



Product Matters!

ISSUE 90 | OCTOBER 2014

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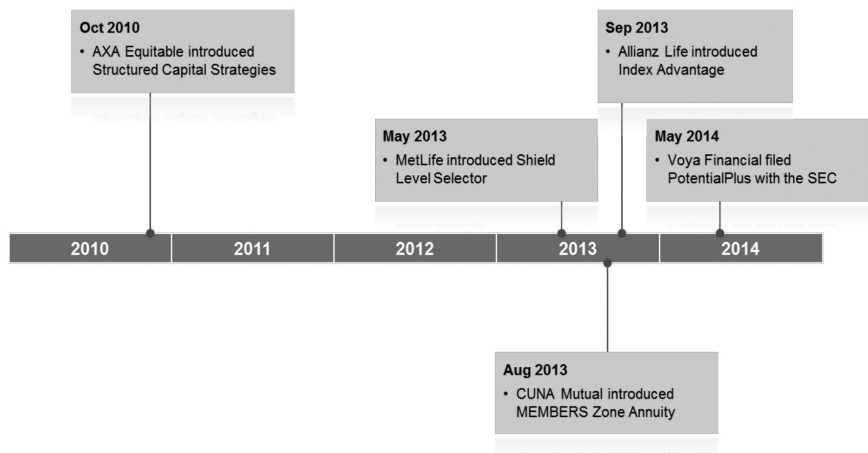
Hybrid Annuities: A Growth Story

By Dean Kerr, Guillaume Briere-Giroux, and Aaron Chiong

Introduction

More and more insurers are designing and offering “hybrid annuities” (also referred to as structured annuities, structured-note annuities, structured variable annuities, structured indexed annuities, indexed variable annuities, and variable annuity/fixed indexed annuity hybrids). These products provide consumers with higher index-linked upside potential—relative to traditional fixed indexed annuities (FIA)—in exchange for sharing some downside return risk. As shown in Exhibit 1, this innovation was first introduced in late 2010. By the end of 2013, the current market leader had garnered more than \$3 billion in cumulative sales. Other entrants are starting to gain significant traction. For instance, in the fourth quarter of 2013, a second carrier reported sales between \$200 million and \$300 million, while another reported \$90 million.

Exhibit 1: Hybrid annuity launches and filings (as of mid-2014)





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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, Jim Filmore, Kurt Guske, or Joe Kordovi by Dec. 1, 2014.

Chairperson's Corner

Closing Time

By Tim Rozar

I believe it was Seneca the Younger who keenly observed that “every new beginning comes from some other beginning’s end.” Or perhaps it was 90’s one-hit wonder Semisonic—I often get my alt-rock bands and Ancient Roman philosophers confused. Either way, while this “Chairperson’s Corner” marks the closing time for my three year stint on the Product Development Section Council, it marks a new beginning for a great slate of council members.

I know that the incoming section council will do a great job delivering on the strategies that we have pursued over the past year. Among the highest priorities is delivering groundbreaking, practical research content including a soup to nuts survey of best practices in the product development process and a thorough review of industry experience on term conversions. We have also focused on improving communication and content delivery to section members through email blasts, podcasts, webcasts, buzz group calls and LinkedIn discussions. While continuing to advance the research, content and communication agendas, I also know that they will seek ways to meet the new and emerging needs of the section membership, both in the United States and beyond.

As we have just elected new council members, I’d like to thank my fellow council members who are also closing out their current elected terms.

- Kurt Guske has served for three years on the council. Kurt has been instrumental in the success of the Product Matters newsletter and the section’s contributions to the Annual Meeting and Life & Annuity Symposium.
- Ken Birk is completing a one year appointment to the council. Ken has taken a key leadership role in coordinating the section’s research projects.

Finally, as I reflect on the past three years, I am struck by a few things:

1. Time really flies. Has it really already been three years since I started on the council? Amazing.
2. The SOA staff members are rock stars. For those of you who haven’t had the privilege to interact with the SOA staff, they are among the most dedicated, professional and friendly people you’ll ever have a chance to be around. I’d like to personally thank Christy Cook, Ronora Stryker, Jan Schuh, Jim Miles, Amy Wojcik, Ryan Smith, Meg Weber, Kathryn Baker and the rest of the SOA staff for their help on section activities. It would simply be impossible to do any of the things that we want to do as a section without them.
3. Friends of the Council are awesome. They are the unsung heroes of the section who bring their dedication and passion for volunteerism to provide continuity and energy to the section. They join our monthly meetings, volunteer on committees and generally enable the section to get things done that we wouldn’t otherwise have the bandwidth to do. Many thanks to PD Section friends Paul Fedchak, Donna Megregian, Al Klein, Paula Hodges, Doug Robbins and too many others to list.

With that, my time on the PD Section council has come to a close. As they say, I don’t have to go home, but I can’t stay here... □



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In this article we aim to address the following questions:

- What is the consumer appeal of hybrid annuities?
- What are key design and pricing considerations?
- What is the future outlook for these products?

What is the consumer appeal?

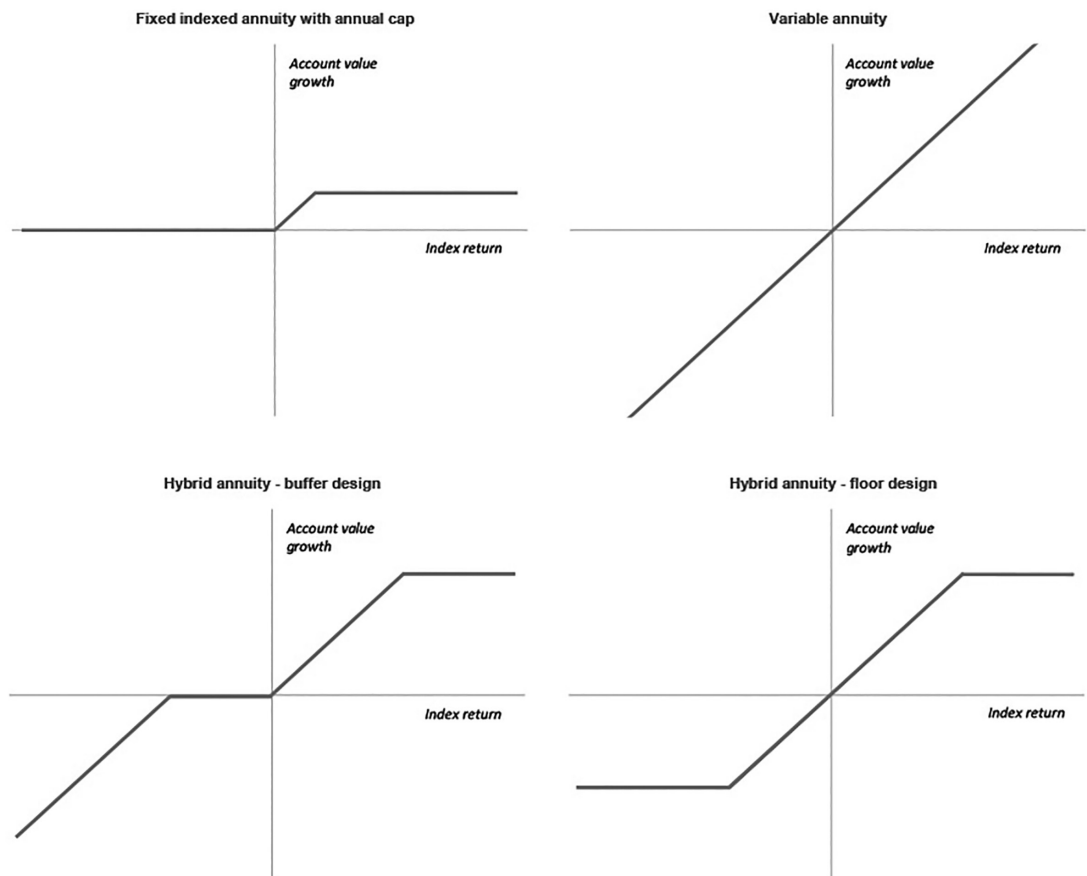
Generally speaking, hybrid annuities fill the risk spectrum between FIAs and accumulation variable annuities (VAs) invested in an indexed fund. Hybrid annuity crediting structures include “buffer” designs and “floor” designs. The consumer risk profile of FIA with annual cap, VA and these two types of hybrid designs is displayed in Exhibit 2.

Exhibit 2: Indexed-linked account value growth profile (before fees)

As shown in Exhibit 2, hybrid contracts can produce negative returns if index performance is negative. For buffer designs, this will be the case when the drop in the index exceeds the buffer. Once the buffer is breached, losses are uncapped. On floor designs, negative returns immediately lead to losses, but losses are limited to the floor.



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Not unlike FIAs and VAs, hybrid annuities typically offer a choice of investment options. Policyholders may generally allocate funds to desired indices, crediting methods, crediting terms and protection levels. Unlike VAs, assets are not invested directly in unitized funds held in the separate account; rather, hybrid annuity policyholders

participate indirectly in the performance of the underlying index, and assets supporting the contract are held in a non-unitized separate account.

What are key design and pricing considerations?

Hybrid annuities are currently registered with a prospectus filed with the Securities and Exchange Commission (SEC). Prospectus language differs by design with respect to whether the contracts represent a “variable and index-linked deferred annuity,” “deferred variable annuity” or “deferred annuity.” Some common characteristics of currently available products are:

- Lack guaranteed living benefits
- Link to an index (typically an equity index)
- Preserve the tax deferral, death benefits, and withdrawal provisions of traditional annuities

Hybrid annuities can be broadly categorized as “FIA like” and “VA like” designs, with the characteristics described in Exhibit 3.

Exhibit 3: Overview of hybrid annuity designs

“FIA like” design	“VA like” design
<ul style="list-style-type: none"> • No M&E fee • Policyholders can allocate to one or more segments/accounts • Each segment/account credits a return based on the underlying index, term, buffer or floor 	<ul style="list-style-type: none"> • M&E fee • Policyholders can allocate between variable options and structured investment/index options <ul style="list-style-type: none"> - Variable options behave like a traditional VA - Structured investment/index options behave similarly to “FIA like” products • Investment expense (applies to variable options only)

When designing and pricing a hybrid annuity, actuaries need to consider a range of pricing, risk management and regulatory matters:



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Comparison of key VA, FIA and hybrid annuity design elements

Fixed Indexed Annuity

- No downside risk¹
- Participate indirectly in the performance of the underlying index
- Choice of index, crediting method and term
- Guaranteed minimum crediting rate
- Fixed account is available
- Guaranteed non-forfeiture value

Variable Annuity

- Unlimited downside risk
- Invest directly in separate accounts/funds
- Fixed account is often, but not always available
- No guaranteed minimum crediting rate outside of the fixed account

Hybrid Annuity

- Downside risk with some protection via buffer or floor
- Participate indirectly in the performance of the underlying index
- Choice of index, crediting method, term and protection level
- No guaranteed minimum crediting rate
- Fixed account is not usually available (only one carrier offers a fixed account in the investment options)

¹ Ignores surrender charges and other account-based charges.

- **Policyholder behavior:** Although the lack of guaranteed living benefits simplifies the pricing, hybrid annuity design brings additional considerations related to interest-sensitive and index-sensitive dynamic lapses.
- **Impact of hedging:** How can the synergies with existing FIA and VA designs be leveraged to reduce costs or increase competitiveness?
- **Complexity:** Certain hybrid annuity designs offer a wide range of crediting methodologies with varying terms. How will this complexity impact the modeling, administration, management of non-guaranteed elements, and general risk management of the business?
- **Reserving:** Hybrid annuities do not have well-established US Statutory or US GAAP accounting frameworks; modeling and implementation of reserving methodologies can be complex.
- **Regulatory concerns:** Regulatory concerns surrounding hybrid annuities are generally related to the filing of these products as VA contracts and possible conflicts with both the Variable Annuity Model Regulation and the Standard Nonforfeiture Law for Individual Deferred Annuities.

What is the outlook for hybrid annuities?

Although banks have offered structured notes for some time, hybrid annuities are relatively new and sales continue to gain momentum, presenting opportunities for new entrants. We believe that the following factors will contribute to existing carriers expanding their offerings and new carriers entering this market:

- **Consumer appeal:** Hybrid annuities help fill the risk spectrum between FIAs and VAs and offer considerable flexibility to consumers.
- **Access to new distribution:** Existing FIA carriers, in particular, may use hybrid annuities to expand sales with registered advisors and gain traction in new channels.
- **Balancing product profile:** Many VA carriers have significantly reduced their appetite for living benefit guarantees or have reached maximum capacity. Hybrid annuities offer existing VA carriers a new

opportunity to attract assets without offering living benefits.

- **Offsetting VA guarantee risks:** Hybrid annuities can be designed in such a way as to help insurers offset risks from existing VA books and provide capital benefits.
- **Sustainable design in a low rate environment:** Hybrid annuities are less exposed to interest rate risk than FIAs or VAs with living benefit guarantees.

The views expressed are the authors' own and may not represent the views of Oliver Wyman.

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How Do Your Universal Life and Indexed UL Products Stack Up?

By Susan J. Saip

Given the recent decline in Universal Life (UL) sales, in particular those with secondary guarantees, it is important for carriers to keep an eye on what is happening in the UL/IUL market. Milliman's seventh annual survey of leading UL insurers is a useful tool for competitive benchmarking purposes and keeping up with the issues and challenges of the UL/IUL market. Over the last 10 years the UL/IUL market share (measured by annualized premium) has ranged from 37 percent to 42 percent¹ of total individual life sales, and was 38 percent¹ as of Dec. 31, 2013. The IUL market share has shown tremendous growth, from 8 percent in 2007 to 14 percent during the first quarter of 2014¹. These facts demonstrate the importance of UL/IUL products in the U.S. individual life market. For purposes of the Milliman survey, sales were defined as the sum of recurring premiums plus 10 percent of single premiums. The scope of the Milliman survey included UL with secondary guarantees (ULSG), cash accumulation UL (AccumUL), current assumption UL (CAUL), and the indexed UL (IUL) counterparts of these products. The definition of these product types is shown below:

UL/IUL with Secondary Guarantees: A UL/IUL product designed specifically for the death benefit guarantee market that features long-term (guaranteed to last until at least age 90) no-lapse guarantees either through a rider or as a part of the base policy.

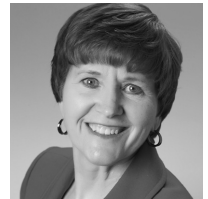
Cash Accumulation UL/IUL: A UL/IUL product designed specifically for the accumulation-oriented market where cash accumulation and efficient distributions are the primary concerns of the buyer. Within this category are products that allow for high-early-cash value accumulation, typically through the election of an accelerated cash value rider.

Current Assumption UL/IUL: A UL/IUL product designed to offer the lowest cost death benefit coverage without death benefit guarantees. Within this category are products sometimes referred to as "dollar-solve" or "term alternative."

Results of the survey are based on responses from 26 carriers of UL/IUL products. This article highlights the key findings of the survey.

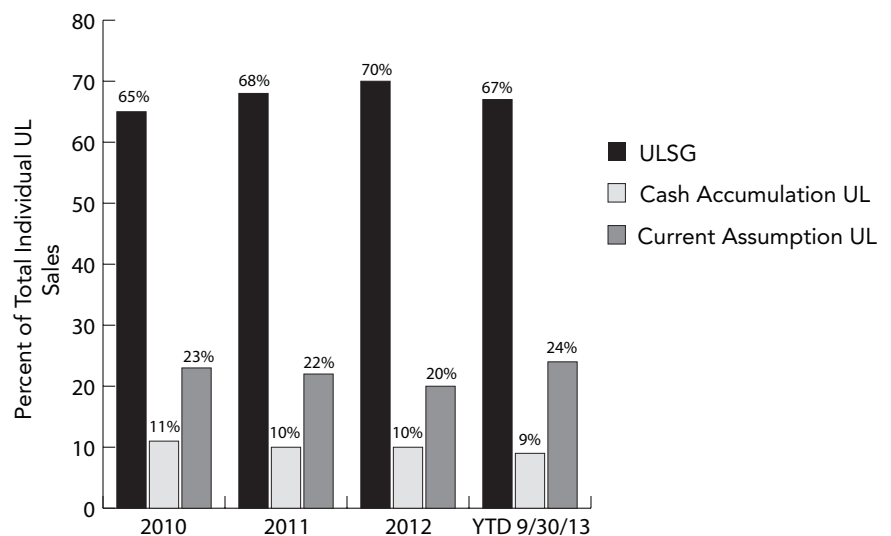
UL Sales

Figure 1 shows the mix of UL sales (excluding IUL sales) reported by survey participants for calendar years 2010 through 2012, and for 2013 as of Sept. 30, 2013 (YTD 9/30/13). Individual company results were varied, but 10 participants reported at least a 25 percent shift from or to any one UL product when looking at the YTD 9/30/13 product mix relative to that of 2012. Eight of the 26 participants reported movement to ULSG products, eight to AccumUL products, and eight to CAUL products. Sales of ULSG products were discontinued by five participants. Actuarial Guideline 38 reserve requirements have made some ULSG product noncompetitive, resulting in some companies withdrawing their products.



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Figure 1: UL Product Mix by Year



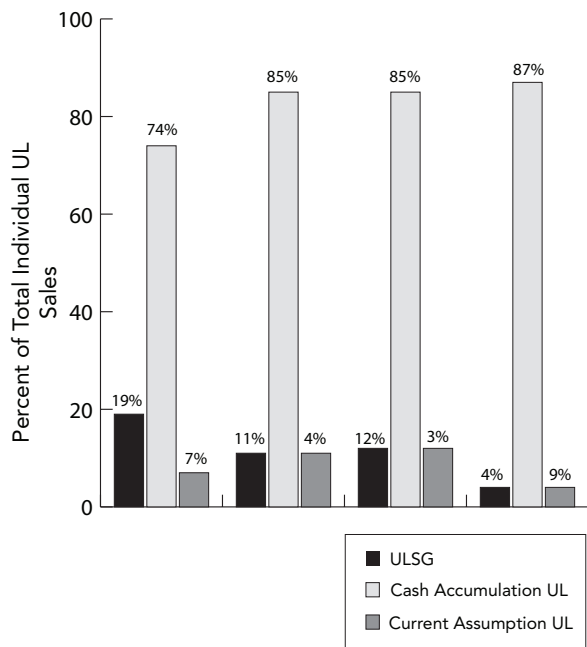
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For the first time, the survey results include the reporting of the percentage of ULSG sales (based on policy count) with the selection of no lapse guaranteed (NLG) premiums to age 90 or longer. The average reported for both 2012 and YTD 9/30/13 was 77 percent, with a median of 88 percent in 2012 and 94 percent during YTD 9/30/13. Survey participants reported percentages that ranged from 14 percent to 100 percent.

Indexed UL Sales

The IUL market has garnered considerable attention recently for a number of reasons. There have been a number of new entrants in the IUL market in recent years, policyholders are interested in the upside potential and downside protection offered by IUL products, and IUL illustrations are attractive. Total IUL sales as a percent of total UL/IUL sales combined for survey participants increased from 14 percent in 2010 to 31 percent during YTD 9/30/13. From 2010 to YTD 9/30/13, AccumiUL sales increased significantly from 52 percent to 82 percent of total cash accumulation UL/IUL sales. Expectations of survey participants suggest that companies will focus more on cash accumulation IUL and current assumption IUL products and less on universal life with secondary guarantees. The graph in Figure 2 shows the significance of AccumiUL products within the IUL market.

Figure 2: IUL Product Mix by Year



Living Benefit Rider Sales

Life insurance products with living benefit riders have been available for a number of years, but recently the popularity of chronic illness and long-term care riders has increased as more and more carriers have added these riders to their UL/IUL products.

Accelerated death benefits provided under chronic illness riders are similar to those provided under long-term care insurance riders. Under chronic illness riders, payment of the death benefit may be accelerated if the insured has a chronic illness condition. Benefit triggers are included that typically utilize a combination of activities of daily living (ADLs) and cognitive impairment, or permanent nursing home confinement. These riders are typically filed under the Accelerated Benefits Model Regulation 620. Under long-term care accelerated benefit riders, payment of the death benefit is accelerated if the insured has a chronic illness condition triggering long-term care (i.e., ADLs, cognitive impairment). These riders are typically filed under Long-Term Care regulations. There are a number of other legal and design differences between chronic illness and long-term care accelerated benefit riders, as well.

Fourteen of the survey participants currently offer a chronic illness accelerated benefit rider on either a UL or IUL chassis. During the first nine months of 2013 sales of policies with chronic illness riders as a percent of total sales were 11 percent for UL products and 33 percent for IUL products. The greater share of chronic illness riders on an IUL chassis rather than a UL chassis is due to the recent development of more new IUL products. New companies entering the IUL market have filed their new IUL products including these relatively new chronic illness riders. The table in Figure 3 shows YTD 9/30/13 chronic illness rider sales as a percent of total sales for UL and IUL products separately by product type.

Figure 3: Chronic Illness Rider Sales as a Percent of Total Sales

YTD 9/30/13 Sales With Chronic Illness Riders As A Percent Of Total Sales (Weighted By Premium)			
Total Individual UL	ULSG	Cash Accumulation UL	Current Assumption UL
11%	12%	24%	4%
Total Individual IUL	IULSG	Cash Accumulation IUL	Current Assumption IUL
33%	10%	36%	21%

Long-term care (LTC) insurance has been a focus in the media recently due to the aging of the population, and the high cost of medical care for retirees. LTC riders to life insurance policies are another form of living benefit, and are available to provide a solution for LTC needs. LTC riders attached to UL/IUL policies (linked benefits) are an alternative to standalone LTC policies. During YTD 9/30/13, sales of policies with LTC riders as a percent of total sales were 17 percent for UL products and 9 percent for IUL products. Sales of LTC riders as a percent of total sales reported by survey participants are shown for UL and IUL products separately by product type in Figure 4. Few companies in the UL/IUL market offer both chronic illness riders and LTC riders. Nearly 85 percent of survey respondents expect to market either an LTC or a chronic illness rider within 12 to 24 months.

Figure 4: Long-Term Care Rider Sales as a Percent of Total Sales

YTD 9/30/13 Sales with long-term care riders as a percent of total sales (weighted by premium)			
Total Individual UL	ULSG	Cash Accumulation UL	Current Assumption UL
17%	22%	9%	6%
Total Individual IUL	IULSG	Cash Accumulation IUL	Current Assumption IUL
9%	31%	9%	1%



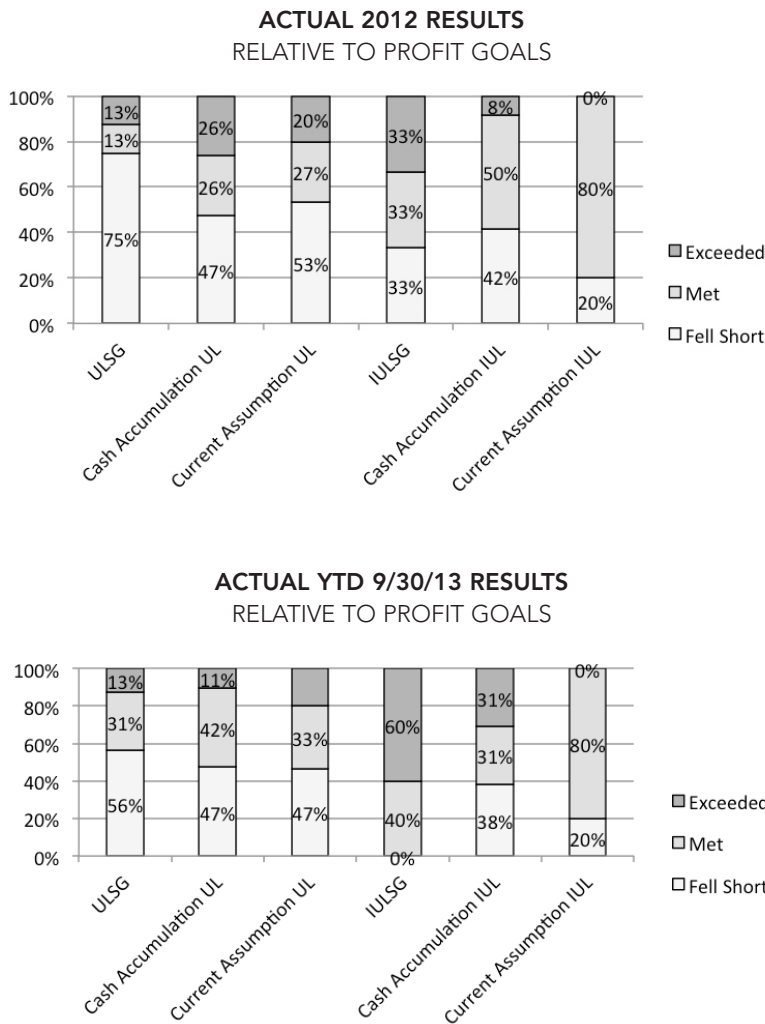
Profit Measures

Consistent with prior surveys, the predominant profit measure reported by survey participants is an after-tax, after capital statutory return on investment/internal rate of return (ROI/IRR). The median ROI/IRR is 12 percent for all UL product types, with the exception of current assumption UL and IULSG where the medians are 11.5 percent and 13 percent, respectively. More changes to profit metrics in the past two years were reported by survey participants than in past surveys. Some participants lowered their profit goals and some increased them. Others did not change targets, but are more willing to consider a statutory IRR below their targets, which is due to the sustained low interest rate environment. New profit measures were added by a few participants (e.g., 5-year GAAP ROE rather than lifetime GAAP ROE, risk neutral pricing).

The percentage of survey respondents reporting they fell short of profit goals decreased from 2012 to YTD 9/30/13 for all UL/IUL product types, except for cash accumulation UL and current assumption IUL where the percentage remained the same. These percentages dropped significantly for ULSG (75 percent to 56 percent) and for IULSG (33 percent to 0 percent). The chart in Figure 5 shows the percentage of survey participants reporting they fell short of, met, or exceeded their profit goals by UL product type. The top two reasons given for failure to meet profit goals were low interest earnings and expenses.

CONTINUED ON PAGE 10

Figure 5: Actual Results Relative to Profit Goals



Reserves

When asked about the impact of Actuarial Guideline 38 (AG 38) Section 8D on 12/31/12 reserves, the majority (12) of the 21 participants responding indicated there was no impact. Six additional participants reported that reserves increased, and the final three participants reported they have no business that is subject to AG 38 Section 8D. The methodology used for policies subject to AG 38 Section 8D was reported as the primary methodology by 14 of 15 participants.

Product Design

Ten participants in the survey repriced their ULSG designs in the last 12 months. Seven of these 10, plus three additional participants, intend to modify their secondary guarantee products in the next 12 months. Another three participants reported that it is possible they may modify their secondary guarantees products in the next 12 months. It is interesting that the majority of those intending to modify their secondary guarantee products reported they were at least meeting their profit goals through the first nine months of 2013, which may indicate that other factors are driving these modification plans.

Survey participants reported the strategies used in light of the low interest rate environment. Following are the strategies reported, with the number of responses shown in parenthesis:

- Intentionally reducing or limiting UL sales by increasing premium rates (13), or discontinuing sales of certain products (9)
- Instituting premium limitations (7)
- Riding it out (6)
- Launching new designs with reduced guarantees (6)

Illustrations

New questions were added to the survey relative to certification for illustration actuary testing and disciplined current scale breakpoint sensitivity testing. Survey participants were asked if they are currently testing in-force business or using ASOP 24 Section 3.7 to not test when certifying for illustration actuary testing on in-force business. ASOP 24 Section 3.7 applies to illustrations on policies in-force one year or more. Ten of 21 participants reported they are currently testing in-force business, and nine are currently using ASOP 24 Section 3.7 to not test when certifying for illustration actuary testing. Of the remaining two participants, one reported that it is using both approaches, and the final participant reported it is using neither approach.

Fifteen participants reported they sensitivity test to see where the disciplined current scale (DCS) breakpoints are (i.e., when the DCS might fail).

Conclusion

The UL/IUL market will continue to present challenges and opportunities to insurers. Is your company in the position to develop creative solutions to meet the challenges or take advantage of the opportunities? Insurers can evaluate their UL/IUL products and practices relative to those prevalent in the industry by using resources such as the UL/IUL survey. A copy of the executive summary of the May 2014 Universal Life and Indexed Universal Life Issues report may be found at <http://www.milliman.com/insight/2014/Universal-life-and-indexed-universal-life-issues--2013-survey/>. □

ENDNOTES

¹ As measured by recurring premium. LIMRA International, Inc.



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Predictive Modeling for Life and P&C Insurance: Two Actuaries, Two Perspectives

By David Wang and Peggy Brinkman



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David Wang is a life actuary with Milliman. He works extensively in the variable annuity area and has explored the application of predictive modeling to life and annuity insurance. Peggy Brinkmann is a Property & Casualty (“P&C”) actuary with Milliman and has 20 years of experience in predictive modeling. David talked to Peggy recently about how predictive modeling is used in P&C insurance pricing to see what life actuaries can learn from our peers.

David: Peggy, I personally think this is an exciting time for predictive modeling. It is one of the hot topics these days in life and annuity insurance industry. On the life insurance side, predictive modeling has been narrowly applied in mortality underwriting and post-level term insurance lapse analysis. On the annuity side, predictive modeling has been applied in lapse analysis for both variable and fixed deferred annuity products. But, in most cases, the results of predictive modeling have not been fully reflected in product development and pricing. I wonder what actuaries on the P&C side are doing in this regard.

Peggy: Well, David, if you can bear with me, I can give you a history lesson on predictive modeling for P&C insurance.

Predictive modeling is used widely by P&C actuaries and its application extends beyond just P&C insurance pricing. A key aspect of P&C insurance pricing is the rating plan, which dictates how premiums vary from risk to risk. Up until 15 to 20 years ago, U.S. P&C insurers used a relatively limited set of rating variables, such as territory, age, gender, marital status, and vehicle symbol for auto insurance. Rating factors that reflect the differences in expected loss from one class to another were based on highly summarized data, analyzed separately for each variable in the rating plan.

David: That does sound like what we still do today on the life and annuity side. Pricing is based on a limited number of factors—age, gender, underwriting status, and perhaps the utilization level of guarantees in the case of annuities.

Peggy: Yes. That all changed in the 1990s on the P&C side, as more companies began using predictive modeling techniques and more granular data to build their

rating plans. Generalized linear models, also known as “GLMs,” were built on loss-cost data at the individual exposure level—a single policy, vehicle, or house—and became the industry standard because of their efficiency and interpretability. GLMs enabled companies to estimate rating factors in a multivariate framework, improve the accuracy of their rating plans and quickly evaluate new potential rating variables.

David: GLMs are also commonly used by life and annuity companies in building predictive models. Some life insurers have studied policy-level experience data using GLMs, but the focus so far seems to be on setting better assumptions in order to have a better impact on pricing results. Little has been done to see if predictive modeling itself can help create new pricing variables. I wonder if we in the life insurance industry are underutilizing the power of predictive modeling. To answer that question, we would probably need more data than insurance companies typically store, like the “big data” people often talk about. Is that right?

Peggy: Actually, you don’t need “big data” to come up with new rating variables. By using existing data at a more granular level, P&C actuaries initially came up with new derived variables and interactions such as household composition. But a lot of improvement has come from using third-party data, such as credit history, to identify new differentiators of expected losses. Predictive models are used to build “scores”—such as credit-based insurance scores or vehicle scores based on vehicle characteristics—that go into subsequent GLMs with other rating variables. This process is continuing today. For example, many auto insurers are using or exploring the use of “driving safety scores” derived from data collected from telematics devices in vehicles. Predictive models are also used to create “light” versions of computationally-intensive simulation models, such as those used to evaluate hurricane risk, that are easier to interpret and calculate. These models are used to differentiate rates by catastrophe risk or to more quickly assess the risk of a new policy without running a full set of simulations.

David: Having worked extensively in the variable annuity area, I happen to know a thing or two about simulation. However, I suspect that it is a different kind of simulation than what you have described. This does bring up the



following concern: pricing work on the life and annuity side—for annuities in particular—is already computationally intensive. For variable annuity modeling, Monte Carlo simulation is a must. “Stochastic on stochastic” modeling often needs to be explored. Implementing such calculations is still a challenge for life actuaries. With the predictive modeling you describe, the pricing exercise can potentially become an even more complicated process. Nonetheless, predictive modeling processes that can reveal factors that make accurate policyholder-behavior projection possible should not simply be dismissed on the grounds of complexity. Implementation efficiency will therefore be key in such cases. The “score” idea that you mentioned may be of help. Instead of having multiple layers of simulations in pricing, dividing potential policyholders into different behavioral cohorts using a “score” may solve the execution problem.

Peggy: Yes, we do the same in P&C insurance. For example, scores based on credit history are typically grouped into what we call “tiers” for pricing purposes. Maybe P&C actuaries like me can help you build the scoring models for lapse and other behavior!

David: That sounds really intriguing. Thanks for the history lesson, Peggy. There is surely a lot we can learn.

Peggy: You’re welcome, but I am afraid the lesson is not over yet.

David: You mean that P&C actuaries have done more than you just described? That sure was a lot already.

Peggy: Absolutely. More recently, P&C insurers have started using predictive modeling to understand the interaction between their pricing and customer behavior, that is to say, how premium changes impact the retention of existing customers and the closing rates for potential new customers using their granular policy and quote data. The problem is that, while raising the rates for a group of customers may increase average profitability, it may not increase total profitability because of a decline in the number of customers arising from decreased retention and new business production. And furthermore, these effects can vary based on the characteristics of the customer. So the latest developments in the use of predictive modeling in P&C pricing involve the integration of loss cost models and customer behavior models into optimization models, to set the premiums in such a way that maximizes a target business outcome, such as number of customers, subject to constraints like the overall target underwriting profit as a percent of the premium. New types of predictive modeling techniques besides GLMs, such as “random forests” and “boosting,” are also making inroads.

David: Now that’s something I think we can definitely use. For example, term carriers will most likely be interested in optimizing renewal premium rates. Fixed annuity carriers will also be interested in optimizing their retention strategy when their blocks are approaching maturity. Even on variable annuity business, we can potentially figure out the optimal mix of policyholder guarantee utilization we want—instead of arbitrarily assigning buckets. - So it does sound like even though we are behind P&C in predictive modeling by a couple of decades, we may catch up fast by borrowing the techniques that you have developed. But I do have an important question. We both know that life insurance is of a much longer duration than P&C insurance. Projections need to be made 30 or even 50 years into the future. Experience data is unfortunately scantier because life insurance claims frequencies

CONTINUED ON PAGE 14

are much lower than P&C insurance claims. How do you think we should handle this problem?

Peggy: Predicting 30 or 50 years ahead is always a challenge. You are looking so far ahead into the future that there can be lots of uncertainties and unprecedented events. Statistical regression can be useful to identify trends in the past that you can use to help predict the future. But judgment is still necessary when such long-term projections are required.

David: That's a good point. We probably can't think of predictive modeling as a complete alternative to judgment calls on long-term projections, but it might provide clues that we can use to improve our long-term projections.

Peggy: That's right. If there are events or combinations of characteristics that occur in the future that I haven't seen in my past data, I can extrapolate to get predictions for them. However, these predictions may not be very good because they are outside of the data I trained the model on. That is why predictive models fail when "black swan" events occur. The longer the prediction window, the more likely this is to happen.

David: Similar issues exist in Monte Carlo simulation. It is often an open question as to whether economic scenarios capture enough "black swan" events that would make resulting tail results useful. A "jump diffusion process" may be introduced to the economic scenario generator to handle this, but judgment and reference to some historical events remain necessary. In such cases, we may have to consider extreme scenarios separately as sensitivity tests on predictive modeling results.

Peggy: On the other hand, there is still good news in your observation on scanty data. You really may not need as much data as you think to build predictive models. In P&C insurance, good predictive models of behaviors such as lapse do not require millions of records. This is because people can be surprisingly predictable, if you have the right data. When modeling events that have more randomness to them—such as who is going to have an auto accident in the next six months, or expected mortality—you do need more data than you would if you were

building just a lapse model. Nonetheless, I expect that you would get better predictive power and be able to use more predictor variables than you otherwise would with current univariate and tabular methods of analysis. When the data is very thin, generalized linear mixed modeling techniques can be particularly helpful.

David: This sounds encouraging. One other thing I have noticed from my recent work in predictive modeling is that the skill sets we require from life actuaries are very different from those we typically require. For example, life actuaries typically use statistics much less than P&C actuaries. But with predictive modeling, statistics become critical and life actuaries may struggle with this. Programming in SAS and R is popular in predictive modeling work, but few life actuaries are conversant in them. Can you please share what skill sets you think are required to do predictive modeling?

Peggy: Predictive modelers do need advanced statistical modeling skills. This would include the ability to program in languages such as SQL, SAS, and R. You can't do this work in Excel. Employers of today look for people with master's or PhD degrees in quantitative fields such as statistics, economics, mathematics, operations research, or engineering for predictive modeling jobs. But you also need to be able to understand the business you are working in and the challenges and limitations of the data that you have available. I think that actuarial training provides a strong foundation of skills in those areas. I do encourage predictive modelers working in insurance to take actuarial exams for this reason.

David: Wow, this may enlighten actuarial students who are currently thinking about their professional future. One more question before I let you go back to predicting: I've always believed that it is wrong to think that understanding policyholder behavior in the life insurance industry is an after-the-fact problem for actuaries to deal with. It should be an "up-front" business problem to be addressed as products are designed and business decisions are made. In other words, we should know in advance to whom we are selling and then design products accordingly. Policyholder behavior then becomes more of what to monitor and less of an item to guess. Is this something P&C actuaries are already doing?

Peggy: I believe so. We do make extensive use of predictive modeling in the product design and pricing, as we've already discussed. We also monitor the actual experience as it develops and compare it to model predictions, in order to ensure that we are on track and that the models are still valid.

The use of predictive models in P&C is not limited to pricing, though. Models to predict the expected profitability or lifetime value for each policyholder are used by underwriting, marketing, and sales units to track expected performance, to look for trends in the quality of new policies being written or the policies that are defecting, to prioritize policies for retention programs, and to analyze agency performance. Models built using variables available on prospecting databases are used by marketing to prioritize households for direct marketing campaigns.

Predictive modeling is not limited to just analyzing profitability. P&C insurers use predictive models to prioritize policies for underwriting audits, to prioritize claims for fraud investigation or quick "fast track" payments, to quickly identify high-risk claims to assign to experienced adjusters or special teams, and even to help select new employees and agents to hire.

David: Thank you, Peggy. This has been very helpful. Though I have not been working in predictive modeling nearly long as you, I dare to predict that more and more predictive modeling work will be done in life and annuity insurance. We certainly will need some guidance from our peers in the P&C area.

Peggy: That sounds exciting... I am happy to help! ■

Trends in Annuity Policyholder Behavior

By Peter Gourley



Peter Gourley, FSA, is an actuary at Ruark Consulting (ruark.co) in Simsbury, Connecticut. He is responsible for experience studies and policyholder behavior analysis for the firm and can be reached at peter@ruarkonline.com.

Is it just me, or are annuity experience studies actuaries walking a little taller these days? More spring in their step? Maybe even making eye contact?

Perhaps that's because of the exalted importance of understanding policyholder behavior to principles-based reserves and capital and the continued importance of that knowledge to product development in order to set appropriate charges and create accurate financial projections. To the font of this wisdom, the experience studies actuary, all hail!

But with increased importance comes increased difficulty. Policyholder behavior is key to the actual cost of guarantees commonly offered on both variable and fixed index annuities. It is hard to measure and predict because of its many dimensions, the possibility of either false or missed positives, and the difficulty of knowing the mindset of these sometimes very human contract owners.

What's Policyholder Behavior?

First, a step back. By policyholder behavior, I mean policyholder actions in response to options granted by the annuity contract, particularly those under contract guarantees. For example, a policyholder can surrender or persist, withdraw money either under a guarantee or on an ad hoc basis, exercise an annuitization option, or transfer funds among sub-accounts.

When evaluating policyholder behavior, we want to answer some key questions, such as

- What are the main drivers of each behavior?
- What is their magnitude, shape, and stability?
- How do they interact?

These questions are best addressed, where possible, with a study of actual, relevant, and plentiful experience. Cue the experience studies actuary.

What's Happening Out There?

These concepts can be illustrated by considering some real-world results. The source for these is the various multi-company annuity industry experience studies by Ruark Consulting, with the most recent covering the 2008–13 timeframe. Let's focus first on two examples of policyholder behavior cited above, persistency and par-

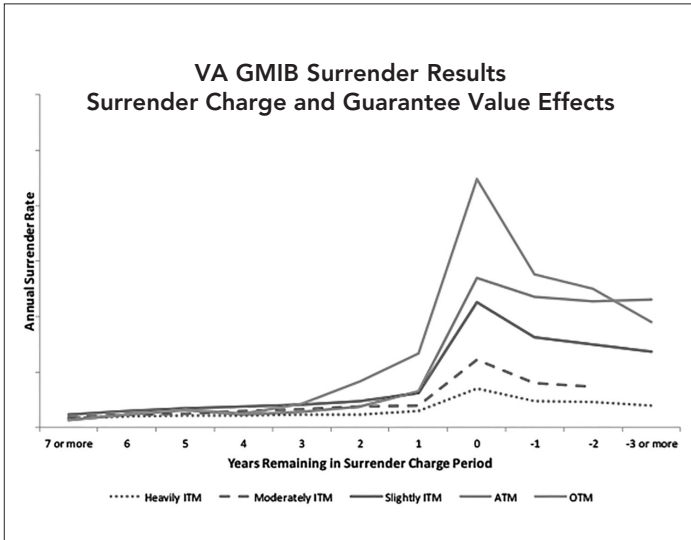
tial withdrawal, and see what lessons these recent studies can teach us.

Lesson 1: Policyholders are rational

Persistency is an assumption to get, Goldilocks' style, just right. Too little persistency and the company doesn't collect enough fee income to offset acquisition costs. Too much and exposure to guarantees risk may be more than anticipated.

As might be expected with rational policyholders, the contract's surrender charge is a key driver to persistency behavior. During the surrender charge period, when cashing in comes at a cost, surrender rates are in the single digits, sometimes low single digits. But rates can be five or more times higher in the first year after the end of the surrender charge period (Contingent Deferred Sales Charge, or CDSC), when the only immediate cost of surrendering is not receiving a prospectus every year. Rates after the initial post-CDSC shock duration settle back to something in between the two extremes, perhaps around 10 percent.

Furthermore, our rational policyholders hold on to contracts with more value. Having a living benefit guarantee present on the contract is valuable. Having a guarantee that is currently worth more than the account value is even more valuable. Both of these effects can be seen in the following picture,¹ which shows the surrender rate for variable annuity contracts with a GMIB rider by the years remaining in the surrender charge period and by the relativity of the rider's benefit base to account value, from heavily in-the-money through out-of-the-money (that is, benefit base is less than account value).



See, I told you: rates are low initially, peak immediately after the CDSC period, and decline to an ultimate rate. They also follow a rational hierarchy of having markedly better persistency for more valuable guarantees.

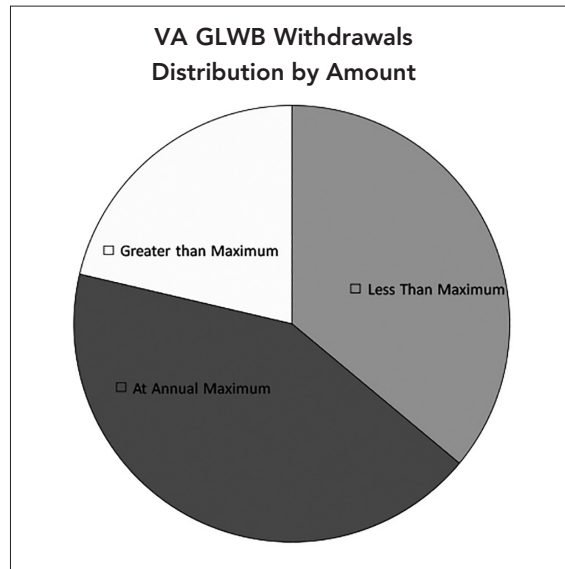
Rational behavior, once the context of rationality is understood, is then predictable, and predictable behavior makes for reliable assumptions. Yup, those policyholders sure are rational.

Lesson 2: Policyholders are not rational

Except when they're not. Consider, for example, partial withdrawal behavior.

This behavior is of course especially relevant in presence of a withdrawal-oriented guarantee. Measuring the behavior involves both the frequency (do they or don't they?) and the severity (if they do, how much?) of withdrawals. From the standpoint of the guarantee,

the greatest risk to the issuing company comes when the policyholder regularly withdraws an amount equal to the guaranteed annual maximum, which runs down the account value but does not diminish the guarantee. But what do we see? Another picture—pie chart this time! This shows, for VA owners with a lifetime GMWB rider who take a withdrawal, the proportion by annual amounts withdrawn, either at the annual maximum or less than or greater than that amount.²



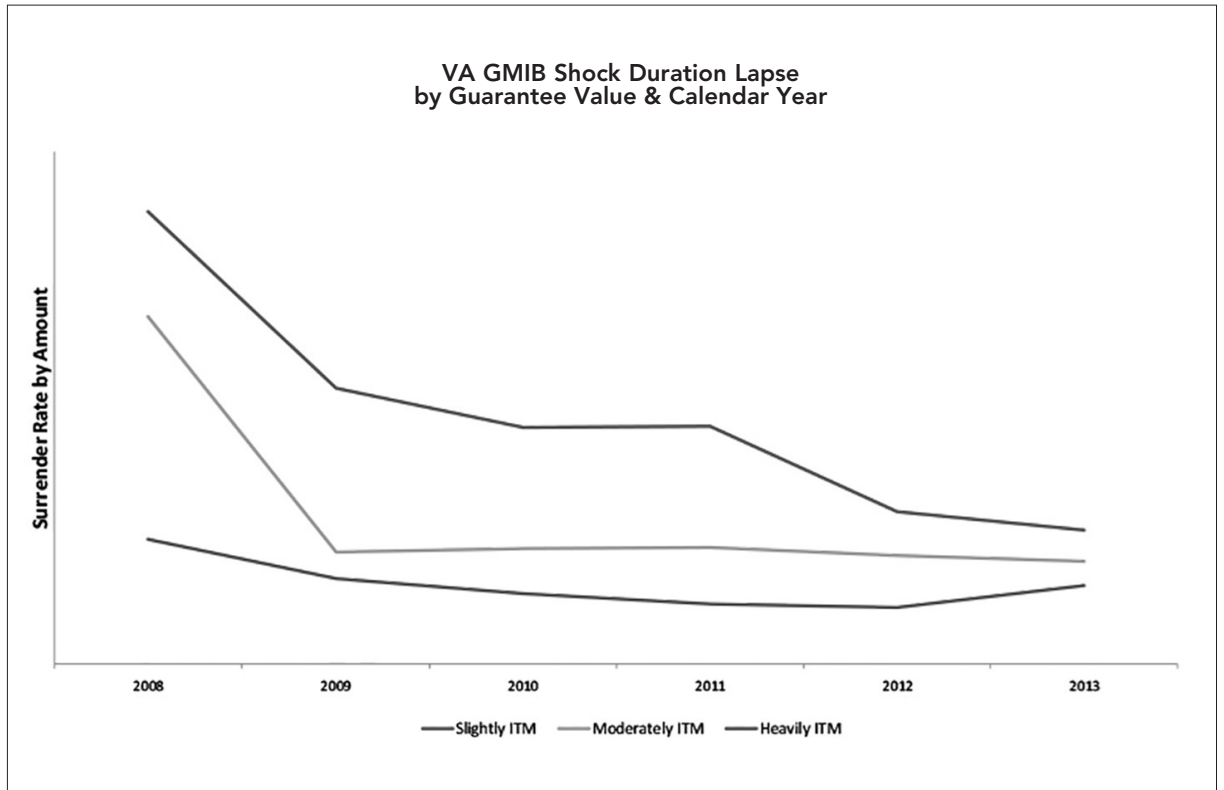
Those withdrawing less than the guarantee are leaving guarantee money on the table, while those taking more are degrading the guarantee (the typical rider reduces future guaranteed lifetime income when a withdrawal in excess of the annual maximum is taken). These two extremes make up the majority of withdrawals. From an actuary's point of view, these owners are not maximizing the present value of benefits! Unless, of course, the owner's personal discount rate is very high; that is, they need the money now.

In the same vein, note that in the "rational" persistency picture earlier, while surrender rates get lower with increasing value of the guarantee, the rates never go to zero, even for the most heavily in-the-money contracts. Immediate circumstances can sometimes trump long-term value. Perhaps that's rational in some context.

Lesson 3: Not all data is created equal, Part 1

When evaluating policyholder behavior, we want all the data we can get. After all, in the interests of credibility, more data is better—except when it isn't. Data must also be relevant, and relevance may have an expiration date. Consider the behavior of variable annuity contract owners with a GMIB rider. Over the past several years, their surrender rates have not been constant relative to the value of the guarantee. The same level of value (in-the-moneyness) now results in higher persistency than it did five years ago, as illustrated below.³

Granted, there are significant environmental differences between 2008 and 2013: lower interest rates, higher volatility, and, consequently, less risky VA rider designs. In fact, that's the point. Those changes have made otherwise perfectly acceptable 2008 experience not as relevant for looking at current behavior.



Lesson 4: Not all data is created equal, Part 2

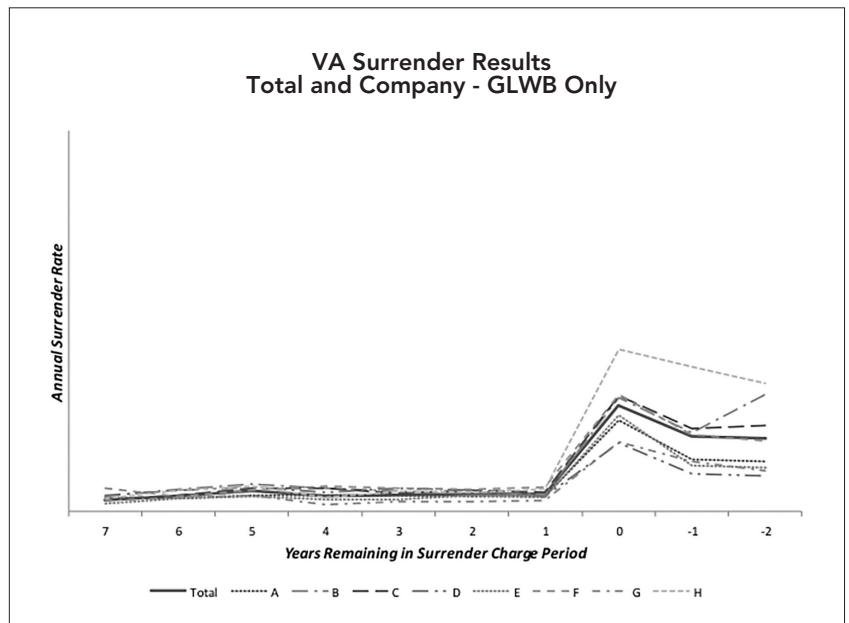
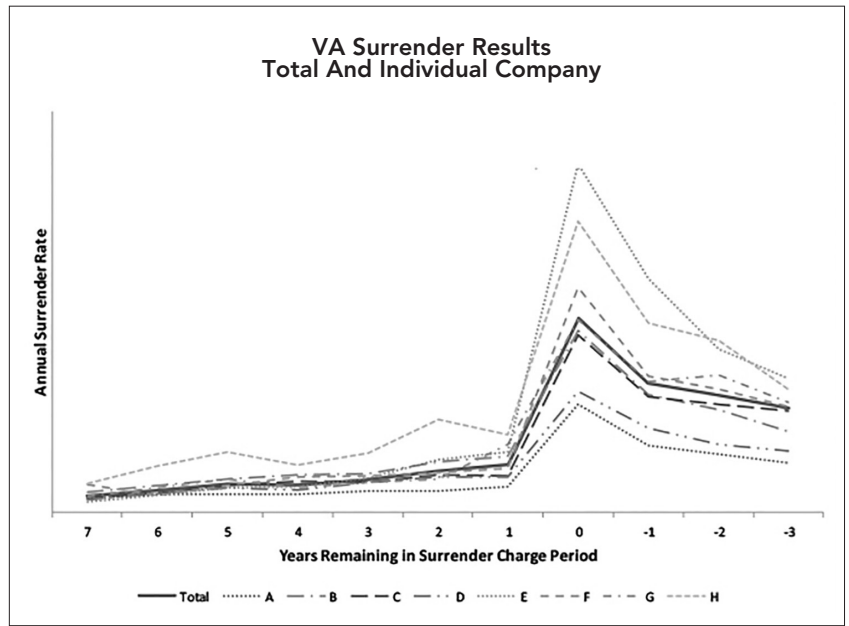
So, relevance in experience data is desirable. But, if from the same time period, so is volume of data. Which wins out? For example, experience from your own company is more relevant to your company than aggregate industry results, but the latter is much weightier. Look at the following picture, which shows individual company surrender rates (again, by years remaining in the surrender charge period) from a recent study.⁴ As these were sizable companies with fully credible data, the fairly wide dispersion of results isn't due to random fluctuation. If you were an actuary at one of the outlier companies, how would you set your assumptions?

First, of course, you'd consult with your experience studies expert, who would adjust for known drivers to tease out the true causes of behavior. In this case, when we reflect the effect of the presence of guarantee riders, the conflict turns to harmony. Here are the same companies' surrender rates but restricted to just their lifetime GMWB blocks.⁵

We're down to only one outlier on the high side now. What should that company do? To quote an old slogan, ask an (experience studies) actuary! That is the real lesson from these experience studies. □

ENDNOTES

- ¹ From Ruark Consulting's 2013 VA Surrender Study
- ² From Ruark Consulting's 2013 VA Partial Withdrawal Study
- ³ From Ruark Consulting's 2013 VA Surrender Study
- ⁴ From Ruark Consulting's 2013 VA Surrender Study
- ⁵ From Ruark Consulting's 2013 VA Surrender Study



Behavioral Simulations

Using agent-based modeling to understand policyholder behaviors

By Louis Lombardi, Mark Paich, and Anand Rao

Editors' Note: This is part two of a two-part series on behavioral simulations. Part one was published in the June 2014 issue of Product Matters.

Simulation Modeling Process

The following exhibit is a high-level overview of the modeling process:

Exhibit 16: Overview of Modeling Process

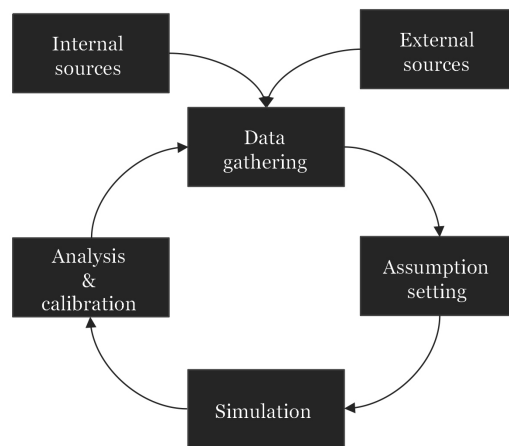
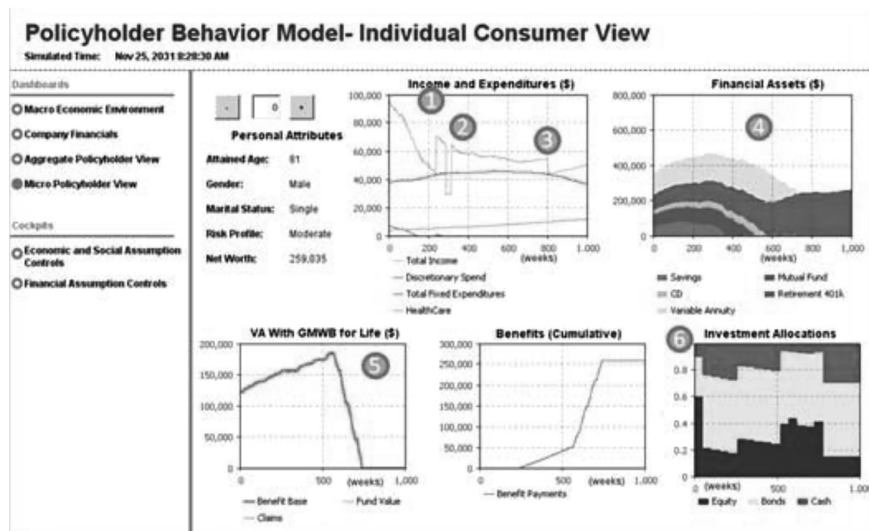


Exhibit 17: Micro Policyholder View



This exhibit divides the modeling process into four major segments:

1. Data gathering
2. Assumption setting
3. Simulation
4. Analysis & calibration.

The data gathering process is more extensive than traditional modeling techniques. In addition to accessing internal company sources for such items as policy data, plan data and claims data, external resources are needed for such items as:

1. Demographic data
2. Economic data
3. Household data.

Often this data needs to be supplemented with surveys and focus groups.

Similarly, the assumption-setting process is much more extensive than traditional modeling techniques. In addition to setting assumptions for such items as morbidity, mortality and lapses, assumptions must be specified for such items as:

1. Gross domestic product (GDP) growth rate
2. Unemployment rate
3. Inflation rate
4. Wage growth
5. Household expenses.

Further, these assumptions are integrated with interest rates investment returns and the state of the economy.

To give some indications of the intricacies of the simulation process, Exhibit 17 is a micro view of a particular policyholder.

The policyholder is a single male who was 60 years old at the start of the simulation.

The Income and Expenditures graph shows his income, nondiscretionary expenses, discretionary expenses and health care costs. The number 1 circle highlights that he:

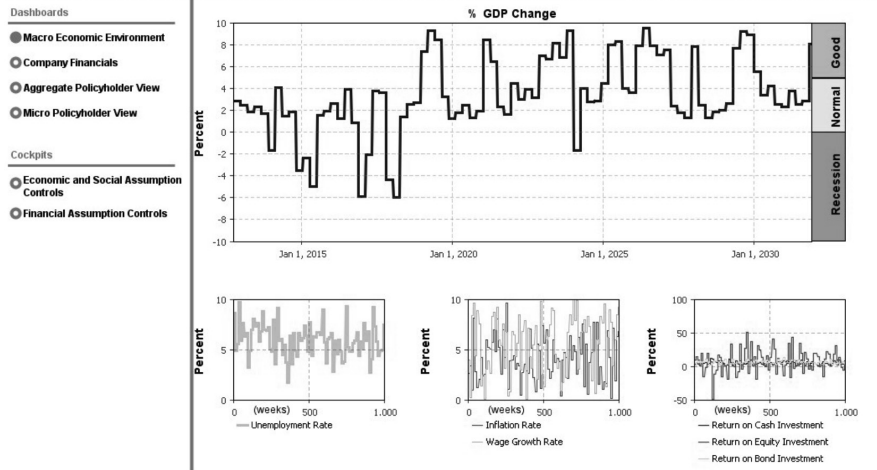
1. Slowly started to retire at age 60;
2. Started to receive Social Security at age 65; and
3. Went back to work part time to have enough income to cover his expenses.



Exhibit 18: Macro View of Economic Environment

Policyholder Behavior Model- Economic Environment View

Simulated Time: Nov 25, 2031 8:28:30 AM



The number 2 circle indicates he tried to fully retire again, but returned to part-time work. The number 3 circle indicates his full retirement.

The Financial Assets graph shows the type of financial assets he owned and how their value changed over time. The number 4 and 5 circles indicate that he was making withdrawals from his variable annuity and his other investments prior to his retirement to cover his expenses. Finally, the Investment Allocations graph shows how he allocated his investments among equities, bonds and cash.

The Exhibit 18 is a macro view of the economic environment that led to some of the above behaviors.

The % GDP Change graph is the percentage change in the real gross domestic product for this particular simulation. It also shows the regime. Below this graph are three other graphs. The left graph is the unemployment rate; the middle graph is the inflation rate and wage growth; and the right graph is the return on equities, bonds and cash.

Exhibit 19 shows the macro view of all policyholders included in the simulation.

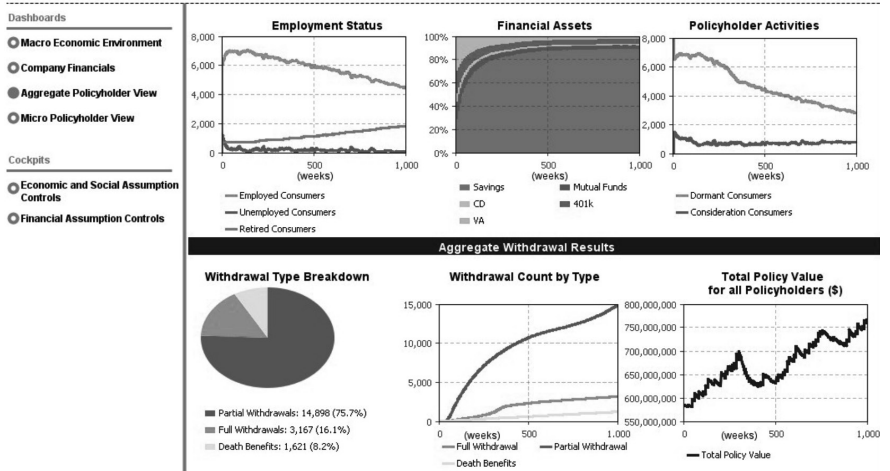
The Employment Status graph shows the number of policyholders that are employed, unemployed and retired. The Financial Assets graph shows the aggregate value of the five asset classes during the simulations. The Policyholder Activities graph shows the number of dormant policyholders and active policyholders. The pie chart shows the percentage of partial withdrawals, full

withdrawals and death benefits. The Withdrawal Count by Type graph shows the number of full withdrawals, partial withdrawals and deaths. The Total Policy Value chart shows the aggregate amount of the policy value in force.

Exhibit 19: Macro View of Policyholders

Policyholder Behavior Model- Policyholder View

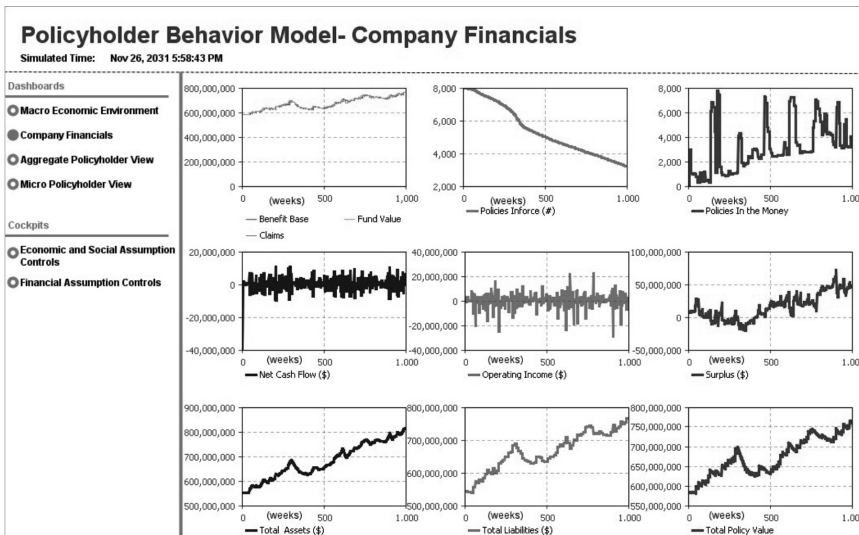
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Finally, Exhibit 20 shows a macro view of the life insurance company.

Exhibit 20: Macro View of Company Financial



The above exhibit shows the graph of the following financial information on a statutory basis:

1. Net cash flow
2. Operating income
3. Surplus
4. Total assets
5. Total liabilities
6. Total policy value.

Case Study

An agent-based model can be used for a variety of applications such as:

- **Asset retention:** Test strategies to improve persistency and retention of account balances.
- **Pricing/product design:** Design products that better address the needs of the policyholder as conditions change.
- **Distribution strategy:** Train the distribution channels on how to address their clients' needs under a variety of circumstances.
- **Strategic analysis:** Allows insurance executives to have a better chance of achieving their strategic goals under various scenarios.
- **Risk management:** Enables risk officers to identify emerging risks due to the complex interactions of numerous factors.

The remainder of this paper discusses how an agent-based model can be used to test an asset retention strategy for a block of variable annuity contracts with a guaranteed minimum withdrawal benefit.

In the mid-1990s, LIMRA International initiated a study of workers eligible for a lump-sum payment from their companies' retirement plans. The purpose of this study was to assist their members in developing products and services that would help employees preserve their retirement benefits. Several companies have used this study to develop asset retention strategies for their retirement services business. These asset retention strategies have increased retentions from less than 10 percent to over 50 percent for many of these companies.



LIMRA's MarketFacts, November/December 1997.

Prior to this study, the behavior of many companies did not focus on asset retention. Specifically, when employees changed jobs or retired, they would call the company and ask for “their money.” The customer service representative was trained to process the request as efficiently as possible.

One of the behaviors this study changed was how the companies responded to these types of requests. When former employees call, instead of narrowly focusing on processing the request as efficiently as possible, the customer service representative will transfer them to a sales representative. The sales representative will explain the various products and services the company will continue to provide should they leave their money with the company.

With this asset retention study in mind, consider a policyholder who owns the following investments:

1. Savings (i.e., checking, money market)
2. CDs
3. Mutual funds
4. Variable annuities
5. 401(k), 403(b) and IRAs

Now consider the question, “Which investment would he tap first to make regular withdrawals?”

In 2009, LIMRA published The Retirement Income Reference Book. In this book, they cite a survey they conducted of 942 retirees aged 55 to 80 with at least \$200,000 in household investable assets. The survey revealed an interesting answer to the above question. In particular, the survey noted that “... taxes top the list of reasons that retirees defer tapping specific investments.” However, when owned, “annuities top the list as the first investment for regular withdrawals.”

What are some of the implications of this behavior? Generally, policyholders should first withdraw from their taxable account (i.e., savings, CD and mutual funds) and let their tax-deferred accounts (i.e., variable annuities and retirement accounts) accumulate. Accordingly, they need “nudging” from their advisors and the life insurance company on withdrawal strategies that help maximize their after-tax withdrawals.

With these LIMRA studies as background, assume you are the head of the strategy department of a large life insurance company. Your company has three major business segments:

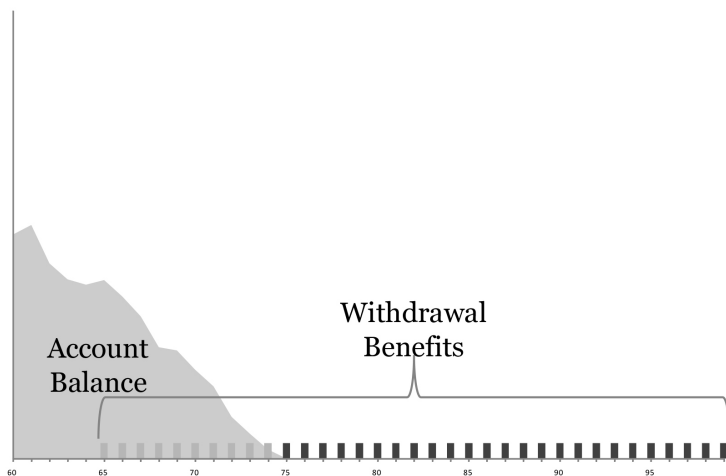
1. Life insurance
2. Annuities
3. Retirement services.

You are currently working with your marketing and customer service department on an asset retention strategy for your annuity operations.

Internal studies have shown that a significant number of policyholders begin taking regular withdrawal payments from their variable annuity contract around age 65.

Exhibit 21 shows a policyholder who elects to exercise a guaranteed withdrawal benefit for life at age 65. The account balance is deleted at age 75 so the contract is “in-the-money” thereafter.

Exhibit 21: Current Situation



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Thus, one of the objectives of your asset retention strategy is to delay when policyholders begin making regular withdrawals.

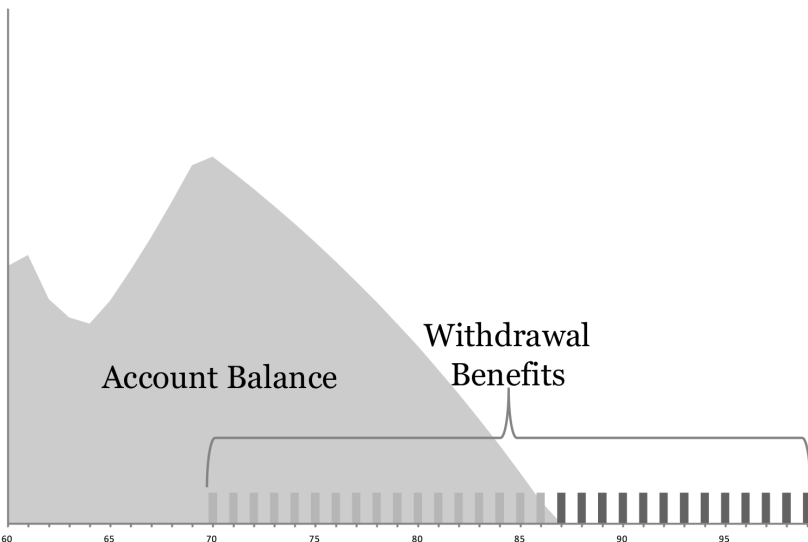
The expectation is that this would better align the interests of the company with those of the policyholder. By delaying when they make regular withdrawals, the policyholder would benefit by:

1. Deferring paying taxes;
2. Receiving a larger withdrawal benefit; and
3. Having an account balance that lasts longer.

The life insurance company would benefit by:

1. Collecting higher fees for a longer period of time; and
2. Lowering expected cost of guaranteed withdrawal benefits.

Exhibit 22: Objectives



Your asset retention strategy centers on influencing the order in which a policyholder makes withdrawals when he owns the following investments:

1. Savings (i.e., checking, money market)
2. CDs
3. Mutual funds
4. Variable annuities
5. 401(k), 403(b) and IRAs.

Simulation Results

First, a simulation was performed assuming that when policyholders make withdrawals from their financial assets they use the following withdrawal hierarchy:

1. Variable annuities
2. Savings (i.e., checking, money market)
3. CDs
4. Mutual funds
5. 401(k), 403(b) and IRAs.

Exhibit 23: Variable Annuities Are First in the Withdrawal Hierarchy

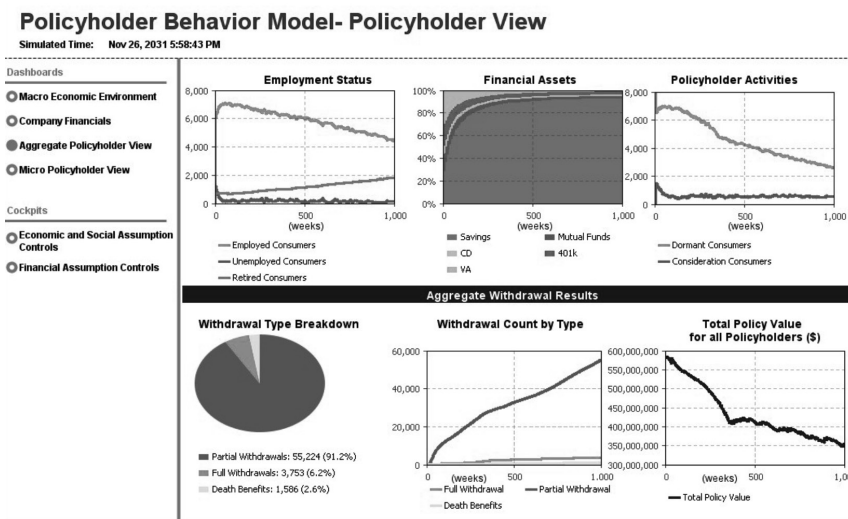


Exhibit 23 shows the macro view of policyholder behavior.

With this hierarchy, policyholders made 55,224 partial withdrawals, and the policy value at the end of the projection period was approximately \$350 million.

Next, a simulation was performed assuming that when policyholders make withdrawals from their financial assets they use the following withdrawal hierarchy:

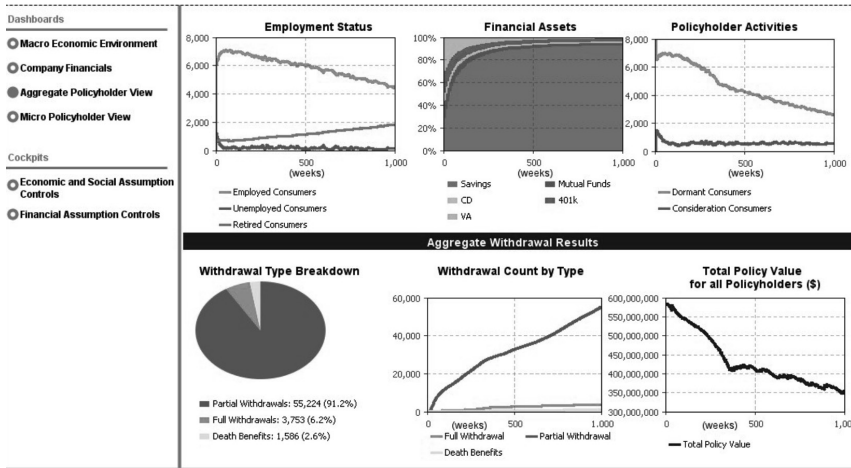
1. Savings (i.e., checking, money market)
2. Mutual funds
3. CDs
4. Variable annuities
5. 401(k), 403(b) and IRAs.

Exhibit 24 shows the macro view of this policyholder behavior.

Exhibit 24: Variable Annuities Are Fourth in the Withdrawal Hierarchy

Policyholder Behavior Model- Policyholder View

Simulated Time: Nov 26, 2031 5:58:43 PM



With this hierarchy, policyholders made 14,898 (versus 55,224) partial withdrawals, and the policy value at the end of the projection period was approximately \$760 million (versus \$350 million).

Conclusion

Understanding and modeling policyholder behavior is critical to insurers; it is a key aspect of the full spectrum of the business, ranging from product design and pricing to reserving and risk management.

Either through deterministic approach or stochastic modeling, traditional techniques of modeling policyholder behavior present two major drawbacks. They focus primarily on the financial drivers and do not take into account other important factors such as social, cognitive and emotional factors. In addition, these approaches do not take into account different behaviors among policyholders, and accordingly the aggregate level results are not refined.

Having embraced behavioral economics and predictive modeling, more recent development has brought policyholder behavior modeling to an advanced level. However, these approaches still face fundamental chal-

lenges in modeling individual policyholder behaviors and also in capturing the causal structure of individual decision making.

Behavioral simulation, as presented in this paper, combines individual decisionmaking rules and artificial intelligence (AI) based software agent modeling to model policyholder behavior. Advances in AI allow insurers to simulate behavior at an individual level and then analyze the outcomes at an aggregate level.

Agent-based modeling promotes more sophisticated business solutions and can be used for a variety of business applications, such as product management and asset retention, pricing and product design, distribution strategy, capital and risk management, and strategic analysis.

We encourage insurers and insurance professionals to explore this unique approach, and we believe that this new technique will bring significant advancement to the policyholder behavior modeling and broad actuarial modeling for the industry.



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Trading Places

LIFE AND PENSION ACTUARIES FIND COMMON GROUND TO EXPRESS FUNDING CONCEPTS

By Tom Herget and Evan Inglis

From Tom: Living in the state of Illinois, funding levels of public pension plans are always in the headlines—and it’s never good news. At an actuarial club speech a few years ago, the speaker lamented that if life actuaries used pension rules to establish insurance company reserves they would be in jail. Still living in my hometown, I’m friends with many of my schoolmates who became firefighters, policemen and teachers. I’m a well-qualified life actuary, but found myself unable to find the prose to express to these pension fund members the gravity of their situation.

So, I searched for a colleague who had the same passion for this issue and who could translate the life terms into pension ones. My first two attempts fell flat. Then, at a dinner party, I was seated next to Evan Inglis and was amazed to discover that, after happy hour, communications went so well. To that, I should credit techniques championed by Raj Koothrappali.¹

From Evan: Tom, public pension plans are in the news in Illinois, but everywhere else too! I’ve been following the issue and working and thinking about it for many years. While some systems are in reasonable shape, there are many city and state plans around the country that are heading for disaster. I know it’s a complicated issue when even other actuaries like Tom don’t fully understand it. Of course, I’ve always wondered about the actuarial numbers behind life insurance products, so when he described his idea to translate pension information into life insurance terms and vice versa, I said, “Sign me up!”

Objective of the Paper

Here’s what we want to do:

- Help life actuaries to understand pension funding mechanics and to help pension actuaries to understand life valuation fundamentals,
- Enable life company actuaries to better grasp the issues surrounding public (state and local government) pension funding,
- Give pension actuaries a look at the funding requirements for life companies, and
- Form a foundation for future comparative and analytic work.

The Method

Translating pension terminology into the life insurance vernacular is as fun and rewarding as translating British English into American. After some less than successful endeavors to grasp the similarities and differences with words, it appeared the only way out was with numbers. A case study. A very simple case study.

U.S. life companies prepare between three and five sets of financial statements. These accounting methods are statutory, GAAP, tax and perhaps economic value or a foreign parent’s shareholder accounting. For this study, we selected U.S. statutory (regulatory) accounting (as opposed to U.S. GAAP) to display life company treatment since required capital calculations are tied to statutory accounting. Also, the resulting liabilities would not be materially different between statutory and GAAP.



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Table 1

Age	Salary	Spiked Salary Last Day of Year	Unspiked Cumulative Retirement Benefit	Spiked Cumulative Retirement Benefit
60	50,000	50,000	1,000	1,000
61	51,875	51,875	2,075	2,075
62	53,820	53,820	3,229	3,229
63	55,839	55,839	4,467	4,467
64	57,933	67,933	5,793	6,793

CONTINUED ON PAGE 28

Pension valuations are typically of two varieties—accounting and funding. In the world of government pensions, the Government Accounting Standards Board (GASB) recently changed pension accounting rules, but conceptually they are still quite similar to the way plans are funded. In this article we will illustrate the pension approach using typical funding techniques to determine contributions made up of a normal cost plus an amount to amortize deficits or surplus.

Pension Benefits

Our illustration will focus on a single employee, Kim, who enters the workforce at age 60 then retires at age 65 with a lifetime benefit.

Kim receives annual salary increases, and the employer allows the inclusion of a final payment for unpaid sick and vacation days in the final year of salary. This pushes up the benefit amount and will allow us to illustrate the effect of amortization of deficits in the pension calculations. Kim's annual retirement benefit is based on years of service and pay, like this:

$$\text{Ben}_{65} = \text{FAP} \times \text{YOS} \times 2\%$$

- Ben₆₅ is the benefit payable at the normal retirement age of 65.
- FAP is final average pay; in this case we use one year of pay only and the last year will include extra pay for unpaid sick and vacation days.
- YOS is years of service.

Key Assumptions

The pricing (not accounting) interest environment is 4.5% level—a 4.5% return on assets (equal to the yield after defaults on a high-quality fixed income instrument) is assumed for the entire pricing period. Since life companies don't put equities into their general accounts, this reflects a high-grade corporate bond type of investing. In the pension world, the typical asset allocation is about 50% to equities, 25% to fixed income and 25% to real estate, private equity and other alternative investments. However, in our example, we assume a 4.5% return on the assets to facilitate comparison with the insurance company world.

We assume that mortality is also the same in the different environments, although government pension plans

would generally use less conservative mortality rates than insurance companies. This study uses the RP2014 healthy table. Mortality improvements of 2% are projected annually for 10 years.

This is an extremely efficient enterprise, so there are no acquisition costs and no maintenance costs on the insurance side. The tax rate in this jurisdiction is 0%.

So far, we have created an environment where insurance and pensions are on even ground.

Now, let's take a look at the differences!

The Insurance Company Gross Premium

An annuity factor at age 65 using the interest and mortality assumptions described above is 13.08. Multiplying this by the annual benefit (with spiked pay) of \$6,793 generates a single premium of \$88,851, which generates a present value of benefits equal to \$68,174 at age 60.

Most life insurance products are developed anticipating the policyholder will pay a level dollar premium. The level premium over five years for these benefits is \$15,098. This premium is then loaded by 12% to cover risk, the cost of capital and to provide a provision for profits. (Please don't ask how the 12% was developed—our proprietary methods cannot be divulged). This generates a gross annual premium of \$16,910. We expect Kim to pay five of these.

Please note that the insurance company insisted on recognizing the retirement benefit based on the expected "spiked" salary average.² While the pension plan provisions may or may not guarantee this, it has been the practice at Kim's employer for over a decade. Had not the life company understood this at contract inception, it still would have been required to establish similar reserves using the expected level of benefit payments based on best estimate assumptions used for cash flow testing in statutory accounting and for loss recognition testing dictated by U.S. GAAP accounting. For U.S. life companies, a liability using best estimate assumptions prevails over the often locked-in assumptions used as of policy issue date.

Cash Flows

The first 10 years' expected cash flow pattern, for the insurer, excluding interest, is:

Table 2

Age	Cash Flows
60	16,910
61	16,779
62	16,640
63	16,492
64	16,336
65	(6,496)
66	(6,424)
67	(6,347)
68	(6,265)
69	(6,177)

The cash outflows starting age 65 would be the same for the public pension plan but the cash inflows will be different, as we will get to in a moment.

Insurer Financial Statement

Assets accumulate from cash flows. Benefit payments draw down the assets. For the insurer, there is an additional source of cash drain: dividends paid to shareholders. Before a shareholder dividend can be paid, the insurer needs to be sure it is retaining an amount of capital adequate to satisfy regulators and to receive a satisfactory evaluation from rating agencies.

In our example, required capital is established as 5% of reserves—in other words, additional funds are set aside to ensure the insurance company's viability, even in adverse circumstances. A key component of this cushion will be to provide for interest rate risk.

A major insurer concern is an unexpected demand by policyholders to cash in their policies in a rising interest rate environment—aka disintermediation. Policyholders take their cash value and run—to seek out higher-yielding policies. This would force an insurer to sell assets at a loss while the policyholder's cash value experiences no loss. As the accumulation period winds down, and the policyholder transfers to income-paying status, the option to cash in the policy disappears and this interest rate risk diminishes. Consequently, at the retirement age of 65, the required capital drops to 3% since this disintermediation risk is no longer a possibility.

Statutory reserves are calculated using assumptions that are conservative for the environment at the time the policy is issued. Interest has been lowered to 3.5%, and mortality has assumed an additional 3% annual improvement forever.

Table 3 shows excerpts from the insurance company financial statements.

Note the distributable earnings (shareholder dividend) column. The negative numbers in the first years indicate that shareholders (often a holding company) will need to provide additional funds—in other words, overall dividends from the company will be reduced in order to maintain a resilient balance sheet while this new business develops. The ability to distribute earnings from this policy improves as the required surplus drops to 3% of liabilities.

Life insurers are often owned by holding companies. These holding companies will periodically provide their subsidiaries with fresh capital to either support new business like Kim's policy or to shore up a weakened position.

How funded is this? In year 1, the ratio of assets to liabilities for the company is 105%; in year 10, 103%. Further, the liabilities use conservative valuation assumptions, which provide for adverse deviation and cushion for solvency.

CONTINUED ON PAGE 30

Table 3

Age	Distributable Earnings	Ending Balance Assets	Liabilities	Surplus
60	(1,322)	18,993	18,089	904
61	(1,038)	38,420	36,590	1,830
62	(468)	58,005	55,508	2,498
63	14	77,836	74,842	2,994
64	505	97,905	94,594	3,311
65	1,652	93,871	91,137	2,734
66	1,122	90,260	87,631	2,629
67	1,085	86,604	84,081	2,522
68	1,048	82,905	80,491	2,415
69	1,012	79,169	76,864	2,306

Surplus actually held by companies is dictated by what the market and rating agencies demand. Actual surplus being held will be notably higher than what we illustrate here.

Kim is sleeping well.

Put on the Pension Hat

Now that we have seen how a life company would determine then fund for its liabilities, let's see how the public pension world differs.

First, the funding would be based not on a level dollar amount, but on a level percentage of salary because the pension is a component of pay. In the real world, this difference is more significant than in our five-year example.

Second, the funding, in practice, has been based on a benefit that doesn't anticipate any surge of annual salary a moment before retirement. This additional benefit has not been accrued during the active working period but is recognized the moment Kim retires. With a typical pension funding approach, any newly observed liabilities are not immediately funded but instead are incrementally recognized evenly over a 30-year period. The term for this delayed recognition is called amortization, a term life company actuaries use for adjusting asset values.

But Wait

Before we proceed, let's look at terminology. The concepts are very much the same, but the names and numbers are different.

Life Insurance	Pension Actuarial
Gross premium	Normal cost
Reserve	Actuarial accrued liability (AAL)
Paid premium	Contribution

The Liability Side Unveiled

For pension calculations, we will use the entry age normal, level percent of pay method for allocating costs. Table 4 shows the actuarial liability using this method.

Table 4

Age	AAL (EOY)
60	12,211
61	25,520
62	39,970
63	55,567
64	88,851
65	85,751
66	82,587
67	79,363
68	76,082
69	72,748

Notice that the liability is pushed up substantially when the actual benefit based on final salary is determined in year 5. Below we describe how this change in liability is paid off gradually over a 30-year period. Here are the amounts that the insurance approach requires to be set aside compared to the pension liability.

The insurer provision (column 4) is significantly higher than its pension counterpart (column 6) for several reasons:

- Use of level, not increasing, funding premiums in the accumulation period,
- Immediate and full recognition of the anticipated benefit,
- Use of conservative interest and mortality assumptions, and
- The requirement to hold capital to support uncertainty.

But Wait, There's More

The prior section dealt only with the liability. What about the assets supporting these commitments?

In the insurer world, the policyholder remits the gross premium. The insurer holds it and invests it. It only relinquishes earnings to shareholders after benefits have been paid and when certain risk thresholds have been surpassed.

In the public pension world, contributions are determined as the normal cost plus an amortization amount to pay down the deficit or reduce surplus—the target is for the plan to eventually be 100% funded. The normal cost pays for benefits during the current year. The amortization is designed, theoretically, to pay off the entire deficit over a certain period of time—often 30 years. The amortization payment is usually backloaded by assuming that it will increase each year with pay and be a constant percentage of the payroll. The amortization is frequently “open,” meaning that a new 30-year amortization is calculated every year and the prior year’s 30-year amortization schedule is wiped out.

Table 6 illustrates how a typical open amortization approach to paying off the unanticipated increase in liability due to spiked salary would work. This information is compared to the insurance company funding. The pen-

Table 5

Life Company					
Age	Company Liabilities	Company Capital	Assets (Liabilities plus Capital)	Pension Actuarial Accrued Liability	Targeted Level of Funding (Assets) Using 30-Year Amortization
60	18,089	904	18,993	12,211	12,211
61	36,590	1,830	38,420	25,520	25,520
62	55,508	2,498	58,005	39,970	39,970
63	74,842	2,994	77,836	55,567	55,567
64	94,594	3,311	97,905	88,851	72,169
65	91,137	2,734	93,871	85,751	68,988
66	87,631	2,629	90,260	82,587	65,743
67	84,081	2,522	86,604	79,363	62,437
68	80,491	2,415	82,905	76,082	59,074
69	76,864	2,306	79,169	72,748	55,657

sion information in column 3 can be compared to the higher level of insurance company funding in column 5.

Note how the amortization of unanticipated increases in the liability for pensions defers funding well into the future, resulting in low levels of assets relative to the AAL.

In Conclusion

So what have you learned? The pension actuary and life actuary can now gauge standard practices in each other’s world where the objective is essentially the same: to make good on promises to pay benefits in the future. The life company actuary can now better anticipate his conversation in the supermarket when the talk turns to public pension funding.

It seems ironic that the same legislators who pass such strict laws for insurers don’t provide the same level of security for employees of their own jurisdictions. Why can’t legislation be passed or accounting rules changed to recognize obligations to safeguard the retirement of its employees? □

ENDNOTES

¹ See any episode of “The Big Bang Theory.”

² “Spiking” has been well-publicized and still exists, but is less common today than it was in the past. In this article, we use spiking as a convenient way to illustrate an unanticipated change in cost for the pension plan to illustrate how pension methods deal with deficits.”

From .ca to .com

By Jacques Frederic



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Earlier this year I landed at Franz Josef Strauss airport. I had previously attended many business meetings at our head office in Munich. However, as I deplaned this time, it felt different.

For the past 12 years, I have been working for the Canadian life branch of Munich Re. During that time, I was fortunate enough to leverage the fact that I was working for an international organization providing reinsurance support for various insurance products. That allowed me to have rich exchanges on various topics with many colleagues around the world. Those exchanges through conference calls, emails or seminars were of great value and interest to me. You see, I always need to be learning. I love to share ideas and see how I can help or how someone else's solution could be adapted to my market.

When I was offered the tremendous opportunity for a transfer to the company's head office in Munich my spouse and I discussed it and it became clear that this was not only a professional opportunity that could not be missed, but also a great family experience that would bring so much to the four of us. I am now writing this article sitting with my spouse on the balcony of our Munich apartment, while our two boys are playing games in the living room. Despite the wonderful support provided by Munich Re, I have to say that the four months leading to my transfer have been an interesting rollercoaster ride. Some personal advice to anyone contemplating a transfer: keep your eye on the prize and go on the ride with the expectation that there will be ups and downs.

This is my first article about sharing my experience as a Canadian actuary living and working abroad. As I write this article, I only have two months of European experience under my belt. I spent the first month acclimating to my new environment and doing some project work. The second month allowed me to familiarize myself with my new responsibilities. In my new role, I will have the opportunity to examine closely the markets of five countries that are part of my division (the Netherlands, Belgium, Luxembourg, France and Israel). That being said, if I walk 20 meters in the office, I can talk to coworkers about the rest of Europe and Middle East markets. The knowledge is there at my fingertips. I am sure that over the next year and a half I will be able to highlight some

of the differences between those markets and the North American ones.

After one month of observation, I can tell you that, overall, North American markets are far more homogenous than the markets I am now currently exposed to. To deal with these new markets, I need to have information about multiple social systems, various regulatory regimes, actuarial guidelines, and taxation and insurance law in the country of origin. I also need to understand the impact of writing this business from Germany.

I have to admit that my first shock was that, despite my knowledge and years of experience, I felt like a graduate student walking into his first job. Yes, the logo at the main entrance is the same as in Canada. However, even though I am familiar with Munich Re's internal guidelines and how they are applied, everything else about the business is different. I am sure that my prior experience will help me climb the learning curve quickly.

We're all familiar with the reputation of German engineering. It is a symbol of quality, efficiency, planning and intellectual rigor. I can attest that the same applies within the insurance world.

European insurance companies are exposed to the same challenges as in North America: product differentiation, increasing competition, profitable growth, changing regulation and recovery from the financial crisis. The ongoing low interest rate environment creates pressure on insurers' balance sheets. Moreover, Solvency II is at the forefront of most discussions in Europe.

For some insurance products, there are significant commonalities no matter which country you are looking at. Mortality is mortality. The benefits offered may take different forms. The delivery system and the integration with the social schemes may vary. However, for other insurance plans, the differences are much more significant. Disability is a prime example. The definition of disability varies from market to market and its integration with the social system can be very different.

The Netherlands is one of those interesting markets

where various types of disability coverage exist. You have a product category for the self-employed call AOV (ArbeidsOngeschiktheidsVerzekering) and a product category for employees called WIA (Wet werk en Inkomen naar Arbeidsvermogen).

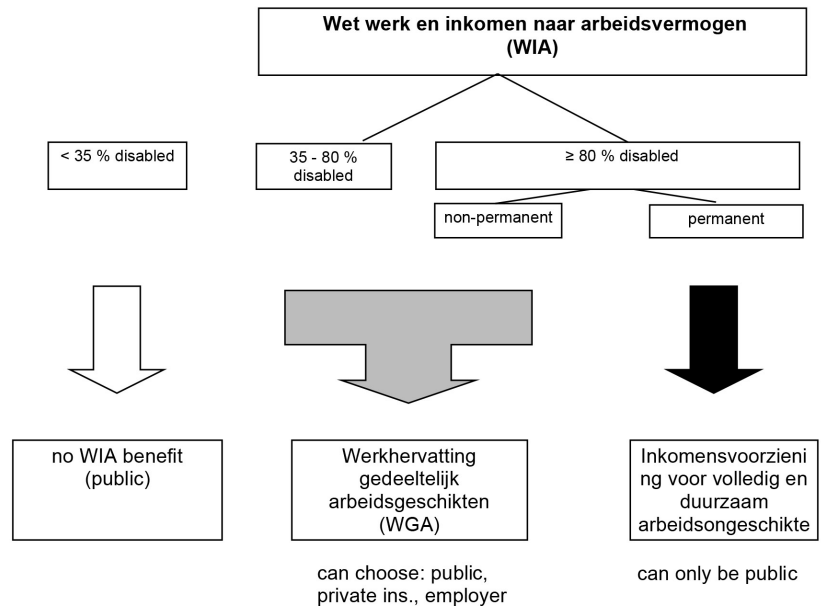
In the AOV model, the first year of disability is covered with Rubriek A using deferment periods that can be between seven and 180 days. If the insured is still disabled after the first year, he or she is automatically transferred to Rubriek B, if purchased. It is possible for an insured to buy only Rubriek A or only Rubriek B. Add to this the potential for four or five occupation classes and three disability definitions, and you get a fairly complex pricing model that shares some similarities with the North American offering.

The WIA scheme is far more complex. The complexity comes from the fact that for every gap not covered by the public system, the private sector created a product solution.

In the chart to the right, coverages under the black arrow can only be provided by the state. Under the gray arrow, the employer can decide to either go to the state or go private. The WIA scheme is only triggered after two years of disability. There are private products that can be purchased by the employer to cover the situation where the employee would be less than 35 percent disabled (white arrow). For any situation above the maximum covered salary, there is another private product available for purchase by the employer. In the first two years, the employer can contract with a private insurer to provide some coverage, or self insure. There are some other factors/modifiers that increase the complexity of the structure. I am still looking at these factors to better understand them and their impact.

WIA Structure of disability regulations for employees in the Netherlands (subject to a maximum salary)


There are significant challenges ahead in looking at fitting all these benefits into a cohesive model. The readers with some expertise of the Netherlands market will note that I have taken the liberty to skip over some details of the



disability coverage. In my actuarial life as a pricing actuary, the disability employee segment in the Netherlands and some of the insurance plans in South Korea are the most complex plans I have encountered. I am glad that I am surrounded by many experienced people and can tap into the large data pool collected over time to which we have access.

In the next article, I am sure I will be able to provide a deeper look into some of the market challenges and different product features that I will have encountered. In the meantime, I will keep up with my German lessons, observe the culture and sample a few of the beers the many beergardens have to offer.

Auf Wiedersehen! □



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