



SOCIETY OF ACTUARIES

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# Actuarial Behavior Risks

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“Most of us understand that innovation is enormously important. It’s the only insurance against irrelevance.”

- Gary Hamel

## WHY ARE WE HERE?

Not existentially, but as actuaries. What are we supposed to be doing? What is the highest and best use for our special set of skills? To paraphrase the SOA: “actuaries evaluate the likelihood of uncertain future events, design creative ways to reduce the likelihood, and decrease the impact of adverse events that actually do occur.”

As captivating as all that is, I prefer to say that we manage risks. Many of us may not think of our day-to-day work in that way, as it may be disguised as assumption-setting or developing and running sophisticated computer models. These are important functions, but they are means to an end—we are here to manage risks.

Which ones? We all know the roll call: investment risks, mortality risks, asset-liability risks, operational risks, and so forth, each with myriad subcategories and potential interrelationships.

But in just the last few years, the U.S. insurance and retirement security industry has hosted the coming out party for a previously under-appreciated risk—policyholder behavior. Adverse policyholder behavior results for deferred annuities have been directly responsible for billions in publicly disclosed losses: policyholders have been holding on to their valuable income guarantees at much higher rates than before the financial crisis, and in the face of this new experience data, actuaries’ assumptions for future policyholder behavior have been updated commensurately, resulting in much higher levels of reserves for future income guarantees.

So that’s it—a good blood-letting, bygones, then onward with updated assumptions, fingers-crossed? That would be pretty weak, and unworthy of our mandate to manage risks. Hope is not a risk management

strategy. The insurance and retirement security system is too large and important to individuals and families to fail or endure repeated trauma like we have experienced in the last few years. But in order to manage policyholder behavior risks, we actuaries first need to manage our own behavior—our risk of being too comfortable with the status quo. We need to stoke our own ambition, expand our thinking, and develop new tools to actually manage these risks, for the dual benefit of improving our companies’ and clients’ ability to offer vital insurance and retirement security products to individuals and families, but also to improve our profession’s value proposition in an increasingly competitive and fluid global employment market.

The gauntlet has been thrown. What are we going to do about it?

I would like to share a sketch of a powerful new tool to help answer the challenge posed by policyholder behavior risks. It starts with understanding large complex data.

Rather than make this overly abstract, let’s stay where the problems have emerged, in the deferred annuity industry. Here there is a large body of complex data



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describing the various aspects of policyholder behavior within these products—such as surrenders, partial withdrawals, annuitizations, mortality, investment fund selection, and optional benefit selection—for each company and across companies for the industry in aggregate. The experience data indicates that these behaviors are complex, with a range of cohorts and multiple drivers such as policyholder age, gender, policy duration, product type, relative value of guarantee features, and distribution channel. And in some cases, it seems that behaviors are interrelated—for example, policyholders that elect rich guaranteed death benefits tend to exhibit higher levels of mortality, as we would expect.

With this high level of complexity, unless we have a rigorous data-driven understanding of the dynamics, we have little hope of managing the risks effectively. This is why analysis of large blocks of each company's business and aggregation across the industry is invaluable—it increases the credibility of analytical refinements and understanding.

So the corporate risk management process must have command of the experience data in all of its glory. Do this first! Understand the risk profile of the business, how policyholder behavior risks and stress scenarios affect that, and how this contrasts with the industry.

What if we do this? Maybe some of us already have. What if we had a deep and quantitatively rigorous understanding of policyholder behavior for our company's block of business? What if we completely understood the surrender behavior cohorts and dynamics, so much so that we could convince another actuary of its validity for the future? Of course, we can never be absolutely certain in extrapolating historical data to the future. But if we are going to make serious progress on this issue, we should be asking ourselves what an ideal answer would look like, and then we can determine what type of adjustments to make in order to deal with shortcomings.

The answer would probably be pretty complicated. But intuitively, for each behavioral cohort, we should be able to express the behavior as a function of a benchmark along with random fluctuations. The benchmark would be a multivariate formula based on analysis of the historical data, likely including parameters for the factors noted above—age, gender, duration, product type, value of guarantee features, distribution channel, etc. The nature of the random fluctuations would be highly dependent on the level of variance between the actual historical data and the benchmark.

Much easier said than done! But think of this like an old fashioned simple linear regression model, where we are trying to fit the best trend line to some data points in two dimensions. Similar thinking applies here, but it is a surface in multiple dimensions—this is a difficult analytical step, and Generalized Linear Modeling techniques will likely be vital, the details of which are beyond the scope of this article. Results will vary between products and companies. But if we could do this, or if some of us have done it already, what would we do with it? Could we go beyond assumption-setting and use it to actually manage the risk?

Yes, I think so! If the benchmark really captures the non-random dynamics for the cohort, then the risk is really in the distribution function for the random fluctuations. As actuaries, surely we know how to construct financial transactions around random fluctuations. With deferred annuity guarantees, as noted above, the sort of behavioral fluctuations that tend to draw the most concern are low surrender rates, which increase the cost of guarantee features even net of the increase in fee or spread income for the base product. Let's consider a simple example.

Suppose that for the next quarter, we are interested in the probability that a block of policies are in the left side of the surrender rate distribution—lower than the benchmark. And suppose that if this happens, it means an average of 1 percent lower surrender rates, which would be a significant deviation in this context. We

should be able to use the historical data to estimate the probability of this happening. Let's call this probability  $p$ . Depending on the shape of the distribution function for the random fluctuations,  $p$  may take on a range of values. If the distribution function is symmetric around zero, then  $p=0.5$ , which would mean that the surrender rate fluctuations are akin to a coin toss. For one quarter, if the proverbial coin flipped tails and surrender rates were lower than the benchmark, would this have a large financial impact? Probably not. Most of us would probably view one quarter of deviation as noise, and although it would draw our continued attention, we would not be inclined to change our long-term assumptions for the future.

What if this happens again the next quarter, and the next? What if it is sustained, say for six quarters in a row? In our simple example, this is a plausible outcome that could occur with probability  $p^6$ , which is about 1.5 percent.

If this happened, then what would we think? We would probably change our expectation of the future in the face of this sustained and significant adverse deviation. This means that we would update our modeling assumptions for new business and inforce, and we would see reserve increases like the ones noted earlier—potentially costing billions. Again.

Unless we bought protection in advance.

Protection? Don't stifle creative thinking with legal and regulatory details just yet—we are working with big concepts right now. Start with the economics. If we could buy protection, how much would it cost? How much should it cost? Suppose we wanted \$200 million of protection in the event that this event of sustained low surrender rates actually happened over the next six quarters. We would intend this to help defray the impact of the reserve increase when assumptions are updated. The probability of the event is about 1.5 percent. So the net premium for the protection should be about \$3 million.

Of course, this would need to be loaded with a margin to cover expenses, risk, and profit for the risk taker. For an innovative type of "catastrophe" risk transaction which this is, it is difficult to be overly precise, but the margin might be about double the net premium. So the gross premium may be about \$10 million to provide \$200 million of protection for the next six quarters.

Can we buy decades-long protection for the life of the deferred annuity? Very unlikely. This is a data-driven transaction, and since the industry does not have decades of relevant policyholder behavior experience data to bring to bear for these types of products, the length of the protection period will be limited by that. But even a few years of coverage is a start, and can conceivably be pieced together and renewed sequentially. This is would be an important new tool in the risk management toolbox, with high financial value and high strategic value for deferred annuity writers and their stakeholders.

Perhaps most importantly, are there risk takers that would consider doing this? Bright ideas and hypothetical examples are fine, and there certainly should be demand for this type of protection on the part of deferred annuity writers who are beset with this risk and have so recently experienced its costly downside. But we need a counterparty to make a transaction—where is the supply?

As noted above, this type of transaction has a catastrophe risk profile and is data-driven with hard analytics, so we would be well advised to look to risk transfer markets with similar characteristics, like P&C "cat" and specialty reinsurers. The P&C reinsurance market is widely known for its cyclical nature, and one of its important features is that it continues to provide capital to the market even after catastrophes make capital scarce, although the cost of this capital will naturally be higher. P&C and specialty reinsurers tend to opportunistically consider unusual types of opportunities to deploy excess capital, as is their well-documented situation now, especially when they fit their risk profile, they can underwrite and price based on first principles,

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and there is a diversification benefit with other lines—the situation with deferred annuity policyholder behavior risk fits the bill! Each company will have its own views on new types of opportunities and may consider them quietly, and each potential transaction will stand or fall on its own merits, but this certainly seems like a natural and promising area for supply.

It is up to us to lead our companies and clients away from catastrophe to safety. Actuaries should continue to design new products that are mindful of policyholder behavior risks and that are priced appropriately. But

let's not stop there with our fingers crossed. Let's try something new—actively manage these risks. It will not be easy, but the solutions to the most important problems rarely are. It will require technical know-how, creativity, connectivity to the right market participants, and business savvy—exactly the behaviors needed by actuaries to be successful in the 21st century. ■

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