If you wish to prepare a paper and presentation at the Actuaries Summit you must prepare a Synopsis and complete this Submission Form then submit both to the email address below no later than Friday 12 September 2014. On acceptance, authors will be advised and synopses will be loaded to the website.

Please submit your synopsis using the template provided on the next page with a copy of this submission form to events@actuaries.asn.au. Synopses and submission forms must be MS Word attachments – they will not be accepted in the body of an email.

### SUBMISSION FORM

**Name:** Michael Sherris  
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<table>
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<tr>
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<tbody>
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**Title of Paper / Presentation / Session to appear in program:**

Product Pricing and Solvency Capital Requirements for Long-Term Care Insurance

**Who will be presenting the presentation at the Summit:**

1. Michael Sherris  
2.  
3.  
4.  

**Who will be the Paper Author(s):**

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2. Michael Sherris  
3.  
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**Will your final submission be?**

☑ Presentation and Paper ☐ Presentation Only

If selected, what level of knowledge will delegates attending your session require (select one)

☑ No prior knowledge ☐ General Industry knowledge assumed ☐ Technical/specific industry knowledge assumed

Please indicate the ‘capabilities’ that will be addressed in your presentation by ticking one or more boxes below.

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<th>Tick Box</th>
<th>Capability Function</th>
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<td></td>
<td>Contribution to Business Strategy</td>
<td>Actuarial contributions to business strategy, This encompasses understanding the context and need for reassessment, followed by the generation and assessment of ideas, strategy and modeling, through to the explanation, promotion and selling of the strategy to ensure implementation.</td>
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<td>Leadership</td>
<td>Demonstration of leadership in deriving some or all of self, others, business or thinking at a high strategic level.</td>
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<td>Actuarial Approach to Problem Solving</td>
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<td>Professional Governance</td>
<td>Adoption of professional approaches and practices required to provide Prescribed Actuarial Advice, while maintaining currency of own capability and contributing to the development of the Profession.</td>
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<tr>
<td>☑</td>
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<td>Demonstration of product management, development and pricing which incorporates and balances stakeholders needs, commercial realities, the external market, sales and marketing consistency, financial objectives and risk management.</td>
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<td>Investment Advice and Governance</td>
<td>Provision of documented, demonstrated advice on management and development of investment portfolios, including consideration of investment objectives, market knowledge, asset liability modeling, strategic Asset Allocation and communication with stakeholders.</td>
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DEVELOPING A LONG-TERM CARE INSURANCE MARKET: PRODUCT DESIGN, PRICING and SOLVENCY CAPITAL REQUIREMENTS
Adam Wenqiang Shao and Michael Sherris

Key words: long-term care insurance, Solvency II, solvency capital requirements

Purpose of your paper: We investigate policy design, premiums, reserves and solvency capital requirements for a broad range of long-term care insurance policy designs, including stand-alone policies sold to individuals in different health states, rider benefit policies (long-term care insurance combined with whole life insurance), and life care annuities (long-term care insurance combined with annuities) sold to individuals in different health states. The results provide insights that assist in the design of affordable long-term care insurance as well as the capital efficiency for long-term care insurance providers.

Synopsis:
1. Background

Long-term care costs are reported to have shown a considerably increasing growth over the past decades and the increasing trend is projected to continue in future (e.g., Congressional Budget Office, 2004; Productivity Commission of Australia, 2013). Long-term care expenses are significantly higher if the insured moves into long-term care facilities (Fong et al., 2012). The primary funding for long-term care costs in Australia is the lifetime stop-loss mechanism funded through the pay-as-you-go tax (Productivity Commission of Australia, 2011, 2013).

Recent discussions in Australia and many other countries have focused on developing the private long-term care insurance market as an important supplement for the public funding source (see e.g., Colombo et al., 2011; Glendinning et al., 2004; Productivity Commission of Australia, 2011, 2013). Though the private insurance is an important source, the share of the private market is small. In the U.S., only 4% of long-term care costs are reimbursed through private insurance (Brown and Finkelstein, 2008). Motivated by the small share of private long-term care insurance, Brown and Finkelstein (2008) investigate the interaction of the public Medicaid program and private long-term care insurance. They find that Medicaid has a very large crowd-out effect due to the implicit tax imposed on the benefits of private long-term care insurance.

2. Long-Term Care Insurance

A long-term care insurance policy entitles the insured to receive benefits when the insured becomes functionally disabled according to the definition pre-specified in the policy (Haberman and Pitacco, 1999). Long-term care insurance policies, however, do not have a uniform definition for the benefit eligibility in the market. The most frequently used criteria for defining functional disability in long-term care insurance are the number of Activities of Daily Living (ADLs) that individuals cannot perform independently and cognitive impairment (Haberman and Renshaw, 1996; Murlaugh et al., 2001; Pritchard, 2006). Instead of using ADLs, Australian Bureau of Statistics defines individuals' functional disability based on the Core Activity Restrictions (CARs) that can be linked to scales of ADLs (Leung, 2006). Australian Institute of Health and Welfare (AIHW) data employs ADLs that are based on different definitions from those used in the HRS data.
The fixed benefit policy is the most typical and widely used type in the private long-term care insurance market. Fixed benefit long-term care insurance can be stand-alone policies, included as a rider benefit in the whole life insurance, or life care annuities (Haberman and Pitacco, 1999). A stand-alone policy pays out the predetermined benefit when the insured becomes functionally disabled. The long-term care cover included as a rider benefit in a whole life insurance policy, or referred to as the rider benefit policy, can be considered as a financial product that allows the insured to draw the death benefit for long-term care costs before death (Haberman and Pitacco, 1999). Long-term care insurance can also be combined with annuities, which is usually referred to as the life care annuity (Brown and Warshawsky, 2013; Murtaugh et al., 2001; Warshawsky, 2007). The life care annuity reduces the adverse selection problem by pooling annuitants who are vulnerable to longevity risk and long-term care insurance policyholders who are vulnerable to disability risk (Murtaugh et al., 2001). This risk pooling of the life care annuity provides a natural hedge and therefore reduces insurance premiums (Murtaugh et al., 2001; Warshawsky, 2007).

Insurers usually include an elimination period and a maximum benefit period in the product. The elimination period is the required minimum number of consecutive payment periods before the insured becomes eligible for benefits. The maximum benefit period is the maximum periods of payment that the insured can possibly receive. A generic long-term care insurance in this paper refers to a long-term care insurance policy with an elimination period of zero and an unlimited maximum benefit period.

3. Abstract

This paper assesses premiums, reserves and solvency capital requirements for a wide range of long-term care insurance policies, including stand-alone policies sold to individuals in different health states, rider benefit policies, and life care annuities sold to individuals in different health states.

We employ the Generalised Linear Model (GLM) to graduate transition rates under the Markov model framework of health dynamics. The model is calibrated to the U.S. Health and Retirement Study (HRS) data (Fong et al., 2013). The graduated transition rates are used as inputs to the pricing and reserving for long-term care insurance.

Thiele’s differential equation is used in deriving premiums and best-estimate reserves for generic long-term care insurance policies where the elimination period is zero and maximum benefit period is unlimited. To take into account typical product features, a simulation-based model is used to calculate premiums and reserves for policies with different combinations of elimination periods and maximum benefit periods. In the simulation approach, the idiosyncratic risk can be assessed using the Value-at-Risk of stochastic liabilities. The elimination period is shown to be very effective in making stand-alone long-term care insurance more affordable, while the maximum benefit period is shown to be more effective in managing the idiosyncratic risk and controlling extreme losses.

Solvency capital requirements allowing for longevity risk and disability risk for different types of policies are then compared based on the Solvency II standard formula. The results show that rider benefit policies and life care annuities provide considerable capital reductions compared to stand-alone policies. Stand-alone policies sold to disabled individuals are shown to require lower capital per unit premium compared to those sold to healthy individuals of the same age.

The pricing and reserving framework developed in this paper takes into a broad range of long-term care insurance policies. Premiums, best-estimate reserves and solvency capital requirements of these different types of policies are investigated. The results provide insights into the design of more affordable products and into the risk management for long-term care insurance providers.
References


