Editorial

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The Geneva Papers (2016) 41, 1–3. doi:10.1057/gpp.2015.32

This issue of *The Geneva Papers* focuses on longevity risk and a number of specific aspects of this risk. For some time, longevity risk has received both practitioner and academic consideration as an issue of importance. As populations age around the world, increased demand is placed on public pension schemes, and the role of private longevity insurance markets increases. Longevity risk is more than just the risk of individuals exhausting financial resources at older ages and imposing a significant financial burden on government budgets from pension costs. For those living longer, there is the increased need for aged care along with increased health costs that must also be financed. There is an increased importance on the share of cost and risks between public support and private insurance markets.

Private insurance markets for life annuities and long-term care are limited. Product innovations are required in order to develop and increase the role these markets will play in financing longevity risk. A role for financial markets in financing longevity risk is also being developed beyond the more traditional reinsurance solutions. Financial markets use longevity indices to determine product payments. As a result, payments on indemnity-based annuity products result in a basis risk when measured against these longevity indices, usually based on available population data, which limits the attractiveness of these market solutions.

This issue contains articles that address many of these current and topical issues in longevity risk, including factors driving the demand by individuals for longevity insurance, the design of public pension schemes to take longevity risk into account, design of life annuities including product innovations in the form of enhanced and long-term care annuities, along with issues in designing longevity indices and measuring basis risk for financial market products.

In the paper by Michael Guillemette, Terrance Martin, Benjamin Cummings and Russell James, the determinants of demand for longevity insurance in the form of deferred annuities is studied using a Survey of Household Financial and Risk Management. Life annuities are the classical insurance product to manage an individual's longevity risk. The fact that individuals do not purchase annuities to the extent expected creates what is referred to as an "annuitisation puzzle". There are many factors proposed in the literature to explain this puzzle. This paper uses a survey to assess the extent to which factors of age, gender, smoking habits, risk aversion, home equity, marital status, income, net worth, level of education, stock market participation and the presence of a defined benefit pension plan determine the demand for longevity insurance in the form of a deferred annuity. Many of the results are consistent with

what theory would predict, but surprisingly more risk-averse individuals are found to be less likely to demand longevity insurance, something that is contradictory to what would be expected. Clearly there are many factors contributing to the demand for longevity insurance and the decision to purchase a deferred annuity. This paper provides a basis for insurers to consider more closely who is more likely to purchase deferred annuities and also raises an important question about the role of risk aversion in this decision.

Séverine Arnold-Gaille, María del Carmen Boado-Penas and Humberto Godínez-Olivares consider the notional defined contribution (NDC) schemes used to fund pensions in countries such as Poland, Latvia and Sweden and also under consideration in Egypt, China and Greece. Although financing is pay-as-you-go, notional accounts are used to track individual retirement accounts which are credited with a notional return. This paper addresses the issue of how to take into account survivor dividends that arise from the account balances of the deceased individuals before retirement in order to manage the longevity risk that increases benefit costs when these accounts are used to fund an annuity at retirement. The paper uses both deterministic mortality shocks and the Lee–Carter model to assess the credited contribution rate against that required in order to balance the total value of contributions and total value of benefits. Numerical illustrations, along with theoretical derivations, are used to show the impact of mortality improvement. Survivor dividends are found to have the capacity to finance significant mortality improvements. This has important implications for the design and financing of other pay-as-you-go schemes considering an NDC approach.

In the paper by Nadine Gatzert and Udo Klotzki, an extensive analysis of the enhanced annuity market is provided. Enhanced annuities have been gaining popularity in recent years particularly in the U.K. They provide an increased, or enhanced, annuity payment based on rating factors or health and lifestyle factors. An extensive literature review along with an empirical survey of the German annuity market is used to assess the supply and demand for these enhanced annuities including life annuities and deferred annuities. The paper highlights the complexity of both the supply and demand side for annuities, particularly these enhanced annuities. Barriers to supply included factors such as a potential cannibalisation effect, lack of pressure from competitors and lack of market potential. On the demand side, such factors as lack of awareness of enhanced annuities and the attractiveness of other investments such as cash were important. The results are valuable for understanding how to develop the private longevity insurance market and have lessons for all countries considering how to increase the role of private insurance markets in funding retirement incomes with longevity-protected products.

Ermanno Pitacco provides an extensive analysis of the full range of life annuities offered in private insurance markets and the guarantees that are included. A major issue in the annuity market is the cost of providing the annuity allowing for the capital costs based on the capital required to support the guarantees. The focus is on the guarantee structures in both the accumulation and payout phase of the product. Products covered include life annuities, deferred life annuities, guaranteed annuity options, advanced life delayed annuities (ALDA), ruin contingent life annuity (RCLA) and variable annuities with the GMxB guarantees. More recent innovations including long-term care annuities and life care annuities. Understanding the guarantees and payoff structures of the different products to finance longevity risk is an essential first step in designing a product and in assessing the required risks and costs of capital to support guarantees.

The paper by Shuji Tanaka considers a care pension benefit in a public pension scheme based on the Japanese pension and public LTCI schemes. Many countries have both public pensions and public long-term care support, usually offered separately. The future costs of these schemes have been increasing as populations' age and long-term care needs increase for the elderly population. An analysis of the Japanese LTCI scheme is provided along with estimated mortality and transition rates according to health state. The proposal considered here is to increase pension benefits based on health-care state. Since mortality is higher in higher level care states, there is the potential to offset costs between pensions and care payments in such a scheme. The importance of considering both longevity risk and health state is critical in finding the right balance between public and private provision for longer run longevity risk and health and long-term care costs.

In the paper by Wai-sum Chan, Johnny Siu-Hang Li, Kenneth Q. Zhou, and Rui Zhou an innovative graphical approach to measuring the difference in mortality improvement between two populations is provided. This is developed in the context of using broad-based mortality indexes as the basis for traded securities in financial markets that can be used to hedge longevity risk by pension funds and annuity providers. The difference between the actual mortality experience of a fund and a market index used to hedge risk is the basis risk, which is widely regarded as an inhibiting factor in these financial market solutions to longevity risk hedging. An example is provided based on measuring Canadian mortality against other countries. Although the method relies on mortality models, the graphical presentation is clear and understandable. The technique has more general applications in understanding differences in longevity risk between different populations.

The contributions in this special issue have considered many of the key topics in the area of longevity risk. In order to fund long-term pension, and pension and health-care costs, an increasing role for private markets must be developed. Understanding the supply and demand issues and the design of contracts that allow for both longevity and health states will be an important part of any developments. Financial markets have a potential role to play, and this will take time as issues such as basis risk are better understood. Individual decision-making and how this impacts annuity purchase decisions as well as customer awareness are also going to be critical. All these issues have been considered in this volume and we hope that they stimulate further investigation and promote a wider discussion of many of these issues in the insurance community.