The Modeling Platform

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Model Governance Checklist
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By Michael Failor

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Letter from the Editors

By Phil Schechter and Mary Pat Campbell

A lot has changed since we assembled the previous issue of this newsletter. In the next few years, it is likely that the regulatory requirements around corporate governance may not be as aggressively pursued at the federal level as we might have anticipated.

However, when it comes to model governance in the insurance industry, I think the cat is out of the bag. Hopefully we (the front-line modelers) have seen the need to keep our models well controlled, and our audiences, including internal audit shops, external reviewers and management, have become accustomed to considering the validity of the models and not just the results.

With this in mind, we continue this newsletter's commitment to this subject with two governance-related articles. Mike Failor provides an overview of the Model Governance Checklist promulgated by the American Academy of Actuaries, and Tim Heng discusses the need to bring Excel models and processes into the governance framework, with specific ideas for doing so.

> The software we use for modeling plays a large part in how we think about models.

The software we use for modeling plays a large part in how we think about models, as well as in our day-to-day work life. Teresa Branstetter takes us through some of the considerations in selecting a software package and how to get to the right team set up to make this decision.

The Society of Actuaries (SOA), and this section in particular, have been looking to provide value to an audience interested in modeling from every angle. Going forward, we will look to summarize resources throughout the SOA, and from other sources as well. In this issue, we assemble all the modeling-related sessions at the various SOA meetings and webcasts throughout 2016; we hope you will find something of interest to check out if you were not at all these meetings, and, of course, you can grab an early jump on those CE credits.

Also, Bruce Rosner, our new section chair, shows results from our section survey. This survey asked our members about topics of interest; it is interesting to line this up against the list of sessions and the articles we've published. One particular mismatch is the area of model validation, where there is clearly a desire for more guidance.

If you have any thoughts on that or any other topic that you feel would be of interest to this section, or a presentation that you think would make a good article, please feel free to reach out to either of us. We would be glad to work with you to write it up for *The Modeling Platform*. ■

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Chairperson's Column

By Bruce Rosner

I sit here at my work desk in the midwinter lull—in between blizzards, ending some projects and starting others, ending one reign of U.S. government philosophy and beginning the next. And, indeed, I feel the static energy in the eye of the actuarial world, as many insurance companies finish cleaning up their models post-financial crisis and seek the next era of product innovation and risk management.

Our goal as the Modeling Section Council is to follow the arc of modeling and support you with current and cutting-edge topics. To that end, we recently surveyed the Modeling Section membership about 12 topics that our council considered. Figure 1 shows the results.

Like all good experience studies, we reserve the right to ignore the data and apply actuarial judgment. But the results were incredibly interesting. Our first reaction was the overall level of interest in all topics—our lowest ranking score was 58%! This was a much-needed reminder to us that the needs of modeling actuaries are diverse, and we need to find both topics that cover the broader interest as well as the smaller niche, cutting-edge topics.

- **Model validation is the most universal topic today,** by a significant margin. A tremendous amount of progress has been made in the last few years, and this will continue to burn its way through the industry for years to come.

- **Scenario generators, economic capital, state-based modeling and asset allocation** are some niche topics where we were uncertain of the level of interest, and the results show in fact a significant level of interest among certain groups.

- **Assumption setting and experience studies** were another wildcard when we set this up, and the extremely high level of interest was probably the biggest surprise to our council. We will pivot to expand coverage over the next year.

One other thought I'd like to share with you is the question of what differentiates us as "modeling actuaries." What is it that we can do in our careers and skill-building to distinguish ourselves, as individuals and as a group, to be indispensable to our industries?

I recall my surprise several years ago, when I first entered the world of model efficiency, how completely different branches of mathematics can be brought to bear on the problem of information redundancy in a seriatim model—spatial mathematics, linear optimization and statistical techniques, among others. The star modeling actuary at a company is the problem-solver. The person who can say yes to the difficult questions. Modeling needs that appear recursive? No problem. Structural data and modeling issues? Been there. Turn too many numbers into a great visual? Sounds like fun. Together, we'll figure how to do better tomorrow. ■

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Figure 1
Modeling Section Membership Survey Results
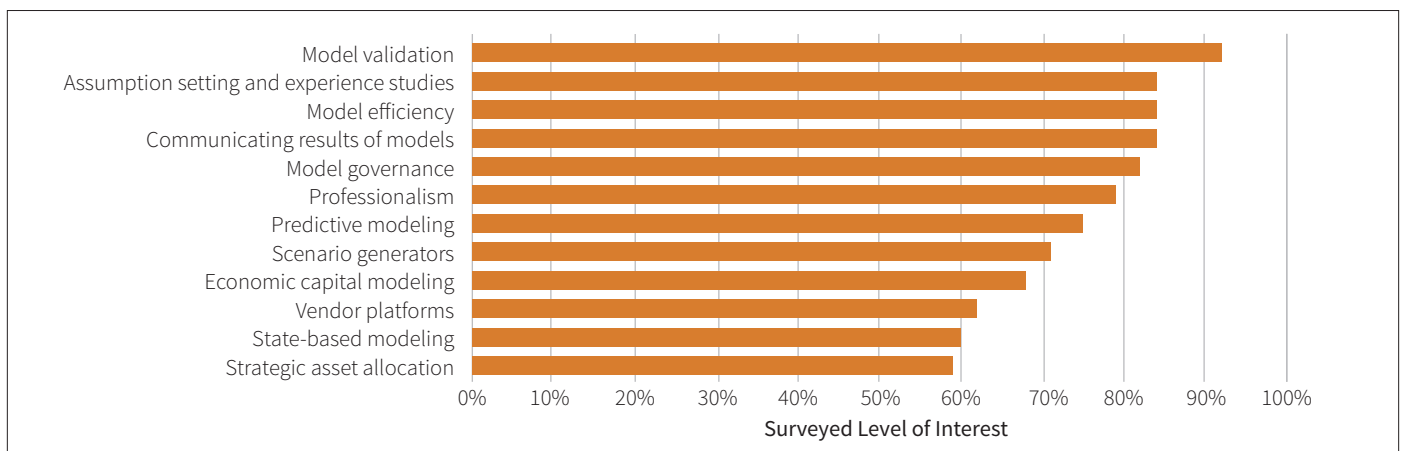
Model Governance Checklist

By Michael Failor

Editors' note: This article originally at http://www.scorgloballife
americas.com/en-us/knowledgecenter/model-governance-checklist-
addresses-broad-risks, *copyright © 2017 by SCOR Global Life
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The American Academy of Actuaries recently released its
"Model Governance Checklist" (dated August 2016). This
checklist is the culmination of work that began one year
ago with the formation of the Principle-Based Reserves Check-
list Subgroup, which I am honored to chair. Our subgroup was
charged with the creation of a model governance checklist in
response to the need for good model governance as addressed
in Principle-Based Reserves (PBR) regulation. However, while
motivated by PBR, this checklist fulfills a more universal need as
a resource applicable across most actuarial modeling endeavors.
(Note that a working draft of this checklist has been previously
shared and discussed at both of the American Academy of Actu-
aries PBR Boot Camps held in 2016.)

When deciding upon the scope of the checklist, we cast a broad
net across the actuarial modeling risk landscape. For example,
risks associated with results consolidation and report generation
have been addressed. Consequently, this checklist may elucidate
areas of risk within an organization that may be overlooked in
its existing model governance practices. And while recognizing
that there will always be room for improvement, knowing where
existing model governance gaps exist is often the necessary first
step in risk mitigation.

As discussed in the checklist's preface, it contains questions that
are intended to foster awareness of potential model governance
concerns. Although these questions are not specifically directed
toward any actuary or group, they provide practicing actuaries
with food for thought when evaluating their model governance
processes. Note also that although this checklist may be a bene-
ficial tool, it does not constitute a list of requirements.

The Model Governance Checklist questions are grouped into
the following 10 categories, which I will discuss further (note
that there is no "Documentation" section, because documenta-
tion issues are addressed within each category):

a. Governance standards
b. Modeling process
c. Assumptions setting
d. Input data/tables/mapping
e. Access controls
f. System/model changes
g. Model selection/versioning
h. Consolidation of results
i. Reporting
j. Analysis/validation

EXPLANATION OF CATEGORIES

These categories are each briefly discussed here to better under-
stand the nature of the corresponding model governance issues.
Realize, however, that these brief high-level synopses may not
fully encapsulate the scope of questions in a given category.

Governance Standards

Questions under this category address an organization's formal,
documented model governance policies. Issues pertaining to
organizational structure, including specific roles and responsi-
bilities, can be found in this section.

> While motivated by PBR, this checklist fulfills a more universal need as a resource applicable across most actuarial modeling endeavors.

Modeling Process

The modeling process section includes questions pertaining to
model management processes and procedures. High-level model
management "documentation" protocols are also included.

Assumptions Setting

Questions in this section surround the development, man-
agement and documentation of modeling assumptions. Also
touched upon in this section is the general use of experience
studies and corresponding credibility.

Input Data/Tables/Mapping

After modeling assumptions have been determined and
approved, they still need to accurately make their way into
actuarial projection models. Questions in this section cover the
input of asset and liability model assumptions, tables and model
settings. This would include seriatim policy in-force files, rate
tables (e.g., premiums, mortality, interest, asset default) and
model point policy mappings.

Access Controls

The adage that "If it is not locked down, it is not under control" holds true for the many modeling components that make up an organization's modeling infrastructure. Input data, models, modeling systems, modeling output repositories and reports should each have their respective access controls evaluated. The half-dozen questions that constitute this smaller category address these concerns, but only at a high level. However, to expound deeper on these issues would invariably depend upon the specific modeling environments encountered within an organization.

System/Model Changes

Model changes and actuarial system modifications require special consideration in an organization's model governance plan. The value of a robust formal system change control process becomes clearer upon the realization that model input validation and output testing alone could miss many system coding and modeling errors. The nature and extent of actuarial system governance within an organization will depend upon the type of actuarial projection system in use. For example, open code systems may require specific code management processes, whereas closed systems may need to rely more on software version testing. The breadth of questions in this category cover these issues in more specific detail and provide plenty of material to consider incorporating into a model governance plan.

Model Selection/Versioning

When evaluating the suitability of a potential model, it is important that the selected model and its underpinning theories/concepts align well with the desired purpose. Questions in this section touch upon this and other issues related to transparency of model inputs and versioning of modeling components.

Consolidation of Results

After actuarial models have completed their executions, their results are typically consolidated and stored in repositories for further analysis and reporting. The associated processes involved in these consolidations may be inadvertently overlooked or inadequately addressed in many model governance plans. Questions in this section cover various consolidation concerns, including issues surrounding late adjustments.

Reporting

Controlling how modeled data make their way into reports should be within the purview of model governance. In fact, reporting should be one of the main focal points of an organization's approach to model governance. Similar to ensuring that actuarial models use correct input, actuaries also take part in ensuring that modeled results are correctly interpreted and appropriately integrated into the many downstream reports. This section contains universal questions that are not restricted to any specific reporting or accounting basis. Questions cover issues such as interpretation of modeling results, report clarity and transparency.

Analysis/Validation

Broadly traversing the spectrum of modeling activities, questions in this section cover the validation of assumptions, model inputs, systems and models, results consolidation and reporting. Because of the inherent technical subject matter, many questions may require the reader to be familiar with common systems validation and testing methods.

DOWNLOAD YOUR COPY

The American Academy of Actuaries has recently announced the release of the Model Governance Checklist as a tool for practicing actuaries. But, if you missed this Academy Alert, the Model Governance Checklist can be downloaded directly from the American Academy of Actuaries website at *http://www.actuary.org/files/publications/PBRChecklist_Final.pdf*. ◼

The views and opinions expressed in this article are strictly those of the author and do not necessarily reflect those of the American Academy of Actuaries.

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Excel and Modeling Governance: What Can We Do Better?

By Tim Heng

More than four years ago, I wrote an article in the *CompAct* newsletter responding to calls for actuaries to move away from Excel and onto more specialized actuarial software such as MoSeS and Prophet.[1]

Looking around at the start of 2017, a few things are apparent:

- Everyone is still using Excel.
- Spreadsheets still contain errors.
- Graduates still don't have the requisite spreadsheet skills upon entering the workforce.
- Companies still aren't regularly enforcing good model governance.

In short, not much has changed!

EXCEL ISN'T GOING ANYWHERE

Every so often, it becomes more fashionable to predict the death of Excel, in favor of other systems that are either (a) more user-friendly and/or faster to use, (b) less prone to error or (c) more powerful and/or capable. It's a bit of a pipe dream though—it's like having the car that has great fuel economy, has lots of power and is cheap to purchase. Chances are, it's a case that you choose one and compromise on the others.

There is an inherent contradiction in the earlier requests. If something is more capable and gives you greater flexibility, then by definition, you open yourself up to a greater range of errors as more things can go wrong. If you lock down parameters that would cause errors, then you give up the user control that may be required to solve problems outside the narrow operating scope. If you create something that is faster to develop, it's likely at the expense of implementing features that you may want to use.

Excel is by no means perfect. However, it represents a balance between usability and accessibility, modeling integrity features (without requiring their use) and the flexibility to be a jack-of-all-trades—a piece of software that you can use for budgeting, pricing, reporting, data transformation, valuations and a range of other day-to-day tasks that upward of one billion users

worldwide use Excel to solve (depending on what estimates you look at). For that reason, the question of power and capability will be ignored throughout the rest of this article—Excel is more than capable enough to solve key modeling issues.

It's generally safe to say at this point that Excel isn't going anywhere, at least not anytime soon. So rather than dream up impossible software solutions to the issues at hand, we can look at company policy and process to address the issues and make spreadsheets more user-friendly and faster to use, less prone to error and more capable of completing the tasks required of them.

EASY TO USE OR BETTER TRAINED?

Excel is already one of the easiest pieces of analytical software on the market. Simply install your chosen version of Office, click the green X, and start doing your calculations. There is little to learn by way of syntax and coding. Despite this, spreadsheets often take a long time to produce, partly because the vast majority of users use only about 1 percent of Excel's capabilities and are unaware of tools and features in it that can improve the efficiency of their work. It would be fair to say that even 99.9 percent of Excel users use no more than 10 percent of its capabilities. If you don't believe this, then ask yourself—how many different types of functions and features in Excel would you use on a day-to-day basis, out of the 500 or so functions available? There are also 46 buttons on just the Home tab of the Ribbon, not counting all the submenus and options available under those buttons.

> a) easy to use; b) less prone to error; c) more powerful—choose one and compromise on the others.

It's not just the knowledge of the tools available, however. It's interesting to note how the treatment of Excel usage (and Microsoft Office more generally) in companies differs from the use of other software tools. I recall being introduced to SAS early in my career at a major bank, being sent on specific training courses on how to use SAS to solve broad types of problems, and receiving user guides and manuals that I could reference if I ran into problems. Regular retraining was scheduled when new software updates became available and new tools were unlocked. In short, the business made an investment to ensure that skills were up-to-date and that new staff were properly trained to use the tools available, to achieve specific outcomes using the tools.

Now we can contrast this with how a typical company treats Excel training. I have never been fortunate enough to be sent

to any sort of formal Excel training course, other than on the teaching side of the classroom. It's assumed that people start off with an inherent ability to use basic Excel, and that they can simply pick up what they need to know from colleagues and by observing more advanced Excel in action. Occasionally, staff may attend general training courses (often labeled Beginner, Intermediate and Advanced), rather than targeted courses that relate to the sorts of business problems that the Excel user will be dealing with in the office.

There's a general understanding that because Excel is easy to use, if you have the tools in the toolbox (you've attended courses to learn the functions), you're capable of building complex spreadsheets that use those tools. That's just as true as the understanding that as long as you know how to use the tools, you can build a house (i.e., *not true at all!*). It's one thing to know how the functions work that are used in a financial model. It's completely different to have been trained how to build a financial model. Here's another analogy—just because a person has a great vocabulary and has read a lot of books doesn't mean that he or she will be any good at *writing* a book.

So to answer the first criticism that other software vendors level at Excel, you don't need a more user-friendly program or one that's faster to use. Instead, what you need is an appropriate level of training to use the software you already have.

INHERENTLY PRONE TO ERRORS, OR ERRORS OF PROCESS?

In my previous article in *CompAct*, I highlighted that a large portion of the fault around the number of errors in Excel models can be attributed to the process of Excel file development when compared to the process of more specialized software development. For people interested, it's worth a quick read—for the time constrained, here is the summarized version: Excel models have more errors because we (collectively, across any and all industries) do not adequately scope, review, test or document Excel models—at least, not to the same rigor that we might apply to models built in specialized software, or to the development of specialized software in the first instance.

It seems a simple matter to say "Do these things better!" and then suddenly errors will start to disappear. However, we then need to ask how we can do these things better, what it will cost and whether the costs sufficiently outweigh the benefits. Let's break it down into sections.

Scoping

Too often, scoping comes in the form of a discussion across a meeting room table, or a brief email containing high-level model requirements. Very rarely is a scoping document prepared for an Excel-based model. If you're looking for a checklist of things that you might want to know before building an Excel model, it

obviously changes by industry and model type, but here's a few to get you going:

- Statement of the model's purpose

- Identifying the model end user and the format of presentation

- Delivery time frame

- Determining who is responsible for signing off on the scoping document

- Determining who is responsible for signing off on completion of the model

- Determining who is responsible for ongoing updates and changes to the model

- Highlighting both explicit assumptions (e.g., numeric assumptions entered in the model) and implicit assumptions (e.g., relationships between variables)

- How the model is to be structured: time series going down or across the page? Deep sheets with lots of rows or many shallow sheets?

- What will the review and/or quality assurance (if any) involve?

This list can go on for a very long time! Of course, contractors and consultants will often use lists like this, but it's rare for internal staff to be this thorough in documenting model requirements. More likely, the documentation is an email along the lines of

> "Hi, Bill! Can you help me work out what's a fair price for ABC Enterprises? I need it for the next board meeting on Tuesday. Thanks."

The act of writing down a set of requirements inherently reduces the risk that the model produced is not going to achieve the desired outcomes. If we scoped out Excel models with the same rigor that we scope other models, many errors and issues that normally arise would be dealt with long before any formulas hit the cells.

Review/Testing

I'm going to lump the two of these together, even though they're slightly different. Testing refers to an internal process where the model is provided to either a dedicated test team or to the end users, and the opportunity is there to use the model and provide feedback to the modeling team on issues relating to functionality, usability and accuracy. Issues raised may be in or out of scope—it's common for new issues to arise after a first draft has been created and the implications of scoped items

realized. This is an important part of any modeling process: to ensure the satisfaction of the end user.

The review component is perhaps even more critical, although it is often overlooked. Review processes in companies can vary from the following:

- It's the responsibility of the model builder to check his or her work before delivering it.

- A colleague must peer review a model before it is delivered, by looking at outputs and "high-risk" calculations.

- Whenever a model is built, an unrelated third-party will check the work before it is signed off, by looking at outputs and "high-risk" calculations.

- Whenever a model is built, an unrelated third-party will check the work before it is signed off, by inspecting every single unique formula and checking for logical and mathematical accuracy.

- … Wait, what review process?

While the last is laughably common in companies around the world, the implicit understanding is that the minimum level of responsibility requires model builders to do their own sense checks and ensure that they are not being negligent in their work.

The other forms of review processes require an investment from the company to receive assurance that the model contain no material errors. Often, it will be seen that a peer review is a "free" (read: sunk cost) form of assurance, since no cash is being paid for the service (explicitly). Realistically, though, if this is part of the culture of a modeling team, it should be perfectly clear that there is no such thing as a "free lunch," and any time spent peer reviewing is time that needs to be paid for, generally by having a slightly larger team than they would use without such a policy. Generally, the benefits of doing so outweigh the costs!

A key problem with the peer review process is that there can still be interference of a political nature, as well as an inherent bias in the way of thinking of different members of the same team. There is also the bias of expectation when outputs are reviewed by members within a company—if a sales target is set at $100m, and the model yields a result close to that number, fewer questions are asked. Even though probability would dictate that, on average, a modeling error would have an equal chance of sending an output up or down, in practice, most errors result in a negative impact on a company's forecast, indicating a persistent bias for companies to identify primarily positive errors upon internal review.

My personal favorite story in this regard is of a company in Australia whose models all pointed to secondary product revenue of $130M, which matched previous estimates (about 9

percent of the total forecast company revenue). However, all previous estimates were based on a calculation that converted dollars into millions of dollars, but divided by 100,000 instead of 1,000,000, meaning the true revenue forecast should have been $13M. Shortly after this was identified, this company went into administration (roughly equivalent to a Chapter 7 bankruptcy for U.S. readers).

This is where a third-party reviewer can add value. Moreover, third-party reviewers will often sign off on a model, putting their professional liability insurance coverage on the line, ensuring that they will perform a thorough inspection. The process usually involves an initial review of the model by the external reviewer, who highlights any errors, issues and questions, and passes it back to the company. Modelers will then update the model and address those issues, and pass it back to the external reviewer to see if the changes satisfactorily solve the problems. This is generally referred to as one "iteration" in the review process, and most reviews will usually take three to five iterations before all of the issues are ironed out, because fixing some issues inevitably cause or shine light on others.

This provides security for all stakeholders—both inside the company and external entities such as banks, shareholders and other involved parties. However, this comes at a cost: model reviews for transactions, for example, are primarily done on a unique formula basis and result in costs ranging from $30K to $100K by the time the model is finalized. As such, this sort of review process might best be left for particularly sensitive internal models or for those models that are being relied upon by a range of stakeholders who are all collectively seeking formal assurance. For less sensitive models that just need an independent set of eyes, reviews can usually be done by consultants on an hourly rate basis.

For other spreadsheets in an organization where there isn't the budget to throw thousands of dollars at a review process, it is important to set up standardized procedures and checklists to make any sort of peer review more effective and overcome the bias effects. These might include the following:

- Ensuring that the peer review is not conducted within the same team, or at least, not by a subordinate (to reduce political risk—would you tell your manager that they can't model?).

- Choosing peer reviewers who are capable of thinking "outside the box" and who don't necessarily do things the same way. This is more likely to catch issues that might otherwise be considered "standard" processes.

- Performing key high-level tests such as:

  - Ratio analyses
  - Sensitivity analyses
  - Chart inspection

  These items are likely to highlight unusual or unlikely results in outcomes that might not be immediately evident in the primary output.

Documentation

The final step of the modeling process that is often poorly implemented revolves around documentation. Different types of relevant documentation need to be considered:

- Notes describing the functions/workings of the model
- Style guides and formats for models
- Modeling guidelines or policies describing the process of model development within a business

The first is self-explanatory—documentation should contain the necessary information for a reasonable user to understand the model's purpose, how it achieves that purpose, and any assumptions, restrictions or other concerns that may relate to the model and how it is to be used.

The second type almost falls more into a marketing-type category, where styles, colors and formats are chosen around what the company brand represents. However, this form of documentation is far from trivial—by having a standardized color scheme, for example, users throughout a business can pick up any model with confidence, knowing that if yellow cells represent assumptions, then any yellow cell they see will contain an assumption. This helps to create an intuitive understanding throughout a business of how models are to be used—a form of implicit documentation, if you like.

The final type is one that is commonly found lacking in companies, particularly regarding Excel models. Several "best practice"

modeling frameworks have been put forward globally, ranging from highly technical papers that dictate how models should work, right down to the functions being used, to high-level guidelines that seek to help clarify and provide guidance on what to do when developing a model.

At our company, we follow four main guidelines—that models should be consistent, robust, flexible and transparent. Personally, I find a modeling policy based on guidelines more useful from a practical perspective, because it gives you the flexibility to adapt rules around the specific requirements that a model might have, if you keep the high-level goal posts in line. However, there is merit in having a more clearly defined, rules-based approach, where you can enforce strict modeling standards to apply consistency across a company's models. Some might also say it's more useful from a practical perspective, because you have specific rules and standards to apply to each modeling situation. I'll leave you to decide which approach you find more suited to your business!

WHAT CAN WE DO BETTER MOVING FORWARD?

If you're still reading this, then you're probably already moving in the right direction! Excel models, like any models, are prone to error, and it's important to have the appropriate policies around scoping, testing and review, and documentation to reduce or mitigate the risk.

There have been many horror stories around Excel errors, perhaps the highest profile in the last few years going to Harvard researchers who inadvertently excluded several countries from a research paper that had been used as the basis for fiscal austerity around the world.[2] It's unfair to suggest that they are the first who have had formulas that did not encompass the entire data range, and it's highly likely that they won't be the last. However, with a bit of oversight and better appreciation for the risks, as reflected through improved corporate policies, we can work to reduce the likelihood of Excel errors slipping through the cracks in the future. ■

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ENDNOTES

1 Tim Heng, "Excel as an IT System," *CompAct*, October 2012, *https://www.soa.org/News-and-Publications/Newsletters/Compact/2012/october/Excel-As-An-IT-System.aspx*.

2 Peter Coy, "FAQ: Reinhart, Rogoff, and the Excel Error That Changed History," *Businessweek*, April 18, 2013. *https://www.bloomberg.com/news/articles/2013-04-18/faq-reinhart-rogoff-and-the-excel-error-that-changed-history*.

Software Selection: Process and Considerations

By Teresa Branstetter and David Minches


"The times they are a changing."

—Bob Dylan

Yes, this is also true in the world of actuarial software. The demands of financial reporting and projection analysis, combined with the complexities of hedge calculations, have resulted in a mad scramble by life insurance companies to find the "perfect" platform. Not only does this platform need to flawlessly perform millions of calculations, it must also play nicely within a well-designed and controlled information technology environment, sometimes controlled by humans and other times by other machines.

Determining the need to "upgrade" software is the easy part. As new regulations require principle-based approaches, the demands on actuarial software have grown exponentially. Most companies update their financials monthly, which puts additional pressures on actuaries. The valuation process does not end with the creation of a set of balance sheet figures; it also requires a full set of analytics to explain any movement in the numbers.

A single reporting or unlocking period in which the reporting actuary runs out of time before fully analyzing the numbers will have the chief financial officer (CFO) demanding a process improvement. Normally the actuary will point to the computer and blame it, and rightfully so.

It is not possible to meet all the current needs without an efficient process. And one of the key components of the efficient process is using the right software.

This article will cover the key steps to an efficient and thorough actuarial software selection process as well as some of the complications companies have faced in selecting and implementing new software. We will cover both valuation and projection software as one since these two sides of the equation are converging. Although no one single correct approach to selecting new software can be identified, we hope to highlight some of the key considerations that should be part of this process.
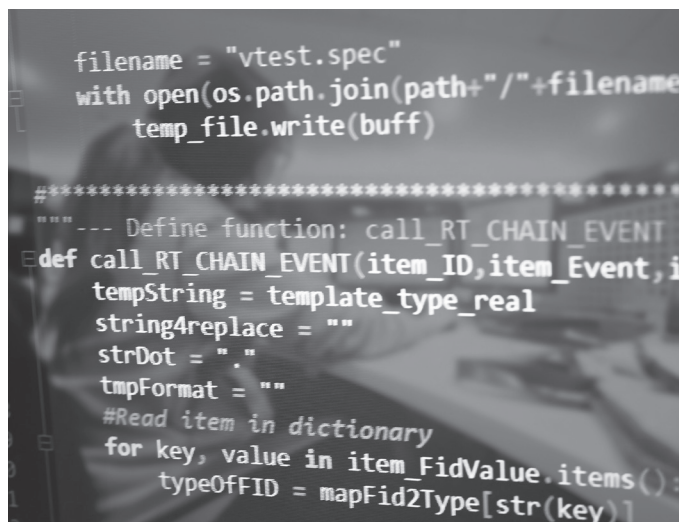
THIS AFFECTS EVERYONE

Any change in software has wide-reaching affects within an organization. The actuarial department is just one of the areas that needs be part of the process. It is critical that all key stakeholders are identified from the beginning. These would typically include the office of the CFO, information technology (IT), operations and actuarial areas. Depending on organization's structure, the list will be different.

This group needs to decide on a process to select a new platform and what the criteria for selection will be. It is critical that this be fully vetted up front so that all future activities are consistent with the plan. Last-minute haggling often occurs among the interested parties. Defining the decision criteria up front will help bring the process to a close at the appropriate time.

In most situations the key criteria will include the ability to meet the current and future functionality and reporting needs for each actuarial area and the ability for the platform to fit into the current or future technology operating model.

It is incumbent on the key stakeholders to assist in the process of refining the key criteria because this helps dictate how the process will unfold and what steps will be followed. Although the number of platforms under consideration is likely limited in number, each of them has different pros and cons across a wide range of attributes. These must all be considered.

NOW WE CAN START

Once the initial groundwork has been laid, the first step is usually to identify the universe of systems that will be studied. This includes legacy systems that are currently widely used, newer systems that are becoming increasingly popular, and the newest entrants in the field whose capabilities are still unknown. The final group presents a challenge to evaluate because it may be

difficult to actually see how these systems are currently used. In addition, oftentimes the systems are not fully developed, which requires potential licensees to take a leap of faith.

The number of systems that actually make it into the process is normally in the range of three to five. A larger group than this could bog down the process. Once these contenders are selected, the company is ready to start gathering information to educate the selection team on the pros and cons of each system and how it would meet its needs.

Very often the selection process results in the development of a scorecard that is used to compare systems. Although these scorecards have value, companies need to be cautious about using the scoring to directly develop a software recommendation. The scorecard is an excellent tool to identify the strengths and weaknesses of each system. They usually cover a number of attributes, including functionality in modeling liabilities and assets, controls built around the system, the underlying technology strengths of the system such as cloud-computing abilities, quality of vendor support, documentation, ease of customization and implementation, and licensing cost. Other attributes can be assessed, but this list covers the most common ones.

Actuaries love to calculate numbers and rely on them for decisions. However, the use of the scorecard should be limited to information gathering. Ultimately, the choice between one tool and another will be determined by its ability to meet a company's "must-haves." These are part of a short list of items that are mandatory for the system. Often seen in this list are items such as ability to fit into the IT operating model, ability to drill into calculations (no black boxes), transparency and auditability, and the ability to model specific products. Speed is generally not on this list; although computing time is important, ways can be found to reduce run time, including adding hardware. Of course, in some situations run time may be a must-have, such as situations in which hedge calculations are performed. However, for regular valuation and projection needs, speed may not be a crucial consideration.

Much of the information used to fill out the scorecards will come from two sources: a request for proposal (RFP) sent to each vendor and vendor demonstrations. The RFP gives the vendor an opportunity to describe its tool's abilities. With either approach, companies need to be cautious because vendors tend to be show their product's best side, as is to be expected. It takes good detective work to uncover the areas that may be problematic in specific situations.

OPEN OR CLOSED?

One of the key differences among the systems is how much access the user has to the code and what level of customization is allowed. The "closed" systems generally limit how much can

be done with respect to system changes, while the "open" systems usually give the user free reign. A full discussion of this is beyond the scope of this article, but a key aspect is that closed systems generally do not require as high a level of programming skills by the staff. This is an important consideration when a company is thinking about the staffing implications of bringing on a new system. Another relates to a company's need to implement new product functionality or other coding changes, such as in pricing, on an as-needed basis. Closed systems create more challenges in this area because some changes require vendor involvement. Some companies find it advantageous to leave all programming up to the vendor. Others cannot work this way. Finally, installing upgrades with closed systems are generally easier since the vendor controls the code at all times.

PROOF OF CONCEPT

Following the vendor sessions and a full reading of the RFPs, some teams are comfortable making a recommendation to management. However, in most situations companies will ask the vendor(s) for a trial license so they can dig deeper into the system. Sometimes this may be limited to a small group of actuaries and IT people who spend two or three weeks drilling through the system to get a feel for it. In a growing number of situations, companies are performing intensive proofs of concepts where they use the system for a few months and execute real model building. Bringing in new software is a significant commitment. Only hands-on experience can identify potential issues or confirm that the choice is correct.

IMPLEMENTATION, CONVERSION AND TRAINING

No level of due diligence can replace actually using software in a real-time setting to meet valuation and analytical needs. Although an extensive selection process, including a proof of concept, will expose potential issues or areas that will stress the implementation team, only during the conversion does a company really get to know how the tool will work for it.

Several considerations need to be contemplated after all the information gathering has been completed but before signing on the dotted line and starting the implementation.

Set a Realistic Timeline and Budget

Conversions will never go as smoothly as planned, so a realistic timeline should include sufficient time for adding and testing new functionality, tracking down issues and dealing with unexpected discoveries. It is important to try to anticipate as many obstacles as possible, but be ready to adapt for the unknown. It is unrealistic to expect the same people doing the conversion to also perform their current jobs; therefore, the budget and timeline needs to contemplate the use of consultants as well as a company's subject-matter experts and dedicated project staff. The timeline should also account for things such as new

products or rate updates that now need to be incorporated into both the current and future-state models.

Timing and Approach

It is important to consider the company's future state of modeling and its approach to implementation. Conversions can take at least one to two years, so plans will need to ensure continued support of the current environment while building toward the future. Consider how frequently the project team will want to rebase to the current quarter. Cutting over to a new system is never going to be perfect, so timing a conversion to coincide with year-end or an assumption unlock quarter is probably less than ideal. Depending on the complexity of the conversion and whether this will impact results, it is recommended to plan for at least one to two quarters of parallel testing and several rebases.

Vendor Dependency

The sales pitch will always make it sound like buying a new system will solve all modeling problems, but no system is perfect. The evaluation team needs to distinguish between what exists today versus promised future enhancements. If the vendor promises a future enhancement, the conversion is dependent on their timeline and is subject to potential resource contention with other clients. Every step should be taken to keep the vendor work off the critical path. Realizing this up front will help set realistic expectations regarding the state of the software at the conversion date—a company may actually be giving up some current functionality for a period of time by moving to the new software. Doing a thorough review on the front end can minimize surprises on the back end.

Opportunity for Thorough Review and Documentation

The greatest value in a software conversion is the resulting reconciliation, review, documentation and model cleansing. It is important not just to replicate the old system, but also to use independent tools to verify that the new setup is correct instead of rolling forward existing issues. This is also the chance to thoroughly document customizations and inputs. This will add time and expense, but it will provide confidence in the new results and set a company up for success to maintain the system in the future.

Examine End-to-End Process

Actuarial modeling is no longer just about the inputs, outputs and code, but now needs to consider automation and controls. A system conversion should also examine any manual processes used to create inputs or aggregate outputs to see if system capabilities exist that could do the same thing faster to free up actuaries to do more analysis.

Cross-functional Project Resources

Most system conversions will not just involve the actuaries. Typically, interactions will take place with IT, finance, internal and external audit, and investments. Within the actuarial department, each area using the model will need to provide subject-matter experts who can help create requirements, evaluate issues and perform user acceptance testing. Support from senior management and a good project management team will be critical to ensure all departments are working toward this common vision and can prioritize actuarial requests appropriately.

Organization Structure and Future Governance

Evaluate the modeling roles and responsibilities: An organization wants to ensure that once the conversion is complete, proper governance is in place for future changes. Many companies are moving to a centralized modeling team to maintain and enhance the models consistently in the future. It is important to discuss this before the project ends so roles and responsibilities are well defined before the first change occurs.

Audit Requirements

Assuming that the conversion work changes results, auditors will need to get comfortable with the new model. By engaging

> A well-designed and -executed selection process provides the best chance of finding the platform that will both meet current needs and be able to grow with the organization.

with them early, any required documentation can be developed along the way instead of trying to go back in time. It is helpful to build spreadsheets that replicate calculations and pull a representative sample of single cells to demonstrate the review. In addition, use this as an opportunity to show evidence of the correct implementation of assumptions by not only running the baseline model, but also running sensitivities. Also, agree on how many quarters need to be tested.

Agreement on Error/Methodology Quantification

No system is coded perfectly, so a conversion will uncover errors or difference in approaches in the existing model. It is good to agree ahead of time whether such an error will be corrected in the existing system or if it will be first addressed in the new model. If the error is material, the project team will need to determine the feasibility of making model changes to quantify the historical impact or if estimates can be used for that purpose.

Scope

Models implemented now must deal with future challenges, not just today's requirements. A multiyear project may first handle the conversion, but then focus on the new and improved future state. Clearly spell out what must be completed for the conversion to go live and what improvements can happen once the system is in use. The scope should also allow for anything new that comes along during the conversion so the system is not out of date as soon as it is implemented.

Technology/Infrastructure

It is important to blend actuarial and technical solutions to modeling problems. Solid IT infrastructure and grid support must be considered. Everything looks good on a small demo scale, but the evaluation team needs to assess what things will look like with more users and an increase in the number and types of projections.

CHANGE IS GOOD

Using a new software system can be an exciting time for a company. In most, if not all, instances it provides an opportunity to do things better and faster and provide management with much needed information that may not have been accessible in the past. Most current valuation and projection installations have evolved to their current state based on emerging needs over a number of years. Converting to a new system provides companies with a chance to actively design their computing environment. A well-designed and -executed selection process provides the best chance of finding the platform that will both meet current needs and be able to grow with the organization. ■

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2016 SOA Modeling Sessions

By Jennifer Wang and Mary Pat Campbell

Welcome to the first of what we hope to be a recurring feature—highlighting recorded sessions, webcasts and slides on modeling topics in the recent past.

Recorded webcasts and virtual sessions are available for a fee, but SOA members have free access to audio recordings synchronized with slide presentations of many of the major 2016 SOA meetings: Investment Symposium, Life & Annuity Symposium, Health Meeting, Valuation Actuary Symposium and the SOA Annual Meeting & Exhibit, as well as various webcasts and a seminar. Slides from meeting presentations are downloadable and free to all online.

Thanks to Eric Schwartz and the SOA staff for help in compiling this list.

2016 INVESTMENT SYMPOSIUM[1]

SESSION 16: MODEL RISK

Moderator: David Paul, FCAS, MAAA

Presenters: David Paul, FCAS, MAAA; Chad R. Runchey, FSA, MAAA

Analytical models of many descriptions and purposes are used throughout insurance and pension organizations. To the extent that a model is not reality but is merely a simplified representation of reality, all models are subject to the risk of simply being wrong. This session focused on how financial organizations can quantify, document and reduce the potential for errors within their models. Due to regulatory concerns (as illustrated in Federal Reserve release SR 11-7), a consistently increasing amount of resources are being applied in this area. Industry critics have argued that this focus has been misplaced on trivial but easily identified problems (e.g., data quality) while ignoring the greater intellectual challenge of dealing with models that are theoretically unsound, as many believed played an important part in bringing forth the global financial crisis of 2008–2009. (See session slides at *https://www.soa.org/Files/Pd/2016/investment-symposium/pd-2016-02-is-session-16.pdf*.)

2016 LIFE & ANNUITY SYMPOSIUM[2]

SESSION 15 PANEL DISCUSSION: MODEL GOVERNANCE

Moderator: Jason A. Morton, FSA, MAAA

Presenters: David R. Beasley, FSA, CERA, MAAA; Jason A. Morton, FSA, MAAA; Robert P. Stone, FSA, MAAA

Model governance continues to be a hot topic in the industry. This topic continues to receive attention from regulators and will become increasingly high profile with principle-based reserves (PBR). Experts at this session provided different viewpoints on the current and likely future state of model governance and the changes that may be necessary. (See session slides at *https://www.soa.org/Files/Pd/2016/las/pd-2016-05-las-session-15.pdf*.)

SESSION 48 PANEL DISCUSSION: EXTREME EVENTS FOR INSURERS: CORRELATION, MODELS AND MITIGATION

Moderator: Ronora E. Stryker, ASA, MAAA

Presenters: Thomas P. Edwalds, FSA, ACAS, MAAA; Kailan Shang, FSA, ACIA; Marc Alexandre Vincelli, ASA

The modeling and mitigation of extreme events is complex due to scarcity of experience data, emergence of new risks, dependence among risks and other factors. Often, familiar traditional statistical techniques are not enough to address these issues. To provide a resource for practitioners outlining more advanced tools for extreme risk analysis, the Financial Reporting Section, the Committee on Life Insurance Research and the Committee on Finance Research sponsored research resulting in a primer on this topic. Experts at this session presented the results of the study and explored extreme events from the perspective of a global insurance company, with an emphasis on market risk, credit risk, insurance risk, liquidity risk and business risk. They also introduced practitioners to extreme risk concepts and models. (See session slides at *https://www.soa.org/Files/Pd/2016/las/pd-2016-05-las-session-48.pdf*.)

SESSION 49 PANEL DISCUSSION: MODEL RISK MANAGEMENT

Moderator: Mark Stephen Mennemeyer, FSA, MAAA

Presenters: Kristen E. Dyson, FSA, MAAA; Mark Stephen Mennemeyer, FSA, MAAA; Daron J. Yates, FSA, MAAA

With the rapid growth in modeling capabilities and technology resources, actuaries are being called upon to produce more frequent and more detailed analysis than has previously been possible. While this is generally good news for product managers who need timely results, risk managers must be aware of the accompanying growth in model risk. Presenters at this session explored sources of model risk and practical approaches for managing it. Topics covered were validation techniques, reporting tools and interaction with governance processes. (See session slides at *https://www.soa.org/Files/Pd/2016/las/pd-2016-05-las-session-49.pdf*.)

SESSION 57 PANEL DISCUSSION: MODEL EFFICIENCY—PART I

Moderator: Anthony Dardis, FSA, CERA, FIA, MAAA

Presenters: Anthony Dardis, FSA, CERA, FIA, MAAA; Trevor C. Howes, FSA, FCIA, MAAA; Tung Tran, ASA, MAAA

Model efficiency is a hot topic in the industry, and it consists of a wide range of techniques. Experts at this session provided an overview and discussion of several of these techniques. They also discussed how model efficiency fits into a model governance framework. (See session slides at *https://www.soa.org/Files/Pd/2016/las/pd-2016-05-las-session-57.pdf*.)

> Actuaries are being called upon to produce more frequent and more detailed analysis than has previously been possible.

SESSION 70 PANEL DISCUSSION: MODEL EFFICIENCY—PART II

Moderator: Anthony Dardis, FSA, CERA, FIA, MAAA

Presenters: Anthony Dardis, FSA, CERA, FIA, MAAA; Ronald J. Harasym, FSA, CERA, FCIA, MAAA; Andrew Ching Ng, FSA, MAAA

The presenters at this session discussed several model efficiency techniques from real-life case studies. These case studies illustrated how companies are actually using model efficiency techniques in practice. The panel consisted of experts speaking from experience regarding methods that have worked well and shared lessons learned in the process. (See session slides at *https://www.soa.org/Files/Pd/2016/las/pd-2016-05-las-session-70.pdf*.)

2016 HEALTH MEETING[3]

SESSION 34 PANEL DISCUSSION: THE ACA, TRANSITIONAL RELIEF AND GROUP MIGRATION MODELING

Moderator: Joseph P. Slater, FSA, MAAA

Presenters: Bethany McAleer, FSA, MAAA; Anthony W. Piscione, FSA, MAAA; Joseph P. Slater, FSA, MAAA; Joshua Ryan Strupcewski, ASA, MAAA

Under the Affordable Care Act (ACA), all individuals and groups with 50 or fewer subscribers will eventually be subject to the ACA's modified community rating rules. While some individuals and small groups have benefited financially from ACA's rating rules, a significant number have avoided the ACA's pools because of the expectation of significantly higher premiums. To date, the most popular ACA avoidance tactic has been the use of transitional relief or "grandmothering" in states with that option available. With the transitional relief window scheduled to close in 2017, many health insurers will need to invest a large amount of time and effort into determining how the end of transitional relief will impact their ACA business. A large part of this task will be modeling individual and group decision making in light of the options available to them. Some will move to an ACA pool. Others will drop coverage. And some will seek other alternatives. (See session slides at *https://www.soa.org/Files/Pd/2016/health-meeting/pd-2016-06-health-session-34.pdf*.)

SESSION 40 LECTURE: PRINCIPLES IN MODEL-BUILDING

Moderator: Douglas T. Norris, FSA, MAAA

Presenters: Joan C. Barrett, FSA, MAAA; Geoffrey R. Hileman, FSA, MAAA

This session focused on key conceptual principles in building and explaining actuarial models. The presenters discussed the importance of explaining potential uncertainties, approaches for properly communicating results, the importance of a priori assumptions and the essential importance of driving stakeholders to key underlying questions rather than simply presenting data and model results. The second presentation proposed 10 questions that should be asked about any analysis. They also covered the importance of data governance as a component of model-building. (See session slides at *https://www.soa.org/Files/Pd/2016/health-meeting/pd-2016-06-health-session-40.pdf*.)

SESSION 115 PANEL DISCUSSION: ADVANCING RISK ADJUSTMENT MODELING IN MANAGED MEDICAID LONG-TERM CARE PROGRAMS

Moderator: Sabrina H. Gibson, FSA, MAAA

Presenters: Aaron Beaudoin, FSA, MAAA; Maria Catherine Dominiak, FSA, MAAA; Mathieu Doucet FSA, MAAA; Sabrina H. Gibson, FSA, MAAA

Since the passage of the American with Disabilities Act more than 25 years ago, an effort has been made in the Medicaid program to transform its primary role as an institutional care-focused financing mechanism to a community-based long-term services and supports (LTSS) program. Many states are using Managed Medicaid Long-Term Care programs to support this transition while at the same time using this financing mechanism as a way to control trends and improve quality in Medicaid Long Term Services and Supports (MLTSS) costs. Managed Care Organizations (MCOs) receive capitation payments to provide services to the population, but the variations in costs across the spectrum of LTSS require a risk adjustment mechanism to support the appropriate distribution of funds across the MCOs. Simple risk methodologies of blending rates by service location have morphed into more complex risk adjustment mechanisms that account for the varying levels of member functionality in the more advanced models. This session discussed these advanced models including the following topics:

- Variables necessary in the models
- Data needed to support the models
- Complexities of building the models
- Case studies on two current models
- The future of MLTSS risk adjustment models

An intermediate to advanced session assumed attendees have some experience with risk adjustment models and familiarity with MLTSS programs and Medicaid rate setting. (See session slides at *https://www.soa.org/Files/Pd/2016/health-meeting/pd-2016-06-health-session-115.pdf*.)

2016 VALUATION ACTUARY SYMPOSIUM[4]

SESSION 3 PANEL DISCUSSION: FIRST PRINCIPLES MODELING FOR LTC

Moderator: Lo Linda Chow, FSA, MAAA

Presenters: Lo Linda Chow, FSA, MAAA; Gwendolyn Gibbs Hart, ASA; Nilesh Mehta, FSA, MAAA

Previously, most companies have priced LTC products with claims cost factors and filed them as such. This has led to valuation models being based off of these factors. Improvements in experience studies have led to the ability to track assumptions for morbidity, mortality on claim and recoveries explicitly. At the same time, computing power and software advances have led to the ability to model these assumptions explicitly for a "first principles" valuation approach. How exactly does a company make the move from a claims cost valuation model to one based on first principles? What is the underlying rationale to move to such a model? What are the actuarial complexities that arise from such a model? What are the regulatory hurdles? And how do you get comfortable with this approach? (See session slides at *https://www.soa.org/Files/Pd/2016/val-act/pd-2016-08-valact-session-03.pdf*.)

SESSION 5 PANEL DISCUSSION: ACTUARIAL MODELS GOVERNANCE SURVEY—THE RESULTS ARE IN

Moderator: Thomas Q. Chamberlain, ASA, MAAA

Presenters: Ronora E. Stryker, ASA, MAAA; Thomas Q. Chamberlain ASA, MAAA

Experts at this session discussed the results of the Actuarial Models Governance Survey sponsored by the Modeling Section. Final results of this survey had not yet been published, so this was a sneak peek. (See session slides at *https://www.soa.org/Files/Pd/2016/val-act/pd-2016-08-valact-session-05.pdf*.)

SESSION 7 PANEL DISCUSSION: ANALYZING ANNUITY POLICYHOLDER BEHAVIOR USING PREDICTIVE MODELING AND CLUSTER ANALYSIS

Moderator: Mark William Birdsall, FSA, FCA, MAAA

Presenters: Mark William Birdsall, FSA, FCA, MAA; Marianne C. Purushotham, FSA, MAAA

Predictive modeling is a tool for developing assumptions that are robust and responsive to stochastic modeling methods. By incorporating both traditional and nontraditional data, experts at this session described methods for developing dynamic functions of full surrender and guaranteed lifetime withdrawal benefits (GLWB) utilization for variable annuities (VAs) with GLWBs. The technique of applying cluster analysis demonstrated a process for applying the VA with GLWB full surrender results to fixed indexed annuities (FIAs) with guaranteed lifetime

income benefits (GLIBs). (See session slides at *https://www.soa.org/Files/Pd/2016/val-act/pd-2016-08-valact-session-07.pdf*.)

SESSION 13 PANEL DISCUSSION: LONG-TERM CARE ASSUMPTIONS, CREDIBILITY AND MODELING

Moderator: Robert T. Eaton, FSA, MAAA

Presenters: Roger Loomis, FSA, MAAA; Missy A. Gordon, FSA, MAAA

Valuation actuaries with responsibility for LTC blocks have seen large swings in projection assumptions during the past 15 years. Experts at this session explored the causes behind these swings and examined what LTC modelers may anticipate in setting assumptions in the future, whether for cash-flow testing or establishing premium deficiency reserves. (See session slides at *https://www.soa.org/Files/Pd/2016/val-act/pd-2016-08-valact-session-13.pdf*.)

SESSION 15 PANEL DISCUSSION: ACTUARIAL TRANSFORMATION: THE STORIES AND THE SUCCESSES

Moderator: Dean K. Slyter, FSA, MAAA

Presenters: Stephen J. Bochanski, FSA, CERA, MAAA; Dean K. Slyter, FSA, MAAA

Actuaries are being asked to provide meaningful results and analysis faster and with more information. Insurance companies are transforming their actuarial processes to achieve this. Experts at this session shared transformation stories and lessons that led to success. (See session slides at *https://www.soa.org/Files/Pd/2016/val-act/pd-2016-08-valact-session-15.pdf*.)

SESSION 25 PANEL DISCUSSION: ACTUARIAL MODELS AND PROCESSES—TO PRODUCTION AND BEYOND

Moderator: Van Beach, FSA, MAAA

Presenters: Daniel L. Ahlgrim, FSA, MAAA; Van Beach, FSA, MAAA; Matthew James Kraick, FSA, CERA, MAAA

Presenters at this session discussed ways in which insurers have successfully developed and implemented models and processes. In particular, presenters focused on the following:

- The design of models that produce information needed by actuarial and nonactuarial managers
- Challenges in managing actuarial models, processes, and resources and
- How to communicate results in an understandable and effective way.

(See session slides at *https://www.soa.org/Files/Pd/2016/val-act/pd-2016-08-valact-session-25.pdf*.)

SESSION 39 PANEL DISCUSSION: REVIEWING PBR RESULTS

Moderator: Hye-Jin Nicole Kim, FSA, MAAA

Presenters: Sam M. Steinmann, ASA, CERA, MAAA; Rostislav Kongoun Zilber, FSA, MAAA

The coming implementation of PBR will present many challenges. One of the biggest of these challenges will be understanding results and preparing for review by external parties, including regulators and auditors. Experts at this session provided insight into possible approaches for becoming comfortable with the reserve movements. The panelists also provided insights to help companies set up a successful model governance framework for PBR. Through their experience auditing AG 43 reserves, these experts have a good sense of what the audit focus areas will be as principle-based reserving for life products is implemented. (See session slides at *https://www.soa.org/Files/Pd/2016/val-act/pd-2016-08-valact-session-39.pdf*.)

SESSION 42 INTERACTIVE FORUM: MODEL GOVERNANCE: WHAT COULD POSSIBLY GO WRONG? PART I

Moderator: David R. W. Payne, FCAS, MAAA

Presenters: Dwayne Allen Husbands, FSA, MAAA; David R. W. Payne, FCAS, MAAA; Chad R. Runchey, FSA, MAAA

Participants in this session worked on a hypothetical insurance company "case study" while role-playing to explore the many things that can go wrong in the absence of governance over model risk management. They worked in teams to prepare solutions before presenting them to other participants and the facilitator/experts. (See session slides at *https://www.soa.org/Files/Pd/2016/val-act/pd-2016-08-valact-session-42.pdf*.)

SESSION 56 INTERACTIVE FORUM: MODEL GOVERNANCE: WHAT COULD POSSIBLY GO WRONG? PART II

Moderator: David R. W. Payne, FCAS, MAAA

Presenters: Dwayne Allen Husbands, FSA, MAAA; David R. W. Payne, FCAS, MAAA; Chad R. Runchey, FSA, MAAA

Session 56 was a follow-up to Session 42, continuing the discussion. (See session slides at *https://www.soa.org/Files/Pd/2016/val-act/pd-2016-08-valact-session-56.pdf*.)

SESSION 66 PANEL DISCUSSION: PREDICTIVE ANALYTICS TOOLS FOR LIFE INSURANCE

Moderator: Dorothy Andrews, ASA, MAAA

Presenters: Dorothy Andrews, ASA, MAAA; Missy A. Gordon, FSA, MAAA; Timothy S. Paris, FSA, MAAA

Experts at this session provided participants with a high-level understanding of the critical considerations and components of the predictive analytics process. They walked through a simple model, discussed its results and demonstrated how to apply some common model validation techniques to validate the model. (See session slides at *https://www.soa.org/Files/Pd/2016/val-act/pd-2016-08-valact-session-66.pdf*.)

SESSION 76 INTERACTIVE FORUM: USING PREDICTIVE ANALYTICS TO SET ACTUARIAL ASSUMPTIONS

Moderator: Dorothy Andrews, ASA, MAAA

Presenters: Eileen Sheila Burns, FSA, MAAA; Minyu Cao, FSA, CERA

This session was designed to help actuaries develop modeling assumptions using predictive analytics. "Best estimate" assumption development is often viewed by some as more "hand-waving" than science. Experts at this session gave participants an analytical framework to support their assumption setting with defendable analytics, thereby removing subjectivity. Participants were exposed to real-world examples of the use of analytics to set assumptions. (See session slides at *https://www.soa.org/Files/Pd/2016/val-act/pd-2016-08-valact-session-76.pdf*.)

> Assumption and model governance has been an evolving practice ... due to ORSA-influenced regulations.

SESSION 78 PANEL DISCUSSION: MODEL GOVERNANCE IN A PBR WORLD

Moderator: Scott D. Houghton, FSA, MAAA

Presenters: Troy Regan Elliott, ASA, MAAA; Scott D. Houghton, FSA, MAAA

Actuaries have traditionally set assumptions and used models for pricing, financial reporting, modeling and risk management functions. Assumption and model governance has been an evolving practice with growing interest as of late due to ORSA-influenced regulations. Now with the advent of PBR, a special emphasis will be placed on governance as the valuation world shifts to a new era. Experts at this session discussed the practical issues of model and assumption governance in a PBR world, especially in light of the requirements of VM-G. (A webcast recording of the session is available for purchase at *https://www.soa.org/prof-dev/events/v78-model-governance-pbr/*.)

2016 SOA ANNUAL MEETING & EXHIBIT[5]

SESSION 20 PANEL DISCUSSION: SENIOR MANAGEMENT'S WANDER THROUGH THE MODEL EFFICIENCY COUNTRYSIDE

Moderator: Anthony Dardis, FSA, CERA, FIA, MAAA

Presenters: Mark A. Davis, FSA, MAAA; Nazir Valani, FSA, FCIA, MAAA

This session was an introduction to the subject of model efficiency. Presenters shared senior management's perspective on model efficiency, including:

- The background of model efficiency usage in the life insurance industry, including a history of how the theory and practice has developed over the past 35 years

- An overview of model efficiency techniques

- Availability of model efficiency resources and

- Senior management's views on areas of skepticism, what works well in practice and hints for "selling" model efficiency to senior management and to the board.

(See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-020.pdf*.)

SESSION 40 PANEL DISCUSSION: HOW WOULD I GET STARTED WITH PREDICTIVE MODELING?

Moderator: Douglas T. Norris, FSA, MAAA

Presenters: Timothy S. Paris, FSA, MAAA; Sandra Tsui Shan To, FSA, MAAA; Qinqing (Annie) Xue, FSA, CERA, MAAA

As predictive analytics is increasingly becoming a needed expertise for actuaries, most actuaries are also very puzzled by learning how to use it in their work. In this session, experts provided guidance and suggestions on where to go to find proper study materials and how to start learning about predictive analytics and modeling. They also covered basic technical terms and important applications in insurance. (See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-040.pdf*.)

SESSION 54 PANEL DISCUSSION: ACTUARIAL MODELING TECHNIQUES FOR MODEL EFFICIENCY: PART 1

Moderator: Anthony Dardis, FSA, CERA, FIA, MAAA

Presenters: Chin-Mei Yvonne Chueh, ASA; Ivan Joseph Parker, FSA, MAAA

This session introduced some of the actuarial modeling techniques being used in practice for model efficiency, including

> ## Analyzing data in search of information for their models is not a new concept to actuaries.

- Scenario reduction and
- Proxy modeling, in particular Radial Basis Functions (RBF).

(See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-054.pdf*.)

SESSION 58 PANEL DISCUSSION: PREDICTIVE MODELING, START TO FINISH

Moderator: Eric J. Carlson, FSA, MAAA

Presenters: Sean J. Conrad, FSA, MAAA; Michael David Hoyer, FSA, MAAA; Guizhou Hu, MD, Ph.D.

Analyzing data in search of information for their models is not a new concept to actuaries. What is new are some of the approaches being leveraged by data scientists and actuaries. To some it might seem that these new approaches are nothing more than throwing a bunch of data into some modeling software and seeing what comes out. In this session the presenters revealed why you should look behind the curtain to give meaning to the output of a model. The first panelist discussed important theoretical, yet still practical, predictive modeling considerations. Then an actuary walked through how he used these techniques for a specific application to develop a predictive model. Finally, a reinsurer discussed how to use more traditional actuarial methods to validate the model and discuss the business implications and use of the model. (See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-058.pdf*.)

SESSION 72 PANEL DISCUSSION: HEDGING VARIABLE ANNUITY PRODUCTS: MODEL RISK AND PRODUCT DESIGN

Moderator: Brian Matthew Hartman, ASA, Ph.D.

Presenters: Maciej Jakub Augustyniak, FSA, Ph.D.; Pierre-Alexandre Veilleux, FSA, FCIA, MSc

This session addressed three issues related to the dynamic hedging of variable annuity products. First, they investigated the importance of hedging interest rate risk in stable, rising or volatile interest rate environments and studied the robustness of interest rate hedges to model risk. Second, they examined model risk with respect to stock market, interest rates and longevity risks for GLWB guarantees. Finally, they studied how the fee structure and surrender charges affect surrender incentives and proposed to use product design to mitigate policyholder behavior risk. (See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-072.pdf*.)

SESSION 78 PANEL DISCUSSION: STAND-ALONE LTC AND LIFE/LTC HYBRID MODELING PRIMER—FIRST PRINCIPLES AND STOCHASTIC

Moderator: Kevin Hyeonwook Kang, FSA, MAAA
Presenters: Lo Linda Chow, FSA, MAAA; Bonnie Elizabeth Wolf, FSA, MAAA

Given the rising needs of LTC, both stand-alone LTC and life/LTC combination products are having a significant impact on the insurance industry. For stand-alone LTC, precise financial modeling techniques that would allow carriers to better manage their in-force blocks has been a hot topic of the industry; for life/LTC combination products, pricing and risk mitigation techniques are still in the developmental stage. This session explored first principles modeling and stochastic modeling techniques to help actuaries and senior management better gain an understanding of the potential levels of benefit payments and risks for stand-alone LTC and the embedded life and LTC coverages in Life/LTC hybrid product. (See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-078.pdf*.)

SESSION 82 PANEL DISCUSSION: LEAF, TREE, FOREST, OH MY: ADVANCED MODELS AND THEIR INSURANCE APPLICATIONS

Moderator: Sheamus Kee Parkes, FSA, MAAA
Presenters: Dihui Lai; Satadru Sengupta

As predictive modeling is becoming a necessary skill for actuaries, basic regression modeling is no longer the only choice in certain applications. Actuaries are interested in learning more sophisticated modeling techniques. In this session, experts discussed some of the advanced tree-based models that potentially will have large impact on insurance industry. The topics included basic math foundations, simple tree and ensemble methods, considerations in model selection, and advantages and disadvantages of each model. Some real examples were introduced to illustrate the concepts and potential applications. (See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-082.pdf*.)

SESSION 88 PANEL DISCUSSION: PBR: PRACTICAL IMPLEMENTATION AND GOVERNANCE ISSUES

Moderator: Helen Colterman, FSA, CERA, ACIA
Presenters: Paul M. Fischer, FSA, MAAA; Carrie Lee Kelley, FSA, MAAA; Christopher Almer Whitney, FSA, MAAA

In this session, presenters reviewed the changes that are being made across the industry to prepare for PBR. This session focused on preparation for reporting under PBR and how companies have addressed the many challenges. One of the biggest of these challenges will be getting comfortable with the results.

PBR places a much heavier reliance on actuarial judgment and actuarial models than the traditional reserving methodologies for life insurance. Results and assumptions will need to undergo a thorough review process to ensure they are reasonable. Because of the nature of the calculation and assumptions no longer being locked in at issue, it will no longer be possible to rely on simple trends; this will make analysis much more complicated. (See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-088.pdf*.)

SESSION 94 PANEL DISCUSSION: ACTUARIAL MODELING TECHNIQUES FOR MODEL EFFICIENCY: PART 2

Moderator: Trevor C. Howes, FSA, FCIA, MAAA
Presenters: Ronald J. Harasym, FSA, CERA, FCIA, MAAA; Andrew Ching Ng, FSA, MAAA

This session followed up on Session 54 and looked at some of the emerging actuarial techniques that, although perhaps not yet so widely used, hold tremendous promise for the future:

- Cluster modeling
- Least Squares Monte Carlo (LSMC) and
- "Hybrid" approaches to model efficiency.

(See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-094.pdf*.)

SESSION 113 PANEL DISCUSSION: DATA AND MODEL—ACTUARIES SHOULD BE AN EXPERT OF BOTH

Moderator: David L. Snell, ASA, MAAA

Presenters: Matthias Kullowatz; Kenneth Warren Pagington, FSA, CERA, MAAA; Qichun (Richard) Xu, FSA

Actuaries traditionally deal with only limited amounts of data that the insurance industry accumulated over years. Today, more data are available to actuaries, not only in amount, but also data sources. Traditional actuarial analysis is no longer effective. Some advanced methodologies are needed to understand data and find business insights. Actuaries are required to have new skills to rapidly understand data and build models for business. (See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-113.pdf*.)

SESSION 128 PANEL DISCUSSION: TECHNOLOGY ASPECTS OF MODEL EFFICIENCY

Moderator: Trevor C. Howes, FSA, FCIA, MAAA

Presenters: Huina Chen, FSA, CERA; Philip Gold, FSA, FIA, MAAA

This session covered emerging technology and how it can be used to help make models efficient, including practical uses of emerging gaming processor technology. This session also addressed where the actuarial projection systems look to be going in the future, and how we can expect their performance to improve and what this might mean for the types of analysis and reporting that we do. (See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-128.pdf*.)

SESSION 165 PANEL DISCUSSION: PROFESSIONALISM ASPECTS OF MODEL EFFICIENCY

Moderator: Anthony Dardis, FSA, CERA, FIA, MAAA

Presenters: James A. Miles, FSA, MAAA; Yifeng (Jeffrey) Mu, FSA, CERA, FCIA

This session examined aspects of the professional code of conduct that need to be considered in the context of model efficiency. This included the important topic of model validation, an especially difficult area when one considers how some model efficiency techniques can be extremely complex technically, so

> What techniques can be used to accelerate the run time for nested stochastic modeling?

that validation results are clear and easily communicated. This is crucial for actuaries to understand. Additionally, this panel discussed the relevant ASOPs that come into consideration when using model efficiency techniques and the use of model efficiency to support statutory calculations and reporting—when is it appropriate—and considerations to be borne in mind. (See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-165.pdf*.)

SESSION 174 PANEL DISCUSSION: NESTED STOCHASTIC MODELING RESEARCH

Moderator: Anthony Dardis, FSA, CERA, FIA, MAAA

Presenters: Anthony Dardis, FSA, CERA, FIA, MAAA; Runhuan Feng, FSA, CERA

Today's computing power makes nested stochastic modeling a possibility, where just a few years ago, it was an actuary's dream. However, for insurers, stochastic modeling remains costly for many reasons including hardware, software and model development costs. The calculation run time involved in such an exercise can still be too long for insurance company management to get results and take actions in a timely manner. Also, output data may be too massive to store and understand. Therefore, companies are still seeking ways to avoid a direct nested stochastic approach.

The purpose of this research project is to create a resource to help actuaries and others answer the following questions: In what situations is nested stochastic modeling commonly used? What other approaches can be used instead of nested stochastic modeling? What techniques can be used to accelerate the run time for nested stochastic modeling? (See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-174.pdf*.)

SESSION 181 PANEL DISCUSSION: BEYOND GENERALIZED LINEAR MODEL, WHAT ARE POSSIBLE MODELS ACTUARIES CAN CHOOSE?

Moderator: Brian D. Holland, FSA, MAAA

Presenters: Gourab De; Jeff T. Heaton, ARA, FLMI; Yexin (Kathleen) Wang, FSA, MAAA

As predictive modeling becomes more important in insurance, actuaries will need it as a basic skill. Actuaries may have basic understanding of generalized linear models and decision tree models that have various applications in actuarial science. Beyond GLM, there are many other algorithms that actuaries may want to understand and apply. In this session experts explained some advanced algorithms, such as SVM, neural networks and deep learning. (See session slides at *https://www.soa.org/Files/Pd/2016/annual-meeting/pd-2016-10-annual-session-181.pdf*.)

MODEL GOVERNANCE—IS YOUR COMPANY THERE YET? SEMINAR[6]

PROFESSIONAL INTERESTS & STAKEHOLDER PERSPECTIVES

Moderator: Trevor C. Howes, FSA, FCIA, MAAA

Presenters: Larry J. Bruning, FSA, MAAA; Trevor C. Howes, FSA, FCIA, MAAA; David K. Sandberg, FSA, CERA, MAAA

The driving forces for improved model governance are originating simultaneously from senior management and the boards of directors of life insurance companies, from the industry regulatory authorities and from the actuarial profession itself, both in the United States and internationally. Speakers representing these key stakeholders discussed model governance issues from differing perspectives, covering both current and emerging developments. (See session slides at *https://www.soa. org/Files/Pd/2016/model-gov/pd-2016-model-gov-professional-interest-stakeholders.pdf*.)

INTERSECTION OF MODEL GOVERNANCE AND TECHNOLOGY

Moderator: Joseph N. Soga, ASA, MAAA

Presenters: Andrew Ching Ng, FSA, ACIA, MAAA; David Halldorson; Darin G. Zimmerman, FSA, MAAA

Technology is embedded in all phases of a model's life cycle. When doing it right, technology can be an enabler for better and more effective model governance. The implementation of a comprehensive model governance framework itself can often be complex as well. Again, proper utilization of technology can make a big difference in helping an organization achieve its model governance objective. In this session, experienced industry practitioners talked about the latest developments and key considerations an organization should pay attention to in the integration of technology and model governance. (See session slides at *https://www.soa.org/Files/Pd/2016/model-gov/pd-2016-model-gov-technology.pdf*.)

INTERSECTION OF MODEL GOVERNANCE AND MODEL EFFICIENCY

Moderator: Zohair A. Motiwalla, FSA, MAAA

Presenters: Anthony Dardis, FSA, CERA, FIA, MAAA; Zohair A. Motiwalla, FSA, MAAA

New and more complex modeling demands have increased the need to employ model efficiency techniques. The first part of this session briefly introduced and contrasted these techniques (clustering, proxy modeling, Least Squares Monte Carlo simulation and replicating portfolios to name a few, as well as use of technology in general) and discussed how companies validate and create governance over the application of these techniques as part of the financial reporting process. The second part of this session looked at model efficiency and governance from the standpoint of VM-20 specifically. (See session slides for both parts of the session at *https://www.soa.org/Files/Pd/2016/model-gov/pd-2016-model-gov-intersection-model-efficiency.pdf*.)

2016 SOA WEBCAST

### AN ACTUARY'S TOOLBOX FOR MODEL RISK MANAGEMENT (JULY 26, 2016)

Moderator: Scott D. Houghton, FSA, MAAA

Presenters: David R. Beasley, FSA, CERA, MAAA; Anh Tu Le, ACIA, FCAS; Katherine Papillon-Rodrigue, ASA, CERA, MAAA

Presenters for this webcast focused on tools and techniques to build an effective model risk management framework. They shared their experiences, successes and learnings on the following topics:

- Definition of model
- Model risk definition
- Potential sources of model risk (what can happen and what can go wrong in actuarial models)
- Model inventory
- Model governance framework
- Model risk policy
- Model controls
- Model validation and testing
- Model risk quantification
- Change management frameworks
- Successes and lessons learned on the above

(A webcast recording of this session is available for purchase at *https://www.soa.org/prof-dev/events/2016-actuarys-toolbox-model-risk/*.) ∎
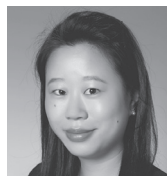
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ENDNOTES

1 *https://www.soa.org/prof-dev/events/2016-investment-symposium/*

2 *https://www.soa.org/prof-dev/events/2016-life-annuity-symposium/*

3 *https://www.soa.org/prof-dev/events/2016-health-meeting/*

4 *https://www.soa.org/prof-dev/events/2016-Valuation-Actuary-Symposium/*

5 *https://www.soa.org/prof-dev/events/2016-SOA-Annual-Meeting---Exhibit/*

6 *https://www.soa.org/prof-dev/events/2016/model-gov/Agenda/*

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