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Small Talk

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Publication Schedule

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Letter From the Editor

By Scott D. Haglund

In reading through this issue of *Small Talk*, I'm struck by the importance of both learning and doing as an actuary. There are great articles on exposure drafts, reinsurance, VM-20 and reports on industry meetings (as well as many other topics). However, they are just words on a page unless they are put into practice.

I thank the authors of this issue for taking the time to put their thoughts into action. As we enter and leave the industry meeting cycle for 2017, I find myself focusing on how to get the most out of a meeting.

BE PRESENT

Industry meetings, webinars and other events are great examples of "you must be present to win." As you look at your development needs, action is necessary. As this year concludes, I am already considering what events and experiences I need to further my development as an actuary. Even after more than 30 years of doing what I do, I am always struck more by what I don't know than what I do know.

During a meeting, you need to be present. Sleeping or texting through it doesn't lead to awareness of the profession. Focus on what is happening, and look for how this applies to your situation. The speakers can't show you every situation within the industry, but you can apply their information to yours.

PARTICIPATE

Remain active during a meeting/event to gain the most benefit from what is happening. Ask questions, use the chat box, evaluate the session or talk to the person sitting next to you, as appropriate. Take full advantage of having a captive audience that is there to help you be your best.

When given the chance to write a newsletter article (hint) or speak, don't immediately say no. We can all learn something from each other, and the diversity of opinions makes us all better as actuaries.

PONDER

How can you use the information you been given? What actions are possible? More than just noting what the speakers are saying, look for opportunities to improve your firm or



products. The speakers have great insights, but you need to personalize the experience.

PERFORM

OK, you've been present, you've participated and you've pondered. Now you need to perform. Words on a page won't help you; it takes action to get performance. After the event, start putting your notes into action. Right now is the best time to make a needed improvement. A future action is still doing nothing.

Hopefully, you have written your notes and defined your action steps based on this letter. If not, give me a shout, and we can discuss how we can help each other become better at what we're doing. ■



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Chairperson's Corner

By Bryan Amburn

By the time this newsletter reaches you, I will be ending my year as Chair of the Smaller Insurance Company Section (SmallCo) as well as my term as a council member. It has been a pleasure interacting with so many talented actuaries as we work through our common challenges inherent in being at a small company.

During my tenure, I have had the opportunity to volunteer in other forums, where I was surrounded mostly by large company actuaries. I marveled at their familiarity with each other and with the upcoming changes to regulations and developments in the industry, until it was pointed out to me that this was their full-time job—to stay informed on changes and challenges that affect their companies.

I have become increasingly convinced of the value of SmallCo and impressed by its accomplishments.

While staying on top of industry changes could indeed be a full-time job, that is just one of the many hats that small company actuaries need to wear. This is why I have become increasingly convinced of the value of SmallCo and impressed by its accomplishments: SmallCo provides support to its members in a world where changes are more frequent all the time.

SmallCo has sent out several blast e-mails about immersing issues to raise awareness of items impacting small companies that might otherwise fall under the radar.

So far this year, the section has already sponsored four webinars on issues relevant to small companies:

1. Practical Aspects of Getting Models and Related Processes Ready for PBR/VM-20

2. Professionalism and Actuarial Models
3. Sensitivity Testing and Margin Setting
4. VM-31 Framework

A fifth webinar is scheduled (Year-End Financial Reporting Issues) for December.

In addition to the webinars and in-person meetings, SmallCo has been active in supporting research that addresses small company considerations. Multiple research projects are currently underway:

- An understanding the product development process (from a small company perspective)
- A review and understanding of VM-20 results, especially the credibility impacts for small companies
- The impact of the VM-20 on the product development process
- Simplified methodologies—a development of less intensive methodologies that are allowed under VM-20
- Development of a modern scenario set for asset adequacy testing

The deliverables of these research projects give small company actuaries support and knowledge they would not be able to produce on their own.

All that SmallCo has accomplished is made possible through the support of its members. There are many ways to get involved, and many hands make light work. Obviously running for a seat on the council is a great way to get involved! But it isn't the only way. Many "friends of the council" participate on the monthly calls and provide support when they can. If you are interested in volunteering, contact Jessica Boyke at jboyke@soa.org for details and to be added to the contact list. To contact any council member, look for contact information on the [SmallCo webpage](#).

Also, we'd like to hear from you on how we can best serve you. Take our quick [survey](#) to help us know how we can improve our newsletter to meet your needs.

I look forward to working with you on many of the initiatives SmallCo will be supporting going forward. ■



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SOA Explorer Tool

Find Actuaries Around the Globe

The SOA Explorer Tool is a global map showing locations of fellow SOA members and their employers, as well as actuarial universities and clubs.

Explorer.SOA.org



April Webinar Topic: ASOP Exposure Draft on Setting Assumptions

By Mark Birdsall

The implementation of principle-based reserves (PBR) and the increased focus on risk management by both regulators and rating agencies has raised the bar for company actuaries in setting assumptions that can be justified and documented in actuarial reports. In an April webinar, the Smaller Insurance Company Section (SmallCo) provided actuaries with professionalism presentations on several topics, including a discussion of the exposure draft of a proposed Actuarial Standard of Practice (ASOP) on setting assumptions. This article provides information related to that presentation.

Assumption setting is fundamental to many kinds of actuarial work, and professional objectivity in setting assumptions gains added importance as results from actuarial models are included in financial statements (including PBR) and related risk analysis.

Some assumption-setting standards already exist, but there has been a perceived need for additional guidance to fill the gaps. This proposed standard would provide such guidance both for setting assumptions and for assessing the assumptions set by others. Its provisions would apply to all practice areas.

The scope of the exposure draft includes giving advice on another party's assumptions and covers a broad set of actuarial activities, including choosing assumptions, performing experience studies and other data analysis, evaluating and incorporating industry studies, trends, economic forecasts and other analyses, and using assumptions set by others.

If this proposed standard conflicted with other, more specific ASOPs or applicable laws, those ASOPs and laws would take precedence. This standard would be effective for projects including data current as of 12 months after its adoption by the Actuarial Standards Board (the "information date").

The following list represents nine guidelines for assumption setting:



1. The actuary should consider available and relevant data from a variety of sources, including the credibility of any such data as discussed in ASOP No. 25, Credibility Procedures.
2. If available data are deficient in some way, the actuary may consider whether adjusting the assumptions could properly compensate for the known deficiencies.
3. The actuary should identify the material assumptions whose variances would significantly impact the results.
4. The actuary should consider the appropriateness of the methodology being used. For example, a gross premium valuation may not be appropriate for a block of business with significant interest rate risk.
5. The actuary should look not only at the individual assumptions but also at the aggregate results produced by the combination of all assumptions, together with the selected methodology. If certain assumptions are prescribed by law, then the aggregate results should be evaluated with the stipulation that the prescribed assumptions are reasonable and may be independent of the other assumptions.
6. Assumptions should be consistent with each other and with the changing conditions over the range of scenarios tested.
7. If margins are appropriate, then they should provide for adverse deviation and uncertainty in parameter estimation. Where limited or no historical data are available, one approach to setting margins described in the PBR Valuation Manual is to establish a plausible range and set the assumption at the conservative end of that range.

8. The actuary should consider whether there are reasons to expect future experience to differ significantly from past experience. For example, if conditions have changed due to either internal or external conditions, past experience may no longer be predictive of future experience. This may be a special case of point 7, where a plausible range could be established for the assumption reflecting the new conditions.
9. Professional objectivity is the key to passing independent, third-party reviews of assumptions, including the following considerations:
 - a. Ensure that assumptions are not set for counteracting the effect of prescribed assumptions set by law. One possible application of this principle applies to predictive modeling: the actuary must not choose predictive variables that are proxies for factors that would be considered discriminatory, such as race, gender, or other factors.
 - b. The actuary should consider to what extent it is appropriate to use assumptions (and methods) that tend to significantly underestimate or overestimate the result.
 - c. In determining whether to use assumptions selected by others, the actuary should follow Precept 8 of the Code

of Professional Conduct, which states, “An Actuary who performs Actuarial Services shall take reasonable steps to ensure that such services are not used to mislead other parties.” Richard Foster provided examples of following this precept, when he served as chief actuary for the Medicare program and publicly questioned the assumptions underlying certain Medicare cost projections.

Much more could be said about assumption setting, but reviewing the ASOP Exposure Draft provides a good feel for the importance of this particular actuarial role. Nonactuaries rely on us to do sound, professional work that considers relevant quantitative information combined with an educated common sense that might be loosely described as the “smell test.” Assumption setting is one of the key activities in which we demonstrate that we are professionals with principles that hold us to a higher standard than may commonly be observed elsewhere. ■



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In the Middle: Role of a Reinsurance Intermediary

By Larry N. Stern

Picture yourself attending a social event, one not related to the insurance industry. We've all been there. Someone approaches you, introduces himself, and you do likewise. Then he asks the dreaded question, "What do you do for a living?" You proudly say, "I'm an actuary by training." Now unless you live in Hartford (CT that is; and I lived there in the early 1990s) where non-insurance industry individuals know what an actuary is, in most other places the person stares at you with a glassy look in their eyes and nods politely. You think to yourself, *Should I go to the next step and say, "I'm a reinsurance intermediary" or try to explain what an actuary is?* It's obvious that the person in front of you has no clue about either of them.

Since this article is appearing in a section newsletter for the Society of Actuaries (SOA), you will have an adequate understanding of the first statement, "I am an actuary by training." However, you may or may not be clear on the second, "I am a reinsurance intermediary." In either event, please read on to come to a better understanding of what reinsurance intermediaries do and what services they offer.

The roll of a reinsurance intermediary is to allow the company actuary to sleep easy at night by transferring the "mystique" of reinsurance to a professional.

WHAT REINSURANCE INTERMEDIARIES DO

A reinsurance intermediary can be compared to the real estate agent who works on your behalf to sell your house, brings in prospective buyers, and is compensated by the buyer of the

property. Incidentally, the said compensation is part of the negotiated price the buyer pays for the house; the amount is disclosed in the settlement documents detailing the terms of the transaction.

Essentially, a reinsurance intermediary—aka, "intermediary" or "broker"—represents a ceding company in need of capital to support liabilities on their balance sheet. The intermediary finds and brings in sources of capital who are willing to assume risks by purchasing the liabilities for a price—the negotiated reinsurance premium. The premium includes the intermediary's compensation and is disclosed in the settlement documents (or "reinsurance treaty") detailing the terms of the transaction. Just like the real estate agent, the reinsurance intermediary "earns" compensation by bringing the two parties together.

But that's not the only service the intermediary offers. In property/casualty reinsurance transactions, intermediaries actually receive the premium payments from the ceding company and remit them to the reinsurer; likewise, intermediaries receive the benefit payments from the reinsurer and remit them to the ceding company. The use of the intermediary relieves the ceding company of dealing directly with and/or negotiating terms of the reinsurance treaty. This places the intermediary in a significant need for liability insurance as he or she is responsible for any mix-ups in the reconciliation of payments, understanding of terms, and so on.

Unlike in property/casualty reinsurance transactions, in life insurance (including annuities) reinsurance transactions, the two parties handle settlement of payments directly; the intermediary receives compensation (initial and renewal, if any) from the reinsurer. In health insurance reinsurance transactions, either practice may be used based on the wishes of the ceding company.

One of the reasons, if not THE MAIN reason, why life reinsurance intermediaries are not involved in collecting/distributing cash flows is the extremely expensive and limiting availability of liability coverage. It is not uncommon for the premium for \$1 million of liability coverage to range between \$10,000 and \$15,000 annually. If, through negligence, the reinsurance intermediary is at fault and is sued, the harmed entity would want to extract more than \$1 million in damages. Therefore, life reinsurance intermediaries choose to be LLCs (limited liability companies) and maintain "lean" bank accounts. On the flip side, many PC intermediaries are housed inside large corporations for which the liability coverage is folded into their normal E & O coverage.



WHAT IS THE PURPOSE FOR REINSURANCE?

Before going into detail about the services provided by reinsurance intermediaries, let's spend some time discussing what reinsurance is and why companies use it. Simply put, reinsurance is insurance purchased by an insurance company to cover all or part of certain risks on policies the company issued. Reinsurance is a financial solution allowing a company to market, solicit and sell policies of any size, regardless of the company's surplus position.

Actuaries determine the appropriate retention level for policies issued by the company in relationship to its surplus. For example, suppose the actuary at ABC Life Insurance Company determines its surplus is sufficient to assume \$200,000 of risk on any policy sold by the company on any life. What happens when the agent for the company sells a \$1,000,000 life insurance policy? ABC retains the \$200,000 of death benefit and sells \$800,000 of death benefit to XYZ Reinsurance Company. This transaction is seamless to the insured. ABC needs to rely heavily on XYZ to live up to its agreed part of the transaction if and when the insured dies.

Reinsurance doesn't involve just one policy; it involves blocks of many policies sold by ABC. Without reinsurance, ABC would be insolvent because it would need to hold enough surplus to cover all the potential death claims on the policies it sells. Therefore, the main purpose of reinsurance is the transfer of risks ABC doesn't want to retain. In exchange for the transfer of risks to XYZ, ABC doesn't need to hold the full reserve (liability) for the amount of death claims in excess of their retention. ABC therefore is allowed a reserve credit for the portion of the risk transferred to XYZ, and XYZ is required to hold the appropriate reserve for the risk it assumes.

WHAT ABOUT THIS TRANSFER OF RISK AND RESERVE CREDIT?

Let's look more closely at the financial implications of reinsurance on the ceding company (ABC) and the reinsurer (XYZ). We all know insurance is a highly regulated industry. Insurance regulators are concerned with protecting the consumers within their jurisdictions to be sure insurance companies live up to the promises they make when selling policies.

Since part of the risk assumed by insurance company ABC is transferred to reinsurer XYZ in exchange for the reserve credit on ABC's balance sheet, regulators want to be sure the risks transferred comply with certain rules before ABC is allowed to take the reserve credit (a reduction in liabilities and an increase in surplus).

Risk transfer is the equitable transfer of all significant risks and responsibility for payment of future benefits, from the ceding company ABC in exchange for reserve credit, to the reinsurer XYZ in exchange for compensation (reinsurance premium). Eleven risk transfer rules apply to coinsurance reinsurance transactions. *Coinurance* is a form of reinsurance whereby ABC and XYZ share an equitable "partnership" in proportion to the premiums paid by the insured: the benefits provided by the policies and the expenses incurred in administering the policies. Other forms of coinsurance are modified coinsurance and coinsurance funds withheld. When *coinsurance* appears in the title of any form of reinsurance, the ceding company and reinsurer retain their respective "partnership" relationship.

If the reinsurance is defined as *yearly renewable term* (YRT), only 7 of the 11 rules apply. YRT is a form of reinsurance whereby XYZ determines the reinsurance premium to be paid by ABC; each company is responsible for its respective proportion of benefits provided by the policies.

As long as the relevant risk transfer rules are followed, the ceding company ABC will be entitled to reserve credit because XYZ holds reserves for its proportion of the risks assumed. Just as there are rules for risk transfer, there are also rules governing the reserve credit allowed to ABC and the collateral required to be held by XYZ. These rules emphasize the consumer protection imposed by the regulators to be sure ABC and XYZ are financially secure and can pay benefits.

WHAT SERVICES DO REINSURANCE INTERMEDIARIES PROVIDE?

Now let's turn to the services intermediaries provide to ceding companies. Since insurance and reinsurance are highly regulated, the services provided by intermediaries coincide with being sure the regulations are followed so that ABC can transfer risks and receive reserve credit. These services include, but are not limited to, the following:

- Adhere to the ceding company's (client's) instructions and written standards
 - Identify the client's need for capital and the purpose for reinsurance
 - Determine if ceding company-owned captive is an alternative; if so, assist in all facets of captive formation
 - Advantages/disadvantages of on-shore versus off-shore jurisdiction
 - Determine if traditional third-party reinsurer is an alternative
 - Identify what risks are to be transferred; in-force block of policies or new business policies as they are issued
 - Assist in the financial analysis of potential blocks of policies to be reinsured
 - Review experience assumptions
 - Review cash-flow analysis
 - Include pre- and post-reinsurance analysis
 - Assist in preparation of requests for proposal (RFPs) to solicit potential reinsurance sources
 - Obtain written permission from the client before negotiating reinsurance terms
 - Disclose any relationship with potential sources of solutions (such as banks, other insurance companies and/or reinsurers) to the client
- Solicit potential reinsurance solutions from reliable sources

- Obtain financial strength and solvency ratings of potential sources
- Assist in the review and analysis of proposed reinsurance solutions from all interested sources
- Facilitate the negotiation of terms and conditions for potential reinsurance solutions between the client and potential sources
 - Do not accept any terms or conditions on behalf of the client
 - Provide only the data the client has authorized for exchange
- Do not accept any allowance, proceeds or other settlements or instructions from any of the potential sources on behalf of the client

Just as regulations govern the actions of ceding companies and reinsurers, intermediaries must be licensed by the state in which they are located and operate. It is generally agreed that each state provides a reciprocal agreement eliminating the necessity of being licensed in all jurisdictions in which the intermediary may practice.

WHAT ABOUT THE FINANCIAL SIZE OF THE CLIENT?

Clients may consider the intermediary as an extension of their staff. The intermediary's purpose is to remove the burden of reinsurance solicitation and negotiation from their plates to allow them to concentrate on their everyday responsibilities. Reinsurance is an infrequent activity, not something a company actuary does on a regular basis. The need for reinsurance arises with the development of new products or an expressed need to raise capital embedded in a block of policies or to acquire a block of policies from another company.

Reinsurance activity is something with which intermediaries are involved on an almost daily basis. Their role is to allow the company actuary to sleep easy at night by transferring the "mystique" of reinsurance to a professional. Here are some examples of client engagements an intermediary may have:

- Performing cash-flow projections of future profitability to determine appropriate quota share proportions of a block to be reinsured
 - Helping clients to evaluate appropriate levels of economic reserves for potential XXX/AXXX reserve redundancy financing solutions
 - Helping clients to form captive reinsurance companies for the purpose of securing XXX/AXXX redundant reserve financing solutions

- Assisting clients in securing financing solutions for XXX/ AXXX redundant reserves
- Helping clients to understand reserve requirements under VM-20, AG 48 and PBR
- Helping clients to recapture blocks of reinsured policies due to an increase in their retention limit
- Helping clients to understand complex reinsurance structures for transferring variable annuity living benefit rider risks
- Helping clients to understand how special banking transactions can overcome the high minimum guaranteed credited interest requirements in legacy fixed annuity blocks of policies
- Assisting clients in preparing request for proposals (RFPs) to evaluate and select mortality risk reinsurance partners for term insurance products
- Representing clients in the role of expert witness to testify at arbitration or mediation proceedings

The degree of assistance depends on the size of the company. Many large clients have existing relationships with the same sources as the intermediary. Thus, they may be reluctant to incur the extra expense of intermediary compensation, which will be a factor in the price of the reinsurance solution. However, the intermediary may be able to complete the transaction

in a much shorter time frame; he or she may know the right decision makers at the potential source company to complete the transaction; and his or her dedicated effort can free up internal resources for other more important tasks. Intermediary compensation is also immaterial for the client compared to the cost of the solution.

With medium and small companies, the intermediary's expertise and knowledge play more important roles. He or she can open doors to potential sources with which the client has no previous contact, and using the intermediary as an extension of the client's staff allows the reinsurance transaction to take prominence over other internal projects.

This has turned into a long explanation of what a reinsurance intermediary does. Back to that social event. At the end of your conversation, you exchange business cards. I like this part, because mine says, "Securing financial solutions to improve the bottom line," to which my new acquaintance usually says, "Oh, that's what you do!"

Until next time, may all your experiences be profitable ones! ■



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Small Co Newsletter
SURVEY

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A VM-20 Mortality and Credibility Factor Observation

By Tim Cardinal

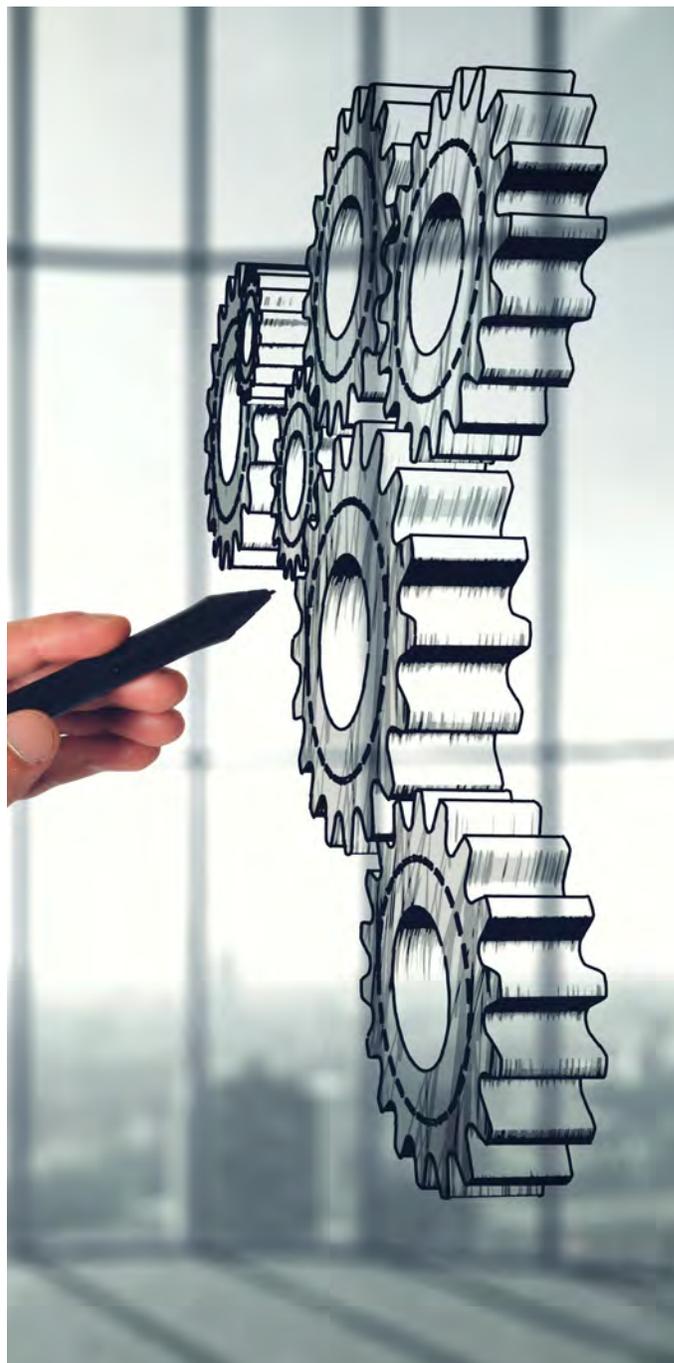
Many questions have been asked regarding VM-20¹ and reserves over the past decade. Will our company's reserves be lower or higher, and by how much? For small companies that are eligible to take the company-wide exemption from VM-20, the answer could affect the decision about if and when to implement VM-20. The answer, "It depends," isn't as clean or easy as a simple "lower/higher" and "by a lot."

Mortality is an obvious driver to answering the lower/higher/how much question. Hence, there is a second series of related questions: What is our mortality assumption? What is our credibility factor, and what does that mean for reserves? How much do reserves change with a higher credibility factor? At the lower end of the credibility spectrum, are reserves higher or lower than Triple X reserves? How much do reserves decrease with a little better credibility? This article presents graphical results² to provide insights into the last two questions.

The VM-20 mortality assumption splits the policy period into three periods:

1. Based on company tables plus margin
2. Graded linearly from 1–3 (company plus margin to industry plus margin)
3. Based on an industry table plus industry margin

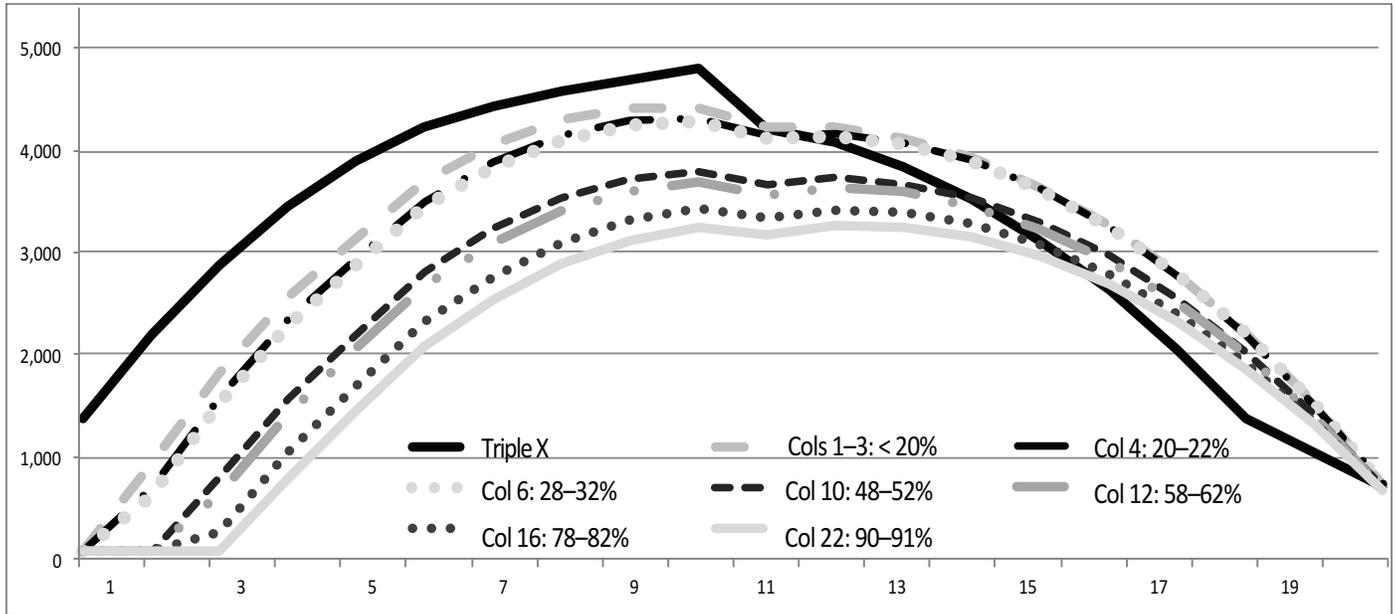
To determine a credibility factor, margins for the company tables are determined via one of two permissible credibility methods—Bühlmann and limited fluctuation. For both methods, the factor is used as a table lookup to determine a vector of margins: the column is based on the credibility factor, and the margins in rows vary by attained age. These margins are applied to company tables. Another dimension to credibility is how long the sufficient data period is; VM-20 defines this period as the last duration in which there were more than 50 claims. The sufficient data period, along with the credibility factor, is used to determine the length, start and end of each of the three periods. However, if the credibility factor is less than 20 percent, the



assumption is based strictly on the industry table (i.e., Periods 1 and 2 are zero years). The details of the mortality assumption process are beyond the intent and scope of this article.

Figures 1–4 present Triple X vs. deterministic reserve results for a 10/20 year term cohort using Bühlmann credibility factors for seven of the VM-20 margin table's 24 columns—those corresponding to the columns for 18–22 percent, 28–32 percent, 48–52 percent, 58–62 percent, 78–82 percent and 90–91

Figure 1
 Projected Deterministic Reserves (DR) + Deferred Premium Asset (DPA) by Policy Year



Source: Graphs adapted from the PBR Consortium, Actuarial Compass LLC, AADicke LLC and Mangini Actuarial and Risk Advisory LLC. Voyager m²Lab PBA Training, 2016.

Table 1
 Age 0–45 Margins Applied to Company Table for the Seven Trials

<20%*	18–22%	28–32%	48–52%	58–62%	78–82%	90–91%
20.4%*	20.4%	19.3%	16.3%	14.6%	10.3%	7.3%

* The margin applied to the industry table.

percent. The margin decreases as one moves across the table from left to right. To avoid the possible confusion that the results are consecutive columns (they are not), I use the word *trial* as a label rather than *column*. The margins at ages 0 to 45 for these trials are shown in Table 1.

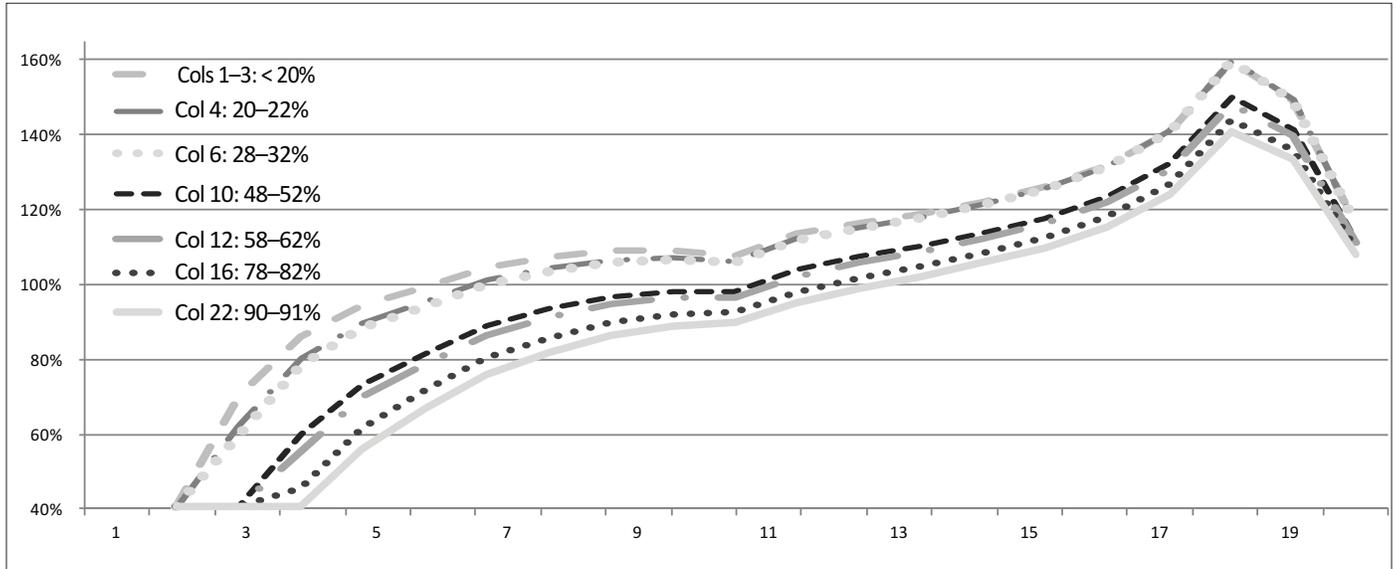
The 10/20 year term cohort consists of one year of issues—40 percent 10 year, 60 percent 20 year—using LIMRA sales mix data. Reserves are on a direct basis. Triple X reserves used an X factor of 60 percent for all policies.

Deterministic reserves depend on a myriad of other assumptions and modeling methods. For our representative block, DR + DPA is larger than Triple X after year 11 for trials using margins from Columns 1–6. DR + DPA starts out much lower than Triple X, but the difference grows smaller over 10 years. Both the projection and DR reflect a shock lapse occurring at years 10 and 20 (100 percent lapsation at the end of the level periods). The Triple X projection “releases more reserve” on the

10-year block due to the projection’s shock lapse rate. As far as years 1–10, lower premiums or different assumptions (such as higher maintenance expenses and surrender rates) could reverse the Triple X to DR + DPA relationship before year 10.

Without knowledge of all the assumptions, one cannot and should not read too much “this is always the case” into the values. Specific contexts matter. However, we are interested in change—namely, change due to a shift in the credibility factor. Changing other assumptions would simply shift all the non-Triple X results by nearly the same amount. In Figure 1, the trials alternate between dark and light and use different dash-dot patterns. Since VM-20 minimum reserves make a comparison of the deterministic reserve plus the deferred premium asset to the net premium reserve (NPR), the analysis considers DR + DPA. As expected, DR + DPA decreases across all policy years as the credibility factor increases, meaning a column farther to the right in the VM-20 table is used, resulting in lower margins for the company table. Visually we see

Figure 2
Ratio of Trial N's DR + DPA to Triple X by Policy Year



Source: Graphs adapted from the PBR Consortium, Actuarial Compass LLC, AADicke LLC and Mangini Actuarial and Risk Advisory LLC. Voyager m²Lab PBA Training, 2016.

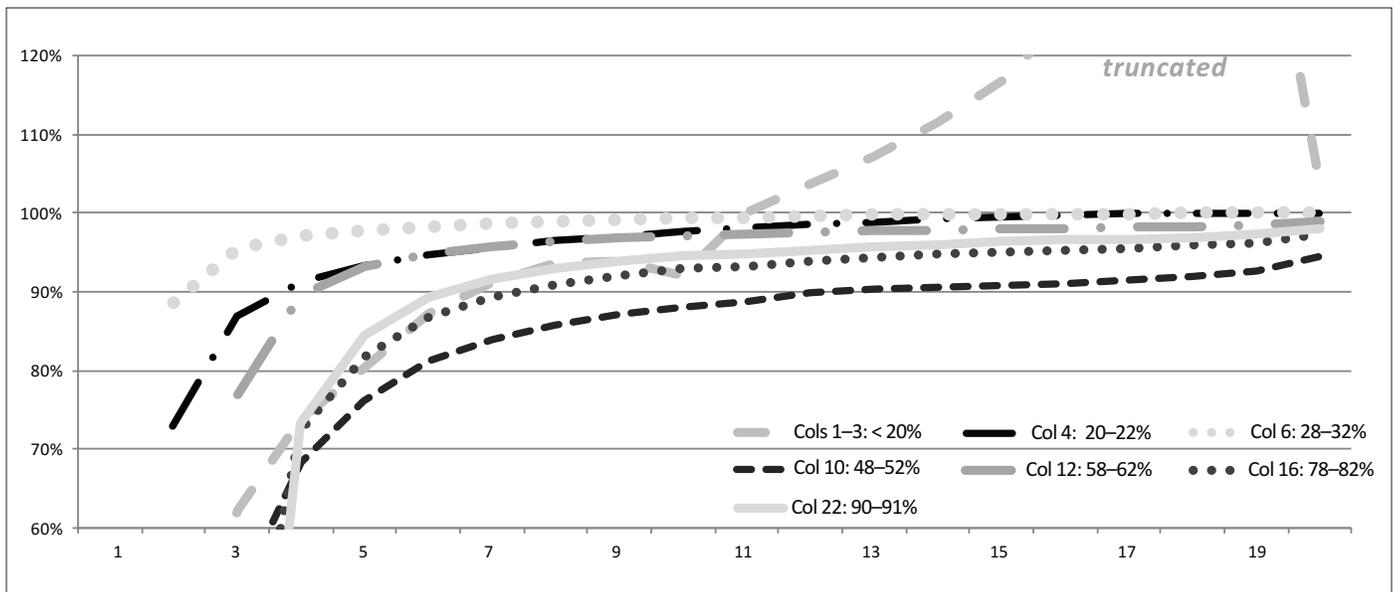
significant reduction in reserves from Trial 3 (Col 6) to Trial 4 (Col 10) and from Trial 6 (Col 12) to Trial 7 (Col 16).

years are not shown because DR + DPA is zero or small, resulting in undefined and/or very large ratios.

Figure 2, by taking the ratio, allows us to see each trial's DR + DPA as a percentage of Triple X. Some values for early policy

Figure 3 compares the percentage change from one trial to the next. The first ratio—Trial 2 (20 percent) to Trial 1 (Triple

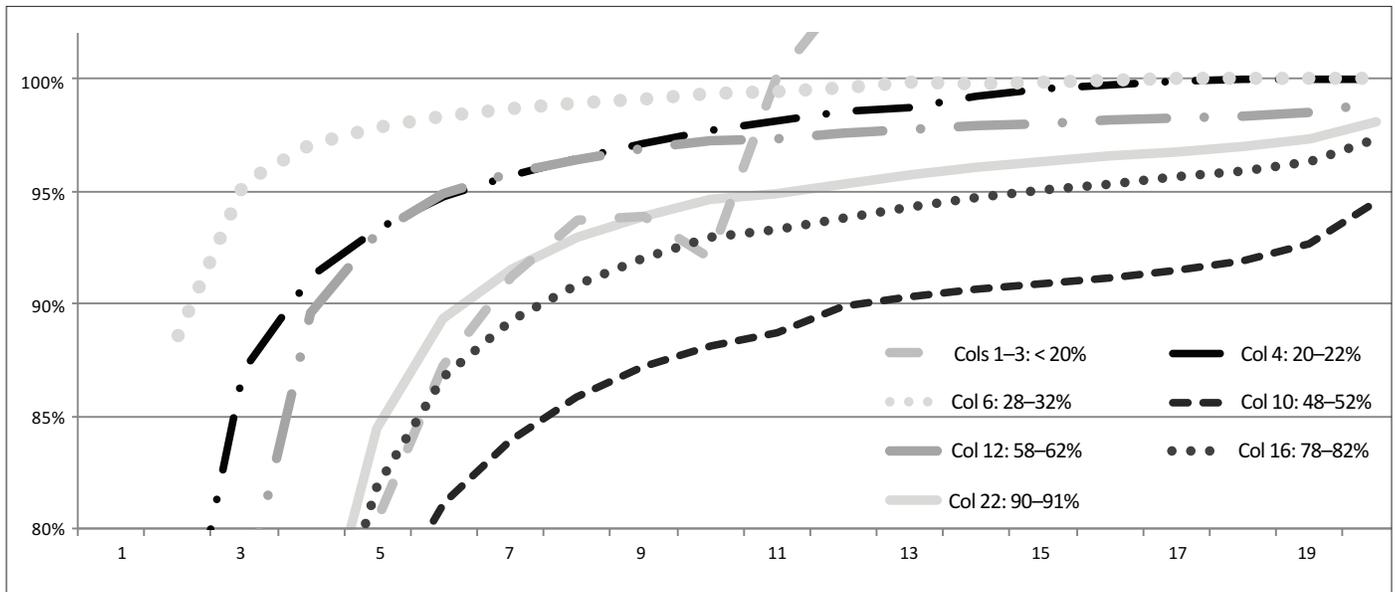
Figure 3
Ratio of N + First Trial's to Nth Trial's DR + DPA by Policy Year



Source: Graphs adapted from the PBR Consortium, Actuarial Compass LLC, AADicke LLC and Mangini Actuarial and Risk Advisory LLC. Voyager m²Lab PBA Training, 2016.

Figure 4

Ratio of N + First Trial's to Nth Trial's DR + DPA—A Closer View by Policy Year



Source: Graphs adapted from the PBR Consortium, Actuarial Compass LLC, AADicke LLC and Mangini Actuarial and Risk Advisory LLC. Voyager m²Lab PBA Training, 2016.

X)—looks different than the others because the comparison is between different reserve bases. The graph is truncated at 120 percent because the ratio gets large in years 16–18. The ratio of Trial 4 to Trial 3 (Col 6 to Col 4) shows that reserves decrease by 0–3 percent. The ratio of Trial 3 to Trial 2 (Col 4 to <20 percent) and the ratio of Trial 6 to Trial 5 (Col 12 to Col 10) show that the reserve reduction is 10–5 percent for years 3–6 and 5–0 percent thereafter. The other ratios show significant reductions between trials across nearly all policy years.

Figure 4 takes a closer look at Figure 3 by limiting the y-axis to 80–100 percent.

COMMENTS

Without turning this article into a monograph and a proliferation of graphs, results using the limited fluctuation method are similar, as are blocks with slightly different assumptions. As far as whether low credibility can result in reserves higher than Triple X reserves—yes, it is possible. Other factors such as lower premiums, higher expenses and so on can move the needle sufficiently to alter the Triple X to DR + DPA relationship. But the “answer,” as stated in the introduction, is “It depends.”

The general observation is that, as suspected, mortality credibility factors do materially impact deterministic reserves. Do not read too much into the precision of the values or ratios in Figures 1–4. But even imprecisely, one can see that higher credibility can lead

to lower deterministic reserves, which may result in competitive advantages relative to companies with lower credibility.

VM-20 permits companies to exercise actuarial judgment in determining the assumption and the relevant data; VM-20 permits internal and external sources of data such as reinsurers, LIMRA and MIB. Widening the quantity and quality of underlying data leads to higher credibility. However, criteria entail sharing similar characteristics, and VM-20 defines neither *similar* nor *characteristics*. Companies and actuaries alike will be looking for solutions to the challenges in developing and setting mortality assumptions. One of the challenges materially impacting deterministic reserves is credibility. ■



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ENDNOTES

- 1 National Association of Insurance Commissioners, *Valuation Manual*, April 2016. http://www.naic.org/documents/cmte_a_latf_related_val_adapted_160829_with_changes.pdf.
- 2 The PBR Consortium, Actuarial Compass LLC, AADicke LLC and Mangini Actuarial and Risk Advisory LLC. *Voyager m²Lab PBA Training*, 2016.

June Webinar Topic: Sensitivity Testing and Setting Margins, Plus a Fully Stochastic PBR Method

By Mark Birdsall

In following the development of principle-based reserve (PBR) requirements from its early days, it seemed that the overall goal was to embed risk analysis in the calculation of reserves. Some referred to this objective as “right-sizing reserves,” in the sense that reserves would more accurately reflect the risk profiles of product liabilities and the assets supporting them. PBR would be the logical next step in the evolution of asset adequacy analysis. Different product types could be evaluated based more on risk characteristics and not on the name or category of the product, creating a more level playing field across products based on risk. In such an environment, product development would flourish with new benefits and combinations of benefits. Regulators could more easily keep up with how the reserves of new products should be determined.

Of course, this “win-win” view of the future has not fully developed yet. Complications introduced into the Valuation Manual have reflected regulatory concerns about the subjective nature of the assumption-setting and margin-setting processes. Support for changes to nonforfeiture requirements has generally been less than enthusiastic, perhaps partly because of the uncertainty about the treatment of “in-kind” nonforfeiture benefits in Sections 7702 and 7702A, as well as tax reserve calculations. In any event, the path to today’s Valuation Manual has been lengthy and at times difficult. The good news is that the original objective of calculating statutory reserves based on the risk profile of a block of business is still achievable in fulfilling VM-20 reserve requirements. This article summarizes a methodology for identifying and quantifying material risks and calculating PBR margins as presented in a June Society of Actuaries (SOA) webinar and describes a methodology for PBR calculations that are principle-based in the spirit of PBR’s original purposes.

SENSITIVITY TESTING AND SETTING MARGINS

Let’s start with the subject of the June SOA webinar: sensitivity testing and setting margins. Sensitivity testing has long been a useful tool to identify material assumptions in actuarial models. But if you take the next step and select sensitivity tests at specified probability levels, you could use the sensitivity testing results in additional ways, including setting margins for PBR and calculating target surplus based on the specific risk profile of a block of business.

Under PBR, margins must be established that provide both for moderately adverse deviations from anticipated experience and for the risk that the anticipated experience has been set incorrectly (parameter risk). The greater the degree of sensitivity of the results to variations in a material assumption, the more rigorous the analysis of both the relevant experience underlying the assumption and the margin established in setting the PBR prudent estimate assumption for that risk factor should be. A change in the method for calculating margins must be documented in the PBR actuarial report.

The SOA has sponsored a research project for testing PBR simplified methods. One of the key deliverables from this project is the development of a multi-risk scenario generator. This generator incorporates the economic scenario generator used for VM-20. The generator used for VM-20 is currently hosted by the SOA, but was developed by an American Academy of Actuaries work group. When the multi-risk scenario generator is finished, it will be available from the SOA at no cost. The generator can produce vectors of actual to expected (A/E) ratios, also called actual to tabular (A/T) ratios, for material risk factors based on knowing the following information for each such risk factor:

1. The anticipated experience assumption, normally in the form of a table of decrement rates
2. Experience study data for a one-year period in the form of:
 - a. The number of contracts exposed
 - b. The number of events (decrements) observed
 - c. The A/T ratio between the observed experience and the table from number 1
3. When experience study data are not available, a user-defined distribution for the A/T ratio

With this information, the generator can produce deterministic scenarios for each material risk at a moderately adverse level of the 84th percentile of the distribution or at an extremely adverse level of the 99th percentile. (The 84th percentile of the distribution of the present value of future cash flows is

considered to be approximately the same level of conservatism as CTE 70, the level specified for statutory reserves.) The generator can also produce “fully stochastic” scenarios in which all the material risks vary at the same time. There is one caveat: some assumption types are better handled through dynamic functions than by A/E ratios (such as flexible premiums).

How would you use the generator to apply margins to the material anticipated experience assumptions for a block of business, thus producing the prudent estimate assumptions required by the PBR Valuation Manual? Recall first that margins are only required on material assumptions where variations in those assumptions would have a significant impact on the reserve. Consider the following steps:

1. Using professional actuarial judgment, propose material risks for each product type under consideration and perform initial sensitivity tests to assess the degree of sensitivity. VM-20 provides a starting point of possible material risks to consider: mortality, morbidity, interest, equity returns, expenses, lapses, partial withdrawals, loans and option elections.
2. Identify relevant company and industry experience for each material risk and perform experience studies. Finding relevant industry experience to supplement relevant company experience for a risk factor can increase the credibility of that experience and reduce the margins required in the reserve calculations for the deterministic reserve and stochastic reserve in VM-20. Note that traditional experience studies may not have identified all significant predictors of experience for a risk factor. Additional significant predictors may include product design elements, distribution channel characteristics, target markets and scenario-dependent in-the-moneyness of benefits. In making the case for the relevance of industry experience to company experience, consideration of all the significant predictors of experience should be included in the analysis. Data aggregators—such as LIMRA, MIB and some reinsurers—are aware of the need to provide relevant industry experience to companies and are working on developing enhanced experience studies that will help companies identify industry experience that would be relevant to their own experience.
3. Set assumptions without margins, or the anticipated experience assumptions.
4. Calculate A/E ratios for the material risks where the relevant historical experience is the numerator and the anticipated experience assumption is the denominator.
5. Develop moderately adverse sensitivity tests (vectors of A/E ratios) for each product type using the multi-risk scenario generator and comparing against historical variations in the



A/E ratios. Note that for certain assumptions, such as lapse, you would need to test which direction is adverse.

6. Use the moderately adverse sensitivity tests to confirm the material risks and rank the material risks for each product type.
7. Use the ranking of material risks and the magnitude of those risks to determine blocks of business with similar risk profiles.
8. Calculate the aggregate risk margin, adjusted for covariance, for each group of policies with a similar risk profile.
9. Per VM-20, aggregate the results of the blocks of business into term, universal life with secondary guarantees (ULSG) and other life. This aggregation allows you to offset cash flows and will result in reduced aggregate margins. Calculating material risk amounts and aggregate margins at both

Table 1
Margin and Modeled Reserve Calculations

	2016	2022
Natural Reserve = Central Estimate Reserve	-4,309,748	113,788,808
84th Percentile Risk Amounts:		
D = Default cost	2,942,409	2,965,812
I = Interest	8,346,500	4,003,348
L = Lapse	846,994	4,788,541
Mf = Mortality fluctuation	5,533,611	5,058,862
Mt = Mortality trend	14,990,356	8,555,984
Sum of 84th Percentile Risk Amounts	32,659,870	25,372,548
Percentile margin (adjusted for covariance)	18,285,810	12,105,780
Modeled Reserve = Natural Res + Pctile Margin	13,976,062	125,894,588
<i>Margin if mortality and lapse are dependent</i>	<i>18,540,354</i>	<i>13,964,206</i>
<p>Percentile Margin = $\sqrt{D^2 + I^2 + L^2 + Mf^2 + Mt^2}$ <i>If Mf and L are dependent, then Percentile Margin = $\sqrt{D^2 + I^2 + (L+Mf)^2 + Mt^2}$</i></p>		

the block of business and aggregated levels permits the calculation of the “product hedge” that results from having diversified-risk product liabilities.

10. Attribute the aggregate margin (adjusted for covariance) of the aggregated blocks of business to the anticipated experience assumption for each material risk. There is no elegant mathematical solution to attribute the aggregate margin to individual risks. If you have used the square root formula to calculate the aggregate margin and adjust for covariance (see the numeric example that follows), then one approach would be to allocate the aggregate margin to individual risks in proportion to the squares of the material risk adverse deviations from the anticipated experience reserve (or natural reserve).

NUMERIC EXAMPLE OF AN AGGREGATE MARGIN CALCULATED FOR LEVEL TERM INSURANCE

In developing this example, we start out with six candidates for material risks: default cost, interest, lapses, expenses, mortality fluctuation and mortality trend (improvement). While the first five would be considered for explicit margins applied to the anticipated experience assumptions, the mortality trend assumption would be tested to measure the implicit margin of the regulatory requirement that mortality improvement not be projected beyond the valuation date. This implicit margin could be included in the PBR Actuarial Report described in VM-31 and may constitute important feedback for the National Association of Insurance Commissioners (NAIC) Life Actuarial Task Force (LATF) to consider as part of updating the Valuation Manual over time.

Table 1 contains key values for the calculation of the aggregate margin using the percentile method for a hypothetical block of level term insurance.

The 84th percentile risk amounts are each calculated by taking the scenario reserve for the particular risk (such as default cost) and subtracting the natural reserve. So, the 84th percentile risk amounts represent a set of differences from the natural reserve. Note that the natural reserve equals the present value of benefits plus the present value of expenses minus the present value of premiums without margins. In the PBR Simplified Methods project, we use the term “central estimate reserve” as a standard of comparison for a reserve without margins. In a PBR context, we could also call the natural reserve the “anticipated experience reserve,” as it is based on the anticipated experience assumptions.

The modeled reserve equals the natural reserve plus the percentile margin, an aggregate margin calculated using the percentile method. Note that the natural reserve is negative in 2016 and positive in 2022. When calculating natural reserves for a newer block of policies, get used to negative values. The addition of the percentile margin may or may not make the modeled reserve greater than zero.

You may have noticed that only five material risks are listed in Table 1. The original list for sensitivity testing included expenses, but it turned out the expense risk was not material in this case, so I have not included it in the margin calculation.

Like the Life RBC formula, the percentile margin is calculated using a square root formula. In applying this formula, we must give attention to the independence or dependence of the material risks. The percentile margin calculated above (and shown in the formula) assumed that all five material risks were independent. In some cases, lapses and mortality fluctuation may be dependent, since when people lapse, they usually are not expecting to make a claim soon. On average, then, lapses represent healthier lives, leaving a remaining in-force population that tends to be less healthy overall.

The italicized values and formula show the aggregate margin if lapses and mortality fluctuation are considered dependent rather than independent risks. For 2016, the difference in this margin is not large, but the difference grows considerably in the 2022 calculations (\$13,964,206 versus \$12,105,780).

If all the material risks were dependent, the aggregate margin would simply be the sum of the values for the five material risks. While this may not be the case for the moderately adverse 84th percentile scenarios, risks tend to become more dependent in extreme scenarios, such as those at the 99th percentile.

In comparing the 2016 results with those for 2022 in Table 1, note how the lapse risk grows over time, while several other risks gradually decrease. In this example, the ranking and relative magnitudes of the risks change between 2016 and 2022.

IDENTIFYING GROUPS OF POLICIES WITH SIMILAR RISK PROFILES

The VM-20 significance of identifying groups of policies with similar risk profiles is related to the following potential PBR tasks:

1. Both the stochastic exclusion test and deterministic exclusion test are performed for groups of policies with similar risk profiles.
2. The option to make an actuarial certification regarding interest rate risk and asset return volatility is done for groups of policies with similar risk profiles.
3. Groups of policies with similar risk profiles are used to develop model segments to calculate net asset earned rates for deterministic reserve calculations.

More generally, it makes sense to organize modeling for PBR and risk analysis purposes into these groups. As noted earlier, the value of product hedging can be quantified when the modeling is done using these groupings.

Criteria for determining “similar risk profiles” may include the following: (1) the products in the group have the same or similar material risks, including both ranking and relative

magnitudes of risk; (2) the margins on the material risks for different products within the group go in the same direction; and (3) the same or similar investment strategies are used for the different products in the group.

ADDITIONAL THOUGHTS

When I first started following the development of PBR, I was working for a small life insurance company. With that perspective, I realized that the PBR modeled reserves (deterministic reserve and stochastic reserve) would reflect the size of the company through the credibility of the company’s mortality experience and the development of margins. In a hypothetical situation of two companies with identical products and experience, the larger company could hold lower PBR reserves than the smaller company. This has not historically been the case with formulaic CRVM reserves and with asset adequacy analysis requirements being unclear about the use of margins. I remember speaking to the LATF at an NAIC meeting about the possibility, under PBR, that a larger company could acquire a smaller company using as currency (in part) the extra reserves that the smaller company was holding due to its smaller size and that the larger company could release upon acquisition. Therefore, smaller companies have an economic incentive to identify relevant industry experience to supplement relevant company experience in setting assumptions and margins and developing dynamic functions to use in modeling. Using the multi-risk scenario generator, the company can build the business case for acquiring that relevant industry experience by quantifying the difference in the reserves at different levels of credibility.

The task of identifying the probability distribution in the multi-risk scenario generator has been simplified by incorporating a methodology developed by Dr. Brian Hartman. Using this methodology in the multi-risk scenario generator, the user need only specify either a binary distribution for risks that have a binary (0,1) outcome such as mortality, lapse or default cost, or a user-defined function for non-binary risks such as mortality improvement. This methodology provides for both types of risk required by the Valuation Manual—process risk and parameter risk. Recall that some non-binary risks, such as flexible premiums, may be modeled more effectively using a dynamic function that would adjust the material assumption based on the conditions projected in each scenario.

To address regulator concerns about subjectivity in the assumption-setting process, the SOA’s PBR Simplified Methods project includes the development of methods to demonstrate the objectivity of assumption setting. While these assumption objectivity methods are not required by the Valuation Manual, voluntarily providing the results of these methods would assure regulators, auditors and other reviewers

that professional objectivity was used in setting the assumptions underlying the reserve calculations.

In comparing modeled reserves with current statutory reserves, you should keep in mind that the modeled reserve will reflect the profitability of the product. For testing purposes, we built models for par whole life and level term. I was surprised to see that the par whole life modeled reserve (natural reserve plus percentile margin) was much lower than both the statutory reserve and the cash surrender value. We were modeling a very profitable par whole life product.

In contrast, our level term model produced modeled reserves that were lower than statutory reserves in the early durations but higher in the later durations. This term product projected losses after the shock lapse at the end of the level premium period.

The use of aggregate margins versus individual margins, both adjusted for covariance, may be more about terminology than substance. VM-20 requires the actuary to produce individual risk margins for the material risks but allows for a covariance adjustment. The method proposed in this article is based on developing an aggregate margin first, including the covariance adjustment, then attributing this margin to individual material risks. This attribution step should be done after the groups of policies with similar risks have been aggregated to the three VM-20 product groups of term, ULSG, and all other life products. The attribution to individual risks would then be done only once and would have no bearing on measuring the product hedge, which can be done using the aggregate margins.

The multi-risk scenario generator can be used for other purposes than calculating margins. Of course, it can be used to calculate PBR reserves using simplified methods (as in the SOA research project). This article has already mentioned quantifying the economic benefits of obtaining relevant industry data and has alluded to developing target surplus. For developing target surplus, you would use the 99th percentile deterministic reserve scenarios and calculate a larger margin to add to the natural reserve in a similar manner as shown in the earlier numeric example. For this calculation, you may want to consider the extreme situation when all the material risks are dependent. For target surplus, it would again make sense to calculate this larger percentile margin for groups of policies with similar risk profiles and for all the groups of policies combined. These values could then help you allocate total target surplus to specific products for pricing and profit analysis.

You could also use the multi-risk scenario generator to perform asset adequacy analysis. While the ideal of “one model for all purposes” may not be achievable, using the multi-risk

scenario generator to develop a consistent analytical structure for analyzing all your company’s long-tailed reserves, pre-PBR and post-PBR, would produce risk information that could feed seamlessly into your company’s risk management reporting structure.

PBR CALCULATIONS USING FULLY STOCHASTIC SCENARIOS

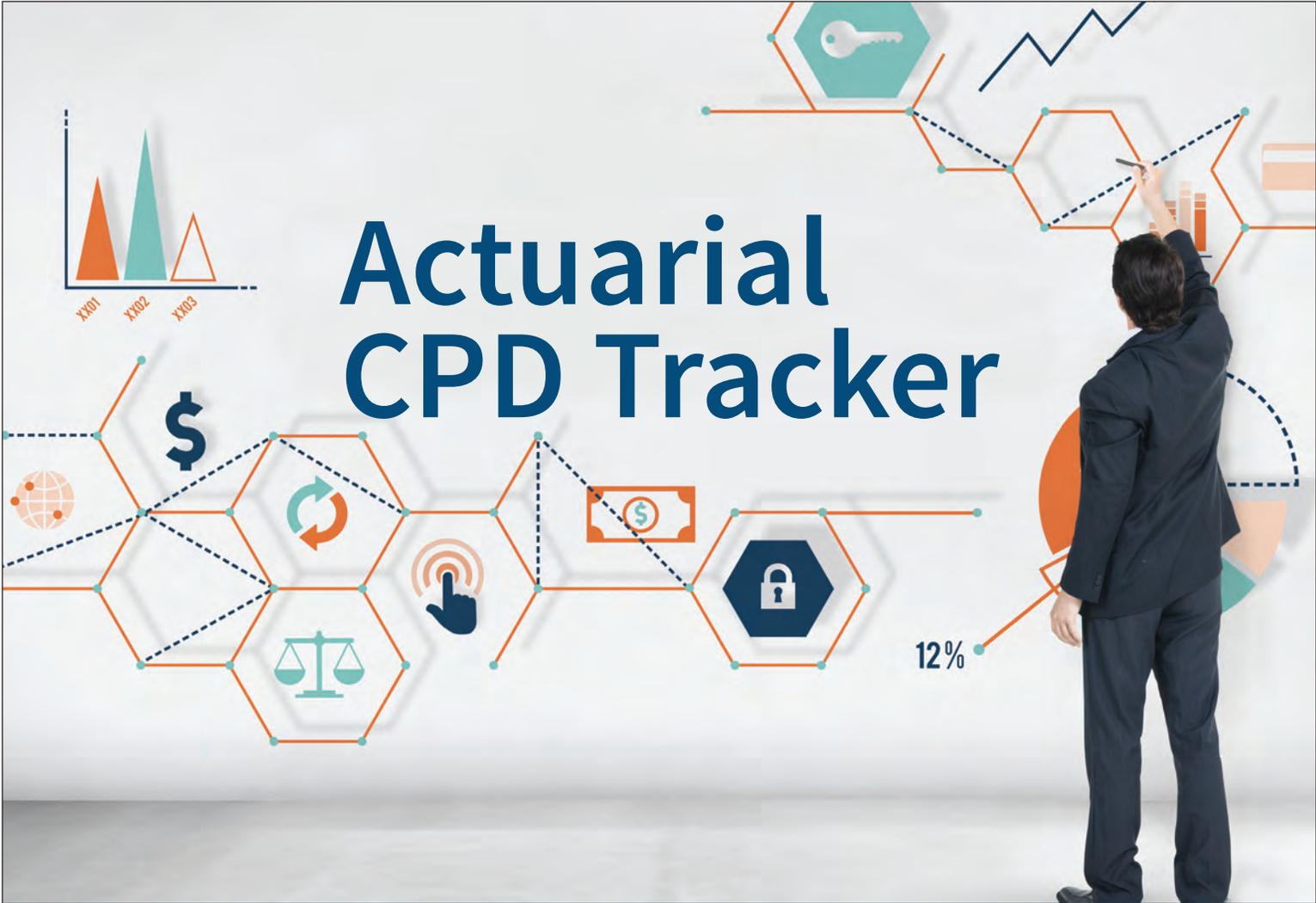
No margins are required in PBR for (1) prescribed assumptions, (2) assumptions that are not considered material and (3) assumptions that are stochastically modeled. If a group of policies with similar risk profiles passed the deterministic exclusion test, you could generate fully stochastic scenarios (in which all material risks vary at the same time) for material risks that fit well with the generator and develop dynamic functions for the other material assumptions that reflect the conditions represented by each scenario. Using this approach, no additional margins would be required other than the CTE 70 calculation itself plus the implicit margins embodied in the prescribed assumptions, such as asset default rates and the restriction regarding projecting mortality improvement beyond the valuation date.

Developing and calibrating the dynamic functions with relevant industry data would be part of the value in acquiring that data. A proposed SOA project focuses on validating predictive models, such as these dynamic functions. That project would likely increase the acceptability of using calibrated dynamic functions in PBR calculations to regulators, auditors and others.

Following this method, a company could choose to run any number of fully stochastic scenarios and add the CTE estimator error adjustment to the CTE 70 reserve based on the number of scenarios. The CTE 70 reserve plus the error adjustment would be the PBR reserve. The sum of the CTE 70 reserve plus the CTE estimator error adjustment appears to decrease with larger numbers of scenarios, which would create an incentive for a company to run a larger number of scenarios for year-end calculations. This method is likely to be the basis of comparison for the simplified methods tested in the SOA PBR Simplified Methods research project. If emerging PBR requirements for annuities, long-term care, and long-term disability have the same exemptions for margins as VM-20, you could use this fully stochastic approach for calculating PBR reserves for these additional product types in the future. ■



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Using Relevant Experience Data to Increase Credibility and Reduce Margins

By Mark Birdsall and Marianne Purushotham

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Principle-based reserves (PBR) and other risk analyses have raised the bar for setting assumptions and establishing margins for material assumptions. Under PBR, documentation requirements are more detailed and include describing the sources of assumptions and the process for setting margins. The size of margins must be related to the level of uncertainty in the assumptions, including the degree of credibility in the historical experience underlying each material assumption. A company with relevant historical experience for material assumptions that is less than 100 percent credible must either find relevant industry experience to increase the credibility of its own historical experience or set wider margins due to the greater uncertainty in setting the assumptions using company experience alone.

The following is an excerpt from Section 9C of VM-20 permitting the use of similar experience from other sources in setting a company's mortality experience assumption:

- b. Company experience data shall be based on experience from the following sources:
 - i. Actual company experience for books of business within the mortality segment.
 - ii. Experience from other books of business within the company with similar underwriting.
 - iii. Experience data from other sources, if available and appropriate, such as actual experience data of one or more mortality pools in which the policies participate under the term of a reinsurance agreement. Data from other sources is appropriate if the source has underwriting and expected mortality experience

characteristics that are like policies in the mortality segment.

- c. The company experience mortality rates shall not be lower than the mortality rates the company expects to emerge, which the company can justify and which are disclosed in the PBR Actuarial Report.

Other terms used in regulations and actuarial literature that describe the appropriateness of the "other experience" to the company experience are *relevant* and *directly applicable*.

Current industry experience studies, such as the study underlying the 2015 Valuation Basic Table (2015 VBT) tend to be highly aggregated, meaning that while the impact of underwriting rules and other factors such as gender, smoking status, policy size, issue age and duration are analyzed, other important factors are not. These other important factors might include product type and design elements, distribution channel characteristics and target markets and the interdependence of material risk factors (such as lapse and mortality experience, especially for term products).

Therefore, companies need to be cautious about applying the results of a highly aggregated study as "relevant experience" in the process of assumption setting under PBR or any risk analysis process.

CENTRAL ESTIMATE ASSUMPTIONS

For the purposes of this discussion, the term *central estimate assumptions* refers to assumptions that combine relevant company experience (that is less than 100 percent credible) and industry experience for the material or key risks underlying a product to develop baseline assumptions for modeling those material risks in cash-flow projection models. Where relevant company experience for a material risk is 100 percent credible, that experience (with consideration of possible trends) for the key risk would be the central estimate assumption. When there is less than 100 percent credibility, the relevant company experience can be credibility-blended with relevant industry experience (with consideration of possible trends) to establish the central estimate assumptions for a material risk.

RELEVANT EXPERIENCE

In this context, *relevant* means the experience is directly applicable to the expected experience of the material risk(s) under consideration. Depending on the risk factor, traditional experience studies may not have identified all significant predictors, which may include the following:

1. Product design elements, including the configuration of riders on a policy;
2. Distribution characteristics, including producer characteristics and compensation patterns;



3. Target markets, including customer characteristics and how the products will be used, such as qualifying for tax-related advantages; and
4. Dynamic policyholder behavior functions reflecting scenario-dependent factors, such as the in-the-moneyness of a benefit.

Where appropriate, both company and industry experience studies should be designed to identify the significant predictors beyond the traditional predictors used in the past.

LIMRA, MIB and other data aggregators have been working with the Society of Actuaries (SOA) on the development of enhanced experience studies that identify significant predictors of experience. These enhanced studies could serve as the basis for identifying industry experience that is relevant to company experience.

Company experience that is used to establish expected experience should also be evaluated for relevance. Enhanced industry studies can provide a road map for enhanced company experience studies. However, a company usually has more detailed information about its business than data aggregators do. In some cases, industry studies show the “company code” as one of the key predictors of experience. In this context, the company

code serves as a proxy for additional information about the business to which the data aggregator does not have access. With more detailed information, the company can identify additional predictors for which company code is a proxy in industry studies and provide feedback to data aggregators to improve those industry studies.

Aligning the key predictors between industry and company experience can serve as the basis for identifying relevant industry experience to supplement company experience in establishing the central estimate assumptions for use in pricing, PBR and other risk analysis. With the combined experience producing higher credibility measures, smaller margins for uncertainty would be needed.

If relevant industry experience is not available to or not considered by the actuary, company experience alone can be used for a key risk, but the lower credibility of using only company experience would result in greater uncertainty in the assumptions and larger margins. In this case, the company experience would become the central estimate assumption for that key risk.

In the case of an emerging key risk (like one associated with a new benefit) for which neither company nor industry experience is available, the actuary would use professional judgment

A new tool is being developed that can assist the actuary in establishing margins based on levels of uncertainty.

in setting the central estimate assumption. However, this lack of historical experience would result in a correspondingly wide probability distribution and margin for that risk, appropriate to the high level of uncertainty. Following these principles would minimize the risk of underpricing and under-reserving products with new benefits.

See the Appendix for references to the term *relevant* in the Exposure Draft of the Actuarial Standard of Practice (ASOP) on setting assumptions and in Section 20 of the Valuation Manual (VM-20). The concept of relevance is also included in many other ASOPs and sections of the Valuation Manual.

CALCULATING THE CREDIBILITY OF COMPANY EXPERIENCE FOR MATERIAL RISKS

Per VM-20, there are two basic methods for calculating credibility: the limited fluctuation method and the Bühlmann method. The latter requires a company to have access to industry-level information. Data aggregators might help provide the industry perspective needed for the Bühlmann method, which in many instances appears to produce higher credibility values. The credibility of the relevant industry experience could likewise be calculated.

CREDIBILITY-BLENDING COMPANY EXPERIENCE AND RELEVANT INDUSTRY EXPERIENCE FOR KEY RISKS

With respect to formally including relevant industry experience in the assumption-setting process, VM-20 provides a road map for a credibility-blending process specific to the mortality assumption for the deterministic reserve and the stochastic reserve. Please note that this process can be applied to other key assumptions as well. While VM-20 applies to setting modeling assumptions for the PBR deterministic and stochastic reserve calculations, the credibility-blending process is a sound methodology for developing central estimate assumptions for other risk analysis purposes, including pricing.

DEVELOPING REDUCED MARGINS DUE TO HIGHER CREDIBILITY

Margins can be developed either for individual material assumptions or as an aggregate margin for the material assumptions taken together. Despite different details in the calculations, these two approaches should produce results of the same magnitude

and may serve as a cross-check for each other, including calibrating the covariance adjustment on individual margins.

To develop prudent estimate assumptions from the anticipated experience assumptions, VM-20 Section 9B.2 provides guidance in setting margins:

The greater the uncertainty in the anticipated experience assumption, the larger the required margin, with the margin added or subtracted as needed to produce a larger modeled reserve than would otherwise result. For example, the company shall use a larger margin when:

- a. The experience data have less relevance or lower credibility.
- b. The experience data are of lower quality, such as incomplete, internally inconsistent, or not current.
- c. There is doubt about the reliability of the anticipated experience assumption, such as, but not limited to, recent changes in circumstances or changes in company policies.
- d. There are constraints in the modeling that limit an effective reflection of the risk factor.

A new tool is being developed that can assist the actuary in establishing margins based on levels of uncertainty. The SOA has funded a project that explores simplified PBR methods. One of the deliverables of this project is a multi-risk scenario



generator that produces both economic scenarios (consistent with the SOA/American Academy of Actuaries economic scenario generator) and scenarios for the other material risks identified by the company. With the user supplying the company's actual to expected ratio for each material assumption, the number of observed events, the exposure and the probability distribution type, the generator can produce scenarios for each material assumption at specified probability levels.

For example, if moderately adverse experience is about the 84th percentile of the probability distribution, then sensitivity tests could be run for each of the material risks using 84th percentile scenarios produced by the multi-risk scenario generator. Taking the differences between the present value of future cash flows for each sensitivity test and the baseline run using central estimate assumptions and then applying a covariance adjustment, an aggregate margin could be derived. One option for the covariance adjustment would be a square root formula analogous to the covariance adjustment for the life risk-based capital process, with consideration of the independence or dependence of the material risks.

The multi-risk scenario generator scenarios will produce narrower distributions for the material risks when more relevant historical experience underlies the central estimate assumptions. As a simple example, assuming mortality rates have a Poisson distribution, adding four times more data to a company's experience from relevant industry experience would reduce the extra mortality in the 84th percentile sensitivity testing factors by 55 percent–60 percent.

CASE STUDY USING REINSURER DATA

In addition to industry studies by data aggregators such as LIMRA and MIB, reinsurers may partner with companies in providing relevant historical experience to supplement company experience in setting assumptions and margins. This approach may be needed when other data aggregators have not yet produced enhanced experience studies identifying the significant predictors for a material risk.

For example, consider the case of a reinsurer providing experience to a direct writer to use in setting the mortality assumption for a term life insurance product. The key issues are twofold: (1) the relevance of the company and reinsurer experience to the expected future experience of the new product; and (2) the combination of relevant company and industry experience to develop the central estimate mortality assumptions for pricing, as well as the anticipated experience assumption for mortality in the VM-20 reserve calculations. Issue 2 becomes important only if issue 1 is satisfied.

With respect to issue 1, the reinsurer may select a block of reinsured term life insurance business for which it has recent first-dollar historical experience with underwriting rules and risk class structures like those that will be used for the new

product. In addition, it may consider other factors such as level premium periods, pattern of post-level term premiums (including size of premium jumps), presence of a return of premium (ROP) benefit and type, method of distribution and pattern of compensation, level of competitiveness and distribution of face amounts and gender.

Based on the limited fluctuation method, the company's relevant fully underwritten experience will be calculated based on face amount and/or policy count. If there is an extremely wide distribution of face amounts, credibility based on policy count may be preferable. The same calculations will be done for the reinsured business.

Ratios of relevant reinsurer mortality experience to relevant company mortality experience will be calculated. These ratios will be evaluated with respect to the direction and magnitude of the differences from 100 percent. Confidence intervals may be established based on credibility levels but should be used with care. The width of the distribution of reinsurer experience should also be considered.

A wide distribution of reinsurer experience may indicate either of the following: (1) outliers that might be better excluded impacting the distribution; and/or (2) the impact of other important factors that have not yet been analyzed in selecting the reinsurer experience.

To refine the reinsurer experience with respect to its relevance to the company experience, the following steps may be followed:

1. Consider the distribution in experience by company within the reinsurer experience and group the companies by the level of their relative experience, particularly for the most important risk classes. Select the grouping that appears to align best with the company's experience overall and for the most important risk classes.
2. Confirm that the face amount and underwriting class distribution are reasonable.
3. Calculate the credibility of this refined reinsurer experience.
4. Calculate the reinsurer to company experience ratios overall and by gender and risk class.
5. Perform statistical tests to confirm that the company's experience is within reasonable parameters.
6. If the ratios in step 4 are reasonably close to 100 percent, develop the mortality assumption as the credibility-weighted blending of the relevant company experience and the relevant peer group experience.

CONCLUSION

When company historical experience for a material risk is less than 100 percent credible, relevant industry experience can be used to supplement that company experience to develop central estimate assumptions for setting pricing assumptions, anticipated experience assumptions for PBR and cash-flow projection assumptions for other purposes. Enhanced experience studies at the industry and company levels may identify additional significant predictors of experience that can be used to identify relevant industry experience and, in turn, to increase the credibility of the experience underlying the company's material assumptions and reduce the margin for uncertainty. Data aggregators such as LIMRA, MIB and others (including reinsurers) should be encouraged to develop enhanced experience studies to identify the significant predictors of experience and dynamic policyholder behavior functions that will serve as a road map for further individual company analysis using additional detailed information available at the company level. Enhanced company experience studies can then feed these additional predictors back to data aggregators to help improve industry studies and enable data aggregators to do a better job of providing relevant industry experience for the use and benefit of companies.

APPENDIX: EXCERPTS FROM VM-20 AND THE DRAFT ASOP ON SETTING ASSUMPTIONS

These excerpts illustrate the uses of the term *relevant* in the Exposure Draft ASOP on setting assumptions and in VM-20. Note also the frequency with which the words *available* and *credible* accompany the references to *relevant*.

ASSUMPTION SETTING EXPOSURE DRAFT

3.1.1 General Considerations—The actuary should set assumptions that are reasonable for the intended purpose, or, if other parties have the responsibility for setting assumptions, assess whether the assumptions set by others are reasonable for the intended purpose. The actuary should consider the following:

- b. available and **relevant** data, including, where appropriate, the credibility of any such data as discussed in ASOP No. 25, Credibility Procedures;
- c. other available and **relevant** information; and
- d. whether there are reasons to expect that future experience will differ significantly from past experience.

3.4 Reliance on Others—Data and analyses **relevant** to the assumptions may be available from a variety of sources, including the principal, representatives of the entity, investment advisers, demographers, economists, scientists, statisticians, health care providers and other professionals. When the actuary is responsible for setting assumptions or assessing the reasonableness of assumptions set by others

within the scope of this standard, the actuary may consider and incorporate the views of such experts, but the setting or assessment of assumptions should reflect the actuary's professional judgment. If the actuary states reliance on other sources and disclaims responsibility for any material assumption selected by a party other than the actuary, the actuary should disclose such reliance in accordance with section 4.2(b).

VM-20

Section 9.A.6. The company shall use its own experience, if **relevant** and credible, to establish an anticipated experience assumption for any risk factor. To the extent that company experience is not available or credible, the company may use industry experience or other data to establish the anticipated experience assumption, making modifications as needed to reflect the circumstances of the company.

- a. For risk factors (such as mortality) to which statistical credibility theory may be appropriately applied, the company shall establish anticipated experience assumptions for the risk factor by combining **relevant** company experience with industry experience data, tables or other applicable data in a manner that is consistent with credibility theory and accepted actuarial practice.
- b. For risk factors (such as premium patterns on flexible premium contracts) that do not lend themselves to the use of statistical credibility theory, and for risk factors (such as the current situation with some lapse assumptions) to which statistical credibility theory can be appropriately applied but cannot currently be applied due to lack of industry data, the company shall establish anticipated experience assumptions in a manner that is consistent with accepted actuarial practice and that reflects any available **relevant** company experience, any available **relevant** industry experience or any other experience data that are available and **relevant**. Such techniques include:
 - i. Adopting standard assumptions published by professional, industry or regulatory organizations to the extent they reflect any available **relevant** company experience or reasonable expectations;
 - ii. Applying factors to **relevant** industry experience tables or other **relevant** data to reflect any available **relevant** company experience and differences in expected experience from that underlying the base tables or data due to differences between the risk characteristics of the company experience and the

risk characteristics of the experience underlying the base tables or data;

iii. Blending any available **relevant** company experience with any available **relevant** industry experience and/or other applicable data using weightings established in a manner that is consistent with accepted actuarial practice and that reflects the risk characteristics of the underlying policies and/or company practices.

c. For risk factors that have limited or no experience or other applicable data to draw upon, the assumptions shall be established using sound actuarial judgment and the most **relevant** data available, if such data exist.

The qualified actuary to whom responsibility for this group of policies is assigned shall annually review **relevant** emerging experience for the purpose of assessing the appropriateness of the anticipated experience assumption. If the results of statistical or other testing indicate that previously anticipated experience for a given factor is inadequate, then the qualified actuary shall set a new, adequate, anticipated experience assumption for the factor.

Section 9.2.B.2. The greater the uncertainty in the anticipated experience assumption, the larger the required margin, with the margin added or subtracted as needed to produce a larger modeled reserve than would otherwise result. For example, the company shall use a larger margin when:

a. The experience data have less **relevance** or lower credibility.

Section 9.2.D.1. The company shall determine prudent estimate policyholder behavior assumptions such that the assumptions:

b. Reflect the outcomes and events exhibited by historical experience only to the extent such experience are **relevant** to the risk being modeled.

Section 9.2.D.3. Margins for Prudent Estimate Policyholder Behavior Assumptions—The company shall establish margins for policyholder behavior assumptions in compliance with subsection 9.B subject to the following:

a. To the extent that there is an absence of **relevant** and fully credible data, the company shall determine the margin such that the policyholder behavior assumption is shifted toward the conservative end of the plausible

range of behavior, which is the end of the range that serves to increase the modeled reserve.

b. The company must assume that policyholders' efficiency will increase over time unless the company has **relevant** and credible experience or clear evidence to the contrary.

Section 9.2.D.4. Additional Sensitivity Testing for Policyholder Behavior Assumptions—The company shall examine the sensitivity of assumptions on the modeled reserve as required under Subsection A.3 of this section and shall at a minimum sensitivity test:

a. Premium payment patterns, premium persistency, surrenders, partial withdrawals, allocations between available investment and crediting options, benefit utilization and other option elections if **relevant** to the risks in the product;

Section 9.2.D.6. For a term life policy that guarantees level or near level premiums until a specified duration followed by a material premium increase, or for a policy for which level or near level premiums are expected for a period followed by a material premium increase, for the period following that premium increase the lapse and mortality assumptions shall be adjusted, or margins added, such that the present value of cash inflows in excess of cash outflows assumed shall be limited to reflect the **relevance** and credibility of the experience, approaching zero for periods where the underlying data have low or no credibility or **relevance**. ■



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Appreciation for Robert Guth's Contributions to SmallCo

By Mark Rowley

Editor's note: Starting with this issue, volunteers who have made a significant impact to the Smaller Insurance Company Section will be highlighted. In this issue, Bob Guth is being recognized for his contributions.

In appreciation of the support that Bob Guth, FSA, CERA, MAAA, has provided to the Smaller Insurance Company Section (SmallCo) and the actuarial profession overall, this article highlights his contributions over the years.

The Actuarial Directory describes Bob's career as follows:

Robert Guth is Actuary at Everence Services LLC, which provides employment services to Everence Association, Inc., and Everence Insurance Company. He has worked there since 1987. In 1999, he became Appointed Actuary of Mennonite Mutual Aid Association (renamed Everence Association, Inc., in 2010) and of MMA Insurance Company (renamed Everence Insurance Company in 2010). He is a Fellow of the Society of Actuaries, a Chartered Enterprise Risk Analyst of the Society of Actuaries, and a Member of the American Academy of Actuaries. He is a 1972 graduate of Goshen College with majors in biology and mathematics. In 1980, he earned a Ph.D. in biological sciences from Northwestern University. As a volunteer, he served on the Academy committee that updated the Asset Adequacy Analysis Practice Note in 2004. He was Secretary/Treasurer of the Smaller Insurance Company Section Council from 2010 to 2013 and has continued as a Friend of the Council. He has been a contributor to *Small Talk* (the Smaller Insurance Company Section [SmallCo] newsletter) and has been actively involved with the annual actuary meetings of the American Fraternal Alliance. He has spoken at many meetings and webinars on fraternal, appointed actuary and low interest rate issues. In 2006, he was awarded the Jacobson-Rugland Award of Luther College for his contributions to the actuarial profession

and to the fraternal system. Bob has been married to his wife, Christine, since 1982, and they have two children.

In reflecting on being part of SmallCo, Bob comments,

Being part of SmallCo was a valuable experience for both me and my company. The contributions and interactions with other actuaries at similar small companies expanded my horizons and kept me current with new, cutting-edge ideas and research. In that manner, I was constantly in touch with projects from the Society of Actuaries (SOA) and NAIC that were potentially relevant to my company. I will miss that interaction in the future, but as I retire over the next few years, there will be other new projects to which I can contribute. Thanks for the opportunity to participate, and I hope others step in to provide similar benefits for themselves and their companies.

Bob has had a distinguished career during which he has made contributions in many ways. By collaborating with other SmallCo members, he has helped the section deliver value by keeping members informed about regulatory and economic developments. SmallCo and the SOA as a whole appreciate everything Bob has done.

On a personal level, Bob taught me to maximize the benefit I receive from SmallCo. It is like a lot of things in life where the more you put in, the more you will get out. SmallCo members get the most value when they make the effort to get involved. As you engage with various projects, you build relationships with other members and a network of actuaries whom you can call when you are wrestling with an issue. I have called Bob on many occasions for exactly this purpose. Bob was active in ways that made him available to SmallCo members—writing articles for the newsletter, speaking at meetings and webinars and more.

I recall very fondly working with Bob (and Don Walker) on low interest rate issues. There were *articles on interest rates* in the June 2011 and January 2012 issues of the newsletter that are worth going back and reading now. Working with Bob on those articles was fascinating and fun. He did some great research while working on them. The articles made a difference in helping companies deal with tumbling interest rates.

One last thought. The key to working with Bob is to first ask him about birds and then go on to actuarial matters. ■



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