



SOCIETY OF ACTUARIES

Product Development  
Section

# Product Matters!

ISSUE 92 | JUNE 2015

**1** Hybrid Indices in Fixed Indexed Annuities: The New Wave  
By Simpa Baiye

**3** Chairperson's Corner  
By Jim Filmore

**8** How Changes in U.S. Statutory Reserve Regulations Could Impact Term Insurance Pricing  
By Kelly J. Rabin and Daniel J. Rueschhoff

**11** A Refreshed Look at Assumption Development: Recap of the SOA Assumption Development and Governance Group 2015Q1 Calls  
By Min Xu and Michael Chan

**14** Senior Market Segments Plus Strategies for Serving Them  
By Dan Mulé

**17** Underwriting Issues and Innovation  
By Donna Megregian & Al Klein

**20** An Efficient Statistical Estimator for Validating Life Expectancy Reports in the Life Settlements Market  
By Gordon Gillespie

**26** The Future of Underwriting: a Reinsurer Partner's View  
An Interview with Joe Gilmour

## Hybrid Indices in Fixed Indexed Annuities: The New Wave

By Simpa Baiye

Life and annuity insurance products in the United States continually evolve both to meet demographic challenges and respond to changes in the financial markets. From the development of universal life insurance partly in response to high interest rates in the late 1970s, to variable-annuity lifetime withdrawal guarantees in the early 2000s both as a response to both the equity-market turbulence at that time and the impending wave of retiring “baby boomers,” secular trends in the financial markets have represented a powerful influence on product development. The latest and perhaps most prominent trend in annuity product development has been the development of managed volatility solutions for variable annuity funds and more recently in “hybrid” index crediting offered on fixed indexed annuities and indexed life insurance. We will review the development of hybrid indices in index annuities, address benefits and drawbacks of this new class of index offering, discuss U.S. state regulatory implications and point to potential developments on the horizon.

### A Short History of Indexing

Product innovation in the insurance and financial services sectors has often taken place against the backdrop of significant changes in macro-economic conditions. Chart 1 demonstrates this by plotting key insurance product milestones along the historical movement in the S&P 500 and the U.S. 10-year Treasury rate. The art and science of indexing is no exception to this truism. Market-capitalization indexing grew in popularity from the 1970s, with the launch of the first S&P 500 index funds by Wells Fargo and Vanguard. The key thesis of index investing—that both markets work efficiently and active management generally costs more than it benefits—was well demonstrated in the 1980s and 1990s, even as market-capitalization index interest crediting made its way to the insurance industry in the form of fixed indexed annuities and indexed universal life insurance.



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### Newsletter Editors

Simpa Baiye, Co-Editor  
e: [SBaiye@SunAmerica.com](mailto:SBaiye@SunAmerica.com)

Kurt Guske, Co-Editor  
e: [Kurt.Guske@AIG.com](mailto:Kurt.Guske@AIG.com)

Vera Ljucovic, Co-Editor  
e: [Vljucovic@scor.com](mailto:Vljucovic@scor.com)

### SOA Staff

Kathryn Baker, Staff Editor  
e: [kbaker@soa.org](mailto:kbaker@soa.org)

Jim Miles, Staff Partner  
e: [jmiles@soa.org](mailto:jmiles@soa.org)

Ronora Stryker, Staff Research Actuary  
e: [rstryker@soa.org](mailto:rstryker@soa.org)



## Articles Needed for the Next Issue of *Product Matters!*

While all articles are welcome, we would especially like to receive articles on topics that would be of interest to Product Development Section members based outside of the United States.

Deadline for article submission for next edition of newsletter: Please email your articles to Simpa Baiye, Kurt Guske, or Vera Ljucovic by **July 17, 2015**.

# The Importance of Effective Communication

By Jim Filmore

**"A**t this stage of your career, it is not about how smart you are. Rather, it is about how effectively you communicate." That quote was made by an actuary at my former company as advice that they gave to new FSAs. Over the years, I have increasingly realized the importance of that statement.

As we all know, actuaries must pass a rigorous set of exams in order to attain their FSA designation. Those exams cover technical topics such as Markov chain models, Black-Scholes option pricing models, and multivariate probability distributions. While it is important to understand these complex technical topics, it can be just as important to develop the skills to communicate the results to a variety of audiences. Can you explain in two minutes or less the value of using Black-Scholes to the CEO of your company? Is that exercise more or less challenging for you if the CEO is not an actuary?

In my experience, mathematical mistakes occur periodically (yes, even by actuaries) that impact the results. However, the more frequent and often more impactful mistakes occur when there is a break down in communications. Thus, our technical expertise can be best utilized when we can clearly explain the significance of our work to both actuaries and non-actuaries.

For example, an actuary could spend a week creating a detailed pricing model that calculates the loading to add a particular benefit or product feature. After completing their work, the actuary concludes that a 3 percent increase in the mortality charge is required and communicates that result to another individual. In this example, the original mortality charge was expressed as 40 percent of the 2001 VBT select & ultimate table. The question is then whether the new rate is  $40\% \times 1.03 = 41.2\%$  or  $40\% + 3\% = 43\%$  of the table. At first glance, the difference may not appear material. However, that difference could make up a significant percentage of the profit margin in today's competitive marketplace. When expressed in those terms, one can see how clear communication of the loading can be just as important as the detailed calculations that were performed to develop the loading. By the way, this was based on a real life example that I observed. The actuary that performed the calculations intended the result to be the higher figure, but the lower figure was applied by the recipient. This is a situation where including an example would have ensured that both parties had the same understanding.

To help actuaries develop these softer skills, the product development section council has promoted various presentations and workshops on communication. For example, effective communication was the focus of our one day workshop that followed the 2014 Life & Annuity Symposium. You can also further develop communication skills in organizations such as Toastmasters or take it one step further by presenting technical topics either internally within your organization or externally at industry meetings. In all of these mediums, it is good to have a feedback loop to ensure that the message received by your audience is what you intended.

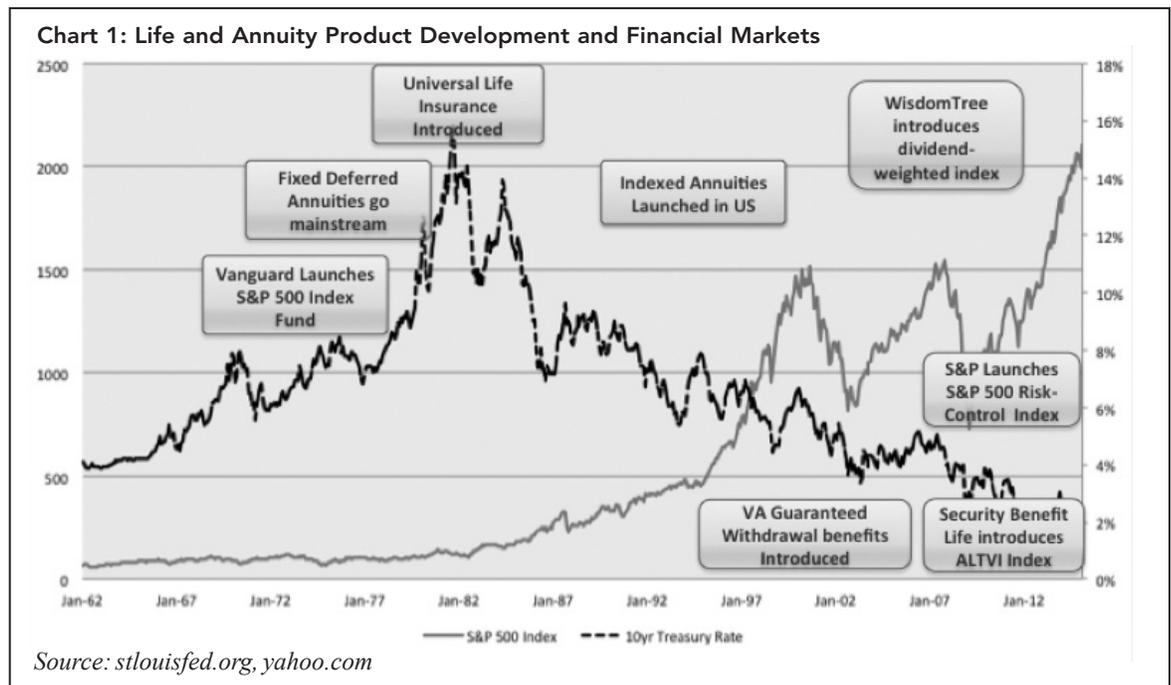
With those comments in mind, I hope that you are entertained and enlightened by the thoughts shared by the authors in this edition of *Product Matters!* □



*Jim Filmore, FSA, MAAA, is a vice president and actuary responsible for Munich Re's U.S. individual life pricing teams. He can be reached at [JFilmore@MunichRe.com](mailto:JFilmore@MunichRe.com).*

Fixed indexed annuities were launched in the United States in 1995 as a way to offer insurance clients a way to benefit from indexing, avoid downside returns and earn potentially better returns relative to certificates of deposit or fixed annuities. The early 2000s marked the end of a period described by former Federal Reserve Bank Chairman Ben Bernanke as the “Great Moderation.” This period began in the early 1980s and was marked by a sustained equity market rally, falling long-term interest rates and moderate market volatility. The stock-market crash in the early 2000s then ushered in a period characterized in retrospect by highly cyclical equity-market volatility. This period also confirmed the existence of anomalies that challenged the efficient markets theory, itself an underpinning of market-capitalization indexing. In 2005, Research Affiliates (considered to be a leader in indexing and asset allocation) launched the RA FTSE Fundamental Index Series. These indices, with stock weights driven by fundamental factors, represented a significant step away from market-capitalization indexing. In 2006, WisdomTree, a key player in the exchange-traded products market, launched one of the first equity indices with dividend-driven weighting.

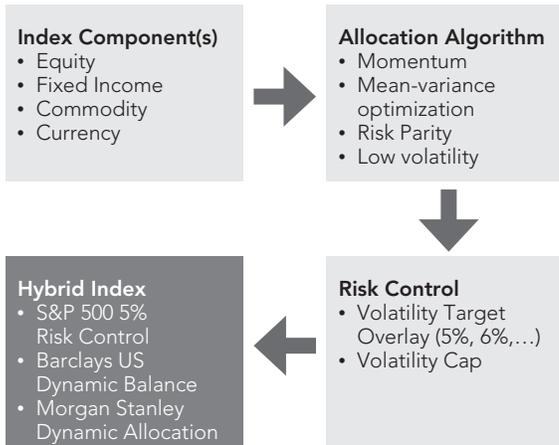
The financial crisis of 2008 reinforced the need for products that could help investors to both exploit observed inefficiencies of market-capitalization indexing and thrive in the new market-volatility regime. In 2009, Standard and Poors launched the first series of S&P 500 risk-control equity indices with explicit volatility targets. This index series, as well the indices developed earlier in that decade in response to similar needs, are commonly referred to as “smart-beta” indices in the world of investment management. The years 2009 to the present time have accordingly been marked by the development and application of hybrid (aka “smart-beta”) indices for use in insurance products.



### What Exactly is a Hybrid Index?

A hybrid index typically represents a combination of multiple index asset classes or a set of securities defined by a tactical allocation algorithm. Many hybrid indices typically come with an additional volatility-overlay mechanism that works to stabilize the returns of the underlying combination of indices. Chart 2 summarizes the process for engineering hybrid indices. For example, a hybrid index can be put together by dynamically combining equity, fixed income and commodity indices using a “momentum” tactical-allocation algorithm and supplemented by a volatility-control mechanism to help stabilize index returns.

**Chart 2: Engineering a Hybrid Index**



## What Distinguishes Hybrid Indices from Traditional Indices?

Traditional indices employ fairly well-defined weighting schemes for a given asset class. The S&P 500 index, for example, is a market-capitalization weighting of individual stocks. Other equity indices such as the Russell 2000 and the Nasdaq 100 follow a similar weighting scheme. These indices are generally viewed as “passive,” meaning that weightings are generally driven by company market capitalization. Hybrid indices, on the other hand, follow tactical weighting schemes that are driven by defined quantitative algorithms. These algorithms employ market signals such as realized volatility, short-term returns and price/earnings ratios in determining formulaic short-term weightings for each component of the hybrid index. These algorithms themselves are generally developed based on accepted asset-allocation practices or observed anomalies that run contrary to the predictions of efficient market theories. Tables 1 and 2 summarize key market anomalies and asset allocation processes that have been employed in creating tactical stock selection and index allocation algorithms for hybrid indices.

The second and most important distinguishing feature of hybrid indices is the volatility-control overlay mechanism. The overlay aims to stabilize returns on the underlying index subcomponents over time. With this feature, weightings to underlying component indices can be shifted from or to a cash index, as often as daily, in order to attain a specific annual volatility target or stay under a specific volatility cap.

**Table 1: Observed Financial Market Anomalies**

Market Anomaly	Description
<b>Momentum</b>	The observed tendency for recent, abnormally good returns to persist further in the short to medium term. This tendency contradicts efficient market precepts. Momentum can thus be employed in the development of tactical rebalancing algorithms across securities or indices.
<b>Low Volatility</b>	The low volatility phenomenon describes the tendency for securities with prior low volatility to produce superior market returns. This runs counter to the traditional market-efficiency hypothesis that links higher volatility with higher returns. Indices that are constructed based on this anomaly typically feature an algorithm that periodically selects stocks that fit predefined volatility and liquidity criteria.
<b>High Dividend Yield</b>	Stocks with a high dividend yield ratio (dividend divided by stock price) tend to outperform their broader market over time. Indices constructed with this anomaly in mind typically feature an algorithm that periodically selects stocks that fit predefined yield and liquidity criteria for inclusion in the index.

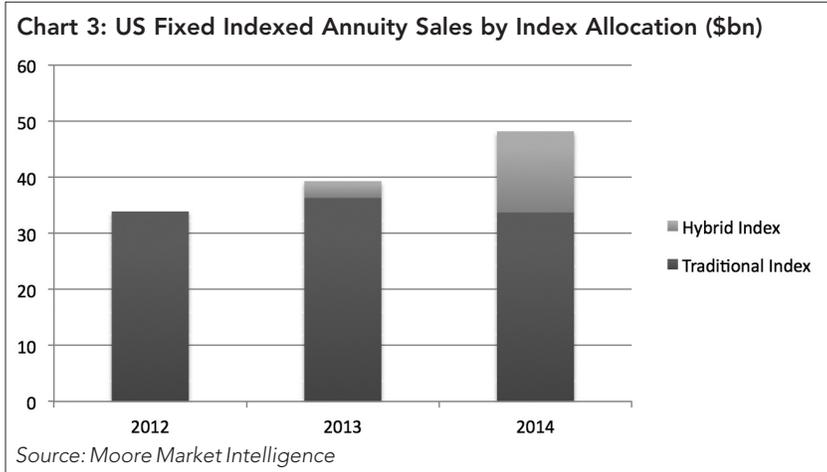
**Table 2: Asset Allocation Practices**

Asset Allocation Method	Description
<b>Mean-Variance Optimization</b>	Traditional mean-variance optimization seeks to solve for the combination of asset classes that provide the highest expected return for the lowest amount of risk. When applied on a tactical basis in index construction, this results in a periodic forecast of expected returns and volatilities that is then applied in the multi-index allocation algorithm. This algorithm then solves for the optimal index weightings combination. This process is repeated periodically.
<b>Risk Parity</b>	Risk parity attempts to equalize the contribution of risk of each asset class by deriving asset-allocation weights based on their expected volatility. This process is independent of the expected returns of the asset class and generally results in a greater relative weighting assignment to less volatile assets. When applied on a tactical basis in index construction, this results in frequent reforecasts of expected index volatility that are applied in a multi-index rebalancing algorithm.

## Hybrid Index Market Share in the United States – Fixed Indexed Annuities

From less than a 5 percent estimated share of the overall allocation to indexed annuities in 2010, hybrid indices accounted for close to a third of overall premium allocations in index annuities by the end of 2014. Chart 3 illustrates this trend and demonstrates that hybrid index allocation opportunities were a factor in the growth in fixed indexed annuity sales in 2014. Indeed, the positive incremental impact of hybrid indices strongly suggests that they are meeting a need that has not been previously fulfilled by traditional index allocation options. As of January 2015, most of the top ten issuers of fixed indexed annuities had introduced one or more hybrid indices on their respective annuity product platforms.

CONTINUED ON PAGE 6



### Hybrid Indices, Crediting Strategies and Hedging

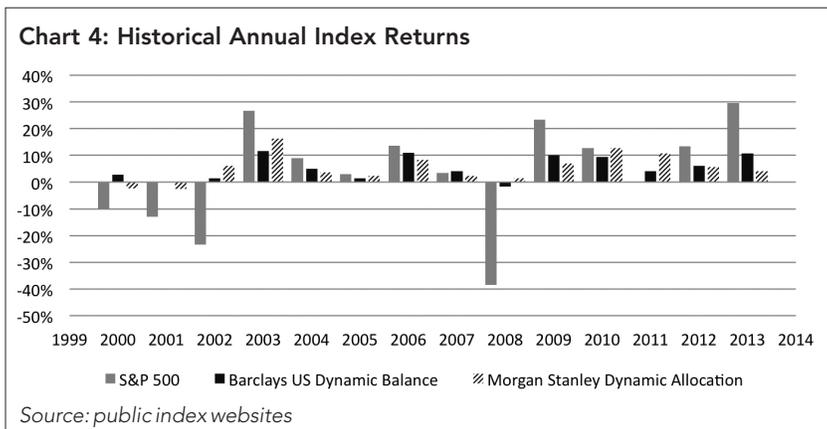
Crediting strategies commonly offered on traditional indices in fixed indexed annuities include periodic point-to-point and monthly index-averaging methods. Point-to-point methods typically pass on periodic positive index returns subject to a ceiling that is referred to as the “cap.” Monthly index averaging takes the average month-end index value over the observation period and divides by the initial index value in order to calculate index performance. This performance result is typically subject to a cap. The periodic point-to-point method is by far the most popular crediting method for traditional indices. For hybrid indices, the crediting method of choice is still the point-to-point method. However, hybrid index crediting typically involves passing on positive index returns in excess of a predefined percentage without a ceiling on credited interest. This predefined percentage is

commonly referred to as a “spread.” The composition of a hybrid index best lends itself to the use of spread-based crediting. This is due to the fact that the annual volatility target of 4 percent to 7 percent commonly found in hybrid indices greatly diminishes the need for caps that are traditionally available on point-to-point crediting methods.

Insurance carriers generally hedge crediting strategies offered in index products by buying derivatives. Hybrid index derivatives are typically available in the over-the-counter market with derivatives dealers. These derivatives are relatively illiquid and currently attract a greater bid-ask spread (the difference between the price at which dealers would sell and the price at which they would buy) than derivatives on other well-known indices such as the S&P 500. This is partly attributable to the fact there is a relatively small secondary market in which derivatives dealers can directly offset their hybrid index exposures. The relative illiquidity suggests that there is an opportunity for the cost of these derivatives to drop further and lead directly to more cost-effective hybrid index crediting for consumers. As the hybrid index derivatives market grows in traded volumes and in uniformity, hybrid index derivative prices could fall and liquidity should improve.

### Benefits and Drawbacks of Hybrid Indices

One key benefit of hybrid indices is the opportunity to provide well-diversified tactical asset allocation opportunities in index format. These indices provide cost-efficient ways for retail insurance clients to participate in their upside performance while retaining the safety of an underlying non-forfeiture insurance guarantee.



The second benefit of hybrid indices lies in the target volatility overlay mechanism. This feature dynamically allocates index weights among a cash index and the component indices, with a view to controlling index volatility. Managing index volatility can lead to more stable index returns, as chart 4 illustrates for two hybrid indices relative to the S&P 500 index. More stable returns can, in turn, lead to better accumulation outcomes. Target volatility overlay mechanisms can also cheapen the cost of participating in the upside performance of underlying index components. In the current low-rate environment, this is an important attribute for both insurance carriers and policyholders.

One key potential drawback of hybrid indices lies paradoxically in their source of strength: the opportunity to capitalize on market anomalies using tactical asset allocation. The more popular and widespread these indices become, the greater the likelihood that market anomalies that drive their added value will cease to exist. Yet another potential drawback lies in the fact that hybrid indices are generally designed with the benefit of hindsight. Should market volatility or interest rates evolve in materially different ways than they have in past decades, future hybrid index returns may not live up to expectations.

## US Regulatory Implications of Hybrid Indices

Hybrid indices are a recent creation and generally have no more than a few years of live history. Their underlying indices, on the other hand, typically have in excess of ten years of live history. As a result, hybrid index values prior to the launch date are recreated under the assumption that the tactical allocation algorithms were both in place and functioned as intended prior to that date. These index values are purely hypothetical and are needed to provide credible illustrations against which other indices and products can be compared. Most state insurance regulators treat these indices in the same way traditional market-capitalization indices such as the S&P 500 are evaluated for approval. However, a number of state regulators have recently adopted the NAIC Annuity Disclosure Model Regulation. Among other requirements, this rule defines certain criteria that an index must fulfill in order to be illustrated within an indexed annuity. For example, the regulation generally requires at least ten years of actual index performance in order for illustra-

tions to be generated. Annuity carriers will therefore need to weigh the desire to offer innovative hybrid indices against what could be seen as the growing regulatory requirement for an index track record.

As hybrid indices proliferate in variety and complexity, regulators may look more critically at how hybrid indices are marketed and illustrated. Given that most indexed annuities and all indexed life insurance contracts are treated as insurance products, insurance carriers will have to carefully position hybrid-index crediting without giving the impression that these insurance products are securities.

## Future Developments

Hybrid indices have contributed significantly to the growth rate in indexed annuity sales in recent years. Sales and distribution trends indicate that hybrid indices will continue to make a meaningful impact on indexed annuity sales in a greater variety of distribution channels. Hybrid index crediting is also likely feature more commonly in indexed universal life products. The algorithmic asset-allocation and volatility management in hybrid indices will likely continue to be seen as a cost-effective way to offer quantitative indexing strategies in insurance products. It is also likely that active asset managers will look to offer rules-based versions of some their successful offerings in hybrid index format. Insurance carriers seeking to differentiate in their hybrid index offerings will have to weigh the benefits of innovation against the drawbacks of complexity. Notwithstanding the bright outlook for hybrid indices in the insurance industry, the future macro-economic landscape remains yet the capricious arbiter of the value of hybrid indexing. □



*Simpa Baiye, FSA, CFA is a consulting actuary and can be reached at [simpbaiye@yahoo.com](mailto:simpbaiye@yahoo.com).*

# How Changes in U.S. Statutory Reserve Regulations Could Impact Term Insurance Pricing

By Kelly J. Rabin and Daniel J. Rueschhoff



Kelly J. Rabin, FSA, MAAA, is a consulting actuary at Milliman Inc in Seattle, Wash. She can be reached at [kelly.rabin@milliman.com](mailto:kelly.rabin@milliman.com).



Daniel J. Rueschhoff, FSA, MAAA, is a consultant at Milliman Inc in Seattle, Wash. He can be reached at [dan.rueschhoff@milliman.com](mailto:dan.rueschhoff@milliman.com).

## Background

On March 27, 2014, Benjamin Lawskey, Superintendent of the New York State Department of Financial Services (NYDFS), sent a letter to the National Association of Insurance Commissioners (NAIC) stating that the NYDFS has been “working to update and rationalize [their] regulations and practices.” The NYDFS “have determined that [their] term life formula results in reserves that are high relative to actuarial experience and should be modernized.” The letter goes on to say that NYDFS would be issuing regulatory updates containing changes to the reserve methodology that would apply to new business written beginning Jan. 1, 2015. According to the letter, these changes are expected to prospectively reduce term insurance reserves by 30 percent to 35 percent. The department proposed to accomplish this by applying prospective mortality improvement factors and implementing a two-year full preliminary term period. What this letter did not say, but which has been communicated through other means, is that NYDFS is opposed to principle-based reserves (PBR) and does not intend to adopt VM-20 (the life insurance regulation for PBR). Instead it developed this alternative approach.

The NYDFS exposed preliminary versions of the Fifth Amendment to New York Regulation 147 (Valuation of Life Insurance Reserves) and the Third Amendment to New York Regulation 179 (Recognition of the 2001 CSO Mortality Table for Use in Determining Minimum Reserve Liabilities and Non-forfeiture Benefits and Recognition and Application of Preferred Mortality Tables for Use in Determining Minimum Reserve Liabilities) for two comment periods. The final amendments to the regulation are effective and apply to business issued Jan. 1, 2015 and later. NYDFS recently proposed a similar amendment to the regulation for universal life policies with secondary guarantees, but the impact of that proposal is beyond the scope of this paper.

In light of these developments, we undertook a research study to accomplish several aims:

- Determine whether the new methodology results in the 30 percent to 35 percent reduction in reserves cited by the NYDFS
- Compare the proposed NYDFS term reserves to other reserving regimes:

- XXX reserves, with and without reserve financing
- VM-20 reserves

- Measure the impact of both the NYDFS proposal and VM-20 on profitability (defined either as statutory internal rate of return [statutory IRR] or profit margin as a percentage of premium)
- Calculate how much premiums would need to change from today’s levels in order to achieve the same statutory IRR under the new reserve regimes as is achieved today when reserves are supported by less expensive sources of capital (“financed”)

We conducted this research using a model office for an illustrative term portfolio intended to be reasonably representative of products offered in the market today. Actual results will vary with specific product features, economic environment, and state premium tax, as well as emerging experience.

## Overview of Reserving Regimes

The XXX reserving methodology came into effect when the revised Valuation of Life Insurance Policies Model Regulation (XXX) was adopted by the NAIC in March 1999. Regulation XXX was adopted in order to eliminate perceived loopholes under the Standard Valuation Law, under which companies designed products that had extremely high late-duration guaranteed premiums, partly in an attempt to drive down reserves. Regulation XXX requires reserves to be calculated separately for each level-premium segment.

An outcome of this regulatory change is that many felt that XXX reserves were excessively conservative when compared to economic reserves. Carriers sought out solutions to finance their “redundant” reserves. Initially this took the form of heavy use of coinsurance, and then ultimately third party, market-based financing solutions facilitated by the use of captive insurers.

It is important to note that most or all competitive carriers in the term insurance market are pricing assuming some kind of reserve relief, be it coinsurance or use of a captive with financing. We decided to show typical profitability both with and without a financing solution (in this case, a letter of credit) in order to show just how sensitive profitability is to the level of reserves.

Many regulators have also come to acknowledge that XXX reserves are unduly conservative and have explored various solutions to this issue. The prevalent approach has been to move toward a principle-based approach to calculate reserves. The belief has been that by using more realistic assumptions in reserve calculations, there would no longer be redundant reserves and, therefore, no need for financing. The outcome of these conversations has been VM-20, which describes how principle-based reserves are to be calculated. As of this writing, the general sentiment is that VM-20 will not take effect until at least 2017.

NYDFS would prefer that reserve calculations remain formula-based, in the manner of XXX. It does concede that reserves are “high relative to actuarial experience” and so has adopted the following changes for business written beginning Jan. 1, 2015:

- Prospective mortality improvement factors are to be applied to 2001 CSO during the level premium period.
  - 1 percent per year from 2008-2047.
  - 0.5 percent per year thereafter.
- A two-year full preliminary term method will be implemented. This means that reserves are zero through the end of year two.

## Modeling Overview

For purposes of this analysis, we modeled a generic middle-of-the-pack term product suite: 10-year and 20-year term plans with level premiums for the length of the term followed by annually increasing premiums to attained age 95. We built a model office that included quinquennial issue ages 25 through 65, males and females, four nonsmoker classes and one smoker class. For simplicity, we modeled the single face amount of \$100,000 with no premium banding.

The base case level term premiums used were chosen so that they would achieve approximately a 10 percent adjusted after-tax statutory IRR under the XXX with reserve financing regime. Post level term, the premiums immediately jump to the maximum guaranteed rates, with shock lapses and mortality anti-selection set accordingly. Post-level-term profitability was included in the IRR calculation.

## Impact of Changes

### Reserve Levels

Chart 1 provides a comparison of the terminal reserve patterns under the different reserving regimes during the 10-year level period for the 10-year plan. Some interesting observations can be made from this chart:

- At peak reserve levels, the NYDFS reserve is 63 percent of the XXX reserve, but 126 percent of VM-20.
- The NYDFS reserve is zero until year two due to the two-year full preliminary term approach.
- The gross premium reserve remains materially below all the other regimes.

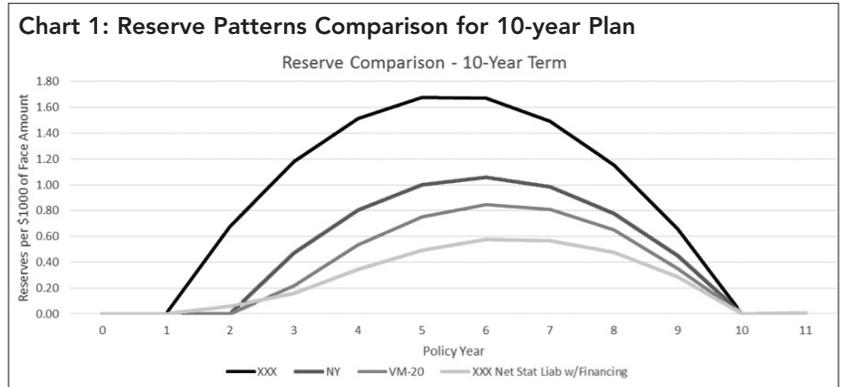
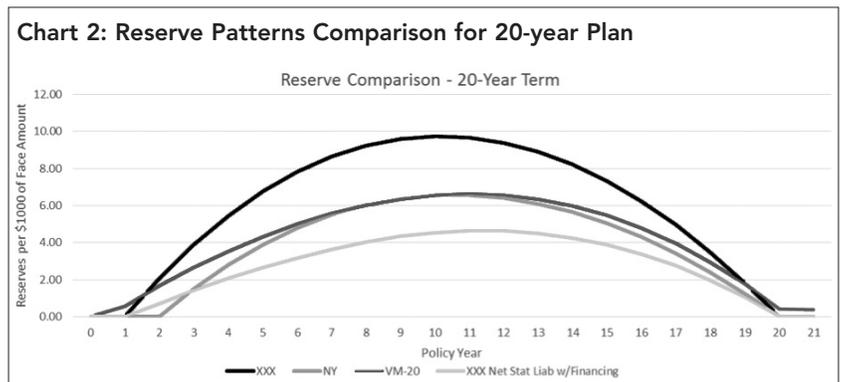


Chart 2 provides a similar comparison for the 20-year level period for the 20-year plan.

- In this case, the NYDFS reserve tracks closely with VM-20, and is in fact lower at the beginning and end of the period.
- At peak reserve levels, the NYDFS reserve is 68 percent of the XXX reserve.



CONTINUED ON PAGE 10

## Profitability

We looked at profitability on both pre-tax and adjusted after-tax bases.<sup>1</sup> There is a much bigger difference between the pre-tax and adjusted after-tax statutory IRRs on the 10-year product than on the 20-year product because initial required capital is a much larger percentage of first-year premium (129 percent on the 10-year vs. 94 percent on the 20-year).

To isolate the impact of the different statutory reserve methodologies, we set tax reserves for all regimes equal to XXX tax reserves, but still capped at statutory reserves. Effectively, this means that in most cases, tax reserves equal statutory reserves. We also set required capital equal to XXX levels for all regimes. One can argue that even though the current RBC formula calculates RBC by applying factors to the level of statutory reserves, the risk associated with the product has not changed even though the statutory reserves are now lower. It is unclear at this point where the regulations will land with respect to these issues.

On both products, the statutory IRRs align with the magnitude of reserves on both pre-tax and adjusted after-tax bases. XXX with financing has a lower pre-tax profit margin due to the impact of financing charges, but that reverses itself on an adjusted after-tax basis.

## Premiums

We assumed that the current gross premiums in this product were priced to achieve approximately a 10 percent adjusted after-tax statutory IRR using XXX reserves sup-

ported by less expensive sources of capital (“financed”). The premium changes below are the percentage change required in the level term gross premium in order to achieve the same statutory IRR under the different reserve regimes.

The premium changes required are correlated with the adjusted after-tax statutory IRRs in the previous section. Even though the adjusted after-tax statutory IRRs are close between the three reserve regimes other than the gross premium valuation, they have different patterns of profits due to different reserve streams, and so the premium increases required can vary significantly. Unsurprisingly, the largest premium increase would be needed if XXX reserve financing were no longer available. For both products, NYDFS would require a marginally higher increase than VM-20. The expected increase under NYDFS and VM-20 is 3 percent to 5 percent on 10-year term and 14 percent to 16 percent on 20-year term.

Reserve Regime	% Change in Premium	
	10-Year	20-Year
XXX	8.6%	29.4%
XXX w/Financing	0.0%	0.0%
NYDFS	4.7%	16.4%
VM-20	3.1%	14.4%

## Conclusion

The reduction in reserves cited by NYDFS does appear to be a reasonable estimate of actual reserve reduction. On the 10-year product, the NYDFS reserve for our model office is 63 percent of the XXX reserve at peak reserve levels. On the 20-year product, it is 68 percent of the XXX reserve.

The premium increase required for NYDFS is material, but less than that required for XXX without financing, and slightly more than that required for VM-20. Even though the adjusted after-tax statutory IRRs are close between the three reserve regimes other than the gross premium valuation, they have different patterns of profits due to different reserve streams, and so the premium increases required can vary significantly. Under both NYDFS and VM-20, 20-year term premiums are expected to be roughly 15 percent higher than under XXX with financing in order to maintain the same profitability. This is certainly a big change for the term market. ■

### 10-Year Term Profitability by Reserve Regime

Reserve Regime	Statutory IRR		Profit Margin*	
	Pre-Tax	Adj After-Tax	Pre-Tax	Adj After-Tax
XXX	22.8%	8.1%	11.7%	5.0%
XXX w/Financing	60.9%	10.2%	10.7%	5.5%
NYDFS	45.9%	8.6%	11.7%	5.0%
VM-20	58.0%	8.8%	11.7%	5.0%

\*Profit margin components are discounted at a net investment earnings rate (NIER) of 5 percent bond equivalent yield

### 20-Year Term Profitability by Reserve Regime

Reserve Regime	Statutory IRR		Profit Margin*	
	Pre-Tax	Adj After-Tax	Pre-Tax	Adj After-Tax
XXX	6.7%	5.3%	4.2%	0.6%
XXX w/Financing	7.1%	10.1%	0.5%	2.2%
NYDFS	9.9%	5.4%	4.2%	0.6%
VM-20	8.4%	5.4%	4.2%	0.6%

\*Profit margin components are discounted at a net investment earnings rate (NIER) of 5 percent bond equivalent yield

### ENDNOTE

<sup>1</sup> The adjusted after-tax results are calculated by applying a 35 percent tax rate as well as a 7.7 percent DAC tax to the pre-tax results, and then reflecting the impact of required capital.

# A Refreshed Look at Assumption Development: Recap of the SOA Assumption Development and Governance Group 2015Q1 Calls

By Min Xu and Michael Chan

In line with the increased scrutiny on assumptions by stakeholders, companies are ramping up efforts and dedicating more resources towards improving the assumption development and governance. The SOA Assumption Development and Governance Group (the Group) was formed in 2013 to provide a hub for actuaries to discuss current topics related to assumptions and to establish industry connections. The Group has since established formal links with the SOA Product Development, Financial Reporting, Modeling and Technology sections in order to coordinate assumptions-related activities.

The 2015 first quarter discussions for the Group took place over two conference calls on March 2 and 3. Representatives from approximately 30 companies were in attendance and additional participants from these companies listened in. Topics of discussion included 2014 accomplishments and “a-ha” moments, the focus for 2015, as well as questions for the Group. Several common themes emerged from these discussions. The most frequently discussed topics included governance structure, documentation requirements, and the role of data and advanced analytics in assumption development.

The most common drivers cited for interest and activities related to assumptions included:

- Increased regulatory demands from both state regulators and federal authorities;
- Anticipation of Principles Based Reserving (PBR);
- Elevated governance and documentation expectations from auditors; and
- Good business practice.

This article will focus on the assumption development discussions. Assumptions governance discussions will be covered separately in the article “A Refreshed Look At Assumption Governance” in the SOA *Financial Reporter* newsletter.

## Assumption Development and Assumption Governance

Although it is not uncommon for companies to set up separate assumption development and assumption gov-

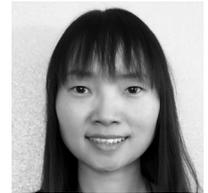
ernance bodies, the two areas are closely interrelated. In line with the Group’s calls last year, assumption governance dominated the discussion. Effective governance has been found to improve the quality and consistency in assumptions. As the governance structure becomes more seasoned and streamlined at insurance companies, it is expected that the focus will naturally shift more towards the refinement and expansion of the assumption development process. A good assumption development process in itself could lead to better documentation and ultimately to improved assumption governance.

## Predictive Modeling Is the New Norm

Predictive modeling techniques are not new. They have been an important tool in non-life lines of business, financial institutions and other data-driven industries for many years. Although the life insurance industry generally had a late start on predictive modeling, many life companies on the calls have already begun using predictive modeling to various degrees. Life companies that had not used predictive modeling in the past have recognized that much of the industry has moved ahead and are seriously considering it for use in 2015. The theme of the calls was not about whether to use predictive modeling, but rather how to use it to improve the depth of the predictive analysis and expand the width of its utilization.

Applications of predictive modeling cited by call participants included analyses of lapses, benefit utilization, mortality, premium patterns, etc. There is an emerging trend that predictive analytics are now increasingly extended beyond these traditional life insurance assumption analyses to other impactful areas such as underwriting, marketing, consumer behavior and product design. In some organizations, certain non-actuarial groups had adopted predictive analytics much earlier. Actuarial groups in these organizations could take the opportunity to leverage the data and tools already developed elsewhere in the organization or risk falling behind. No matter where the organizational responsibilities lie, the better actuaries can identify the underlying drivers of consumer behavior pre- and post-issue, the more equipped they will be to develop products, services and more appropriate assumptions.

CONTINUED ON PAGE 12



Min Xu, FSA, MAAA, is assistant vice president, Enterprise Risk Management at Pacific Life in Newport Beach, CA. She can be reached at [min.xu@pacificlife.com](mailto:min.xu@pacificlife.com).



Michael Chan, FSA, is manager at PricewaterhouseCoopers (PwC) in New York, N.Y. He can be reached at [michael.ky.chan@us.pwc.com](mailto:michael.ky.chan@us.pwc.com).

Many participants noted that their focus for 2015 would be to expand the use of statistical analysis in experience studies and assumption setting. In order to strengthen their statistical analysis capacities, some companies on the call recruited non-actuarial statisticians. The technical expertise and fresh perspectives of statisticians certainly bring welcome opportunities and new ideas, though their different thought processes pose some challenges. One piece of advice shared during the call was to help non-actuarial statisticians to think more from a “cause-effect” perspective (given the long-term nature of life insurance business) in addition to their natural “correlation” perspective.

### Data Science is the Next Frontier for Innovation and Competitiveness.

Data science (e.g., big data, business analytics, predictive modeling) is a hot topic nowadays. Predictive modeling is one application of data science that is familiar to actuaries. McKinsey research<sup>1</sup> classified the various sectors of economy into five clusters based on potential gains from the use of big data. According to this study, the finance and insurance sector is in the second highest-ranked cluster that is “positioned to benefit very strongly from big data.” As a reference, the highest-ranked cluster is the electronic products and information sector that has already been benefiting from the use of big data. McKinsey research also predicted a significant supply shortage of data scientists (a 50 to 60 percent talent gap by 2018) to meet the increasing future demands. The actuarial profession was cited as one of the few professions in which practitioners possess the deep analytical skills needed to meet this future demand, presenting both an opportunity and risk.

Call participants also discussed the agent-based modeling<sup>2</sup> presentation to the Group from last year. Agent-based models, in combination with behavior economics, simulate the individual decision-making and the emergent group behavior to re-create and predict behavior in the real world. This technique takes data analytics beyond predictive modeling. A question was raised on how actuaries could be catalysts in introducing new and advanced statistical analyses such as agent-based modeling to life insurance companies. Several ideas were shared among the Group, for example, getting familiar with a new concept first, evaluating how it can help the company and also considering practical limitations.



It was very encouraging to learn that some of the participants on the call are building comprehensive data marts that include not just traditional liability data, but also market data. For some participants, the data mart is managed at the enterprise level. This type of infrastructure not only provides a centralized, single source of truth, but also provides the potential to prepare for big data initiatives down the road. Some participants are also experimenting with analyses on household data. To benefit from the big data move, it takes time, resources and a data-driven mindset to help cross the initial barriers. Companies that start early in this move could gain competitive advantages.

### PBR Promotes Modernization of Assumption Development

Under PBR, certain assumptions are no longer prescribed and static. Companies are now permitted to perform experience studies to derive appropriate assumptions. These studies need to be complete, repeatable and provide the rationale for chosen assumptions. It was not surprising to learn that many participants on the call plan to focus on modernizing experience studies and developing PBR assumptions in 2015. The modernization process may involve getting data, storing data, developing analytical tools, etc., and ultimately leads to the practice of data science and predictive modeling.

Credibility standards become more important under PBR. Lack of credible data was frequently mentioned as a challenge, especially for small companies and for newer product designs. Another frequently mentioned topic was how to set provisions for adverse deviation (PADs). In order to facilitate deeper dialogue on topics of common concern, the Group plans to schedule further discussions in the near future on topics related to better practices in assumption setting.

## Other Assumption Development Topics

The following topics were brought up for further consideration:

- Consistency not only in the use of assumptions across various functions within the same line of business, but also across lines of business
- Coordination of assumptions. With the general exception of post-level term lapse and mortality assumptions for term insurance products, individual actuarial assumptions have traditionally been developed in isolation. Evolving product complexity, anti-selective

policyholder behavior and competitor behavior are making assumptions more correlated than before. For example, a question was raised on how to develop assumptions for renewal premium, mortality and lapse collectively.

- Assumptions in the tail and long-term assumptions
- Older age mortality and preferred mortality “wear-off” at older ages

Assumption Group discussions take place quarterly. If you are interested in participating or just staying informed on developments, please contact Liz Olson at [olsonl@nationwide.com](mailto:olsonl@nationwide.com) or 614-249-0605 to get on the distribution list. There is no on-going commitment. Also, please look for our group on LinkedIn.<sup>3</sup> □

### ENDNOTE

<sup>1</sup> *Big Data: the next frontier for innovation, competition and productivity* - McKinsey Global Institute, June 2011

<sup>2</sup> *A discussion on behavioral simulations* – PwC presentation at SOA Assumption Development and Governance 2014Q3 call

<sup>3</sup> <https://www.linkedin.com/groups/SOA-Assumption-Development-Governance-Group-4997015/about>

# 5 Senior Market Segments Plus Strategies for Serving Them

By Dan Mulé



Dan Mulé has held numerous senior leadership positions in sales and distribution. Most recently he led the AIG Financial Network as Chief Distribution Officer. He can be reached at [muledan@aol.com](mailto:muledan@aol.com).

As insurance and financial services professionals entrusted with helping clients make wise decisions, it is imperative our industry understands the crucial segmentation of the so-called “senior” population. Age figures into a variety of legal and financial milestones; but more than divisions based on age, the truest insight into senior segments is cohorts organized around work, leisure, health, income, and income sources. These filters provide windows into the needs and concerns of pre-retirees, silver entrepreneurs, retirees, as well as their spouses and family members.

Selling to seniors is not a one-note call to action. The concerns of a 70 year old are not often the same concerns of a 50 year old, yet both people are part of the senior market, along with a 90 year old. Clients are looking for multifaceted solutions that help them where they are today, and are flexible enough for tomorrow and the next day as well.

Let’s remember consumer needs from an emerging financial professional perspective. As I recall, going back to the 1970s, agents often offered a single-minded or one-note protection mindset: death and disability. As time moved on, our industry evolved into offering clients various kinds of protection and accumulation strategies and tactics. Financial professionals learned to help clients save more effectively and protect their families and assets via multiple products.

Now, our industry is in a completely new phase facilitated by holistic interaction with clients regarding protection and the need to help ensure sufficient income in retirement. As financial professionals, we have the potential to best serve clients when we become very well educated in who we are serving, as well as the different tools and new product features we can leverage for the protection of assets people have accumulated and still are accumulating during working senior years.

## Senior Segment One: pre-retirees

While “senior” might typically start at 55 years of age and up, many people turning 50 need help making plans for what previously seemed so far away. Additionally, a younger spouse (for example, ages 45-54) married to an older retiree often is ready to make financial changes and

pre-retirement decisions. The pre-retiree segment also has an elastic maximum age, since some people either choose to work, or need to work, into their 70s and beyond.

Whatever their ages, pre-retirees are still actively earning and accumulating. While they certainly should consider innovative solutions for the breadth of retirement, which I’ll discuss below, some younger pre-retirees might consider term life insurance. As you know, term life is popular early in life, when clients are trying to protect a multitude of priorities. Later though, term life products can address specific, unique challenges relative to retirement, as some clients’ working lives extend from 55 to 65 and beyond. While a permanent life insurance solution alone may not be appropriate due to budget or other considerations, a strategy using a combination of term-life coverage and a permanent life policy could be just what is needed.

As a hypothetical example, let’s look at the need to insure \$1 million for a pre-retiree client. Understanding any ideas discussed are purely conjectural, perhaps we might divide the coverage equally—50 percent each—into what some call the “term and perm” combination, where needs are both covered and more affordable. Leveraging policy features along the way, as clients transition through senior market segments, may be the optimal solution. Term insurance by definition is for a specific term, not forever, and can be a very cost-effective means for protecting income streams as Americans work longer.

## Senior Segment Two: underfunded yet still working

As with pre-retirees, this segment encompasses diverse age groups within the senior population. The U.S. National Retirement Risk Index (NRRI) warns that more than half of today’s households will not have enough retirement income to maintain a pre-retirement standard of living, even if the wage-earners work to age 65.<sup>1</sup> Raising an even more urgent warning, a recent Employee Benefit Research Institute survey of workers age 55 and older indicates almost 60 percent have saved less than \$100,000 for retirement, and 24 percent have saved less than \$1,000 for retirement.<sup>2</sup>

Many people will need to consider working longer than anticipated. If a client is not in optimal condition to retire, he or she can choose to take advantage of “catch-up provisions” in 401(k) plans, and—as income continues longer and beneficiary spouses are exposed—consider the benefits of life insurance to protect loved ones for longer periods of time. The good news is innovations in life insurance can do more than simply pay for a catastrophic death. Some new products feature a suite of riders that not only allow accelerated access to a portion of the death benefit, but also offer the potential for clients to leverage cash value in the policy to access a stream of income, if needed due to longevity or critical illness.

### Senior Segment Three: actively retiring

When we consider it is now quite possible to work for 30 years, and then retire for 30 years, the challenge of how to appropriately handle distribution of assets during longer retirement years comes into even sharper focus.

Some of us never truly retire into the classic mythology of endless golf rounds and bridge games. Whether we ever fully retire or not, Americans described in this third senior segment are reaching retirement milestones delineated by legal thresholds.

When clients approach age 55, they start engaging decision matrixes similar to these:

- Do I retire? (If so, when?)
- At age 59.5, do I take early distributions or do I wait?
- At age 62, do I start taking minimum Social Security payments or wait and receive a normal or even maximum benefit later?
- At ages 65-68, must I retire from certain age-limited careers and will I start taking delayed benefits? Will I sign up for Medicare?
- At age 70.5, if I have qualified plans, how will I handle required distributions?

These can be complex questions carrying a tremendous number of variables. Many Americans are not prepared to conduct this analysis and need the advice of qualified

professionals to help them make the wisest choices for their particular lives and their unique situations. While clients are accustomed to looking online for information, there is no so-called “holy grail” that answers these questions: they can’t simply look at a website filled with general information and hope to formulate and execute a successful plan. Financial professionals can help clients navigate these important and potentially confusing and stressful decisions.

### Senior Segment Four: fully retired

For this discussion, I define fully retired clients as not actively earning or in the workplace, instead drawing their income from some combination of savings, assets, pensions, Social Security, annuities, and any other similar sources. Typically, these clients are also described as being on a “fixed income,” i.e., with no variables resulting from additional streams of new income. As with most segments, these seniors might be any age over 55, but in my view, they tend to be 65 and older.

It is important to note the workplace definition that differentiates segment four from the first three: People in the first three segments are still generating a workplace income for living expenses, whether their retirement sources are well funded or underfunded. Here, in segment four, fully retired clients are drawing only from the combination of saving and assets described above. For these clients, the hope is that they have saved throughout their lifetimes and have multiple sources to fund their retirement years. Financial professionals serving fully retired clients can focus on solutions that may help extend existing resources and may help when confronting emergencies.

Before we turn to the last segment, Senior Segment Five, let’s take a step back.

### Senior Segment Moment: the three challenges

For all segments of the senior market, the question is how to make the money last long enough for the three basic challenges: We either die too young, we live too long, or we get sick along the way.

CONTINUED ON PAGE 16

If we die while we're still earning and accumulating, the challenge of making the money last long enough applies to our loved ones. Did we protect their lives? Did the money last long enough for them?

If we live "too long," (which we increasingly are, according to the U.S. Centers for Disease Control and Prevention<sup>3</sup>) will the money last long enough for our needs? This is not only a logistical challenge; it is an emotional and psychological challenge. Many people view turning to adult children or other family members for help as "being a burden." We don't want to be a burden on others. We're independent; we value being able to care for ourselves. Living beyond our savings and financial independence is a pervasive concern; a 2014 Bank of America national survey of people with assets ranging from \$50,000-\$250,000 indicates more than half of Americans fear they will run out of money in retirement.<sup>4</sup>

If we are diagnosed as so critically ill as to need long-term care or highly specialized care, we can quickly exceed our careful budget and savings. While Medicare and its various supplements certainly help with some health care costs, they don't cover the full costs of comprehensive care for assisted living and highly specialized disease management.

This triple threat of dying too soon, living too long, or getting sick along the way is why I am so excited about the new products I mentioned earlier featuring accelerated benefit riders designed to address each of those three concerns.

### Senior Segment Five: independent and leaving legacies

From a financial professional perspective, our industry has evolved into one that is quite analytical, and often, we talk to people in analytical terms: charts, graphs and numbers. But the so-called emotional things truly matter: dignity, independence, and the legacy we leave. This is crucial for financial professionals, that we understand how emotions can impact people at these incredibly meaningful moments.



Think about pre-retirees and retirees: so many have always provided for others, educated their children, and lifted them up into the world. I believe the pervasive mindset of retirees is to take care of others, not "be a burden" on children or grandchildren. It would behoove us to understand this motivation to be independent, and take a holistic approach to planning with the goal of providing independence, maintaining dignity, and creating a legacy to leave to heirs.

As financial professionals, we are there for clients in their most meaningful moments. We can be inspired and motivated by the role we play in those meaningful moments to help people change their lives, and the lives of their loved ones, for the better. ■

#### ENDNOTE

- <sup>1</sup> *National Retirement Risk Index*, MarketWatch, December 17, 2014, accessed February 6, 2015 at <http://www.marketwatch.com/story/retirement-index-shows-many-still-at-risk-2014-12-17>
- <sup>2</sup> *10 things retirees won't tell you*, MarketWatch, January 30, 2015, accessed February 6, 2015 at <http://www.marketwatch.com/story/10-things-retirees-wont-tell-you-2014-09-19>
- <sup>3</sup> *Mortality in the United States*, Centers for Disease Control and Prevention, October 2014, accessed February 6, 2015 at [http://www.cdc.gov/nchs/data/databriefs/db168.htm#which\\_population](http://www.cdc.gov/nchs/data/databriefs/db168.htm#which_population)
- <sup>4</sup> *Many Americans fear going broke in retirement*, USA Today / Bank of America, August 21, 2014, accessed February 6, 2015 at <http://www.usatoday.com/story/money/personalfinance/2014/05/25/retirement-affluent-americans-going-broke/9383019/>

# Underwriting Issues and Innovation

By Donna Megregian & Al Klein

For the past two years, underwriters and actuaries have been getting together for a unique and interactive seminar sponsored by the SOA and the Product Development Section. This seminar offers a special opportunity for underwriters and actuaries to learn about and discuss topics related to current and new underwriting techniques and tools. Feedback from the seminar has been very positive and powerful. At the first seminar, we received comments (even during the seminar!) from attendees that this was the best seminar they ever attended. We believe this was due to the cutting edge material and the opportunity to collaborate between underwriters and actuaries in the unique seminar format.

The original format for this seminar was to bring in a number of providers of various underwriting tools (and put them on a panel) to describe the benefits and appeal of their offerings. Attendees were able to compare and contrast the offerings in one easy setting by asking questions on the panel. The seminar evolved in its second year to bringing in the users of these products. Attendees had the opportunity to interact and share their personal experiences and the impact on their business. This year we are focusing on the hottest underwriting topics and latest advances, while continuing to provide opportunities for collaboration between actuaries and underwriters. Our goal is to keep evolving the seminar so it is always exciting, unique, and cutting edge.

The third seminar will take place **August 2-4, 2015** at the Westin O'Hare Hotel in Rosemont, Illinois. If you haven't attended this seminar before, you might want to read on about the topics that have been covered in the last two years and what is in store for this year. Find out more about the 2015 Underwriting Issues and Innovation Seminar at <https://www.soa.org/underwritingseminar/>.

## Past Seminar Highlights

Predictive modeling and data analytics are on the mouths and minds of most people working in any industry. If you

aren't asking the question "How can I use data to predict a result or improve my process?" a competitor certainly is. Predictive modeling and big data are not new to insurance, but what is new is how they are being leveraged in the life insurance space. Models are being developed to be used before, during and after the underwriting process in ways such as identifying adverse mortality, the impact of wellness data, cross-selling and upselling, and persistency. The first seminar included a lively debate amongst the laboratory vendors on their scoring tools. Predictive modeling has been a staple of the last two seminars and will be included again in this year's seminar.

Simplified Issue has been a hot topic for many companies. This seminar has explored how having a preferred class is possible when leveraging build, smoking status, MVR, prescription histories, tele-interviews, and other data. A number of people now believe it is only a matter of time before data replaces a blood draw and rates may be equal to those of standard fully underwritten classes. Possible or probable? You can join in the debate at this seminar as well as learn about the latest versions of accelerated underwriting and simplified issue.

Last year, we heard multiple speakers discuss their vision of the future on topics such as regulation, distribution, product innovation, technology, genetics, health, mortality, and underwriting. We also divided the attendees into groups to try to solve several real life fraud cases.

## Topics for 2015

While we won't be pitting the actuarial family against the underwriting family in another game of Family Feud, we promise plenty of excitement and learning at the seminar this August. The planning committee strives to change the seminar each year to add fresh content and learning formats. On the docket this year are the following topics:

- Future Technology
- Wellness
- Fraud



Donna Megregian, FSA, MAAA, is vice president & actuary at RGA in Chesterfield, Mo. She can be reached at [dmegregian@rgare.com](mailto:dmegregian@rgare.com).



Al Klein, FSA, MAAA, is consulting actuary at Milliman Inc. in Bannockburn, Ill. He can be reached at [al.klein@milliman.com](mailto:al.klein@milliman.com).

CONTINUED ON PAGE 18

- Preferred Underwriting—What if we started with a clean sheet?
  - Protection Gap
  - Accelerated Underwriting and the New Simplified Issue
  - Why is communication between actuaries and underwriters important?
  - Latest on practical uses of Big Data and Predictive Analytics
  - Trends in Causes of Death
  - Buzz Groups on a variety of topics
- Closing potpourri session to include topics such as genetics, infectious disease, e-cigarettes, marijuana, opioid use and abuse, and prescription histories
- You will hear from actuaries, underwriters, medical directors and a CEO. We hope you are able to join us for this exciting seminar and also potentially earn valuable CPD credits. The seminar has attracted international attendees and disciplines besides underwriters and actuaries. The Product Development Section encourages all to attend to find out why we keep hearing “This is the best seminar I have ever attended!” □

## On the Research Front

Large data sets can be used for modeling and data analysis techniques to discover predictive patterns and relationships for businesses. The Society of Actuaries developed an article collection on the ways actuaries are applying predictive modeling techniques. The collection highlights tangible examples of predictive analytics within life and health fields. Access the essay collection at <http://www.soa.org/News-and-Publications/Publications/Essays/2015-predictive-analytics.aspx> visit SOA's research page (<https://www.soa.org/Research/Research-At-A-Glance.aspx>) to watch a summary video on some of the essays. □



# LIVING to 100

SOCIETY OF ACTUARIES  
INTERNATIONAL SYMPOSIUM

## Call for Papers—2017 Living to 100 Symposium

The Committee on Living to 100 Research Symposia requests professionals, knowledgeable in the important area of longevity and its consequences, prepare a high quality paper for presentation for the 2017 Living to 100 Symposium. The topics of interest include, but are not limited to:

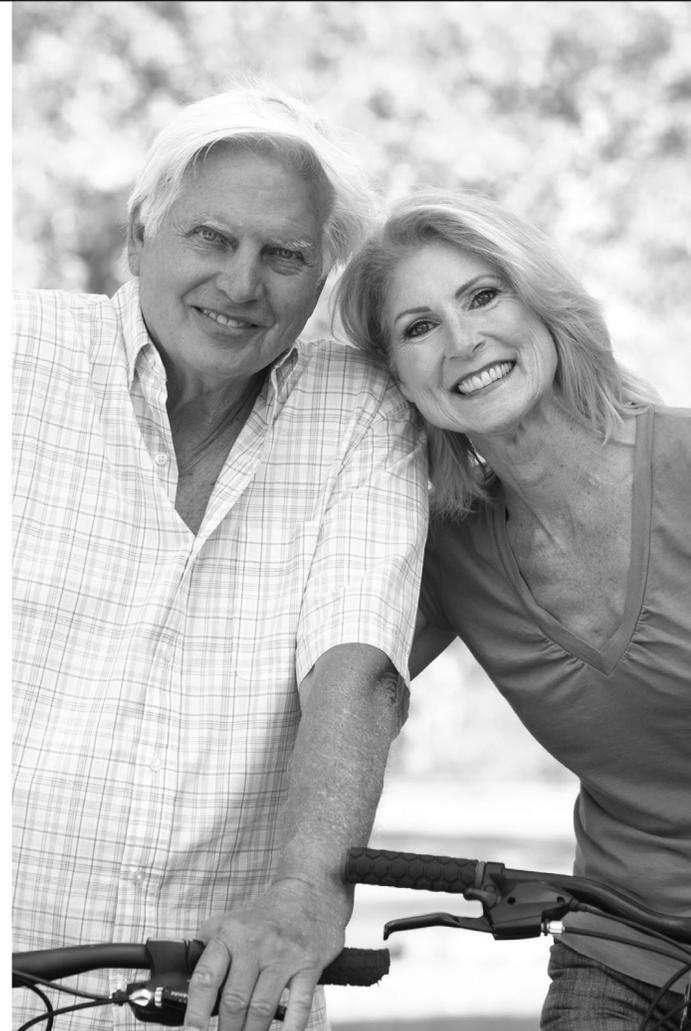
- theories on how and why we age,
- methodologies for estimating future rates of survival and
- potential benefits and risks associated with the increasing numbers of retirees and potential answers to other difficult issues that arise.

Please submit an abstract or outline of your proposed paper by **Sept. 30, 2015**. The abstract should include a brief description of the subject of the paper, data sources and methods to be used, key items to be covered, and how your paper will contribute to current knowledge, theory and/or methodology.

A brief curriculum vitae or resume is also required.

Submit the information by email to:

Jan Schuh  
Sr. Research Administrator  
Email: [jschuh@soa.org](mailto:jschuh@soa.org)



Learn more about the call for papers, including the complete topic list, by going to [Livingto100.soa.org](http://Livingto100.soa.org)

Questions may be directed to

Ronora Stryker, research

actuary, at [rstryker@soa.org](mailto:rstryker@soa.org).

# An Efficient Statistical Estimator for Validating Life Expectancy Reports in the Life Settlements Market

by Gordon Gillespie



Gordon Gillespie is an actuarial consultant based in Berlin, Germany. He has been offering quantitative risk management expertise to insurers, banks and other financial institutions since 2006. You can reach him at [info@gillespie-aktuar.de](mailto:info@gillespie-aktuar.de).

## Introduction

Investors in the life settlements market require a quality assessment of life expectancy reports. They generally rely on “actual to expected” analyses based on historical life expectancy reports, mostly issued or authorized by the medical underwriters who provided the reports. These analyses purport to and seemingly do show that the life expectancy estimates provided by the medical underwriters were reasonably accurate, or at least not statistically inconsistent. However, as we will show, a mere actual to expected analysis is inconclusive, if not misleading.

This article will present an alternative validation methodology, which makes much better use of the available mortality information. In its simplest form, it reduces the testing to the estimation of a single parameter which can be considered as a measure for a certain kind of systematic over or underestimation of the life expectancies.

Investors are thereby able to perform their own analyses, even for rather small portfolios with shorter histories, and to draw statistically valid conclusions concerning the life expectancies on which they have based their pricing and management of future cash flows.

## The Role of Medical Underwriters in the Life Settlements Market

The basic principles underlying a hypothetical life settlement transaction include the following:

- An elderly insured person with a medical condition resulting in a substandard state of health no longer requires the protection provided by the life insurance policy.
- “Selling back” the policy to the insurer is not an attractive option for the insured, since the insurer’s offer, the cash surrender value, lies far below the “fair” value.
- The investor makes an offer much more lucrative for the insured, however, at a price point that is still considerably below the fair value.
- If the insured accepts the investor’s offer the policy stays in effect with the investor becoming the new beneficiary, in return for paying the offer price to the insured and the future premiums due to the insurer.

Obviously, investment in a single policy bears far too great a risk of financial loss. Therefore, investors usually purchase entire portfolios with at least 30 to 40 insured persons which creates a more predictable and less risky block of business.

This reassuring message to investors holds true only if the life expectancy estimates for the insured persons provided by medical underwriters and taken as key parameters for pricing the policies are not too “optimistic,” i.e., more favorable than the “true” life expectancies. So, why rely on these estimates? Why not simply base one’s pricing on accessible and generally accepted mortality tables, such as the Valuation Basic Table(s) developed and published by the Society of Actuaries?

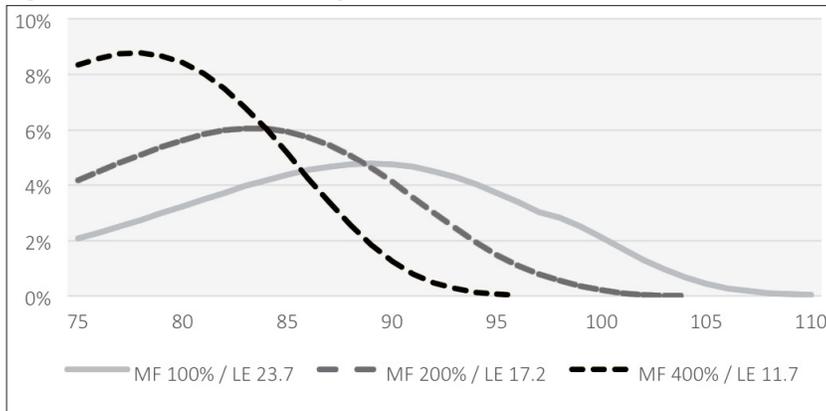
The main reason is that, in the typical case of life settlements, we are dealing with an insured persons with severe medical conditions and a more substandard population as a result. The basic table underestimates the mortality for such a group, leading to an offer price below the fair value, equally unattractive to the insured as the surrender value. Therefore an appropriate estimate is needed for the degree by which the mortality rates in the basic table are to be increased for pricing purposes. Providing such estimates is the main service medical underwriters have to offer in the life settlements market.

## The Medical Underwriters’ Methodology

The methodologies employed by expert medical underwriters can differ in various respects—for instance, the amount and type of medical and socio-economic data taken into account. For the purpose of this article, however, we can neglect the differences and regard the methodologies alike, simply as functions taking biometrical and other relevant parameters as input and rendering a *mortality factor* as output, by which the mortality rates of the basic table are to be multiplied in order to derive the appropriate mortality rates.

In the past, mortality factors well above the 100 percent standard were common, and it was not unusual to see numbers as high as 500 percent for example. The impact of such figures can be seen in the following diagram, showing the mortality probability distributions, of a cohort of female insureds age 75, with the VBT 2008 as the basic table:

**Mortality Probability Distributions for a cohort of Female, Age 75, for different Mortality Factors based on VBT 2008**



The diagram above shows that applying a constant mortality factor greater than 100 percent to the mortality rates of an insured person for all future years not only reduces the life expectancy estimate but also the “longevity risk.” If one also takes into account that many policies traded in the life settlements market have flexible premiums, potentially growing year by year at ever higher rates, it is clear that overestimated mortality factors can lead to significant overpricing of policies for sale.

Therefore, investors were shocked by news in 2008 that some of the leading medical underwriters had started to drastically lower their mortality factors, so that life expectancy estimates increased by 20 to 25 percent on average.<sup>1</sup>

### Poor Validation Methods

Were the reductions of the mortality factors the consequence of necessary corrections to previously flawed methodologies or incorrect weighting schemes for certain medical conditions? Or were they merely due to the replacement of the VBT 2001 by the VBT 2008 as the “official” basic table as some medical underwriters have suggested?<sup>2</sup>

Quantitative analysis by the medical underwriters based on their comprehensive historical records could shed some light on these issues. However, to the author’s knowledge, no such analyses, with statistically valid conclusions as to whether historical mortality factors were systematically overestimated, have been published.

Instead, investors were presented with actual to expected analyses, which simply compared the actual number of deaths for a specific portfolio with the expected number of deaths to date according to life expectancy reports previously provided to the investors. Actual to expected ratios around 100 percent were then considered proof or, at least, an indication of a valid methodology used in the past.

With respect to such analysis, one market expert has commented:<sup>3</sup>

*“You would think that the expected deaths used to determine a life expectancy provider’s Actual to Expected ratio would be based on the actual LE estimates it gave to its clients. However, in the face of A/E ratios based on actual/historical data that are too low, some life settlement providers have adopted the practice of just lowering their “expected” deaths, ostensibly to reflect current methodologies and mortality tables, with the convenient benefit of making their adjusted A/E ratios higher and closer to 100%.”*

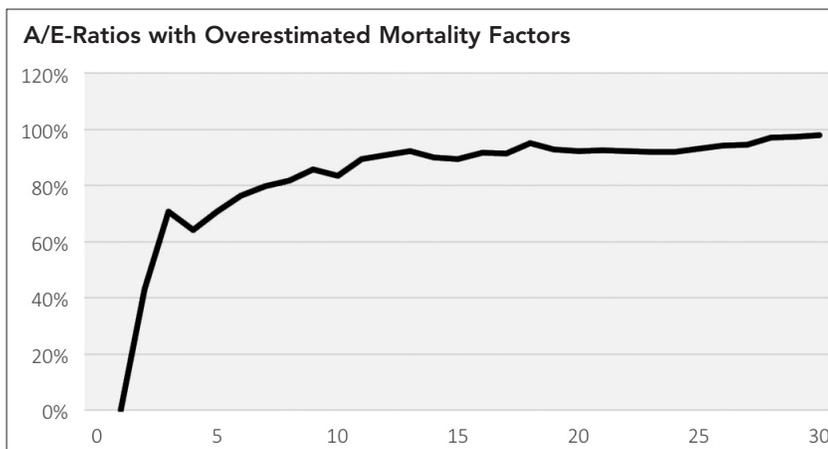
The Actuarial Standards Board, in an Exposure Draft of May 2013, has also drawn attention to a lack of rigorous estimation standards:

*“The life settlements market has demanded actual-to-expected (A/E) results from the LE providers, but in the absence of specific guidelines and disclosures, practices for calculating A/E results have varied widely. A limited*

CONTINUED ON PAGE 22

*number of states require LE providers to file A/E ratios, but again, lack of specific guidelines has led to concerns with mortality tables and methodologies used.”*

Simple actual to expected ratios have little relevance and can actually be quite misleading, as the following diagram shows:



The graph depicts a series of actual to expected ratios for a fictitious portfolio of 48 men and 52 women whose policies were purchased eight to 10 years ago and whose ages at the time ranged from 60 to 90 years. Further, the mortality factors ranged from 150 percent to 300 percent of the 2001 VBT table. Finally, the ratios were simulated under the assumption that for each mortality factor the portion exceeding 100 percent is twice what it should have been in order to render the actual mortality rates (e.g., estimated factor 180 percent, correct factor 140 percent).

According to this assumption the average life expectancy for each insured person at the time of purchase of his or her policy was 10.1 years. This figure is significantly greater than the average, 8.4 years, of the life expectancies featured in the hypothetical medical underwriting reports. Yet, seven years after the first purchase the actual to expected ratio has already reached a level of 80 percent and, in the following years, it continuously approaches the “perfect” 100 percent level.

This example demonstrates that a simple actual to expected analysis can make historical mortality factors appear much more accurate than they actually are, all the more so if the mortality factors are subsequently reduced

for the purpose of the analysis (as hinted at in the above quote). Whether the latter is the case or not, in light of the methodological deficiencies of the actual to expected approach it should come as no surprise that most medical underwriters have presented ratios above the 90 percent level. Such figures cannot be taken as “statistical proof” of a valid underwriting methodology in the past.

Improved variations of the simple actual to expected approach have been developed.<sup>4</sup> These alternatives cannot fix the problem of the simple approach, though—namely not to take the entire *mortality distributions* associated with the mortality factors into account but only certain key figures thereof. By condensing the available information to, for instance, the number of deaths up to now and only comparing the expected and actual value with each other, too much information may be neglected.

It is often argued that statistical tests based on the *entire* information encoded in the mortality distributions (for the testing period) are so restrictive that they *have* to lead to a rejection of the medical underwriters’ models.<sup>5</sup> Thus, it could be argued further that such tests are just as useless for validation purposes as simple actual to expected analyses, only for opposite reasons.

This argument would indeed have some merit if such tests were employed in order to verify, or rather falsify, the assumption of a perfect alignment between the actual mortality distributions and the ones implied by the mortality factors. Such a match is highly unlikely anyway. It is quite obvious that applying one factor to all future mortality rates for the insured in question is bound to lead to a more or less skewed or otherwise distorted mortality distribution.<sup>6</sup> One might concede that the mortality distributions implied by the medical underwriter’s models only have to be in the general proximity of the actual mortality distributions.

Next, a statistical method is presented that provides investors with a reliable measure to satisfy that requirement.

### An Alternative Method

How could an investor assess the quality of the historical life expectancy reports for the hypothetical portfolio of 48 men and 52 women? The investor will certainly not

be able to assess each report, or rather each implicitly reported mortality factor *by itself*. The only information available for such an assessment would be that the respective insured person is still alive or, if not, when he or she died. These bits of information are clearly insufficient for any valid statistical conclusion.

Thus, some kind of connection has to be established between the mortality factors for *all* insured persons. One way of doing so is by introducing a parameter,  $\alpha$ , which corresponds to a certain kind of systematic over- or underestimation of the mortality factors. Let  $\mu_1, \mu_2, \dots$  be the reported mortality factors, and assume that the true mortality factors are

$$\mu_{\alpha,k} = \alpha(\mu_k - 1) + 1 \quad (k = 1, 2, \dots)$$

Then,  $\alpha = 100\%$  means that the reported mortality factors were correct, and  $\alpha = 0\%$  means that, in contrast, the mortality rates given by the basic table directly applied to the portfolio. The assumption under which the series of actual to expected ratios depicted above was simulated corresponds to  $\alpha = 50\%$ .

This way of connecting the mortality factors can be criticized as being arbitrary. Indeed, it is not very plausible that all mortality factors were estimated with a systematic error expressible in such a simple manner by a single parameter. But the aim is not to develop a realistic model of how the mortality factors were systematically over or underestimated, if that was indeed the case. The aim is rather to develop a model that allows a statistically valid conclusion as to whether there was *some* kind of systematic estimation error based on the sparse mortality data available for the portfolio. And that is exactly what the proposed model does. Say, for instance, a low value for  $\alpha$  is implied by the data, with a narrow margin of error and at a high level of confidence. Then the investor can justifiably claim that the life expectancy reports in question significantly overestimated the mortality factors, at least “on average.” Perhaps more importantly, the investor will have a better basis for the modeling of future cash flows.

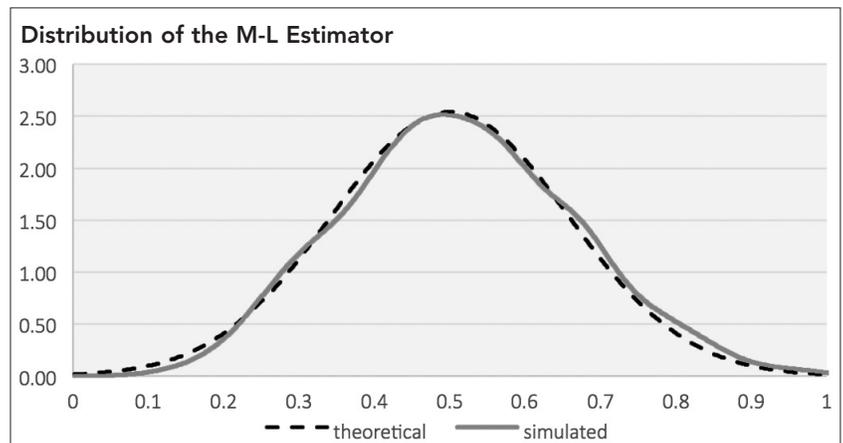
The classical maximum likelihood methodology offers a suitable estimator  $\hat{a}$  for  $\alpha$ . This estimator is determined as follows: Let  $T_k$  be the random time of death of the insured  $I_k$ , measured in full units, for instance months, viewed from the time of purchase  $t_{0,k}$  of his or her policy. And let  $t_k$  and  $\tau_k$  be the actual time of  $I_k$ 's death and today, respectively, measured in the same full units and with respect to  $t_{0,k}$ , but viewed from some time in the future when all insureds will have deceased. Then  $\hat{a}$  is the  $\alpha$ -value for which the following product reaches its maximum:<sup>7</sup>

$$P = \prod_{t_k \leq \tau_k} P_\alpha(T_k = t_k) \prod_{t_k > \tau_k} P_\alpha(T_k > \tau_k)$$

$P_\alpha(T_k = t)$  being the probability of the event  $\{T_k = t\}$  according to the mortality distribution of  $I_k$  implied by  $\mu_{\alpha,k}$ , as viewed from  $t_{0,k}$ .

A great advantage of the maximum likelihood estimator is that it not only renders a measure for a potential overestimation of mortality factors but also a measure for the reliability of that measure. For  $\hat{a}$  is asymptotically normally distributed with mean  $\alpha$  and variance  $I(\alpha)^{-1}$ , and  $I(\alpha) = -E\left(\frac{d^2 \ln(P)}{d\alpha^2}\right)$ .<sup>8</sup> Together with an estimate of  $\alpha$  statistical software packages will usually also provide an estimate of  $I(\alpha)$ .

The following diagram shows how well the asymptotic approximation works, even for a relatively small portfolio with a moderately long history as the one considered above:



CONTINUED ON PAGE 24

The solid line shows the smoothed empirical probability distribution (or rather density) of  $\hat{a}$ , simulated for the hypothetical portfolio, with  $\alpha = 50\%$ . The first simulation run rendered  $\hat{a} = 54.95\%$  and  $I(\hat{\alpha})^{-1} = 15.69\%$ .<sup>2</sup> The dotted line depicts the density of the normal distribution with mean 0.5 and standard deviation 0.1569.

This example shows that the back testing method described above provides investors with estimates for the degree by which the historical mortality factors for their portfolios were possibly overestimated in a certain kind of way and “on average.” Moreover, it also provides them with a reliable measure for the accuracy of those estimates.<sup>9</sup> In the hypothetical case the investor could conclude, at the 95 percent confidence level, that  $\alpha$  is no greater than  $54.95\% + 1.6449 \times 15.69\% = 80.76\%$ .

## Conclusion

For validating life expectancy reports, a mere actual to expected analysis is less than a valid substitute for quantitative studies which enable one to draw genuine statistical conclusions. This is due mainly to the loss of a notable portion of the information associated with any particular set of mortality factors, resulting from focusing solely on certain key figures of the mortality distributions involved.

The maximum likelihood estimator,  $\hat{a}$ , in contrast, uses the entire information and thereby allows investors to perform their own analysis. This analysis is intended to detect a systematic overestimation of mortality factors, if indeed such an overestimation did occur in the past.

The estimator,  $\hat{a}$ , and more sophisticated alternatives can prove to be powerful new risk management tools for investors in the life settlements market.  $\square$

## ENDNOTES

- <sup>1</sup> See <http://www.lifepolicygroup.com/press/market-rocked-as-21st-services-changes-mortality-tables>
- <sup>2</sup> See Siegert, Paul *Evolution of Life Expectancies in the Life Insurance Secondary Market*, Insurance Studies Institute, 2010.
- <sup>3</sup> Rebello, R. *How Poor Actuarial Practices result in Multi-Million dollar losses for Life Settlement Investors*, Colva Insurance Services
- <sup>4</sup> See Bauer, D., Russ, J. *A New Methodology for Measuring Actual to Expected Performance*, 2012, <http://www.ifa-ilm.de/downloads/DCLE.pdf>
- <sup>5</sup> *Ibid.*: “Due to size of portfolio, deviations that would be considered small by practitioners would be statistically significant.”
- <sup>6</sup> Consider the case of a patient upon whom a life-saving operation needs to be performed. Assume that the outcome of that operation will either be the patient’s death or the patient’s complete recovery. It is clear, in this case, that not all mortality rates are equally affected.
- <sup>7</sup> It is assumed that  $T_1, T_2, \dots$  are independent.
- <sup>8</sup> See e.g. Green, W.H. *Econometric Analysis*, 7th Ed., 2012.
- <sup>9</sup> With a further simulation study it can be shown that the estimates for the variance of do not vary too much, themselves.

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# The Future of Underwriting: a Reinsurer Partner's View

## An Interview with Joe Gilmour



Joe Gilmour, FSA, FCIA is Chief Executive Officer of SCOR Global Life Americas, overseeing all aspects of SCOR's life reinsurance business in the Americas, including operations in the U.S., Canada and Latin America.

*In the following Q&A feature, Joe Gilmour, the CEO of SCOR Global Life Americas, shares his views on innovation in the underwriting arena as a key to growth of individual life insurance in the U.S. market.*

**Q:** The protection gap—the large group of uninsured people in the United States—has received a great deal of attention over the past few years. Can the industry reach them?

**Joe Gilmour:** I believe today's insurance industry (composite) can reach the under-insured but we must also be watching for the disrupters who have an existing business model which reaches consumers en masse.

The protection gap exists in both the middle market—where financial planning is relatively simple—and the affluent market—where financial planning is relatively complex. They're different but not mutually exclusive. By that I mean a solution in reaching the middle market could likely be leveraged into the more affluent markets.

**Q:** Focusing then on the middle market, what do you think is the formula for success?

While this market has many segments, I believe there are five key commonalities for success: 1. a simple product, 2. a simple application, 3. a competitive price, 4. a simple acceptance process, quick and non-invasive, and 5. advocates of good/great standing.

Insurers in the United States and abroad have already shown that large and viable businesses can be built by companies selling many small-amount life insurance policies (and related coverages).

For existing distribution, the traditional acceptance process is too time consuming and costly. We will always need traditional underwriting for important segments of the market, but to successfully penetrate the middle market we also need a very quick and non-invasive sales process.

**Q:** What do you mean by quick and non-invasive?

**A:** By quick I mean at the **point of sale**, which obviously has significant market penetration possibility if the distribution channel is aligned with the target market. And non-invasive means a simple application without collecting private medical information.

We have examples of organizations that are reaching the middle market for financial products. They perform needs analysis efficiently and quickly, usually through electronics. They reach out to different consumer groups with producers who understand what makes that customer tick.

Does the evidence suggest we still need to offer the middle market purchaser more competitive rates?

The evidence is mixed, though if rates that are close to larger size traditionally underwritten policies suddenly become available, then I expect the answer will be obvious.

To be competitive I believe we need electronically available data sources and an underwriting algorithm. We may not be talking *Flash Boys*<sup>1</sup> technology. I'm essentially talking about replacing an underwriting manual with an algorithm that makes mortality risk decisions in real time, including financial assessment. The only way an algorithm can do this is by having electronic data available on an applicant at the time of underwriting, which is greatly enhanced if also at the time of application.

Pricing the mortality risk, of course, is dependent on the validity of data that is available. When underwriting electronically, the biggest risk is not effectively filtering out the poorer risks that normal underwriting would catch—because letting in a few bad risks can have significant impact.

**Q:** Are sufficient data sources available to underwrite at the point of sale?

**JG:** Data sources are growing quickly and in ways that can be delivered in an algorithm-readable format. Full geographic coverage is advancing as well. We now have prescription drug records available for a majority of the population (which are priced for consumption on a per transaction basis). This has enabled replicating underwriting algorithms to move forward at the standard underwriting classes.

In the future, underwriting algorithms with sufficient data have the ability to make instant underwriting decisions on a very large percentage of applicants. Perhaps not 100 percent but it could be very high—85+ percent for term products. For the remaining non-decisions, the algorithm can serve as triage to other underwriting processes.

Replicating underwriting performance through algorithms and electronic data isn't fiction, but has a long way to evolve. Early findings, based on broad mortality pools, are promising. As we narrow the pool definitions to preferred and sub-standard rate classes, we will need more electronic data per applicant to offer competitive rates.

**Q:** How do you put all these things together?

**JG:** In order to sell life insurance at the point of sale and at competitive rates you need an algorithm and the technical support behind it. The algorithm can't be perfect right away. There will be some element of trial and error, a constant refinement from parallel testing with traditional underwriting and to mortality experience. Having an alignment of parties will be key—distribution, insurer and (perhaps) a reinsurer with experience and know-how so new underwriting risks can be covered.

**Q:** How much of an issue is cybersecurity?

**JG:** The security of data and the ability to move it around at the point of sale is a critical component of this business model. Fortunately, the cloud offers a whole new level of security and some very able providers are offering OpEx type cost structures.

**Q:** You listed "Advocates of good/great standing" as one of the components of successful middle market formula. Can you expand on that?

**JG:** It's no secret that the life insurance industry needs to build up our reputation in the consumer market place. One of the surest ways to do this is to extend our reach through the internet and other alternative means. We need people talking about how easy and affordable it is to get a great life insurance policy, no matter what the size.

**Q:** In your vision of the future, what does simplified issue look like?

**JG:** I'm being a bit facetious, but it may come down to a one question application: Can I access your e-records?

*Mr. Gilmour was named CEO in October 2013, following SCOR's acquisition of Generali U.S., which established SCOR as the leading life reinsurer in the U.S. market. In 2008, Mr. Gilmour joined the senior management team of Transamerica Reinsurance, which was acquired by SCOR in August 2011. He was previously with New York Life International, where he served as Chairman and CEO and, before that, as Chief Financial Officer. He also served in various senior positions at Canada Life.*

*Mr. Gilmour holds a Bachelor of Science degree from the University of Toronto, is a Fellow of the Society of Actuaries and a Fellow of the Canadian Institute of Actuaries.*

#### ENDNOTES

<sup>1</sup> See <http://www.lifepolicygroup.com/press/market-rocked-as-21st-services-changes-mortality-tables>

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