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Editorial

Longevity Risk and Capital Markets: The 2010–2011 Update

David Blake[a], Christophe Courbage[b], Richard MacMinn[c] and Michael Sherris[d]

[a]Pensions Institute, Cass Business School, Pensions Institute, City University London, 106 Bunhill Row, London EC1Y 8TZ, U.K.
E-mail: D.Blake@city.ac.uk
[b]The Geneva Association, 53 route de Malagnou, 1208, Geneva, Switzerland.
E-mail: christophe_courbage@genevaassociation.org
[c]Katie School of Insurance, College of Business, Illinois State University, IL 61790-5480, U.S.
E-mail: rmacmin@ilstu.edu
[d]Australian School of Business, University of New South Wales, Sydney, NSW 2052, Australia.
E-mail: M.Sherris@unsw.edu.au

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This Special Issue of *The Geneva Papers on Risk and Insurance—Issues and Practice* contains ten contributions to the academic literature, all dealing with longevity risk and capital markets. Draft versions of the papers were presented at *Longevity Six: The Sixth International Longevity Risk and Capital Markets Solutions Conference* that was held in Sydney on 9–10 September 2010. It was hosted by the Australian Institute for Population Ageing Research, the Australian School of Business and the University of New South Wales. It was sponsored by PricewaterhouseCoopers, Australian Prudential Regulation Authority (APRA), Coventry Capital, Swiss Re and Institute of Actuaries of Australia.

Longevity risk and related capital market solutions have grown increasingly important in recent years; both in academic research and in the markets we refer to them as the new Life Markets, that is, the capital markets that trade longevity-linked assets and liabilities. Mortality improvements around the world are putting more and more pressure on governments, pension funds, life insurance companies, as well as individuals, to deal with the longevity risk they face. At the same time, capital markets can, in principle, provide vehicles to hedge longevity risk effectively and transfer the risk from those unwilling or unable to handle it to those willing to speculate in such risk for increased returns or who have a counterpoising risk that longevity risk can hedge, for example, life insurance. Many new investment products have been created both by the insurance/reinsurance industry and by the capital markets. Mortality catastrophe bonds are an example of a successful insurance-linked security. Some new innovative capital market solutions for transferring longevity risk include longevity (or survivor) bonds, longevity (or survivor) swaps and mortality (or q-) forward contracts. The aim of the *International Longevity Risk and Capital Markets Solutions Conferences* is to bring together academics and practitioners from all over the world to discuss and analyse these exciting new developments.

The conferences have followed closely the developments in the market. The first conference (*Longevity One*) was held at Cass Business School in London in February 2005. This conference was prompted by the announcement of the Swiss Re mortality catastrophe bond in December 2003 and the European Investment Bank/BNP Paribas/PartnerRe longevity bond in November 2004.

The second conference was held in April 2006 in Chicago and was hosted by the Katie School at Illinois State University.[1] Since *Longevity One*, there have been further issues of mortality catastrophe bonds, as well as the release of the Credit Suisse Longevity Index. In the U.K., new life companies backed by global investment banks and private equity firms were setting up for the express purpose of buying out the defined benefit pension liabilities of U.K. corporations. Goldman Sachs announced it was setting up such a buy-out company itself (Rothesay Life) because the issue of pension liabilities was beginning to impede its mergers and acquisitions activities. It decided that the best way of dealing with pension liabilities was to remove them altogether from the balance sheets of takeover targets. So there was now firm evidence that a new global market in longevity risk transference had been established. However, as with many other economic activities, not all progress follows a smooth path. The EIB/BNP/PartnerRe longevity bond did not attract sufficient investor interest and was withdrawn in late 2005. A great deal, however, was learned from this failed issue about the conditions and requirements needed to launch a successful capital market instrument.

The third conference was held in Taipei, Taiwan on 20–21 July 2007. It was hosted by National Chengchi University.[2] It was decided to hold *Longevity Three* in the Far East, not only to reflect the growing importance of Asia in the global economy, but also in recognition of the fact that population ageing and longevity risk are problems that affect all parts of the world and that what we need is a global approach to solving these problems.[3] Since the Chicago conference, there had been many new developments, including: the release of the LifeMetrics Indices covering England & Wales, the U.S., Holland and Germany in March 2007 by J.P. Morgan, the Pensions Institute and Towers Watson (*www.lifemetrics.com*); the world's first publicly announced longevity swap between Swiss Re and the U.K. life office Friends' Provident in April 2007 (although this was structured as an insurance contract or indemnification rather than a capital market transaction).

Since the Taiwan conference, there were further developments in the capital markets. In December 2007, Goldman Sachs launched a monthly index suitable for trading life settlements.[4] The index, QxX.LS, was based on a pool of 46,290 anonymised U.S. lives over the age of 65 from a database of life policy sellers assessed by the medical underwriter AVS. In 2008, Institutional Life Services (ILS) and

[1] The conference proceedings for *Longevity Two* were published in the December 2006 issue of the *Journal of Risk and Insurance*.

[2] The conference proceedings for *Longevity Three* were published in the Fall 2008 issue of the *Asia-Pacific Journal of Risk and Insurance*.

[3] In fact, Asia has the world's largest and fastest growing ageing population (United Nations, 2007).

[4] Life settlements are traded life policies. In April 2007, the Institutional Life Markets Association started in New York, as the dedicated institutional trade body for the life settlements industry.

Institutional Life Administration (ILA), a life settlements trading platform and clearing house, were launched by Goldman Sachs, Genworth Financial, and National Financial Partners. ILS/ILA was designed to modernise dealing in life settlements and meet the needs of consumers (by ensuring permanent anonymity of the insured) and of the capital markets (by providing a central clearing house for onward distribution of life settlement assets, whether individually or in structured form).[5]

Xpect Age and Cohort Indices were launched in March 2008 by Deutsche Börse. These indices cover, respectively, life expectancy at different ages and survival rates for given cohorts of lives in Germany and its regions, Holland, England and Wales.

The world's first capital market derivative transaction, a *q*-forward contract[6] between J.P. Morgan and the U.K. pension fund buy-out company Lucida, took place in January 2008. The world's first capital market longevity swap was executed in July 2008. Canada Life hedged £500 million of its U.K.-based annuity book (purchased from the defunct U.K. life insurer Equitable Life). This was a 40-year swap customised to the insurer's longevity exposure to 125,000 annuitants. The longevity risk was fully transferred to investors, which included hedge funds and insurance-linked securities (ILS) funds. J.P. Morgan acted as the intermediary and assumes counter-party credit risk. There have been nine publicly announced longevity swaps in the U.K. since the beginning of 2008, covering five insurance companies' annuity books, three private sector pension funds and one local authority pension fund. The largest to date, covering £3 billion of pension liabilities, was the longevity swap for the BMW (U.K.) Operations Pension Scheme, arranged by Deutsche Bank and Paternoster in February 2010, and involving a number of reinsurers, including Hannover Re, Pacific Life Re and Partner Re. The most recent swap to date, announced in February 2011, was between the Pall (U.K.) Pension Fund and J.P. Morgan: this was innovative in being the world's first swap to hedge the longevity risk of non-retired pension plan members. In February 2010, Mercer launched a pension buy-out index for the U.K. to track the cost charged by insurance companies to buy-out corporate pension liabilities: at the time of launch, the cost was approximately 44 per cent higher than the accounting value of the liabilities, which highlighted the attraction of using cheaper alternatives, such as longevity swaps.

The fourth conference was held in Amsterdam on 25–26 September 2008. It was hosted by Netspar and the Pensions Institute.[7] In 2008, Credit Suisse initiated a longevity swap with Centurion Fund Managers, whereby Centurion acquired a portfolio of synthetic (i.e., simulated) life policies, based on a longevity index built by Credit Suisse. In 2009, survivor swaps began to be offered to the market based on Deutsche Börse's Xpect Cohort Indices.

The fifth conference was held in New York on 25–26 September 2009.[8] On 1 February 2010, the Life and Longevity Markets Association (LLMA) was established in London by AXA, Deutsche Bank, J.P. Morgan, Legal & General, Pension

[5] In 2010, National Financial Partners became the sole owner of ILS/ILA.

[6] Coughlan *et al.* (2007).

[7] The conference proceedings for *Longevity Four* were published in the February 2010 issue of *Insurance: Mathematics and Economics*.

[8] The conference proceedings for *Longevity Five* were published in the *North American Actuarial Journal* (Volume 15, Number 2, 2011).

Corporation, RBS and Swiss Re. The original members were later joined by Morgan Stanley, UBS, Aviva and Munich Re. The LLMA was formed to promote the development of a liquid market in longevity- and mortality-related risks. This market is related to the insurance-linked securities (ILS) market and is also similar to other markets with trend risks, for example, the market in inflation-linked securities and derivatives. The LLMA aims to support the development of consistent standards, methodologies and benchmarks to help build a liquid trading market needed to support the future demand for longevity protection by insurers and pension funds. In April 2011, the LifeMetrics indices were transferred to the LLMA with the aim of establishing a global benchmark for trading longevity and mortality risk.

In December 2010, building on its successful mortality catastrophe bonds and taking into account the lessons learned from the EIB bond, Swiss Re launched a series of eight-year longevity-based ILS notes valued at US$50 million. To do this, it used a special purpose vehicle Kortis Capital, based in the Cayman Islands. As with the mortality bonds, the longevity notes are designed to hedge Swiss Re's own exposure to longevity risk.

In January 2011, the Irish government issued bonds that allow the creation of sovereign annuities. This followed a request from the Irish Association of Pension Funds and the Society of Actuaries in Ireland. If the bonds are purchased by Irish pension funds, this will have a beneficial effect on the way in which the Irish funding standard values pension liabilities.

In April 2011, the International Society of Life Settlement Professionals (ISLSP)[9] formed a life settlement and derivatives committee and announced that it was developing a life settlement index. The purpose of the index is to benchmark net asset values in life settlements trading. Investors need a reliable benchmark to measure performance, and the index will help turn U.S. life insurance policies into a tradable asset class according to ISLSP. The calculation agent for the index is AA Partners.

At the same time as these practical developments in the capital markets were taking place, academics were continuing to make progress on theoretical developments, building on the original idea of using longevity bonds to hedge longevity risk in the capital markets.[10] These included:

- Design and pricing of longevity bonds and other longevity-linked products.[11]
- Design and pricing of longevity-linked derivatives, such as survivor swaps,[12] survivor forwards and swaptions,[13] *q*-forwards[14] and mortality options.[15]
- Longevity indices.[16]

[9] *www.islsp.org*
[10] Blake and Burrows (2001).
[11] For example, Blake *et al.* (2006), Bauer (2006), Bauer and Ruβ (2006), Denuit *et al.* (2007), Barbarin (2008), Bauer *et al.* (2010), Chen and Cummins (2010), Kogure and Kurachi (2010), Dowd *et al.* (2011a) and Mayhew and Smith (2011).
[12] For example, Dowd *et al.* (2006).
[13] For example, Dawson *et al.* (2010).
[14] For example, Deng *et al.* (forthcoming).
[15] For example, Milevsky and Promislow (2001).
[16] For example, Denuit (2009).

- Securitisation of longevity risk.[17]
- Hedging of longevity risk.[18]
- Mortality modelling and mortality term structure[19] modelling.[20]
- Improvements in the analysis and design of longevity-linked retail products.[21]

It was also becoming clear that policymakers needed to have a greater understanding of the developments in the new Life Markets. This is because there is an important role for governments to play in helping these markets grow, namely by issuing longevity bonds. As argued in the study by Blake *et al.*,[22] government-issued longevity bonds would allow longevity risk to be shared efficiently and fairly between generations. In exchange for paying a longevity risk premium, the current generation of retirees could look to future generations to hedge their aggregate longevity risk. There would also be wider social benefits. Longevity bonds would lead to a more secure pension savings market—both defined contribution and defined benefit—together with a more efficient and hence more generous annuity market resulting in less means-tested benefits and a higher tax take. The new Life Markets could get help to increase market participation through the establishment of reliable longevity indices and key price points on the mortality term structure and could build on this term structure with liquid longevity derivatives. There is increasing global support for government-issued longevity bonds.[23]

As mentioned before, not all paths to progress are smooth. In recent years, this has been particularly true in currently the largest market dealing with micro-longevity risk, namely life settlements.[24] The life settlements market has been dogged by systematic underestimates of policy-holders' life expectancies by certain medical underwriters, issues concerning premium financing, frauds and ethical issues associated with "profiting" from individuals dying and policies maturing. In December 2009, Goldman Sachs announced that it was closing down its QxX.LS index. This was partly because of the

[17] For example, Cowley and Cummins (2005), Lin and Cox (2005), Dahl (2004), Cox and Lin (2007), Biffis and Blake (2010), Wills and Sherris (2010) and Tsai *et al.* (2010).

[18] For example, Dahl and Møller (2006), Friedberg and Webb (2007), Wang *et al.* (2010), Tsai *et al.* (2010), Coughlan *et al.* (2011), Li and Hardy (2011) and Tzeng *et al.* (2011).

[19] The mortality term structure is a two-dimensional surface showing projected mortality rates at different ages for different future years.

[20] For example, Brouhns *et al.* (2002), Cairns *et al.* (2006, 2008, 2009, 2011), Renshaw and Haberman (2006), Blake *et al.* (2008), Hari *et al.* (2008), Biffis *et al.* (2010), Jarner and Kryger (2009), Plat (2009), Brockett *et al.* (2010), Cox *et al.* (2010), Dowd *et al.* (2010), Yang *et al.* (2010), D'Amato *et al.* (2011), Dowd *et al.* (2011b), Hanewald (2011) and Milidonis *et al.* (2011).

[21] For example, Deng *et al.* (2011), Gong and Webb (2010), Stevens *et al.* (2010) and Richter and Weber (2011).

[22] Blake *et al.* (2010).

[23] For example, the U.K. Pension Commission (2005, p. 229), International Monetary Fund (2006), Antolin and Blommestein (2007) and World Economic Forum (2009).

[24] The market for micro-longevity risk trades assets involving a small number of lives. In the case of life settlements, for example, the products involve individual lives and hence are subject to a significant degree of idiosyncratic mortality risk. This contrasts with the market for macro-longevity risk, which deals with pension plans and annuity books and hence involves a large number of lives: here idiosyncratic mortality risk is much less important than aggregate mortality risk, which is essentially the trend risk of getting life expectancy projections wrong.

reputational issues associated with life settlements, but mainly because of insufficient commercial activity in the index. While the ethical issues are no different in substance from those relating to the macro-longevity market,[25] the micro-longevity market needs to learn some important lessons from the macro-longevity market. The macro-longevity market has been very successful at promoting good basic research on the analysis of the stochastic mortality forecasting models it uses and putting these models into the public domain and has also been much more transparent with the data it uses. This suggests a way forward for the life settlements micro-longevity market.

As with the previous conferences, *Longevity Six* consisted of both academic papers and more practical and policy-oriented presentations. The conference location in Sydney was motivated by the fact that, while Australians are successfully accumulating funds for retirement, there is a negligible annuity market in Australia, implying that Australians will be seriously exposed to longevity risk when they retire. The conference was addressed, among others, by the following keynote speakers:

- Guy Coughlan (Managing Director and Global Head of LifeMetrics and Pension Solutions, J.P. Morgan): "The Life & Longevity Markets Association: The Development of a Longevity and Mortality Trading Market" and "The Role of Longevity Indices in Longevity Hedging: A Framework for Evaluating Basis Risk and Hedge Effectiveness".
- Morton Lane (Lane Financial Chicago): "Longevity Risk from the Perspective of the ILS Markets".
- Ross Jones (Member and Deputy Chairman of APRA, President of the International Organisation of Pension Supervisors, Deputy Chairman of the OECD Working Party on Private Pensions): "Longevity Risk: Public and Private Sector Solutions and the Government's Role".
- Martin Clarke (Executive Director of Financial Risk, Pension Protection Fund, U.K.): "Longevity Risk Transfer: A PPF Perspective".
- David Blake (Professor of Pensions Economic and Director of the Pensions Institute, Cass Business School): "Sharing Longevity Risk: Why Governments Should Issue Longevity Bonds".
- Marco Flores (Managing Director, Credit Suisse, London): "Developments and Structuring in Longevity Markets".
- Michael Crane (Coventry Capital): "Longevity Risk and Life Settlements".

The academic papers that were selected by us as the editors of this Special Issue went through a refereeing process subject to the usual high standards of *The Geneva Papers*. They cover the following themes: longevity risk, the valuation of mortality-linked securities, mortality modelling, securitisation in the reverse mortgage market, hedging longevity and financial risk in life insurance companies and incidence experience in life insurance companies. We briefly discuss each of the ten papers selected.

In "Longevity Risk from the Perspective of the ILS Markets", Morton Lane reflects on the development of the risk transfer vehicles that are beginning to appear in the longevity market and to contrast them with the experience of risk transfer in the

[25] See, for example, Blake and Harrison (2008).

natural catastrophe market. The natural catastrophe market has used nontraditional vehicles—catastrophe (or cat) bonds, a form of insurance-linked security—for more than 15 years, arguably starting as far back as 1992 after Hurricane Andrew. The longevity market is newer, in that ILS-like longevity risk transfer only began some three years ago. The concept of transferring longevity risk has been around somewhat longer but early experiments did not meet with immediate success. The paper answers the question: in what ways are these two markets different and what lessons can one market learn from the other?

In "Longevity Risk in Fair Valuing Level-Three Assets in Securitised Portfolios", Peter M. Mazonas, P.J. Eric Stallard and Lynford Graham argue that fair value accounting aims to establish a three-level hierarchy that distinguishes (1) readily observable measurement inputs from (2) less readily observable measurement inputs and (3) unobservable measurement inputs. Level 3 longevity valued assets will pose unique valuation risks once securitised pools of these alternative asset classes come to market as investment vehicles for pension plans and individual retirement accounts. No uniform framework is available to assure consistent fair market valuation and transparency for investor decision-making. Applying existing international auditing standards and analytical procedures (IFRS 13) will offer a platform upon which fund managers, their auditors and actuaries can agree upon uniform valuation and presentation guidelines. Application of these quasi-governmental standards will bring future liquidity to otherwise illiquid capital market instruments. This paper presents a valuation methodology consistent with fair value accounting and auditing standards. The methodology incorporates longevity predictive modelling in a form that is compatible with Bayes factor weighted average valuation techniques. The methodology is applicable to fair valuation of life settlement portfolios where the combination of too few large death benefit policies and large variances in individual life expectancy estimates currently challenge accurate valuation and periodic re-valuation.

In "Economic Pricing of Mortality-Linked Securities in the Presence of Population Basis Risk", Johnny Siu-Hang Li, Rui Zhou and Ken Seng Tan argue that standardised mortality-linked securities are easier to analyse and more conducive to the development of liquidity. However, when a pension plan relies on standardised instruments to hedge its longevity risk exposure, it is inevitably subject to various forms of basis risk. In this paper, the authors use an economic pricing method to study the impact of population basis risk, that is, the risk due to the mismatch in the populations of the exposure and the hedge, on the prices of mortality-linked securities. The pricing method considered is highly transparent, allowing us to understand how population basis risk affects the demand and supply of a mortality-linked security. The authors apply the method to a hypothetical longevity bond, using real mortality data from different populations. Illustrations show that, interestingly, population basis risk can affect the price of a mortality-linked security in different directions, depending on the properties of the populations involved.

In "Applications of Forward Mortality Factor Models in Life Insurance Practice", Nan Zhu and Daniel Bauer argue that two of the most important challenges for the application of stochastic mortality models in life insurance practice are their complexity and their apparent incompatibility with classical life contingencies theory, which provides the backbone of insurers' electronic data processing systems. Forward

mortality factor models comprise one model class that overcomes these challenges. Relying on a simple model version that originates from a semi-parametric estimation based on British population mortality data, the paper demonstrates the merits of this model class by discussing several practically important example applications. In particular, the authors calculate the economic capital for a stylised life insurer, present a closed-form solution for the value of a guaranteed annuity option and derive the fair option fee for a guaranteed minimum income benefit within a variable annuity contract. The numerical results illustrate the economic significance of systematic mortality risk.

In "Modelling Mortality with Common Stochastic Long-Run Trends", Séverine Gaille and Michael Sherris argue that modelling mortality and longevity risk is critical to assessing risk for insurers issuing longevity risk products. It has challenged practitioners and academics alike because of, first, the existence of common stochastic trends and, second, the unpredictability of an eventual mortality improvement in some age groups. When considering cause-of-death mortality rates, both aforementioned trends are additionally affected by the cause of death. Longevity trends are usually forecasted using a Lee–Carter model with a single stochastic time series for period improvements, or using an age-based parametric model with univariate time series for the parameters. This study assesses a multivariate time series model for the parameters of the Heligman–Pollard function, through vector error correction models that include the common stochastic long-run trends. The model is applied to circulatory disease deaths in the U.S. over a 50-year period and is shown to be an improvement over both the Lee–Carter model and the stochastic parameter ARIMA Heligman–Pollard model.

In "A Quantitative Comparison of the Lee–Carter Model under Different Types of Non-Gaussian Innovations", Chou-Wen Wang, Hong-Chih Huang and I-Chien Liu remind us that in the classical Lee–Carter model, the mortality indices that are assumed to be a random walk model with drift are normally distributed. However, for long-term mortality data, the error terms of the Lee–Carter model and the mortality indices have tails thicker than those of a normal distribution and appear to be skewed. This study examines five non-Gaussian distributions—Student's t-distribution and its skew extension (i.e., generalised hyperbolic skew Student's t-distribution), one finite-activity Lévy model (jump diffusion distribution) and two infinite activity or pure jump models (variance gamma and normal inverse Gaussian)—to model the error terms of the Lee–Carter model. With mortality data from six countries over the period 1900–2007, both in-sample model selection criteria (e.g., Bayesian information criterion, Kolmogorov–Smirnov test, Anderson–Darling test, Cramér–von-Mises test) and out-of-sample projection errors indicate a preference for modelling the Lee–Carter model with non-Gaussian innovations.

In "Securitisation and Tranching Longevity and House Price Risk for Reverse Mortgage Products", Sharon Yang recognises that reverse mortgage products are growing increasingly popular in many developed countries. The paper designs a tranching security to deal with longevity and house price risks for reverse mortgage products. The securitisation structure for reverse mortgage products, the collateralised reverse mortgage obligation (CRMO), is similar to that for the collateralised debt obligation (CDO). However, unlike the CDO, the CRMO takes into account the

dynamics of future mortality rates and house price returns instead of the default rate. To capture longevity risk for reverse mortgage borrowers, this study employs the Cairns–Blake–Dowd model to project future mortality rates, as well as compares these results with those from the Lee–Carter model and a static mortality table. The house price return dynamics are modelled using an ARMA-GARCH process. The calculation of fair spreads of CRMO in different tranches is illustrated under the risk-neutral valuation framework. On the basis of mortality experience and the programme of Home Equity Conversion Mortgage in the United States, this study demonstrates the problems of using static mortality tables and models risk for pricing fair spreads for CRMO numerically.

In "Securitisation of Crossover Risk in Reverse Mortgages", Hong-Chih Huang, Chou-Wen Wang and Yuan-Chi Miao show that when the outstanding balance exceeds the housing value before the loan is settled, the insurer suffers an exposure to crossover risk induced by three risk factors: interest rates, house prices and mortality rates. Taking into account housing price risk, interest rate risk and longevity risk, the paper presents a three-dimensional lattice method that simultaneously captures the evolution of housing prices and short-term interest rates in order to calculate the fair valuation of reverse mortgages numerically. For a reverse mortgage insurer, the premium structure of reverse mortgage insurance is determined by setting the present value of the total expected claim losses equal to the present value of the premium charges. However, when the actual loss is higher than the expected loss, the insurer will incur an unexpected loss. To offset the potential loss, the authors design two types of crossover bonds to transfer the unexpected loss to bond investors. Hence, through the crossover bonds, reverse mortgage insurers can partly transfer crossover risk onto bond holders.

In "Using Reserve Mortgages to Hedge Longevity and Financial Risks for Life Insurers: A Generalised Immunisation Approach", Jennifer Wang, Ming-hua Hsieh and Yu-fen Chiu argue that the launch of new innovative longevity-linked products, such as reverse mortgages, increases the complexity and challenges faced by insurers in implementing an asset-liability management strategy. With house price dynamics to account for and a large final payment received at the end of the policy year, a reverse mortgage provides a different liability duration pattern from an annuity. The authors propose a generalised immunisation approach for obtaining the optimal product portfolio that will hedge the longevity and financial risks of life insurance companies. The proposed approach does not rely on specific assumptions about mortality or interest rate models. As long as the scenarios generated by the adopted models are highly correlated, the proposed approach should be effective. By using stochastic mortality and interest rate models and Monte Carlo simulations, the authors show that the proposed generalised immunisation approach can serve as an effective vehicle for controlling the aggregate risk of life insurance companies. The numerical results further demonstrate that adding reverse mortgages to the insurers' product portfolio creates better hedge effectiveness and reduces total surplus risk.

Finally, Jack C. Yue and Hong-Chih Huang in "A Study of Incidence Experience for Taiwan Life Insurance" argue that mortality improvement has become a major issue in ratemaking for insurance companies and that ratemaking is especially difficult in Taiwan. Two reasons contribute to the difficulty: one is the population size and the

other is the rapid improvement in mortality. Because the history of life insurance in Taiwan is relatively short, all life insurance products are typically based on the same experience life table, which is constructed from the population purchasing all types of insurance products in Taiwan. In this study, the authors use experience data from Taiwan life insurance companies to explore whether there are risk factors related to the mortality rates. Further, experience data is also used to evaluate whether the customers of life insurance companies possess mortality patterns similar to that of the overall population in Taiwan.

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Longevity Seven took place in Frankfurt on 8–9 September 2011. The *Journal of Risk and Insurance* will publish a Special Issue of selected papers presented at this conference. *Longevity Eight* will take place in Waterloo, Canada, on 7–8 September 2012 and *Longevity Nine* will take place in Beijing in 2013.

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