SOCIETY OF ACTUARIES Product Development Section

Product Matters!

ISSUE 89 | JUNE 2014

I Can't Pass! Now What?

by Donna Megregian and Linda Rodway

No, this article isn't about taking exams. It's about Life Illustration Model Regulation, Actuarial Standard of Practice 24 (ASOP 24) and the testing that goes along with it, most commonly known as the self- and lapse-support tests. This article will discuss the revisions to the American Academy of Actuaries (the Academy) Life Illustration practice notes that were published in the later part of 2013, and some situations that companies are discussing when a product does not appear to satisfy the requirements of the regulation. The views in this article are those of the authors, and in no way representative of RGA, the SOA, the illustration workgroup as a whole, or the Academy.

The Illustration Practice Notes Revision

If you are having trouble passing, you should review the Academy's illustration practice note dealing with ASOP 24 and compliance with the NAIC Illustration Model Regulation. The Academy's life Illustration workgroup worked over a year to revise the practice notes that are available on the Academy website at *http://www.actuary.org/files/Life_Illustrations_Practice_Note_8-29-13.%5Beventyyyy%5D.8.pdf*. The workgroup is a great group of people from a variety of companies that have worked very hard to discuss and come to a consensus on various topics actuaries would like to find answers and guidance on. The Academy's life illustration practice notes are a means to bring to light current practices used by actuaries when complying with ASOP 24. They are not intended to be interpretations of actuarial standards or regulations, nor codifications of generally accepted actuarial practice. Practice notes are intended to help an actuary consider various aspects of a problem in order to get comfortable with a decision they have made or need to make.

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Actuaries
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Product Matters!

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This newsletter is free to section members. Current issues are available on the SOA website (www.soa.org).

To join the section, SOA members and non-members can locate a membership form on the Product Development Section Web page at www.soa.org/product-development.

2014 SECTION LEADERSHIP

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 July 18, 2014.

Chairperson's Corner

Feedforward

By Tim Rozar

Tim Rozar, FSA, CERA, MAAA, is senior vice president, Global R&D at RGA in Chesterfield, Mo.

As any fan of Jimi Hendrix can attest, feedback can be a beautiful sound. Sure, it may be a bit dissonant and hard on your ears at first, but eventually you learn to love it. Feedback in our personal and professional careers can have a similar effect. Insightful feedback from a trusted friend, partner or mentor is a wonderful gift, even if it may be a bit painful at first. Feedback can help illuminate our blind spots and provide an objective view of our past performance. Without feedback, we would have no benchmark to measure our accomplishments or identify our shortcomings.

I have always viewed feedback as a crucial tool in my own personal development, but I have recently become familiar with a related concept: feedforward. While feedback provides a perceptive lens for viewing the successes and failures of the past, feedforward provides actionable advice that can proactively influence how we approach the future.

The Product Development Section has always been very active in publishing newsletters and facilitating meeting sessions, webcasts podcasts, seminars and research for our members. With all of this activity, it is critical to step back and reflect so we don't find ourselves veering down the wrong track. The section council wants to know how we've been doing, and even more importantly what we should be doing in the future to meet the evolving needs of the membership. In short, we need your **feedback**—and your **feedforward**—to chart our course for the future. The good news is that there is no shortage of ways for you to engage with the PD Section Council and membership to have your voice heard and influence the strategic direction of the section:

1. **LinkedIn** – The PD Section has created a LinkedIn group (accessible at *https://www.linkedin.com/groups?gid=4227361*) to engage with members. While the section council does its best to keep this group fresh and topical, we recognize that there is a lot more potential for this medium as an engagement and information portal. Jeremy Bill from the section council has been developing a strategy for improving our use of this tool, but ultimately it will require more activity from section members. If you have any thoughts, feedback or suggestions that you'd like the membership and section council to consider, please don't hesitate to start a discussion on LinkedIn.

2. **Membership Survey** – Dennis Martin of the Product Development Section Council recently led our biannual membership survey project. This will help us identify emerging areas of interest and receive candid input on the value created from section activities. If you didn't get a chance to complete the survey, please send your comments directly through LinkedIn or to any section council member.

3. **Volunteer** – The best way to engage direction with PD Section activities is to volunteer. There is no better way to get involved with section activities and directly shape the future of our section. We are always looking for eager and energetic volunteers so if that sounds like you—we want to hear from you as soon as possible! ◻

Donna Megregian, FSA, MAAA, is vice president and actuary at RGA, and co-chair of the life illustration workgroup.

Linda Rodway is currently chair of the Life Illustrations work group. She spent over 30 years working as an actuary with a variety of companies focusing on various aspects of individual life and annuity products. She can be reached at RodwayL@aol.com.

Every question was reviewed, and in addition, some new questions were added. The questions that were added were based on a variety of discussions from industry meetings, webcasts, and general inquiries made to the workgroup members. Just about every question in the 2013 practice note revision was modified or word-smithed in some way. Everyone can benefit from a thorough read through of the practice notes, but I will highlight some of the bigger updates here.

1) Assumed future improvement could be considered for a number of. This is why a question related to assumption improvement that had been in Mortality Assumption Section E was generalized to discuss improvement in experience assumptions in general and was moved to Section A - Assumptions (question five specifically). Per the ASOP, improvement may be included up to effective date if it is real, credible, and reasonable to include, but not beyond the effective date. Deterioration if credible and determinable should be included up to the effective date as well, and can be used beyond the effective date if it is anticipated to continue.

2) Indexed products have become more popular because of the downside protection with upside potential. The investment return section of ASOP 24 revision of 2007 was updated to include a reference to indexed products. An entire section of the practice notes deals with issues related to indexed products was added in 2009, and updated again for 2013. It is our experience that there are different views on a few items related to indexed products, like what are you certifying – current credited rates, max credited rates, hedge costs, caps, etc.?

3) Some new questions were included relating to inforce testing. Section P, question 10 addresses requirements to retest and/or recertify business inforce more than five years. Section P, question 11 discusses what some actuaries consider when the guaranteed interest rate in the policy is higher than the investment factor underlying the disciplined current scale.

4) Section Q on reinsurance was split into unaffiliated and affiliated third party reinsurance.

But I Still Can't Pass??!!

You have completed your review of the practice notes, and you still don't feel comfortable about certifying you scale. Ok, you aren't alone. Many companies are having issues with a particular product's non-guaranteed scale not passing or even just being able to find a scale that will pass the self-support or lapse support tests. There isn't a silver bullet that exists out there, but there are options available in some situations. I'll separate the issue between inforce and new business.

New business – there really isn't much you can do. The regulation is pretty clear for new policies or policies inforce less than one year. For those products, you should reprice and find a scale that satisfies the requirements. Another option to consider is to declare the product as a non-illustrated form or only show the guarantees.

"Revising the illustrated scale or just showing the guarantees are also options available for inforce."

Inforce - Revising the illustrated scale or just showing the guarantees are also options available for inforce. At the 2013 Annual Meeting, there was a workshop (Session 85 WS) in which 61 percent of the audience indicated they have products that are no longer showing non-guaranteed elements. Many of the products are likely term or secondary guarantee universal life (SGUL) products, but certainly others may fall into this category of no longer showing non-guaranteed elements. There are many items to consider if your company goes down this route of not illustrating non-guaranteed values—such as marketing materials, annual statements, requests for illustrations, informing the states. The bottom line is there may be values and statements produced different systems but still possibly have a projection will need to be updated as well as the illustration software for the company. Be careful about the downstream impact of any change.

Ok, so removing the policy from being illustrated is not a desirable option. I would then ask a few more questions:

1. Are all other experience and assumptions up to date? Are there assumptions that you don't have information on that might be able to help counteract the issue you may be seeing? For example, if you know that your portfolio rate drifted below a threshold but the company has enacted an expense savings program and mortality has improved up to the effective date, maybe the two goods can for the moment mitigate the bad. You will need time to investigate, so there could be the option to use prior gains or surplus from the company until you have more information is available to you.

2. Did you include all the riders and substandards that are reasonable to include? Sometimes these policies may have additional profit that may help if you have marginal issues with passing. This is more of a band-aid and you will need to address the growing concern, but it may give you time to develop a more reasonable scale that you are comfortable with.

3. Using distributions of surplus or prior gains. Under ASOP 24, Section 3.7, for policies receiving distributions of accumulated surplus or prior gains, the actuary should consider including these distributions both in the disciplines current scale and in the illustrated scale, but only to the extent that (1), such distributions are currently being paid to the policyholder by the insurer, and (2) the insurer has indicated it intent and ability to continue to do so for the foreseeable future. Such accumulated surplus or prior gains may be used in conducting the tests for self-support and lapse-support. Section P, questions 4 and 9 in the practice notes offer some ideas on use of distributions of surplus and how some actuaries might show intent and ability.

Try not to panic. More than likely, you aren't the only one facing the issue, and many are successfully dealing with their concerns.

Members of the workgroup often attend meetings and are looking for question submissions all the time. If there is something you would like included in the practice notes or meeting discussions which others could benefit from as well, reach out to the workgroup through meetings or email *lifeanalyst@actuary.org*. ☐

VELOCITY OF **DIVERSIFICATION**

by Doug Robbins

Doug Robbins, FSA, MAAA, is the product feasibility actuary for the Retirement Solutions Division at Pacific Life Insurance Company in Indianapolis, Ind. He can be reached at doug.robbins@pacificlife.com.

Given the technician in me, it's always pleasant to discover a new area in which basic actuarial mathematics can be put to work on the job. Just in the last year, I applied a Calculus concept (first time ever!) to a product development project at my company. A few months later, I then stumbled upon what I think could be—at least for some—a useful application of basic probability and statistics.

For many years at the Valuation Actuary Symposium, I have led and co-taught a session called "Avoiding Statistical Pitfalls in Actuarial Work." Discussions in this session have generally covered economic scenario analysis and use (and misuse) of linear regression. However, one of the areas on which I did some new thinking in 2013 happens to be strongly related to product development.

A New Line of Thought

This new line of thought began essentially as an intuition and is based on nothing more than a personal impression picked up over the course of my career. The gut-level impression is that there are two potential pitfalls regarding the way many actuaries talk and think about mortality:

- Rather than speaking about a set of probabilities (estimated statistically) of death by age and future duration, I often hear actuaries speak of "my mortality assumption." This assumption is seen as a fixed array of values, which when plugged in, helps a model spit out a profit figure.
- Actuaries who might quail at a "CTE99" set of market-driven losses for a given product (and the immense volatility therein) often blithely assume they know very well just what a 65-year-old's mortality rate will be 25 years from now. In fact, the factors that will impact this future mortality rate could be just as volatile as those impacting the economy.

I will discuss the first pitfall more extensively in this article. It is an easy thought pattern to get into, and gets even easier as more time is spent on refining and perfecting the "mortality assumption." This includes extensive time that is also likely spent on considering slope of the mortality curve, and turning the curve into a time series by including mortality improvement. After spending all that time and effort, what more is there to consider?

My response to that would be to consider a product design technique that truly takes the overall mortality assumption into account from a company's risk perspective.

As noted previously, a product development actuary concerned about the markets might run 10,000 scenarios or more and analyze possible results. However, valuation and risk folks will surely remind him or her that only one

Table 1: Profit Streams for Life-only Annuity Due

Life Only PolYr	q	q(x+t)	Premium	Commission	Expense	Profit Margin: Payments	8.0% Profit	Profit Margin By Year Of Death
1	10%	10%	$100,000	$3,750	$100	$24,000	$72,150	72.2%
2	20%	18%	$0	$0	$90	$21,600	-$21,690	48.1%
3	30%	22%	$0	$0	$72	$17,280	-$17,352	24.0%
4	40%	20%	$0	$0	$50	$12,096	-$12,146	-0.2%
5	50%	15%	$0	$0	$30	$7,258	-$7,288	-24.3%
6	60%	9%	$0	$0	$15	$3,629	-$3,644	-48.4%
7	70%	4%	$0	$0	$6	$1,452	-$1,458	-72.5%
8	80%	1%	$0	$0	$2	$435	-$437	-96.6%
9	90%	0.3%	$0	$0	$0	$87	-$87	-120.7%
10	100%	0.04%	$0	$0	$0	$9	-$9	-144.8%

Table 2: Profit Streams for 5yr Certain and Life Option

Life w/ 5 PolYr	q	q(x+t)	Premium	Commission	Expense	Profit Margin: Payments	8.1% Profit	Profit Margin By Year Of Death
1	10%	10%	$100,000	$3,750	$100	$16,750	$79,400	12.0%
2	20%	18%	$0	$0	$100	$16,750	-$16,850	12.0%
3	30%	22%	$0	$0	$100	$16,750	-$16,850	12.0%
4	40%	20%	$0	$0	$100	$16,750	-$16,850	12.0%
5	50%	15%	$0	$0	$100	$16,750	-$16,850	12.0%
6	60%	9%	$0	$0	$15	$2,533	-$2,548	-4.9%
7	70%	4%	$0	$0	$6	$1,013	-$1,019	-21.7%
8	80%	1%	$0	$0	$2	$304	-$306	-38.6%
9	90%	0.3%	$0	$0	$0	$61	-$61	-55.4%
10	100%	0.04%	$0	$0	$0	$6	-$6	-72.3%

future economic scenario will actually occur. The same concept applies with mortality: the holder will die at one-and-only one future point, one's finely honed mortality assumptions notwithstanding. Of course, we count on diversification to solve this conundrum. (And that's surely more reasonable to do with regard to mortality than the economy, since you can have multiple lives, but not multiple economies, at any point in time!) But how well will that work for you? It depends on product design, and that's what this article is really about.

My Line of Thought Illustrated

I am going to work through just one example of what I mean. In Table 1 (page 6), I will assume an annual annuity due (so that lapse/withdrawal issues don't confuse the issue), a 0 percent interest rate for simplicity, along with a matching 0 percent discount rate on profits. (That combined assumption eliminates the need to worry about reserves as well.) The annuity due is issued at age 105, and my mortality table assumes certainty of death in year 10. My other assumptions can be inferred from the output that I show in Table 1. Under those assumptions, a life-only annuity of 24 percent of premium per year gives me roughly an 8 percent profit margin.

On the other hand, the five-year certain and life option shown below also gives me about an 8 percent profit margin. Due to the impact of the certain period on the otherwise high mortality at this issue age, I can only pay out 16.75 percent to obtain that result. This is shown in Table 2.

On this life and with $100k of premium, I expect to make roughly $8k of profit either way. Does that make me indifferent to which is sold?

I would argue that (all other things equal) I should absolutely not be indifferent—I should prefer the second case. To see why, you would need to look at the profit streams for the individual life at the various points where that life might expire. For this, I use the same product examples—along with an additional illustrative column of values.

As before, the profit margin is 8 percent. But now, I have calculated this 8 percent a different way—as a mortality-weighted average of the 10 possible profit margin figures based on year of death. These numbers vary a lot and represent staggering losses in the worst cases. (This phenomenon is well understood in the life insurance industry and is a likely driver of the presence of a deep life reinsurance market.) Let us also look at the same "revised" analysis for the life annuity with five-year certain period in Table 4.

In this case, the first thing that you—as the product development actuary—might notice is the loss of the chance of making a huge early profit, if the owner dies "young." But the risk and valuation actuaries looking over your shoulder might be more attracted to the much reduced the tail loss picture. Which is the more important of those two

CONTINUED ON **PAGE 8**

Table 3: Updated Profit Streams for Annuity Due

Life Only PolYr	q	q(x+t)	Premium	Commission	Expense	Profit Margin: Payments	8.0% Profit	Profit Margin By Year Of Death
1	10%	10%	$100,000	$3,750	$100	$24,000	$72,150	72.2%
2	20%	18%	$0	$0	$90	$21,600	-$21,690	48.1%
3	30%	22%	$0	$0	$72	$17,280	-$17,352	24.0%
4	40%	20%	$0	$0	$50	$12,096	-$12,146	-0.2%
5	50%	15%	$0	$0	$30	$7,258	-$7,288	-24.3%
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8	80%	1%	$0	$0	$2	$435	-$437	-96.6%
9	90%	0.3%	$0	$0	$0	$87	-$87	-120.7%
10	100%	0.04%	$0	$0	$0	$9	-$9	-144.8%

considerations? The answer is actually a combination of both considerations, along with the probability distribution implied by the array of mortality rates.

Here's the real issue that I'm trying to shed new light on: If you looked at case 1 (life only), you would see that in this case you have almost exactly a ***50 percent*** chance of either a profit or a loss. In case 2 (life w/ 5 certain), your chance of ***turning a profit*** on a single case has risen to about ***85 percent***! Keep in mind that all I've done is adjust the payout patterns of my annuity in a way that many annuitants tend to prefer anyway. And yet I've ***dramatically*** altered the stochastic nature of the transaction.

What are the implications of that? Isn't it true that by selling a lot of cases, I diversify and achieve profitability for my overall portfolio with little risk? Yes, that is true (-ish), but how ***quickly*** does that diversification occur and reduce my risk?

- In the life-only product version, the shape of my overall mortality variable would require about 70-75 similar cases sold, to be 95 percent confident that I will not lose money overall. And even then (assuming I do achieve a gain) the amount of that gain could be very large or very small.

- In the life with five-year certain product, one only needs to sell seven or so cases to achieve the same probability of being profitable overall! (Needless to say, if you were to sell the 70-75 cases as before, you'd also have ***much*** higher confidence on the overall profit level.)

I thus refer to the speed at which confidence in profitability is attained as the "velocity of diversification." I'm not sure yet of the best theoretical form for the statistic in question—I do believe it is a valid concept for actuaries to consider. One form the statistic might take would be {100 * (1 / # similar policies needed to be 95 percent confident of overall profitability)}, for example. So the velocity of diversification of the life-only policy above would be in the ballpark of 1.4; for life w/ five, it would be 10 times that, coming in at about 14.

Conclusion and Application

Looking at the extreme age and mortality probabilities used above, a reader might be tempted to dismiss this concept as less important in more run-of-the-mill cases. I would encourage everyone to experiment with some of the different product options for any product line you deal in (term life insurance with return-of-premium options versus standard term life insurance comes to mind.) You may be surprised how often this effect is still quite material!

For a company that expects to sell a very large number of homogenous cases in a product line type, this effect might

Table 4: Updated Profit Streams for Five-Year Certain and Life Annuity

Life w/ 5 PolYr	q	q(x+t)	Premium	Commission	Expense	Profit Margin: Payments	8.1% Profit	Profit Margin By Year Of Death
1	10%	10%	$100,000	$3,750	$100	$16,750	$79,400	12.0%
2	20%	18%	$0	$0	$100	$16,750	-$16,850	12.0%
3	30%	22%	$0	$0	$100	$16,750	-$16,850	12.0%
4	40%	20%	$0	$0	$100	$16,750	-$16,850	12.0%
5	50%	15%	$0	$0	$100	$16,750	-$16,850	12.0%
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8	80%	1%	$0	$0	$2	$304	-$306	-38.6%
9	90%	0.3%	$0	$0	$0	$61	-$61	-55.4%
10	100%	0.04%	$0	$0	$0	$6	-$6	-72.3%

be immaterial. Instances in which I would suggest that diversification velocity be considered carefully would include:

- New blocks for where you are concerned that you might only sell a few cases that might still be large enough to be of concern to management
- Lines of business for which premiums are received infrequently (e.g., structured settlements)
- Blocks of business for which you have reasons to believe your case sizes will be very heterogeneous (imagine selling a hundred $150,000 cases, but having a star agent in the local country club who might sell a few cases with premium of $10,000,000 or so each).

In each of those cases, I believe it makes sense to use product design to nudge sales toward product forms that diversify quickly, all else equal. In annuity product examples earlier referenced, policyholders could very well approve of the reduction in their estate's risk by taking the life with certain period option. This would lead to a "win-win" situation for all parties.

Final Thoughts

What happens in the examples if my mortality experience unfolds such that the mortality improves by five percent (from 30 percent to 25 percent) in year three, 10 percent in year four, and 15 percent for years five and later? The answer is that my expected profit margin is now slightly negative for the life only annuity. However, it is only down to just over four percent for the life annuity with period certain—not nearly as bad.

With any time series (and a mortality variable over many future years clearly is one of those), it is worth considering that you are much more confident of your values in early projection periods than you are in later ones. Anything that can be done in product development to make the accuracy of any assumption—inclusive of but not limited to mortality—less critical in later projection periods is worth considering. Aiming for products with a high velocity of diversification may help in this regard. □

Please note a correction has been made to tables 3 and 4 within this article. The original article that was printed and distributed to members had incorrect tables due to a mistake made in the layout process. We apologize for any inconvenience.

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Post-Level Term Survey **Results**

By Jason McKinley

Term shock lapse and mortality deterioration assumptions are more critical than ever in an increasingly competitive marketplace. In 2013 RGA investigated industry assumptions and experience regarding term products at the end of the level premium period and beyond. That effort was sponsored by the SOA and was divided into two phases:

- Phase 1 was a summary of company responses to a survey of the mortality and lapse assumptions used by actuaries for pricing and modeling term products.
- Phase 2 was a study of mortality and lapse experience from companies with term policies beyond the end of the level period.

A copy of the complete 2013 survey can be found at: *http://www.soa.org/Files/Research/Projects/research-shock-lapse-survey-report.pdf.*

RGA and the SOA teamed up to produce a similar report in 2009. Where applicable, some results from the 2009 Phase I survey are included in this discussion for comparison.

RGA received responses from 41 of the top 100 term writers in the industry by face amount sold, representing approximately 62 percent of all 2012 term sales. The survey questions asked companies to describe pricing assumptions, product design characteristics and premium structures for their term products issued at the end of 2012. This article summarizes some of the more interesting findings from Phase 1 of the 2013 survey.

Product Design

A number of survey questions related to the structure and design of term products. Topics addressed in this section include product mix, distribution channels, post-level premium structure, premium modes and premium jumps. Some high level observations follow:

- The most prevalent product design was a jump to an annually increasing premium scale immediately following the level period. Only a few companies reported a grade-in to an ART or other premium structure.
- Premiums after the level period were typically set as 200 percent to 300 percent of 2001 CSO Ultimate. Only two respondents were pricing relative to the 1980 CSO Ultimate.
- There was no consensus among respondents regarding the difference between current premium rates and guaranteed rates at the end of the level period. Responses were very evenly distributed among three groups: products where current rates are less than guaranteed rates, products where current rates equal guaranteed rates and products with only guaranteed rates.
- Premium rates normally varied by risk class and face amount band during the level period but not during the post-level period. This leads to a more pronounced jump for the best class products at the end of the level period.
- Policyholders may maintain coverage at the end of the level period through persisting or through lapsing and re-entering. In general, the premium increase after the level period is greater for those that persist versus those that lapse and re-enter, particularly if they re-enter with the same company, face amount and underwriting class. Among those that lapse and re-enter, the premium jump is largest for those in the best class and the jump increases with age.

Shock Lapse Assumptions

Respondents were asked to provide their lapse assumptions from the last year of the level period and the immediate five years after the level period. Some companies provided one flat assumption; others vary their assumptions based on any number of factors or combination of factors: issue age, level period, risk class, premium jump ratio, premium mode, face amount, smoker status, conversion options and gender.

Of the 38 respondents providing lapse rate assumptions for 10-year level term products, 29 (76 percent) assumed a shock lapse of less than 100 percent at the end of the level premium period. Of these 29 companies, 24 also provided a shock lapse of less than 100 percent for their 20 year products. Most companies either provided no shock assumptions or used 100 percent for their 30 year products. Here are a few items of note from the companies that varied assumptions:

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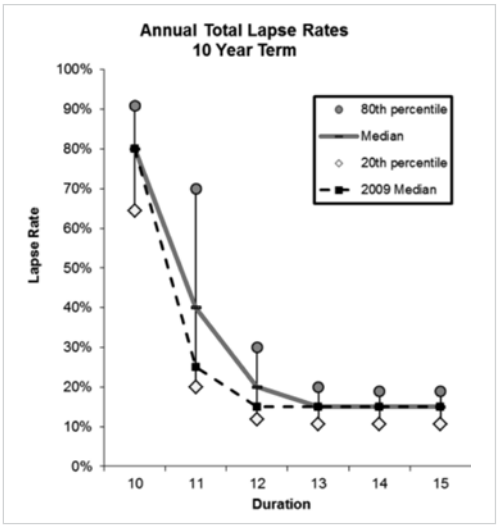
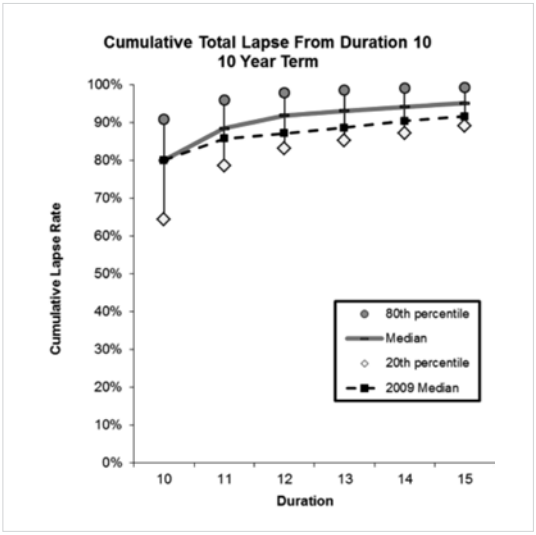
- The median shock lapse assumption was 80 percent in duration 10 for a common T10 pricing cell, which is the same finding as 2009. In duration 20, for a common T20 pricing cell, the median shock lapse assumption was 90 percent, which is up from 82 percent in 2009.
- The median cumulative lapse rate assumption for durations 10 through 14 for T10 was 94 percent, up from 90 percent in 2009. For T20, the median cumulative lapse rate for durations 20 through 24 was 96 percent, up from 92 percent in 2009.
- Respondents gave a variety of lapse assumptions in the durations following the level period. For ten-year term, eight described an initial shock followed by a much lower level assumption, 12 described an initial shock followed by a grade down to level, and nine described multiple shocks, including some responses where the second shock was larger than the first.
- Phase 2 of the 2009 study clearly demonstrated through aggregate company experience that lapses in the last year of the level period are skewed toward the end of the year and lapses in the first year after the level period are skewed heavily to the beginning of the year. In the 2009 assumption survey, only six respondents expressly accounted for this. In the 2013 survey 29, of the 37 respondents who answered the question skew lapses toward the end of the final year of the level period and 17 of the 30 who answered the question skewed lapses toward the beginning of the first year after the level period.
- Premium jumps showed no strong relationship with assumed shock lapses for 10 and 20 year products.

"The median lapse assumptions for 10 Year Term plans have increased in durations 11 and 12 relative to the 2009 survey."

As the following chart demonstrates, the median lapse assumptions for 10 Year Term plans have increased in durations 11 and 12 relative to the 2009 survey. The charts for the other level periods and pricing cells show a similar trend over time.



The following chart shows the cumulative lapse rate assumptions starting in duration 10 for a ten-year term product. Use of a cumulative lapse rate helps smooth out timing differences for companies that distribute the shock assumptions beyond the 10th duration.

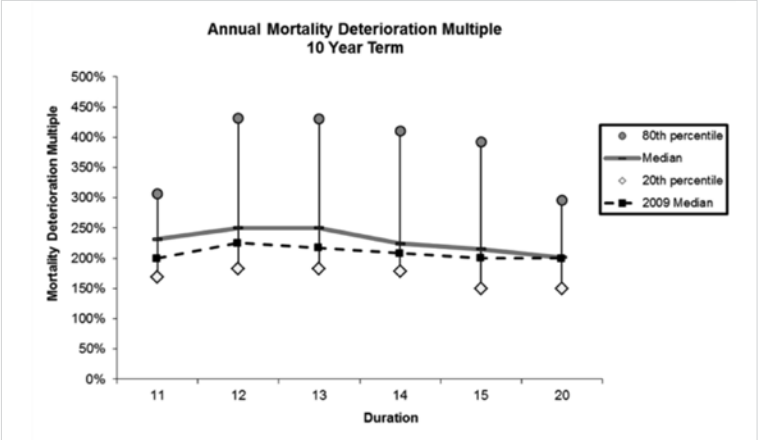


Mortality Deterioration Assumptions

It is common to assume that policyholders who choose to pay the significantly higher premiums in the post level period will have worse mortality experience than those that lapse. Respondents were asked to provide their mortality assumptions for the first five years after the level period. Assumptions varied by a number of factors, including length of the level term period, policy duration, issue age, risk class and gender. Additionally, some respondents varied their assumptions by policy size, premium jump ratio and the conversion options available on the product. For ten-year term, 27 respondents provided mortality deterioration assumptions:

- The median mortality deterioration assumption was 232 percent for T10 in duration 11, which is higher than the 200 percent assumption in the 2009 survey. For T20, the corresponding assumption was 300 percent in duration 21, up from 250 percent in the 2009 survey.
- Among the respondents that provided mortality deterioration assumptions only four use a flat multiple after the end of the level period, compared to six responses in the 2009 survey.
- The most common method for developing mortality assumptions among respondents is Dukes-MacDonald (D-M) and its derivatives such as Becker-Kitsos (14 respondents). The next most commonly cited method was to employ a flat multiple (13 respondents). However, most companies that cited use of a flat multiple usually varied their assumption by some other parameter(s) such as duration.
- Six used other methods, including the CIA Valuation Technique Paper #2 (CIA), internally developed methods and externally developed methods.
- Mortality deterioration multiples that varied by duration generally graded down. This diminishing anti-selection assumption is likely associated with the generally decreasing pattern of lapse assumptions by duration after the initial shock lapse and the diminishing impact of the grace period.
- Companies who varied mortality multiples by issue age generally increased the multiple by decennial age from 25 to 55, then decreased the multiple for ages 65 and older. In the 2009 study all cases with that pattern were developed using either D-M or CIA; this time there were other methods that resulted in that pattern.
- Of the 32 respondents that offer some type of conversion option, 17 assume different mortality deterioration multiples upon conversion than for policies that persisted into the post-level period. This is up from 10 out of 33 companies in the 2009 survey.

The chart below shows the mortality deterioration assumptions provided for a common 10-year term pricing cell. There is a wide range of assumptions at each duration. As previously described, the aggregated mortality deterioration assumptions generally started to level out and grade down after duration 12, although several respondents provided flat multiples across all durations. The median assumption has increased since the 2009 survey median.



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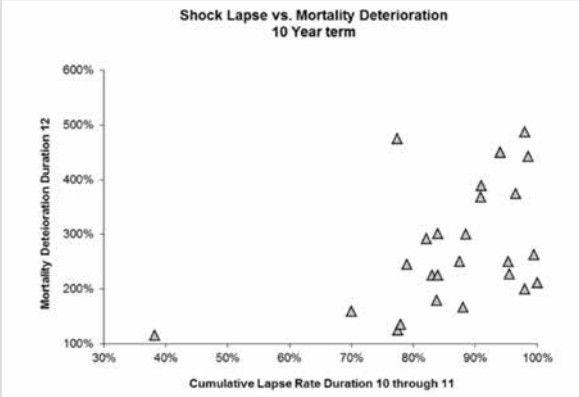
The following scatterplot shows the relationship between each company's shock lapse assumption and their mortality deterioration assumption. This plot shows the mortality assumption in duration 12 as a function of the cumulative lapse assumptions in durations 10 through 11 for 10-year term; other level periods show similar relationships. Companies with larger shock lapse assumptions generally have the largest assumptions for mortality deterioration multiples.

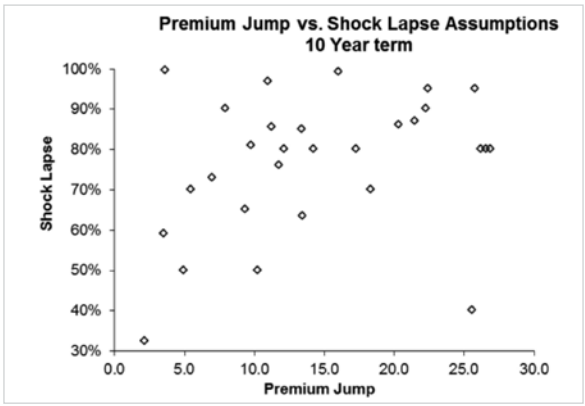


Conclusion

There is some correlation evident between the assumed shock lapse and the assumed mortality deterioration. However, there is almost no correlation between the actual premium jump from the level to the post level period and the assumed mortality deterioration, nor is there much correlation between the actual premium jump and the assumed shock lapse. These relationships suggest that companies may still need to better optimize the relationship between the actual premium jump and the assumed shock lapse.

As will be demonstrated in the Phase 2 experience results, the mortality deterioration assumptions are probably not optimally aligned with the premium jump. If the assumptions were closer to experience, the results for the three premium jump groups below would be more clearly stratified by group across levels of mortality deterioration.

Companies generally increase the mortality deterioration assumptions as the shock lapse increases, which usually matches experience. The issue then, appears to be the relationship between the shock lapse assumption and the actual premium jump. Based on experience data, a more log based relationship is expected than what we see when plotting the shock lapse assumption versus the premium jump as below.



Following the 2009 survey results, companies have further refined assumptions to more closely match emerging experience. This is a constant process and product development actuaries are continually vigilant in their review of data from all sources when developing and refining assumptions. Correctly defining and implementing sound assumptions for the post-level period on a term product is essential to profitability in the post-level stage of a product's life cycle.

The authors would like to express our thanks to the SOA and RGA for their support of this research project. We would also like to thank the SOA staff and the volunteers on the Project Oversight Group for their valuable contributions and guidance. We hope that Phase 1 proves useful as product development actuaries consider their current assumptions, and that these results whet the appetite for the experience results in Phase 2.

Goodbye to **Nested Stochastic?**

By David Wang

Not long ago, nested stochastic simulation was hailed as a revolutionary solution for projecting stochastically-calculated liability value in pricing. At one time it was believed the fast growth in computing power meant that a new era of nested stochastic simulation was at hand. It is true that actuaries have learned how to program the calculations into pricing work. However, as of today, nested stochastic simulation is still not widely used. And the roadblock for that, ironically, also happens to be computing power.

Here's how it works. Let's assume a 30-year projection for a single pricing cell with 1,000 scenarios, five of which are illustrated in Figure 1. A reserve is determined at every projection year along each scenario, with 1,000 inner paths—the shorter lines stemming out at each year along each scenario. This amounts to a total of 30 million scenarios of calculation. Stochastic simulation today is almost always run via distributed computing on a grid of computers. However, with today's technology, most companies still struggle with sufficient computing power to finish all the 30 million scenarios of calculation within a reasonable time. Thus, true nested stochastic calculation is still shunned in most cases.

To get around this problem, more efficient modeling is required. This article discusses two alternative approaches: a table factor strategy, and using Least Squares Monte Carlo (LSMC).

Table factor approach

A common approach today is the table factor approach. It starts with a table that stores the liability value factors varied by dimensions, such as the in-the-moneyness (ITM) of the guarantee, age and sex, in-force duration, etc. In the case of a variable annuities, ratios of reserve/capital amounts over account value are typically generated before the pricing exercise, and then loaded as inputs in the exercise. The generation of these figures calls for multiple stochastic projections, the exact number of which depends on the combinations of dimensions in the table. In essence, a nested stochastic process is transformed into multiple separate stochastic processes. The projected reserve and capital amounts will then be the projected account values multiplied by the corresponding ratios, based on the combination of ITM ratio and in-force duration over the outer-loop stochastic calculations.

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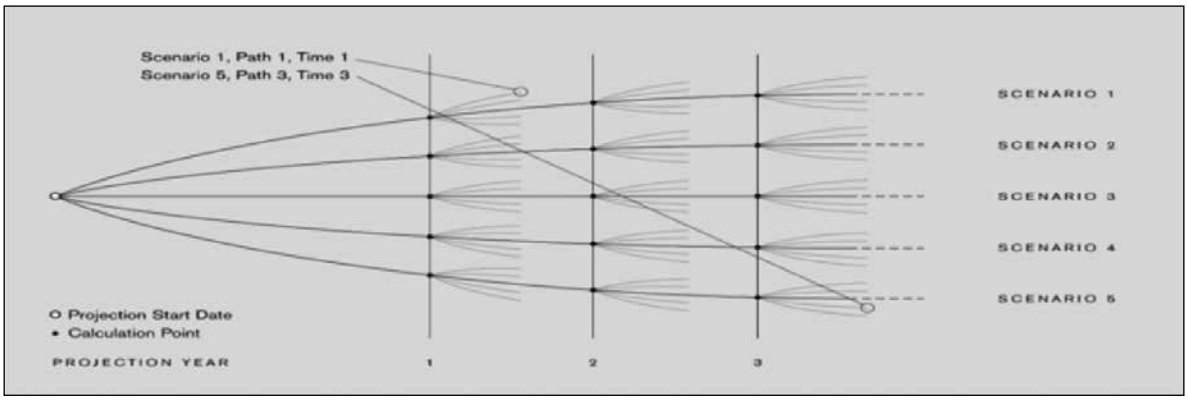
Figure 1 Nested Stochastic Simulation



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As an example, one possible table is shown in Figure 2.

Figure 2: Table Factor Approach Example

ITM/Year	150	130	100	90	80	70	60	50	20
1									
2									
3									
4									
5									
10									
15									
20									
25									
30									

The table has factors generated for selected ITM ratios, ratios of Guaranteed benefit over base account value, and policy years. Then, in the actual pricing stochastic run, the pricing model will locate the factor based on the policy year and the ITM calculated at that year along a certain stochastic outer loop. However, as the table in Figure 2 shows, not all possible ITM and policy years are generated. This is for reasons of practicality. The table in Figure 2 has 10 rows and 9 columns, so in total 90 values will be generated and thus 90 stochastic simulations are required prior to the pricing run. Each simulation again involves 1,000 stochastic scenarios, so in total 90,000 scenario calculations are involved. This is quite manageable on a typical grid today. The more ITM columns and year rows, the more run time will be required. Therefore, for practical reasons, the factors are typically generated for selected ITM/year combinations, with reasonable interpolation to fill in the missing values.

The process to generate the factors is similar to an in-force valuation exercise. The pricing cell needs to be aged into the future with different ITM values, and then runs through the stochastic simulation to determine the factors. Therefore, it can be quite a tedious process, though the process can be automated.

The table in Figure 2 does not take into consideration changes in interest rates along the projection over the outer-loop scenarios. Allowing for changes in interest rates requires the addition of another dimension, which will significantly increase the number and/or size of the tables, and correspondingly the run time needed.

Least Squares Monte Carlo

Another approach that is getting increasing attention is proxy modeling. In this context, proxy modeling means a way of modeling that provides good estimates of the liability value without requiring a full seriatim stochastic run. There are different forms of proxy modeling, including replicating portfolios, curve fitting, and Least Squares Monte Carlo (LSMC).

Probably the most well-known LSMC application was discussed by Francis Longstaff and Eduardo Schwartz in their 2001 paper, "Valuing American Options by Simulation: A Simple Least-Squares Approach." Its direct application in actuarial work, however, has been discussed more recently by various actuaries in the industry.

A full theoretical discussion of LSMC is beyond the scope of this article. Simplistically, LSMC employs a combination of Monte Carlo simulation and Least Squares Regression to derive a functional relationship, typically a polynomial function, between the liability value and the explanatory variables. These variables may be considered risk drivers that are crucial determinants of the liability value. The liability value can be anything that is stochastically generated, whether a risk-neutral fair value or a real world conditional tail expectation (CTE) value. The risk drivers include both market variables such as equity level and interest rates, and also nonmarket variables such as lapse and mortality assumptions.

For each risk driver selected, a number of shocks will be performed on the current level and then Monte Carlo simulation will be generated based on the shocked value of each risk driver. This is illustrated in Figure 3 (page 17).

Think of each shock to the risk drivers as an instantaneous change in the starting position of the current market condition or liability position. The Monte Carlo simulation is essentially what needs to be done to calculate the specific liability value, which is risk-neutral or real world depending on the liability value to be proxied. However, instead of generating thousands of simulations for each shock, much fewer are required to save run time, in some

Figure 3: LSMC Approach

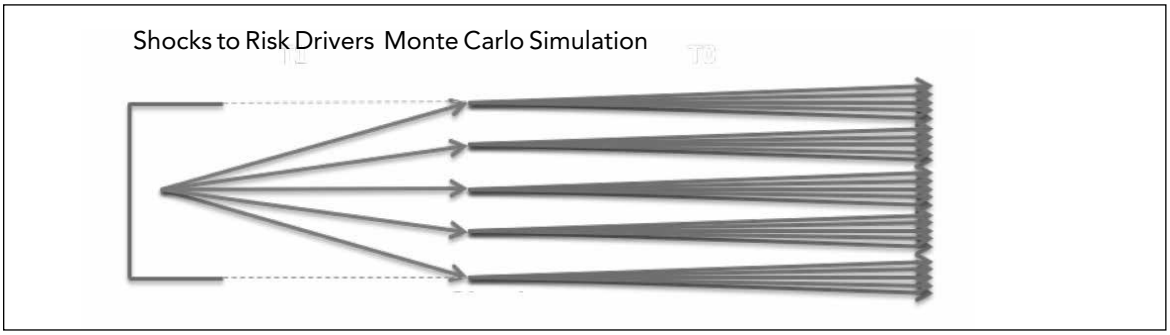
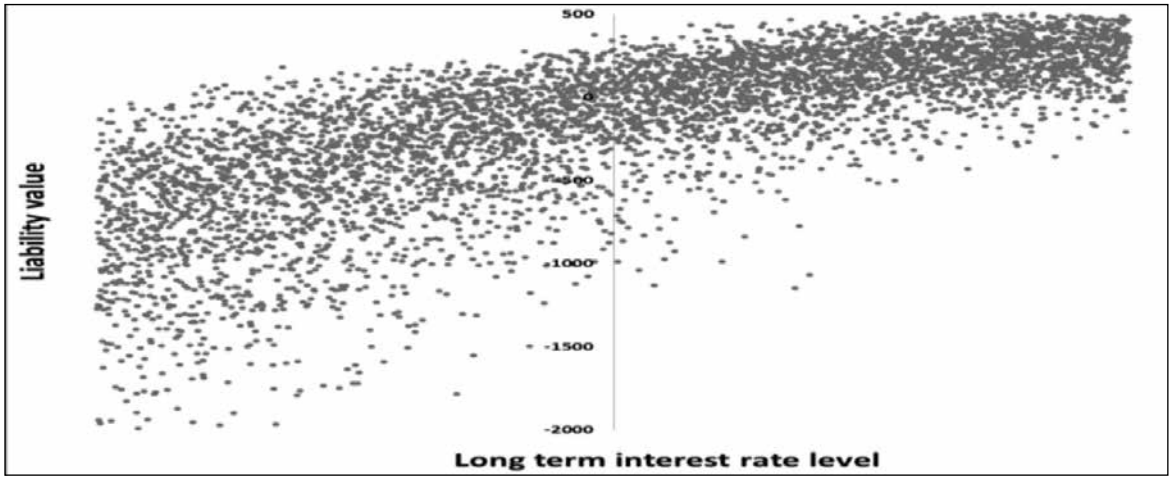


Figure 4: Liability Values and Interest Rate Levels



cases less than 10. Correspondingly, the resulting liability value calculated for each shock itself is inaccurate.

Up to this step, many inaccurate liability results are collected. However, as long as the shocks are performed uniformly across the risk drivers, then the resulting liability value will allow a Least Squares Regression to be performed. Figure 4 shows an example of the liability value that falls under shocks to interest rate level.

The result of the regression is a polynomial function that equates the liability value with the risk drivers as inputs. This function can then be used in the pricing run to replace nested stochastic projection.

However, a very important issue to note is that what is described so far assumes that the same function can be used repeatedly at future times. This is inaccurate as the liability value is expected to change over time even if nothing else changes. Instead of generating one polynomial function for each future time, a more elegant solution is to include time itself as a risk driver. Therefore, one of the terms in the polynomial function will be time and the function is now suited to project future liability value.

Summary

Though LSMC and the table factor approach may seem to be very different solutions, they do have similarities. The table factor approach may be considered as providing a discrete way of building the relationship between the liability value and the different risk drivers (dimensions). The LSMC can be considered a continuous way of building the same relationship, filling all the missing values in the table.

With the advent of efficient modeling solution such as LSMC, will actuaries ever need brute-force nested stochastic simulation? Maybe, if computing power evolves to a stage where 30 million scenarios of calculations can be done in an acceptable time. For now, we may just wave our goodbye to it, even if temporarily. □

Turning Pricing IRRs into **Intelligent Rates of Return**

By Harrison Weaver

What do the following projects have in common?

Table 1: Projects available for investment

Project	CF_1	CF_2	CF_3	CF_4	CF_5
A	(1,000)	100	100	100	1,100
B	1,000	(100)	(100)	(100)	(1,100)
C	(100,000)	10,000	10,000	10,000	110,000
D	(1,000)	700	700	(500)	235

If you read the title of this article, you may guess (correctly) that the answer lies in the Internal Rate of Return (IRR) for each project. All are 10 percent, when calculated using the Excel IRR function. Which project, then, is the best investment? Are all acceptable?

The answers to those questions depend on a number of variables which are not captured in the IRR: available capital (now and in the future), reinvestment rates, borrowing rates, and company strategy, to name a few. So what does that 10 percent mean?

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IRRs can be difficult to understand, potentially returning illogical solutions or no solutions at all. The purpose of this article is to examine the theory behind IRRs, their practical limitations, and how to get the most out of IRR calculations.

IRR Theory

The internal rate of return for a project is defined as the interest rate that makes the Net Present Value (NPV) of all cash flows equal to zero. In other words, it is the interest rate that equates your investments to your returns, on a present value basis.

IRRs are easiest to understand in a venture capital-type setting of only two cash flows: an initial investment at time zero followed by a payoff at some time in the future. While this simplicity would be a pricing actuary's dream, insurance cash flows are never quite that easy.

In practice, because it is such a succinct measure of profitability, a project's IRR has come to be used frequently by corporate executives in much more complicated settings. Specifically, IRRs are considered very valuable because they allow comparison of projects irrespective of the magnitude of the investment and subsequent cash flows. Applications to insurance products, however, may be inconsistent with the definition of an IRR.

Using IRRs with Insurance Products

What happens when cash flows occur between the initial investment and the ultimate payoff? That answer depends on the sign of the cash flow, whether it is positive (a profit) or negative (an investment).

Interim profits – When calculating an internal rate of return, *every* cash flow is discounted at one rate (the IRR), implicitly assuming that all profits earned over the life of the product will be reinvested in the same project or a project with an equivalent rate of return.

In reality, the project's profits are more akin to distributable earnings, and they will only earn a return based on the investments available to the company at the time the profit is realized. For a life insurance product, profits may be earned over many decades, in many different reinvestment environments.

For instance, consider Project A from Table 1. A $100 profit is earned in the second year of the project (CF2), but this is a five year project. In order for the project's overall return to be 10 percent, the $100 earned in year two must grow to $133.10 by the end of the project (three years of compounded 10 percent growth). Are reinvestments available to facilitate that growth? If profits are retained, will free surplus earn a 10 percent return?

Often, reinvestment rates are much lower than the IRR, because higher reinvestment rates would imply that a better investment option exists than the project being funded. An IRR calculation will overstate profitability when interim profits cannot be reinvested to earn the IRR (or understate profitability if interim profits can be reinvested at a rate greater than the IRR).

Interim investments – Similar to interim profits, additional investments (negative cash flows) occurring during a projection will also be discounted at the IRR.

Ignoring the mathematical issues caused by losses amid profits (discussed in the next section), the IRR may be an inappropriate discount rate if it is significantly different from the rate at which the company would finance additional investments.

Calculating the IRR of an Insurance Product

Assuming that an IRR is appropriate in the pricing situation, there are still potential issues related to the mathematics of an IRR calculation. Solving for an IRR is essentially solving a polynomial equation with degree equal to the period of the ultimate payoff. This becomes more complicated as the number of terms increases, and may cause three undesirable outcomes.

No solution – There are several ways to get a series of cash flows without an IRR. The simplest is all positive or all negative cash flows, i.e., a product that does not require an investment or never makes money. Another is to have a positive cash flow surrounded by larger negative cash flows on either side. The earlier negative cash flow is larger than the positive cash flow when the discount rate is high, and the latter negative cash flow is larger than the positive cash flow when the discount rate is low. Thus, it is impossible to find a discount rate to equate the cash flows.

Multiple solutions – As mentioned previously, an IRR calculation involves solving a polynomial based on the projected cash flows. Frequent sign changes (when cash flows alternate between profits and losses) increase the number of roots for this polynomial and can lead to multiple answers.

Illogical solutions – Suppose that a project generates a positive cash flow followed by a series of negative cash flows (such as Project B in Table 1). In this case, a positive IRR is mathematically possible, and increasing the magnitude of the negative cash flows will raise that IRR. From a practical standpoint, the IRR has lost its meaning as a rate of return on an investment. Because it is an upfront "return" followed by subsequent "investments," the solved for rate is more synonymous with a borrowing rate than a return.

Alternative IRR Calculations

Today, stochastic projections are common practice for many product types. While a standard IRR calculation will typically produce a reasonable number for deterministic modeling, stochastic projections generate increased volatility in earnings, and are more likely to produce one of the three situations described above. To deal with these issues, there are two main alternative formulas for calculating an IRR.

Generalized (Becker) IRR – This IRR method is calculated from the last cash flow, working backward, by making a binary decision at the time of each cash flow. If the present value of future profits is negative, discount at the finance rate. If it is positive, discount at the IRR (start with a guess).

This process will result in a present value of profits at time zero based on the initial IRR guess. To calculate the IRR, iteratively adjust the guess until the present value of the stream of profits is zero.

Modified IRR – While the generalized IRR method assigns a separate discount rate to interim investments, the modified IRR formula also accounts for interim profits. The mathematical formula can be expressed as:

$$MIRR = \sqrt[n]{\frac{FV(Positive\ CFs\ @\ reinvestment\ rate)}{-PV(Negative\ CFs\ @\ finance\ rate)}} - 1$$

All profits are accumulated forward to the end of the project, while all investments are discounted back to the start of the project, and then the root corresponding to the duration of the project is found. By accumulating and discounting at rates which may differ from the IRR, the formula can provide a truer measure of the return provided solely by the project's cash flows, stripping out reinvestment and financing inaccuracies. Modified IRRs may be easily calculated in Excel using the built-in "MIRR" function.

CONTINUED ON **PAGE 20**

For a demonstration of these methods, consider Project D from Table 1 above. The finance rate (used in both generalized and modified IRR calculations) is typically assumed to be the reserve valuation rate, representing the cost of holding adequate liability provisions, and is assumed to be 5 percent in this demonstration. The reinvestment rate (used by the modified IRR calculation only) is usually equal to the company's cost of capital rate as a proxy for available investments, and is assumed to be 9 percent. The three IRR methods produce the following results:

Table 2: Demonstration of IRR methodologies

Method	Value
IRR	10.0%
Generalized IRR	9.2%
Modified IRR	8.3%

As the table shows, for this pattern of cash flows the IRR function returns the highest value, because it is overly optimistic about reinvestment returns and understates the cost of future losses.

Note that in a venture capital-type investment of only two cash flows, both of these alternative methods will produce the same result as the standard IRR calculation. This is also true if the reinvestment rate, finance rate, and IRR are all equal.

Other Pricing Considerations

Corporate financial theory tells us to maximize shareholder wealth by choosing projects with the highest NPV of cash flows. IRRs, in contrast, are a secondary decision-making criterion which identifies the universe of satisfactory projects from which to choose: those with an IRR above a cost of capital or hurdle rate. What should that rate be?

The reference to cost of capital is an important one, because cost of capital will vary with the economic environment. Pricing is not a static exercise, and (as current interest rates continually remind us) it is unrealistic to price to a fixed percentage return in all economic climates. IRR targets should be reflective of the options available to the company at that time.

Conclusion

When evaluating insurance products, pricing metrics are often viewed as a hurdle; there is a target level above which the product becomes satisfactory and below which the product must be adjusted. IRRs in particular are useful in this role, because they allow easy comparison of different investment sizes. Understanding the math behind an IRR number can provide a more complete picture of the project and maximize its value to your company. □

The views expressed are the author's own and not representative of Oliver Wyman's.

IRRs and Excel

Commonly, IRRs will be calculated in Excel from a given stream of projected cash flows. Before using this value, it is important to understand the calculations Excel performs with the built-in IRR function. Excel uses an iterative process, similar to using the Goal Seek option, to solve for the discount rate that sets the NPV of a series of cash flows equal to zero. The maximum number of iterations performed is 20, after which an error message is displayed.

If there is more than one answer, Excel requires a "guess" (defaulting to 10 percent if left blank), and will converge to the solution closest to that input even if it returns a nonsensical answer.

Behavioral Simulations

Using agent-based modeling to understand policyholder behaviors

By Louis Lombardi, Mark Paich, and Anand Rao

Editors' Note: This is part one of a two-part series on behavioral simulations.

Introduction

Understanding past policyholder behavior and making assumptions about how current and future policyholders are likely to behave in the future are critical to the insurance industry. Policyholder behavior in terms of purchase behavior (e.g., the type of guarantees or riders purchased), withdrawal behavior (e.g., partial or full withdrawal, when and for what reasons), surrender or lapse behavior, and option exercise behavior (e.g., the decision to annuitize or not annuitize or the exercise of long-term-care rider within an annuity contract) are all essential in determining how to (a) market insurance products, (b) price products and evaluate product profitability, (c) compensate agents and advisors for acquisition and retention of policyholders, (d) value assets, liabilities, reserve and capital for various economic conditions, and (e) transfer or hedge the risks.

Insurance professionals have used a number of mathematical, statistical, financial and economic theories to understand policyholder behavior and quantify future liabilities and risks. Assumptions about future policyholder behavior form a key aspect of insurers' pricing, reserving, and hedging strategies and policies. Earlier attempts at modeling policyholder behavior have taken deterministic (or closed-form solutions) or stochastic approaches of modeling the base and dynamic behavior of policyholders. Such approaches suffer from two major drawbacks:

1. **Aggregate Level Modeling:** The approaches have been at an aggregate level with little or no differentiation of policyholder behavior based on different socio-demographic, attitudinal or behavioral factors. Such an aggregate level analysis fails to account for the value that different policyholders place on certain features (e.g., number and type of fund choices available within a life insurance policy or annuity contract, liquidity versus guarantees).

2. **Rational Approach:** The approaches have assumed a classical rational expectations approach, and do not account for how strongly social, cognitive and emotional factors influence consumers' financial decisions. For example, policyholder decisions around lapses or surrender may not be based on in-the-moneyness (ITM) of an option, but may be driven by loss aversion, job insecurity and the need for liquidity.

Recently, insurance professionals have begun to address these two issues by embracing behavioral economics and predictive modeling.

Behavioral Economics: Behavioral economics is the study of actual (as opposed to rational) decision making by consumers and takes into account their social, cognitive and emotional biases. In addition, behavioral economics provides insights into changing policyholder behaviors by "nudging" policyholders to make decisions that are beneficial to them and the system overall. The Society of Actuaries (SOA) has conducted workshops and published papers that demonstrate the application of behavioral economics in analyzing retirement savings, modeling lapse rates in insurance products, projecting when policyholders might exercise options, and determining how customers react to changing economic patterns. These analyses have uncovered the underlying behavioral principles such as bounded rationality and willpower driving decision making. For example, risk-averse consumers should place a higher value on annuities with minimum guarantees that provide income for life because they offer protection against longevity and equity risk. However, it is well known that pre-retirees and retirees fail to annuitize any lump-sum savings, either in full or partially. This is often referred to as the *annuity puzzle*.

Predictive Modeling: According to the SOA Predictive Modeling Survey Subcommittee, upwards of 40 percent of survey respondents are using or considering using predictive modeling to better understand policyholder behavior. Predictive modeling uses statistical techniques to understand the interactions between many factors that influence a policyholder's decisions. For example, predictive modeling can help insurers determine the interaction between income and age, and the impact it has on lapse rates. This is more powerful than traditional techniques that commonly account for very few variables when modeling policyholder behavior, and do not typically account for the interaction effects of those variables.

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While significant advances are being made in the use of behavioral economics and predictive modeling in understanding policyholder behavior, we see two fundamental challenges:

1. **Modeling individual policyholder behaviors:** Behavioral economics describes a number of shortcuts or decision rules that people use when making decisions under limited and uncertain information. These decision rules (e.g., use of defaults, hyperbolic discounting, endowment principle, etc.) are often used to explain policyholder decisions discussed earlier. However, using these decision rules to consistently model and evaluate impact on insurer assets and liabilities requires us to move away from an aggregate level model to an individual consumer or policyholder-level model.

2. **Modeling causal structure of individual decision making:** While predictive modeling is more effective than traditional techniques in capturing the interaction between multiple variables, it fails to capture the rich structure of causal influences and nonquantitative factors (e.g., the emotional and social factors) that influence policyholder decision making. Furthermore, predictive modeling relies on historical experience to predictive future experience. Thus, it is not very reliable predicting future experience when there is a fundamental change in the environment. Individual software agent-based models, extensively used in artificial intelligence (AI) based systems, can effectively capture the complex causal structure of individual policyholder decision making under diverse environmental conditions.

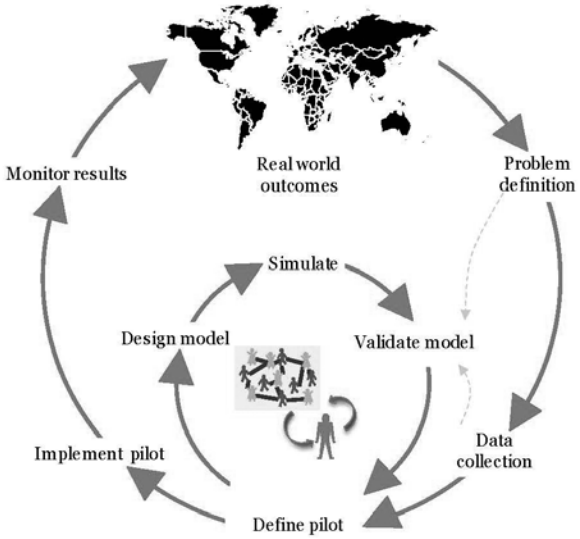
In this paper, we present a unique approach, called behavioral simulation, which combines individual decision rules and AI-based software agent modeling to model policyholder behavior. Advances in artificial intelligence allow us to simulate behavior at an individual level and then analyze the overall, aggregate outcomes. These models simulate the simultaneous operations and interactions of multiple individuals to recreate a system and predict complex phenomena. This process results in emergent behavior at the macro level based on micro-level system interactions. The concept is that the simple behavioral rules that define the simulated individuals' actions generate complex behavior at the macro level. The behavioral rules for each individual are based on the segment-specific behavioral economic principles informed by the consumer data.

This approach is applicable for modeling a variety of purchasing, withdrawal, lapse or surrender, and option exercise behaviors. Simulation models are beginning to play a central role in the design, distribution and risk management of insurance products. They promote a more sophisticated understanding and evaluation of product design, pricing, valuation, reserving and hedging. In this paper, we describe the specific application of this method to modeling withdrawal and lapse behavior of variable annuity policyholders.

Agent-Based Modeling Background

Software agent-based modeling simulates agents' (e.g., individuals' and companies') interactions with their environment and other agents in order to understand the emergent behavior of complex systems.[1]

Exhibit 1: Agent-Based Models

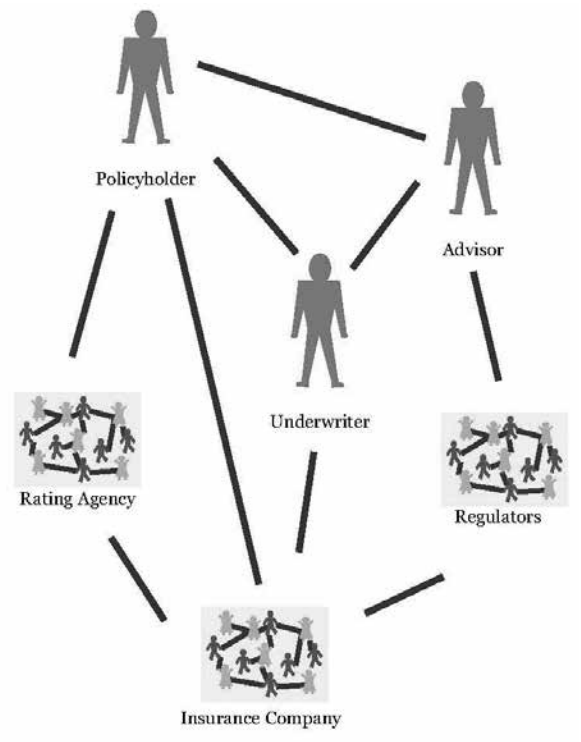


A striking feature about these models is they can be designed to "learn" as more data become available. Initially, certain assumptions will be made about how environmental factors will affect the behaviors of various agents and how they interact with the environment and with other agents. Then, as certain behaviors emerge in response to changes in the environment and interactions with other agents, these assumptions will be refined to more accurately capture and understand this emerging behavior.

Key Concepts

Anyone or anything that makes decisions can be viewed as an agent. For example, policyholders, financial advisors and insurance underwriters can be modeled as agents. The same is true for insurance companies, regulators and rating agencies.

Exhibit 2: Examples of Agents



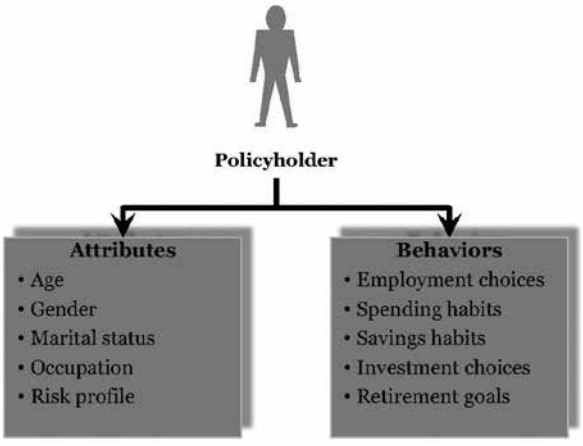
Agents are the central building blocks of an agent-based model. They:

1. Receive information from their environment and from other agents,
2. Process that information, and
3. Act on that information.

In many instances, agents will adapt or learn as they react to changes in the environment. Conversely, the actions of agents may cause the environment to change. These interactions result in a complex, dynamically changing system.

In an agent-based model, each agent has a set of attributes and behaviors. The combinations of attributes like age, gender, marital status, occupation and risk profile uniquely identify the agent.

Exhibit 3: Defining an Agent



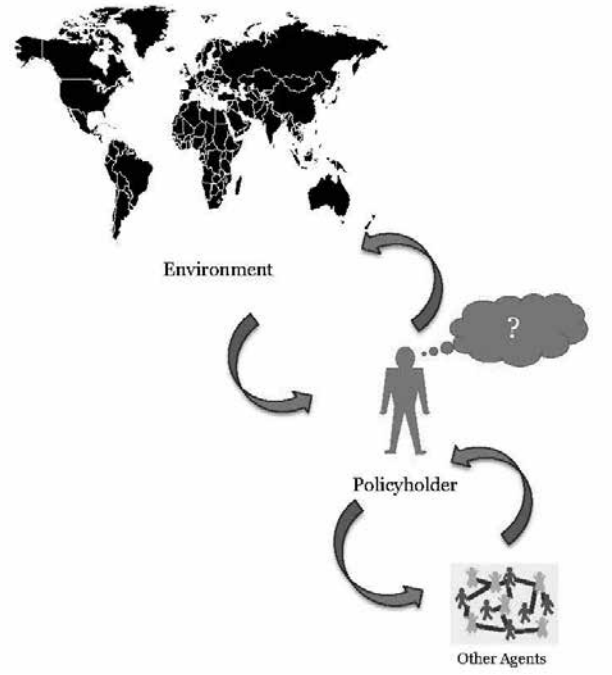
The behaviors are a set of rules that define how the agent will react to changes in its environment and to interactions with other agents. For example, a policyholder's actions with regards to employment choices, spending habits, savings habits, investment choices and retirement goals will be strongly influenced by his life situation and the state of the economy.

The behaviors define an agent's "personality" and are usually governed by the following decision process. First, the agents assess the current environment and

CONTINUED ON **PAGE 24**

decide on a course of action. Second, the agents perform the chosen action. Third, agents evaluate the results of their actions and adjust their behavior accordingly.

Exhibit 4: Agent Behaviors



For example, consider a policyholder who is retired and owns a 30-year U.S Treasury bond with a 12 percent coupon rate that is about to mature. She discusses with friends what she should do with the proceeds when this bond matures. Given the current low interest environment and the advice she receives, she chooses to invest in a one-year certificate of deposit and to cut back on discretionary expenses to compensate for the loss of income. Each year, she will reassess this decision. Among other considerations, this reassessment will take into account the advice from others, the level of interest rates, her spending needs and her wealth.

In our behavioral simulation approach, the retired policyholder is modeled as a "software agent." This agent contains attributes of the specific policyholder (e.g., their age, gender, occupation, the asset holdings and their maturity dates). This agent communicates and can share information with other agents (e.g., receive advice from friends, consult an insurance agent) to make decisions about her portfolio (e.g., reinvest, withdraw).

Environment

There are numerous environmental factors that influence a policyholder's behavior. This paper will focus on two environmental influences:

1. Where the policyholder is in his life cycle; and
2. The current state of the economy.

These two environmental factors have a significant influence on behaviors. In fact, they probably are the most important environmental variables that substantially influence policyholder behavior. This is not to say that other environmental factors are not important. The restriction to these two environmental factors puts a reasonable limit on the scope of this paper without sacrificing realism.

A natural extension of the focus of this paper is modeling:

- Interaction of policyholders with their advisors;
- Changes in government social programs such as Social Security and Medicare; and
- Changes in the tax system.

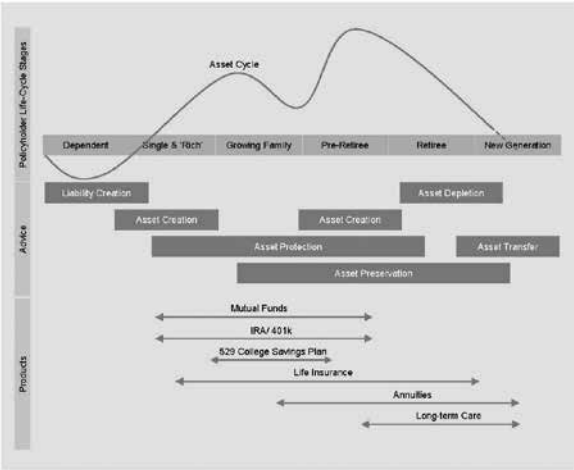
Other natural extensions are modeling how various agents behave under extreme environmental conditions. One example is modeling the behaviors of retired policyholders if the current low interest rate environment continues for a prolonged period of time; conversely, modeling what would be the impact on this same cohort if there is a sudden shift to very high interest rates and inflation. This type of agent-based stress testing will facilitate more comprehensive product design and risk management.

There are many other environmental factors that can be explored using the techniques discussed in this paper.

Life Cycle

At the model's start date, the policyholder is placed in a particular life situation as per his age, marital status and other attributes. As he ages, he will progress through various stages.

Exhibit 5: Life Cycle



As shown in the above exhibit, the life cycle of a policyholder will be divided into six stages:

1. Dependent
2. Single & "Rich"
3. Growing Family
4. Pre-Retiree
5. Retiree
6. New Generation

"New Generation" refers to the heirs who inherit the remaining assets.

The current life stage of the policyholder affects the type of advice he will seek from other agents and the types of investment and insurance products he will purchase, such as mutual funds, retirement accounts, college savings plans, life insurance, annuities and long-term care.

Where the policyholder is in his life cycle will also affect his behavior on managing his standard of living, wealth and health. Specifically, it will affect behaviors with regard to:

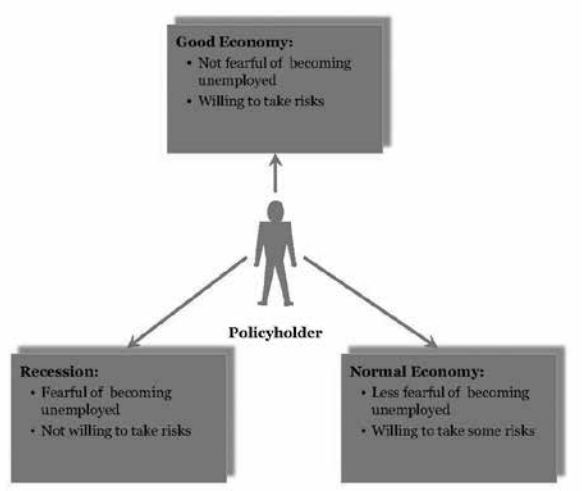
1. Income sources
2. Spending habits
3. Savings rate
4. Asset allocations
5. Risk profile

For example, a 30-year-old female who is married, has two children and is working full time will behave very differently than a 75-year-old female who is retired, has a few health issues and is living on Social Security and a small pension.

Economic

The behavior of individuals will be strongly influenced by their cognitive, emotional and social status, as well as the state of the economy. For example, in a good economy, policyholders are generally not fearful of becoming unemployed and are willing to take risks. Conversely, in a recession, policyholders are generally less confident about their employment situation and are less willing to take risks.

Exhibit 6: Economic Environment



Similar to the life cycle of the policyholder, the state of the economy will affect:

1. Income sources
2. Spending habits
3. Savings rate
4. Asset allocations
5. Risk profile

Of particular interest will be the effect that the state of the economy has on the decision-making process the policyholder goes through when tapping his investments to provide for shortfalls in the income sources (e.g., salary, Social Security and pension).

CONTINUED ON **PAGE 26**

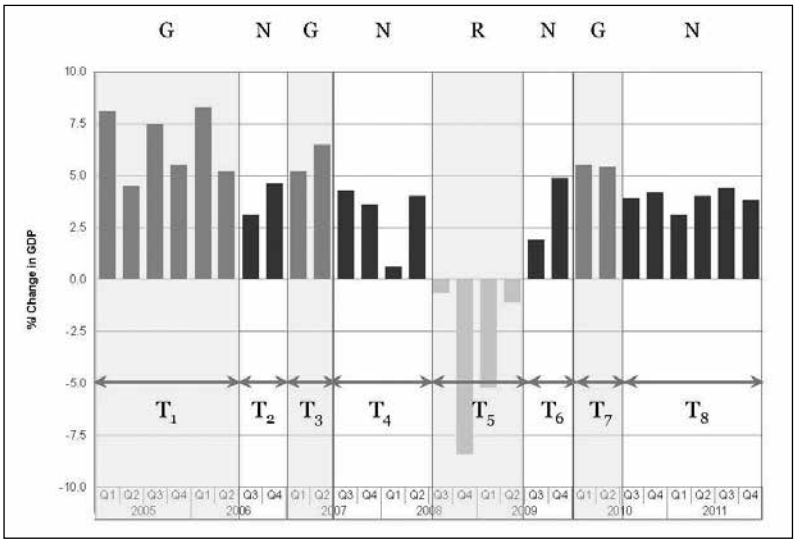
Regimes

A regime-switching framework will be used to simulate the behavior of individuals in three different economic states or regimes:

1. Good economy
2. Normal economy
3. Recession

This paper defines these states using the percentage change in the real gross domestic product. The economy is in a good state when the real gross domestic product is growing at a rate greater than 5 percent. The economy is in a normal state when the real gross domestic product is growing at a rate between 0 percent and 5 percent. Finally, the economy is in a recessionary state when the real gross domestic product is contracting (i.e., the grow rate is less than 0 percent).[2]

Exhibit 7: Waiting Periods



The random variable $T_{i|r}$ will denote how long the economy is in a particular state. Algebraically,

$T_{i|r} \square$ Exponential (λr)

Where,
$T_{i|r}$ = number of time periods before the i^{th} switch given the r^{th} regime; and
λr = expected waiting time given the r^{th} regime.

Using the quarterly percentage (%) change in the real gross domestic product from the first quarter of 1954 through the first quarter of 2012, the following exhibit shows the average waiting time for each state of the economy.

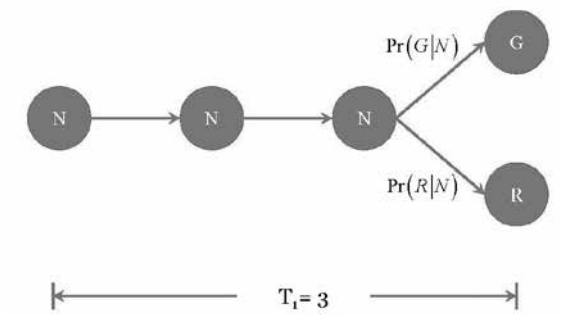
Exhibit 8: Average Waiting Times

State	Average Time
Good	2 Quarters
Normal	3 Quarters
Recession	1 Quarter

Transitions

At the end of the waiting period, the economy will switch to a different state. For example, if the economy is currently in a normal state and the end of the waiting period is reached, then it will switch to either a good economy or a recession.

Exhibit 9: Transitions



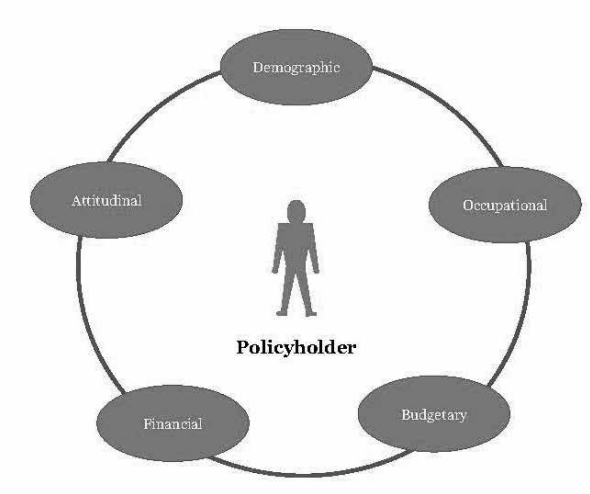
Returning again to the quarterly percentage change in the real gross domestic product from the first quarter of 1954 through the first quarter of 2012, the following exhibit shows the transition probabilities from one state of the economy to another state.

Agents

Attributes

Attributes uniquely identify the policyholder. Five categories of attributes will be used to identify a policyholder:

1. Demographic
2. Occupational
3. Budgetary
4. Financial
5. Attitudinal.



Demographic attributes include the following about the policyholder:

1. Age
2. Gender
3. Marital status.

These attributes will be used for a variety of purposes such as where they are in the life cycle, spending needs, likelihood of needing medical care, and likelihood of dying.

Occupational attributes include the following about the policyholder:

1. Employment status
2. Occupation
3. Income

These attributes will be used to determine policyholders' major source of their income, their likelihood of becoming unemployed, and the timing of their retirement.

Correlated with the demographic and occupational attributes, the budgetary attributes identify their spending habits. Their spending habits will be classified into three categories:

1. Nondiscretionary expenses
2. Discretionary expenses
3. Health care expenses

Nondiscretionary expenses are expenses that the policyholder has limited control over, including costs for food, clothing and shelter. Discretionary expenses are expenses that the policyholder does have control over, including costs for travel, hobbies and charitable donations.

Also correlated with the demographic and occupational attributes, the financial attributes identify the level and type of financial assets they are likely to own. Specifically, the net worth of the policyholder will be allocated among five asset classes:[3]

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

A policyholder will not necessarily own all five of these asset classes. Ownership will depend on several attributes such as age, income and net worth.

Attitudinal attributes describe the policyholder's attitude toward risk (i.e., risk profile). A policyholder's attitude toward risk will fall into one of three risk profiles:

1. Conservative
2. Moderate
3. Aggressive

These risk profiles will be used to allocate the assets within mutual funds, 401(k) and variable annuities among equities, bonds and cash.

The allocation to equities, bonds and cash will change as the policyholder progresses through the life cycle. For example, the following exhibit shows the investment allocations of a policyholder with a moderate risk profile when the economy is in a good state.

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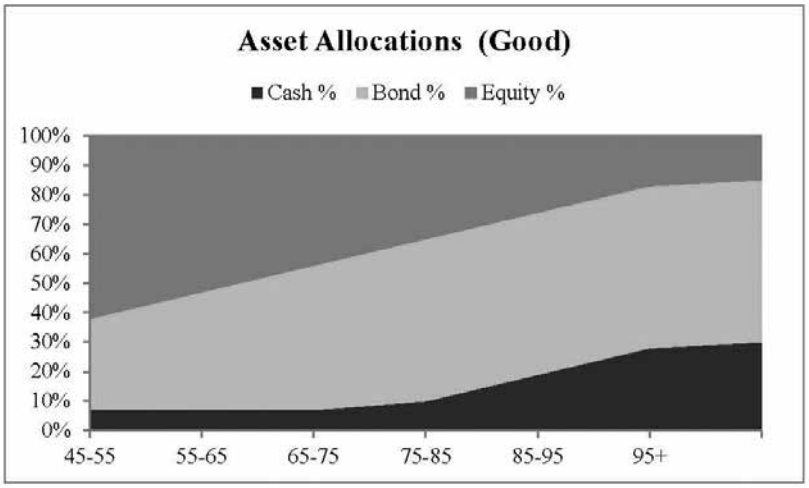
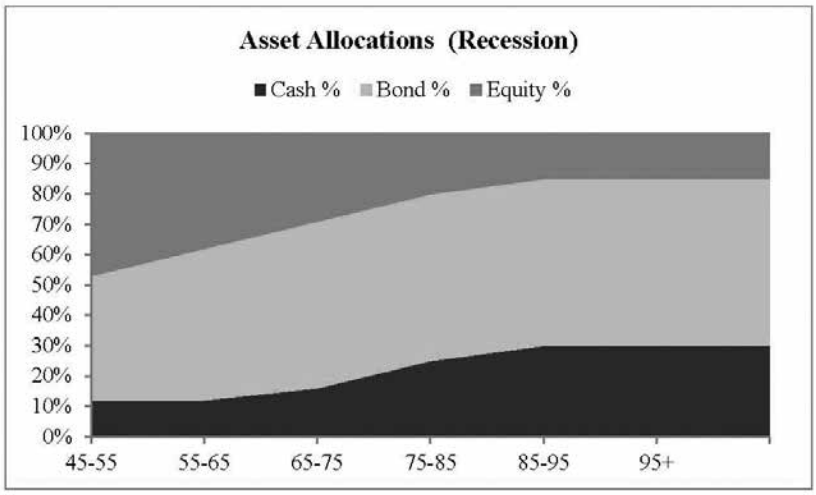
Exhibit 11: Investment Allocations During a Good Economy



Allocations to bonds and cash increase as this policyholder ages. For example, at age 50, approximately 60 percent of his portfolio is in equities, 30 percent in bonds and 10 percent in cash; whereas, starting at age 95, approximately 20 percent is in equities, 60 percent in bonds and 20 percent in cash.

Similarly, the allocation to equities, bonds and cash will change when the economy switches states. For example, the following exhibit shows the investment allocations of a policyholder with a moderate risk profile when the economy is in a recessionary state.

Exhibit 12: Investment Allocations During a Recession



For example, in the previous exhibit, where the economy is in a good state, a 50 year-old policyholder with a moderate risk profile has approximately 60 percent of his portfolio invested in equities, 30 percent in bonds and 10 percent in cash. In contrast, when the economy is in a recession, this same policyholder is expected to have approximately 45 percent invested in equities, 40 percent in bonds and 15 percent in cash.

Behaviors

With policyholders as the primary focus, it is essential that not only are their attributes accurately specified, but also that their behaviors are properly identified.

Multiple behaviors can be captured by behavioral simulations. However, for purposes of this paper, the two behaviors of policyholders that will be observed closely are their employment choices and withdrawal choices. Specifically, a behavior that will be modeled is when the policyholder chooses to:

1. Retire; or
2. Return to work, if he is currently retired

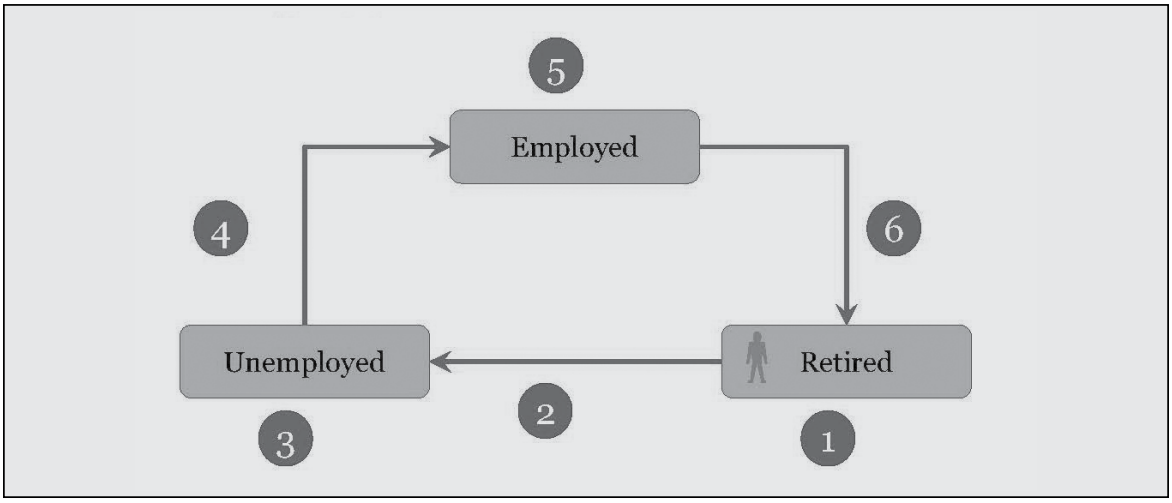
Another behavior that will be the observed closely is when the policyholder decides to utilize his variable annuity contract to:

1. Make a partial withdrawal;
2. Surrender his contract (i.e., make a full withdrawal); or
3. Do nothing

Employment Status

Using the various attributes of the policyholder such as the age, occupation, and income and unemployment rates, the model simulates the employment status of the policyholder—actively at work, seeking employment or retired.

Exhibit 13: Employment Decisions



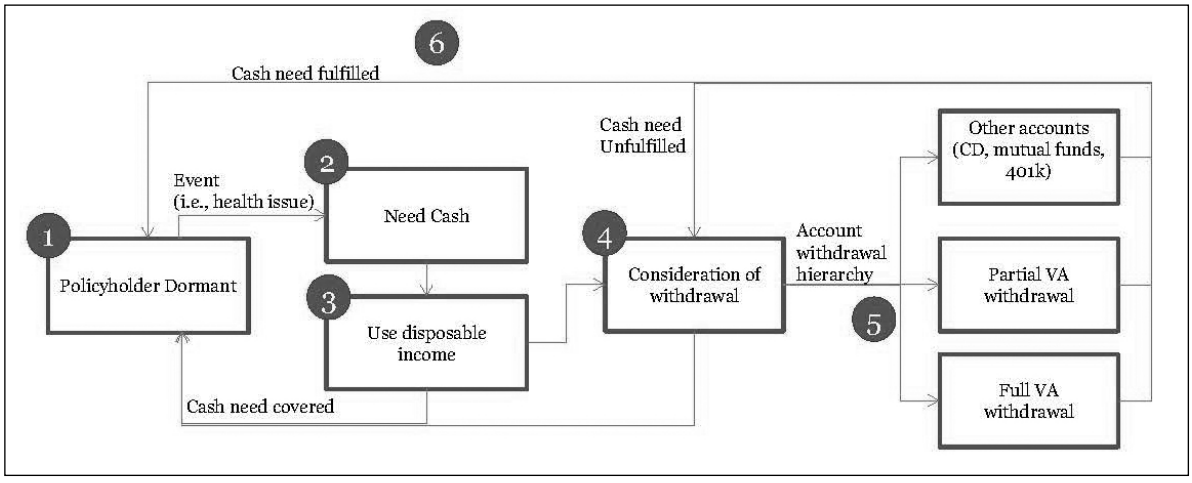
For example, consider a policyholder who just retired but his income barely covers his expenses. If his expenses increase (e.g., because his wife has unexpected health care costs), then he may be forced to look for a job. He will be considered unemployed while he searches for a job to cover his extra expenses. He will then find a new job with a probability based on his age, occupation and the current state of the economy. While he is employed, he will have enough income to cover these new health care costs. Once her illness passes and the health care costs drop or he becomes too ill to work, he will return to retirement.

Cash Fulfillment Needs

When a policyholder's income sources (e.g., salary, Social Security and pension) exceed his expenditures, he will be considered dormant. In other words, he will not be deciding to make a withdrawal from his investments but instead will be adding money to these investments.

When a policyholder determines that he needs to make a withdrawal from one of his investments, he will be considered active. During this active state, he will determine how much money he needs and from which investment he will make a withdrawal.

Exhibit 14: Withdrawal Decisions



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Continuing with the previous example, the retired policyholder will remain dormant with no financial concerns as long as his income covers his expenses. When his wife gets sick, he will calculate how much money he will need to cover her medical bills. While he is looking for a job to cover her medical bills, he will calculate how long they can live off of their current income sources. If he does not believe his sources of income will cover his expense during the time he is job searching, he will begin to worry and consider withdrawing cash from his investments. If he decides to withdraw, he will follow a "withdrawal hierarchy," tapping into one account at a time until he has fulfilled his cash need. Once his cash need is fulfilled, he will return to the dormant state.

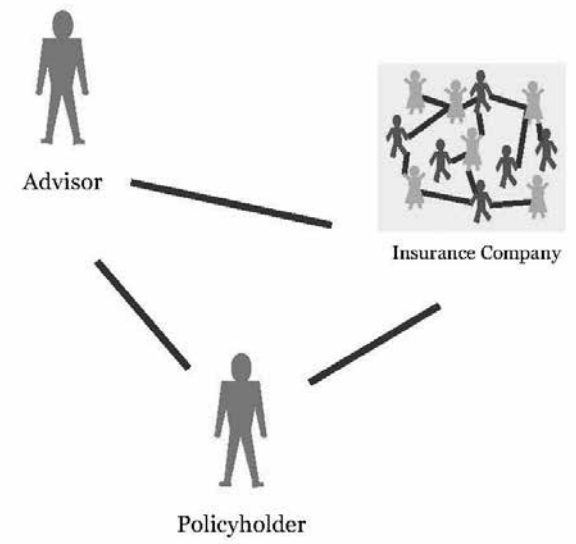
Withdrawal Hierarchy

When there is a cash need, the policyholder's decision of whether to make a withdrawal from his variable annuity contract will depend on:

1. What other type of financial assets he owns;
2. What are the tax consequences; and
3. How much the variable annuity contract is "in-the-money"

With regard to the last criteria, consideration will also be given to various contract provisions such as the surrender penalty and whether the guaranteed minimum benefit of the variable annuity contract is still in the waiting period.

Exhibit 15: Influences of Other Agents



Other influences that will affect the policyholder's withdrawal behavior are:

1. The relationships with the advisor and insurance company;
2. The policyholder's bias;
3. The policyholder's awareness of the tax implications; and
4. The policyholder's understanding of the provisions of the variable annuity contract.

In short, policyholders' decision to withdraw money from their variable annuity contract is not based solely on the moneyness of the contract, but on a variety of factors that more closely reflect real life. □

The opinions expressed and conclusions reached by the authors are their own and do not represent any official position or opinion of the Society of Actuaries or its members. The Society of Actuaries makes no representation or warranty to the accuracy of the information.

[1] *The word "agent" in this paper refers to a "software agent" or a computer process that encapsulates the decision making of individuals, companies, etc. It does not refer to an "insurance agent."*
[2] *This definition of recession is different from the official definition, which is two successive quarterly contractions.*
[3] *The primary residence of the policyholder will be ignored.*

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Strategy: **Reinventing Life Insurance**

By Dr. Anand S. Rao

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Many life insurance executives with whom we have spoken say that their business needs to fundamentally change in order to be relevant in today's market. It is true that the life insurance industry faces formidable challenges.

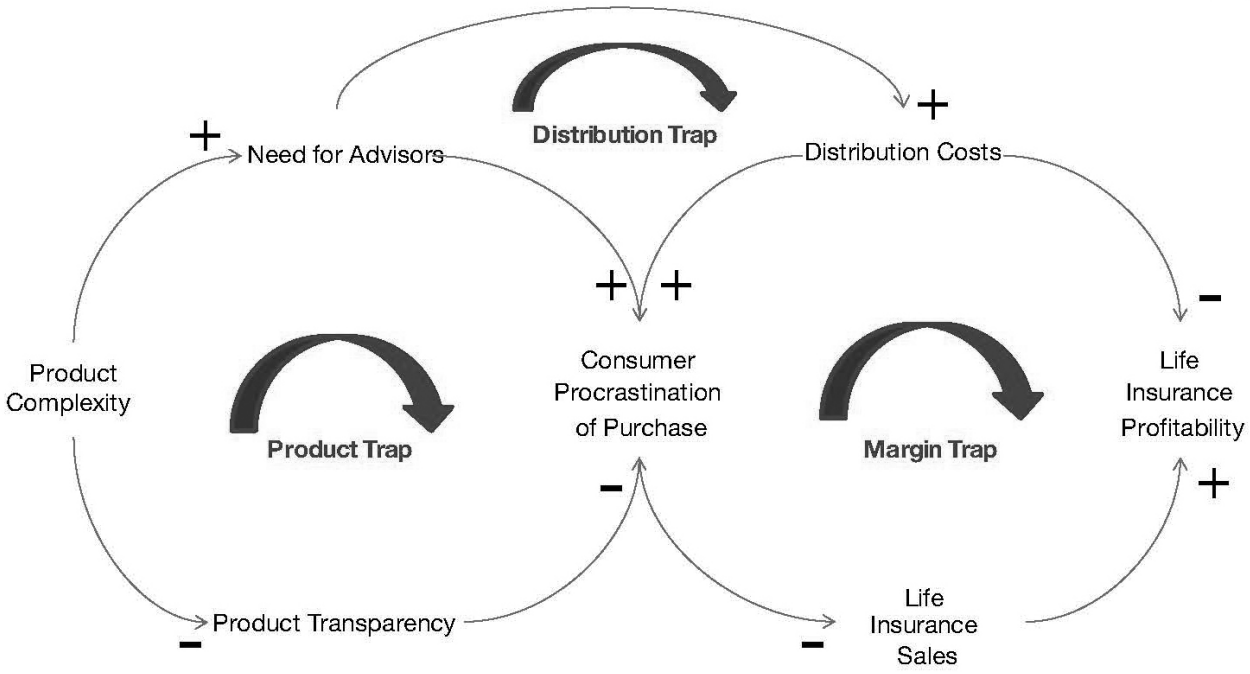
First, let's take a hard look at some statistics. In 1950, there were approximately 23 million life policies in the US, covering a population of 156 million. In 2010, there were approximately 29 million policies covering a population of 311 million. More recently, the percentage of families owning life insurance assets has decreased from over a third in 1992 to below a quarter in 2007. The stagnation or decline of life insurance contrasts with the rise of mutual funds; less than a quarter of the population owned such investments in 1990 but over two-fifths (or 51 million households and 88 million investors) did by 2009.

A number of socio-demographic, behavioral economic, competitive, and technological changes explain why this has happened:

- ***Changing demography:*** Around 11.7% of men and an equal number of women were between the ages of 25-40 in 1950. However, only 10.2% of males and 9.9% of females were in that age cohort in 2010, and the percentage is set to drop to 9.6% and 9.1%, respectively, by 2050. This negatively affects life insurance in two main ways. First, the segment of the overall population that is in the typical age bracket for purchasing life insurance decreases. Second, as people see their parents and grand-parents live longer, they tend to de-value the death benefits associated with life insurance.
- ***Increasingly complex products:*** The life insurance industry initially offered simple products with easily understood death benefits. Over the past 30 years, the advent of universal and variable universal life, the proliferation of various riders to existing products, and new types of annuities that highlight living benefits significantly increased product diversity, but often have been difficult for policyholders and customers to understand. Moreover, in the wake of the financial crisis, some complex products had both surprising and unwelcome effects on insurers themselves.
- ***Individual decision-making takes the place of institutional decision-making:*** From the 1930s to the 1980s, the government and employers were providing many people life insurance, disability coverage and pensions. However, since then, individuals increasingly have had to make protection/investment decisions on their own. Unfortunately for insurers, many people have eschewed life insurance and spent their money elsewhere. If they have elected to invest, they often have chosen mutual funds, which often featured high returns from the mid-1980s to early 2000s.
- ***Growth of Intermediated distribution:*** The above factors and the need to explain complex new products led to the growth of intermediated distribution. Many insurers now distribute their products through independent brokers, captive agents, broker-dealers, bank channels, aggregators and also directly. It is expensive and difficult to effectively recruit, train, and retain such a diffuse workforce, which has led to problems catering to existing policyholders and customers.
- ***Increasingly unfavourable distribution economics:*** Insurance agents are paid high, front-loaded commissions, some of which can be as high as the entire first-year premiums and a small recurring percentage of the premium thereafter. Moreover, each layer adds a percentage commission to the premiums. All of this increases costs for both insurers and consumers. In contrast, mutual fund management fees are only 0.25% for passive funds and 1-2% for actively managed funds. In addition, while it is difficult to do so with insurance agency fees, it is relatively easy to compare mutual fund management fees.
- ***New and changing customer preferences and expectations:*** Unlike their more patient forebears, Gens X and Y – who have increasing economic clout – demand simple products, transparent pricing and relationships, quick delivery, and the convenience of dealing with insurers when and where they want. Insurers have been slower than other financial service providers in recognizing and reacting to this need.

The preceding factors have resulted in a vicious cycle (see graphic on page 33) for insurers. Insurers claim that, in large part because of product complexity, life insurance is "sold and not bought," which justifies expensive, intermediated distribution. For many customers, product complexity, the need to deal with an agent, the lack of perceived need for death benefits, and cost of living

Vicious cycle



benefits make life products unappealing. In contrast, the mutual fund industry has grown tremendously by exploiting a more virtuous cycle: it offers many fairly simple products that often are available for direct purchase at a nominal fee.

Reasons for optimism

Despite the bleak picture we have painted so far, we believe it is possible for the industry to redesign its business model and reinvent itself. This will require fundamental rethinking of value propositions, product design, distribution and delivery mechanisms, and economics. Some of the most prescient insurers are already doing this and focusing on the following in order to become more attractive to consumers:

- ***From living benefits to well-being benefits***: There is no incentive built into life policy calculations for better living habits because there traditionally has been very little data for determining the correlation between these behaviors and their impact on life expectancy.

  However, the advent of wearable devices, real-time monitoring of exercise and activity levels, and advances in medical sciences have resulted in a large body of behavioral data and some preliminary results on how they impact life expectancy and quality of life. There are now websites that can help people determine their medical age based on their physical, psychological, and physiological behaviors and conditions. We refer to all these factors collectively as "well-being behaviors." Using the notion of a medical age or similar test as part of the life underwriting process, insurers can create an explicit link between "well-being behaviors" and expected mortality. This linkage can fundamentally alter the relevance and utility of life insurance by helping policyholders live longer and more healthily and by helping insurers understand and price risk better.
- ***From death benefits to quality of life***: Well-being benefits promise to create a more meaningful connection between insurers and policyholders. Rather than just offering benefits when a policyholder dies, insurers can play a more active or even proactive role in changing policyholder behaviors in order to delay or help prevent the onset of certain health conditions, promote a better quality of life and even to extend insureds' life spans.

CONTINUED ON **PAGE 34**

This would give insurers the opportunity to engage with policyholders on a daily (or even more frequent) basis in order to collect behavioural data on their behalf and educate them on more healthy behaviors and life-style changes. In order to encourage sharing of such personal information, insurers could provide policyholders financial (e.g., lower premiums) and non-financial (e.g., health) benefits.

- ***From limited to broad appeal***: Life insurance purchases are increasingly limited to the risk-averse, young couples, and families with children. Well-being benefits are likely to appeal to additional, typically affluent segments that tend to focus on staying fit and healthy, including both younger and active older customers. For a sector that has had significant challenges attracting young, single, healthy individuals, this represents a great opportunity to expand the life market, as well as attract older customers who may think it is too late to purchase life products.

"... behavioral economics shows us that individuals are not particularly good at making long-term saving decisions, especially when there may be a high Cost to recover from a mistake."

- ***From long-term to short-term renewable contracts***: Typical life insurance contracts are for the long-term. However, this is a deterrent to most customers today. Moreover, behavioral economics shows us that individuals are not particularly good at making long-term saving decisions, especially when there may be a high cost (i.e., surrender charges) to recover from a mistake. Therefore, individuals tend to delay purchasing or rationalize not having life insurance at all. With well-being benefits, contract durations can be much shorter – even only one year.
- ***Towards a disintermediated direct model***: Prevailing industry sentiment is that "life insurance is sold, not bought" and by advisors who can educate and advise customers on complex products. However, well-being benefits offer a value proposition that customers can easily understand (e.g., consuming X calories per day and exercising Y hours a day can lead to a decrease in medical age by Z months), as well as much shorter contract durations. Because of their transparency, these products can be sold direct-to-the consumer without intermediaries. More health conscious segments (e.g., the young, professional, and wealthy) also are likely to be more technologically savvy and hence prefer direct online/call center distribution. Over time, this model could bring down distribution costs because there will be fewer commissions for intermediaries and fixed costs that can be amortized over a large group of early adopters.

We realize that life insurers tend to be very conservative and sceptical about wholesale re-engineering. They often demand proof that new value propositions can be successful over the long-term. However, there are markets in which life insurers have successfully deployed the well-being value proposition and have consistently demonstrated superior performance over the past decade. Moreover, there are clear similarities between what we describe above and what has happened in the US auto insurance market over the last 20 years. Auto insurance has progressively moved from a face-to-face, agency driven sale to a real-time, telematics supported, transparent, and direct or multichannel distribution model. As a result, price transparency has increased, products are more standardized, customer switching has increased, and real-time information is increasingly informing product pricing and servicing.

Implications

Significantly changing products and redesigning a long-established business model is no easy task. The company will have to internally and externally redefine its value proposition and/or create an entirely new one, target individuals through different messages and channels, simplify product design, re-engineer distribution and product economics, change the underwriting process to take into account real-time sensor information, and make the intake and policy administration process more straight through and real-time.

So, where should life insurers start? We propose a four step "LITE" (Learn-Insight-Test-Enhance) approach:

- **Learn** your target segments' needs. Life insurers should partner with health insurers, wellness companies, and manufacturers of wearable sensors to collect data and understand the exercise and dietary behaviors of different customer segments. Some leading health and life insurers have started doing this with group plans, where employers have an incentive to encourage healthy lifestyles among their employees and therefore reduce claims and premiums.
- Build the models that can provide **insight**. Building simulation models of exercise and dietary behavior and their impact on medical age is critical. Collecting data from sensors to calibrate these models and ascertain the efficacy of these models will help insurers determine appropriate underwriting factors.
- **Test** initial hypotheses with behavioral pilots. Building and calibrating simulation models will provide insights into the behavioral interventions that need field testing. Running pilots with target individuals or specific employer groups in a group plan will help test concepts and refine the value proposition.
- **Enhance** and roll-out the new value proposition. Based on the results of pilot programs, insurers can refine and enhance the value proposition for specific segments. Then, redesign of the marketing, distribution, product design, new business, operations, and servicing can occur with these changes in mind. □

Why the Future Won't Be Like the Past

A commentary on the SOA's Report on the Lapse and Mortality Experience of Post-Level Premium Period Term Plans (2014)

By Jimmy Atkins

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I welcomed the SOA's report on post-level term (PLT) lapse experience with great interest. I have been heavily involved with this form of term life insurance for most of my professional career. I think the committee has done a great job gathering and analyzing the data and demonstrating the biggest predictor of the lapse rate at the end of the initial level premium period is the jump ratio, for example the ratio of the eleventh to the tenth premium on a nominal ten-year term policy. I think their conclusions are a spot-on assessment of the past and the present. However my reading of the marketplace leads me to think that the future for this product will be nothing like the past and we should prepare now for a radically different future.

My forecast is that the shock lapse rates could very well rise to the highest levels in the report for any and all jump ratios. In a world of rapidly growing social media and technological advancement everyone will know what their options are and someone will make the process easy enough to get even the biggest procrastinator to move. That someone might even be me.

Let me share my history and rationale with you. Term life insurance in the form we sell today has been the predominant form since the early 1980's. The biggest problem for term insurance in those days was deficiency reserves. If the gross premiums were less than the valuation net premiums you had to prefund the difference in a non-tax deductible "deficiency reserve." Special rules disallowing future sufficiencies to offset present deficiencies were in place for Annual Renewable Term (ART). This resulted in straight-forward renewable term insurance being impractical from a capital strain and Return on Equity (ROE) point of view. Not so for long duration life insurance with non-level premiums.

The first attempt to work around these ART deficiency reserve constraints was a whole life policy recast as an ART lookalike product with annually increasing premiums for 20 years before holding level to endowment. The premiums for the first five years were extremely low, but this led to lapse rates of 25-50 percent PER YEAR. At the low end, even 25 percent annual lapse rates could be profitable. At the high end nothing was profitable, especially for reinsurers who were paying allowances at or exceeding 100 percent of premium.

To solve both the deficiency reserve problem and the lapse problem we could just flip the "whole life as ART" concept. Charge a level premium for a limited number of years, then let premiums increase annually. As needed you could push up the premiums after the initial level period to cover anti-selective mortality rates and to produce an overall premium that was not deficient. Under the unitary methodology of the time, even higher Post Level Term (PLT) premiums would bring the reserves during the level period down to economic reserves or lower. These reserving considerations caused the PLT premiums to be higher than was otherwise necessary and so PLT premiums were potentially more profitable than would have otherwise been the case. Of course PLT profitability depends on the margin after claims and the proportion of policies that actually persist and pay those premiums. The fewer people who persist, the lower the potential to earn a profit, and the greater the expected mortality will be as the worst risks are surely persisting, reducing margin on those who persist. Your overall mortality depends on how many "average" lives persist, and an attractive premium is required to retain average lives.

In a typical design of the day after an initial 10 year level premium period the policy continues in force with no evidence of insurability but with the premium increasing 10-fold. Contrast that with the three-fold increase more appropriate for a reentry premium with evidence of insurability. Guaranteed premiums leaped 20-fold at the end of the level period and grew from there.

At the time, there was no statistically credible data on which to base an end-of level-period or "shock" lapse assumption. We did have the experience of the whole life as YRT product. So, making an educated guess and testing sensitivities was the best one could do. I suspect that there were some, but not all, companies and reinsurers that assumed 100 percent lapse at the end of the level period.

By 1990, industry data was developing actual shock lapse results on the five year product and by 1995 on the 10 year product. Actual lapse rates were in the mid-60 percent range but were not uniform. The bigger the dollars involved the higher the lapse rates. Lapse rates were higher on large face cases than small face cases. Older ages lapsed more than younger ages. All these observations are still with us today, as detailed in the SOA report. While

actual lapse rates during the level period were lower than some might have thought the shock lapse rates were a bit higher than anticipated and overall earnings were a little less than expected.

By the late 1990s, change was needed, and raising the premium did not seem to be the right answer. It would just drive more people away. However, if premiums were lowered dramatically for a few years, it might ease people into the higher rates. Ultimately the previous PLT rates would resume keeping the deficiency problem at bay. This would give up some premium per unit but lead to the expectation that even more people would keep their coverage. A range of premium patterns and lapse and mortality combinations were tested to see what pattern would most likely optimize margins and persistency. Making some high level assumptions, which in hindsight are supported by the SOA report, seemed to indicate that a straight-forward five year linear grading of the premiums from the initial level period into the original increasing PLT scale would be close to optimal.

When experience on the 10 year level term product (T10) graded PLT scale began to emerge, lapse rates during the initial level premium period were as low as ever but the shock lapse rate was higher than anticipated and still varied by the demographic measures of age, class, face amount.

Today I am now the president of Legal & General America (LGA), underwriting this same form of term life with Banner Life Insurance Company and The William Penn Life Insurance Company of New York. LGA's current experience is part of the SOA report and is generally consistent with the collective experience in that report. What I have observed is that the shock lapse rates emerging today are higher than the experience of 10 years ago. What is not clear is whether these higher lapses are a result of a more price-sensitive customer base, a lower starting rate or a changing of customer and distributor behavior over time.

Either way I don't think the historical data shown in this report will be a good predictor of customer behavior going forward. In recent months more than one independent brokerage general agent (BGA) has told me their business model is now less about recruiting and serving new brokers and more about soliciting the policy owners of the in force term book for replacement at the end of the level period. When you look at how social networks are developing and financial transactions are becoming digital, it becomes clear that far more policyholders will know they should pay attention to the end of the level period, and many will take action. Mobile technology will make it easier than ever to do so. Activist agents will work this lucrative market and BGAs will handle the orphans. Lapse rates will be higher. The quick claims won't lapse. Even if the owner no longer wants or needs the coverage settlement companies will step in to pay the premiums where it is economically sound. Mortality rates will be higher.

So I believe that the future for these products is likely to involve significantly higher lapses, even for policies with the relatively low jump ratios, as described in the report. By the time policies sold today reach the end of

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"...based upon that same experience and my look to the future, lapses will increase"

their initial level period there will be somebody there, virtually or actually, to assure that policy owners at least attempt to seek a better deal. Even if it is not the agent who initially handled the case, everybody will be solicited to re-enter. Policies will have to make their profits during the level period and 10 year term will be the most affected either with substantial price increases or fading away altogether, like the five year plan did years ago.

Regulation Triple-X has already "cut off the tail" for basic reserves while X-factors have largely eliminated deficiency reserves as a problem. More regulatory changes are in order. It seems like we should have reverted to pure term products, such as a 10 year term policy that expires in 10 years. But two things keep that tail attached. First, without the tail, the nonforfeiture law would require cash values analogous to Triple-X reserves. All 30 year term would become non-viable and 10, 15 and 20 year plans would have to end before age 70. Second, companies still count on PLT profits. Without the tail there are no PLT profits. It's time to take away the tail and simplify the product. Companies should be able to offer simple, affordable term policies and not have to complicate the coverage and the premiums with a tail. But at the same time they should have some relief from the otherwise required cash values. The current product design is driven by law and regulation, and clearly our laws and regulations should change to permit the elimination of the tail.
So, this is a great report. The authors have given us a multi-company study validating the experience I have seen first hand over the last 20 years. But, based on that same experience and my look to the future, lapses will increase. If that occurs, the future will not unfold the same as the past. Pricing actuaries should count on everybody lapsing. The nonforfeiture law must be revised to allow reasonable nonforfeiture values so that we can offer simple, transparent products and consumers will be able to buy the products that best fit their needs. □

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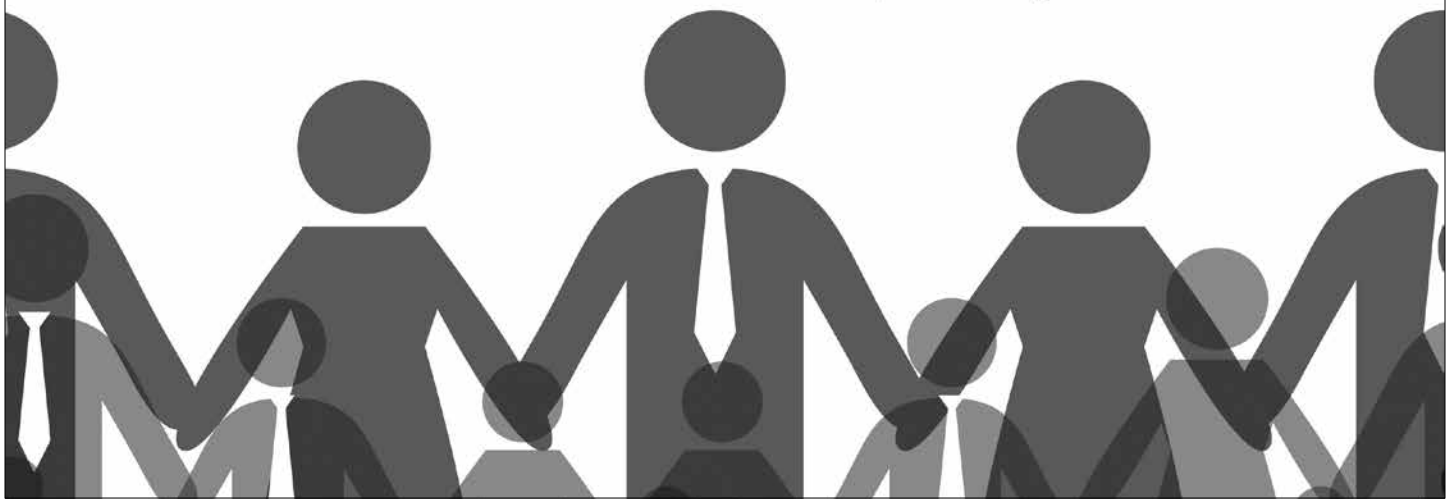

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