pension Protection Fund (UK) said: "*We welcome its [Cass Pension Institute's] interdisciplinary approach involving economics, finance and actuarial science. The PPF has found its extensive work on longevity in recent years of particular interest*" [11].

To date, Blake's work has contributed to significant success in the use of longevity swaps to hedge longevity risk, with index-based swaps which minimise basis risk increasing in use. There have been a total of 16 swaps worth £21billion in the UK since 2009, with 20 internationally since 2007 valued at £25billion. There has also been one international longevity swap, namely the Aegon swap, valued at €12billion. In the context of a society where longevity is increasing, the long-term benefits of the Life Market are clear. In addition to the economic value to the insurance and pensions industries, more companies can unwind their legacy defined benefit pension liabilities and do so with less expense. These liabilities are a dragging anchor on a company's performance, if not its very survival. As a result, pension plan members receive better security and the risk that governments will have to pick up the pension liabilities of failed companies through, for example, the PPF in the UK, is significantly reduced.

5. Sources to corroborate the impact

1. JP Morgan Chase & Co. (2007). JP Morgan Launches Longevity Index: Investment Bank Creates LifeMetrics Platform Press Release, 13th March, and the Library for LifeMetrics [http://www.lifemetrics.com]
2. Symmons, J. (2008). Lucida Guards against longevity, Financial News, 19th February
3. Mercer (2011). World's First Longevity Hedge for Non-Retired Pension Plan Members Completed, Press Release, 1st February
4. Life and Longevity Markets Association (2010). Technical Note: The q-forward, 29th October
5. Life and Longevity Markets Association (2011). Life and Longevity Markets Association takes ownership of J.P. Morgan's LifeMetrics Index, Press Release, 26th April
6. Life and Longevity Markets Association (2010). Technical Note: The S-forward, 29th October
7. Swiss Re (2010). Swiss Re completes first longevity trend bond, transferring USD 50 million of longevity trend risk to the capital markets, News Release, 23rd December
8. Cobley, M. (2012). Deutsche agrees record longevity swap deal, Financial News, 17th February
9. World Economic Forum (2009). Transforming Pensions and Healthcare in a Rapidly Ageing World, p. 59, World Scenarios Series in collaboration with Mercer and the OECD
10. International Monetary Fund (2012). The Financial Impact of Longevity Risk, Chapter 4 in *Global Financial Stability Report*, World Economic and Financial Surveys, April
11. Individual letters of support dated between 5th May and 22nd June 2011, available on request