



LIFE INSURANCE AND WEALTH MANAGEMENT PRACTICE COMMITTEE

Information Note: Variable Annuities Taskforce Reading List

December 2009

1 Purpose

The purpose of this Information Note is to provide members with a reference to reading material from around the world on variable annuity products and, in particular, management of the guarantees available with those products. The Taskforce's search for papers has not been exhaustive. Equally, it has tried to highlight papers that it believes could have the widest interest to members and the appendix contains references to some other papers. The Taskforce would welcome feedback on any other papers that may be relevant to the Taskforce and members.

2 Background

The Life Insurance and Wealth Management Practice Committee ("LIWMPC") established the Variable Annuities Taskforce to consider the knowledge available in overseas variable annuity markets and identify how that style of guarantees could be applied in Australia. The Taskforce aims to educate members and add to the public debate on how these guarantees should be implemented in the Australian market. At the end of 2009, AXA and ING are the only providers to have variable annuity style products available in Australia.

The next goal of the Taskforce is to analyse the nature of variable annuity style guarantees and how the work completed overseas may apply in the Australian market. The Taskforce does not have a research mandate.

3 Introduction

Variable annuities ("VA"'s) are unit linked savings contracts with attaching guarantees. Features of these contracts have been seen before in various guises, such as products including:

- ▶ guaranteed minimum annuity rates;
- ▶ death benefit protection including return of contributions; and
- ▶ ratcheted returns and/or capital protection.

The guarantees on VA products are collectively referred to as "GMxB's" and the most common of these are:



GMDB: Guaranteed Minimum Death Benefit

GMAB: Guaranteed Minimum Accumulation Benefit

GMWB: Guaranteed Minimum Withdrawal Benefit (with a lifetime variation)

GMIB: Guaranteed Minimum Income Benefit

4 Overview

Technical aspects of the design and ongoing management of VA style guarantees are wide ranging and, as such, the Taskforce has split the work into the following streams:

- (1) product, pricing and opportunity;
- (2) risk management and operations;
- (3) hedging and investments;
- (4) financial reporting; and
- (5) capital requirements.

The following sections provide a summary of higher level reading material available on each topic. The appendix contains a reading list with more specific and detailed information.

4.1 General

SIAS paper “Variable Annuities” by Tamsin Abbey and Catherine Henshall

<http://www.sias.org.uk/data/papers/VariableAnnuities/DownloadPDF>

We recommend this paper as a good overall introduction to the topic. Some other references of general use are:

- ▶ **Variable Annuities (Institute of Actuaries UK) by Ledlie, Corry, Finkelstein, Ritchie, Su & Wilson**
http://www.actuaries.org.uk/_data/assets/pdf_file/0003/127623/fac_sm20080317.pdf

The paper provides a UK market context for VA products, the state of the retirement income market and the opportunity it presents for the development of VA products, however development of the variable annuities in international markets including US, Japan and Europe is also considered. The development of VA products and types offered are presented in the context of each market including demographics, economic environment, product asset allocations, with data relevant up to 2007.



A sample product design and features is provided, including the development of assumptions. The outcomes of sample product under different stochastic scenarios and the implications for product pricing and design are provided. There is a discussion of the need to provide adequate advice and services to customers, marketing and distribution. Pricing methodology, important considerations and assumptions, sensitivity testing for economic and insurance assumptions, dynamic policy holder behaviour and various product features are discussed.

The paper also contains a detailed examination of a number of the features of VA products and provides a section specifically focused on risk management including use of hedging. There is an extensive list of risks together with a thorough examination of each of those risks, including: market risk, credit risk, mortality/longevity, lapses/persistency, election, switching asset allocations, operational risk, strategic risk, pricing risk and extreme events.

- ▶ The recently published book "Variable Annuities: A Global Perspective" edited by Tigran Kalberer and Kannoo Ravindran (although not reviewed by the Taskforce) seems to cover the full range of topics related to VAs.
- ▶ The Institute of Actuaries (UK) has a member interest group dedicated to the topic:
http://www.actuaries.org.uk/members/migs/topical_migs/variable_annuities_members_interest_group

An example of a fully featured VA product from the USA is AXA Equitable's Accumulator – see:

http://www.axa-equitable.com/prospectus/pdf/Accumulator_Prospectus_Series_9.pdf

At the end of 2009, two products offering a subset of VA style guarantees in Australia are:

- ▶ AXA North:
<https://north.axa.com.au/>
- ▶ ING MoneyForLife:
<http://ing.com.au/personal/superannuation/ingmoneyforlife-overview.aspx>

4.2 Product, pricing and opportunity

A universal pricing framework for guaranteed minimum benefits in variable annuity contracts
by Daniel Bauer, Alexander Kling, Jochen Russ

http://www.ifa-ulm.de/downloads/Pricing_Framework_Guaranteed_Minimum_Benefits.pdf

This article presents a general framework for valuing the cost of variable annuity contracts using risk neutral pricing techniques. Considering the main VA contract types (Death Benefit, Accumulation Benefit, Income Benefit, Withdrawal Benefit) and an overview of existing



literature on guarantee benefit pricing. The article introduces a theoretical pricing framework using both deterministic and dynamic policy holder behaviour. A monte carlo numeric pricing algorithm is presented, as well as a method for pricing under the assumption of dynamic rational policyholder behaviour. Cost of options on money back, ratchet and annual roll-ups are calculated and contrasted under deterministic and dynamic policyholder behaviour. Guarantee price sensitivities are calculated for risk free and volatility assumptions. Finally guarantee costs are compared to typical market prices.

Rethinking Variable Annuity Guarantees

<http://www.towersperrin.com/tp/getwebcachedoc?webc=TILL/USA/2004/200412/LeitzLeBelModi.pdf>

This paper describes the typical guarantees as found in the US market that expose the carrier to equity market risks. The nature of the guarantee, the standard and enhanced features and typical price of these guarantees are summarised. As guaranteed benefits have become richer, reinsurance has become scarcer, yet most VA writers have continued to offer these guarantees. The paper then describes various methods of limiting benefits, explaining how applying benefit limitations to VA guarantees can be beneficial to both policyholders and insurance companies, particularly in the light of current drives by regulators to set new minimum capital standards for writers of VA guarantees.

Policyholder Behaviour in the Tail (SOA)

<http://www.soa.org/files/pdf/research-2008-pbitt-survey.pdf>

This paper outlines the results of a regular SOA study into the nature of the policyholder behavioural assumptions employed by US insurers. This survey offers valuable insight into the actual lapse assumptions employed, discussing common lapse rate features including:

- ▶ relationship between lapse rates and surrender charges;
- ▶ source of lapse assumptions; and
- ▶ dynamic lapse modelling features.

4.3 Risk management and operations

VA VA Voom by Oliver Wyman

<http://www.mmc.com/knowledgecenter/OliverWymanVariableAnnuities.pdf>

The paper considers the holistic risk management process for variable annuities stressing the importance of risk management beyond just hedging and product design. This paper highlights the critical relationship between risk management and product design with examples of what can go wrong when product design is conducted without consideration of the risk management implications. The paper goes on to discuss the interaction between



hedging and other risks as well as discussing the various options with regard to managing market risks.

Beyond the Greeks : Managing Unhedgeable Risks (IAA) by Gebler, Matterson & Tindall

http://www.actuaries.asn.au/IAA/upload/public/FSF08_8b_PPT_Matterson-Gebler-Tindall.pdf

This presentation outlines the risks in variable annuities with a focus on the risks that cannot be managed via hedging. Along with identification and specification of the various risks, product design and guarantee structuring solutions are offered as potential risk management strategies.

Measuring (and Managing) Policyholder Behaviour (SOA) by Winkler

<http://www.soa.org/files/pdf/2008-hk-chng-winkler-07.pdf>

These presentations summarise the range of risks that are inherent in variable annuities other than market risks. The two presentations cover similar material outlining the range of risks including:

- ▶ lapses – including examples of dynamic lapse adjustments;
- ▶ benefit utilisation;
- ▶ transfers & switches;
- ▶ mortality; and
- ▶ contributions & withdrawals.

In addition, the presentations offer a range of product design levers that can be used to manage the risks.

4.4 Hedging and investments

Results of Survey on Variable Annuity Hedging programs for Life Insurance Companies

Charles Gilbert, K Ravindran, Robert Reitano, Society of Actuaries 2007

<http://soa.org/files/pdf/va%20hedging%20final%2007.pdf>

This paper documents the results of a survey conducted by SOA together with the ALM Institute on variable annuity hedging programs by life insurance companies. The survey covers factors including:

- ▶ hedging objectives;
- ▶ valuation of assets and liabilities;



- ▶ use of derivatives usage plans, governance and audit of hedging programs; and
- ▶ implementation challenges.

Understanding the True Cost of Hedging in Volatile Markets by Craig Turnbull, Barrie + Hibbert Insights November 2008

http://barrhibb.com/documents/downloads/Understanding_the_true_cost_of_VA_hedging.pdf

This paper uses the case study to explain the risks left on the table by a dynamic delta hedging strategy commonly adopted by life insurers to hedge their guaranteed benefit embedded in VA products. Notably they are change of implied volatility risk (Vega) and change of delta (gamma risk). The recent volatile market since October 2008 should have some life insurers suffer from the hedging losses due to these two types of risk that delta hedging does not cover. The author also believes the experience learnt from recent events might have some implications on VA product design, pricing, risk management and even the level of guarantees to be offered.

Impact of recent market turbulence on hedging programs for equity-linked guarantees, Milliman Research Report - May 2008

<http://au.milliman.com/perspective/pdfs/impact-of-recent-market-05-01-08.pdf>

The paper presents the results of a survey of US, Asian and European VA writers, to assess their views of the performance of their hedging programs to May 2008. The study sets out details of the hedging objectives and strategy adopted by providers, as well as the performance of those programs. The paper concludes that hedging programs incurred few unanticipated losses at the time of writing.

Measuring and managing the economic risks and costs of with-profits business by A.J. Hibbert and C.J. Turnbull, British Actuarial Journal, 9, p725-786 and p1141-1154, 2003.

http://www.actuaries.org.uk/_data/assets/pdf_file/0012/31620/sm20030602.pdf

Although not specific to VA's, the paper discusses the same valuation and hedging concepts as applied to UK par business. Discusses dynamic policyholder behaviour, calculation and use of greeks to hedge market risks. The appendix contains an introduction to dynamic hedging.

4.5 Financial reporting

The information provided in this reading list refers to the accounting standards and regulatory requirements of the United States only. Care should be exercised to adapt the findings of these papers to the financial reporting requirements of Australia or other countries.



McKinsey working papers on Risk, 2009, Responding to the variable annuity crisis

http://www.mckinsey.com/client/service/financialservices/pdf/Responding_to_the_Variable_Annuity_Crisis.pdf

Relevant sections: Pages 16-17

This paper is generally concerned with the impacts on the global financial crisis on variable annuities. The appendix, however, gives a good, concise summary of the accounting treatment in the US. It demonstrates that different standards apply if there are insurance risks compared to when the benefits are largely independent of insurance risks.

The paper covers the risk management implications of the different reporting methodology. While the paper covers USGAAP reporting, there are most likely to be analogies with Australian and international reporting standards.

American Academy of Actuaries, Practice Note on Common Practices Relating to FASB Statement 133, Accounting for Derivative Instruments and Hedging Activities, As It Relates to Variable Annuities with Guaranteed Benefits

http://www.actuary.org/pdf/practnotes/life_fas07.pdf

This practice note was prepared by the American Academy of Actuaries to represent the views of actuaries in industry, consulting and public accounting firms involved in implementation of FAS 133 with respect to variable annuities with guaranteed benefits. The purpose of this practice note is to assist actuaries with application of FAS 133.

American Academy of Actuaries, Practice Note on FAS 157 & FAS 159

http://www.actuary.org/pdf/life/fas157_0209.pdf

This practice note was prepared by a work group organised by the Life Financial Reporting Committee within the Life Practice Council of the American Academy of Actuaries. It presents observations of actuaries working in the life insurance industry.

It covers FAS 157, which defines fair value measurement for USGAAP accounting purposes. FAS 157 establishes a framework for GAAP fair value calculations and expands the disclosures required for items measured at fair value. FAS 157 provides concepts and principles for the fair valuation, while not specifically providing prescriptive requirements for the calculations.

4.6 Capital requirements

The Australian regulatory capital standards do not cater specifically for variable annuity products at present. There is also little in the public domain regarding how to determine regulatory capital requirements in Australia for variable annuities.



The approaches taken in other markets are obviously specific to the regulatory capital frameworks applying in those markets. The Taskforce has selected three presentations from North America as providing a reasonable overview of issues to contend with in considering capital requirements for variable annuities.

2005 Valuation Actuary Symposium

www.soa.org/files/pdf/034bk-val05.pdf

Although a little dated, this presentation provides a reasonable overview of issues to contend with in modelling capital requirements for VAs in the context of a risk-based capital framework. The US RBC framework for VAs is the C-3 Phase II referred to in the presentation. There is also an overview of the interaction between capital calculations and hedging (an important consideration for setting capital for VAs).

**Society of Actuaries: Life 2009 Spring Meeting, May 18-19, 2009, Session 58 Workshop
What You Must Know Before Implementing Actuarial Guideline VACARVM**

www.soa.org/files/pdf/2009-co-life-motiwalla.pdf

This presentation focuses mostly on new US risk-based reserving requirements for variable annuities (VA CARVM), rather than capital requirements. It has been included because it provides a reasonable overview of methodology and implementation issues that might be seen as common across reserving and capital determinations (even though specific calibrations may differ). Also, it provides a summary of how US risk-based reserving requirements compare with US risk-based capital requirements.

The presenter has also co-authored a discussion paper on the VA CARVM reserving requirements, which is included in the list of further reading below.

Society of Actuaries: ERM Symposium April 2009

RA2-Lessons from the International Regulatory Systems: What has Worked and What Hasn't?

www.soa.org/files/pdf/2009-chicago-erm-brender.pdf

This presentation by a Canadian regulator provides thoughts on lessons learned from the recent financial crisis, with a particular focus on the risks associated with VA-style guarantees, the challenges these pose and potential shortcomings in capital methodology for such guarantees.

The Implications of Solvency II for U.S. Insurance Regulation by Dr. Therese M. Vaughan

[http://www.networksfinancialinstitute.org/news/documents/vaughan_the%20implications%20of%20solvency%20ii%20for%20u%20\[compatibility%20mode\].pdf](http://www.networksfinancialinstitute.org/news/documents/vaughan_the%20implications%20of%20solvency%20ii%20for%20u%20[compatibility%20mode].pdf)

This presentation by a US regulator provides a general comparison of the US capital framework and Solvency II. Although not specific to VAs, this has been included to contrast the different approaches.



Institute of Actuaries of Australia

LIFE INSURANCE AND WEALTH MANAGEMENT PRACTICE COMMITTEE

Information Note : Variable Annuities Taskforce Reading List

December 2009

5 Comments and feedback

Comments and feedback on this Information Note are welcomed and should be sent to:

Mr Daniel Levy
Convenor, Variable Annuities Taskforce
DanielLevy@iinet.net.au



Appendix

This appendix contains additional references identified by the Taskforce (but not exhaustive). This material generally has more specific or technical content than in the papers listed in the main section of this Information Note.

"Investment Guarantees - Modelling and Risk Management for Equity-Linked Life Insurance" by Mary Hardy is a text book on the more technical aspects of modelling guarantees (not reviewed by the Taskforce).

Pricing and Risk Management of Variable annuities with multiple guarantees

http://www.soa.org/library/journals/actuarial-practice-forum/2006/october/APF0610_4.pdf

The Vexed Question of Convexity (Institute of Actuaries UK) by Maher

http://www.actuaries.org.uk/_data/assets/pdf_file/0020/161237/VAMIGNewsletter0809.pdf.pdf

Variable Annuities - issues relating to dynamic hedging strategies by Christophe Bonnefoy, Alexandre Guchet, Lars Pralle, presented at AFIR / LIFE Colloquium, Munich 2009

http://www.actuaries.org/Munich2009/papers/LIFE/Wed_11.40_LIFE_Pralle_Financial_marktes_Paper.pdf

A universal pricing framework for guaranteed minimum benefits in variable annuities by Daniel Bauer, Alexander Kling and Jochhen Russ, Astin Bulletin 38(2), 621-651.

http://www.actuaries.org/Munich2009/papers/LIFE/Tue_08.30_LIFE_Bauer_Products_Paper.pdf

Hedging interest and equity risk

<http://www.cs.uwaterloo.ca/~yuying/papers/interestRisk.pdf>

Impact of recent market turbulence on hedging programs for equity-linked guarantees, Milliman Research Report - May 2008

<http://au.milliman.com/perspective/pdfs/impact-of-recent-market-05-01-08.pdf>

New Approaches to Variable Annuity Hedging by Stephan Reulein, Stefan Jaschke, 4th Chief Risk Officer Assembly 2009

http://www.genevaassociation.org/PDF/Working_paper_series/GA_E&D_353.06_REULEIN_&_J_ASCHKE_Annuities,Risk_management,Theory.pdf

Pricing and Hedging of Variable Annuities by Daniel Blamont & Pretty Sagoo, Life and Pensions Magazine, February 2009

http://db.riskwaters.com/data/lifepensions/pdf/cutting_edge_0209.pdf



Performance of insurance company hedging programs during the recent capital market crisis - Milliman Research Report - November 2008

<http://www.milliman.com/expertise/life-financial/publications/rr/pdfs/performance-insurance-company-hedging-rr12-01-08.pdf>

The Market Consistent Valuation Of Life Assurance Business by T.J. Sheldon & A.D. Smith, British Actuarial Journal 10, III, p543 – 626, 2004

http://www.actuaries.org.uk/_data/assets/pdf_file/0014/31712/sm20040223.pdf

Tricia Matson, 2009, GAAP for Fixed and Variable Annuities, Deloitte Consulting

<http://www.soa.org/files/pdf/2009-washington-matson-4b.pdf>

FSA (UK): Solvency II

<http://www.fsa.gov.uk/pages/About/What/International/solvency/index.shtml>

Standard & Poor's: Adoption of C-3 Phase II

<http://www2.standardandpoors.com/portal/site/sp/en/au/page.article/2,1,1,0,1204836566062.html?vregion=au&vlang=en>

Milliman Research Report - A Discussion of Actuarial Guideline 43 for variable Annuities, Junus and Motiwalla, April 2009

<http://www.milliman.com/expertise/life-financial/publications/rr/pdfs/discussion-actuarial-guideline-43-RR04-01-09.pdf>

Society of Actuaries – Risk and Rewards Newsletter

<http://www.soa.org/news-and-publications/newsletters/investment/pub-investment-risk-and-rewards-newsletter.aspx>

Recommended Approach for Setting Regulatory Risk-Based Capital Requirements for Variable Annuities and Similar Products, American Academy of Actuaries Life Capital Adequacy Subcommittee, June 2005

http://www.naic.org/documents/committees_e_capad_lrbc_2_LCASDocFinal.pdf

Practice note for the application of C-3 Phase II

http://www.actuary.org/pdf/practnotes/life_c3.pdf

Combined US practice note for risk-based reserves and capital

www.soa.org/files/pdf/2009-co-ag-43-gaule.pdf

Recommended Approach for Setting Regulatory Risk-Based Capital Requirements for Variable Annuities and Similar Products from the American Academy of Actuaries

www.actuary.org/pdf/life/c3_june05.pdf



There are many products with VA style guarantees available in the market; the list below contains a small sample.

- ▶ Lincoln:
http://www.lfg.com/lfg/DOCS/lif/CP_Assurance_B_Share.pdf
http://www.lfg.com/lfg/DOCS/lif/CP_Design_3.pdf
- ▶ Jackson National Life Insurance:
[http://notes1.jacksonnational.com/ResearchCenter/RcIndex.nsf/Index1_V/01262005-E23S-I8WT/\\$file/vc5890.pdf](http://notes1.jacksonnational.com/ResearchCenter/RcIndex.nsf/Index1_V/01262005-E23S-I8WT/$file/vc5890.pdf)
- ▶ The variable annuity life insurance company (owned by AIG) provider of employer sponsored arrangements:
http://www.valic.com/Images/potentia_contract_tcm82-19188.pdf
- ▶ MetLife - Retirement Income Portfolio:
<http://www.metliferp.co.uk/>
- ▶ Aegon Income for Life Product:
<http://www.aegonse.co.uk/adviser/pensions/income-in-retirement/income-for-life/index.html>