

How Fair Value Measurement Changes Risk Management Behavior in the Insurance Industry

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I. Executive Summary

Market-Consistent Accounting

Insurance companies in the United States already account for some guarantees in insurance products using fair value in U.S. GAAP and IFRS. Furthermore, we expect the exposure to market-consistent accounting standards to grow through the upcoming insurance contracts accounting standards that the Financial Accounting Standards Board and the International Accounting Standards Board are developing and voluntary adoption of Market-Consistent Embedded Value (mainly for U.S. subsidiaries of European-domiciled companies).

The upcoming Solvency II European solvency capital standard contains a market-consistent-type balance sheet. Also, the National Association of Insurance Commissioners in the United States is working on the Solvency Modernization Initiative. Although this is not currently slated to go in a market-consistent direction, it has that potential.

As a result of the recent and upcoming changes to regulatory frameworks, insurance companies will have significant exposure to market-consistent accounting.

Is Market-Consistent Accounting Appropriate for Insurance Liabilities?

Market-consistent accounting produces a value that is consistent with the price of related financial instruments in the market. The intention is that all companies (e.g., banks and insurance companies) will account for their business on the same basis. This should increase transparency and comparability, as well as highlight areas of increased risk. That is the theory; in practice:

- Companies in this study do not believe that market-consistent accounting actually produces more transparent results, and they tend to remove the impact of market movements from operating earnings to improve clarity.
- The various market-consistent accounting frameworks continue to incorporate ambiguous elements (e.g., the liquidity premium) that interfere with consistency between companies and between industries.
- The majority of companies in this study are not in favor of market-consistent valuation for insurance liabilities, since they largely believe the methodology is not reflective of the long-term nature of their business and produces short-term results that are out of management's control. A minority are in favor, citing reduction in balance sheet and earnings volatility after incorporating appropriate asset/liability matching, including hedging.

Why Do Insurance Companies Hedge?

Hedging can be dual purpose in that it protects companies from financial distress while reducing earnings volatility. A company's priorities relative to these two objectives will affect the nature

of their hedging activities and other means of immunization to financial risk. If the only objective were protection from financial distress, hedging might take the form of out-of-the-money put options to protect against extreme market movement. Typical industry hedging programs for variable annuity guarantees, e.g., are closer to full immunization against market movement for liabilities accounted for under fair value, indicating that companies place significant value in reducing earnings volatility. The cost of full immunization is akin to investing the general account largely in risk-free assets—in other words, a reduction in risk is accompanied by a reduction in return.

Company Actions Driven by Market-Consistent Frameworks

Insurance companies engage in certain activities to manage the company's risk profile and stabilize earnings, as noted above. These activities will likely change over time as companies adapt to the upcoming regulatory environments.

- The most common forms of market risk management applied to new business today for products with significant financial guarantees are product design and hedging. In the past, companies commonly used reinsurance. Currently reinsurers are generally unwilling to reinsure these guarantees, due to differences in pricing metrics, accounting bases, and concerns over policyholder behavior.
- Companies writing financial guarantees tend to struggle between conflicting hedging targets through U.S. GAAP/IFRS and statutory and capital standards, particularly where one standard is sensitive to market movements and another is not.
- The introduction of upcoming accounting and capital standards will provide incentive for tighter asset/liability management and hedging of guarantees in order to reduce earnings volatility. Hedging programs will likely expand further in scope to cover additional products and market risks, although it is unclear to what degree insurers will be willing to reduce expected profit. It will also provide similar accounting for insurers and reinsurers, removing some of the obstacles to obtaining reinsurance for variable annuities and other products with significant financial guarantees.
- There is a small possibility that some insurance companies will remutualize in order to avoid the issue of earnings volatility entirely.

II. Reliances and Limitations

II.A. Use of the Term “Review”

The services we performed throughout this engagement were advisory in nature; therefore, this report/work product does not represent an assurance report or opinion, nor does it constitute an audit, review, examination, or other form of attestation as those terms are defined by the American Institute of Certified Public Accountants (AICPA). Any use of the term “review” within this report should be interpreted in the common use of that term, and not in the definition of “review” promulgated by the AICPA. Also, this report/work product does not constitute a legal opinion or advice.

II.B. Data and Qualitative Information

In preparing our analysis, we relied on data and qualitative information collected from available literature and financial statements produced by insurance companies. We have relied on the oral and/or written statements of the participating companies regarding the quality, accuracy, and completeness of the data and information supplied to us. Any inaccuracies or inconsistencies in the data could have a significant effect on our results.

We did not perform a review of the data provided to us because such a review was outside the scope of our engagement. Also, we did not deem it necessary to perform such a review, because our use of quantitative data was limited for the purpose of illustrating certain points only.

In addition, the discussion and examples presented in this paper are for educational purposes. They are not to be viewed as an authoritative statement by the Society of Actuaries or Ernst & Young LLP on the quality and/or appropriateness of an individual company’s practices or an indicator of “better” practice from one company relative to another.

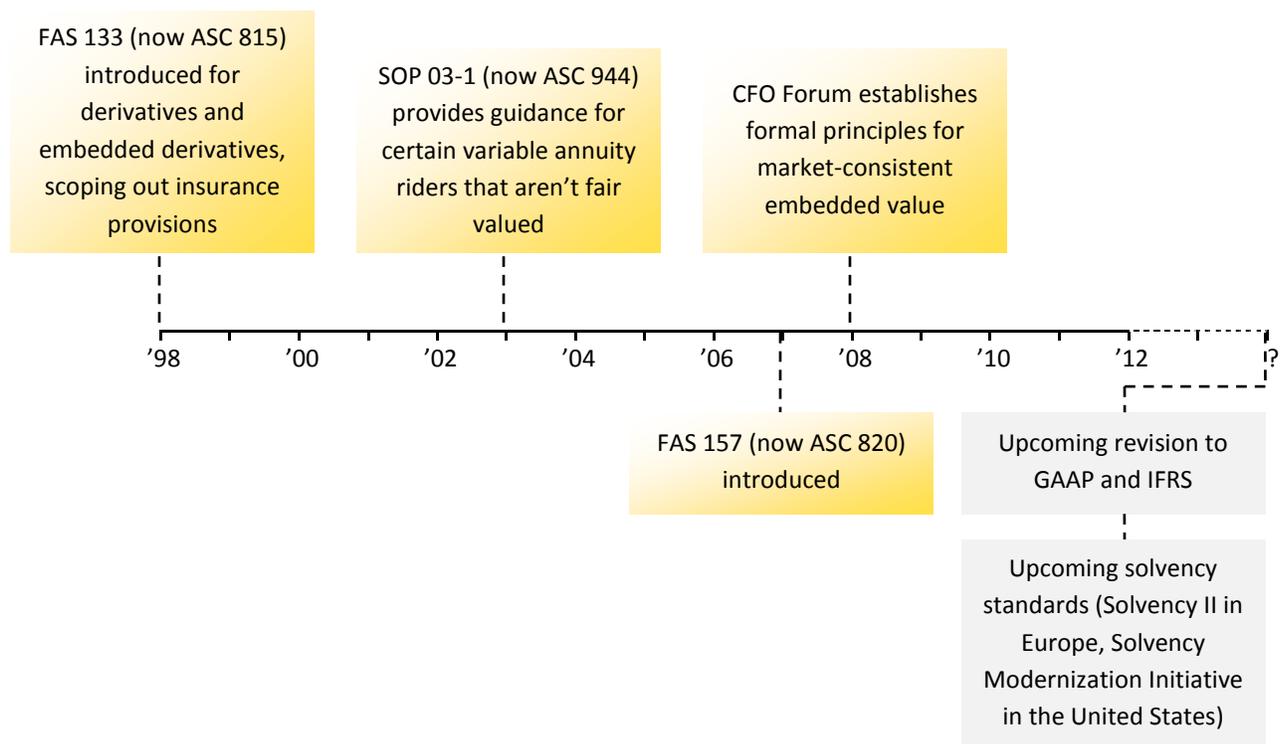
II.C. Responsible Party for Methods and Assumptions

Bruce Rosner, FSA, MAAA, and Mark Freedman, FSA, MAAA, are responsible for this report. We are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to perform this engagement and provide the findings contained herein. Comments or questions regarding this report should be directed to Bruce Rosner at 212-773-1190 or Mark Freedman at 215-448-5012, who are also available to provide supplemental information and/or explanation as requested.

III. Introduction

Over the past decade, insurance companies have been gradually introduced to fair value reporting for liabilities (Figure 1).

Figure 1: Timeline of Fair Value Reporting in the United States



The purpose of this report is to present how insurance companies mitigate the risk (or volatility) in earnings and the balance sheet arising from fair value measurement of liabilities, or similar accounting measures that have market-consistent elements.

When the Financial Accounting Standards Board (FASB) first introduced Statement of Financial Accounting Standard No. 133: *Accounting for Derivative Instruments and Hedging Activities* (SFAS 133 or ASC 815), they scoped out insurance provisions in embedded derivatives from being fair valued. Insurers lobbied for this outcome, possibly because they did very little hedging of these liabilities in that time period. As a result, there were no accounting standards for valuing some of the variable annuity riders at that time. The FASB addressed this void by

incorporating rules for the valuation of these variable annuity provisions into Statement of Position 03-1: *Accounting and Reporting by Insurance Enterprises for Certain Nontraditional Long-Duration Contracts and for Separate Accounts* (SOP 03-1 or ASC 944). Note that SOP 03-1 liabilities tend to be both lower and less volatile than those computed according to SFAS 133 for the same product provisions. Ironically, many insurance companies now recognize a need to immunize financial guarantees in their products, and the non-fair value liability inherent in SOP 03-1 acts as a deterrent to hedging.

The desire to immunize financial risks has grown over time and in particular after several companies became financially distressed during the financial crisis of 2008.

Many insurance companies based in Europe now voluntarily prepare Market-Consistent Embedded Value (MCEV) financial statements, which has many fair value characteristics and applies to the entire balance sheet. Consequently, European companies with operations in the United States have brought over the need to report under this standard.

The next major drivers of fair value or similar accounting measures are the upcoming insurance contracts accounting standards using current fulfillment value (defined in Section IV below). Both the FASB and the International Accounting Standards Board (IASB) are in the midst of revamping their current accounting standards for insurance contracts, and the current direction of both FASB and IASB is toward a more market-consistent standard.

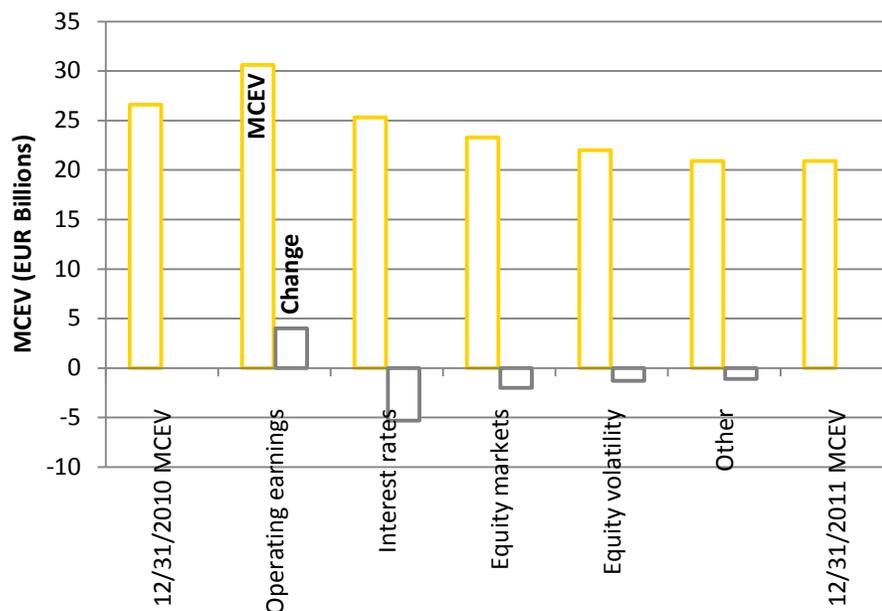
The common thread between valuation bases that incorporate fair value elements is that they contain assumptions that are based on market prices (hence, market-consistent). For example, if market values for put options rise, and equity prices and interest rates hold steady, this implies that the market has revised its view of future volatility upward in the underlying equity prices because there is no other reason for the market to revise its valuation for put options (under several simplifying assumptions, which are out of scope for this report). See Appendix B for an illustration showing how volatility affects put option values. See the Groupe Consultatif Actuariel Européen paper on Market Consistency¹ for a further theoretical discussion on the use of market-consistent assumptions.

Insurance companies apply this logic in reverse, and use the revised volatility assumption (also known as “implied volatility”) as an input into the valuation of a liability, resulting in a corresponding increase in the value of the liability. Mechanically, this is done by entering the revised volatility assumption into the economic scenario generator so that higher levels of volatility will produce more widely dispersed scenarios.

¹ http://www.gcactuaries.org/documents/MC_paper_and_letter_051212.zip

Figure 2 shows a sample market-consistent rollforward from the Allianz 2011 MCEV Annual Report.² This illustrates the accounting volatility that companies experience in a market-consistent environment. Despite positive operating earnings, each market movement results in a separate, tangible impact to results that can overwhelm other sources of earnings.

Figure 2: Allianz MCEV 2011 Rollforward



The ongoing evolution of market-consistent standards for insurance liabilities along with an increasing desire for immunization of financial risk has resulted in a shift in risk management practices at insurance companies over the last decade.

This topic has several facets, which we discuss in this report:

- The expanding use of fair value in the insurance industry
- How accounting can encourage or discourage risk management practices
- The various means that an insurance company can use to manage financial risks embedded in liabilities
- Advantages and disadvantages of the various approaches to managing financial risks.

See Appendix A for a discussion on the theoretical foundations of risk management behavior grounded in the Modigliani-Miller theorem.

² https://www.allianz.com/media/investor_relations/en/results_reports/annual_report/ar2011/evr2011.pdf

We base this report on the following sources of information:

1. A series of interviews with eleven insurance companies in the United States and Europe. We included in this study only companies that currently issue products accounted for under fair value standards and that apply risk management to some extent using fair value. The companies represent the following four categories:

- Domestic stock company insurers
- Domestic mutual company insurers and stock subsidiaries of mutual company insurers
- European stock company insurers with subsidiaries in the United States
- Global reinsurers.

Prior to each interview, we sent companies the following list of topics:

- Background on metrics/products where company is exposed to volatility in earnings as a result of fair value of liabilities
- Importance of managing volatility in earnings relative to volatility in economics or other reporting bases
- Strategy for managing volatility in earnings, including hedging, reinsurance, product design, and other techniques
- Experience and perception of how effective these techniques are, and why they chose to use or not use certain techniques
- Practical challenges encountered in each of the techniques used. This encompasses internal challenges (e.g., difficulty in changing product design) and external challenges (e.g., market pricing of options)
- Future concerns due to the upcoming Insurance Contracts standards, Solvency II (if a subsidiary of a European company), or other concerns in the next five years related to fair value—like accounting and how the company may respond to those challenges
- General thoughts about the state of fair value reporting in the industry.

2. Various sources of literature pertaining to this subject. We found a substantial literature available targeting specific topics, including fair value of liabilities, hedging, variable annuity risk management, etc.; however, very little is available that focuses on how fair value changes risk management behavior in the insurance industry. Sources of data included the following:

- Prior Society of Actuaries research reports
- Society of Actuaries section newsletters
- Independent consulting firms active in variable annuity risk management
- Academic research nonspecific to insurance companies.

3. Public company filings including annual statements under U.S. GAAP and MCEV

4. Prior experience of the researchers.

IV. Use of Fair Value in the United States Today

Table 1 provides an overview of how companies apply fair value techniques under U.S. statutory, U.S. GAAP, IFRS, and MCEV at this time.

Table 1: Overview of Liabilities Fair Valued by U.S. Insurance Companies

	U.S. Statutory	U.S. GAAP	IFRS	MCEV
Variable annuity accumulation benefits	No	Yes	Yes	Yes
Variable annuity withdrawal benefits	No	Most companies apply either fair value or SOP 03-1, depending upon the nature of the guarantees	Similar to U.S. GAAP for most companies	Yes
Variable annuity death and income benefits	No	No, except companies fair value most reinsurance treaties involving income benefits. One reinsurer applies a fair value option to its death benefits.	Similar to U.S. GAAP for most companies. One company applies a fair value–type technique to its reinsured ceded income benefits.	Yes
Embedded derivatives within equity-indexed annuities and equity-indexed life insurance	No	Yes	Yes	Yes
Stable value (separate account guaranteed minimum crediting rate products)	No	Most companies apply fair value techniques to these features	Similar to U.S. GAAP	Yes
Embedded derivative within modified coinsurance treaties and coinsurance with funds-withheld treaties	No	Yes	Yes	Yes
All other life, annuity, and health contracts and features ³	No	Usually not	Usually not	Yes

³For example, general account minimum crediting rates and universal life secondary guarantees.
How Fair Value Measurement Changes Risk Management
Behavior in the Insurance Industry

As we noted in Table 1, domestic insurers in the United States currently have a limited exposure to fair value reporting of liabilities. European-domiciled insurance companies tend to be better versed in market-consistent techniques through widespread adoption of MCEV and the corresponding Market-Consistent Value of New Business (MCVNB) that they use partly as a pricing metric.

IV.A. Current Fair Value Accounting under U.S. GAAP and IFRS

Under both U.S. GAAP and IFRS, companies normally use a direct approach to compute the fair value of liabilities. Under this approach, the liability is equal to the probability weighted discounted value of cash flows. Companies use best estimate noneconomic assumptions and risk-neutral economic assumptions and provide for risk margins (which increases the liability) and for their nonperformance risk (which decreases the liability).

Table 2 shows the benefits that are fair valued in Lincoln Financial Group’s 2011 Annual Report under U.S. GAAP as an example of fair value disclosures.^{4 5} (“GLB” refers to guaranteed living benefits in variable annuities.)

Table 2: Lincoln Financial Group Fair Value Liabilities

December 31, 2011, Liabilities, \$millions	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	Total Fair Value
Futures contract benefits:				
Indexed annuity contract embedded derivatives	-	-	399	399
GLB reserves embedded derivatives	-	-	2,217	2,217
Reinsurance related embedded derivatives	-	352	-	352
VIEs’ liabilities – derivative instruments	-	-	291	291
Other liabilities:				
Deferred comp. plans embedded derivatives	-	-	304	304
Credit default swaps	-	-	16	16
Total liabilities	-	352	3,227	3,579

See the American Academy of Actuaries practice note “Practice Note on Common Practices Relating to FASB Statement 133”⁶ for more information on this topic.

⁴ <https://www.lfg.com/LincolnPageServer?LFGPage=/lfg/acc/abt/ivrel/gaaprpt/index.html>

⁵ This study analyzed financial statements from several companies. We show an excerpt from Lincoln Financial Group’s financial statements as an example of how the information is typically presented.

⁶ http://www.actuary.org/pdf/practnotes/life_fas07.pdf

IV.B. Market-Consistent Embedded Value

MCEV is a broader standard in the application of fair value in that it covers the entire balance sheet. Many, but not all, companies compute MCEV using an indirect approach; the basic formula for MCEV is

$$\text{MCEV} = \text{ANW} + \text{PVFP} - \text{TVFOG} - \text{FCRC} - \text{CRNHR},$$

where

- *ANW* (adjusted net worth) is the statutory required capital and free surplus
- *PVFP* (present value of future profits) is the after-tax statutory book profits, assuming that assets earn the risk-free rate, and includes only embedded guarantees to the extent that they can be exercised on the valuation date
- *TVFOG* (time value of financial options and guarantees) is the additional value associated with embedded guarantees resulting from the possibility that they will be exercised in the future
- *FCRC* (frictional cost of required capital) is the cost associated with holding the required capital
- *CRNHR* (cost of residual nonhedgeable risks) is a reduction in value that results from being exposed to risk.

See the American Academy of Actuaries practice note “Market-Consistent Embedded Values”⁷ for more information on this topic.

The main theoretical differences between IFRS and U.S. GAAP fair value and MCEV are the following:

- *Reflection of income taxes*—Under MCEV, companies handle income taxes as a liability cash flow, whereas under U.S. GAAP and IFRS, companies compute the fair value liability on a pretax basis and reflect the related tax impact in the deferred tax liability item on the balance sheet.
- *Reflection of risk margins*—Under MCEV, companies hold an explicit provision for frictional costs, using a cost of capital approach. Under U.S. GAAP and IFRS, while most companies hold a risk margin, not all use a cost of capital approach to do so.
- *Nonperformance risk*—Under U.S. GAAP and IFRS, most companies add a spread on top of risk-free rates to provide for their nonperformance risk. Under MCEV, most companies add a spread on top of risk-free rates to provide for a liquidity premium.

⁷ <http://www.actuary.org/files/MCEV%20Practice%20Note%20Final%20WEB%20031611.4.pdf/MCEV%20Practice%20Note%20Final%20WEB%20031611.4.pdf>

MCVNB is the equivalent of MCEV for new business as of the issue date (before the first premium/consideration comes in). Note that MCVNB is scoped out of the definition of MCEV above.

IV.C. The Upcoming Insurance Contracts Accounting Standards

Both the FASB and IASB are in the midst of revamping their current accounting standards for insurance contracts. The FASB expects to issue an exposure draft in the second quarter of 2013. The IASB has indicated they will issue something around the same time, in the form of a discussion document targeting specific items. The current directions of both FASB and IASB are toward a more market-consistent standard.

As of today, the proposed standards for most long-duration insurance contracts are a current fulfillment value measure, which is defined by the IASB as the present value of the resources required to fulfill the obligation measured using the expected value approach. This includes the following features:

- Discount rates can be either bottom-up (risk-free rates plus an additional component for liquidity) or top-down (asset earned rate less spread for expected and unexpected defaults)
- Economic scenarios/assumptions must be risk neutral
- Noneconomic assumptions must be best estimates
- There will be margin(s) on top of the basic liability, unless the contract is unprofitable under the FASB approach
- There is no provision for a company's nonperformance risk; however, as mentioned above, there will be some provision for liquidity in the discount rate.

See the FASB discussion paper,⁸ the IASB exposure draft,⁹ and the IASB updates¹⁰ for the latest information on this topic as of the writing of this report.

IV.D. Solvency II

The Solvency II Directive 2009/138/EC is a European Union directive introducing new solvency standards for companies operating in Europe. Pillar 1 of Solvency II creates quantitative requirements:

- *Technical Provisions*—This is a baseline balance sheet using an exit value measure, which is defined as “the amount an insurance or reinsurance undertaking would have to pay if it transferred its contractual rights and obligations immediately to another
- undertaking.”¹¹ This is calculated in a similar way to an MCEV balance sheet.

⁸ http://www.fasb.org/jsp/FASB/FASBContent_C/ProjectUpdatePage&cid=1175801889812

⁹ <http://www.ifrs.org/Current-Projects/IASB-Projects/Insurance-Contracts/Pages/Currentstatus.aspx>

¹⁰ <http://www.ifrs.org/Updates/IASB-Updates/Pages/IASB-Updates.aspx>

- *Solvency Capital Requirement*—This is the amount of capital that a company must hold in order to protect against insolvency over one year at the 99.5th percentile.

Solvency II is scheduled to be effective in 2015 or later. It will apply to all entities with a parent company domiciled in the EU and will apply to any entities operating in the EU. The EU intends to grant equivalency to capital standards in certain countries if they deem them to be adequate. At this time, the United States has not applied for equivalency.

IV.E. Variable Annuity Guarantees under U.S. GAAP That Are Not Fair Valued

Most companies apply SOP 03-1 to account for these benefits. Typically, companies use a range of real-world scenarios and historically derived assumptions, as opposed to fair value, which is risk neutral and uses market-consistent assumptions. In addition, companies use a retrospective deposit approach for unlocking these liabilities. As a result of these methods and assumptions, an SOP 03-1 reserve is not as sensitive to market movements as fair value techniques.

See the American Academy of Actuaries practice note¹² “Practice Note on Anticipated Common Practices Relating to AICPA Statement of Position 03-1” for more information on this topic.

IV.F. Statutory Reserves and Required Capital in the United States for Variable Annuity Guarantees

Insurers in the United States typically use Actuarial Guideline XLIII (AG43; Commissioners’ Annuity Reserve Valuation Methodology for Variable Annuities, adopted in September 2008 by the National Association of Insurance Commissioners) and C3 Phase II (a principle-based approach to calculating the market risk and interest rate risk components of risk-based capital in the United States, adopted in 2005 by the National Association of Insurance Commissioners) to calculate statutory reserves and required capital for variable annuities, respectively, in the United States:

- AG43 aggregate reserves are equal to the maximum of the Conditional Tail Expectation Amount (CTE) and the Standard Scenario Amount, where the CTE is equal to the average of the worst 30% of results (CTE 70) from a set of real world scenarios.
- C3 Phase II capital requirements are equal to the maximum of the Total Asset Requirement and the Standard Scenario Amount, where the Total Asset Requirement is equal to the average of the worst 10 percent of results (CTE 90) from a set of real-world scenarios.

¹¹ See Paragraph 55 of the Solvency II directive, as of November 25, 2009

¹² http://actuary.org/pdf/practnotes/life_aicpa04.pdf

See the American Academy of Actuaries practice note¹³ “The Application of C-3 Phase II and Actuarial Guideline XLIII” for more information on this topic.

¹³ <http://www.actuary.org/files/VAPN%20FINAL%20WEB%20040511.4.pdf/VAPN%20FINAL%20WEB%20040511.4.pdf>

V. How Accounting Can Encourage or Discourage Risk Management Practices

As we discussed above, a company may be subject to a number of different reporting standards for a product, and different standards can create conflicting objectives in risk management practices.

V.A. An Illustration

To illustrate, let us take the example of ABC Life, which has issued a variable annuity product with guaranteed accumulation benefits. ABC Life uses fair value for the guaranteed accumulation benefits under U.S. GAAP, uses AG43 for its statutory liabilities, uses C3 Phase II for its required capital calculations, and reports MCEV results to a European parent. Furthermore, the company believes that due to recent market events, the implied volatility seen in market prices for index options is overstated. The company has also observed that on a statutory basis, the standard scenario produces higher reserves than under a stochastic approach (discussed further below).

If ABC Life chooses to hedge the market risk embedded in the variable annuity guarantees, they will need to define a hedging target, that is, the target value that the company intends to stabilize through hedging.

ABC Life has at least five potential hedging targets:

- *The U.S. GAAP fair value liability*—This is the most common approach companies use at this time, except that no company in the study included nonperformance risk in the hedging target, and many do not include risk margins.
- *The company's own view of the economic value of the guarantees*—This is similar to hedging the U.S. GAAP fair value liability, given that companies exclude nonperformance risk and sometimes risk margins. However, there are instances where companies take a view of future volatility or risk-free rates that is not derived purely from market prices. This diverges from how almost all companies calculate the U.S. GAAP fair value.
- *MCEV*—This metric differs from U.S. GAAP fair value through use of frictional costs and a liquidity premium. As companies do not necessarily derive frictional costs and the liquidity premium from market prices, companies do not view those items as reasonable hedge targets.
- *Statutory reserves (AG43) and capital (C3 Phase II)*—As a result of different levels of sensitivity between the stochastic and deterministic components of each standard (described in Section IV.F), depending upon which component is greater at any given time, the statutory reserves and capital may or may not be sensitive to movements in

interest rates and will have varying levels of sensitivity to equity market movements. While it is technically possible to hedge statutory reserves or capital (with potential added difficulty of recursive formulas that may result from projecting hedge cash flows within the stochastic component of the projection), none of the companies in the study specifically hedge these amounts or have any plans to do so. Note that companies do tend to layer on “macro hedges” (discussed further in the section “Hedging” below), which provide a broader coverage of financial risk exposure across the statutory balance sheet, and C3 Phase II results do contribute to the overall exposure.

If ABC Life chooses to go down the path most common in the industry today, that is, to hedge the economic liability (or U.S. GAAP liability, excluding nonperformance risk and possibly risk margins), they will encounter the following difficulties:

- On a U.S. GAAP basis, they will have volatility, because the discount rate used in the hedge target does not include nonperformance risk (this increases the hedge target relative to the GAAP liability), and the hedge target sometimes excludes a liability component for risk margins (this decreases the hedge target relative to the GAAP liability).
- On a U.S. GAAP basis, they will also have volatility in earnings arising from movement in risk margins and the company’s nonperformance risk (i.e., the spread for nonperformance risk changes with no offsetting change in hedge asset cash flows).
- Hedging interest rates will create substantial volatility in statutory capital, because the statutory liability using the standard scenario is not sensitive to interest rate movements, and ABC Life decides to hedge this risk by entering into interest rate swap agreements. ABC Life, like most companies, fair values these swap arrangements on a statutory basis.

The industry generally views the first two issues, while not necessarily small, as issues that they can explain to investors. However, companies view the statutory capital issue as a major concern. Unfortunately, this is a case where financial reporting under two regimes (statutory and U.S. GAAP) diverge and have put companies into a position in which they must choose which basis will be volatile, and that decision has a meaningful effect on the company’s economic risk profile.

An Oliver Wyman study, involving 12 large variable annuity writers, has analyzed the statutory accounting difficulties with hedging programs (Hancock 2010).

V.B. Risk Management Priorities

As part of our study, we asked companies which risk management targets are most important to them and drive their decisions around risk management in general.

- The majority of companies stated that they continue to focus on the company's own view of the economic liability of the guarantees, although many of these companies still do not hedge guarantees valued under SOP 03-1.
- Approximately one-third of companies focus primarily on GAAP/IFRS accounting.
- Other companies target a hybrid of economic and GAAP/IFRS accounting.
- One company maintained that statutory capital is their primary concern, and while other companies agreed that it is a concern, they did not view it as a candidate for a primary risk management target.
- Only one company uses a variation of MCEV as an actual risk management target.

There was no clear distinction between domestic and internationally owned companies with respect to risk management priorities. Mutual companies who report on a U.S. GAAP basis tend to have a lesser focus on U.S. GAAP than stock companies. We excluded certain mutual companies from this study because of this.

Our findings were similar to those presented in the results from a Society of Actuaries survey in 2007 (Gilbert 2007), which received the following number of responses for benchmarking objectives of hedging programs:

- Twelve companies listed economic risk
- Five companies listed GAAP/IFRS accounting volatility
- Six companies listed accounting levels (i.e., generally producing higher or lower reserves).

There also appears to be a trend following the 2008 financial crisis toward keeping a closer eye on GAAP/IFRS accounting, whereas before that time companies were less concerned with these accounting movements. The Geneva Association 2004 survey results (Dickinson 2004) predicted this.

We observed in the study that many companies will hedge only the guarantees they fair value under U.S. GAAP, despite a very similar economic risk profile in the guarantees that they account for under SOP 03-1. In many cases, this is true despite statements from the company that they are managing to economic risk, and not to accounting metrics. The only explanation that we have for this phenomenon is that companies are reluctant to create accounting volatility through the introduction of assets that create more volatility than the liability accounting basis, indicating another example of how accounting can significantly affect risk management practices.

For further discussion on the difficulty in operating in multiple regulatory regimes, see Hancock (2010) and Chopra (2009).

For further discussion on how companies can better integrate their risk management practices with financial management practices, see Halpert (2007).

Bibliography. How Accounting Can Encourage or Discourage Risk Management Practices

-
- 1 Chopra, Dinesh, et al. "Responding to the Variable Annuity Crisis." April 2009
http://www.mckinsey.com/~media/mckinsey/dotcom/client_service/Risk/Working%20papers/10_Responding_to_the_Variable_Annuity_Crisis.ashx

 - 2 Dickinson, Gerry, et al. "Impact of a Fair Value Financial Reporting System on Insurance Companies—A Survey." The Geneva Association, May 2004
<http://www.genevaassociation.org/ATF%20report%20survey.%20pdf.pdf>

 - 3 Gilbert, Charles, Ravindran, K., and Reitano, Robert. "Results of the Survey on Variable Annuity Hedging Programs for Life Insurance Companies." January 2007
<http://www.soa.org/files/research/projects/va-hedging-final-07.pdf>

 - 4 Halpert, Aaron, and Marlo, Leslie. "Linkage of Risk Management, Capital Management, and Financial Management." April 2007
<http://www.soa.org/research/research-projects/risk-management/research-linkage-rm.aspx>

 - 5 Hancock, Geoffrey, et al. "Observations on Emerging Variable Annuity Statutory Accounting Results." June 2010
http://www.oliverwyman.com/media/OW_FS_EN_2010_PUBL_VA_Accounting_Results.pdf

VI. Risk Management Techniques for Fair Value Liabilities

Over the course of the study, we categorized the risk management approaches into a standard framework that a company can apply to their own business. This framework is as follows:

- Accepting financial risk in liabilities
 - *Product mix*—The company decides whether it wants to be in a business that exposes it to systematic market risk, and what proportion of the business is permitted to have this exposure.
 - *Product design*—This is an ongoing effort where a company decides the extent of any guarantees and iteratively adjusts products after gaining experience and learning how policyholders will utilize the guaranteed benefits.
- Immunizing financial risk in liabilities
 - *Asset/liability management (ALM)*—This is a broad term that encompasses matching of duration or cash flows for any long-term liability.
 - *Hedging*—This is a subset of ALM where companies enter into derivatives that offset financial exposures in liability guarantees.
 - *Reinsurance*—This is also a form of immunization where the company still retains the business, but is indemnified by a reinsurer for all or a portion of the risks in the liabilities, replaced by credit risk of the reinsurer.
- Miscellaneous other techniques discussed below.

One can generally categorize risk management approaches in the industry at this time into the above framework. A strong risk management function will have this entire view at hand and make deliberate decisions about which strategy the company will choose and why.

The prevalence of each of these approaches listed above along with the advantages and disadvantages of each approach are discussed in more detail in sections VII–IX. We discuss ALM in section XI.

VII. Product Mix and Product Development

VII.A. Overview

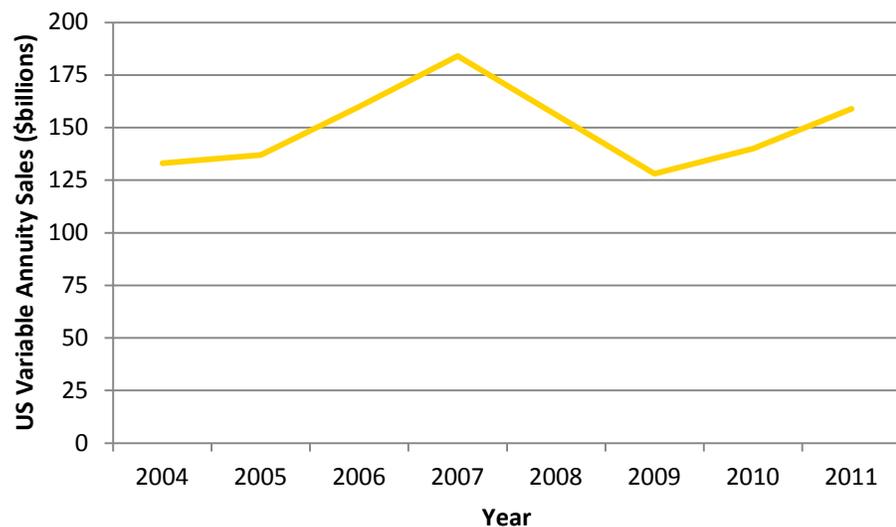
Based on our interaction with companies participating in the study, we observe that companies generally have some limit to the financial exposures that they are willing to underwrite:

- One company has a limit where they will not allow more than one-third of their inforce to contain significant financial guarantees.
- Several companies have told us that they are no longer issuing variable annuities or are scaling back on their exposures.
- None of the companies in the study was looking to aggressively expand new business sales of variable annuities, although several companies are moving ahead cautiously with new products and fully intend to remain active in this arena.

Figure 3 shows variable annuity sales in the United States over the last eight years.

Figure 3: U.S. Variable Annuity Sales 2004–2011

Source: U.S. Individual Annuities Sales Survey, LIMRA.



The variable annuity market in the United States is still undergoing a transition in the post-2008 era. Companies are enjoying reasonably favorable market movements at this time, but nonetheless most are proceeding cautiously with new products as they seek to regain investor confidence and develop products which are more predictable and have less tail risk exposure.

VII.B. Market-Consistent Value of New Business (MCVNB)

Companies are starting to make use of MCVNB in pricing. While most companies are using this technique for variable annuity guarantees, many European companies are using this technique for all products. A survey by the Society of Actuaries (Megregian 2010) confirms this general movement, although it notes that this is not necessarily companies' primary metric. One company that we spoke to noted that if the market moves and the MCVNB drops below zero, they try as quickly as possible to adjust their prices and/or cut off sales.

The use of MCVNB has a twofold impact on reducing volatility in the market-consistent balance sheet:

- Because companies can avoid selling products with a negative economic value, this prevents negative volatility resulting from inclusion of new business.
- This also limits the volume of business that is sold, which dampens volatility in future earnings as there will be a lower proportion of business exposed to market volatility.

VII.C. Trends in Variable Annuity Product Design

There have been numerous trends in the market for variable annuities over the last few years:

- Severely reduced ratchets and rollups
- Insurance companies are generally becoming much more restrictive in the types of funds that are available in variable annuities:
 - a. Companies can more closely align the fund choices with tradable indices to limit basis risk in hedging programs.
 - b. We have seen widespread adoption of target volatility funds, or other similar designs intended to embed tail risk protection directly into the fund. The concept is that the fund should always have a target level of volatility, so when implied volatilities in the market rise (which is generally associated with a market downturn) the proportion of equities within the fund decreases and the proportion of fixed income rises. To some extent, this approach locks in the loss before it becomes significant during a market downturn, although volatility is not entirely eliminated. The potential for larger movements in account value returns as the market stabilizes and volatility returns to historical levels.
 - c. One company performs the reallocation procedure automatically across the entire account rather than within a single fund.
 - d. There are generally more restrictions in exposure to higher volatility funds.

Available literature also recommends additional approaches to minimizing risk associated with variable annuities:

- Companies can consider setting up fee structures in a way that they are either not tied to the account value or designed to be countercyclical to market movements (Alleyne 2011).
- Companies should account for the cost of hedging in the pricing process and preferably model it explicitly (Alleyne 2011; Zhang 2010; Chopra 2009).
- Companies should take into account how policyholders may react to guarantees under different market conditions and eliminate any guarantees for which behavior is particularly difficult to predict, or which contain a potential for extreme tail risk (Alleyne 2011).

Bibliography. Product Mix and Product Development

-
- 1 Alleyne, Jason, Neff, Ben and Ying, Min. "Perspectives on Variable Annuity Guarantees." *Risk Management*, March 2011
<http://soa.org/library/newsletters/risk-management-newsletter/2011/march/jrm-2011-iss21.pdf>

 - 2 Megregian, Donna, et al. 2010. "Survey of Reflecting Risk in Pricing." September 2010 <http://www.soa.org/research/research-projects/risk-management/research-reflecting-risk-pricing.aspx>

 - 3 Zhang, Frank. "Integrating Robust Risk Management Into Pricing: New Thinking for VA Writers." *Risk and Rewards*, February 2010
<http://www.soa.org/library/newsletters/risks-and-rewards/2010/february/rar-2010-iss55.pdf>

VIII. Hedging

VIII.A. Common Hedging Practices

Hedging has become standard practice for a number of products:

- Hedging is nearly universal among variable annuity writers, although most companies do not hedge business that they do not account for at fair value under their main external accounting regime, i.e., U.S. GAAP or IFRS.
- Companies often hedge interest rate risk embedded in long-term care products using forward starting swaps or interest rate swaps.
- Companies typically hedge equity indexed annuity and life guarantees by purchasing call options to replicate the policyholder option.

Companies also often set up a “macro hedge” or “capital hedge,” which consists of out-of-the-money put options to protect total company capital from a significant market downturn. This is not specific to any single product, although typically variable annuities can generate much of the overall company exposure requiring the macro hedge. While companies are not purchasing a macro hedge to protect against earnings volatility, in a significant market downturn it will likely have that effect as well to some degree.

Companies do not typically hedge liabilities discussed in Table 1, including stable value products and certain reinsurance-related derivatives.

As noted, hedging is nearly universal among variable annuity writers. In Table 3, we expand on hedging practices for the basic set of market risks in these products, each denoted by the Greek letter that practitioners commonly use to refer to them.

Table 3: Hedging Practices for Variable Annuities That Are Fair Valued under U.S. GAAP

Greek Letter	Description	Typical Hedge Instrument	Prevalence of Hedging
Delta	Market price risk	Short futures and some total return swaps	Almost universal
Gamma	Second-order market price risk	Put options	Less than 25%
Vega	Implied volatility risk	Variance swaps and put options	Less than 50%
Rho	Interest rate risk	Interest rate swaps and some swaptions	Very common
Cross-greeks	Other second-order risk	Custom derivative from banks	Uncommon

Note that U.S. subsidiaries of European insurance companies have a similar profile to U.S. domestic insurance companies in terms of the prevalence of hedging. This information is based on discussions with companies in this study.

The general rule that we have observed is that insurance companies are hedging the risks that they consider feasible to hedge:

- Insurance companies consider long-dated options and variance swaps to be overpriced; put another way, they tend to consider the implied volatilities to be unreasonable.
- The cross-greeks do not have tradable instruments, and while companies can purchase customized derivatives from the banks, they are generally reluctant to do so, because of the cost and complexity of such a transaction.
- Even where a company can tightly match an index, in many cases (particularly for older blocks of business), the index movements do not correspond well to changes in the funds. Some indices are not even tradable (e.g., EAFE) and require additional mappings in order to hedge. Some companies hedge using total return swaps for funds that are not tradable using futures.
- Some companies do not fully hedge interest rate risk, particularly on non-fair valued liabilities, because they believe that interest rates will rise from the current historic lows.

A recent survey by Towers Watson (Czernicki 2011) found that the following proportions of common variable annuity guarantees in the United States are hedged:

- Death benefits: 63%
- Income benefits: 68%
- Accumulation benefits: 100%
- Withdrawal benefits: 100%.

Note that companies do not typically fair value death benefits and income benefits under U.S. GAAP or IFRS. Our own study shows that while the proportion of products that are hedged to some degree may be as high as two-thirds, companies are typically only hedging a small proportion of the financial risk in those products, whereas for accumulation benefits and withdrawal benefits, companies largely hedge first-order price risk and interest rate risk.

Some other features of the variable annuity hedging programs include the following:

- Most insurers dynamically hedge. This means that they rebalance periodically. Standard practice in the industry is to perform runs overnight to calculate the current asset and liability Greeks, and use a formulaic approach to determine intraday positions. Companies do not necessarily rebalance daily. We did not collect information on trading patterns in our study. The 2007 survey commissioned by the Society of Actuaries (Gilbert 2007) found that two-thirds of companies that hedge do so approximately daily and one-third trade monthly. This has likely shifted toward more frequent trading patterns over the last five years.
- None of the companies in the study include nonperformance risk in the hedging program and sometimes exclude risk margins as well, and they report the breakage resulting under U.S. GAAP as it occurs.
- The majority of companies in the study use unadjusted implied volatilities to calculate the hedge target, even when they do not actively hedge implied volatility. Other companies use modified forms that they believe are more realistic and less volatile.

VIII.B. Variable Annuity Hedging Effectiveness

Companies generally consider variable annuity hedging programs highly effective at immunizing financial risks. There are two potential methods for measuring effectiveness of a hedging program that are common in practice:

- *Effectiveness relative to the overall financial risk in the liabilities*—This is typically a CRO or CFO perspective, where companies base their risk management strategy and even product design on the proportion of the financial risks they can reasonably expect to hedge.
- *Effectiveness relative to the financial risk in the liabilities that the hedging program is attempting to immunize*—This is a hedging program perspective, where a hedging program measures its own effectiveness relative to its goals. For example, it is not useful for a hedging program to continually flog itself for gains/losses arising from cross-greeks if they are not hedging these risks. The theory is that those losses sit with the CRO or other governance body that chose to expose the company to that risk.

It was estimated (Sun 2008) that during the September 2008–October 2008 period of the recent financial crisis, variable annuity hedging programs were 93% effective relative to the hedged risks in the liability. Anecdotal evidence collected for this study indicates that effectiveness relative to hedged liabilities in the last two years is closer to 100%.

In some cases, the investment function directs the hedge function at a company not to fully hedge a risk in order to align with the company’s view on future market direction (see our comment on interest rate risk earlier in this section). When this is the case, the hedge program

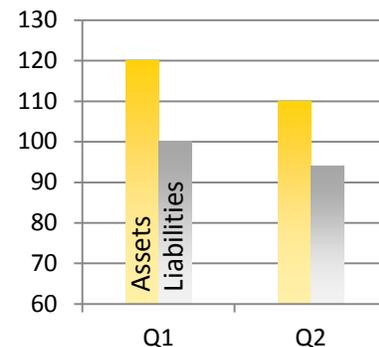
can calculate the hedged earnings as if the risk was fully hedged, and separately calculate the earnings from a hypothetical offsetting derivative. With this approach, the hedge program can measure its own effectiveness as if they were fully hedged, and the investment function will be assigned ownership of earnings from the offsetting derivative.

VIII.C. Other Challenges in Variable Annuity Hedging

Companies face the following challenges with hedging operations:

- Hedging requires a significant investment by the company, specific skills sets, a process spanning multiple departments, models used by multiple departments, and careful controls around the entire operation.
- Companies must exercise judgment when hedging with illiquid instruments.
- Currently it is not always straightforward to offset market exposures in funds available to variable annuities. This is becoming less of an issue due to product design changes, discussed above.
- Hedging depends on an accurate prediction of policyholder behavior. Unfortunately, much of the behavior is dynamic, and we certainly have not experienced every combination of market movements in the past 15 years, so uncertainty in policyholder behavior remains an issue. Note that overestimating utilization of benefits is not much better than underestimating it with respect to earnings volatility.
- Hedging can make accounting movements harder to interpret, as the net result from a market movement can go in either direction depending on the basis difference between the liability and hedge assets. For example, suppose that equity markets rise 10% over three months. Investors will likely expect the company to produce positive earnings as the fair value of insurance company liabilities drops. However, in this example, further suppose that a company's fund manager underperforms by 4%, so fund values only rise by 6%. If the company is 100% hedged using market instruments, the fair value liability will decrease less than expected, but the derivatives will produce an even larger loss. This places the company in an awkward position, having to explain how they lost money in an up-market.
- Companies currently require a significant amount of computing capacity to recalculate greeks daily. Additionally, certain accounting metrics may require nested stochastic

Figure 4: Illustrated Impact of Market Movements



calculations that are even more calculation intensive, such as Canadian GAAP reserves, Liability Adequacy Testing under IFRS 4, or cash flow testing in U.S. statutory accounting. Companies use up to hundreds of servers to perform these runs in a grid environment, and maintaining this grid environment poses IT challenges. See Rosner (2010) and Czernicki (2008) for further discussion on how companies alleviate computational demands.

See Ravindran (2007) and Czernicki (2011) for further discussion around the challenges faced by hedging programs.

VIII.D. Challenges in Hedging Other Products

We noted earlier that most companies are unwilling to hedge variable annuity guarantees that they value under SOP 03-1, because they want to avoid creating accounting volatility. Long-term care is another product that companies do not tend to fair value under U.S. GAAP or IFRS, yet many companies hedge a significant amount of the interest rate risk. One reason they do this is because they have been successful in obtaining hedge accounting treatment for the interest rate swaps and forward starting swaps under U.S. GAAP and IFRS. This means that because they do not fair value the liabilities, they also do not fair value the changes in the purchased derivatives through net income. At this time, we are not aware of any companies that have successfully obtained hedge accounting treatment for derivatives backing SOP 03-1 liabilities.

To the extent that companies dynamically hedge equity indexed annuity and life guarantees, which is infrequent, the hedging program is affected by many of the same challenges as variable annuities listed above.

When hedging equity indexed annuity and life guarantees relies on the purchase of long-dated index options, companies currently face an accounting mismatch under U.S. GAAP. Companies design annual reset equity indexed annuity and life products so they can purchase options one year at a time. Each year, they essentially reprice the product and purchase a new set of options, based on the inforce at the time. However, for their U.S. GAAP liabilities, companies tend to project the guarantees over the life of the contract. The projected guarantees beyond the first year have no offsetting derivative exposure in place (since the companies purchase those options at a later date). This creates volatility on the income statement and balance sheet.

Bibliography. Hedging

-
- 1 Chopra, Dinesh, et al. "Responding to the Variable Annuity Crisis." April 2009
http://www.mckinsey.com/~media/mckinsey/dotcom/client_service/Risk/Working%20papers/10_Responding_to_the_Variable_Annuity_Crisis.ashx

-
- 2 Czernicki, Dave, and Maloof, David. "Variable Annuity Hedging Practices in North America." October 2011
http://www.towerswatson.com/assets/pdf/5567/Towers-Watson_Insights-Variable-Annuity-Hedging.pdf
-
- 3 Czernicki, Dave, and Maloof, David. "Practical Variable Annuity Hedging." October 2008
http://www.towersperrin.com/tp/getwebcachedoc?webc=USA/2008/200810/Emp83_Hedging_Final.pdf
-
- 4 Rosner, Bruce. "Model Efficiency Study Results." November 2011
<http://www.soa.org/Files/Research/Projects/research-2011-11-model-eff-report.pdf>
-
- 5 Sun, Peter, and Mungan, Ken. "Performance of Insurance Company Hedging Programs during the Recent Capital Market Crisis." November 2008
<http://publications.milliman.com/research/life-rr/pdfs/performance-insurance-company-hedging-rr12-01-08.pdf>

IX. Reinsurance

IX.A. An Illustration

Very few new reinsurance agreements for variable annuities have been executed since the financial crisis in 2008.

To understand this, we take the example of ABC Life, which has a large block of legacy variable annuities. They seek to immunize themselves against financial risks. Here 50 percent of the guarantees are death benefits they account for under SOP 03-1, and 50 percent are withdrawal benefits they account for at fair value under FAS 133.

The company determines that the block has an expected one-time hedge cost of \$2 billion, and all other cash flows net exactly to zero. ABC Life approaches a reinsurance company, and the reinsurer quotes them \$2 billion, as they did the same calculation and are willing to break even.

Based on discussions with insurance companies and reinsurance companies in this study, the following thought process underscores the lack of reinsurance today:

1. ABC Life currently accounts for some of the guarantees under SOP 03-1, which tends to produce a reserve that is lower than a fair value liability and is less volatile. The reinsurer will typically price on a market-consistent basis that is closer to fair value. If ABC Life purchases reinsurance, they will set up a prepaid reinsurance asset to defer the loss over the life of the policies.
 - ABC Life is unwilling to cede the business accounted for under SOP 03-1, because they do not want to lock in the future loss. They may be willing to cede the business that they are already fair valuing.
2. Hedging only immunizes financial risk, whereas reinsurance immunizes against policyholder behavior as well. This means that (a) the reinsurer will want additional compensation beyond the cost of hedging and (b) the reinsurer has the luxury to refuse legacy blocks that may have some of the more “toxic” benefits, i.e., less predictable behavior.
 - ABC Life is aware that their business is somewhat unpredictable and may be willing to pay the extra cost, but the reinsurance company declines to quote on the risk.
3. One of the drivers of reinsurance typically is that there are economies of scale gained by shifting the risk management to a reinsurer. This allows smaller companies to take on mortality risk, for example, knowing that they will be able to cede the business at a

reasonable rate. However, the current market for variable annuities is dominated by large companies, which are capable of sustaining hedging programs.

- ABC Life is large enough that they do not consider the cost of operating a hedging program to be a significant deterrent.
4. Another driver of reinsurance is typically that mortality and morbidity experience converge to the mean when the company aggregates enough lives, following the law of large numbers. This logic does not apply to the financial risks in variable annuities, as these are systematic risks, and the law of large numbers applies only to independent variables.
 5. Many direct insurers are still willing to sell variable annuity business at a loss under market-consistent measurement in order to stay in the market. Reinsurers are less willing to do this, creating a pricing gap between direct insurers and reinsurers. Additionally, there is potential for an informational asymmetry problem, where past revisions to estimates leaves reinsurance companies concerned that there may be further surprises.
 - This highlights why the above example where the reinsurer is willing to break even is unlikely. Typically, reinsurers would want to charge more than the hedge cost for the reasons mentioned, and ABC Life would not be willing to bridge this price gap.

Despite this, some reinsurance activity does take place. Specific reasons can be identified why it may still make sense to reinsure business at this time:

1. Smaller companies may have a need to issue products with financial guarantees but may not be ready or have the skill set to perform hedging operations.
2. Companies that are underweight on insurance risk (C-2) and overweight on financial risks may be able to gain Risk-Based Capital (RBC) efficiency by balancing the components of the RBC formula.¹⁴

¹⁴ The NAIC RBC formula for the company action level is as follows:
 $C0 + [(C1o + C3a)^2 + (C1cs)^2 + (C2)^2 + (C3b)^2 + (C4b)^2]^{.5} + C4a$,
where

C0: Insurance affiliate investment and (nonderivative) off-balance sheet risk
C1cs: Invested common stock asset risk
C1o: Invested asset risk, plus reinsurance credit risk except for assets in C1cs
C2: Insurance risk
C3a: Interest rate risk
C3b: Health provider credit risk
C4a: Business risk—guaranty fund assessment and separate account risks
C4b: Business risk—health administrative expense risk

(http://www.actuary.org/pdf/finreport/jrbc_12feb02.pdf).

3. Companies tend to take full credit in statutory reporting for coinsurance arrangements, whereas hedging may not materially reduce AG43 and C3 Phase II requirements.

See Tucker (2011) for further analysis of where reinsurance may be helpful in the current environment.

IX.B. Potential Drivers for Change

With this understanding of the obstacles in mind, the following changes to the variable annuity marketplace may result in a more vibrant market for reinsurance:

1. As companies gain a better understanding of the tail risks in the newer products, reinsurers may become more amenable to taking on this business.
2. Once an active reinsurance marketplace exists, smaller companies may become willing to write business anticipating that they can obtain reinsurance, further improving the market.
3. If interest rates rise, the reinsurance pricing (which is generally based on fair value) will become more in line with insurance company pricing.
4. As it becomes more common to price business so that the MCVNB is always positive, direct writers will likely price their new business more in line with how reinsurers price it.
5. New forms of reinsurance may be developed that limit the reinsurer's tail risk coming from policyholder activity. For income benefits, reinsurers may design treaties that pay over the life of the annuity. This might cause companies to account for their assets and liabilities on a more parallel basis.

Bibliography. Reinsurance

-
- 1 Tucker, Rich, and Paris, Tim. "State of the Variable Annuity Reinsurance Market in 2010." *Reinsurance News*, Issue 69, January 2011
<http://www.soa.org/library/newsletters/reinsurance-section-news/2011/january/rsn-2011-iss69.pdf>

X. Other Risk Management Techniques

X.A. Management Compensation

Swiss Re is one company that we are aware of that ties variable compensation to their economic value measurement (EVM) results (a variation on MCEV). Swiss Re's 2011 annual report¹⁵ states the following:

The payout factor on the VAI [Value Alignment Incentive, paid out over three years] is based on EVM results—EVM is used to evaluate price, reserve and steer the business decisions within Swiss Re. As EVM recognizes all cash flows associated with a contract upfront, measuring the VAI over the following three years enables a clawback of VAI if development is lower than expected; conversely, if performance is higher than expected, a premium will apply. The VAI tracks the EVM Profit Margin over the subsequent three years after grant.

This practice may be a prelude to similar changes across the industry, as accounting standards become more market-consistent. It is possible that management at companies with this practice will pay extra attention to volatility in market-consistent results, since it affects their pay.

X.B. Accounting Presentation

Over the last few years, many companies have begun to move earnings from hedged risks in variable annuities under U.S. GAAP, IFRS, and MCEV into nonoperating income. Operating income tends to include the gains/losses that would occur hypothetically if markets behaved exactly as anticipated by the company. The deviation in liability movement and hedge asset movement between actual market movement and expected market movement falls into nonoperating income.

This is, in fact, a trend in the opposite direction of the item noted under section X.A. Most of these companies that are removing hedged risks from operating income are compensating management, based on operating income.

Table 4 shows a sample consolidated MCEV earnings statement from the Munich Re 2011 MCEV Annual Report.^{16 17} We see operating results of €2,426, with an economic variance of -€3,904.

¹⁵ http://files.swissre.com/annualreport/downloads/financial-report/eng/swiss-re-annual-report-2011_financial-report.pdf

¹⁶ http://www.munichre.com/app_pages/www/@res/pdf/ir/publications/reports/2011_mcev_report_en.pdf

¹⁷ This study analyzed financial statements from several companies. We show an excerpt from Munich Re's financial statements example of how the information is typically presented.

Table 4: Munich Re 2011 MCEV Economic Earnings Variance

€m	
Market Consistent Embedded Value 31.12.2010	12,393
Opening adjustments	-261
Adjusted MCEV 31.12.2010	12,132
Value of new business	680
Expected return at reference rate	224
Experience variances	378
Assumption changes	396
Other operating variance	419
Operating MCEV earnings 2011	2,426
Economic variances	-3,904
Other non-operating variance	13
Total MCEV earnings 2011	-1,465
Closing adjustments	200
Market Consistent Embedded Value 31,12,2011	10,867
<hr/>	
IFRS equity excluding goodwill	9,777
Value not recognized in IFRS equity	1,090

The Munich Re annual report does not quantify the exact sources of the economic variance, but does provide some explanation highlighting the key factors resulting in this movement during 2011 including the value of in-force covered business (VIF):

The poor economic variances refer almost entirely to the VIF, and are mainly due to the extraordinary widening of spreads between government bonds and swap rates in many European countries, coupled with lower interest rates, higher interest-rate volatilities and higher corporate bond spreads. In particular, the disruptions on government bond spreads have a significant impact on the valuation of the VIF which, according to our current methodology based on swap rates, does not benefit on the liability side from higher returns offered by government bonds, but on the contrary is depressed on the asset side by lower market values of government bonds in our investment portfolio.

Similarly, Lincoln Financial Group noted the following regarding operating income for U.S. GAAP:¹⁸

Segment operating revenues and income (loss) from operations are internal measures used by our management and Board of Directors to evaluate and assess the results of

¹⁸ <https://www.lfg.com/LincolnPageServer?LFGPage=/lfg/acc/abt/ivrel/gaaprpt/index.html>

our segments. Income (loss) from operations is GAAP net income excluding the after-tax effects of the following items, as applicable:

- Realized gains and losses associated with the following (“excluded realized gain (loss)”):
 - Sale or disposal of securities
 - Impairments of securities;
 - Change in the fair value of derivative instruments, embedded derivatives within certain reinsurance arrangements and our trading securities;
 - Change in the fair value of the derivatives we own to hedge our GDB riders within our variable annuities;
 - Change in the GLB embedded derivative reserves, net of the change in the fair value of the derivatives we own to hedge the changes in the embedded derivative reserves; and
 - Changes in the fair value of the embedded derivative liabilities related to index call options we may purchase in the future to hedge contract holder index allocations applicable to future reset periods for our indexed annuity products accounted for under the Derivatives and Hedging and the Fair Value Measurements and Disclosures Topics of the FASB ASC.

This provides a means for the company to help analysts and investors distinguish between profits that reflect changes in how the business was managed during 2011 and changes that reflect market movements that are out of management’s direct control.

X.C. Liquidity Premium

The liquidity premium is arguably the most elusive concept in market-consistent frameworks. The basic concept is that a spread is added onto the risk-free rate because the investor requires additional return for investing money in an illiquid instrument (the insurance contract).

The American Academy of Actuaries practice note on MCEV¹⁹ discusses approaches used in practice to determine the liquidity premium. The CFO Forum also provides guidance for determining the liquidity premium for use under Solvency II.²⁰

Spreads include three basic components: expected losses from default (1), the liquidity premium (2), and a risk premium, which is the additional spread required for investors to invest in a risky

¹⁹ <http://www.actuary.org/files/MCEV%20Practice%20Note%20Final%20WEB%20031611.4.pdf/MCEV%20Practice%20Note%20Final%20WEB%20031611.4.pdf>

²⁰ http://ec.europa.eu/internal_market/insurance/docs/solvency/qis5/cfo-forum-cro-forum-paper-risk-free-rates_en.pdf

security (3). When spreads rise, typically only a portion of that is due to a true expectation of higher defaults. If some of that increase comes from the liquidity premium, then applying an approach that increases the liquidity premium when spreads rise can create a natural offset to mitigate earnings volatility. See Appendix C for further discussion on discount rates and an illustration showing how liquidity premiums fit into the general interest rate framework.

Various industry articles, including Paton (2011) and Foroughi (2009), express concern over ambiguity in the liquidity premium.

Bibliography. Other Risk Management Techniques

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- 1 Foroughi, Kamran, et al. "Revised MCEV Principles Include Liquidity Premium." October 2009
http://www.towersperrin.com/tp/getwebcachedoc?webc=GBR/2009/200911/Final_10-29-09_Update_MCEV_liquidity_premium.pdf

 - 2 Paton, Brian. "Communicating under Revised Insurance Accounting Proposals." *The Financial Reporter*, Issue 86, September 2011
<http://www.soa.org/Library/Newsletters/Financial-Reporter/2011/September/frn-2011-iss86.pdf>

XI. Upcoming Changes to Accounting and Solvency Standards

While European insurance companies do generally calculate MCEV and use it for product pricing decisions, it has not been a major driver of risk management decisions on in force blocks. However, the upcoming insurance contracts accounting standards using current fulfillment value and Solvency II using exit value are expected to significantly increase the proportion of the balance sheet that companies value using market-consistent elements.

The sections below address potential effects of the upcoming standards on insurance company risk mitigation behavior through pricing, hedging, and reinsurance.

XI.A. Pricing

Companies participating in this study generally did not have an opinion as to whether the upcoming insurance contracts accounting standards would drive them to make any changes to their products. This was not for lack of interest in the topic—nearly every company had an unfavorable view of applying market-consistent accounting techniques to their long-term business. They generally believed rather strongly that the increased accounting volatility would not be reflective of the long-term nature of the business and the way that they manage that business.

XI.B. ALM and Hedging

It is generally unknown how ALM and hedging behavior will change in light of the upcoming standards. However, it is reasonable to expect that there will be incentives for companies to more tightly match asset and liability duration on any long-term business that becomes sensitive to risk-free rates through discounting. On the other hand, companies in the United States will still need to pay attention to statutory accounting that is not market-consistent.

A separate issue that may arise is that some long-term businesses like long-term care can have material cash flows extending beyond the period that companies can immunize using liquid instruments like bonds, interest rate swaps, and forward starting swaps (currently up to 30 years in the United States). Companies in the study noted this as a concern, possibly putting them in a position where the new accounting standards inherently create volatility for certain products, and are not reflective of the long-term nature of this business (Dickinson 2004).

One potential remedy for this issue suggested by a company participating in this study may be projecting very low interest rates beyond 30 years for pricing purposes, so that any deviation from experience will likely be positive. This is only a partial remedy, as the upcoming insurance contract accounting standards will likely require market-consistent discount rates, so the volatility will exist regardless of any steady positive earnings coming from release of this interest rate margin over the life of the contract.

XI.C. Reinsurance

It is generally unknown how reinsurance will change in light of the upcoming insurance contracts accounting standards. However, it is reasonable to expect certain influences:

- There will be a level playing field between most insurance companies and reinsurers, as they will likely account for all business in a similar manner. As an example, there will not be an accounting mismatch for variable annuity guaranteed minimum income benefits between the direct liability and the reinsurance ceded asset. Note that there will still be statutory accounting differences across states and countries.
- Conversely, reinsurance companies based in the United States currently have an advantage in taking on fixed business issued by Canadian-domiciled companies. This is because Canadian GAAP tends to have some sensitivity to market prices. If the United States and Canada achieve convergence, they will lose that advantage.
- Companies may seek more tightly matched ALM, and reinsurance is one means to do this.

XI.D. Features of the Insurance Contracts Accounting That Impact Risk Mitigation Practices

Note that there are still likely to be accounting mismatches in the insurance contracts standards under U.S. GAAP and IFRS. These impacts will likely have an impact on hedging, just as they do today.

The FASB and IASB are currently considering whether companies should account for liability changes resulting from changes in the liability discount rate through Other Comprehensive Income instead of through net income.²¹ If the boards allow this and also allow companies to hold many of its general account assets as available for sale, the future income statement will be closer to amortized cost, since volatility will go through the balance sheet instead of the income statement.

However, this method is not foolproof, since there may still be accounting mismatches. For example, insurance companies are not likely to characterize all of its assets as available for sale.

XI.E. Is Market-Consistent Accounting Appropriate for Insurance Liabilities?

Market-consistent accounting produces a value that is consistent with the price of related financial instruments in the market. The intention is that all companies (e.g., banks and insurance companies) will account for their business on the same basis. This should increase

²¹ <http://www.ifrs.org/Updates/IASB-Updates/Documents/IASBupdateMay20122.pdf>

transparency and comparability, as well as highlight areas of increased risk. That is the theory; in practice:

- Companies in this study do not believe that market-consistent accounting actually produces more transparent results, and they tend to remove the impact of market movements from operating earnings to improve clarity.
- The various market-consistent accounting frameworks continue to incorporate ambiguous elements (e.g., the liquidity premium), which interfere with consistency between companies and between industries.
- The majority of companies in this study are not in favor of market-consistent valuation for insurance liabilities, since they largely believe the methodology is not reflective of the long-term nature of their business and produces short-term results that are out of management's control. A minority are in favor, citing reduction in balance sheet and earnings volatility after incorporating appropriate asset/liability matching, including hedging.

Bibliography. Upcoming Changes to Accounting and Solvency Standards

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- 1 Dickinson, Gerry, et al. "Impact of a Fair Value Financial Reporting System on Insurance Companies—A Survey." The Geneva Association, May 2004
<http://www.genevaassociation.org/ATF%20report%20survey.%20pdf.pdf>

XII. Appendix A: Theoretical Foundations of Risk Management

It is impossible to fully disassociate the activities that companies undertake to mitigate accounting volatility and the activities that are used for true risk management. Therefore, we provide an overview of the underlying principles that drive risk management, and use this to understand where these principles may drive a company to focus on managing accounting volatility.

In a 1958 paper “The Cost of Capital, Corporation Finance and the Theory of Investment,” (later extended in 1961 and 1963), Modigliani and Miller (1958) proposed that leverage is irrelevant to the value of a company. They hypothesized that if an investor can reproduce the investment activities undertaken by the company, then investors can leverage up or down on their own, making the investment and capital decisions by the company irrelevant to the investor. This would hold true regardless of the utility function of the investor (risk averse versus risk neutral).

This argument will likewise hold true for an insurance company engaging in any activity intended to reduce variability in earnings (hedging, diversification). If investors could reproduce the company’s hedging program on their own, they would be indifferent to whether or not an insurance company undertakes a hedging program.

This argument as applied to insurance company hedging practices is based on several assumptions, all of which are false:

- There is no additional cost associated with financial distress.
- Individuals and corporations have access to the same securities at the same interest rates, and there are no transaction costs.
- There are no agency problems.

XII.A. Costs Associated with Financial Distress

The reality is that when a company is in or near bankruptcy, it generally incurs additional costs. In the broader market, any particular costs associated with financial distress are not considered overly material; however, for an insurance company, this can be a major factor in the decision to hedge. Insurance companies operate in a highly regulated environment, and if a company’s assets fall below certain thresholds relative to the liabilities, the insurance company can experience the following costs:

- Negative publicity and reduced ratings from rating agencies, indirectly resulting in less aggressive pricing on new products and more difficulty retaining existing policyholders
- Direct costs of legal and administrative overhead from dealing with regulators
- Distraction of managing financial distress causes company to miss business opportunities.

There is no apparent link between cost of financial distress and whether a company reports liabilities at fair value.

XII.B. Corporations Have Preferential Access to Capital Markets

The argument that hedging activities are irrelevant applies only to a normal, risk-averse investor when that investor is capable of performing those hedging activities independently. For reasons not discussed here, an average investor is not capable of hedging shares in an insurance company that contain embedded exposure to market risk.

There is no apparent link between access to capital markets and whether a company reports liabilities at fair value.

XII.C. Agency Problems

The agency problem can be split into two components:

1. Management goals are not aligned with those of investors
 - It has been generally established that management is more risk averse than a typical investor, because management has more at stake than the average investor.
2. Investor's lack of insight into the company
 - Investors may not have the ability to interpret accounting movements and will therefore discount the value of a company that produces highly volatile (unpredictable) earnings.

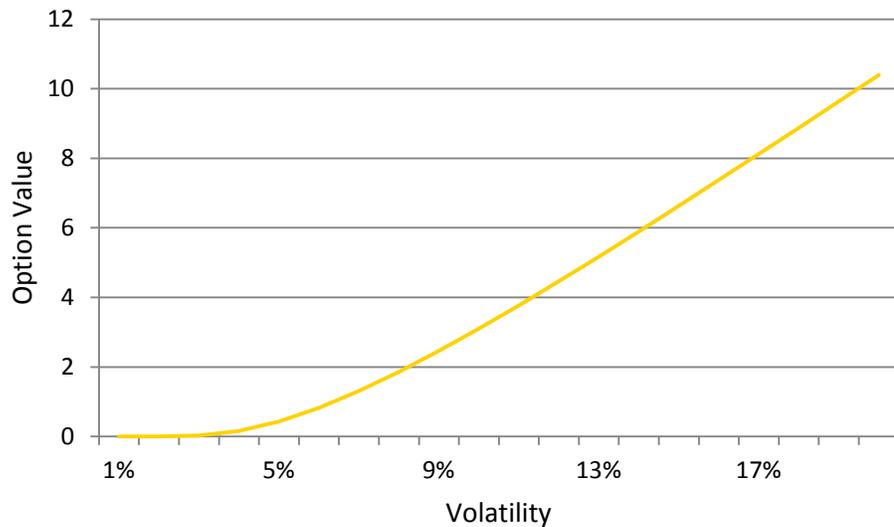
From a theoretical standpoint, it is possible that the expanding use of fair value can result in an increase in hedging activity due to management's desire to provide the appearance of predictability in earnings.

Our analysis above draws on Viklund (2006) and adapts the arguments to the insurance industry. Glavan (2011) also discusses these topics.

XIII. Appendix B: Illustration of Put Option Value Relative to Volatility

We illustrate in Figure 5 how a sample put option value is proportional to the underlying volatility assumption. This sample put option is a European option with five-year term and strike price of \$100, currently at the money, and assumes a 3% risk-free rate.

Figure 5: Put Option Value at Different Levels of Volatility

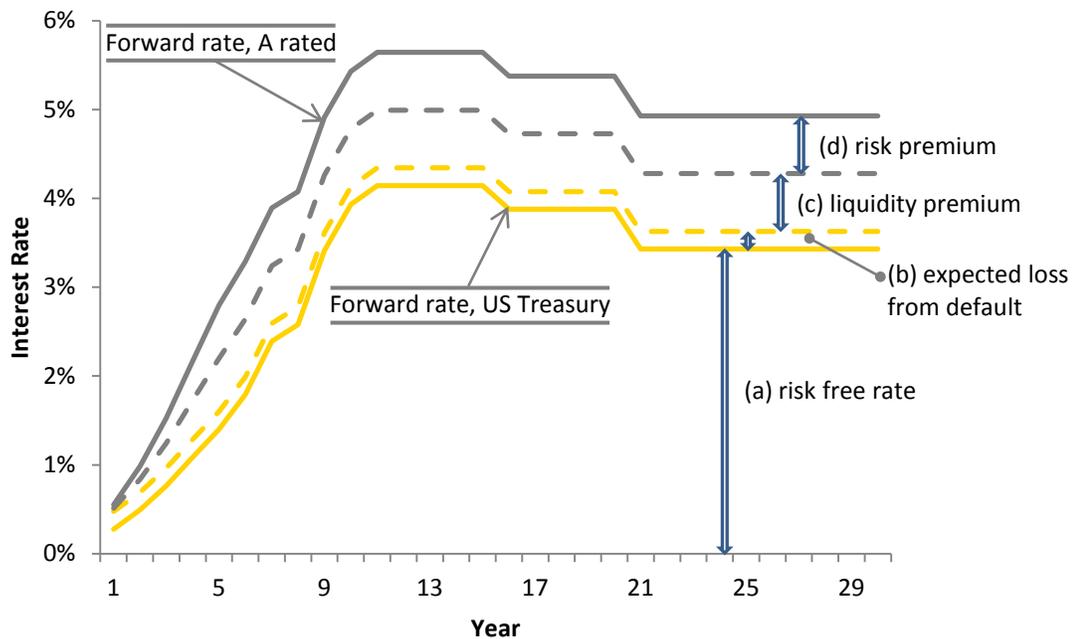


Notice that at zero volatility, an at-the-money put option has zero value because it is impossible to result in a payoff. As the volatility rises, the likelihood of a payoff increases as well, resulting in increased values for the put option.

XIV. Appendix C: Use of Discount Rates in Market-Consistent Accounting

The calculation of interest rates used for discounting varies even among market-consistent accounting frameworks. Figure 6 illustrates some of the components of an interest rate.

Figure 6: Sample Illustration of the Components of an Interest Rate



Actuaries often split interest rates into the risk-free rate (a) and the spread (b + c + d). In Figure 6, we further decompose a sample asset spread into expected losses from default (b), the liquidity premium (c), and the risk premium, which is the additional spread required for investors to invest in a risky security (d).

Actuaries generally view the risk-free rate as an observable factor, typically drawing from the swap curve or the U.S. Treasury curve. However, it is likely that both of those curves are not truly risk-free, which the CFO Forum discusses in a paper on risk-free rates.²²

Companies can observe expected loss from default using historical data. Companies can review industry data to determine the probability of a loss in each of the rating agency categories, as well as the loss given default percentage, and combine these to determine the expected losses that will occur through defaults.

²² http://ec.europa.eu/internal_market/insurance/docs/solvency/qis5/cfo-forum-cro-forum-paper-risk-free-rates_en.pdf

The remaining components of the spread, liquidity premium (c) and risk premium (d), are not directly observable. As noted in section X.C, the American Academy of Actuaries produced a paper on the liquidity premium, but the various approaches that they discuss can result in very different answers, so a substantial amount of ambiguity remains.

Table 5 provides an overview of how the insurance industry generally determines the discount rates used in selected accounting bases.

Table 5: Overview of Discount Rates

Accounting Basis	Description
U.S. GAAP FAS 133/157	Risk free rate + insurance company nonperformance risk.
U.S. GAAP SOP 03-1 (non-fair value)	Liability crediting rate, which is usually derived from the expected asset portfolio earned rate at issue, less a profit margin.
MCEV	Typically, risk-free rate + a liquidity premium for some liabilities. Some companies use a top-down approach similar to what they anticipate using for insurance contracts accounting, and some companies use the same approach that they anticipate using for Solvency II. See the Academy of Actuaries' MCEV practice note, which discusses approaches to calculate the liquidity premium. ²³
Anticipated Solvency II standard	<p>Companies are considering two approaches:</p> <ul style="list-style-type: none"> • Risk free rate + matching adjustment (the matching adjustment corresponds to the liquidity premium in our illustration above) • Risk free rate + a countercyclical premium to be applied in times of stress, as determined by the regulator <p>An industry report is anticipated in early 2013 that will lay out the various options in more detail.</p>
Anticipated insurance contracts accounting	<p>Companies have two options:</p> <ul style="list-style-type: none"> • <i>Bottom-up</i>. Risk free rate + liquidity premium • <i>Top-down</i>. Earned rate less expected and unexpected defaults (unexpected defaults corresponds to the risk premium in our illustration above) <p>Guidance continues to evolve.</p>

²³ <http://www.actuary.org/files/MCEV%20Practice%20Note%20Final%20WEB%20031611.4.pdf/MCEV%20Practice%20Note%20Final%20WEB%20031611.4.pdf>

XV. Appendix D: Bibliography

Alleyne, Jason, Neff, Ben, and Ying, Min. "Perspectives on Variable Annuity Guarantees." *Risk Management*, March 2011

<http://soa.org/library/newsletters/risk-management-newsletter/2011/march/jrm-2011-iss21.pdf>

Chopra, Dinesh, et al. "Responding to the Variable Annuity Crisis." April 2009

http://www.mckinsey.com/~media/mckinsey/dotcom/client_service/Risk/Working%20papers/10_Responding_to_the_Variable_Annuity_Crisis.ashx

Czernicki, Dave, and Maloof, David. "Practical Variable Annuity Hedging." October 2008

http://www.towersperrin.com/tp/getwebcachedoc?webc=USA/2008/200810/Emp83_Hedging_Final.pdf

Czernicki, Dave, and Maloof, David. "Variable Annuity Hedging Practices in North America." October 2011

http://www.towerswatson.com/assets/pdf/5567/Towers-Watson_Insights-Variable-Annuity-Hedging.pdf

Dickinson, Gerry, et al. "Impact of a Fair Value Financial Reporting System on Insurance Companies—A Survey." The Geneva Association, May 2004

<http://www.genevaassociation.org/ATF%20report%20survey.%20pdf.pdf>

Foroughi, Kamran, et al. "Revised MCEV Principles Include Liquidity Premium." October 2009

http://www.towersperrin.com/tp/getwebcachedoc?webc=GBR/2009/200911/Final_10-29-09_Update_MCEV_liquidity_premium.pdf

Gilbert, Charles, Ravindran, K., and Reitano, Robert. "Results of the Survey on Variable Annuity Hedging Programs for Life Insurance Companies." January 2007

<http://www.soa.org/files/research/projects/va-hedging-final-07.pdf>

Glavan, Silviu. "Fair Value Accounting in Banks and the Recent Financial Crisis." *Estabilidad Financiera*, Issue 19, July 2011

<http://www.bde.es/webbde/Secciones/Publicaciones/InformesBoletinesRevistas/RevistaEstabilidadFinanciera/10/Nov/Fic/ref0419.pdf>

Halpert, Aaron, and Marlo, Leslie. "Linkage of Risk Management, Capital Management, and Financial Management." April 2007

<http://www.soa.org/research/research-projects/risk-management/research-linkage-rm.aspx>

Hancock, Geoffrey, et al. "Observations on Emerging Variable Annuity Statutory Accounting Results." June 2010

http://www.oliverwyman.com/media/OW_FS_EN_2010_PUBL_VA_Accounting_Results.pdf

How Fair Value Measurement Changes Risk Management Behavior in the Insurance Industry

Megregian, Donna, et al. "Survey of Reflecting Risk in Pricing." September 2010 <http://www.soa.org/research/research-projects/risk-management/research-reflecting-risk-pricing.aspx>

Modigliani, Franco, and Miller, Merton. "The Cost of Capital, Corporation Finance and the Theory of Investment." June 1958
<http://www.jstor.org/discover/10.2307/1809766?uid=3739808&uid=2&uid=4&uid=3739256&sid=21100999054603>

Paton, Brian. "Communicating under Revised Insurance Accounting Proposals." *The Financial Reporter*, Issue 86, September 2011
<http://www.soa.org/Library/Newsletters/Financial-Reporter/2011/September/frn-2011-iss86.pdf>

Rosner, Bruce. "Model Efficiency Study Results." November 2011
<http://www.soa.org/Files/Research/Projects/research-2011-11-model-eff-report.pdf>

Sun, Peter, and Mungan, Ken. "Performance of Insurance Company Hedging Programs during the Recent Capital Market Crisis." November 2008
<http://publications.milliman.com/research/liife-rr/pdfs/performance-insurance-company-hedging-rr12-01-08.pdf>

Tucker, Rich, and Paris, Tim. "State of the Variable Annuity Reinsurance Market in 2010." *Reinsurance News*, Issue 69, January 2011
<http://www.soa.org/library/newsletters/reinsurance-section-news/2011/january/rsn-2011-iss69.pdf>

Viklund, Emanuel, and Zachrisson, Jacob, "Why Do Risk Neutral Firms Hedge?" Stockholm School of Economics, November 2006
<http://arc.hhs.se/download.aspx?MediumId=238>

Zhang, Frank. "Integrating Robust Risk Management into Pricing: New Thinking for VA Writers." *Risk and Rewards*, February 2010
<http://www.soa.org/library/newsletters/risks-and-rewards/2010/february/rar-2010-iss55.pdf>

XV.A. American Academy of Actuaries Practice Notes:

Practice Note on Common Practices Relating to FASB Statement 133
http://www.actuary.org/pdf/practnotes/life_fas07.pdf

Market Consistent Embedded Values

<http://www.actuary.org/files/MCEV%20Practice%20Note%20Final%20WEB%20031611.4.pdf/MCEV%20Practice%20Note%20Final%20WEB%20031611.4.pdf>

The Application of C-3 Phase II and Actuarial Guideline XLIII

<http://www.actuary.org/files/VAPN%20FINAL%20WEB%20040511.4.pdf/VAPN%20FINAL%20WEB%20040511.4.pdf>

Practice Note on Anticipated Common Practices Relating to AICPA Statement of Position 03-1

http://actuary.org/pdf/practnotes/life_aicpa04.pdf

XV.B. Other

FASB Web site with the Discussion Paper and other information regarding the upcoming insurance contracts accounting standard:

http://www.fasb.org/jsp/FASB/FASBContent_C/ProjectUpdatePage&cid=1175801889812

IASB Web site with the Exposure Draft and other information regarding the upcoming insurance contracts accounting standard:

<http://www.ifrs.org/Current-Projects/IASB-Projects/Insurance-Contracts/Pages/Currentstatus.aspx>

IASB updates

<http://www.ifrs.org/Updates/IASB-Updates/Pages/IASB-Updates.aspx>

Comparison of the NAIC Life, P&C and Health RBC Formulas

http://www.actuary.org/pdf/finreport/jrbc_12feb02.pdf

QIS 5 Technical Specification: Risk-Free Interest Rates

http://ec.europa.eu/internal_market/insurance/docs/solvency/qis5/cfo-forum-cro-forum-paper-risk-free-rates_en.pdf

Groupe Consultatif Actuariel Européen paper on Market Consistency

http://www.gcactuaries.org/documents/MC_paper_and_letter_051212.zip

[Allianz] Market Consistent Embedded Value Report 2011

https://www.allianz.com/media/investor_relations/en/results_reports/annual_report/ar2011/evr2011.pdf

Lincoln 2011 GAAP Consolidated Financial Statements

<https://www.lfg.com/LincolnPageServer?LFGPage=/lfg/acc/abt/ivrel/gaaprpt/index.html>

Munich Re Market Consistent Embedded Value Report 2011

http://www.munichre.com/app_pages/www/@res/pdf/ir/publications/reports/2011_mcev_report_en.pdf

Swiss Re 2011 Annual Report

http://files.swissre.com/annualreport/downloads/financial-report/eng/swiss-re-annual-report-2011_financial-report.pdf

How Fair Value Measurement Changes Risk Management Behavior in the Insurance Industry