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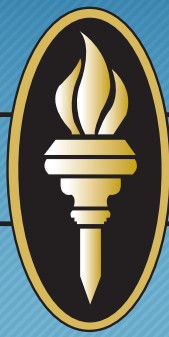
Legislative Levee

Can private insurance help the National Flood Insurance Program meet its congressional expectations?
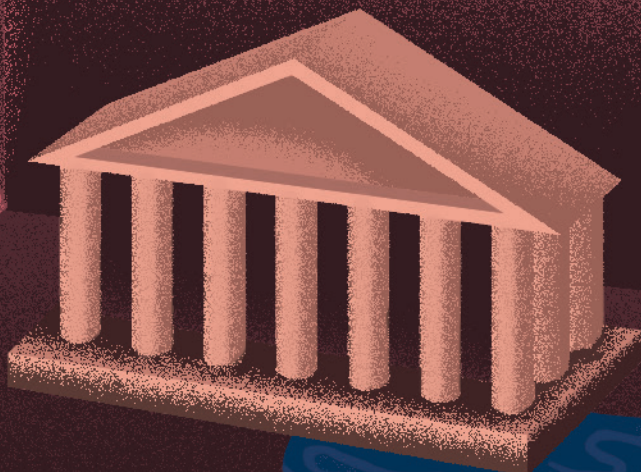
Plus CAS Election 2017

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actuarialREVIEW

July/August 2017

departments

FSC LOGO

on the cover

Legislative Levee
32

BY ANNMARIE GEDDES BARIBEAU

Can private insurance help the National Flood Insurance Program meet its congressional expectations?.

2017 CAS Election
29

Meet the Candidates for President-Elect and Board Directors.

editor's NOTE

Timeless Advice

This past spring, the CAS welcomed the class of May 2017: 319 new ACAS, 52 new FCAS, four new FCAS by Mutual Recognition and three new CERAs.

Cheering them on was Mike Fusco, FCAS, a past president of the CAS, who gave the address to new members. The following is an excerpt from his speech that addresses the question, "So now what will you do?"

CAS President Nancy Braithwaite with long-time colleague and friend, Mike Fusco.

1. *Volunteer … I encourage you to volunteer to help the CAS …but also volunteer at your workplace … You will learn more and faster and will be recognized and rewarded for it.*

2. *Embrace change. You will have far more opportunities to work internationally than your predecessors did. Learning new languages and cultures will be exciting and valuable to you. You can also work within the insurance industry in other than pure actuarial positions … Or you can go outside the industry …*

3. *Work hard, especially on communication skills … Your work ethic will be noticed and will allow you to get better assignments. And be sure to focus on communications skills because getting your message across is just as important as developing the message.*

4. *Remember three little letters … LOL. Laugh out loud! Have a sense of humor … whether you are an extrovert or an introvert. Don't take yourself too seriously. But show how much you are enjoying your work.*

Whether you are just starting out or "well-seasoned or somewhere in between," Fusco's advice is timeless. ●

Actuarial Review always welcomes story ideas from our readers. Please specify which department you intend for your item: Member News, Solve This, Professional Insight, Actuarial Expertise, etc.

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Responsible Predictive Modeling in the Age of Big Data

With the influx of data scientists and predictive modelers into our world there has been a lot of enthusiasm for the new tools, as well as a lot of discussion about the new competition from these specialists. Let's look at each of these two issues in turn.

Actuaries have always been users of big data and we have adapted as the data and tools have grown. I remember touring ISO's data center many years ago, which outside the IRS, was one of the biggest data facilities in the U.S. at the time.

Today, we have more data than we ever could have imagined and new tools to evaluate the information to be gleaned from that data. But the concept of increasing data and better tools is not new; it's just that the magnitude is different. Some of you will remember the days of the mainframe computer with terminals in a shared "bullpen," where you had to sign up for use by the hour? After that, having a PC on your desk was a significant change — and we adapted quickly, learning the new skills needed to maximize the benefits of those tools. Now, we quickly adapt to the latest app on our phones.

As computer storage became cheaper and cheaper, the amount and types of information we could save about our insureds grew exponentially. The ability to match losses and premiums from specific policies and coverages has become the norm and is now done routinely. Not so long ago, this function took a significant investment of time and resources.

Given our history, I am confident that actuaries will learn the skills required to adapt to our new world of big data and predictive analytics. Actuaries will also use those skills to find innovative solutions to the new challenges we will face.

Now to the second point. How will actuaries fare now that we are faced with competition from specialists who may be more skilled in these new techniques than we are?

The new world of big data and predictive analytics has a bit of a flavor of the "wild west" — we don't always control the data, so issues of data reliability and accuracy may appear to be taken out of our hands. Despite this, we continue to look at the data and see what it tells us.

I strongly believe that we will continue to be greatly valued, especially because we adhere to the ethical and professional principles that we have always esteemed. The new world of big data and predictive analytics has a bit of a flavor of the "wild west" — we don't always control the data, so issues of data reliability and accuracy may appear to be taken out of our hands. Despite this, we continue to look at the data and see what it tells us.

We have the history, skills and knowledge to be a voice of reason in this changing environment. We may not have control over data from third-party vendors, but we do have the domain knowledge that can make us question results that seem counterintuitive, or worse, are at odds with the intent of regulation and law. We have the ethical responsibility to apply that knowledge. Sometimes innovation for innovation's sake can be destructive to the aims of our employers. Sometimes the data simply is wrong or the model may rely on assumptions that are too simple, are wrong, or are changing.

As CAS members, we are committed to our ethics and values and instill them into everything we do. The new credential from The CAS Institute, the Certified Specialist in Predictive Analytics (CSPA), requires designees to complete an ethics course. The CAS has also formed a new working party that will focus on raising awareness of ethical, social, data quality and other issues related to the expansion of advanced analytics into the actuarial space. As actuaries increasingly team up with data scientists and other professionals, we have an opportunity to export our actuarial professionalism and ethics to the other professionals we work with. These and other measures are concrete examples of how the CAS can influence other professionals in the big data space.

Adapting to innovative new tools and managing big data, while applying our domain knowledge and adhering to our ethics and professionalism, will make us even more valuable to our stakeholders as we move forward and adapt to change. ●

readerRESPONSE

Dear Editor:

I found the article "The Darker Side of Data" ("On the Shelf," *AR* November-December 2016) to be very thought provoking, but I found some of the author's assertions regarding insurance mechanisms to be way off-base and I was surprised to find certain statements in a CAS publication. The author claims that "Insurance is pooled risk … in order for insurance to work, you kind of need to be ignorant in certain kinds of ways. In particular, you don't know exactly who's going to need the money." Really? According to CAS Statement of Principles concerning ratemaking,

Ratemaking should provide for the costs of an individual risk transfer so that equity among insureds is maintained. When the experience of an individual risk does not provide a credible basis for estimating these costs, it is appropriate to consider the aggregate experience of similar risks. A rate estimated from such experience is an estimate of the
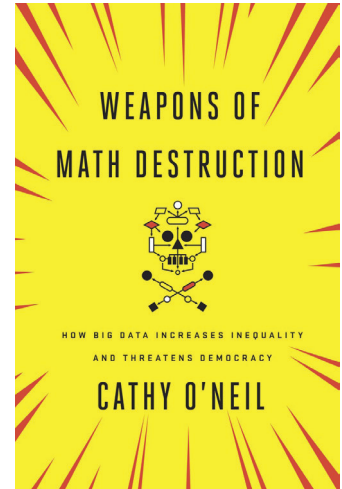
costs of the risk transfer for each individual in the class.

The goal of ratemaking is to establish the costs associated with individual risks. To that end, big data enhances our ability to identify risk factors and develop prospective loss costs on a more refined basis. Certainly the creation of algorithms and interpretation of data requires a comprehensive understanding of the process, and careful judgment must be exercised in the application of such methods. Yet that doesn't undermine our attempt to improve upon existing methods for determining exactly who will need the money and how much of it.

—*Jonathan Brand*

Grover Edie, *AR* Editor in Chief responds:

Having read Jonathan Brand's letter and thought about it, I am still inclined to agree with the phrase "you don't know exactly who's going to need the money." The key word in the CAS Statement of Principles is "estimating." We don't know the costs beforehand, we only can estimate them. The advent of big data and other tools enable us to do a better job of estimating expected costs, but if we ever get to the point where we can predict, with 100 percent accuracy, the frequency and the ultimate severities of losses for an individual risk, then we move away from an insurance situation and into a different realm. ●

memberNEWS

COMINGS AND GOINGS

Loren Nickel, FCAS, director of business risk and insurance at Google, was recognized as the 2017 Risk Manager of the Year by RIMS, the Risk Management Society. The Risk Manager of the Year award spotlights outstanding programs that risk management practitioners have implemented within their organizations. Nickel joined Google in 2015 and is responsible for business risks that impact all Alphabet Inc. (formerly known as "Google") companies worldwide. He is an active CAS volunteer and is currently serving as a CAS University Liaison. He is a former president of the Casualty Actuaries of the Bay Area (CABA), a CAS Regional Affiliate.

The Bermuda Insurance Institute (BII) announced that **Jamie Botelho, FCAS**, will receive the 2016 Young Industry Leader of the Year Award, given by the BII to an individual under the age of 35 who has made a significant contribution to his or her organization by promoting professionalism, ethics and the development of talent and technical expertise. Botelho, who earned his FCAS in 2011, currently serves as senior vice president, head of pricing at Validus Reinsurance. He told the BII that his career as an actuary "has given me many challenging and rewarding opportunities." Prior to joining Validus, Botelho was an actuarial analyst at XL Re from 2004 to 2008.

American International Group, Inc. (AIG) announced that **Brian Duperreault, ACAS**, has been named president, chief executive officer and director effective May 14, 2017. Duperreault previously served as chairman and CEO of Hamilton Insurance Group, a Bermuda-based holding company. The appointment marks a return for Duperreault, who served in various executive positions at AIG early in his career from 1973 to 1994. Duperreault earned his ACAS in 1975 and shared his industry expertise with his fellow CAS members at the 2014 CAS Centennial Celebration and Annual Meeting at the session "Future of the Insurance Industry — The Next 100 Years."

CAS Vice-President Research & Development **Dave Cummings, FCAS**, has been named chief actuary for USAA in San Antonio. Cummings previously served as senior vice-president for ISO and director-ERM for State Farm Insurance Companies.

Richard Easton, FCAS, and his co-author Eric Frazier appeared on C-SPAN3's American History TV discussing their book *GPS Declassified: From Smart Bombs to Smartphones*. The two spoke at the New York Military Affairs Symposium on May 5. Easton is the subject of a Downtime column in the *AR* March/April 2014. To view the video, visit http://cs.pn/2rE0yxk.

Steve Mildenhall, FCAS, CERA, has published "Actuarial Geometry" in *Risks* 5:2. The paper is available in pdf at www.mdpi.com/2227-9091/5/2/3 and concerns capital allocation and fitting and determining the distribution of aggregate losses. Mildenhall is assistant professor in the School of Risk Management at St. John's University. ●

CALENDAR OF EVENTS

September 10-12, 2017
Casualty Loss Reserve Seminar (CLRS) & Workshops
Loews Philadelphia Hotel
Philadelphia, PA

October 2-3, 2017
In Focus Seminar:
The Actuary of Tomorrow
Hyatt Regency Wacker Drive
Chicago, IL

October 2-3, 2017
ERM for the
P&C Actuary Seminar
Hyatt Regency Wacker Drive
Chicago, IL

November 5-8, 2017
Annual Meeting
Fairmont Austin
Austin, TX

March 19-21, 2018
Ratemaking, Product and
Modeling Seminar & Workshops
Fairmont Chicago, Millennial Park
Chicago, IL

May 13-16, 2018
Spring Meeting
Boston Marriott Copley Place
Boston, MA

IN REMEMBRANCE

In Remembrance is an occasional column featuring short obituaries of CAS members who have recently died. Longer versions of these obituaries are posted on the CAS website at http://bit.ly/CASProceedings.

The New Yorker
Theresa "Terri" Giunta (FCAS 2001)
1967-2014
Theresa "Terri" Giunta died February 8, 2014, at the age of 47. She earned a BS in math from Drexel University in Philadelphia and was active in her regional actuarial group, Casualty Actuaries of Greater New York. Her last post was as vice president for Arch Insurance in New York City. Giunta's actuarial career was typical of many of her CAS contemporaries coming up in the late 1990s. Early in her career she moved around a bit, working for different companies in New York, Philadelphia and Chicago, before returning to New York City, the city where she got her start. Supervisors who endorsed her for CAS membership gave her glowing recommendations, complimenting her work ethic, intelligence and professionalism. She was employed by Guy Carpenter & Co., whose offices were in World Trade Center II in New York; she was fortunate to have been accounted as safe after the 9/11 attack.

The Angler
Charles Patrick "Charlie" Neeson (ACAS 1997)
1949-2014
Charlie Neeson, a 45-year veteran of actuarial practice and owner of C.P. Neeson LLC in Westfield Center, Ohio, died unexpectedly on November 9, 2014. Born October 4, 1949, in Dayton, Ohio, he earned a BS in economics from Ohio State University in 1971. Neeson began his career in 1971 at Westfield Insurance Company, serving as the company's first actuary. He became an expert in credit scoring, which led to his testifying before Congress on the subject. In 2010 he retired from Westfield and started his own consulting firm. Neeson loved fly fishing and traveled to Chile, New Zealand and throughout the U.S. for his sport. He spent many hours teaching his grandson to fly fish. His CAS service included the Member Advisory Panel (2010-12); Committee on Management Data & Information (2011-14); and the Hachemeister and Michelbacher Prize Committee (2010-14). He participated in the regional actuarial groups Buckeye Actuarial Continuing Education and Midwestern Actuarial Forum. He is survived by his wife, Robin; two sons and their wives; three grandchildren; one brother; and two sisters.

The Candidate
Dale F. Ogden (ACAS 1983)
1951-2014
Dale F. Ogden, politician and founder of Dale F. Ogden and Associates in San Pedro, California, died October 26, 2014. He worked at Equifax Services while attending Towson State College, where he earned a B.A. in mathematics and a minor in accounting in 1974. He began his career as a high school math teacher in Baltimore City. After a layoff, he went back to Equifax and later got his first actuarial job with the Maryland Automobile Insurance Fund. His later career included posts at KPMG and Kramer Capital Consultants in New York and Los Angeles. Owning his own business, Ogden gained an understanding of government by consulting for a wide variety of clients, including state insurance regulators, government agencies, attorneys and insurance companies. This experience would later set the stage for his interest in politics. Ogden was active in California Libertarian Party politics for about 15 years, running for insurance commissioner in 1998, 2002 and 2006, state assembly in 2000 and state senate in 2004. In 2001 he ran for governor. In that race, Ogden garnered 150,895 votes or 1.5 percent of the total. Ogden is survived by his wife of 21+ years, Colleen, and his son, Dale Ogden Jr.

The Arts Patron
Eugene G. Thompson (ACAS 1971)
1948-2014
Gene Thompson was a joyous man with a friendly smile. He passed away suddenly on November 3, 2014. He worked as an actuary in Philadelphia at General Accident and INS Consultants, Inc., his last post. He loved beautiful and unique objects and was an enthusiastic collector of crafts and fine art. Thompson generously supported numerous talented artists, including painters, photographers, sculptors and furniture makers. A member of All Saints' Torresdale Episcopal Church, he is survived by his brother-in-law Don Minniak; two nieces; and two great nieces and nephews. In lieu of flowers, memorial donations can be made to the American Heart Association in Philadelphia. ●

CAS STAFF SPOTLIGHT

Meet Sophie Uy, CAS IT and Online Services Coordinator

Welcome to the CAS Staff Spotlight, a column featuring members of the CAS staff. For this spotlight, we are proud to introduce you to Sophie.

- **What do you do at the CAS?**
  As the IT and online services coordinator I have a pretty wide range of responsibilities, including but not limited to providing tech support, programming marketing emails, and managing the CAS events mobile app as well as the online community. The digital version of the *Actuarial Review* also happens to be within my purview.

- **What do you enjoy most about your job?**
  I enjoy the variety of tasks that I am assigned — not being stuck doing the same thing all day every day is very important to me. Everything that I do at the CAS calls upon different skills and speaks to various interests I've developed so far in my life.

- **What's your hometown?**
  Gennevilliers, France is where I spent the bulk of my childhood.

- **Where'd you go to college and what's your degree?**
  I graduated from the University of Pennsylvania with a bachelor's degree in linguistics.

- **What was your first job out of college?**
  I worked part-time at Penn's Linguistic Data Consortium, where we conducted research studies and prepared data. I interviewed human subjects to record their speech, edited machine translations, transcribed phone conversations, and so on. Officially, the university considered me a "temporary part-time extra person." That's word-for-word what was written on the university-issued ID!

- **Describe yourself in three words:**
  Eager to learn.

Sophie Uy

- **What's your favorite weekend activity?**
  It's actually something I do every day: training. On Saturday mornings I typically run a couple of miles to the climbing gym so I can put in a one- or two-hour bouldering session before it gets crowded. Sunday used to be a rest day but my Muay Thai gym recently added classes on that day, so now there's that, plus a 5-6 mile run beforehand to get me warmed up!

- **What's your favorite travel destination?**
  Right now, it's France. I have only managed to go back twice in the past 16 (almost 17!) years, so I kind of obsess about it. There's no place like home, right?

- **Name one interesting or fun fact about you:**
  If you're reading this right around the time of this issue's publication, I'm in Thailand! ●
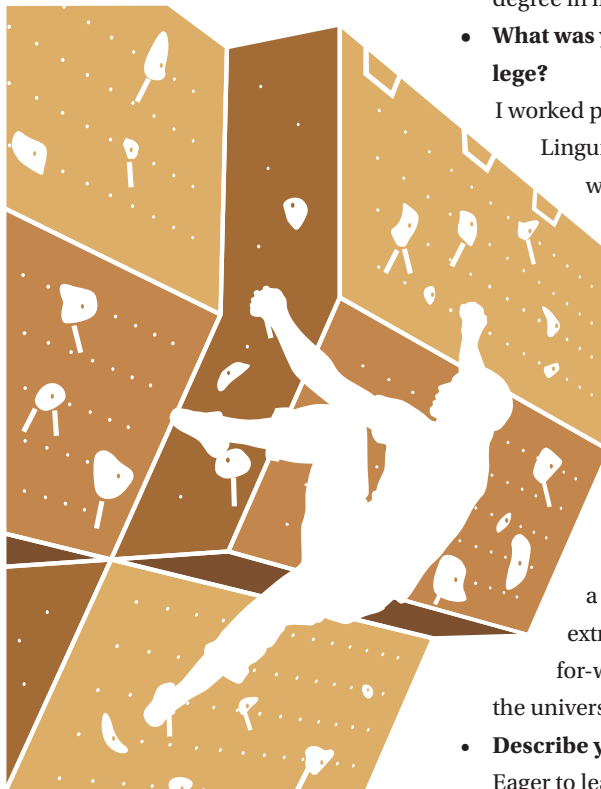
Casualty·Loss·Reserve·Seminar

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HUMOR ME

Actuarial Thriller Part 2 BY URI KORN

We've all read legal thrillers and medical thrillers and police thrillers, but the truth is that those professions just aren't so interesting and neither are their thrillers. At least not when compared to an actuarial thriller....

Chapter 1

Keaton sat at the end of the long table wondering if Sammy would show. Sammy was late, but this wasn't unusual. His eyes drifted from the study materials in front of him to the beige walls hanging with the most generic pictures imaginable. They traveled down to the dark gray carpet with an abstract design that was really intended to cover up coffee stains. He watched the blinking light on the old copy machine in the corner indicating that it had another paper jam. He exhaled and took another sip of his coffee.

He had arranged a secret meeting place where there would be no one around to overhear anything, at an actuarial social function. Sammy sent a signal to Reserving yesterday indicating that he had important information about something going on in Pricing. Most actuaries were more loyal to their divisions, but Sammy had started struggling with his exams a couple of years ago. No longer getting the exam raises his lifestyle had grown accustomed to, he offered to sell secrets to Reserving to support his appetite for fast calculators and his growing fantasy football debts.

Sammy finally entered the room and looked around nervously. He spot-ted Keaton and sat down next to him at the table.

"You're late," Keaton reminded him while looking back down at his study materials.

"It'll be worth it," Sammy reassured him. "Did you know that Pricing doesn't perform their own profitability studies? They just take your numbers and subtract 10 points."

"Everyone knows that. Is that what you kept me waiting for, Sammy?" Keaton replied. He was irritable from too many hours of consecutive studying.

"No, no, I have something else," Sammy told him.

"It better be good, Sammy. We're paying you a lot of money."

A dripping could now be heard from the coffee dispenser behind them. Sammy shifted anxiously in his seat and leaned forward, lowering his voice to a whisper. "Pricing is planning to reduce the loss ratios dramatically this quarter. They're going to try to make the business look profitable."

"*Profitable?*" Keaton repeated with disgust. That was one word that any Reserving actuary hated to hear. "How can they do that?"

"They're going to enlist the help of Predictive Modeling," Sammy explained.

Keaton cursed loudly, "Bimodal!" He waited for Sammy to leave and then sent the code for such a scenario back to Reserving. He finished his study time and went back to the Reserving side of the building. He knew there would be an uproar when he returned.

Chapter 2

When Keaton arrived, there was a message on his desk to report to Harris. Harris had been around for years and had seen it all — triangles blowing up, discontinued business, even severe cases of adverse development. His experience had turned him into a hardened Reserving actuary. Some even said that he had lost faith in actuarial methods.

He was standing by the window watching the cars go by below when Keaton arrived. "I'm tired, Keaton," he said, more to the cars than to Keaton.

"Don't start getting all philosophical on me again," Keaton warned him.

"Don't tell me what to do." Harris turned to face Keaton. "I've seen things with my own two monitors that you've only read about in Actex manuals!"

Harris walked back to his desk and sat down heavily. "The head of Reserving is flipping her top." He took out some rolled up papers from his jacket pocket. "Mind if I study?" he asked.

"Go ahead," Keaton told him. Keaton watched as he took out his highlighter and highlighted the word, "conservatism," one of the actuarial considerations, in his study notes. He grabbed a file folder from the side of his desk and tossed it across to Keaton.

"What's this?" Keaton asked, opening the folder.

"Case file on the head of the profitability operation. Goes by the name, Alec." Harris read off his description from a paper on his desk, "Bayesian, prefers Python, has a background in

banking. You get the idea."

Keaton opened the folder. Inside was a picture of a 40-something-year-old man wearing an expensive suit and a wide grin. In the picture, he was strolling past the elevator bank with a model documentation under each arm.

Harris reached into his desk drawer and handed another object to Keaton. "You may need this as well."

Keaton looked at the newly printed company ID with his picture, a fake name, and the title, "Senior Predictive Modeler" on the front. "But what if they suspect me?" Keaton asked.

"We've taken precautions." He handed Keaton a piece of paper. "If someone starts suspecting you, just mention one of these phrases."

Keaton took a look down at the paper and read the first few lines, "'It's over-parameterized.' 'I can build a GLM to model that.' 'What's a loss triangle?'"

"Not bad, but try not to speak so clearly." Harris looked up and fixed his gaze on Keaton. "Be careful, you're entering enemy territory. If they catch you, you'll be forced to sit through hours of statistical video tutorials."

Keaton got up to leave. "Oh, and Keaton," Harris called out. "Find out more and put a stop to it. The future of the quarterly results depends on you."

To be continued in the next issue of the AR. ●

Uri Korn, FCAS, works for AIG in New York City. His first "Actuarial Thriller" is published in AR *May/June 2016.*

The CAS in Asia

The CAS and its members made their marks in Asia promoting the actuarial profession.

Dalian

CUFE-CAS Month Promotes the P&C Profession

In May the CAS and the Central University of Finance and Economics (CUFE) in Beijing launched "CUFE-CAS Month" to promote the P&C actuarial profession in Chinese universities.

The campaign kicked off at the CUFE campus on May 9, 2017. Its goal is to make more students aware of what P&C actuaries do and of the skills necessary for a successful P&C actuarial career.

Pictured, left to right are Yefu Kou, a professor in the CUFE Actuarial Department; Prof. Sujin Zheng, dean of the CUFE Actuarial Science Department; Bo Huang, FCAS, president-elect of the CAS Asia Regional Affiliate ARECA; Prof. Hua Zhou, deputy director of the China Institute for Actuarial Science at CUFE; Xiaoxuan (Sherwin) Li, FCAS, chair of the CAS Asia Regional Committee; and Michael Chou, CAS international relations manager.

The CAS representatives spoke to CUFE professors and students about the P&C actuarial profession's global development and its growing importance in China. CUFE-CAS Month also aims to foster communication and build relationships between the academic and practitioner communities. ●

Allen Visits Dalian University of Technology

CAS University Liaisons are committed to expanding the CAS's influence to students beyond the southeast coastlines and developed areas in China.

CAS Chinese University Liaison Coordinator, Sheen Allen, visited Dalian University of Technology (DUT) on May 13, 2017, marking the first time that a CAS volunteer held a face-to-face meeting at a university in Northeast China. DUT is located in Dalian City, Liaoning Province, People's Republic of China.

Allen talked about the P&C actuarial profession, daily work, and CAS exam preparation, and she presented an

Sheen Allen talks to DUT Students.

example of a P&C pricing project. Later, she answered students' questions.

To keep the discussion going, a Wechat online group of 70 student and faculty members has been formed for

Q&A discussions and job openings in China. The online group also helps students to make the transition from study to work and to further develop their P&C actuarial careers. ●

The CAS Represents at the IFoA Asia Conference 2017

The Institute and Faculty of Actuaries (IFoA) Asia Conference 2017 was held May 11-12 in Hong Kong. A number of CAS members who attended and presented during the conference.

CAS President-Elect Brian Z. Brown spoke about the growing demand for predictive analytic skills and the Actuarial Climate Index, a collaboration among the CIA, SOA, the Academy and the CAS. Brown also discussed the expected growth of actuaries in mainland China due to the government allowing more rating flexibility for motor insurance. ●

CAS President-Elect Brian Z. Brown on panel.

NEW FELLOWS ADMITTED IN MAY 2017

Row 1, left to right: *Alyssa Potter, Benjamin Marshall Permut (FCAS 2016), François Guérard, Diana Shen,* **CAS President Nancy Braithwaite**, *Hoi Cheng (Nicole) Fong, Rong Li, Samanvitha Vangala, Jenna Ann Kice (FCAS 2016).*
Row 2, left to right: *Grace Buckley (FCAS by Mutual Recognition), Sneha Ramesh Soni, Jimmy Chun Meng Tan, Cheryl J. Vu, Guangjin Xiao, Christopher D. Hickey, Hana Jin.*
Row 3, left to right: *Gary James Vadnais, Jean-François Vallée, Ravi Ranjan, Mark Mwiti Kalothi (FCAS 2016), Yevgeni Plaksienko.*

Row 1, left to right: *Samantha Amy Ugol, Laura Bernadette Smith (FCAS 2016), Virginia Jones, Matthew S. Blumenthal,* **CAS President Nancy Braithwaite**, *Gina Marie Consorti, Buu M. Huynh, Nicholas Caramagno, Marion Grégoire-Duclos.*
Row 2, left to right: *Jeremiah N. Reinkoester (FCAS 2016), Jia Wen (Natalie) Tan, Derek Ryan Ziegler, William H. Alpert, Ming Keen Tran, Wesley Jenq, John Wanielista, Matthew C. Morris.*
Row 3, left to right: *Daniel F. Gibson, Andrew Joseph Krieger, Matthew Michael Kershner, Steven Chamberlain (FCAS 2016), Cale Andrew Nelson, Alex B. Lubbers, Ali Ahmed Bukhari, Elvar Snorrason.*

New Fellows not shown: *William Chabot, Hao Ding, Christine L. Garvey, Joseph Homer Gravelle, Clifford Kin Lok Lau, Chun Hei Leung, Vincent Paradis, Leonid S. Plaksienko, Yunshan Qin, Keith J. Raymond, Raul J. Retian, Michael L. Smith, Chunlei Tan, Julie-Anne Thériault-Cauchon, Chi Hang Wong.*

NEW ASSOCIATES ADMITTED IN MAY 2017

Row 1, left to right: *Yong Hao Bai, Buddy Niece, Gregory Spindell, Nicholas Blaubach,* **CAS President Nancy Braithwaite**, *Minh Phan, Victor Lauzon, John Pagliarulo, Jason Nikowitz.*
Row 2, left to right: *Courtney Sibert, Kara Boehm, Nathan Dykstra, Juan McNamara, Marino Vasantharajah, Gao Niu, Dustin Duncan, Xiang Wang.*
Row 3, left to right: *Alyssa Ferrando, Michael Liston, Victor Lopez, Zhoujie Guo, Tyler Eberly, Matthew Galinsky, Maximillian Kehrli, Jason Wix, Andrew Switzer.*

Row 1, left to right: *Phillip Spolarich, Nicholas DeNardo, Jianming Zhang, Fang Shi,* **CAS President Nancy Braithwaite**, *Rachel McNutt, David Ren, Alexander Stemplewski, Shevon Retske.*
Row 2, left to right: *Ruiqi Li, May Ho, Cesar Franco, Katherine Zuckerman, Selene DeWolfe, Nicholas Gurgone, Logan Jaklin, Jonathan Almagro, Michael Burr.*
Row 3, left to right: *Julius Ekow Appah, Nathan Heng, Dmitriy Korogodskiy, Huan Liu, Ravi Sharma, Aaron Halpine, Jill Gonzales, Derek Shupe, Andrew Brooks, Benjamin Kane.*

NEW ASSOCIATES ADMITTED IN MAY 2017

Row 1, left to right: *Erik Fingar, Sunanda Mishra, Yue Xu, Hio Lam Lao,* **CAS President Nancy Braithwaite,** *Ryan Voll, Kirsten Soucek, Young Kyu Park, Lindsey Peniston.*
Row 2, left to right: *Ruth Maringi, Eric Brecht, Debralynn Kahikina, Arthur Okura, Christina Dussault, James Wood, Derrick Bennett, Travis Murnan, Steven Caster.*
Row 3, left to right: *Carl Earnest, Christian Hauprich, Jialing (Jeri) Xu, Mary Beth Lee, Stephanie Dobbs, Robert Henault, Nicholas LeClaire, Stephen Giusti, John Masci, James Bengtson.*

Row 1, left to right: *Wing Chi Eugenie Cheng, Meiching Fong, Stanley Wang, Shuo Zhang,* **CAS President Nancy Braithwaite,** *Kasey O'Connor, Jamie Gallagher, Joshua LaPointe, Ling-Yu Li.*
Row 2, left to right: *Shayn Weidner, Si Hao Cao, Michael Brahm, Benjamin Cheung, Sinead Cummins, Sonia Barlet, Kathryn Yerry, Danielle Brennan, Jennifer Dyson.*
Row 3, left to right: *Neal Holland, Michael Erd, Jonathan Huang, Julia Osborn, Dean Parnell, Carl Sorel, Kedi Wang, Shiyun Zhang.*

Row 1, left to right: *Wenjing Miao, Kwan Cheung, Michael Gordon, Allen Huang,* **CAS President Nancy Braithwaite**, *James Kwok, Amanda Chou, Tasha Jeirath, Joseph Barnett.*
Row 2, left to right: *Gregory Tucker, Wang Xu, Jeffery Chen, Nan Zhou, Katherine Unger, Erica Boulay, Jenny Tam, Joyce Wang, Katherine Buehler.*
Row 3, left to right: *Furquan Burke, Shaolong Wang, Corey Rousseau, Douglas McKean, Kevin Goldsmith, Zachary Kassmeyer, Ellen Raushel, Justin Teal, Michael Donohue.*

Row 1, left to right: *Jonathan Griglack, Daniel Wechsler, Michael Mancuso, Josiane Morin,* **CAS President Nancy Braithwaite**, *Melissa Brisson, Matthew Dunlap, Samuel Cleveland, Justin Morrey.*
Row 2, left to right: *Stacey Smith, Erica Palm, Matthew Gatsch, Stephan Bigg, Troy Meadows, Pauline Bao, Phillip Briggs, David Dunlap.*
Row 3, left to right: *Marc Pezzicara, Zachary Altman, Alan Johnson, Robert Prusiewicz, Austin Lynch, Dean Vanden Bush, Erick Vertein, Jay Call.*

NEW ASSOCIATES ADMITTED IN MAY 2017

Row 1, left to right: *Anna Pan, Yuan Zhao, Megan Hagner, Kathryn Magruder,* **CAS President Nancy Braithwaite***, Ryan Snyder, Promise Tober, Katherine Tubbs, Jacqueline Dufficy.*
Row 2, left to right: *Mu Zhao, Jack Pipa, Winston Tan, Peng Zhao, Xiaoxiao Wang, Mark Woods, Jordan Hammond, Tyler Smith, Adam Weeks.*
Row 3, left to right: *Bethany Giordano, Rabia Momin, Shuai Wang, Zi Chuen Soo, Sebastien Vignola, Michael Murphy, Alexandra Taggart, Codey Mack.*

Row 1, left to right: *Ashley Leonard, Erin Yetter, Ashley Wirz, Mary McAlexander,* **CAS President Nancy Braithwaite***, Sarah Cast, Kelli Chupp, Yuwen Liang, Jodi Gubernat.*
Row 2, left to right: *Samantha Delperdang, Kara Anderson, Neal Kalinsky, Melissa Pinsonneault, Colleen Duggan, Kevin Zech, Bradley Parent, John Laing.*
Row 3, left to right: *Kyle Koenig, Timothy Barnett, Zachary Keller, Salil Tamhane, Alex Sadowski, Kory Raisbeck, Raza Masood, Chao Huang, Patrick Khalil.*

Row 1, left to right: *Joanie Cloutier, Julie Godbout,* **CAS President Nancy Braithwaite**, *Bruno Veillette-Cossette, Mathieu Jacob.*
Row 2, left to right: *Benoit Plante, Will Brown, Amy Carlson, Jordan Pilgrim, Keith Keaveny.*

Row 1, left to right: *Yilin Wei, Matthew Godkin,* **CAS President Nancy Braithwaite**, *Yevgeni Plaksienko, François Guérard.*
Row 2, left to right: *Michael Bertoli, Jonathan Prud'Homme Tasse, Joanie Gosselin-Allard, Dave Prud'Homme Tasse, Vincent Lavallée-Laliberté, Etienne Girard-Proulx, Raphael Milot.*

New Associates not shown: *Chelsea Adler, Ankit Anand, Ka Lap Au, Jeong Baek, Kyle Benzing, John Blaser, Stanislav Bogatine, Anthony Bredel, Jonathan Brockman, Joel Bruxvoort, William Bryan, Alex Butensky, Yanjun Chen, Jaehyup Chun, Ho Chung, Benjamin Conrad, Pelepala Coulibaly, Jillian Cudak, Charles Cullen, Linda Deng, Zhifeng Deng, Earon Denovchek, Jeffrey Dozier, Kathryn Fargnoli, Mikalai Filon, Sarah Fiset, Dennis Funkhouser, Sharifa Garcia, Graham Gersdorff, Xue Han, Keith Hebert, Caitlin Hendricks, Yang Hou, Jing Huang, Alice Hung, Hao Jiang, Nancy Kelley, Emily Kessler, Soon Cheol Kim, Ievgen Korol, Kohei Kudo, Bradford Lee, Edward Lee, Jamie Lenney, Changcheng Li, Nathaniel Loughin, Regina Ma, Adam Marszalek, Sydney McIndoo, Matthew Michaels, Zhen Ming, David Morneau, Andrew Newbill, Jesse Nickerson, Sungho Noh, Daniel Nysch, Jeremy Pachtinger, Walker Parent, Brian Paul, Nicole Perilstein, Jamie Phone, Sophie Poulin, Michael Richard, David Schofield, Darin Showalter, Nicole Sims, Elvar Snorrason, Andrew Spisak, Brandon Stevens, Deepti Tammareddi, Jennifer Teter, Angjela Tiko, Kevin Town, Christian Twietmeyer, Matthew Van Hala, Laurence Verheye, Christopher Walendin, Xiaowen Wang, Yaoyan Wang, Amy Watson, Carolyn Wise, Jonathan Woelfel, Victor Wong, Nicholas Wood, Xialing Wu, Tyler Wykoff, Ting Xia, Tianzi Xie, Fei Xu, Xin Xu, Zheng Xu, Zhuoqun Yan, Jonathan Yiu, Lina Yu, Qianyi Zhao, Yue Zhao, Shi Yong Zheng, Wenjie Zhu.*

Frank Yeou-Gong Huang, FCAS, (right) gets his chance to have a picture taken with the CAS President, Nancy Braithwaite. Huang received his FCAS in November 2016 but was unable to attend the 2016 Annual Meeting.

CAS President Nancy Braithwaite (left) with new ACAS Daniel Nysh.

NEW CHARTERED ENTERPRISE RISK ANALYSTS

Alan M. Parham, FCAS
Parker B. Koppelman, FCAS, CPCU
Diego Fernando Antonio, FCAS

New CERA Diego Fernando Antonio, FCAS, (right) and CAS President Nancy Braithwaite.

NEW FELLOWS BY MUTUAL RECOGNITION

Grace Buckley
Zurich Insurance Company, Ltd
Fellow of the Institute and Faculty of Actuaries, U.K.

Robert John Moss
XL Catlin
Fellow of the Institute and Faculty of Actuaries, U.K.

Shiraj Patel
EY
Fellow of the Institute and Faculty of Actuaries, U.K.

Jayson James Ramdany
AIG
Fellow of the Institute and Faculty of Actuaries, U.K.

IN FOCUS:
THE ACTUARY OF TOMORROW

OCTOBER 2-3, 2017 • HYATT REGENCY WACKER DRIVE • CHICAGO, ILLINOIS

CASUALTY ACTUARIAL SOCIETY

2017 SPRING MEETING

May 21-24, 2017 • Sheraton Centre Toronto Hotel • Toronto, ON

1. **"Step and Repeat."** Spring Meeting attendees capture a moment at the CAS photo station.
2. **Happy to be here!** (Left to right) Claudine Modlin, CAS President-Elect Brian Z. Brown, Camille Minogue and Leslie Marlo stand and are introduced as CAS leaders during the CAS Business Meeting on May 15. Modlin, Minogue and Marlo are CAS Fellows serving on the CAS Board of Directors.
3. **Welcome!** Colleagues catch up at the Sunday Night Welcome Reception.
4. **He shoots! He scores?** Stephen Giusti, a new ACAS and Paul Giusti fan, tries to score on Carey Price at Toronto's Hockey Hall of Fame. Photo credit: Matt Caruso.
5. **Families make merry.** Hina Vignola (top left) and Martin Maringi (top right) celebrate their spouses, new Associates Sebastien Vignola and Ruth Maringi, respectively, at the Reception for New Associates. Accompanying the two are (below, left to right) Sophia Vignola, Sasha Maringi, Abigail Maringi and Kaleb Vignola.
6. **Taking a break.** New FCAS Samanvitha Vangala (left) chats with Jason T. Smith, ACAS.

Foreground photo of Toronto by Getty Images. All others by Craig Hughey, unless otherwise indicated.

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2017

CAS ELECTION

C AS Fellows will vote on a slate of candidates for the CAS Board of Directors and CAS president-elect, with online voting beginning on August 1, 2017. On that day, the CAS will email Fellows a link to the online ballot. Paper ballots will be mailed on August 1 to those Fellows who do not have an email address on file with the CAS office. Completed ballots must be submitted online or returned to the CAS office by August 29, 2017.

In the following pages, readers can learn about the candidates through the 100-word summaries they provided regarding their interest in running for CAS leadership positions. More details about each candidate can be found in the Meet the Candidates section of the CAS website.

Please contact Mike Boa (mboa@casact.org) with any questions or comments about the election process. ●

Meet the *Candidates*

President-Elect Nominee

James K. Christie
FCAS 1982

I have actively volunteered within the CAS and the Canadian Institute of Actuaries for over 30 years. This volunteer experience has positioned me well to take on the role of CAS president-elect. During my term in office my primary focus will be on ensuring the CAS education and accreditation processes continue to be world leaders.

Board Director Nominees

Katherine H. (Kathy) Antonello
FCAS 2001

I am enthusiastic about the opportunity to give back to the organization that laid the foundation for my career, with an emphasis on adapting the educational processes and offerings so that the CAS remains relevant in this rapidly changing environment. With more than 30 years of broad actuarial background, I will strive to bring a unique perspective to the CAS Board by drawing on lessons learned from my company, consulting and bureau experience. My understanding of the varied actuarial needs of numerous stakeholders, including executives, students, companies, regulators and legislators, will help the CAS formulate a competitive strategy and thrive.

Peter Bothwell
FCAS 1984

I have built my career around being a change agent. I have led process redesign projects, built data science capabilities from scratch and sponsored data management, metadata and third-party data initiatives at multiple companies. The CAS is beginning to embrace the rapid evolution that technology has enabled in data and analytics. I would like to help make those changes faster and easier to achieve.

Frank H. Chang
FCAS 2009

I am excited to shape the strategic direction of the CAS. I have held various traditional and nontraditional actuarial roles over my 12-year career. At two different tech companies, I built actuarial teams from scratch. I have created meaningful and engaging opportunities for actuaries and students at both companies. I firmly believe in the value of the education provided by the CAS, but also believe that we need to adapt to maintain that value as our industry and the world evolves. I humbly ask for your vote.

Xiaoxuan (Sherwin) Li

FCAS 2013

The new strategy adopted by the CAS in 2015 requires us to take more care of the international markets besides the U.S. and Canada. In comparison with some other professional organizations, however, the CAS still has many things to do on the road of internationalization. Otherwise, the influence and the brand of the CAS will be weakened gradually in the world in the future. I hope everyone is aware that the CAS does not only belong to the North America but the world, and the CAS is a P&C actuarial solution expert for the whole world.

James P. Lynch

FCAS 2001

I've seen the insurance industry as a skeptical outsider (journalist) and in a variety of roles as a passionate insider (pricing/ reserving, insurance/reinsurance, domestic/international, practitioner/ observer). I believe that background helps me understand the major issues casualty actuaries face: the importance of globalization, the way technology is reshuffling exposures and the need to keep top talent entering the profession. I also believe I can use my background to help the CAS continue to find innovative ways to address these and other challenges as they emerge.

Christopher Smerald

FCAS 1992

I am passionate about the future of the actuarial profession. I have a diverse and international background and have had continual involvement with many of the most important issues affecting the CAS. This includes data science, modernizing our approaches, risk management, improving actuarial communication and value added, and collaborating with other professionals. I have developed strong personal and professional growth through my professional and voluntary commitments. I have a particular interest in improving society for our future and the role of professionals and volunteerism in this. I listen carefully, lead effectively, collaborate productively and value diverse input in challenging situations.

Katey Walker

FCAS 2008

I currently work in Pinnacle's predictive analytics practice area, which requires the ability to assess situations and create implementable solutions, sometimes through complicated methods but more often with negotiation and influence. I would like to invest these same efforts in developing programs and policies that benefit the CAS membership. I have been fortunate to have many opportunities within the CAS — to be on committees, to find mentors, to grow personally and professionally. So, with the thought of "using my powers for good," it would be a privilege to work within the CAS leadership to ensure others have opportunities to succeed.

Caleb M. Wetherell

FCAS 2016

I am committed to advancing the actuarial profession and strengthening the strategic direction of the CAS. I will bring value to the CAS Board through a fresh perspective; recently attaining Fellowship gives me a different angle with which to view the profession. With a lengthy career ahead of me I have a vested interest in ensuring the CAS supports its current and future members by providing the education and resources needed to succeed in the future. ●

Legislative Levee

By ANNMARIE GEDDES BARIBEAU

*Can private insurance help
the National Flood Insurance Program
meet its congressional expectations?*

There is nothing like a statutory deadline to focus legislators on updating programs. At a minimum, Congress is to vote on reauthorizing the National Flood Insurance Program (NFIP) by September 30, or it will lapse. The NFIP, part of the Federal Emergency Management Agency (FEMA), is the nation's primary flood insurer for consumers and small businesses.

"There is huge pressure to resolve it in a timely manner and not let it expire," says Jim MacGinnitie, senior property/casualty fellow at the American Academy of Actuaries (the Academy).

Beyond reauthorizing the NFIP, the direction of reform is significantly different than in the past. As lawmakers consider changes to address the agency's multifold challenges, they are also contemplating provisions to encourage more private insurers to offer flood coverage. The NFIP currently sells up to $250,000 in property coverage to residential customers and $500,000 for businesses.

Many insurers are interested in offering flood insurance, says Nat Wienecke, senior vice president of federal government relations for the Property Casualty Insurers Association of America (PCI). "There are quite a few companies that feel they can offer not just equal but better coverage and can be price competitive," he adds.

Private sector interest in flood insurance stems from a convergence of developments. Reinsurers, which have been backing private sector policies in other countries, possess a growing appetite for offering flood insurance in the United States. Excess capacity has been triggered by several factors, including a decade of low interest rates, which compels reinsurers to seek out new markets, said Rade Musulin, vice president of the Academy and chair of its Flood Insurance Work Group. In other countries, private insurers often profitably underwrite flood insurance.

Musulin explains that there is also greater data availability and technological innovations that are piquing insurer interest. (See sidebar.) "Modeling technologies similar to those used in other fields, such as earthquake and tropical cyclones, have helped improve many other markets including flood," he adds.

Other stakeholders, such as the Center for Economic Justice, a consumer advocacy group, and state regulators through the National Association of Insurance Commissioners (NAIC), see expanding privatization as a way to better serve consumers. "The NAIC supports legislative efforts to facilitate the growth of a state-regulated private flood insurance market," reads the organization's letter to Congress dated May 2, 2017, "to help provide consumers with more choices and coverage potentially at more affordable prices."

Strengthening the private market, however, could also weaken the NFIP's position to meet its legislative mandates. This raises the public policy question: What is the best way to ensure that American lives and property will be protected from current and long-term losses? "The right way forward is to blend the best of both worlds to produce good public policy," Musulin says.

Considering this question and related implications begins with understanding why the federal government became a public flood insurer in the first place.

Why the NFIP?

The NFIP was a long way in coming. By 1929, the private insurance industry effectively stopped offering coverage, according to "A Chronology of Major Events Affecting the National Flood Insurance Program," published by FEMA in 2005. In 1952, President Harry S. Truman pushed for a federal flood insurance program, recommending $50 million to start it, the report notes. Congress passed the National Flood Insurance Act of 1968, which included creation of the NFIP.

Congress tasks FEMA with several roles to serve the public interest, with the purpose of reducing federal financial exposure to flood loss, improving community resilience to flooding, mitigating potential damage to properties and speeding recovery after a loss. This article focuses on the NFIP's role as the nation's primary insurer against weather-related flood loss, the private sector's potential expansion into the flood insurance market and potential implications.

Since its inception, the NFIP's insurance role has been fraught with conflicts stemming from various congressional mandates, according to *The National Flood Insurance Program: Challenges and Solutions*, written by the American Academy of Actuaries' Flood Insurance Work Group and published in April. The conflicts, in short, are that the NFIP must collect sufficient premium to cover losses *and* provide subsidized rates to a significant number of policies *and* charge affordable premiums to expand participation *and* pay off its debt to the U.S. Treasury.

The NFIP started operations in 1969. Since that time, the agency has been able to borrow money from the U.S. Treasury as needed and pay it back, according to "Flood Insurance: Comprehensive Reform Could Improve Solvency and Enhance Resilience," released by the U.S. General Accountability Office (GAO) in April.

That changed in 2005, when hurricanes Katrina and Rita

> **The conflicts, in short, are that the NFIP must collect sufficient premium to cover losses *and* provide subsidized rates to a significant number of policies *and* charge affordable premiums to expand participation *and* pay off its debt to the U.S. Treasury.**

— among the top 10 most costly U.S. storms — contributed to an additional $16.6 billion of debt to the U.S. Treasury, according to the GAO report. Hurricane Sandy added $6.25 billion more to the debt in 2012. As of March 2017, NFIP owed $24.6 billion to the Treasury.

The NFIP also faces program participation and retention issues. It is common for people to buy flood coverage after a major weather event only to drop it later, according to the NAIC's Center for Insurance Policy and Research's report, "Flood Risk and Insurance," released in April. The NAIC report also cites research estimating that about half of those who live in a 100-year-flood plain, also known as Special Flood Hazard Area (SFHA), do not purchase coverage and that participation outside of SFHAs is low.

According to FEMA.gov, NFIP's average flood claim payout is $43,000 and the average annual premium is $700. Flood insurance penetration is in the high single digits in the United States, indicating a large potential market, Musulin says. As of March 31, there were 4.99 million policies in force nationwide, generating $3.5 billion in premium (excluding surcharges) and $1.2 trillion in coverage.

This is a mere slice of the overall potential need for flood insurance. The potential total property exposure to flood loss, including buildings and contents, was estimated to be more than $90 trillion for the year 2014, assuming that all the nation's properties need flood coverage, according to "Increasing Concentrations of Property Values and Catastrophe Risk in the US," a report published in 2015 by Karen Clark & Company, a catastrophe modeling firm.

Of that $90 trillion, 45 percent is residential property and another 24 percent are industries with mostly small businesses, says Karen C. Clark, the company's president and CEO. This means that the potential coverage need could be more than $62.1 trillion.

Unpacking Some NFIP Challenges

The NFIP faces several challenges in satisfying congressional mandates. Perhaps most notably, the agency does not collect sufficient revenue to pay its losses, especially those caused by catastrophic flood events. This is largely due to past congressional directives requiring coverage to be affordable and because catastrophe loss potential historically has not been fully factored into rates.

The NFIP looks at rating differently than private insurers would, Musulin says, because the agency was created to address many problems beyond offering affordable and available flood coverage. "The NFIP has a tool kit built to solve what Congress has asked it to solve and Congress has changed priorities over time," he explains, "The tool kit is different than what insurance companies would use."

It can be argued that underwriting flood risks is much more difficult than any other major peril. Coastal storm frequency tends to be low by geographical location and severity can be quite high. Add to this the many causes of flooding, including: rain, rapid snow and ice melt; failure of dam or levee; or just unusually high tides.

Further, robust flood insurance models have only recently become available. As result, they are relatively untested in the United States, according to the Academy report. While catastrophe hurricane models have been around for years, inland flood models were just released a couple years ago, the Academy report notes.

"Developing rates between areas with riverine flooding exposure and those on the coast is very different," Musulin says. Catastrophic coastal floods have low frequency but extremely intense losses often driven by tropical cyclones," he explains. Meanwhile, "riverine areas have more gradual losses that occur in a much wider area and generally affect the first floor as opposed to an entire structure," he adds. Currently, the NFIP does not distinguish rating between these very different perils.

In the midst of this, the NFIP has a rating structure designed to meet the congressional mandate to make flood insurance more affordable. About 78.5 percent of NFIP policyholders pay "full-risk rates," which differ from actuarial rates that insurers would charge, according to the Academy report. This majority of NFIP policyholders pay premiums to help subsidize the other 21.5 percent.

These subsidies, according to the Academy report, only apply to the $60,000 basic limit of coverage. However, while the average subsidy is about 50 to 55 percent of full-risk premium, the average rate per subsidized policy is nearly three times the average price of full-risk rated policies, the report notes. This does not include the NFIP's additional fees, including the policy surcharge for mapping and paying off past debt. Musulin says that these considerations would not be included in a private sector rate base.

Homeowners are often not aware of their subsidies or their properties' risk potential. Instead of baking subsidies into the rates, MacGinnitie says that the NFIP should transparently indicate discounts to policyholders. This will help insureds understand their degree of risk, which should encourage flood damage mitigation, he explains.

One key point Musulin makes is that FEMA and private insurers have significantly different mandates, which helps explain why its approaches to problems sometimes seem very different. A specific example he cites is that FEMA is interested in a forensic understanding of a neighborhood for flood mitigation, leading the federal agency to invest significant resources in mapping.

The NFIP relies on these same maps for rating, Musulin explains. The maps identify risks in SFHAs (also known as the 100-year-flood plain) and those that are not. This triggers many government requirements, including community mitigation plans and mandatory purchases of flood insurance to qualify for mortgages.

Location of property on FEMA maps oversimplifies the risk variation among properties. This can give consumers a false impression that coverage is not necessary, experts say. This approach is problematic for attracting and retaining customers, MacGinnitie says. "If people believe they are on the right side of the line they think they do not need coverage."

This false impression unnecessarily exposes consumers to absorbing damages the NFIP was created to cover, sources say. This also leads rating inequities among policyholders. In contrast to the NFIP, MacGinnitie says, "The private market will have zones or individual risk rating and charge you less the further you get from the river."

Musulin says that private insurers take a more risk-level view consistent with their use of house-specific pricing. The NFIP does consider specific property factors, including elevation, category of FEMA flood risk zone, occupancy type, number of floors and the nature of basement or crawl space, says Andy Neal, the agency's chief actuary. In contrast,

Musulin says, private insurers take a more robust individual property assessment for finer rating and include factors such as the property's value, type of electrical wiring, power cut-off and contents.

The NFIP needs forward-looking maps to account for rising sea levels, Musulin says. Currently, he explains, the maps reflect today's hydrology. FEMA has tools to forecast future conditions but these are generally limited to looking at the effect of development on drainage such as parking lots, though they could be used for examining sea-level rise. "The program's large inventory of coastal properties makes consideration of rising sea levels critical, particularly when you consider the NFIP's effect on building codes," he adds.

> "The real problem is that we are building things that will last 50 years (absent being washed away) based on today's exposure to floods when in fact we need to be considering the conditions that will exist over the design life of the building."
> —*Rade Musulin*

While private insurers are considering entry into the flood market due to new tools to assess flood risk, the NFIP is in the process of deploying many of them. "We are looking to incorporate current practices industry uses," Neal says. This includes moving to more granular rates, considering inland and coastal flood models and adopting latest actuarial science techniques to make sure NFIP rates are "credible and accurate," he adds.

Making changes to the NFIP takes a significant amount of time, according to the Academy report, due to congressional oversight and because the federal rulemaking process can take up to two years. A cursory look at legislative changes in recent years also demonstrates how Congress can impede the NFIP's financial progress. The Biggert-Waters Flood Insurance Reform Act of 2012 contained provisions to improve the NFIP's financial strength, including phasing out discounted insurance premiums and moving towards full-risk rates, according to the GAO report. The Homeowner Flood Insurance Affordability Act of 2014 (HFIAA), however, decelerated movement toward implementing risk-based rates and renewed some subsidies, the report notes.

However, Neal says that evolving the rating approach does not depend on new congressional legislation.
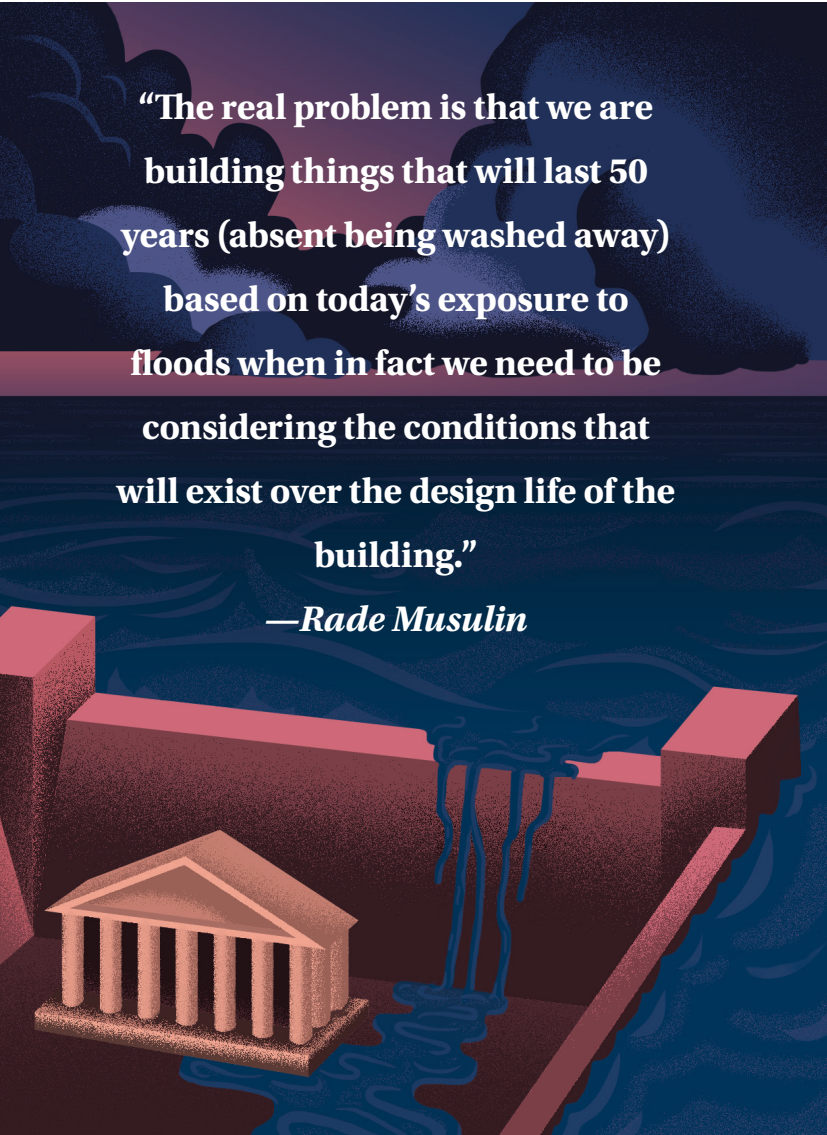
What is unknown, MacGinnitie says, is "How long will rate changes take and what will they look like?"

The Case for Greater Privatization

Sources agree that technological improvements and the reinsurance appetite for covering flood risk largely explain why insurers' interest is growing.

Private insurers can offer multifold benefits. Besides deploying finer-tuned rating structures, carriers could expand available products and coverage. For businesses, packages could include other types of insurance such as business interruption coverage. For residential properties, insurers could either fold coverage into homeowners and renters policies or offer it as an endorsement. "(It's) more efficient to offer one product that covers fire, wind and flood," says Birny Birnbaum, executive director of the Center for Economic Justice.

MacGinnitie points out, "If you can get this in a homeowners policy or as an endorsement, two good things happen." First, more people will be covered for flood. Second, even with claim causation issues such as water vs. wind, policyholders would be covered.

Promising Developments

Until recently, the private sector lacked sufficient information and tools to confidently underwrite flood coverage in the United States. Thanks to higher quality data and technological innovation, the understanding of flood risk is improving, boosting the confidence of reinsurers, excess insurers and an increasing amount of private insurers.

The same big data revolution affecting other insurance lines is also providing more insight into flood coverage, says Rade Musulin, vice president of the American Academy of Actuaries and chair of its Flood Insurance Work Group. For example, insurers can glean more property specific information that was too costly to collect in the past.

Several new tools have recently become available, such as mobile LIDAR, which uses light detection and ranging to reveal house level elevation. "Mobile applications are being developed that can provide a quote from an iPhone and bind in two minutes," he says. Even Google Street View will support underwriting from a remote location instead of requiring a costly physical inspection, he adds.

Greater storage capacity and computing power are also greatly improving flood models, says Karen C. Clark, president of Karen Clark & Co. Not only are property and hazard characteristics data fuller and more accurate, but also weather and flood models have grown in sophistication, she says. "There's higher resolution data and more ability to analyze them," she adds. Her company offers transparent models that show the underlying data and methodologies along with high-resolution interactive maps, instead of black box models that offer only a numerical value.

Standards for evaluating flood models are also underway, according to "The National Flood Insurance Program: Challenges and Solutions," written by the American Academy of Actuaries' Flood Insurance Work Group and published in April 2017. The Florida Commission on Hurricane Loss Projection Methodology, which is developing such standards, is considered to have the most complete set of requirements for development and use of hurricane models in the United States, the report notes.

Since people tend to automatically renew homeowners and renters policies, offering flood insurance could encourage retention. Experience is showing that the private sector already does a better job at retention, Wienecke says. "Even just having the ability to settle the claims using the company's methods, rather than those mandated by the federal program, may lead to less disputes and better results for private sector policyholders," he adds.

Right now, Musulin says, the NFIP primarily offers credit for raising a structure above the flood elevation. Private insurers often offer a range of mitigation credits, often costing much less than elevating a structure. Rewarding policyholders for more modest mitigation strategies would also improve risk, MacGinnitie says.

Insurer Interest

Private insurers are already involved in the flood market. According to the NAIC report, there are about 20 insurance products in the nation.

Also, private insurers participate in the NFIP's Write Your Own (WYO) program. They act as third-party administrators and, along with insurance agents, sell the majority of policies (though coverage can be purchased directly from the NFIP). Currently, there are about 900 active home or farmowners insurers, with fewer than 8 percent of eligible WYO insurers choosing to participate, according to PCI.

"The number of WYOs in the program has dropped from 107 to 70 since 2004 — more than 35 percent," Wienecke says. Several household name insurers, including State Farm, Travelers and Nationwide, have left the program in recent years, he adds. Among the reasons are the "narrow" average profit margin of 4 percent, the program's growing complexity to administer and reputational issues. After Hurricane Sandy, he explains, the media portrayed insurers as being unfair to consumers when in most cases, this was due to NFIP rules.

Whether private insurers should begin selling small-risk flood insurance boils down to profitability. Before Biggert-Waters, a 2011 PCI study revealed that private insurers could not compete with the NFIP's prices, Wienecke says. At that time, private insurers' premiums would have averaged twice the NFIP's low-risk policies and as much as four times more for higher risk properties, he explains. However, since the NFIP is

moving slowly closer to government-determined risk-based rates, the picture is different today.

Private sector interest in offering flood coverage is not universal. While surplus lines and reinsurers are very much in favor of providing coverage, MacGinnitie says that there is reluctance among some of the household name insurers. "These companies are worried that if they get (involved) in flood insurance in a big way they might be forced to subsidize rates," he explains, "just like what sometimes occurs in auto and hurricane coverage."

Insurers are concerned about the degree of profit potential, the regulatory environment, and possible fees and subsidies, Musulin says. While flood insurance is widely available in other countries, he explains, rates are often unregulated. Therefore, insurers' willingness to offer coverage will also depend on the flexibility of state regulators when private insurers gain new insight and need to adjust rates. Further, since there has been relatively little private flood insurance offered in the United States, models are largely untested and the market is immature, he explains.

While the details of weather models have greatly improved, rising sea levels and growing population density in coastal areas put more properties at risk. The Actuaries Climate Index and the National Oceanic and Atmospheric Administration show sea levels are clearly on the rise, according to the Academy report. When considering risk, Musulin says, the effect that maps have on building codes is critical. "The real problem is that we are building things that will last 50 years (absent being washed away) based on today's exposure to floods when in fact we need to be considering the conditions that will exist over the design life of the building," he adds.

Higher risk potential, however, is not a deterrent for insurers. The challenge is to find the "equilibrium price where insurers are willing to sell it and people willing to buy it," Clark says. While models have come a long way, she adds, it is important to keep in mind that there will always be much uncertainty with flood perils because the nature of low frequency events means data is limited.

Congress also would have to remove a laundry list of impediments to encourage private insurance participation. The PCI would like to see greater lender acceptance of private flood policies, Wienecke says. The organization is also advocating for policyholders to be able to move between the private market and the NFIP without penalty, with the NFIP viewing these policyholders as having continuous flood coverage.

Legislation should also require FEMA to share its data, Wienecke says. The optimal approach, sources say, is for the NFIP and private insurers to share data through a third-party aggregator such as Insurance Services Office, Inc. or the Independent Statistical Service, Inc. Further, Wienecke adds, the WYO noncompete clause should be eliminated, with the understanding that a WYO's propriety data will not be used to unfairly compete.

In a statement before the Housing and Insurance Subcommittee Financial Services Committee in March, Roy E. Wright, FEMA's deputy associate administrator of federal insurance and mitigation administration, said that, for its part, FEMA supports private insurers offering flood coverage.

However, Wright also expressed concerns about adverse selection. "This could lower NFIP premium revenue while increasing potential claims payouts. Such actions would leave the program and taxpayers with even more financial risk," he said. Already, private insurers are selectively picking specific properties in SFHAs that could be overpriced, according to the NAIC report.

Conclusion

Congress started the NFIP because private insurance was unprofitable. Thanks to finer rating techniques, greater data, recent technological innovation and reinsurance appetite, there are good reasons to believe private insurers will have the profit incentive necessary to reenter the flood market after a nearly century-old hiatus. After all, flood insurance is profitable in other nations.

While the NFIP is in the process of implementing many of the new developments that are enticing private insurers to offer flood coverage, it faces several issues, including financial debt, low consumer participation and inadequate maps for granular ratemaking.

Many of NFIP's struggles stem from contradictory congressional directives. Sorting out an optimal public-private partnership for covering flood loss likely will take more time than the September 30 deadline allows. ●

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ERM FOR THE P&C ACTUARY

Big Data Meets Literature

Nabokov's Favorite Word Is Mauve: What the Numbers Reveal About the Classics, Bestsellers, and Our Own Writing **By Ben Blatt, Simon & Schuster, 2017, 288 pp, $25.**

*T*he Federalist Papers are a collection of 85 essays written by Alexander Hamilton, John Jay and James Madison to promote the ratification of the U.S. Constitution. The three men all used the pen name "Publius" to preserve the anonymity of each essay. Years later, both Hamilton and Madison published lists that named the author of each essay. But for 12 essays, both Hamilton and Madison claimed authorship. Historians studied the documents, using the political ideology espoused within to try to determine who wrote what. Their work was inconclusive, and the mystery remained unsolved for over 150 years. In the 1960s, two statisticians and professors, Frederick Mosteller and David Wallace, used statistically inferred probabilities and Bayesian analysis to address the problem. They compared the frequency of 30 common words — for example, the number of times the word "upon" is used per 10,000 words of text — in the disputed essays to the frequency in papers known to be written by either Hamilton or Madison. They concluded that Madison was the author of all 12 essays. Later statistical studies performed by other authors agreed with this conclusion.

By necessity, Mosteller and Wallace went about their word-counting exercise in a rudimentary way: They cut paper copies of the essays into individual words, then alphabetized and counted. (In the book describing their research, they write, "During this operation a deep breath created a storm of confetti and a permanent enemy.") In *Nabokov's Favorite Word is Mauve*, statistician and journalist Ben Blatt builds upon the work of Mosteller and Wallace, using digitized texts and modern computing power instead of paper and scissors. Like Mosteller and Wallace, Blatt studies the unique fingerprint that defines an author's style, but he asks a broad range of other questions as well, from whether writers follow their own writing advice, to how word choice varies between male and female authors. Most of Blatt's work concentrates on fiction novels — classics, modern literary fiction and popular bestsellers.

One area of exploration is the use of adverbs. English students are warned to avoid them. Acclaimed authors shun them. ("I believe the road to hell is paved with adverbs," says horror writer Stephen King.) Hemingway, the master of tight prose, is praised for not using them. But do the best writers really use fewer adverbs? Blatt used a suite of programs and libraries called the Natural Language Toolkit to count the number of adverbs used by Hemingway, King and several other authors in their complete bodies of work. The results are surprising. Hemingway and King both use adverbs at a higher rate than E. L. James,
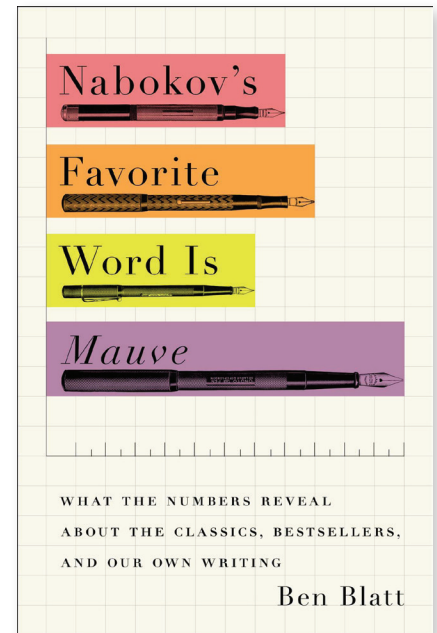
author of the erotic *Fifty Shades* trilogy. And Hemingway's usage is also slightly higher than that of Stephenie Meyer, author of the *Twilight* series.

But wait — are all adverbs the same? Isn't it the ones that end in -ly ("swiftly," "slowly," "softly") that stand out? Adverbs like "not," "also" and "often" generally slip by unnoticed. And it's plausible that top writers can create vivid scenes without needing to rely on these -ly adverbs. Toni Morrison, Nobel Prize-winning author of *Song of Solomon* and *Beloved*, said in an interview, "I never say 'She says softly.' If it's not already soft, you know, I have to leave a lot of space around it so a reader can hear that it's soft." When Morrison builds

a scene with enough details to let readers *hear* the softness, there's no need to *tell* them it's so.

Considering just the adverbs that end in -ly, Blatt compiles results that align closer with expectation. Hemingway's usage is almost half that of E. L. James and about 40 percent lower than that of Stephenie Meyer. In this test, the master of concision lives up to his name. And it's not just better writers who use fewer adverbs. Blatt even found that within a great author's canon, his most popular books tend to have the lowest -ly adverb frequency. For instance, Hemingway's lowest -ly adverb rates are found in his most popular works, including *The Sun Also Rises* and *A Farewell to Arms*. His less well-known novels, like *Across the River and Into the Trees* and *True at First Light*, have the highest rates.

Some might protest the distillation of art into numbers and graphs. But the data has a lot to say about what makes an author great, and why certain of that author's works are more popular than

others. It's one thing to analyze a section of tight prose from a Hemingway classic and quite another to review data show-

Some might protest the distillation of art into numbers and graphs. But the data has a lot to say about what makes an author great, and why certain of that author's works are more popular than others.

ing that his prose is significantly tighter, in a statistical sense, than that of other authors.

The author's enthusiasm for literature comes through as strongly as his zeal for statistics. Blatt doesn't just condense data into graphs, though he does this very well. He also posits *why* the data shows what it shows. (Why, for example, might the highest-acclaimed books use the fewest -ly adverbs?)

Readers seeking details on the methods used to produce Blatt's results might be left disappointed. But this type

of reader isn't Blatt's target audience; he says in his introduction, "You probably don't care about the Poisson distribution or the parsing program used to decipher parts of speech." And besides, the basic idea isn't overly complex. Blatt is essentially counting the relative frequency of certain types of words and phrases. The innovation is in the use of text analysis to answer questions about writing and uncover patterns in great literature. ●

Julie Lederer, FCAS, MAAA, works for the Missouri Department of Insurance, Financial Institutions, & Professional Registration.

ETHICAL ISSUES

Should Reserves Reflect Anticipated Savings?

Ethical Issues is written by members of the CAS Committee on Professionalism Education (COPE). The column's intent is to stimulate discussion among CAS members. Therefore, positions are sometimes stated in such a way as to provoke reactions and thoughtful responses on the part of the reader. Responses are welcomed. The opinions expressed by readers and authors are for discussion purposes only and should not be used to prejudge

the disposition of any actual case or modify published professional standards as they may apply in real-life situations.

Editor's Note: *This article was published previously in the Ethical Issues column in the November 2000 issue of* Actuarial Review. *COPE made some small adjustments and updates, but the title and topic addressed are essentially unchanged.*

Jane Smith, FCAS, MAAA, is a consulting actuary. Jane has been asked to complete an actuarial analysis of Widget Incorporated's (Widget) self-insured workers' compensation program. Widget has been self-insured for workers' compensation for the past 20 years but has never staffed a risk management or safety department. As might be expected, Widget's self-insured losses are ap-

proximately 50 percent higher than losses that would be expected based on industry rates and Widget's level of payroll by job class. Claim frequency is approximately 20 percent higher than the expected level.

Jane has just completed her loss reserve analysis, projecting a required retained loss reserve of $50 million for past accidents and $10 million for the prospective accident period.

Before presenting her results, Jane learns that Widget has just hired Betty McCormick to fill the newly created position of Risk and Safety Manager. Betty joins Widget from Trinkets Incorporated

historical accidents and a 50 percent reduction in the prospective period. Betty's compensation is partially tied to the reduction in losses that she can achieve.

Although Jane recognizes that Widget's lack of risk management has likely led to their higher than average loss experience, Betty has not provided any concrete evidence of the effectiveness of her proposed programs. She has not actually put any of these programs into place yet at Widget, nor has the company budgeted for them. In addition to the company financial statement accrual, Jane is also required to issue a state-

should consider whether there have been significant changes in conditions, particularly with regard to claims, losses, or exposures, that are likely to be insufficiently reflected in the experience data or in the assumptions used to estimate the unpaid claims." Note, however, that Jane should remember to disclose the change considered as required by paragraph f in section 4.1 of the same standard.

- Section 3.7 of ASOP No. 36, "Statement of Actuarial Opinion Regarding Property/Casualty Loss and Loss Adjustment Expense Reserves," indicates that a reserve should be considered reasonable if "it is within a range of estimates that could be produced by an unpaid claim estimate analysis that is, in the actuary's professional judgment, consistent with both ASOP No. 43, "Property/Casualty Unpaid Claim Estimates," and the identified stated basis of reserve presentation."

Can Jane produce a report and corresponding actuarial opinion that incorporates Betty's estimates of the likely impact of these new programs?

(Trinkets), Widget's main competitor. Jane reaches out to Betty to discuss any potential operational changes. Betty enthusiastically tells her about her tenure at Trinkets, indicating that her programs reduced workers' compensation costs and claim frequency by 75 percent and 50 percent, respectively. She further indicates that she has studied the situation at Widget and believes that the programs implemented at Trinkets can also be effective at Widget. As such, she feels very strongly that it is appropriate for Jane to reduce her loss reserve and prospective period estimates to incorporate the likely impact of these programs. Betty thinks that it is reasonable to expect a 33 percent drop in the costs associated with

ment of opinion regarding Widget's loss reserves to the self-insurance regulators.

Can Jane produce a report and corresponding actuarial opinion that incorporates Betty's estimates of the likely impact of these new programs?

Yes

It is appropriate for actuaries to consider operational changes in the loss projection process. At least two specific professional statements/standards give us guidance in this area:

- Section 3.6.7 of Actuarial Standard of Practice (ASOP) No. 43, "Property/Casualty Unpaid Claim Estimates," addresses changing conditions. It states: "The actuary

No

It would be inappropriate for Jane to reduce her figures without any hard evidence of the implementation and impact of these new programs. This is particularly true since Betty's compensation is tied to loss experience. It is very common for new risk managers to feel that the changes that they implement will produce significant savings. While incorporating operational changes is appropriate, the standards of practice do not require the actuary to use an unsubstantiated figure. ●

Getting the Most Out of Your Capital Model BY JIM LYNCH

Capital models can do so much more than fulfill regulatory requirements — they can improve decision-making. At many insurance and reinsurance companies they do, while at others it can seem like the models, having satisfied regulators and rating agencies, are underutilized.

How can companies make the most of their models?

Three actuaries considered the question in a panel session titled "Economic Capital Modeling — Is It Impacting Business Decisions?" at the Casualty Actuarial Society Spring Meeting in May in Toronto.

The actuaries, all veterans of capital modeling and enterprise risk management, included: Kendra Felisky, FCAS, member of the CAS Board and a past chief risk officer for a European insurance group; David Ingram, FSA, executive vice president at Willis Towers Watson and a well-known thought leader in ERM; and Kevin Madigan, ACAS, CERA, chair of the CAS Risk Management Committee and a director at Willis Towers Watson with years of capital modeling and ERM experience.

The panelists held a wide-ranging discussion, and two themes emerged: numbers and communication.

Numbers

The modeling process has quantification at its core. Even the risks that defy quantifying — reputation and operations, for example — are assigned a number.

But Madigan noted that most people don't look at risk quantitatively; only actuaries do. "We're the ones who think about it in terms of numbers and exact probabilities," he said.

The numbers issue has several facets. Regulators and others are interested in the extremes of capital models — for example, how much capital is needed to survive a 1-in-100 year event? The mathematics, such as using copulas, is complex.

While companies need to understand the extremes, the managing of a business mostly involves means and averages — the everyday. Said Ingram: "People filter out rare events." A 1-in-200 year event "is much too remote to think about." In his experience, the only time that management worries about solvency is if they are solvency-challenged at that moment.

Unfortunately, non-quants tend to shy away from numbers. They rely on actuaries for number-crunching, but that can be a problem if boards and executives also cede the curiosity and skepticism critical to their job.

Said Felisky: "We'd like to get away from when the actuaries went into isolation and came back with an answer" and the board "has no understanding why the number changed."

If the model seems confusing or irrelevant, it is more likely to be underutilized.

Actuaries should emphasize that models can help understand the everyday. They can estimate the probability that a company will hit or exceed a plan, Felisky said, or the probability of breaking even. They can also look at earnings volatility as well as facilitate important activities like reinsurance purchases or planning. Some companies have even used models to help set salaries, though Madigan argued against the practice, as it jeopardizes buy-in and could subject the model to attack.

Maximizing the use of the model has a regulatory benefit as well. In many jurisdictions, one of the most important risk management tests is the use test, in which a regulator assesses how well the risk management process is integrated into the operations of the company. That ensures the model is utilized, Felisky said. "The use test is paramount."

Communication

If a lack of expertise — and a little innumeracy — holds back model understanding, it often falls on actuaries to communicate more clearly.

One way is to educate.

Felisky says that, primarily due to Solvency II, European boards have joint and several responsibilities for the model; this gives board members plenty of incentive to know the model well. "The best thing for communicating is

Said Felisky: "We'd like to get away from when the actuaries went into isolation and came back with an answer" and the board "has no understanding why the number changed."

training," she said. She knows of boards going on "multiple away-days" to discuss relevant issues such as underwriting risk and how the model handles it. "Once you've got the board trained, they know what questions to ask," she said. "They know what they are seeing."

Madigan emphasized that management should be educated repeatedly on the model, though not necessarily on the details. The results that management sees should be succinct. "It should say, 'This is what we did. This is why we did it. Here is the result.'"

Ingram suggested taking a cue from catastrophe modelers, with whose work management is more familiar. He has noticed that executives respond to simple reports — maps that are red, orange and yellow to indicate how much risk exists in different areas. Communicating concisely is important in the rest of the organization as well.

The model should be flexible, Felisky said, so that parts of it can be run quickly to respond to business needs. That means setting up the model so that it can be run piecemeal. That way it can

be quickly updated to learn more about, say, alternative reinsurance programs.

In the end, Madigan said, it is important that the modelers "understand the psychology of the people using the model."

Modelers need to give management "the information they need and want" so "they will actually use it in a way that is understandable." ●

James P. Lynch, FCAS, is chief actuary and director of research for the Insurance Information Institute.

Internet of Things: A New Flood of Data Awaits BY JIM LYNCH

In today's interconnected world, it seems like anyone can keep track of anything from anywhere. That's an exaggeration, of course, but the ability to remotely monitor via the internet promises to change how insurance policies are priced and underwritten and how claims are handled.

That's the promise. And while it seems clear that the Internet of Things (IoT) will affect insurance, there are some questions regarding how great the impact will be.

A pair of speakers examined the potential implications at the 2017 CAS Spring Meeting in Toronto in May. One looked at homeowners insurance, the other at workers' compensation.

There are about 2.3 billion items — e.h., cameras, refrigerators, blenders — that are plugged into the internet, and estimates say there could be 13.5 billion by 2020, said George Hosfield, a senior director at LexisNexis Risk Solutions.

He laid out the insurance potential of IoT with the story of a colleague

whose teen child flushed a wad of paper towels down a second floor toilet that had a faulty shutoff assembly. The ensuing flood poured into the kitchen, causing a multi-thousand-dollar claim.

"It was a major thing that could have been easily prevented with technology today," he said. An IoT water moisture sensor on the bathroom floor would have detected the water earlier and pinged a smartphone, preventing (or at least mitigating) the claim.

There are other examples, like a smoke alarm that pings a smartphone when it goes off.

Insurers have several ways to raise interest in such devices, Hosfield said.

1. They can co-market with the device provider or give the device to their customers as a promotion, where the law allows.

2. They can offer an early-adopters discount, anticipating that the device will lower claims or that early adopters of safety technology will tend to be safer risks overall.

3. They can pay for the mitigating device themselves, expecting a net cost savings.

4. They can rate based on confirmation that the device is present and active.

5. Finally, they can employ an actuarial approach to the live data sent by the device, using it to rate by identifying patterns of behavior that correlate to the insured's risk profile.

Right now most carriers that are engaged with smart homes are between steps 2 and 3, Hosfield said.

In the long run, how much of a discount is possible? It depends, of course, on what consumers choose to monitor.

Consumers prefer anti-theft devices, he noted, but those make up a relatively small portion of homeowners insurance non-cat loss costs. Most losses come from fires and non-weather water claims, like that overflowing toilet, but people aren't buying sensors that monitor those.

Another challenge for insurers will be sifting through all the data those billions of devices are collecting. Not only is there a lot of data, there is no guaran-

In manufacturing, for example, the number of serious injuries declined 63 percent from 1993 to 2012, a falloff only partly explained by the decrease (33

patients — as an example of how new technology could work. The device could intervene at four stages:

- Prediction — telling in advance that the patient will be difficult to lift.
- Real-time monitoring — determining if the hospital aide is moving the patient correctly.
- Assistive — indicating if more than one person is needed to lift the patient.
- Robotic — eventually, replacing the worker with a robot or other device.

An insurer would want to have ways to analyze and monitor each of these, Rousmaniere said.

The promise today is that an IoT device could alert managers when an employee gets hurt or — even better — determine when a hazard looms.

tee that the data feed from one brand coffeemaker, for example, will look like the feed from another.

It may make sense, Hosfield said, for insurers to partner with a data platform that translates the disparate information into a single feed.

While home monitoring is just starting to establish itself, worker monitoring via IoT promises to be the next phase of a generations-long trend of technology making safer workplaces, said Peter Rousmaniere, a journalist who has written about workers' compensation insurance for decades.

percent) in manufacturing jobs over the same time period.

The promise today is that an IoT device could alert managers when an employee gets hurt or — even better — determine when a hazard looms.

The improvements not only reduce injuries, he said, they increase productivity — an added incentive to employers.

"Behind every work injury is a productivity advance trying to get out," Rousmaniere said.

He focused on hospital injuries — specifically, those caused by lifting

Hosfield, the homeowners expert, listed these steps for insurers and actuaries to learn more:

- Get engaged, perhaps by getting an IoT device, to see how it operates and what data it gathers.
- Work with data partners to determine how best to mine data.
- Be realistic about what the IoT can deliver. "It isn't going to be a panacea, but it will be useful." ●

Insurtech: Marrying the Promise to Reality BY JIM LYNCH

The digital era is transforming society, and the insurance industry is along for the ride.

Call it *insurtech* — technologies that change the way that insurance is priced, sold or administered.

Naturally, actuaries are interested in this combination of insurance and technology. About 60 turned out for a session at the CAS Spring Meeting in Toronto titled "An Introduction to Insurtech." They heard an overview of the hot-growth topic and got an up-close look at how insurtech startups operate from two industry professionals.

CAS Fellow Adam Troyer, a managing director at Aon Benfield, gave an overview of the industry. Chad Nitschke — one-time insurance professional and now CEO of a startup known as Bunker — talked about the strategies and challenges that companies face in that space.

Insurtech, Troyer explained, is the cousin of *fintech* — the move to automate the more cumbersome processes that banks undertake. Interest in fintech grew in 2015. Silicon Valley's gaze turned toward insurance a year later, though the banking sector continues to get far more attention and funding, since it is so much bigger than the insurance industry.

Insurtech products take several forms, Troyer explained:

- **Peer-to-peer insurance.** Companies help a group of individuals mutually share risk, rather than ceding risk to an insurance company. If claims are few, the group shares a dividend. An example is Friendsurance, a European company.
- **On-demand insurance.** Companies let the insured toggle coverage on and off, usually via smartphone. The app Trov lets customers turn on coverage for, say, their camera when they leave for vacation then turn it off when they have returned home.
- **Online insurance marketplaces.** These online services reproduce the workings of an agency or brokerage, providing quotes online or binding coverage. Coverhound is an example.

Call it *insurtech* — technologies that change the way that insurance is priced, sold or administered.

- **Telematics.** Smartphone apps monitor insureds activities. Zendrive, for example, uses sensors on a smartphone to measure and improve driving behavior. The data can also help underwrite risks.
- **Internet of things.** This is the catch-all for everyday objects with computers that let their owners monitor them via smartphone. (Think of a system that lets you control your home temperature with an app.)

There are more than 500 insurtech startups, Troyer said, and their funding is $14 billion. About $3 billion of that is dedicated to businesses primarily focused on insurance. Those numbers are fairly small, he said, compared with, say the $78 billion that investors have poured into alternative capital arrangements like catastrophe bonds. "It's still early" for Insurtech, he said, "but it's certainly on a trajectory to have a big impact."

About 60 percent of the funding focuses on distribution, such as marketplaces like Coverhound. Next in line are underwriting operations like Zendrive, followed by insurance operations like Trov. The smallest segment focuses on streamlining claims — eight companies with funding around $100 million.

These figures are a tiny bit of the $230 billion U.S. insurers are spending on those processes, but interest is high, as Troyer demonstrated by sharing a series of quotes from executives regarding the new automation. Typical was this from Travelers CEO Alan Schnitzer: "One of the things changing most significantly and maybe poised to have the biggest impact on us is the world becoming more digital and more mobile."

Insurtech products have straightforward advantages: They can improve a product or the insurer's efficiency, or they can improve the customer experience.

But there are challenges, too, Troyer says. Developers tend to lack insurance experience, so they underestimate how complex an insurance product can be. They also don't fully fathom the challenge of having to satisfy 50 regulatory regimes.

Troyer says that developers also don't understand that most potential customers are apathetic to insurance products, such as apps that let customers insure a product only while they are

using it. "I don't know people who say before they go on a ski trip, 'Hey, let's get some insurance on my skis,'" says Troyer.

Still, interest is high, both among companies and developers. Thirty percent of the top 25 insurers have announced partnerships with startups.

For industry professionals who wanted to learn more, Troyer suggests:

- Follow the landscape. This could be as simple as subscribing to a free newsletter like *CB Insights*.
- Build your individual skill set, developing qualities that would be attractive to innovators.
- Support innovation efforts at your company.

Or you could take the route that Chad Nitschke took. He took his 15 years of insurance experience and entered the innovators' realm.

His company, Bunker, helps smooth out the bumpiness of business insurance transactions, commonly between an enterprise and their partners, vendors and independent contractors.

The idea for the company came from the answer to a question, Nitschke asked: "When a small business needs to buy insurance, what's the catalyst for that?"

Usually, he says, a small business buys coverage because a business partner — like a landlord or client — requires it. So, the small business wants insurance solutions that are fast, easy and affordable.

Then Nitschke looked at what the client needs. Larger companies have to keep track of all of the small vendors they deal with, making sure that vendors have insurance — the right coverage

with the right terms.

They get that information in haphazard ways — over the phone or via email — and they often keep track with an Excel spreadsheet. "That is a really painful process for both parties," Nitschke said. His company's product automates the process, then stands as a logical broker for any transaction.

Next, his company is trying to tailor policies more closely to the needs of a small business, starting with independent contractors in the "gig economy."

Carriers are sometimes interested in partnering with insurtech innovators, he said, but there is a wide range of interest from carrier to carrier. Much depends on an insurer's product mix and where the innovator can add value.

"I don't think there's a one-size-fits-all," he said. ●

Microinsurance: A Small Start Could Get Big Results BY JIM LYNCH

Microinsurance presents actuaries with the opportunity to do well by doing good. Policies focus mainly on less prosperous people in developing nations. These are people who have few possessions, but the loss of any of those possessions would be devastating.

So there's a social good to creating microinsurance protection. But there's a business case as well.

Actuaries heard the business case at a session called "Current Applications of Microinsurance Innovations" at the CAS Spring Meeting in Toronto in May. The session was also a way to bring attention to the work being done by the CAS Working Party for Microinsurance

Research, which will begin publishing a series of papers this year.

Helping emerging markets develop — which microinsurance does — will grow the middle class in those markets, and people will be primed to buy more products — insurance included.

Actuary Barbara Chesire-Chabbaga, a director at AB Consultants, works in Kenya. She laid out the growing potential for insurance there as an example of how microinsurance could prosper.

Right now, only 1.3 percent of Kenyans have life insurance; 75 percent of Kenyans have never had any kind of insurance. And of those who have had coverage, it usually was health insurance, not a property-casualty product.

But there is potential for growth.

According to the St. Louis Federal Reserve Bank's database (known as FRED), real GDP per capita has grown faster in Kenya than in the United States for six of the past seven years. (In the seventh year, the two nations essentially tied.)

The economy remains primarily agricultural, but there are signs of a tech boom. Kenya is an IT hub, according to the website TechCrunch.com. Ninety percent of residents have mobile phones.

The so-called Silicon Savannah got its start with M-Pesa, a mobile money platform that obviates the need for a bank. You can deposit cash into a kiosk, and your mobile account is credited.

Banks responded with their own products, so now the country is growing

more financially savvy as its tech acumen grows.

Meanwhile the government has been digitizing its services. That means "the majority of Kenyans are now forced to be computer literate," Chesire-Chabbaga said.

In her presentation, she showed a picture of a colorfully dressed herdsman, using a mobile phone. "He is probably on WhatsApp," she said. "We have a WhatsApp group for everything."

That herdsman — and millions like him — is ready for risk protection, she said, though he might not realize it. "What can we do to make insurance important for this man?" she asked.

The tech movement is promising, but nascent. Most people operate in the *kadogo* (small in Swahili) economy. They are informally employed and paid in cash at day's end. On the way home, a worker buys oil, food, perhaps a sachet of laundry soap — just enough for that day.

Traditional insurance wouldn't work in that economy. Such a worker can't pay a monthly premium.

The mobile platforms have helped, Chesire-Chabbaga said, but the record so far is mixed. The oldest venture goes back to 2010. She listed five ventures in that time; two quickly folded.

The challenge becomes finding a way to market a policy, said Scott Swanay, an FCAS and an assistant vice president at XL Catlin. Swanay works on microinsurance issues with Blue Marble, a consortium of 10 leading worldwide insurers. The consortium plans to do 10 insurance ventures in 10 years.

The first product was drought protection for Zimbabwe maize farmers. And the product had to be designed to cater to the vagaries of that particular marketplace. The policy is marketed and administered through a seed company because it is cheaper for the insurer to deal with one agent than a lot of policyholders. When farmers buy their seed, they can select coverage and have their names added to a group policy.

The insurance covers the cost of seed and fertilizer; this is a bit different from standard crop insurance, which guarantees a yield or the value of the crop in the field. In the climate of Zimbabwe, however, standard crop insurance would just be too subjective and too hard to administer.

What constitutes a claim? The microinsurer decided to use a parametric trigger: The policy would pay if rainfall fell below a certain amount. But how do you measure rainfall? It wouldn't be practical to install a rain gauge at every farm, and weather stations are spread too far apart to be reliable. Blue Marble's solution: Use weather satellites to take readings of the moisture content of clouds; that is a good proxy for rainfall, or at least good enough for now.

But the satellite's measurements are valid across a 10 km by 10 km swath — really too big for the insurer's needs. Swanay said the insurer may try to find better satellites or use drones.

There were no claims in the first year, Swanay said. That's good for the farmers — no crop failures! — but has a drawback for the insurer.

"If you don't pay claims," Swanay said, "you don't know if this product works."

The program may be expanded to cover excessive rainfall and pestilence in the future.

If you do microinsurance right, said Tom Johansmeyer, assistant vice president, PCS strategy and development at Verisk Insurance Solutions, "you can create a massive market." Often insurers think making coverage compulsory will create the massive market. But Johansmeyer cited two examples of compulsory schemes that had mixed results: earthquake insurance in Turkey and Romania.

A compulsory scheme needs four things to succeed:

1. It must be truly compulsory — meaning the mandate can't be winked at.
2. There should be a mechanism to monitor compliance. A classic example of the success and failure here is Turkey's earthquake insurance mandate. A homeowner must show proof of insurance to get power and light into their home, which means everyone has insurance when they buy a home. There is no subsequent enforcement mechanism, however, so most people drop coverage.
3. The insurance industry must invest in financial education. If people don't understand the value of insurance, they will be more likely to quit a program given the chance.
4. The insurance has to be affordable.

"The compulsory market might help you get started," said Johansmeyer, "but you have to enhance the benefits of the insurance market." ●

Predictive Modeling and March Madness BY CURTIS GARY DEAN

Every year in March tens of millions of people predict the future. They are participants in the March Madness (Big Dance) forecasting ritual: filling out the National Collegiate Athletic Association (NCAA) Men's Basketball Tournament bracket. They do it for fun, fame and fortune. Often there are monetary rewards for good predictions, but bragging rights for winning the office or family pool may offer more personal satisfaction than the money.

Two students at Ball State University, Tim Hoblin and Cody Kocher, decided to combine their passion for basketball with their desire to learn more about predictive modeling. As students in the honors program they were required to produce an honors thesis. Several months before the start of the 2017 NCAA Basketball Tournament, they asked me, their thesis advisor, if using predictive modeling techniques to build better brackets would be an acceptable thesis topic. My answer was immediate and affirmative; pursuing a passion and having fun can enhance the learning process.

As with many sports there is an abundance of publically available information about college basketball. There are statistics about an individual team's performance during the regular season prior to the tournament such as points per game, margin of victory (or loss), shooting percentage, turnovers, rebounds, etc. There also are measures such as strength of schedule and tournament seed that were determined through algorithms and judgment. Kocher and Hoblin used data from 2006 through 2016 and the results of the NCAA Tournaments in each of those years to build their predictive models.

Building predictive models for the Big Dance has been going on for years. A search of the internet will turn up many models. Kaggle, a company that sponsors predictive modeling and analytics competitions, has held NCAA Tournament predictive modeling competitions.

The NCAA Men's Basketball Tournament starts with 68 teams from Division 1, generally the colleges and universities in the U.S. with the strongest athletic programs. The First Four play-in has eight of the lower-ranked teams play against another team in this group of eight, and the four winners progress to the First Round. The First Round (the Round of 64) consists of 32 games with each of the 64 teams competing against another for a spot in the Second Round. The Second Round (the Round of 32) has 16 games which again eliminates half of the teams. Each round eliminates half the teams until the champion emerges in the National Championship final game.

What is a *bracket*? It is a series of predictions for the winning teams in each game throughout the entire tournament, from the First Round until the National Championship. So, a bracket has 32 + 16 + 8 + 4 + 2 + 1 = 63 predictions.

How do you score your success with your bracket? What is the objective function that you want to maximize? A commonly used scoring method assigns weighted points for each correct prediction. For each correct game prediction in the First Round you get one point. For each correct prediction in the Second Round you get two points. If N is the round, then you get 2^{N-1} points for each correct game prediction in that round — the total number of points possible in

each round is a constant 32. If you build a perfect bracket (good luck with that!), then you would attain the maximum possible 6 x 32 =192. ESPN uses this system but multiplies the values by 10.

Kocher and Hoblin analyzed the data and built their predictive models using GLMs and random forests in R. Excel was also extensively used in the project. As good modelers do, they constructed models using subsets of the data and then validated and scored them with other data subsets. Because some predictive data was highly correlated with other data, they applied principal component analysis to create new predictors. They also had to deal with basketball rule changes relevant to their modeling. For example, in 2009 the three-point line was moved back a foot lowering the three-point shooting percentage and in 2016 the shot clock was reduced from 35 seconds to 30 seconds which increased the pace of play and points scored per game.

After their models were built and tested, they entered 24 brackets on ESPN.com: eight GLM-modeled brackets, 12 random forest brackets, one bracket from a computer model they designed (the beginning of a stochastic model) and three control brackets. The ESPN system scored their brackets and ranked their success as the tournament unfolded against the other 18.8 million brackets that had been submitted. Two of the control brackets were those filled out by Kocher and Hoblin individually relying on their own intuitions. The third control was a bracket constructed by choosing the higher seeded team in each game.

After the first day of the tournament with 16 games completed, their brackets were doing extremely well. Five

of their 24 brackets, or 20.8 percent, had correctly predicted the winners of all 16 games. Among the 18.8 million submissions to ESPN only 0.8 percent were perfect after the first 16 games. When their average score for all 24 brackets was compared against the 58,000 other group entries that included a similar number of brackets, they were ranked an impressive 7th out 58,000.

Seeing the results after the first day, I congratulated them but they immediately replied that it would not last. As they discovered in their modeling, it

among the 18.8 million submissions when the tournament ended. If there is a 50 percent chance that a one submission would above the 50th percentile then the probability of getting 17 or more out of 21 submissions into the top 50th percentile is only 0.36 percent. The two controls based on their individual intuitions did not fare too well ending up in the bottom 50th percentile.

The control bracket constructed by choosing the higher seeded team in each game finished at a respectable 72nd percentile among the 18.8 million sub-

It becomes increasingly difficult to make good predictions in later rounds of the tournament. As stronger teams defeat weaker teams earlier in the tournament, the winners face increasingly stronger teams as the tournament progresses. Predictions become less reliable.

becomes increasingly difficult to make good predictions in later rounds of the tournament. As stronger teams defeat weaker teams earlier in the tournament, the winners face increasingly stronger teams as the tournament progresses. Predictions become less reliable.

Their standing took a big hit with the defeat of Villanova by the University of Wisconsin in the second round. Sixteen of their brackets had Villanova as the national champion. None of their brackets had predicted that the University of North Carolina would become national champion.

Removing the three control brackets, 17 out of their 21 submissions finished above the 50th percentile

missions. In their modeling and testing, Kocher and Hoblin had observed that tournament seed was a powerful predictive variable and decided to make this simple model a benchmark to compare against. If you are filling out a bracket, you probably will beat the majority of your friends and colleagues with this simple algorithm.

Kocher and Hoblin graduated in May and have started their actuarial careers. Kocher joined Nyhart and Hoblin will be at Allstate. Their thesis is online at cardinalscholar.bsu.edu. ●

Curtis Gary Dean, FCAS, is the Distinguished Professor of Actuarial Science at Ball State University in Muncie, Indiana.

Combining Paid and Incurred Data in a Bayesian MCMC Model

One way to include more data into a loss reserve model is to use both paid and incurred data. Over the years, a number of authors have explored this idea. See, for example, Quarg and Mack (2004), Posthuma et al. (2008) and Venter (2008). Until recently, I have avoided that path because I have been using different models for paid and incurred data. All this changed when Ned Tyrrell, FCAS, showed me how to use the Bayesian MCMC language, Stan, to combine different models for paid and incurred data. Tyrell's motivation for doing this was that using more data will reduce the range of possible outcomes. This article shows what happens when we combine the CSR and CCL models that are in my previous work, Meyers (2015).

Let's start by specifying my current versions of these models.

The Changing Settlement Rate (CSR) Model for Paid Losses

1. Let C_{wd}^P be the cumulative paid loss for a 10 x 10 triangle for accident year w and development year d.
2. Let P_w be the earned premium for accident year d.
3. Let $\alpha_w \sim Normal(0, \sqrt{10})$ for $w = 2$, ..., 10. Set $\alpha_1 \equiv 0$.
4. Let $\beta_d^P \sim Normal(0, \sqrt{10})$ for $d = 1$, ..., 9. Set $\beta_{10}^P \equiv 0$.
5. Let $logelr \sim Normal(0, \sqrt{10})$.
6. Let $\gamma \sim Normal(0, 0.05)$.
7. Let $a_i^P \sim Uniform(0, 1)$ for $d = 1$, ..., 10. Then set $(\sigma_d^P)^2 = \sum_{i=d}^{10} a_i^P$. This forces $\sigma_1^P < \sigma_2^P < ... \sigma_{10}^P$.

8. Set $\mu_{wd}^P = log(P_w) + logelr + \alpha_w + \beta_d^P \cdot (1-\gamma)^{w-1}$ for $w = 1$, ..., 10 and $d = 1$, ..., $11-w$.
9. Then $C_{wd}^P \sim lognormal(\mu_{wd}^P, \sigma_d^P)$

The expected loss ratio for accident year, w, after 10 years is given by $exp(logelr + \alpha_w + (\sigma_{10}^P)^2/2) \approx exp(logelr + \alpha_w)$ since $(\sigma_{10}^P)^2$ is generally very small.

While there are any number of equivalent ways to specify this model, I chose to formulate the model with a *logelr* parameter since many actuaries have access to prior information about the expected loss ratio for their business. They also expect market forces to change the expected loss ratio from year to year, and the α_w parameters allow for these changes.

Once the model is coded, the Stan software will draw a sample from the posterior distribution of the parameters *logelr*, $\{\alpha_w\}_{w=1}^{10}$, $\{\beta_d^P\}_{d=1}^{10}$, γ and $\{\sigma_d^P\}_{d=1}^{10}$. Let's refer to this collection of parameters as θ_P. With these parameters, one can calculate any statistic of interest to the actuary, such as the expected outcome and the standard deviation of the outcomes.

The Correlated Chain Ladder (CCL) Model for Incurred Losses

1. Let C_{wd}^I be the cumulative incurred loss for a 10 x 10 triangle for accident year w and development year d.
2. Let P_w be the earned premium for accident year w.
3. Let $\alpha_w \sim Normal(0, \sqrt{10})$ for $w = 2$, ..., 10. Set $\alpha_1 \equiv 0$.

4. Let $\beta_d^I \sim Normal(0, \sqrt{10})$ for $d = 1$, ..., 9. Set $\beta_{10}^I \equiv 0$.
5. Let $logelr \sim Normal(0, \sqrt{10})$.
6. Let $\rho \sim \beta(2, 2)$ scaled to go between -1 and 1, where $\beta(., .)$ denotes the β distribution.
7. Let $a_i^I \sim Uniform(0, 1)$ for $d = 1$, ..., 10. Then set $(\sigma_d^I)^2 = \sum_{i=d}^{10} a_i^I$. This forces $\sigma_1^I < \sigma_2^I < ... \sigma_{10}^I$.
8. Set $\mu_{1d} = log(P_1) + logelr + \beta_d^I$ for $d = 1$, ..., 10.
9. Set $\mu_{wd}^I = log(P_w) + logelr + \alpha_w + \beta_d^I + \rho \cdot (log(C_{w-1,d}^I) - \mu_{w-1,d}^I)$ for $w = 2$, ..., 10 and $d = 1$, ..., $11 - w$.
10. Then $C_{wd}^I \sim lognormal(\mu_{wd}^I, \sigma_d^I)$

Again, once the model is coded, the Stan software will draw a sample from the posterior distribution of the parameters *logelr*, $\{\alpha_w\}_{w=2}^{10}$, $\{\beta_d^I\}_{d=1}^{10}$, ρ and $\{\sigma_d^I\}_{d=1}^{10}$. As above, let's refer to this collection of parameters as θ_I.

A key assumption that we can make to combine these models is that the *logelr* and the $\{\alpha_w\}_{w=1}^{10}$ parameters are the same for both the paid and incurred loss models. An additional modification, suggested to me by Ned Tyrrell, is to drop the assumption that $\beta_{10}^I \equiv 0$. This modification accounts for the fact that the case incurred losses recognize the further adjustments that could happen after the 10th development year.

The Stan software combines the paid and incurred models by adding the log-likelihoods, $ll(\theta_P | \{C_{wd}^P\}$ and $ll(\theta_I | \{C_{wd}^I\})$. Stan then provides a sample from the posterior distribution of θ_P and θ_I in which the parameters *logelr* and $\{\alpha_w\}_{w=1}^{10}$ are the same in both parameter sets

θ_p and θ_I. One can then calculate the statistics of interest for both the paid and incurred triangles.

I ran each model for Commercial Auto Insurer #353 (The Illustrative Insurer in Meyers (2015)). Table 1 contains the loss estimates and the standard deviations for standalone CSR and CCL models. Table 2 contains the loss estimates and standard deviations for the combined CSR and CCL model.

Note that the standard deviations of the estimates for the combined model in Table 2 are smaller than the standard deviations standalone estimates in Table 1. To see how often this happens, I ran the combined and standalone models on 50 loss triangles in each of the Commercial Auto (CA), Personal Auto (PA), Workers' Compensation (WC) and Other Liability (OL) lines of insurance[1] Figure 1 shows a histogram of the standard deviation ratios for both the CSR and CCL models. The results show that the standard deviation is reduced in a clear majority of the cases, showing the positive effect of the additional data in reducing the uncertainty in the estimates.

While reducing the predictive standard deviation of the outcomes is desirable, it is not the goal of a stochastic loss reserve model. The goal is to correctly predict the distribution of outcomes. Following the methodology I proposed in Meyers (2015), Figures 2 and 3 test the predictive distribution on the observed outcomes by comparing the pp-Plots of the CSR and CCL models derived from the combined model with the corresponding plots from the standalone models. The CA and OL lines pass the test. PA just barely misses, but the

Table 1. Standalone CSR and CCL Models.

AY	Premium	CSR Estimate	CSR Std. Dev.	CCL Estimate	CCL Std. Dev.
1	5,812	3,912	0	3,917	0
2	4,908	2,562	107	2,549	65
3	5,454	4,134	181	4,110	125
4	5,165	4,283	208	4,312	143
5	5,214	3,514	193	3,549	131
6	5,230	3,319	222	3,332	155
7	4,992	4,965	414	5,291	304
8	5,466	3,311	406	3,803	337
9	5,226	3,739	746	4,180	619
10	4,962	3,747	1,407	4,116	1,261
Table	52,429	37,485	2,338	39,159	1,774

Table 2. Combined Model for CSR and CCL.

AY	Premium	CSR Estimate	CSR Std.Dev.	CCL Estimate	CCL Std.Dev.
1	5,812	3,912	0	3,912	0
2	4,908	2,544	65	2,549	53
3	5,454	4,123	112	4,132	92
4	5,165	4,304	123	4,314	106
5	5,214	3,557	110	3,563	97
6	5,230	3,389	131	3,395	122
7	4,992	5,209	260	5,218	248
8	5,466	3,790	297	3,797	293
9	5,226	4,094	474	4,101	469
10	4,962	3,802	794	3,809	796
Total	52,429	38,722	1,343	38,796	1,294

combined models perform better than the standalone models.

For WC, the combined model performs noticeably worse. I am not sure why this is the case, but it is worth noting that the difference between the paid and incurred losses is noticeably larger for WC than for the other lines.

While there are some questions that remain to be answered, I believe the combined models are worthy of further consideration.

The R/Stan scripts for the combined and standalone models are on the CAS

website along with summary statistics for all 200 loss triangles.

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[1] There have been a handful of changes from the set of insurers I used in Meyers(2015). The original set had a small number of "questionable" triangles. When the pp-Plots in Figures 2 and 3 are compared with the corresponding plots in Meyers (2015), the conclusions still hold.

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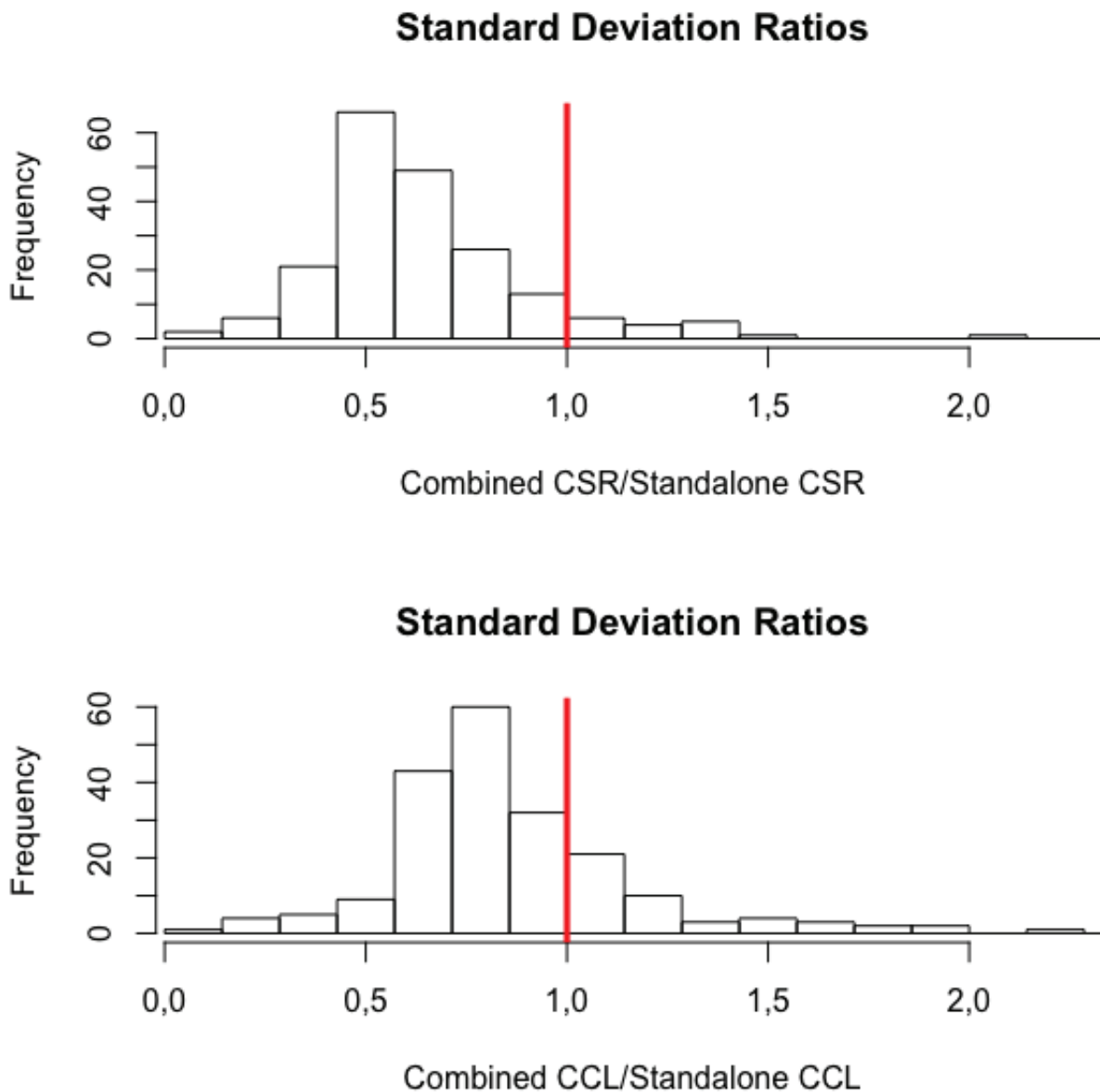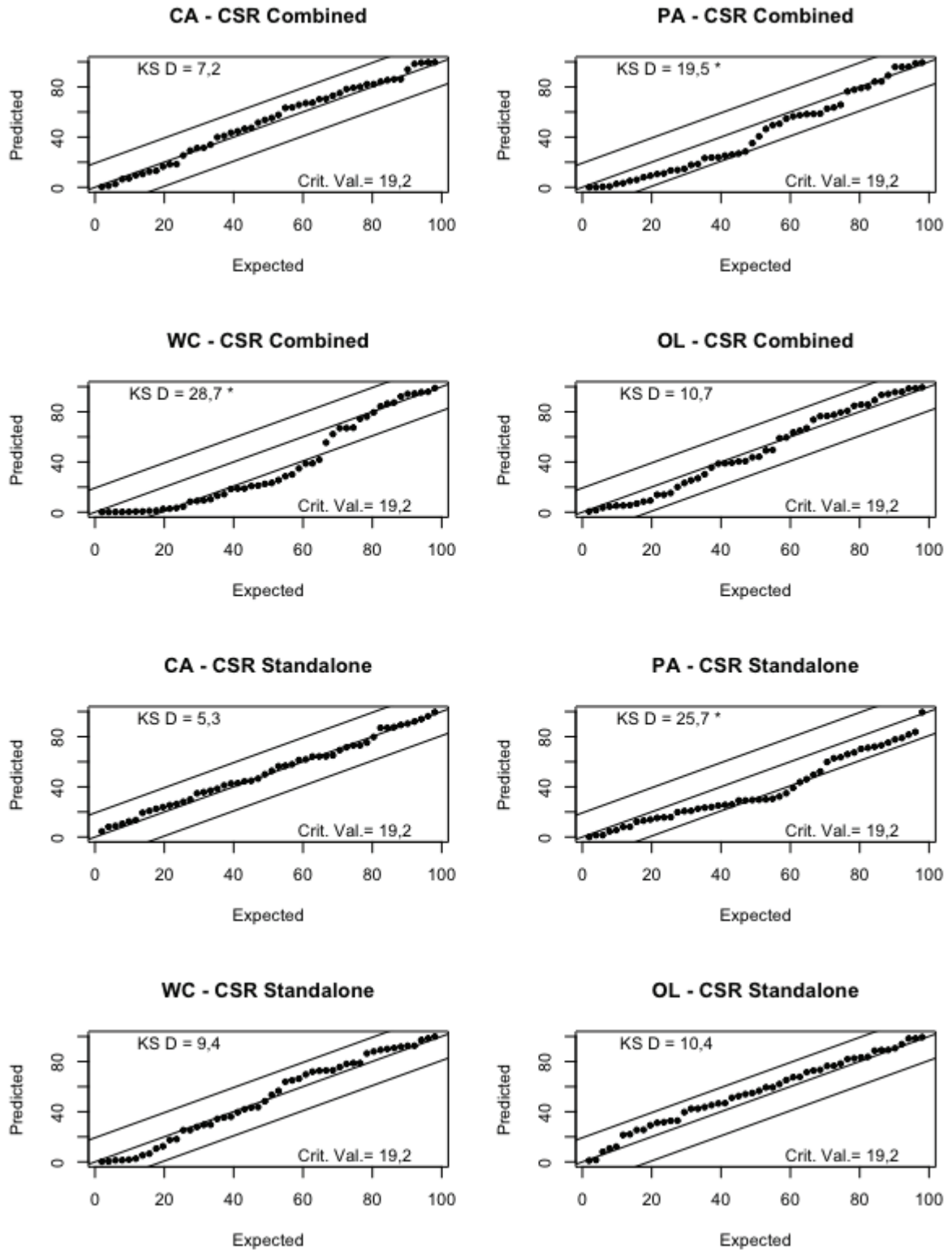4. Venter, Gary, "Distribution and Value of Reserves Using Paid and Incurred Triangles," *Casualty Actuarial Society E-Forum*, Fall 2008. http://www.casact.org/pubs/forum/08fforum/15Venter.pdf ●
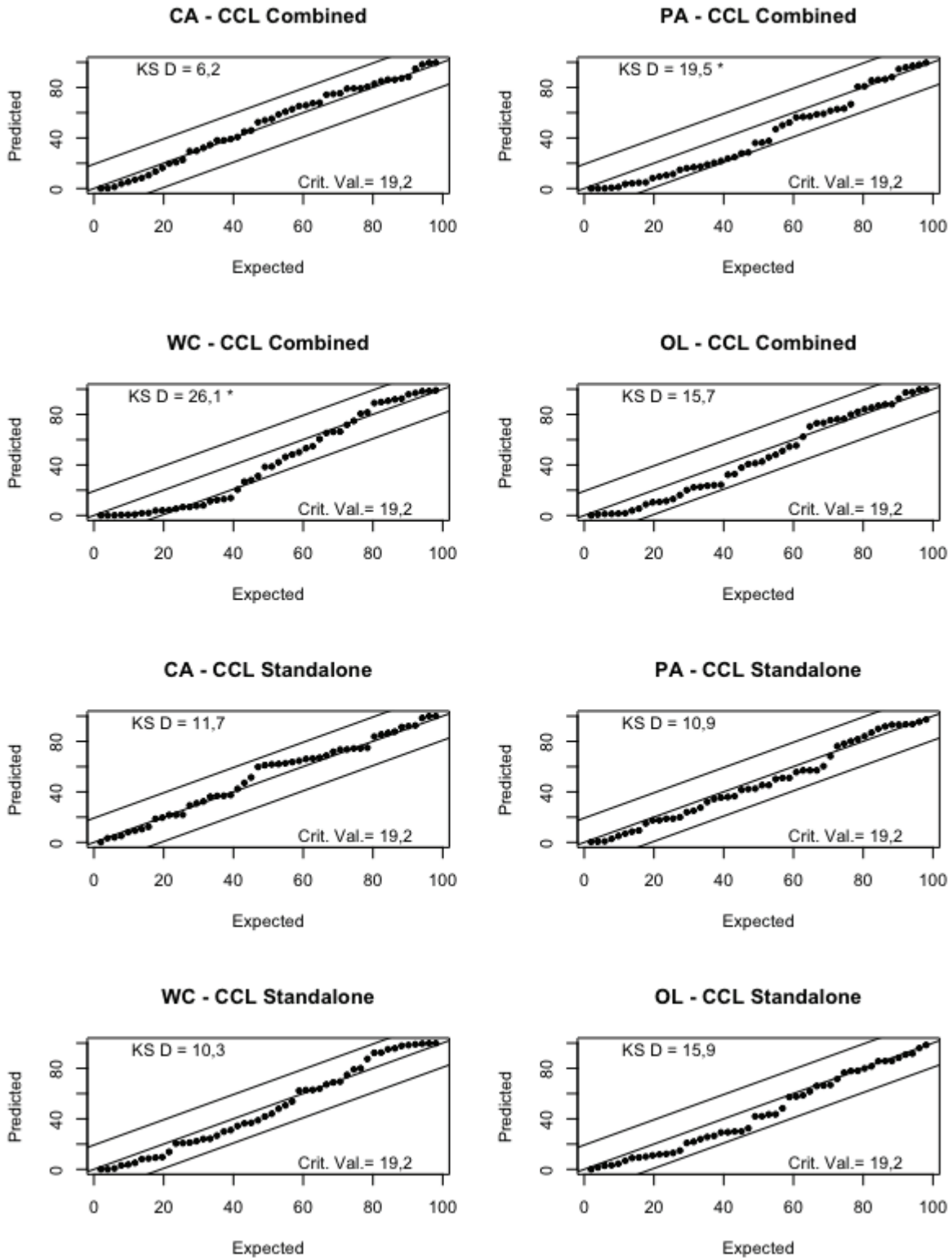
Figure 1

Figure 2

Figure 3

IN MY OPINION BY STEPHEN LOWE

Becoming an Analytics-Based Insurer: A Road Map

As they move to an analytics-based business model, insurers must overcome both talent shortages and cultural resistance.

Editor's Note: This article was first published in Best's Review*, November 2016.*

An analytical arms race is disrupting the traditional insurance company business model and changing the imperatives for success. Predictive modeling is steadily expanding, reaching beyond merely being a tool for product strategy to becoming an integral function within a new data and analytics-based business model.

Transformations come with challenges. Insurance executives are now facing two concurrent implementation challenges. Namely, they must find the talent necessary to transition the traditional business model to the data and analytics driven one while also engaging in companywide change management.

Necessary Skills

Since introducing predictive models to auto pricing more than 20 years ago, insurers have gradually expanded their use of them well beyond personal auto to include pricing for homeowners, small commercial, large accounts and especially specialty insurance lines. Insurers are also expanding predictive modeling applications beyond pricing. The three most common predictive modeling applications are underwriting/ risk selection, evaluating fraud potential and deciding when to order reports

(such as credit), according to Willis Towers Watson's 2015 Predictive Modeling and Big Data Survey.

Additional applications in the ranking include: premium auditing, advertising strategy, claim triage, underwriting expense efficiency, determining litigation potential, agency management/ compensation, loss control and agent placement/distribution management. Released in February [2016], the report's conclusions were based on the responses of 61 North American property/ casualty insurers.

Capitalizing on the new technological landscape requires a team to possess three primary skill sets.

The first is data hacking, which in this context does not refer to criminal activity but describes the mindset to develop solution-yielding approaches. Hacking skills include data sourcing knowledge, capabilities in data assembly and management, and experience in scrubbing and extracting information from raw data.

Facility in contemporary analytics tools built on new era math and statistics is the second necessary skill. These include generalized linear models, classification and regression tree analysis, machine learning, data visualization, etc., that permit deeper insights into relationships evidenced within the data.

However, access to infinite data and statistical prowess is not enough

to build a truly analytics-based insurance company. For that, the third skill is required: contextual knowledge, referred to by some as domain knowledge, which includes full appreciation of insurance risk.

Context is the deep knowledge of the critical nuances and complexity of insurance that assures a focus on relevant data rather than data for its own sake. No one can adequately and effectively analyze a set of data without fully understanding its context — the environment from which it emerged. Context, for example, is necessary for considering how the predictive models should be developed for appropriate decision-making and what will happen if the external environment or the internal incentives of the decision-makers change.

The skills and knowledge required to become a truly analytics-based insurer differ from traditional business skills primarily because of three incredibly rapid technological advances. First, the cost of computation and data storage is no longer a significant part of the strategic calculus. Thanks to low-cost cloud servers, insurers can gather, retain and manage massive amounts of data.

Second, data sources are plentiful and growing exponentially as monitoring devices have become ubiquitous. Automobiles will allow insurers to capture location, acceleration and speed a

dozen or more times a second and analyze how usage translates into accidents. By deploying drones, home insurers can capture roof condition before and after a storm to settle damage claims.

Third, the tools and applications to assemble, manipulate and analyze data are better than ever and continue to improve. Summarizing and segmenting data is no longer necessary to make analysis manageable. Transactional level data, even in volumes measured in terabytes, works with today's predictive models.

Technological change has been profound. It has even shifted the focus of statistics away from traditional sampling theory since an entire population can now easily be analyzed. State-of-the-art applications and contemporary programming languages such as R and Python allow insurers to handle very large and complex data sets, perform analytics, create meaningful data visualizations and build quite effective predictive models.

Further, analytic models are also changing, from merely descriptive to predictive and ultimately, to prescriptive. Claim triage applications, for example, are prescriptive because they analyze the attributes of a claim when it is reported and recommend the appropriate adjuster based on their experience and expertise. To become analytics-based, insurers are aggressively staffing predictive analytics teams and linking them into the business. However, as interest in predictive analytics has spread from a few carriers to the majority of them, the demand for talent is outstripping supply, making talent acquisition and management critical issues.

Talent Shortage

An insurer's ultimate goal is to benefit from the intersection of the three skill sets as outlined in the figure on [this] page, which is a variant of one suggested by Drew Conway, a prominent data scientist.

Since there is currently a shortage of analytical professionals, those responsible for building predictive analytics teams find themselves on the horns of a dilemma. Should they hire newly minted data scientists straight out of universities and teach them insurance? Or, should they redeploy actuaries and ask them to round out their contemporary statistics and analytics skills? Both approaches mean that team members require training to overcome a steep learning curve, thus affecting immediate productivity.

Data scientists are one potential talent source. Those being hired by insurers generally are recent graduates, usually with an advanced degree, who have been trained in the first two skill sets. Their advantage is the currency of their education, giving them up-to date technological knowledge.

However, in conversations with analytic team managers, newly-minted data scientists typically lack understanding— or context—of how insurance and risk work. They require training in this third skill area before they can be effec-

Building an Effective Predictive Analysis Capability: Converging Around Three Key Skill Sets
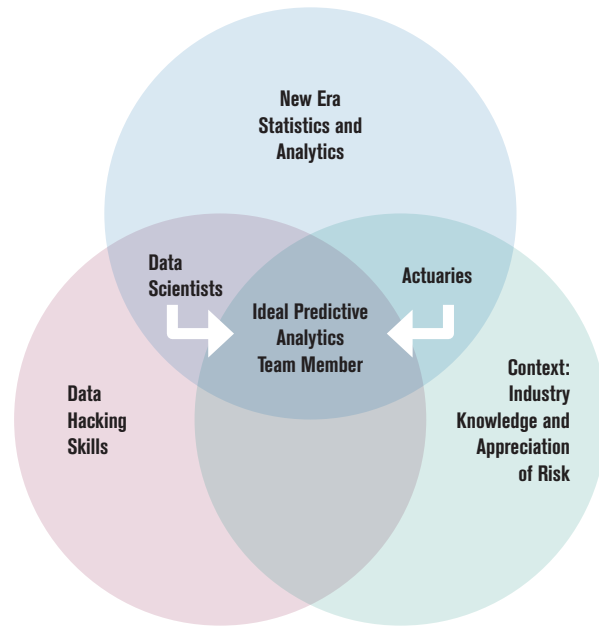
tive and it takes a while to be well versed in insurance.

As the original architects of the insurance industry's predictive models, actuaries possess contextual knowledge as well as aptitude in hacking and analytics. From the first predictive model in 1880 to predict life expectancy to current applications, actuaries have been in the predictive modeling game since the profession was created.

To help fill the talent gap that exists today, the Casualty Actuarial Society will offer both data scientists and actuaries a new data and analytics credential to provide an objective skills benchmark. The CAS Institute's program will not only focus on the three skill areas, but will feature a capstone project requiring candidates to apply what they have learned to develop a solution to a real-world problem.

Challenges Beyond Team Building

As the analytics team expands predictive models to more decision areas and quantitative professionals master the three necessary skill sets, insurers pioneering the data driven and analytics approach face other challenges to overcome. Such insurers are finding that big data is important, but it isn't enough. Despite a wealth of available data, decision-makers can often still be starved of true insight. This should change once the appropriate analytical teams are put into place and appropriately trained.

Becoming a data-driven and analytics-based insurer requires preparation for necessary changes in culture. To create the most value, analytics must be deeply embedded in an organization's operations so that information and insights are shared across business units and functions. Oftentimes, the hardest aspect of implementation is not generating and sending the signal insights, but assuring the appropriate decision-makers can receive and accept them.

Resistance to change is natural. Managers can be surprisingly unreceptive or feel threatened by the insights predictive models can provide. This is especially true if the modeling team is not fully supported by the C-Suite ("tone from the top") or is perceived as merely part of the "backoffice." The challenge is exacerbated when end-users do not understand the terminology or the predictive models are not well explained.

Part of the push toward being analytic-based is the clear benefits from better insights to support decisions. Research shows that analytical judgment outperforms what behavioral scientists call clinical judgment. The latter is the

experience and instinct underwriters develop to determine individual risk selection and make pricing decisions. Claim adjusters also employ their own clinical judgment to make individual claim handling decisions. Analytical judgment is superior to clinical, however, because it is based on all available experiences rather than the experience of one person.

While the benefits are objectively demonstrative, insurers still sometimes encounter clashes between analytical results and clinical judgments. This is not an uncommon problem, as illustrated in the book and movie *Moneyball*, in which the baseball scouts are unable to accept even the idea that a statistician could make better recommendations on player selection. They correctly perceived the possibility as an existential threat. Underwriters and claim managers must not be put in the same position, lest they react the same way.

Of course it is best to seek a combination of analytical with clinical judgment, as this can be superior to either in isolation. The availability of big data

coupled with technological innovation are disrupting the traditional insurance company business model, moving it to one driven by analytics. Since data scientists and actuaries generally bring different skill sets to an analytics team, they will need to cross-pollinate until individual professionals can offer all three skills necessary for successful analytics: data hacking, modern statistical prowess and intimate insurance knowledge.

While insurers are building analytical teams to complete the three necessary skill sets for the new data and analytics insurance company model, it is just as critical to address barriers to integrating analytics into the company. Effective change management that helps employees embrace the benefits of the analytics model is another necessary element for effective transition from a traditional business model. ●

Stephen Lowe, FCAS, MAAA, CERA, is currently serving as chair of the Casualty Actuarial Society Board of Directors.


Key Points

What's New: Insurers are expanding their use of predictive models, using them not just for pricing in personal auto, but for homeowners, small commercial, large accounts and especially specialty insurance lines.

Challenge No. 1: As interest in predictive analytics has increased, the demand for talent is outstripping supply. Three skills are necessary for successful analytics: data hacking, modern statistical prowess and intimate insurance knowledge.

Challenge No. 2: Insurers also may face clashes between analytical results and clinical judgments. Effective change management that helps employees embrace the benefits of the analytics model is important for success.
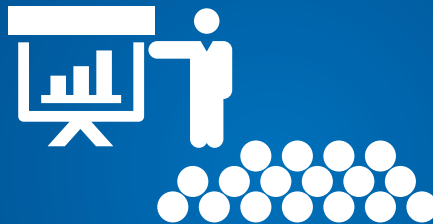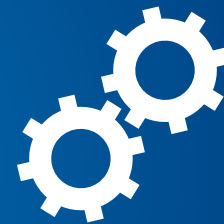
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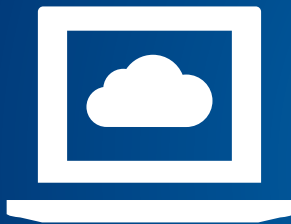
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solveTHIS

IT'S A PUZZLEMENT BY JON EVANS

Rockets Into Deep Space

Walter manages a research station deep in intergalactic space far from any stars or planets. The station routinely launches probes propelled by one or more identical ordinary expendable chemical rocket boosters. If two boosters are used and fired simultaneously, the probe is accelerated to a velocity 14 percent higher than if just one booster is used. Similarly, three boosters result in 20 percent higher velocity than just one.

Walter asks his assistant Wernher how many boosters would be required for double the velocity of using just one booster. Wernher calculates the answer using classical mechanics, appropriately ignoring any relativistic effects. Though the answer is accurate, Walter is disappointed. Walter then asks Wernher how many boosters would be required to double the velocity if, instead of firing them all at once, the boosters are fired sequentially one at a time, with each booster discarded immediately after it completes its burn. Again, Wernher gives a correct answer.
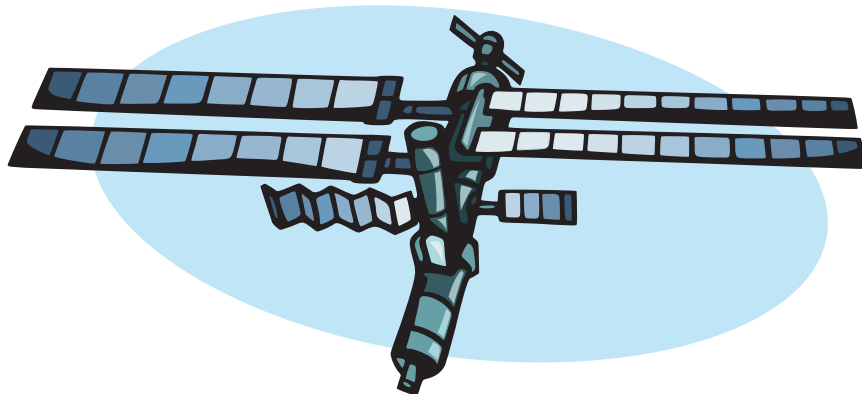
How did Wernher answer each of these questions?

A Simple Equation to Solve

Given the simple equation below, where the pattern of nested operations on the right hand side continues ad infinitum, what is the exact value of x?

$$\pi^{2/3}+e^{1/2} = \sqrt{1+x\sqrt{1+(x+1)\sqrt{1+(x+2)\sqrt{1+\dots}}}}$$

Let

$$f(x) = \sqrt{1+x\sqrt{1+(x+1)\sqrt{1+(x+2)\sqrt{1+\dots}}}}$$

Then the functional equation $f(x)^2 = 1+xf(x+1)$ holds for which $f(x) = 1+x$ is a solution. Since $f(x) = \pi^{2/3}+e^{1/2}$ then it should follow that $x = \pi^{2/3}+e^{1/2}-1$. However, we still need to prove uniqueness. The following sandwich inequality holds,

$$\sqrt{x\sqrt{x\sqrt{x\sqrt{\dots}}}}$$

$$\leq \sqrt{1+x\sqrt{1+(x+1)\sqrt{1+(x+2)\sqrt{1+\dots}}}}$$

$$\leq \sqrt{(1+x)\sqrt{2(x+1)\sqrt{4(x+1)\sqrt{\dots}}}}$$

Note that

$$\sqrt{x\sqrt{x\sqrt{x\sqrt{\dots}}}} = x^{2^{-1}+2^{-2}+\dots} = x \text{ and that}$$

$$\sqrt{(1+x)\sqrt{2(x+1)\sqrt{4(x+1)\sqrt{\dots}}}}$$

$$= ((x+1)^{2^{-1}+2^{-2}+\dots})\sqrt{1\sqrt{2\sqrt{4\sqrt{\dots}}}}$$

$$= (x+1)\sqrt{1\sqrt{2\sqrt{4\sqrt{\dots}}}}$$

with $\sqrt{1\sqrt{2\sqrt{4\sqrt{\dots}}}} = 2^A$ where

$A = \sum_{n=0}^{\infty} n\, 2^{-n-1} = 1$ so that $\sqrt{1\sqrt{2\sqrt{4\sqrt{\dots}}}} = 2$ and hence $\sqrt{(1+x)\sqrt{2(x+1)\sqrt{4(x+1)\sqrt{\dots}}}} = 2(x+1)$. The sandwich inequality can now be stated as

$$x \leq \sqrt{1+x\sqrt{1+(x+1)\sqrt{1+(x+2)\sqrt{1+\dots}}}} \leq 2(x+1)$$

Since $3 < 3.79\dots = x = \pi^{2/3}+e^{1/2} = \sqrt{1+x\sqrt{1+(x+1)\sqrt{1+(x+2)\sqrt{1+\dots}}}} \leq 2(x+1)$

It follows that $x > \frac{1}{2}$ and the sandwich inequality can be restated again as $\frac{1}{2}(x+1) < f(x) \leq 2(x+1)$, and we already can form another sandwich inequality $\frac{1}{2}+xf(x+1) < f(x)^2 < 2+xf(x+1)$ so that $\frac{1}{2}(1+x(x+1)) < f(x)^2 < 2(1+x(x+2))$ and consequently $\sqrt{\frac{1}{2}}(x+1) < f(x) < \sqrt{2}(x+1)$. Repeated iteration leads to $\sqrt[n]{\frac{1}{2}}(x+1) < f(x) < \sqrt[n]{2}(x+1)$. Since $\lim_{n\to\infty}\sqrt[n]{\frac{1}{2}} = \lim_{n\to\infty}\sqrt[n]{2} = 1$, the solution must be $f(x) = 1+x$ and $x = \pi^{2/3}+e^{1/2}-1$.

Solutions were submitted by David Andrist, Roger Bovard, Bob Conger, Mario DiCaro, Sidharth Garg, Akshar Gohil, Rob Kahn, Jerry Miccolis, Sean Moore, Anthony Salis, Dave Schofield, Alex Twist, Mark Woods and Michael Ziniti. ●

Know the answer?
Send your solution to
ar@casact.org.

EZRA PENLAND HAS THE MOST P&C OPPORTUNITIES

CONTACT THE ACTUARIAL RECRUITMENT LEADER: actuaries@EzraPenland.com

MIDWEST USA – CHIEF PRICING ACTUARY

For Position 75796, a Chief Pricing Actuary is immediately sought by a Midwest USA insurer. FCAS with 15+ years of property and casualty actuarial experience sought. Requires several years of commercial lines and reinsurance pricing experience of casualty lines of business.

FLORIDA – PROPERTY ACTUARY

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For Position 75850, a property and casualty associate actuary is sought by an insurer in Germany. ACAS with German language skills preferred. Pricing, modeling, profitability analysis, business strategy, risk management and management reporting role.

SOUTHEAST USA – NON–STANDARD AUTO ACTUARY

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Senior property and casualty pricing actuarial analyst is immedi–ately sought by a Midwest USA insurer for Position 75721. 3 to 9 years of property and casualty actuarial experience required. Requires personal auto ratemaking and predictive modeling skills.

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NEW YORK – COMMERCIAL PRICING ACTUARY

For Position 75680, a New York insurer has asked Ezra Penland to find a commercial lines pricing actuary. FCAS or ACAS with 4 to 12 years of experience preferred. Predictive modeling skills and large accounts pricing expertise ideal.

ILLINOIS – PRICING ACTUARY

For Position 75872, our Chicago client has asked Ezra Penland to find a property and casualty pricing actuary. ACAS or FCAS with commercial lines pricing experience ideal. Excess Workers Compensation experience a plus but not required.