actuarial REVIEW
VOL 49 / NO 5 / SEPTEMBER OCTOBER 2022
PUBLISHED BY THE CASUALTY ACTUARIAL SOCIETY

RESEARCH IN ACTION

Building Skills for the Future Column Debuts

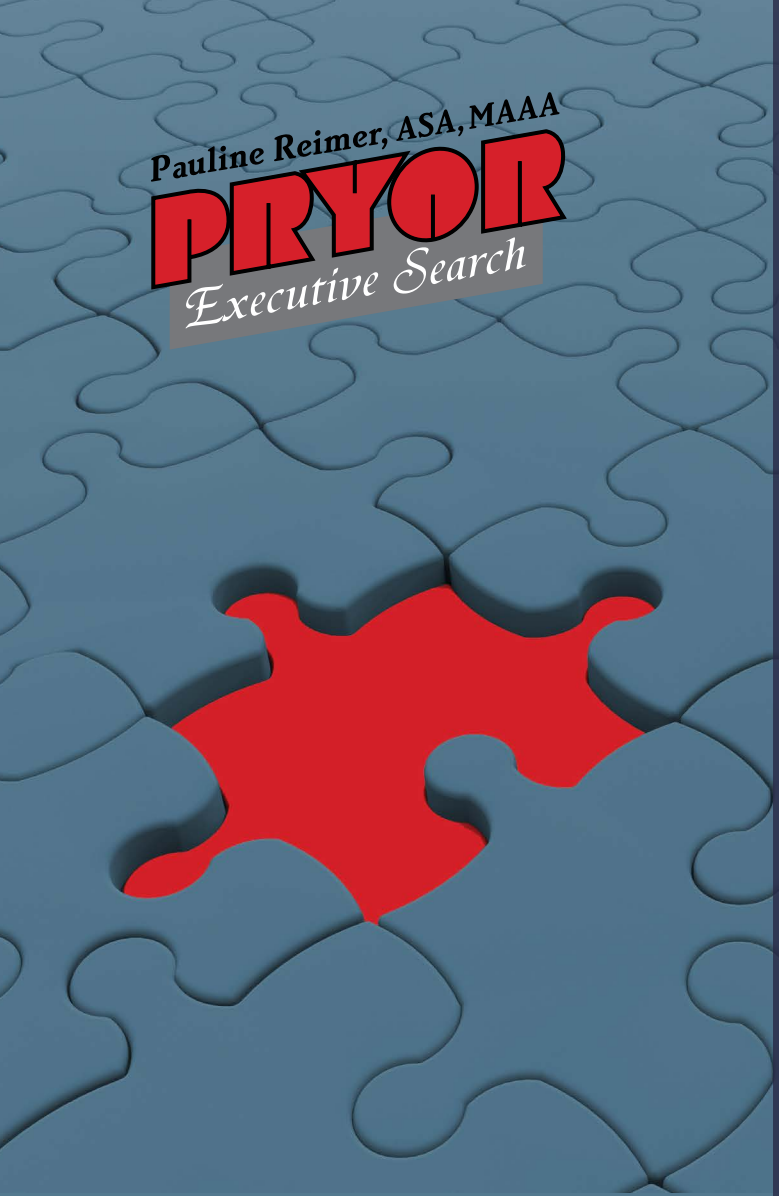
Election 2022: The Results are In!

Trusted by actuaries worldwide.

www.actuarialcareers.com
800.766.0070

Pauline Reimer, ASA, MAAA

PRYOR Executive Search



The Perfect Fit...

It Takes One to Know One... An Actuary Placing Actuaries

To have Pauline personally advise you on finding your perfect fit, please contact her at:

pauline@ppryor.com

www.ppryor.com

(516) 935-0100 x 307 or
(866) 6-ACTUARY

For five decades, local, national, and international insurance communities have benefited from Pryor's exceptional recruitment services.

Our renowned Actuarial, Risk, and Modeling Division has been directed by Pauline Reimer, ASA, MAAA, for the past thirty-five years.

Beyond Transactions

Commitment Beyond Numbers

Alternative Markets | Enterprise Risk Management | Legislative Costing | Litigation Support | Loss Reserving | Predictive Analytics | Pricing and Product Management | Reinsurance

It's about partnerships and relationships.

When you work with Pinnacle, you become a partner. We start by getting to know your organization's business goals, geographic and industry mixes, risks and corporate culture.

Our consultants provide you with the highest level of professional expertise and service. The result is a true partnership to help guide you through available options and make **better business decisions.**

PINNACLE
ACTUARIAL RESOURCES

pinnacleactuaries.com

September-October 2022

actuarial REVIEW

departments

FSC LOGO

on the cover

Research in Action

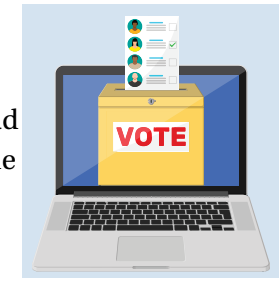
Get the latest news about progress in the CAS Research Council, the Research Working Groups and technology.

36

Election Results

19

The tallies are in! Read who won a seat on the board.



Building Skills for the Future: Looking for Social Inflation in Loss Development

42

Social inflation is hard to define, but Jim Lynch and Dave Moore decided to try, finding that traditional loss triangles provide evidence that social inflation increased aggregate losses by more than $20 billion between 2010 and 2019 in commercial auto liability insurance alone. Learn how they did it.

Actuarial Review (ISSN 10465081) is published bimonthly by the Casualty Actuarial Society, 4350 North Fairfax Drive, Suite 250, Arlington, VA 22203. Telephone: (703) 276-3100; Fax: (703) 276-3108; Email: ar@casact.org. Presorted standard postage is paid in Lutherville, MD. Publications Mail Agreement No. 40035891. Return Undeliverable Canadian Addresses to PO Box 503, RPO West Beaver Creek, Richmond Hill, ON L4B 4R6.

The amount of dues applied toward each subscription of *Actuarial Review* is $10. Subscriptions to nonmembers are $50 per year. Postmaster: Send address changes to *Actuarial Review*, 4350 North Fairfax Drive, Suite 250, Arlington, Virginia 22203.

actuarialREVIEW
The magazine of the
Casualty Actuarial Society

Editor in Chief
Grover M. Edie

***AR* Managing Editor and CAS Director of Publications**
Elizabeth A. Smith

CAS Editorial/Production Manager
Sarah Sapp

CAS Managing Editor/Contributor
Donna Royston

CAS Graphic Designer
Sonja Uyenco

Copy Editors
Rebecca Armon
Daryl Atkinson
Karen Ayres
Nathan Babcock
Sean Bailey
Glenn Balling
Robert Blanco
Sara Chen
Meng-Fang Chung
Todd Dashoff
Charles Grilliot
Stephanie Groharing
Julie Hagerstrand
Kenneth S. Hsu
Wesley Jenq
Rob Kahn
Rebecca Knackstedt
Julie Lederer
David Levy
Stuart Montgomery
Katrine Pertsovski
Shama S. Sabade
Eric Savage
Michael Schenk
Robert Share
Craig Sloss
Rebecca Sze
Sukaina Visram
James Weiss
Radost Wenman
Ian Winograd
Gerald Yeung
Yuhan Zhao

Humor Editor
Michael D. Ersevim

Explorations
Glenn G. Meyers
James C. Guszcza
Stephen Mildenhall

Puzzle
Jon Evans
John P. Robertson

Advertising
Al Rickard, 703-402-9713
arickard@assocvision.com

Expertise. Insight. Solutions.®

CAS Research and Building Skills

A recent survey of the CAS Member Advisory Panel shows that 93% of them agreed that research continues to be an important part of the CAS's mission. So how are we keeping you up to speed? Our cover story author, CAS Research Actuary Brian Fannin, reports on the multilayered activities of the CAS Research Council and the Research Working Groups. As of this printing, three new CAS Research Papers are soon set to be released concerning wildfire, flood risk and inclusive insurance. The new CAS Research Council has identified six high-priority projects, and there are many more projects waiting in the wings. CAS Research is truly "working!"

We are excited to announce the debut of a new *AR* column, Building Skills for the Future. If the name sounds familiar, it's because it is taken directly from the CAS Strategic Plan. The column will periodically feature articles that direct members to explore actuarial literature or session recordings or any other kinds of media and materials that will help them hone their practical, theoretical and communication skills.

The column premieres with two stories. First, Jim Lynch and Dave Moore give further details about their February 2022 CAS Research Paper collaboration, "Social Inflation and Loss Development," which tackles two topics very much top of mind today. Second, *AR*'s own Julie Lederer (Julie is one of our magazine copy editors) writes about the 2022 Call Paper Program on Reserves.

The news of these call papers is extra exciting to us in publications because they will be posted on a new, improved E-Forum microsite whose features include improved readability, searchability and cross-referencing. Be sure to take a look at these papers and navigate the new site.

From meeting, seminar and webinar offerings to literature and session recordings, the CAS has so much that members can tap into to enlarge their actuarial and business capabilities, but there are many other sources too. *AR*'s Building Skills for the Future column is also open to other resources, so please send your column ideas to ar@casact.org.

Please enjoy this issue!

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

SEND YOUR COMMENTS AND SUGGESTIONS TO:
Actuarial Review
Casualty Actuarial Society
4350 North Fairfax Drive, Suite 250
Arlington, Virginia 22203 USA
Or email us at AR@casact.org

Follow the CAS

LexisNexis®
RISK SOLUTIONS

Accurate Benchmarking

with insights delivered 60-80% faster than the industry standard

LexisNexis® Insurance Market Insights offers a current view of auto market data with updates in as little as 7 to 30 days after event vs. waiting a typical 6 to 12 months.

FREQUENCY

Compare your current and historic claim frequency to the industry and sub-segments

SEVERITY

Drill down into severity trends by state and metro area to better focus strategies

SHOPPING

Examine the latest shopping data for emerging trends, so you can act on them confidently

Ready to test drive LexisNexis® Insurance Market Insights?
Schedule your free benchmarking assessment by contacting our team at 800.458.9197 or insurance.sales@lexisnexisrisk.com

Governance, Transparency, DE&I Strategic Approach

The CAS Board of Directors recently held an in-person Board retreat and meeting in Chicago, where we:

- Discussed a market intelligence report focused on the actuarial profession today and trends for the future.
- Revisited the CAS Strategic Plan's envisioned future and pillars.
- Reviewed the key performance indicators that inform us of our progress towards achieving the ambitious goals of the Strategic Plan.

After two engaging days of extensive discussions, it is clear that the CAS must continue to maintain our focus to ensure our ongoing relevance in an ever-changing landscape, as there are ample opportunities in front of us to strengthen our position as the gold standard for credentialing property-casualty actuaries. The current Strategic Plan was adopted in 2020, and we are now completing the second year of what is a three-year plan. However, our work to achieve our goals will stretch beyond 2023.

During the retreat, we confirmed the continued relevance of our Envisioned Future, which is that:

> CAS members are sought after globally for their insights and ability to apply analytics to solve insurance and risk management problems.

To help guide our efforts toward our Envisioned Future, the Strategic Plan is organized around three broad pillars focused on building skills for the future, diversifying our pipeline and expanding globally, all while building our overall organizational capabilities at the CAS. Our board retreat discussions found us in agreement that the broad structure of our plan has served us well and should continue to be our focus going forward.

There is much we can learn from our members, and open dialogue such as this should always be viewed as an opportunity to gather valuable input to improve our organization.

While the board is confident in the direction of our Strategic Plan, we also understand that there is room to adjust in response to the changing environment and lessons learned from the past.

The recent elections generated much discussion and debate among our members about the future of the CAS, particularly related to our governance, our transparency and our strategic approach to diversity, equity and inclusion (DE&I). There is much we can learn from our members, and open dialogue such as this should always be viewed as an opportunity to gather valuable input to improve our organization.

Governance

Just over a year ago during the 2021 elections, the membership did not approve the proposed bylaws change that would have retired the CAS Executive Council layer of governance and its role in CAS operations. The board recognizes the critical connection our volunteer vice presidents provide between our members and the CAS staff and the important role they play in the successful execution of our Strategic Plan. We have taken steps to ensure that our vice presidents are utilized to their fullest as the volunteer-staff model evolves. In addition, to ensure our governance meets the highest of standards and that we are operating in accordance to the current CAS Constitution, Bylaws and adopted Procedures, the board recently approved the formation of a temporary board-level committee that will work with an outside consultant to bring much-needed clarity to roles and responsibilities, authority levels and our committee structure. We look forward to providing updates on this important project.

Transparency

During the August meeting, the board also discussed the need for more transparency in our work. We recognize and understand that certain issues did not provide the opportunity for input and level of transparency that CAS members deserve. We will continue to take steps to increase transparency so that our members can provide comments on topics that impact our profession or need further clarity before they are implemented.

To aid in that effort, the Board adopted a resolution in August to post approved meeting minutes on the CAS website for members to access at their convenience. Previously, individual members needed to make a written request to receive minutes. In addition,

President's Message, page 8

President's Message

from page 6

the CAS Board's Risk Management Committee was asked to review and report its assessment of the risks and benefits of making board materials available to members. Transparency will continue to be a focus of the board during my upcoming term as chair.

that professionalism is at the heart of the CAS. All members are entitled to their own diverse opinions, but it is imperative that those opinions be expressed in professional and respectful ways.

In addition, to support our community of diverse opinions and in accordance with the Article IX of the CAS Constitution, going forward our publications and any opinion of the CAS Board of Directors or a committee authorized by the Board to express an opinion will clearly indicate that any expressed opinions "do not purport to represent the views of the Casualty Actuarial Society, but only of the Board of Directors or the committee," as the case may be.

Our Strategic Plan goals are bold. I believe we will achieve them much more efficiently and effectively as a unified and focused organization.

Strategic Approach to DE&I

Our strategic approach to DE&I was developed to support the pillar Diversifying the Pipeline from our Strategic Plan, and it is critical to attract and retain diverse and talented candidates to our esteemed profession. We remain committed to our DE&I strategy, as adopted by the board this past February, and are also seeking member input as we review the strategy annually going forward. CAS members agree on many aspects of our DE&I strategy, and I hope that we can focus our energy on those areas and work together to achieve our goals. As we do that, I'd like to remind our community

Our Strategic Plan goals are bold. I believe we will achieve them much more efficiently and effectively as a unified and focused organization. I encourage you to join me in committing to working together collegially as we aggressively pursue the opportunities that will drive us towards achieving our envisioned future.

ACTUARIAL REVIEW *LETTERS POLICIES*

Letters to the editor may be sent to ar@casact.org or to the CAS Office address. Please include a telephone number with all letters. Actuarial Review *reserves the right to edit all letters for length and clarity and cannot assure the publication of any letter. Please limit letters to 250 words. Under special circumstances, writers may request anonymity, but no letter will be printed if the author's identity is unknown to the editors. Event announcements will not be printed.*

A lesson from history

Dear Editor:

Alice Gannon's piece on how change happens (In My Opinion, *AR* July-August 2022) is particularly valuable now when the CAS is undertaking a massive effort trying to implement its DE&I strategy. She argues that the dramatic increase in the proportion of women in the CAS, from near zero to over 30% is not due to anything that the CAS did. Gannon attributes the change in the percentage of women in the CAS to a major societal trend that saw more women entering previously male-dominated professions. And that wave is what also carried the CAS along. This point of view should at least serve to cause the CAS Board to exchange hubris for humility, by recognizing the practical limits of any initiative it champions in this area. No evidence has been advanced that *any* of these initiatives will yield the results the CAS DE&I policy is aimed at. Gannon's point is sobering and invites the board to consider the limits of what it can and cannot achieve in terms of the societal change necessary to cause the change in demographics it is seeking. Wouldn't it be sad to look in five years' time and see that all this effort, expense and energy has produced nothing? The way the CAS is attacking this issue without recognition that it will take a much greater societal change to achieve its ambitious goals, promises a major disappointment ahead.

—Stan Khury, FCAS

DW SIMPSON®
GLOBAL ACTUARIAL & ANALYTICS RECRUITMENT

CELEBRATING
30 YEARS
IN ACTUARIAL RECRUITMENT

Browse our Remote P&C jobs: www.dwsimpson.com/job-seekers

Assistant Vice President / Vice President, Actuary (Remote)
Need the peace of mind that comes from working for a well-established company? In this role, you will price reinsurance contracts across varying insurance coverages and products and provide clients with continuous support throughout the (re)insurance lifecycle. The ideal candidate should have 3-7 years of reinsurance pricing experience, an ACAS or FCAS certification, and experience with personal and commercial lines insurance product development. Must have strong capital modeling software and programming software experience. Workers Comp experience a plus. (#52875)

Sr Actuarial Analyst - Pricing (Remote)
Current role too traditional? Come work for a company that is heavily invested in seeking new solutions for a changing industry. As a Pricing Actuarial Analyst, you will perform pricing analyses, experience and profitability reviews and/or state rate filings, and support business units as needed. The ideal candidate should have 4 years of industry-related experience, completion of at least 5 CAS exams, and excellent communication and interpersonal skills. (#52855)

Head Reserving Actuary (Remote)
Come work for a stable organization with a solid growth plan. P&C client has a great opportunity for a designated FCAS who will oversee quarterly traditional reserve analyses, present to the Reserve Committee and Audit Committee of the Board quarterly and lead monthly claims and actuarial discussions. The ideal candidate would have 15+ years of experience, preferably in personal lines reserving. Must have leadership ability to manage a team and excellent analytical, quantitative, and problem-solving skills. (#52905)

Actuarial Analyst (Remote)
Drive change and innovation in the industry. As an Actuarial Analyst you will work as a member of the reserving team and will assist in processing data and building analysis templates, models, and ad-hoc reports. The ideal candidate will be a student actuary or recent ACAS with 2 to 3 years of actuarial experience, including experience with Medical Professional Liability reserving and/or pricing. Must be proficient in Excel, SQL, and familiar with R and/or Python. (#52998)

Actuarial Consultant (Remote)
Join an innovative company looking to drive change in the marketplace. Well-established and growing firm is seeking an ACAS level Actuarial Consultant for their P&C group. The ideal candidate will be a self-starter who is open to business development and who has the potential to move into a client facing role. This individual should possess at least 3 years of actuarial experience and a commercial auto/fleet or general liability background. (#52960)

Sign up for actuarial job updates today! **Simply register at** https://jobs.dwsimpson.com

| www.dwsimpson.com | (312) 867-2300 | actuaries@dwsimpson.com

COMINGS AND GOINGS

Danny Engall, FCAS, has joined the Berkshire Hathaway Homestate Companies' (BHHC) Workers Compensation Division's Executive Leadership team as their senior vice president, chief underwriting and analytics officer. Engell will lead the company's strategic underwriting and data analytics efforts in this role, providing innovative expertise and creative solutions to further enhance BHHC's market presence as an industry leader in workers compensation insurance products.

Elizabeth Hansen, FCAS, has been appointed chief actuary at AIG, Universal Insurance Holdings. Hansen was previously senior vice president of Blue Atlantic Reinsurance Corporation, a wholly owned subsidiary of Universal. In her new role, Hansen will oversee pricing, reserving and co-lead risk monitoring enterprise wide.

Chris Wei, ACAS, has been appointed Sun Life's executive vice-president and chief client and innovation officer (CCIO). He reports to Kevin Strain, president and CEO of Sun Life. Wei will be a member of Sun Life's Executive Team and has more than 25 years of experience as a global leader in the insurance and wealth management industries. He will take charge of directing the organization's dedication to superior client experience in this recently created position. He will also be the primary point of contact for the chief sustainability officer, chief marketing officer and director of corporate communications.

Dustin Loeffler, FCAS, MAAA, has been promoted to U.S. head of legacy solutions for Aon's Reinsurance Solutions. In this role, he will drive legacy deal execution in the U.S., in addition to his other structured reinsurance broking engagements. He has experience in personal lines, commercial lines and reinsurance actuarial roles, prior to transition to his broker role in 2017.

EMAIL "COMINGS AND GOINGS" ITEMS TO AR@CASACT.ORG.

See real-time news on our social media channels. Follow us on Twitter, Facebook, Instagram and LinkedIn to stay in the know!

CALENDAR OF EVENTS

October 13, 2022
In Focus Seminar
Virtual

November 6–9, 2022
Annual Meeting
Hilton Minneapolis
Minneapolis, Minnesota

December 2, 2022
CAS Road Show
The Linq Hotel & Casino
Las Vegas, NV

March 13–15, 2023
Ratemaking, Product and Modeling Seminar
San Diego, CA

June 5–6, 2023
Seminar on Reinsurance
Philadelphia, PA

Visit casact.org for updates on meeting locations.

September is International Month

The CAS has a growing membership of highly skilled actuaries working outside of North America. Throughout the month of September, we are celebrating our international community by highlighting profiles of CAS members around the world. Follow along on our social media accounts, and see our coverage in November/December *AR* to learn how CAS members are applying their expertise to actuarial work in diverse markets around the globe.

IN MEMORIAM

Gregory Scott Grace (FCAS 1985)
1956-2022

Thank You to 2021-2022 Society Partners

The CAS appreciates the support of the 2021-2022 Society Partners.

DIAMOND PARTNERS

AKUR8

EzraPenland.com
Actuarial Recruitment

GALECKI
SEARCH ASSOCIATES

Pauline Reimer, ASA, MAAA
PRYOR
Executive Search

PLATINUM PARTNER

CARFAX
Banking & Insurance Group
MORE INFORMATION. BETTER DECISIONS.

ISO
Verisk Insurance Solutions

PINNACLE
ACTUARIAL RESOURCES, INC.

GOLD PARTNERS

ACTUARIAL CAREERS, INC.

DW SIMPSON
GLOBAL ACTUARIAL & ANALYTICS RECRUITMENT

Insureware

Red Mountain
TECHNOLOGIES

Willis
Towers
Watson

SILVER PARTNERS

Gross
Consulting

Milliman

TRAVELERS

BRONZE PARTNERS

RStudio

IN REMEMBRANCE

In Remembrance is an occasional column featuring short obituaries of CAS members who have recently passed away. These obituaries and sometimes longer versions are posted on the CAS website; search for "Obituaries."

Music, Mathematics and Family

John Paul Booher (ACAS 1992)
1946-2021

John Paul Booher died on Jan. 12, 2021, due to complications from COVID-19. He was born in Milan, Indiana, and lived most of his early life in Tennessee. He graduated from York Institute in Jamestown, Tennessee. Booher was a brilliant and self-taught musician on the guitar and piano but was just as brilliant in the field of mathematics. After receiving a full academic scholarship to college, he completed his bachelor's and master's degrees in mathematics from Middle Tennessee State University. He pursued a career as an actuary in 1972 and founded Actuarial Insurance Consultants, Ltd. in 1990. He made his home in Snellville, Georgia, for 37 years. He was committed to his fundamental Christian beliefs, remained active in his church and, in keeping with his love of music, enjoyed singing in the choir. His other passion was golfing with his church friends and especially playing with his grandson Trey. He was preceded in death by his parents, Wellington and Mary Booher. He is survived by his wife of 50 years, Pat Sullivan Booher; children, John Paul Booher II and Tanda Booher Lane, and their spouses; and four grandchildren. He also leaves behind his beloved sisters and brothers and several cherished nieces and nephews.

Tall, Devoted and Driven

Gregory Scott Grace (FCAS 1985)
1956-2022

Greg Grace of Washington Crossing, Pennsylvania, passed away suddenly on July 2, 2022. Born in Pottstown, Pennsylvania, he was married to Emily DeWitt Grace for the past 32 years. The son of the late George Albert Grace and Ruth Hedrick Grace, he earned a degree in actuarial science from Lebanon Valley College in Annville, Pennsylvania, in 1978. Grace's professional career spanned many years working as an actuary for several Fortune 500 insurance companies, including Cigna, Reliance, American Reliance and ARI. After finding his niche and his expertise, he founded Grace Actuarial Consultants and was the CEO until he retired. An avid and focused runner, he was a member of the Bucks County Road Runners for many years and served four years as club president. Grace ran over 30 marathons, many of them after his Parkinson's diagnosis. He loved rock music and listened to WMMR radio daily. Grace was also a Star Trek and Marvel Comic aficionado. A true Philadelphia sports supporter of the Eagles and Phillies, he and his wife attended Phillies spring training in Florida for several years. At 6'7" tall, he was easily recognized wherever he went. In addition to his wife, he is survived by his daughter Christine Marie Grace and her fiancé Daniel Gallant; son Andrew Scott Grace; sister Linda Van Pelt; a granddaughter; two nieces; and a great nephew.

Read and Earn Continuing Education Credits

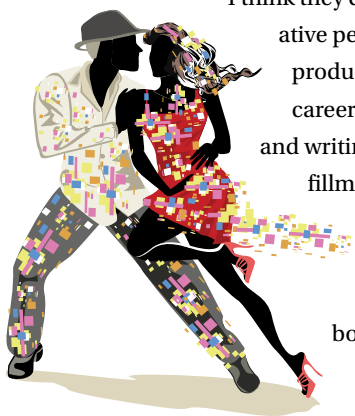
Did you know you can earn continuing education credits for reading CAS research? This applies to *Variance* and Monograph articles, as well as in the *E-Forum papers* such as call papers and reports. The same way you calculate your credits from meetings (one CE for every 50 minutes of attending), you also get one CE for every 50 minutes of reading you do. Don't forget, you must have your CEs recorded by December 31 to maintain your designation.

Meet Alicia Burke, iCAS Director of Portfolio & Product Development

Alicia Burke

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

- **What do you do at the CAS?**
  I direct portfolio and product development for The CAS Institute (iCAS). iCAS is a subsidiary of the CAS dedicated to career development and professional acknowledgement of non-actuary specialists that reside within or adjacent to the P&C environment. In addition to our current credential offerings (the CSPA, CSCR and CCRMP), I'm focused on learning other ways we can expand support through educational offerings, online communities and curated content.
- **What inspires you in your job? What do you most love about your job?**
  I'm always inspired by the passion and dedication of volunteers and the opportunity to collaborate with them on innovative solutions. I love to connect with those working in the profession to hear about their career journey, the challenges they face and any ideas for how we can better serve them. If any readers are willing to connect to share their stories or help us test new concepts for educational offerings, please reach out any time at aburke@casact.org. Your insight and feedback are invaluable.
- **Describe your educational and professional background.**
  Immediately prior to joining the CAS, I spent nine years at the Project Management Institute (PMI) where I was the global manager of certification products. I was responsible for portfolio growth, maintaining the quality and relevance of PMI products and ensuring a seamless customer journey for more than 1 million active certification holders and 300,000 exam takers every year. Prior to PMI, I held senior level marketing and project management roles within education software organizations. I'm a graduate of Kutztown University of Pennsylvania, where I earned a Bachelor of Science in telecommunications, and of Lehigh University, with a Master of Business Administration in marketing.
- **What is your favorite hobby outside of work?**
  I'm an avid student of Latin dance. I've been studying salsa and bachata for many years and just added Argentine tango to the list. Most evenings I'm either training or out social dancing in the Philadelphia scene.



- **If you could visit any place in the world, where would you go and why?**
  I've been fortunate to visit many amazing locations in prior business travel, but I haven't made it to Antarctica yet. I would love to see the remote landscapes and, of course, penguins! I've read about some tours where there's a chance to kayak along the coastlines, so I think that would be my ultimate way to experience it.
- **What would your colleagues find surprising about you?**
  I spent a few years as a professional vocalist in a funk band that played all over the U.S.

Some of my favorite venues were the Hammerstein Ballroom in New York City and the Houston Astrodome.

- **How would your friends and family describe you?**
  I think they'd describe me as a creative person. Whether it's new product innovation in my career or the music, dance and writing I do for personal fulfillment, I'm always working on something new and trying to think and live outside the box.

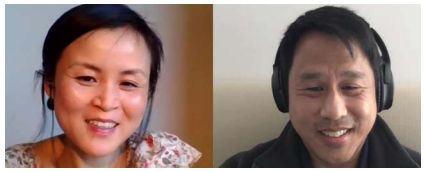
CAS Marketing and Communication Efforts Recognized with 12 Industry Awards

For exemplary work completed in 2021, eight Casualty Actuarial Society publications received 12 awards across three association award programs: EXCEL Awards, TRENDY Awards and Communicator Awards.

"The CAS is exceptionally proud to be recognized for our dedication, creativity and innovation in the field by receiving these 12 industry awards," said CAS CEO Victor Carter-Bey.

Following is the complete listing of awards:

AR's President's Message Series 2021



Communicator Award Of Distinction

In March 2021, the CAS launched a new video series on the CAS YouTube Channel as an added enhancement to *Actuarial Review*'s President's Message column. In this series designed for career-minded professionals, CAS President Jessica Leong interviews six distinguished actuaries whose work and career paths embody the new Envisioned Future for the CAS. Covering topics well beyond the actuarial industry, the interviews include business, technology and career advice from industry CEOs. Viewers gain a deeper insight into the careers of prominent actuaries through personal anecdotes that make the career more relatable and approachable to a wider audience. To see the videos, visit *AR* Web Exclusives or the Casualty Actuarial Society YouTube Channel.

Student Central Summer Program

Communicator Award Of Distinction

Silver Trendy Award From Association Trends For

STUDENT CAS CENTRAL
SUMMER PROGRAM

E-Learning And Live Training

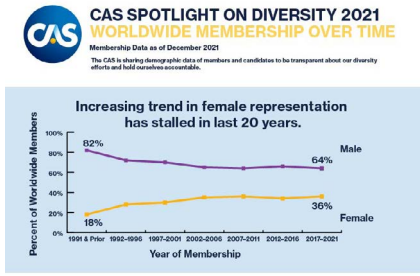
The Student Central Summer Program had a second fruitful year in 2021. The CAS Staff and volunteers ran this eight-week program that covered a variety of actuarial skills and offered mentoring by 72 seasoned actuaries. Out of 399 applicants, 246 were admitted into the mentor-led program and the remaining applicants were offered an independent-study version of the program. The mentor-led students, who represented 17 countries and 153 universities, were organized into 35 cohorts that met weekly. The program included 20 online seminar presentations and 12 mock interviews. Volunteers included nine "Ask an Actuary" panelists and 18 case competition judges.

CAS Spotlight on Diversity Infographics

Bronze Excel Award In Diversity And Inclusion Initiatives

Communicator Award Of Distinction

As part of the CAS Strategic Approach to



Diversity, Equity and Inclusion (DE&I), the CAS committed to setting concrete goals and maintaining transparency and accountability on progress on its DE&I initiatives. To this end, a set of detailed demographic metrics were built for CAS members and candidates that are designed to help understand the current state of diversity in the CAS, set goals and track changes over time.

Foundations of Diversity, Equity & Inclusion Series Mini-Training on Race/Gender/Meritocracy

Silver Excel Award In Diversity And Inclusion Initiatives
Communicator Award Of Distinction

CAS DE&I Staff Actuary Mallika Bender, FCAS, MAAA, took to the small screen in part one of this two-part video series. Presented to CAS members and leaders, the series concerns the issues underly-

ing diversity efforts and tactics with the goal of deepening understanding and clearing up common misconceptions.

Actuaries in Community Social Media Campaign

GOLD TRENDY AWARD FROM ASSOCIATION TRENDS FOR SOCIAL MEDIA CAMPAIGN

COMMUNICATOR AWARD OF DISTINCTION

In June 2021, the Actuaries in Community Campaign highlighted CAS members doing work in their communities on LinkedIn, Instagram, Facebook and Twitter platforms using the hashtag #ActuariesinCOMMUNITY. We highlighted partner organizations enhancing the actuarial field, peer-submitted features of actuaries' civic excellence and personal profiles of our members. This campaign showcased the diverse ways in which actuaries are often involved in acts of service for their communities, be it actuarially related or not.

National Hispanic Heritage Month (NHHM) Social Media Campaign

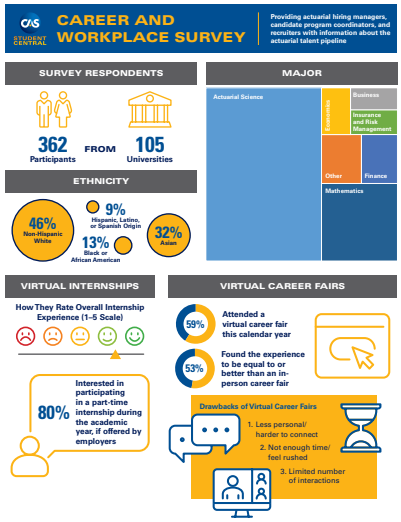
COMMUNICATOR AWARD OF DISTINCTION

A year ago in September, the CAS ran its first-ever social media campaign for National Hispanic Heritage Month,

which commemorates and encourages the study, observance and celebration of Hispanic independence. Using the hashtag #NHHMxCAS, the "NHHMxCAS" campaign ran from September 15 to October 15 and highlighted exceptional Hispanic actuaries in a variety of creative ways. Concluding the campaign, Ana Mata, FCAS, shared her journey to become an actuary on the CAS Roundtable Blog.

Individual-Infographic for Branded Content "CAS Career and Workplace Survey Infographic"

COMMUNICATOR AWARD OF DISTINCTION



In 2021 the CAS surveyed members of CAS Student Central, the CAS's membership program for university students, for insight into virtual recruitment practices. The survey results were released as an infographic with key information for actuarial hiring managers, candidate program coordinators and recruiters about the career preferences for the actuarial talent pipeline. The survey drew on responses from 362 participants from 105 universities and covered a variety of recruitment topics, including recruiting in a virtual world, and what students are seeking from employers in the current environment.

CAS Website Redesign

COMMUNICATOR AWARD OF DISTINCTION

After more than a year of development, the new CAS website offered our members, candidates and other stakeholders a better user experience across a wide range of features. Redesigning and launching the new website involved a team of 40 volunteers, from candidates to members, who shared their perspectives and provided feedback through the project.

The CAS Grants 2022 University Awards

By MARGARET GADDY, CAS UNIVERSITY ENGAGEMENT MANAGER, AND DR. SARAH SAPP, CAS EDITORIAL/PRODUCTION MANAGER

Universities are critical to the future of the actuarial profession. They advance the body of knowledge of actuarial science and fill the pipeline of future actuaries with skilled and prepared students.

In July 2022, the CAS recognized four schools through its 6th Annual University Award Program: Bryant University, Drake University, Sri Sathya Sai Institute of Higher Learning (SSSIHL) and the University of Wisconsin-Eau Claire. The CAS University Award Program was created in 2016 to facilitate the promotion and sharing of ideas around property-casualty curriculum and research within academic communities. This year's award-winning schools are honored for their achievements in exposing students to the P&C insurance industry through curriculum, research, engagement and innovation.

Following are brief descriptions of the 2022 CAS University Award Winners.

Bryant University

Bryant University's actuarial science program comprises four faculty and 90 actuarial students as well as a significant number of P&C actuaries among its alumni. The University particularly stood out for its connection to the P&C industry and research. Program highlights include:

Bryant University Faculty Left to Right: Rick Gorvett, FCAS, Math Dept Chair; James Wood, ACAS, Executive in Residence; Gao Niu, ACAS, Actuarial Math Program Coordinator

- Bryant's actuarial science program stresses student engagement in research and consulting. One of Bryant's many projects regards machine learning in P&C actuarial science and insurance, where a computer is taught to identify and estimate the cost of automobile damage based on a picture.
- Bryant's actuarial faculty have written a series of research articles relevant to P&C insurance and actuarial science that have been published in journals and presented at conferences, often with the help of Bryant undergraduate students.

"Currently we have three CAS members on our full-time faculty. These faculty have extensive experience as practicing P&C actuaries, significant research accomplishments and are some truly gifted teachers," said Rick Gorvett, FCAS, professor and mathematics department chair. "Our students benefit from a number of P&C-related courses and industry relationships, and many enter the P&C actuarial profession, so this recognition is particularly special and appreciated here at Bryant."

Drake University

With more than 60 years in operation, Drake University's actuarial science program currently consists of five core faculty, 132 majors and 17 minors. Drake University was recognized for the following:

- Drake University's Kelley Insurance Center for Innovation partners with many Des Moines-based insurance companies to educate and inform students about insurance trends, innovations and insurtechs. The Kelley Center has organized the insurance innovation lab, where students work on year-long projects on how insurance companies can expand their sustainability efforts and insurtechs can play an important role in insurance innovation.

Drake' University Professor Toby White

- For the past five years, Drake students have hosted the Drake Symposium, a student-run actuarial conference attended by over 150 students each year. Students from over 30 universities from around the U.S. and Canada have attended the event over the last three conferences. Students learn more about specific industry trends and actuarial roles through breakout and general sessions.
- Drake offers a yearly capstone class to graduating seniors that uses real business problems to "simulate" working in the actuarial industry. Students can piece together all the actuarial and business education at Drake while preparing for various career roles after graduation. P&C-related class topics have included fitting distributions to real-world data, insurance economics and

insurance regulation.

"This award is a reflection of our focus on continuous improvement to ensure Drake remains the actuarial science program of choice for students seeking a career in this burgeoning field," said Alejandro Hernande, dean of Drake's College of Business and Public Administration. "Our pursuit of this recognition was propelled by the encouragement of alum Jack Richards and the contributions of two current Drake students, Caitlyn Nielson and Benjamin Ticali, who together with our faculty generated this first-ever distinction for Drake."

Sri Sathya Sai Institute of Higher Learning

The Sri Sathya Sai Institute of Higher Learning (SSSIHL) is home to six faculty members and 36 students enrolled across undergraduate, master's and doctoral programs in actuarial science. The actuarial program commenced in 2017 with a vision to graduate highly skilled actuaries to serve society. The university impressed the judges with its focus on P&C insurance across curriculum, research and industry engagement. Following are some of SSSIHL's program highlights:

Students and faculty from SSSHIL's program.

- The SSIHL Insurance Fraud Classifier helps identify insurance fraud in real-time. Machine learning dynamically generates rules with a very high level of accuracy.
- SSSIHL provides free education for all students at the undergraduate, postgraduate and doctoral level. There are no fees for tuition, exams or any other services for students during the program.
- In addition to building several courses' syllabi around CAS exams and 10 P&C course topics at the post-graduate level, all post-graduate students are required to work on a P&C research project the final year of the program.

"The platform provided by the department of mathematics and computer science working with actuarial professionals bolsters our effort to integrate actuarial concepts with data science and prepare actuaries for the future," said Professor Dr. Carani B. Sanjeevi, SSSIHL vice-chancellor. "Through research, our students could explore technological innovations in industry-relevant actuarial themes and present findings in international journals and conferences. This award motivates us to continue working with students on topics that contribute to the industry, the profession and the society at large."

University of Wisconsin-Eau Claire

Consisting of four faculty and 90 students, the University of Wisconsin-Eau Claire's actuarial science program has a 20-year history of producing young actuarial professionals. The institution rose to the top for its depth of P&C curriculum. Following are some of the highlights of its program:

UW-Eau Clair actuarial students celebrate at graduation and awards banquet.

- To ensure that students are well-rounded and ready to enter the actuarial workforce upon graduation, UWEC has created several data science courses that are included in the curriculum requirements for actuarial science majors. Recognizing the importance of balancing numerical and soft skills, students are required to take business communications courses.
- Faculty have written several publications in conjunction with the CAS and other actuarial societies. Examples include "Risk Assessment Applications of Fuzzy Logic" as well as papers on emerging data analytics techniques with actuarial applications.

"Over the past 20 years, actuarial science has grown from a small emphasis within our math major to a large, stand-alone program. The focus of our efforts has always been on the student experience, ensuring that they emerge with the skills to succeed and an appreciation for the challenges within this field," said Kristopher K. Presler, FSA, MAAA, professor and actuarial program director. "Our P&C industry partners have been vital in assisting on both fronts. This award provides an endorsement of our efforts thus far, while also providing inspiration to further enhance the learning experiences for our students to build foundations for successful future careers in the P&C industry. We are truly honored and grateful to be included amongst this year's winners."

CAS Expands Staff Actuary Role to Include Executive, Leadership Responsibilities

Effective July 27, 2022, Ken Williams, FCAS, MAAA, formally took on an expanded staff actuary role to enhance the voice of the profession and further support the work of the CAS leadership team. In this expanded role, chief of actuarial advocacy, Williams will serve as a member of the CEO's leadership team and partner with executive leadership, the CAS Board of Directors, volunteer members and CAS staff on key operational and strategic business matters. The role will continue to offer the perspective of an experienced and credentialed property-casualty actuary on issues related to examinations, thought leadership, content development, strategic planning, growth opportunities and communications.

Williams joined the CAS as staff actuary in November 2018. The staff actuary serves as the voice of the profession, supporting the implementation of CAS's long-term vision and strategic plan and contributing to ongoing efforts to deliver value to members and non-members in the casualty actuarial profession.

"The new focus of this role will be to provide regular input and guidance on items of business to the CEO and to the board to ensure they reflect and address core actuarial interests," said CAS CEO Victor Carter-Bey. "Ken's expanded role is an important step in ensuring CAS remains focused on the needs of its actuarial members, candidates and other stakeholders. We are fortunate to have Ken as a member of our team."

Williams previously spent 26 years with COUNTRY Financial Insurance Company. In addition to his work at COUNTRY Financial, Williams was a lecturer in the mathematics department at Illinois State University for over 20 years, instructing future actuaries on the basic applications of property and casualty ratemaking and reserving. Williams also volunteered extensively on Future Fellows as a member and chair of the Candidate Liaison Committee.

Ken Williams
CAS Chief of Actuarial Advocacy

The CAS Institute Announces New CSPAs

Eight new individuals have earned The CAS Institute's Certified Specialist in Predictive Analytics credential since September 2021. For more information about The CAS Institute and to see a full list of CSPA honorees, visit https://thecasinstitute.org/.

Tyson Mohr, CPCU, FSA, CSPA
Allie Cashion, CSPA
Nathan D. Pritzl, ACAS, CSPA
Hunter Hicks, ACAS, CSPA
Taylor Stern, CSPA
Stephen M. Nagy, ACAS, CSPA
Bobby Jaegers, ACAS, CSPA
Neil Ramchandani, CSPA

Election 2022: The votes are in!

Frank Chang has been elected president-elect of the CAS. Balloting for the 2022 CAS election opened on August 1, 2022 and closed on August 31, 2022.

Steve Belden, Julie Lederer, Len Llaguno and Amber Rohde have been elected to the Board of Directors.

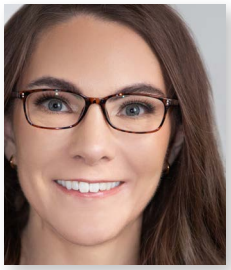
According to the election procedures approved by the CAS Board, all vote counts are released to the membership. The results follow:

Frank Chang	2,305
Amber Rohde	1,656
Julie Lederer	1,558
Len Llaguno	1,507
Steve Belden	1,385
Alan M. Hines	1,382
Carolyn "Coe" Bergh	1,321
John Gleba	1,241
David Skurnick	1,190

A total of 3,070 voting members cast ballots (37%), as compared to 2,924 voting members last year (37.9%).

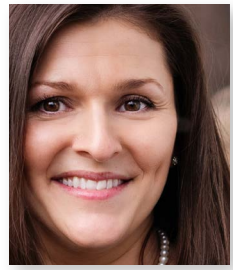
Frank Chang, FCAS

Steve Belden, FCAS



Julie Lederer, FCAS

Len Llaguno, FCAS



Amber Rohde, FCAS

ACTUARIAL SIGHTINGS

Work Follows Him Even on Vacation

During his time in Kekaha, Hawaii, Guy Avagliano, FCAS, spotted this sign.

NEW FELLOWS ADMITTED OR RECOGNIZED IN MAY 2022

Row 1, left to right: *Jacob William Sechler, Megan Baker, Ashleigh Tufnell, Matthew Schreckenberger,* ***CAS President Katherine Antonello,*** *Elizabeth Anne Jackson, Diana Krulevich, Kayla Greeson, Ashley Michelle Hamberg.*
Row 2, left to right: *Jia Qi Ruan, Kayla Wood, Yu Meng Wang, Joel Belliveau, Justin Kyle Greene, James B. Coen, Justin Malmgren, Shujun Liu.*
Row 3, left to right: *Dhimal Vagh, James Francis Boyle IV, Daniel Turenne, Trevor Schaap, Andrew John Ford, Scott C. Sutton, Jeffrey Durham, Brandon Thorne.*

Row 1, left to right: *Jeffrey B. Huang, Zdravko Paskalev, Jonathan James Laubinger, Marco Sung,* ***CAS President Katherine Antonello,*** *Katherine Ann Pipkorn, Jacqueline Nyokabi Mathenge, Robert Tiger, Alexandre Monette-Pagny.*
Row 2, left to right: *Chris Chiho Moon, Dominic Defuria, Jonathan Leo Wang, Jonathan Jacques, Jinhee Song, Jennifer Zheng, Yun-An Liu, Jennifer Leigh Tripp.*
Row 3, left to right: *Joshua Lieberg, Peter Hohman, Nicholas Schneider, Menglong Yang, James Lentivech, Charles L. Page, Cal Wila, Gary Tsai.*

Row 1, left to right: *Taylor Yeaton, Laurel Brown, Michelle Muzulu, Juhyun Justin Yi,* ***CAS President Katherine Antonello,*** *Colin Christopher Anderson, Keith Lam, Sowon Kang, Nancy Nguyen.*
Row 2, left to right: *Likang Zhang, Bright Amudzi, Claudio Aguirre, Daniel Andrade, Catherine Rose Erdelyi, Stephanie M. Kalina, Courtney Rohde, Daniel Dal Piao.*
Row 3, left to right: *Katherine Wood, Alycia Barron, Fei Hao, Andy Dao, Jeffrey Molgano, Christopher Davey, Andrew Switzer, Nickolas Alexander Alvarado.*

Row 1, left to right: *Sherry Young, Austin Mancenido, Sajid Suleman Virani, Erick Arnaldo,* ***CAS President Katherine Antonello,*** *Boya Du, Jerry Zhang, Cindy Wan-Hsin Chou, Stephen DiCillo.*
Row 2, left to right: *Rachel Miccolis, Wanyi Yang, John Franco Dawdy, Andrea Jeanne Monterotti, Steven Getselevich, Jeffrey Lanza, Colleen Laughlin.*
Row 3, left to right: *Joseph W. Dunham, Joel Bruxvoort, Pat Lesiewicz, Michael John Bertoli, John Irving, Daniel Richard, Corey Zeutzius, Tom Roltgen.*

NEW FELLOWS ADMITTED OR RECOGNIZED IN MAY 2022

Row 1, left to right: *Justin Caruso, Kurt Jager, Erin Bruggeman, Reese Walker Mularz,* ***CAS President Katherine Antonello,*** *Audrey-Anne LeBlanc, Isabelle Morency, Geneviève Gervais, Emma Wieduwilt.*
Row 2, left to right: *Sean Hannah, Shuo Zhang, Stanley Wang, Michael Lange, Jack Nicholas McCann, François Dumont, Jean Forest, Alyssa Westfall.*
Row 3, left to right: *Jeffrey Lyle Kessin, Joseph Testa, Austin Mitchell, Geoff Udell, Alexandre Parent, Jared McKinney, Craig Pierre Nelson, Bradley A. Parent.*

Row 1, left to right: *Gloria Asare, Katherine Schwartz, Sara Chen, Lawrence Wang,* ***CAS President Katherine Antonello,*** *Emily Wu, Vicky Liang, Carri Nicodemo, Andrew J. Baglini.*
Row 2, left to right: *Catherine Haughney, Bailey E. Jenson, Elizabeth Schmitt, Connor R. Cain, Colleen Stapleton, Michael F. Borysek, Wayne Chu, Tiffany Valdecantos, George You.*
Row 3, left to right: *Jean-Philippe Tardis, James P. Morin, Kirk Jared Leesman, Caleb Blodgett, Justin Michael Rubin, Michael Schleis, Chase Wurdeman, Robert Golightly, Lalith Devireddy.*

Row 1, left to right: *Kevin Shao, Xuan Qin, Danika Babin-Demers, Hien (Haley) Dang,* ***CAS President Katherine Antonello,*** *Mihaela Boboc, Molly Covill, Promise Tober, Phillip Briggs.*
Row 2, left to right: *Hai Qi Liang, Kevin Heroux Prescott, Maxime Richer, Julie Godbout, Dylan Martz, William Craic Van Alsten, Mark Andrew Hebert.*
Row 3, left to right: *Daniel Chammas, Hugo Houde, Simon Jones, Nick Zaharopoulos, Anthony Methe, Charles Dupuis.*

Row 1, left to right: *Melinda Moss, Matthew Gliebe, Jiajia Yin, Chu-Chun (Michelle) Hsiao,* ***CAS President Katherine Antonello,*** *Amanda Chou, Antoine Cabrera, Francis Crevier Raymond, Tobie-Eloi Hinse-Pare.*
Row 2, left to right: *Pavel Derlukiewicz, Irina Kretskaia, David Chung-Chum-Lam, Kevin Ka-wing Lin, Benson Chek-Long Lung, Kristin Ryan, Shimon Epstein, Micah Zart, Sam Gim, Chen (Jennifer) Liu.*

New Fellows not shown: *Anna Jeanine Breigenzer, Erin Bretzman, Scott D. Brown, Yang Cai, Alexandre Chabot, Chor Kit Cheung, Yen Wei Chu, Alexa Cosenza, Jessica L. Crumrine, Melanie Marie Famiglietti, Caleb Fitzgerald, Marie-Christine Fournier, Brandon A. Grangruth, Luxi He, Kai Wen Hew, Long Yan Huang, Steven Huang, Jackson M. Hunt, Kihoon Jeong, Li Jiang, Dr. Nicholas Jay Kunkle, Maxime Labonte, Ian Michael Long, Alexander David Loveland, Hoi Ching Lu, Ian David Mackenzie, Alec Martini, Thomas McCarthy, Lawrence G. Miley, III, Piratheep Navaratnam, Moira Rose O'Connell, Chin Yang Ong, Paul Oshana, Vandan Patel, Nicole Elizabeth Pettis, Vincent Philip Pomo, Sabina Preda, ZiZhen Qiu, Jean-Christophe Richard-Poissant, Maxime Romano, Neal Saulnier-Holland, Brent Arthur Sianez, Dalton Thomas Streff, Dominick Sullivan, Elaine Tan, Kah Hong Tan, Andrew Tang, Gilles Therien, Bradley Thompson, Christopher J. Woidill, Lei Wu, Xuan Hao Xu, Yunxuan Yang, Annie H. Ye, Chi Yan Yeung, Connie Yeung, Tianyi Zhang, Wenzheng Zhang, Yuqing Zheng.*

NEW ASSOCIATES ADMITTED OR RECOGNIZED IN MAY 2022

Row 1, left to right: *Sovanna Ly, Avraham Wisotsky, Yeshaya S. Pollack, Jacob Burns,* ***CAS President Katherine Antonello,*** *Alan Paul Schad, Seth B. Shively, Julia Stella, Joseph Eichorn.*
Row 2, left to right: *Matt Murray, John Anthony Smarto IV, Anthony Dery, Alexandre Fallu, Mehdi Ben Hamouda, Lisa Jaskowiak, Joseph Drennan.*
Row 3, left to right: *Jeffrey John Price, Vincent Edward Anderson, Eugene Yan, Francis Costanzo, Katie Doherty, Steven Tomala, Daniel Muckenhirn, Ismet Ibadullayev.*

Row 1, left to right: *Lei Huang, Karla L. Jeggle, Shayla Carey, Alan Schomburg,* ***CAS President Katherine Antonello,*** *Mengyi Li, Veronica Brown, Xiangyao Wu, Rocco Joseph Bavuso.*
Row 2, left to right: *Emma Casehart, Lauren Caputo, Benjamin Bradley, Max Peterson, Brittany LaRocque, Thomas Stava, Abigail Bruce, Christine Sheffield.*
Row 3, left to right: *Andy Walker Hufford, Dalton Cowan, Frank George Desmond IV, William Howard Schwartz, Jr., Menglong Yang, Jerry Jackson, Shane Carter, Erik Millstine.*

NEW ASSOCIATES ADMITTED OR RECOGNIZED IN MAY 2022

Row 1, left to right: *Melanie Carlson, Nikolas Dreyer, Nicholas Bonasera, Erin Sherman,* ***CAS President Katherine Antonello,*** *Nabeel Saeed Zuberi, Alicia Huang, Thomas Michael Duncan, Logan Stern.*
Row 2, left to right: *Michelle Muller, Jessica Joyce, Shushangxuan Li, Ragnar Kempf, Eric Hang, Huiru Zhang, Yiming Gao, Abigail Christine Benz.*
Row 3, left to right: *Meredyth Hurlbert, Benjamin Raibley, Brian Krawczynski, Timothy Stump, Puneet Varier, Jeffrey R. Stanczyk, Nicholas E. Vogl, Mark Miresse.*

Row 1, left to right: *Timothy Cheng, Mitchell Post, Jordan McCort, Yi Yang,* ***CAS President Katherine Antonello,*** *Jason Hartman, Matthew Kaufman, Tzong Her Lee, Siyu Lin.*
Row 2, left to right: *Andrew Mac, Thomas Glen Herben, Emily Roche, Benjamin Bostick, Woosuk Yoo, Erica Wong, Jamie Eversdyke, Ziwei Jiang, Jaisal Parshotam.*
Row 3, left to right: *Kristen Marshall, William Miller, Anthony Beadling, Nicholas Tyler Wong, Andrew Yang, John Stark, Ben-Iddo Manda, Kyle Casalla, Skylar Nicol.*

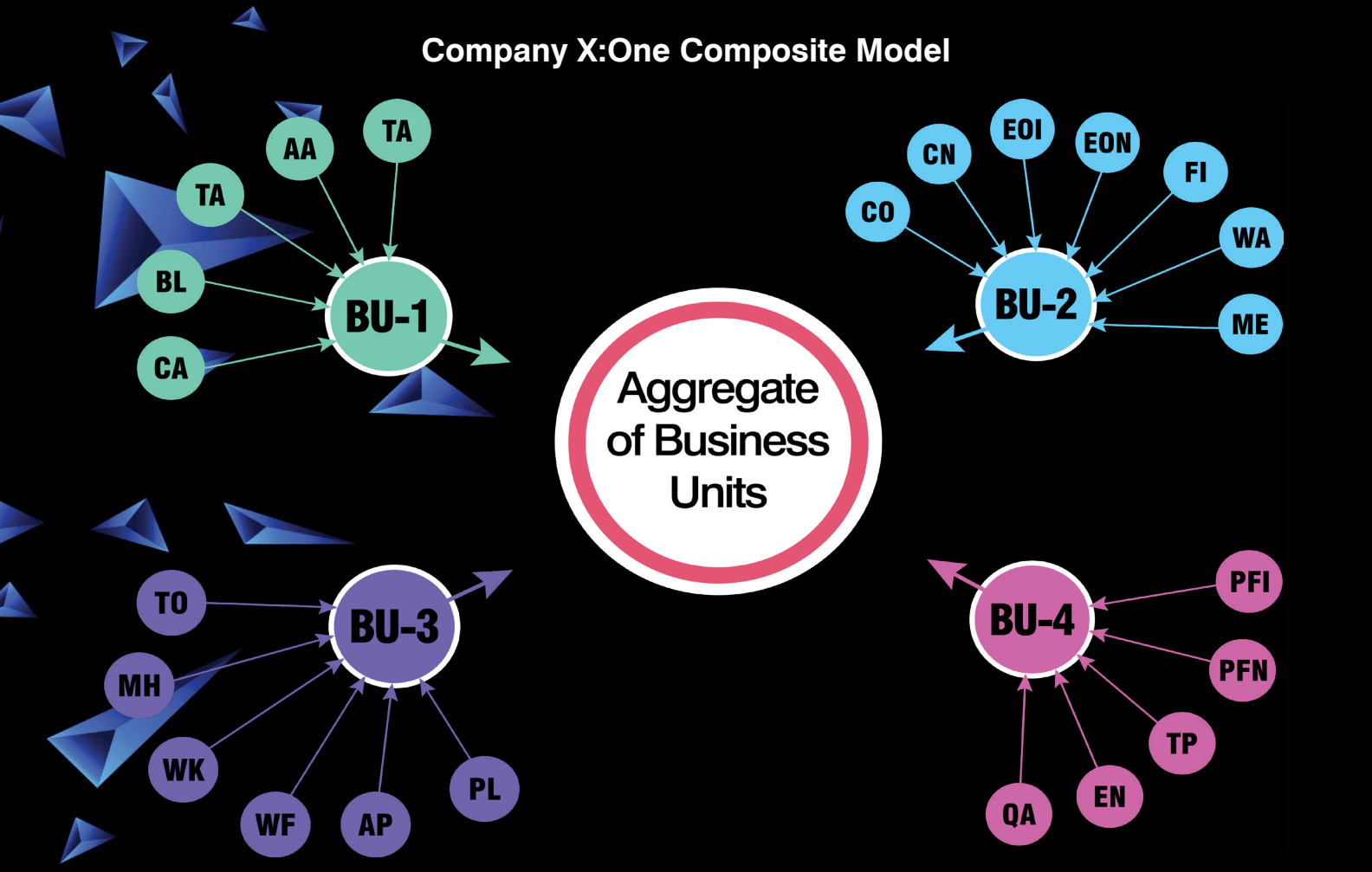
One Single Composite Model

The Multiple Probabilistic Trend Family (MPTF) modeling framework of ICRFS™ gives:

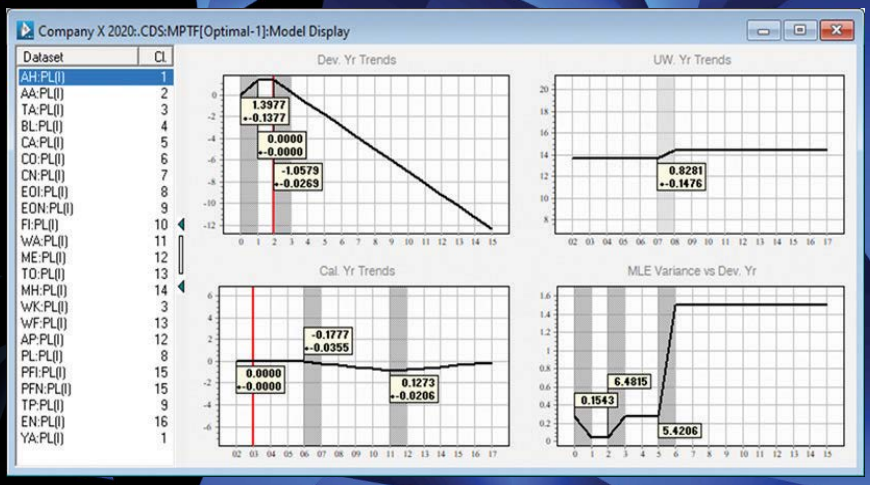
- one single optimal composite model identified from the data for multiple lines of business and segments
- a company wide picture encapsulating trends (including social inflation) and volatility in each line (or segment) and relationships between them
- the diversification credit based on volatility correlations between lines/segments and any common drivers all driven by the data
- risk capital metrics for optimal risk capital management - including reinsurance

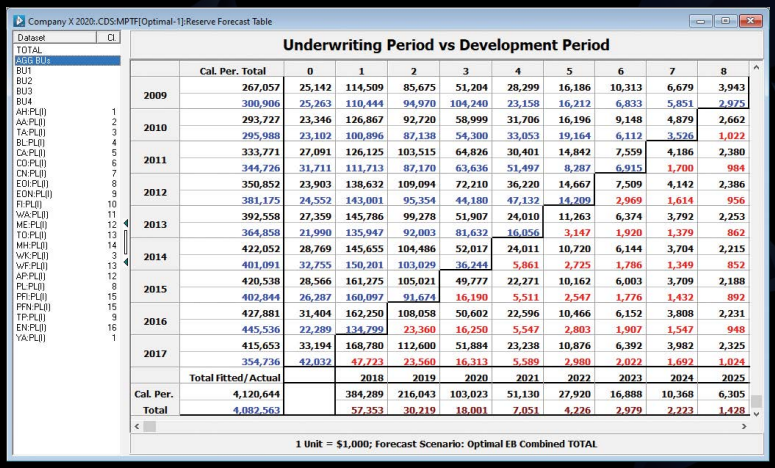
Access to much information by segment, business unit, or any combination of aggregates with a few mouse clicks!

Company X:One Composite Model



The composite model retains the trend and volatility structure identified for each individual segment. Segments are linked by volatility correlations. Common drivers across segments, if found, form a stronger relationship than volatility correlation as movement in means is a more direct relationship than randomness.




Company X 2020:.CDS:MPTF[Optimal-1]:Reserve Forecast Table

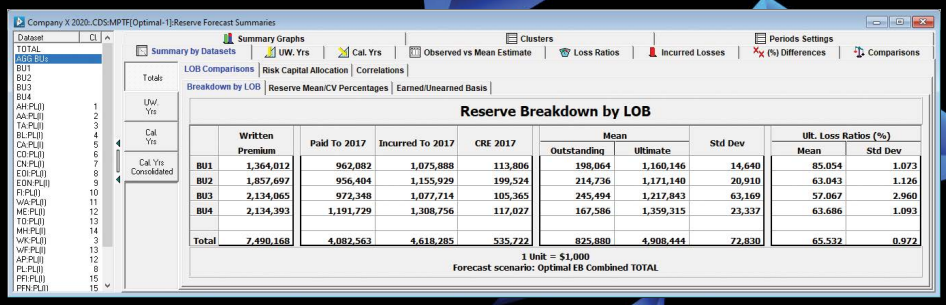
Underwriting Period vs Development Period

	Cal. Per. Total	0	1	2	3	4	5	6	7	8
2009	267,057	25,142	114,509	85,675	51,204	28,299	16,186	10,313	6,679	3,943
	300,906	25,263	110,444	94,970	104,240	23,158	16,212	6,833	5,851	2,975
2010	293,727	23,346	126,867	92,720	58,999	31,706	16,196	9,148	4,879	2,662
	295,988	23,102	100,896	87,138	54,300	33,053	19,164	6,112	3,526	1,022
2011	333,771	27,091	126,125	103,515	64,826	30,401	14,842	7,559	4,186	2,380
	344,726	31,711	111,713	87,170	63,636	51,497	8,287	6,915	1,700	984
2012	350,852	23,903	138,632	109,094	72,210	36,220	14,667	7,509	4,142	2,386
	381,175	24,552	143,001	95,354	44,180	47,132	14,209	2,969	1,614	956
2013	392,558	27,359	145,786	99,278	51,907	24,010	11,263	6,374	3,792	2,253
	364,858	21,990	135,947	92,003	81,632	16,056	3,147	1,920	1,379	862
2014	422,052	28,769	145,655	104,486	52,017	24,011	10,720	6,144	3,704	2,215
	401,091	32,755	150,201	103,029	36,244	5,861	2,725	1,786	1,349	852
2015	420,538	28,566	161,275	105,021	49,777	22,271	10,162	6,003	3,709	2,188
	402,844	26,287	160,097	91,674	16,190	5,511	2,547	1,776	1,432	892
2016	427,881	31,404	162,250	108,058	50,602	22,596	10,466	6,152	3,808	2,231
	445,536	22,289	134,799	23,360	16,250	5,547	2,803	1,907	1,547	948
2017	415,653	33,194	168,780	112,600	51,884	23,238	10,876	6,392	3,982	2,325
	354,736	42,032	47,723	23,560	16,313	5,589	2,980	2,022	1,692	1,024
	Total Fitted/Actual		2018	2019	2020	2021	2022	2023	2024	2025
Cal. Per.	4,120,644		384,289	216,043	103,023	51,130	27,920	16,888	10,368	6,305
Total	4,082,563		57,353	30,219	18,001	7,051	4,226	2,979	2,223	1,428

1 Unit = $1,000; Forecast Scenario: Optimal EB Combined TOTAL

The forecast tables are available for all individual segments, as well as any selection of aggregates, or aggregates of aggregates. As usual the black numbers are fitted [projected] mean values, the blue numbers are observed values, and the red [burgundy] values are standard deviations for each cell [aggregate]. For each segment the forecast distribution for each cell is lognormal.

Forecast summary breakdowns are available for each aggregate - and include a number of tables showing allocations into each element comprising the selected aggregate (here business unit).


Company X 2020:.CDS:MPTF[Optimal-1]:Reserve Forecast Summaries

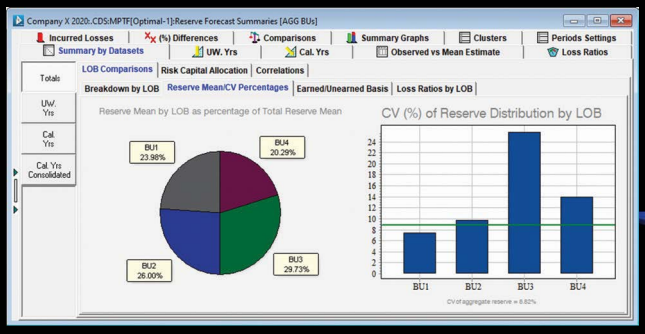
Reserve Breakdown by LOB

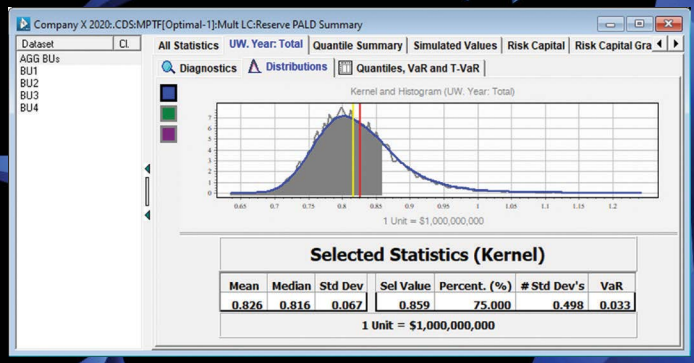
	Written Premium	Paid To 2017	Incurred To 2017	CRE 2017	Mean Outstanding	Mean Ultimate	Std Dev	Ult. Loss Ratios (%) Mean	Ult. Loss Ratios (%) Std Dev
BU1	1,364,012	962,082	1,075,888	113,806	198,064	1,160,146	14,640	85.054	1.073
BU2	1,857,697	956,404	1,155,929	199,524	214,736	1,171,140	20,910	63.043	1.126
BU3	2,134,065	972,348	1,077,714	105,365	245,494	1,217,843	63,169	57.067	2.960
BU4	2,134,393	1,191,729	1,308,756	117,027	167,586	1,359,315	23,337	63.686	1.093
Total	7,490,168	4,082,563	4,618,285	535,722	825,880	4,908,444	72,830	65.532	0.972

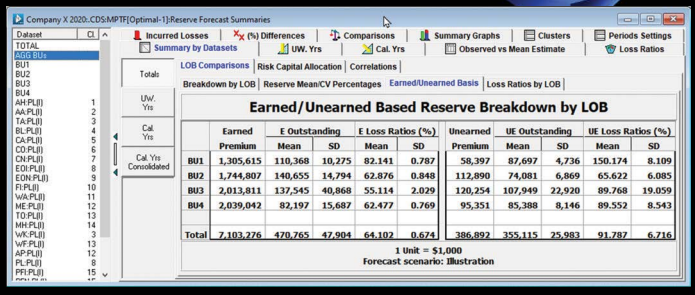
1 Unit = $1,000
Forecast scenario: Optimal EB Combined TOTAL

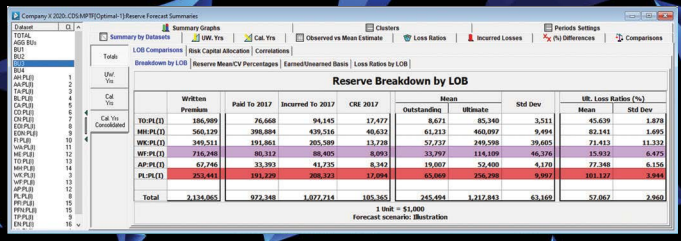
Insureware
Innovative Statistical Solutions for P&C Insurance

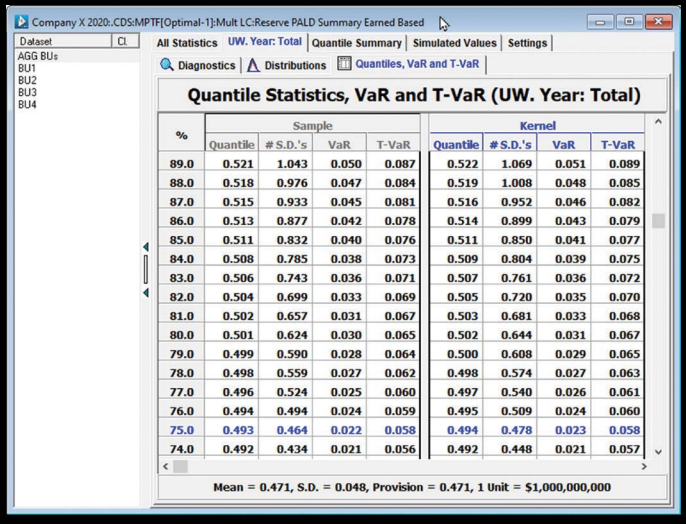
From one composite model

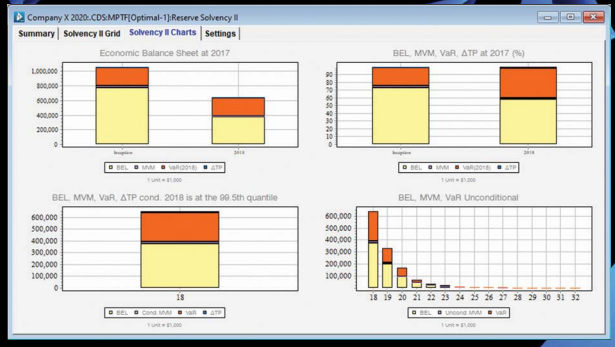


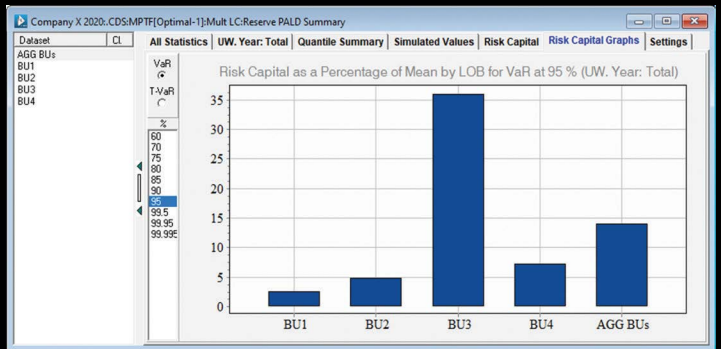


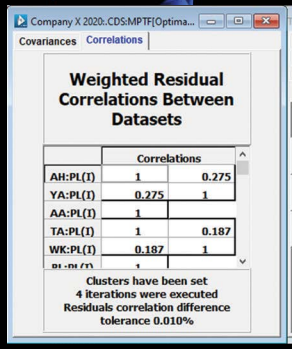


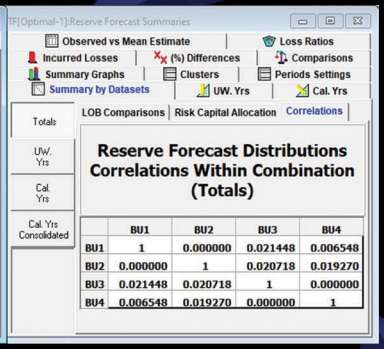


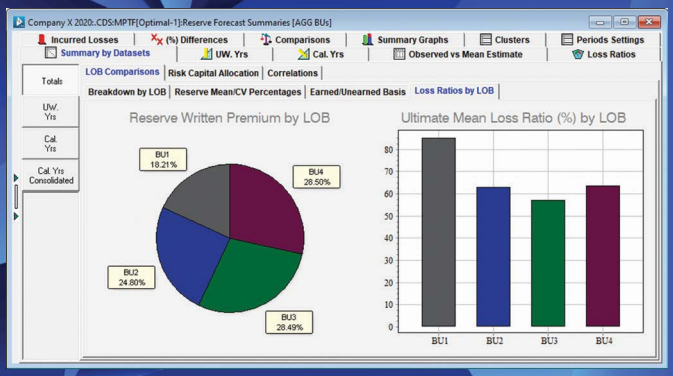


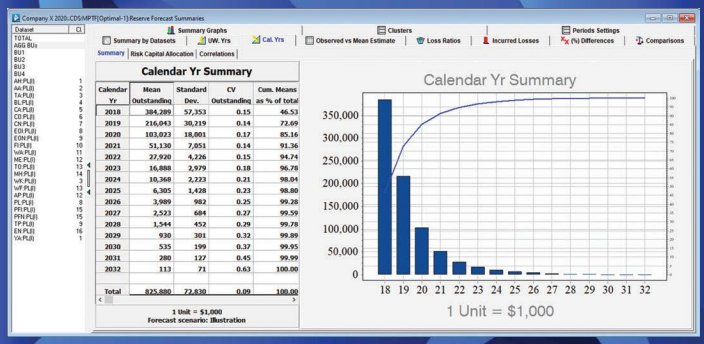


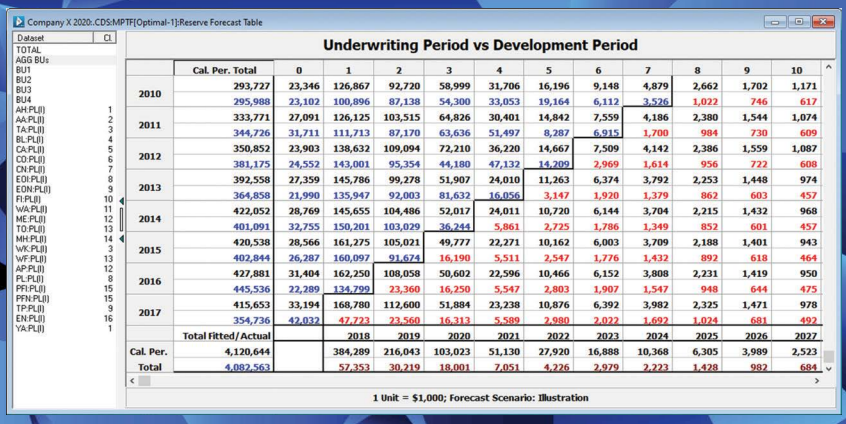


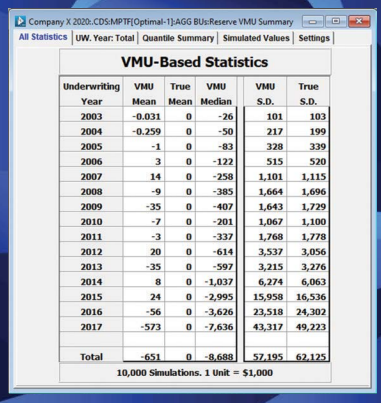


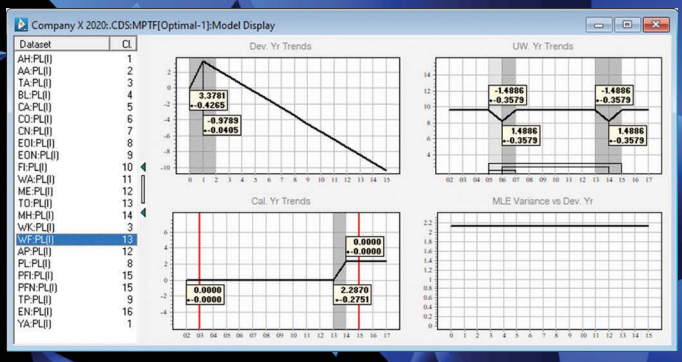


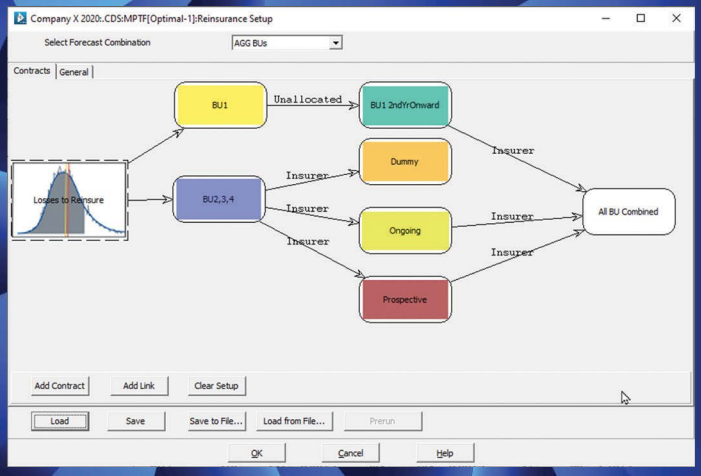


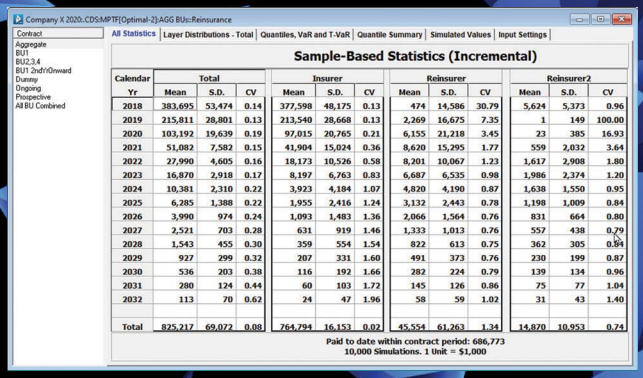


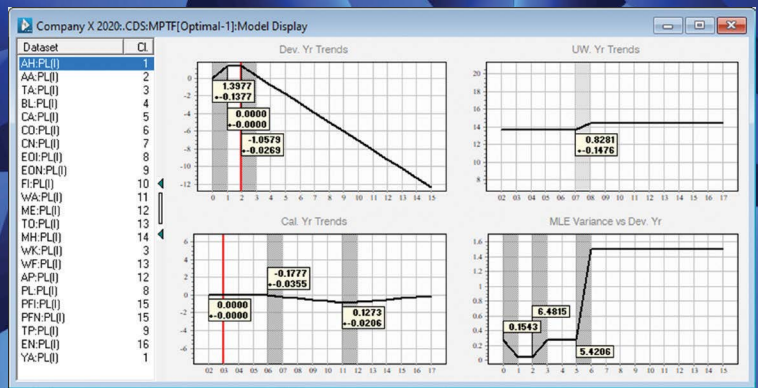










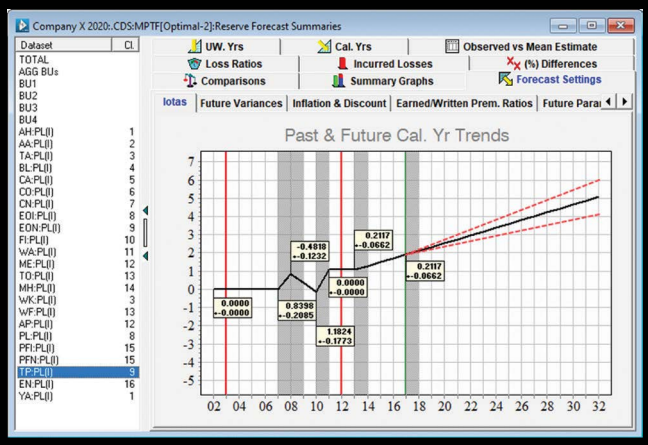


comes a wealth of information

Get more from ICRFS™

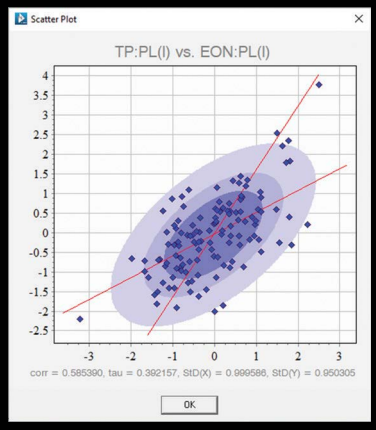
Quantify social inflation in long-tail LoBs

There are many reasons for insurance and reinsurance companies to have concerns about inflation – not only economic inflation (which is rising around the world), but also social inflation. With the Multiple Probabilistic Trend Family modeling frameworks, actuarial analysts can identify the inflationary trends in their Lines of Business.



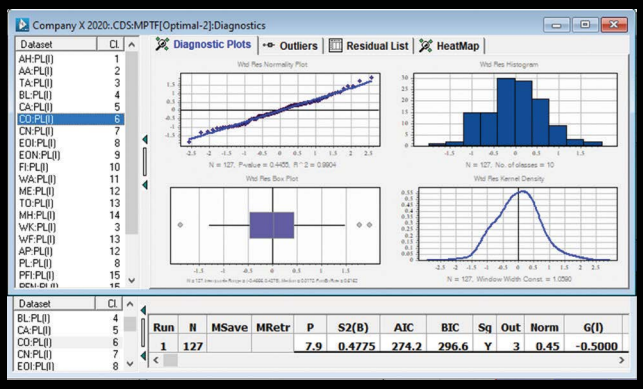
Common drivers versus correlation

Common drivers have much stronger impact on reserving and pricing than correlations in the randomness. Trends imply means moving in tandem, typically arising from social or economic sources. The ICRFS™ software solution allows you to quickly distinguish between common drivers and volatility correlation.



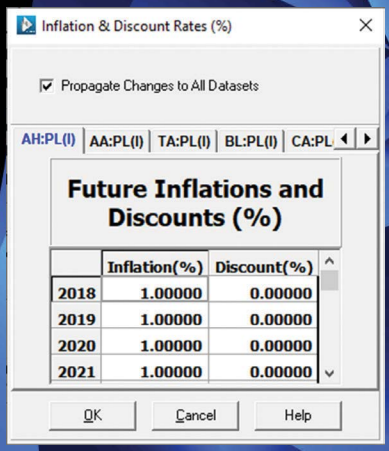
Mitigate model specification risk

It is not enough to have a model crunching out forecasts. The model, and forecast, must project the future losses utilising all information available and have clear markers to determine quality of the projection. ICRFS™ modeling frameworks have diagnostics that enable analysts to minimise the risk of selecting a poor model. Forecast scenarios are interpretable relative to historical trends.



Sensitivity testing

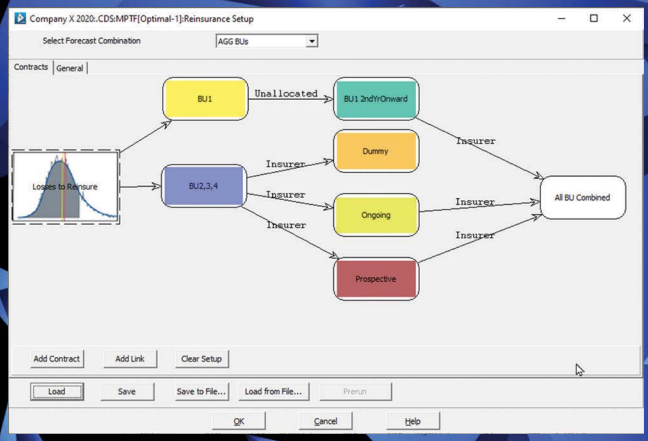
The Multiple Probabilistic Trend Family modeling frameworks have calendar period trends as a fundamental feature of the model definition. They are also an essential component of any future forecast scenario. Assessing the impact of increases/decreases in social or economic inflation is a trivial analysis step.



Comprehensive Reinsurance module

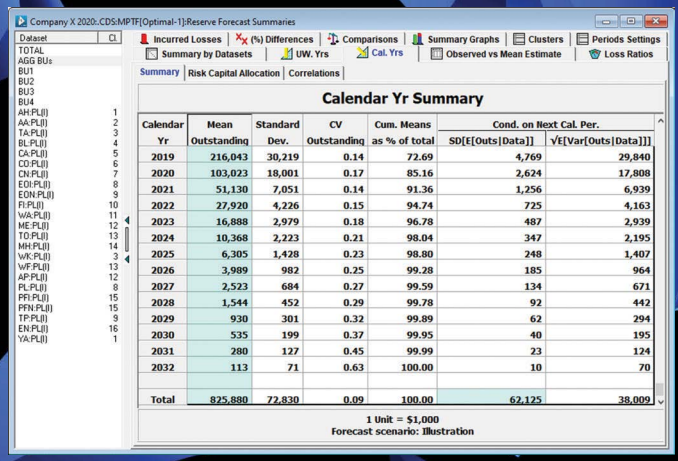
ICRFS™ includes a comprehensive reinsurance component for assessing and monitoring any reinsurance applying to the aggregate of claims – like an LPT or ADC.

Further, reinsurance contracts can be stacked sequentially or in parallel with capital being distributed in any number of ways.



IFRS 17 ready metrics

- Liability stream by calendar period - including the application of discount rates
- Models for underwriting year, accident year, or report year
- Separation of Earned and Unearned reserves
- Various methods for calculating risk margins
- Complete data integrity by separating data management from software users - source data are read only
- Complete history retained in database



Insureware provides more than just software. We create a collaborative relationship with all our clients. Contact Insureware (info@insureware.com) to arrange a virtual coffee meeting to discuss how ICRFS™ can work for you!

Insureware
Innovative Statistical Solutions for P&C Insurance

NEW ASSOCIATES ADMITTED OR RECOGNIZED IN MAY 2022

Row 1, left to right: *Connor P. von Korff, Kayla Wood, Tianqi Yu, Austin Aten,* ***CAS President Katherine Antonello,*** *Nitai Jagdip Patel, Colin Closson, Michael David Leonard, German Valenzuela.*
Row 2, left to right: *Shelby Heinemann, Elaine St. Germain, Meredith Manchester, Josephine Herrington, Jacqueline Perfetti, Cristina Fernandez, Eric DiCandilo, Daniel Sakhnovskiy.*
Row 3, left to right: *Jacob Gottier, Ernest Lin, Daniel Karr, Matthew Thomas Roller, Patrick Alan Underhill, David Savoia, Caleb Wesley Carswell, Samuel Bermke.*

Row 1, left to right: *Emily Genereux Valcourt, Amber Munderville, Katherine Curran, Jonathan Haglund,* ***CAS President Katherine Antonello,*** *Sampson Eason, Nicholas Edward Graves, Kevin Boren Zhu, Florina Or.*
Row 2, left to right: *Gloria Zhongmin Hu, Caitlin Elizabeth Metcalfe, Madalyn Winger, Eric Lee Gladfelter, Jana Renee Amstutz, Arpen Patel, Veronica Chan, Su Leng Poon, Lily Yuu.*
Row 3, left to right: *Daniel Gong, Robert Ferguson Wallace, Fiachra Crowley, Alice Li, John Varnas, Alvin Liu, Zhi Huan Low.*

NEW ASSOCIATES ADMITTED OR RECOGNIZED IN MAY 2022

Row 1, left to right: *Chipo Runesu, Swarnima Taparia, YiFan Zhou, Sabrina Tan,* ***CAS President Katherine Antonello,*** *Kabiseba Étienne Kabiseba, Daniel Kang, Tingting Shi, Katelyn Lobman.*
Row 2, left to right: *Colin Piscitello, Sean Michael Durner, Kwok Wa Lam, Fan Dong, Amanda Piscitello, Shauna Tremblay, Soo Jin Lee.*
Row 3, left to right: *Samuel Tam, Sean Kirwan, Shibo Chen, Ryan Diedrich, Samuel Gilmour, Wei Jiang, Nicholas Mosur, Chase Yetter, Josh Young.*

Row 1, left to right: *Stephanie Crowe, Neli Tomova, Katherine Cahoon, Christopher Butz,* ***CAS President Katherine Antonello,*** *Andreea Gheorghita, Marius Bejan, Matthew Garabed, Keven He.*
Row 2, left to right: *Daniela Paykin, Yassine Bennane, Jay Jie Liu, Alain Yaacoub, Kevin Shao, Raleigh Miller, Yujie Yan, Andrew Moulakis.*

NEW ASSOCIATES ADMITTED OR RECOGNIZED IN MAY 2022

Row 1, left to right: *Brent Hanson, Claudio Aguirre (FCAS 2021),* ***CAS President Katherine Antonello,*** *Han Xia, Darian Garner.*
Row 2, left to right: *Sungwon Yeo, Matthew Miles, Rhys Leonard, Allan Ouyang, Madison Bemis, Gregory Ryan Stambaugh, Yabing Yang.*

New Associates not shown: *Olga Alpatova, Brian Andersen, Nicole Irene Anderson, Zachary Anderson, Brandon Armao, Matthew Kyle Blanchard, Ariane Cantin, Erik Douglas Carlson, James Matthew Carraher, Alexandre Carrier, Jia Wen Chang, Xin Chang, Daniel Chong, Desmond Chong, Joshua Chou, Justin Cicchini, Courtney Brooke Cote, Lydia Daigle, Brett Dobinski, Kapil Vira Venkata Duvvuri, Fan Feng, Xiaowen Feng, Mikael Michael Gabouchian, Melanie Gagnon, Jie Gao, Robert Glicksman, Elizabeth A. Hatch, Jonathan Hayne, Xiang Ying Heng, Bradley David Herbst, Ryan Ho, David Hoskins, Emily Shu-Mei Huang, Syed Fahim Hussain, Rabi Ibrahim, Nafyal Ibrat, Heather Ann Inglis, Jacob Joseph Jakubowicz, Ivan Mikhail Karavitchev, Ahsan Khalid, Do young Kim, Matthew Kulczak, , Dewesh Kumar, Riddhi Kumar, Justin Kwok, John Woodfin Landers, Anass Lechgar, Cheuk Him Lee, G Ping Lee, Qi Zheng Leong, Simeng Liu, Steven Yin Min Lock Son, Sean Le Ming Loke, Ronni Luftig, Khanh Luu, Ryan Thomas Martin, Matthew Robert McDermott, Hitomi Mori, Albert Morin, Daniel Mottola, Maxwell Musakanda, Gilbert Ky Ng, Stephanie Anne Acuna Oliveros, Alvaro E Ortiz, Aisha Nuval Binti Othman, Alyaa Nuval Binti Othman, Bernard Park, Leonardo Pasciuta, Aakash S. Patel, Bo Peng, Megan E. Pierce, Barry John Posterro, Lin Yi Qu, Ryan Ream, Kaya Robertshaw, Jhavid William Rouhani, Charles Richard Schwartz, Bryanna Seefeldt, Andrew Sena, Sameer Shah, Brendan Shefcik, Simian Shen, Nadeem Shivji, Paul Shoemaker, Cheng Soon Soo, Jeffrey Spahl, Maxime Emile St-Onge Amoretti, Jue Su, Edward M. Sudol, Pei Gim Tee, Akshiti Vohra, Son Hoang Vuong, Matthew Waaland, Vickie Wang, Collin Whipple, Matthew James Wieckhorst, Khai Shern Wong, Bryn Woodling, Qi Wu, Chaofan Xu, Ningyuan Xu, Ryne Yamada, Jie Xiao You, John Young, Fengzhu Zhang, Grace Zhang, Zhong Zhou, Genyuan Zhu, Rui Qing Zhu Ge.*

November 6-9, 2022

Hilton Minneapolis

Minneapolis, Minnesota

ANNUAL MEETING

BUILDING SKILLS FOR THE FUTURE

RESEARCH IN ACTION

By BRIAN FANNIN, ACAS, CAS RESEARCH ACTUARY

The actuarial year doesn't follow the traditional calendar. Depending on what line of coverage you support or what practice area you're in, your year may begin in early November and "winter break" may be something that you only hear about from other people. Meanwhile, you'll be taking a well-deserved week off in late February or early March after the financial statements have been signed, or all the renewal contracts are out the door. Of course, that's only true if a professional reprieve is available to you. For quite a few actuaries, an absence of work commitments is simply an opportunity to focus on studying for exams in May and October.

However, there is something that almost feels universal: Late July and early August present our best chances to exhale and contemplate. And so here we are looking back on the most recent "year" of research, which will encompass projects that took place in the last six months of 2021 and the first part of 2022.

The CAS Research Council

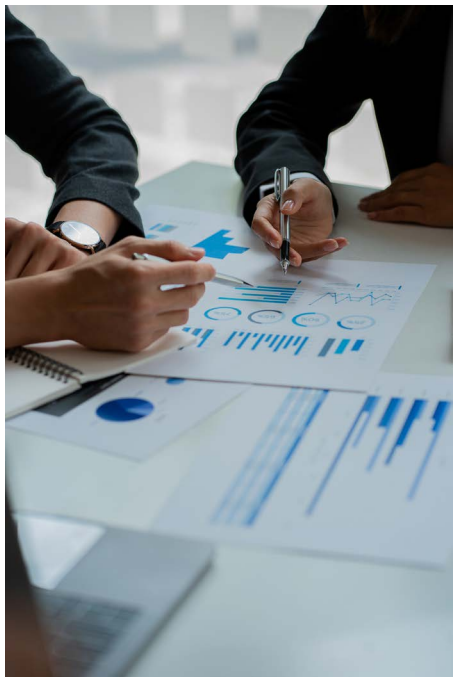
Last year, we wrote about the nascent Research Council — a group of leading actuaries that will prioritize the many ideas that we have for research projects. I've often said that research does not suffer from a dearth of ideas, and the first council meetings bore this out. Before we met, council members were asked to arrive with their most significant ideas. In our first call we discussed 33. As I like to say, the Research Council is not an idea-generating body, they are a prioritization engine.

The Research Council met twice at the end of 2021, and this initial list was whittled down to six high-priority projects. To date, we have released five requests for proposals (RFPs). By the time this article appears in print, another RFP will have been released and another project will be on its way to review by the CAS Executive Council. Things are taking shape.

We are excited to see how the first few projects com-

ing through the Research Council process emerge and are received. There has been strong membership interest in joining project oversight groups for the requested works. This is an encouraging sign that the Research Council had its finger on the pulse of members and, by extension, their broader stakeholders.

Societal concerns such as cyber-risk and social inflation are not standing idly by, waiting to see what CAS research will eventually have to say about them. The Research Council can help reduce turnaround time by identifying those topics in greatest need of support — and marshalling resources so that the topics achieve the required velocity. In aid of that, the Council met again at the end of June to talk about how things were going and what challenges we wanted to take on going forward. We will adopt a quarterly cadence of meetings to ensure that the CAS continues to successfully identify high priority research projects.



Does this mean that standing research working groups have stepped away from their own role in supporting funded research? It does not! Read on.

Research working groups

During the final half of 2021, the Reinsurance Research Working Group was pleased to shepherd a piece of research on wildfire modeling from Hong Li of the University of Guelph and Jianxi Su of Purdue University. Rather than producing a fine-grained simulation of wildfire at the location level, the paper focuses on Bayesian methods to estimate frequency and severity in a much more computationally efficient manner than Markov chain Monte Carlo methods, while also considering seasonal effects. This framework is not restricted to wildfire alone. Other geographically sensitive perils may be modeled with this approach.

We have received a final draft of another wildfire paper by Milliman and CoreLogic that we are also very excited about. This work examines the pricing impact of loss mitigation for individual houses and their collective impact across communities. The authors and reviewers have had conversations with several California-based fire chiefs who have taken an interest in the work. In turn, the paper will benefit from the domain expertise that professional firefighters bring to the conversation.

Reinsurance is a challenging space for research. A lack of public data sets for large claims makes it difficult to build, calibrate and test models. In addition, the long-time horizon required to estimate even basic model inputs like trend complicates exploration. That said, there is significant space for actuaries to distill and synthesize the substantial amount of research that the CAS and other organizations have made available. A recent example of such synthesis was Neil Bodoff's 2021 CAS Working Paper on principal-agent theory that explains insurance choices through an established but underused framework. This working paper was parlayed in to a webinar/on demand course with the great name "The Roulette Wheel and the Drunken Sailor: Principal-Agent Theory and its Ramifications for Insurance and Reinsurance Risk Management," which is available through the CAS Online Learning Center. Another continuing focus in reinsurance research is the actuary as interpreter of cat model results. While we are not technical experts in the operation and execution of catastrophe models, reinsurance actuaries are showing continued interest in the mechanics and integration of catastrophe models into pricing.

Beyond our funded research projects, we continue to see a wide variety of work from our volunteers, appearing in both the *E-Forum* and *Variance*. Of particular note are our call papers. The Reserves Research Working Group saw a fantastic set of submissions for this year's call paper program. Touching on ideas from behavioral research to LaPlace transformations to artificial intelligence and many others besides, they are well worth reading. These will appear on the new *E-Forum* microsite (https://eforum.casact.org/), and we expect to have three of the papers presented at this year's Casualty Loss Reserves Seminar in St. Louis this September. A cash prize for

Research in Action, page 40

Access More Qualified Applicants. Period.

Expertise. Insight. Solutions.®

The CAS Career Center allows employers and recruiting firms to post open positions to a focused audience of credentialed P&C actuaries, actuarial candidates, and interns.

Posted positions average nearly 1,000 hits each.

Learn more at https://careers.casact.org/employers/

CAS Society Partners receive a discount on all Career Center advertising. **Learn more at https://www.casact.org/advertising**

Research in Action

from page 38

the best papers will be announced at that event. (For more on the Reserves Call Papers, see Julie Lederer's story in *AR*'s new column, Building Skills for the Future.)

Can't make it to Missouri? Not working on loss reserving? Our call papers still have you covered. The Ratemaking Research Working Group issued a call for papers for their 2023 program. The working group has approved five proposals and writers are preparing their initial drafts. A few proposals are sitting in my inbox now.

Technology and actuaries

We should all feel proud of how the first annual CAS Technology Survey turned out, because it took a village to create it. CAS staff did a wonderful job designing and conducting the survey. Over 1,200 members and candidates responded in droves, and volunteers helped review the final work. The result was an invaluable resource that anyone from analysts to chief data officers can use to understand how actuaries are — and in some cases are not — using the latest technology and techniques.

By the time you read this, the 2nd Annual Technology Survey will have launched. This time, we will not only be able to gauge where things stand, but we will also get a sense for how things have changed. Are scripting technologies like R and Python finally becoming mainstream? Is there acceleration towards the adoption of methods like deep learning? How quickly are we moving to the future? Look for the results of the survey to appear later this year.

Speaking of technology, let's talk about the 2022 CAS Hacktuary Challenge. "Hacktuary" isn't a calendar month that we've just invented. This is a term that captures many actuaries' daily reality — the work of developing new, creative and practical solutions to solve real-world business problems. The CAS has sponsored a prize fund of up to $15,000 for the individual or team who can develop a web, mobile or desktop app that addresses a personal auto risk management problem. Winners will be announced at the CAS Annual Meeting this fall in Minneapolis. All code associated with the entries will be available from the CAS GitHub site (https://github.com/casact).

And that's where things stand as the summer comes to a close. If you have the time and inclination for some beach reading, you're certain to find something of interest. Whatever you're doing, we hope that your summer is giving you a chance to relax a bit — at least until tropical storm season begins in earnest.

March 13–15, 2023
San Diego, CA
Loews Coronado Bay Resort

Ratemaking, Product and Modeling Seminar

BUILDING SKILLS FOR THE FUTURE

Looking for Social Inflation in Loss Development

By JIM LYNCH AND DAVE MOORE

The term *social inflation* isn't new — Warren Buffett used it in the 1970s to describe "a broadening definition by society and juries of what is covered by insurance policies."[1] You hear it a lot today as insurance companies try to describe the contemporary societal forces that they believe are accelerating loss costs.

"The concept of social inflation is hard to define," writes Christopher Mackeprang, senior actuary at General Reinsurance, "which makes it hard to find empirical evidence that supports or disproves it." Mackeprang is Gen Re's treaty pricing analyst and vice president.

We decided to try. And we found that traditional loss triangles provide evidence that social inflation increased aggregate losses by more than $20 billion between 2010 and 2019 in commercial auto liability insurance alone.

Our research was published in February 2022, in "Social Inflation and Loss Development," a joint publication of the CAS and the Insurance Information Institute (Triple-I). We examined industry loss triangles from Annual Statement Schedule P and found loss development patterns that are consistent with most descriptions of social inflation.

Our paper defined social inflation as excessive inflation in the size of claims. Some believe social inflation is also driving up claim frequency; for example, the brokerage Amwins suggested that social inflation was caused by "an increase in both frequency and severity of liability claims … driving up the cost of claims, but also contributing to rate increases across the board." But claim frequency was outside the scope of our work.

This article will summarize our work and provide some pricing and reserving considerations for actuaries. The complete paper goes into detail showing how we used macroeconomic data to normalize and identify trends in premium and losses and how actual vs. expected analysis can shed light on social inflation trends.

In our paper, we assert that basic actuarial techniques such as the chain-ladder method assume that losses move from unreported to reported in a consistent, predictable manner, albeit with some random variation. Many factors drive that movement, one of which is inflation. Embedded in the typical process of selecting a loss development factor — taking the average of several link ratios — is the assumption that development factors are values taken from a random process with a stable mean. When you take an average, you are implicitly saying that inflation over the period has been constant.

However, if losses accelerate, age-to-age factors will increase from accident year to accident year. The process no longer has a stable mean. The instability could, in theory, have many causes, but for the data we examined, we assert that the most likely reason is an excessive increase in the size of claims, or, in modern parlance, social inflation. We discuss other data considerations that could impact development patterns, such as homogeneity, reinsurance and operational changes. These will have a greater impact on an individual company's development patterns while the impact will be more muted at the industry level.

We looked at U.S. industry loss development triangles from the National

[1] Warren Buffett, "Chairman's Letter—1977," March 14, 1978, accessed June 15, 2021, https://www.berkshirehathaway.com/letters/1977.html.

Association of Insurance Commissioners as reported by S&P Global Market Intelligence. We looked at several lines of business, but this article will focus on commercial auto liability.

Table 1 shows the net paid loss and defense and cost containment (DCC) link ratio triangle for commercial auto liability from 2000 to 2019. Red highlighting in a cell indicates that the link ratio increased relative to its counterpart in the prior year. As can be seen, there is a lot of red for commercial auto liability.

Every column in this exhibit should look familiar to casualty actuaries — except the last. The last column is the product of the 12-to-24-, 24-to-36-, 36-to-48- and 48-to-60-month link ratios along a given diagonal of the development triangle. We call this the calendar year 12-60 development factor (CYR 12-60).

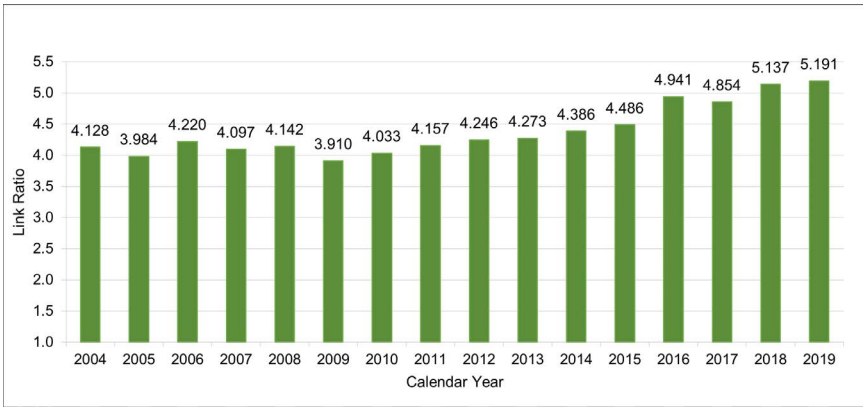
For example, the 2019 CYR 12–60 development factor shown in Table 1 is 5.191. This equals the product of the 12-to-24-, 24-to-36-, 36-to-48- and 48-to-60-month link ratios along the latest diagonal (= 2.358 × 1.511 × 1.284 × 1.135). The 2018 CYR 12-60 development factor is 5.137, being 2.293 × 1.518 × 1.288 × 1.145.

If the CYR 12-60 factor is higher than its predecessor, that is evidence of growing inflation. Chart 1 is a visual representation of the CYR 12-60 ratios shown in Table 1. Note the steady increase in the factor since 2009.

Table 1. Net paid loss and DCC link ratio — P&C industry — commercial auto liability

Acc Year	12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-108	108-120	CYR 12-60
2000	2.097	1.420	1.198	1.097	1.050	1.019	1.011	1.007	1.004	
2001	2.058	1.422	1.201	1.095	1.045	1.021	1.011	1.005	1.003	
2002	2.080	1.481	1.225	1.110	1.051	1.023	1.010	1.005	1.003	
2003	2.117	1.454	1.232	1.116	1.050	1.020	1.010	1.005	1.005	
2004	2.041	1.442	1.236	1.115	1.049	1.021	1.010	1.006	1.002	4.128
2005	2.140	1.439	1.226	1.105	1.046	1.019	1.010	1.003	1.004	3.984
2006	2.064	1.444	1.213	1.107	1.043	1.023	1.011	1.005	1.004	4.220
2007	2.099	1.424	1.222	1.106	1.049	1.022	1.007	1.006	1.003	4.097
2008	2.048	1.433	1.228	1.111	1.049	1.022	1.010	1.006	1.002	4.142
2009	2.081	1.440	1.238	1.117	1.053	1.022	1.012	1.006	1.005	3.910
2010	2.125	1.450	1.232	1.120	1.051	1.025	1.011	1.005	1.004	4.033
2011	2.129	1.440	1.242	1.127	1.057	1.023	1.012	1.007		4.157
2012	2.155	1.454	1.249	1.127	1.050	1.025	1.012			4.246
2013	2.169	1.465	1.273	1.130	1.056	1.029				4.273
2014	2.174	1.515	1.262	1.145	1.057					4.386
2015	2.273	1.489	1.288	1.135						4.486
2016	2.287	1.518	1.284							4.941
2017	2.293	1.511								4.854
2018	2.358									5.137
2019										5.191

Chart 1. Net paid loss and DCC CYR 12-60 loss development factors — commercial auto liability



We observe a low point in the paid CYR 12-60 LDFs at calendar year 2009. Since 2009, this metric has increased every year with the exception of 2017. The calendar year 2018 LDF increased above both the 2016 and 2017 LDFs.

We saw the same sort of pattern for case incurred losses, as shown in Chart 2.

The low point occurs at calendar year 2007. Again, the CYR 12-60 LDFs show a clear, increasing pattern. Small decreases are observed in 2013 and 2017, but those were followed by

increases to levels higher than the two preceding years in each case. The case incurred CYR 12-60 LDFs began increasing in 2008, two years sooner than the paid CYR 12-60 LDFs.

We performed similar calculations for other lines of business. We determined that CYR 12-60 LDFs were generally lowest around 2008. We saw increasing LDFs for commercial auto, other liability (occurrence) and medical malpractice (claims made), particularly

Chart 2. Net case incurred loss and DCC CYR 12-60 loss development factors — commercial auto liability

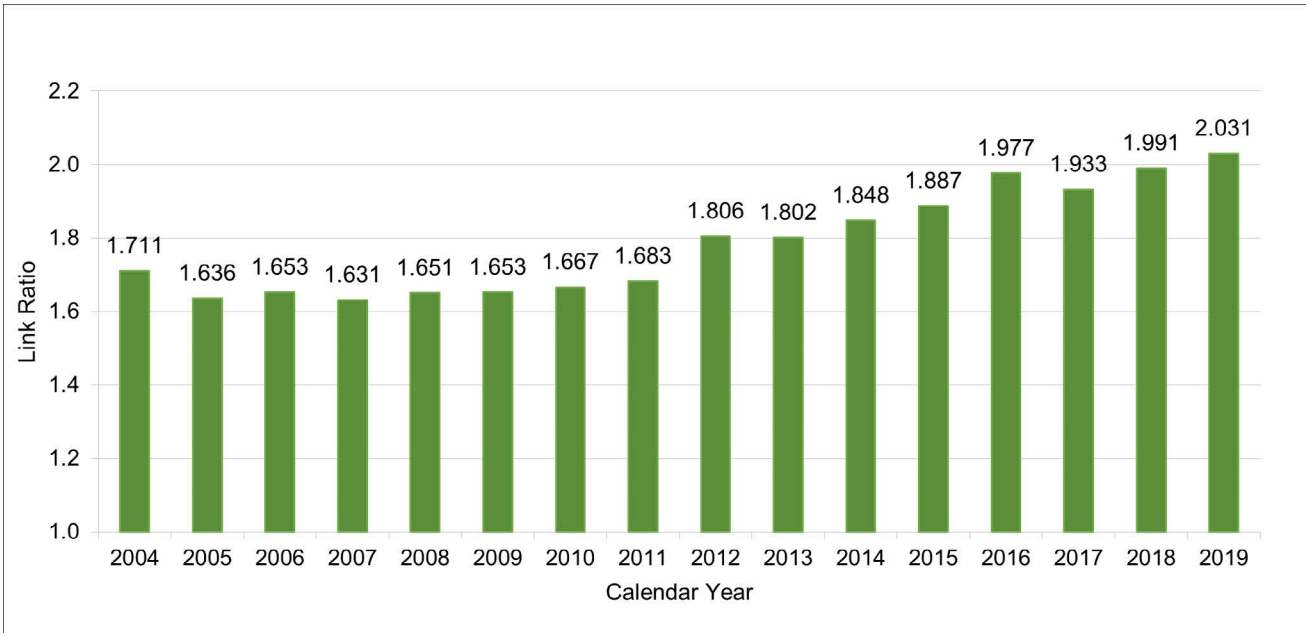


Table 2. Implied net ultimate loss and DCC using 12/31/2008 alternative LDFs — P&C industry — commercial auto liability

Amounts in Millions	A	B	C	D = A*(Alternative LDF)	E = B*(Alternative LDF)	F = D - C	G = E - C
	Per 12/31/YYYY Schedule P		Per 12/31/2019 Schedule P	Implied Net Ultimate Loss & DCC using Alternative LDFs		Variance to Booked	
Year	Net Paid Loss & DCC @ 12 months	Net Case Incurred Loss & DCC @ 12 months	Net Ultimate Loss & DCC	3yr Weighted Average as of 12/31/2008 (Paid)	3yr Weighted Average as of 12/31/2008 (Case Incurred)	3yr Weighted Average as of 12/31/2008 (Paid)	3yr Weighted Average as of 12/31/2008 (Case Incurred)
2010	2,305	5,959	10,836	10,522	10,015	-314	-821
2011	2,447	6,193	11,714	11,168	10,407	-546	-1,307
2012	2,453	6,299	12,028	11,196	10,587	-832	-1,441
2013	2,554	6,603	13,065	11,657	11,097	-1,407	-1,968
2014	2,655	6,946	14,065	12,119	11,673	-1,946	-2,392
2015	2,791	7,504	15,275	12,739	12,611	-2,536	-2,664
2016	2,917	8,081	16,236	13,318	13,581	-2,918	-2,655
2017	3,078	8,465	16,647	14,051	14,226	-2,595	-2,421
2018	3,379	9,404	18,468	15,426	15,803	-3,042	-2,664
2019	3,554	10,375	19,856	16,222	17,436	-3,633	-2,420
Total	28,131	75,829	148,189	128,419	127,436	-19,771	-20,753
					% Variance	-13.3%	-14.0%

from the late 2000s and onward.[2]

Looking at these factors, it is clear that something is driving loss development factors higher. We know it is not general inflation, which stayed fairly consistent from 2010 to 2019. We attributed it to social inflation.

Next, we tried to quantify the impact of rising LDFs. We calculate an implied net ultimate loss and DCC for commercial auto liability based on the paid and case incurred loss development methods using alternative LDF assumptions for accident years 2010 to 2019. These alternative LDF assumptions are based on using three-year weighted average link ratios from the latest three calendar years as of December 31, 2008. We reason that in the absence of social inflation, loss development factors would not have crept higher.

We calculated the implied ultimates using the historical paid and case incurred loss and DCC at 12 months and applied the 12-to-ultimate implied LDFs as of December 31, 2008. This allows inclusion of all loss development caused by increased LDFs after 12 months.

The results are displayed in Table 2. Columns F and G show the difference between the booked ultimate and what would have been booked in a world without social inflation. This method indicates that the potential impact of social inflation is approximately $20 billion, or roughly 14% of all booked commercial auto liability losses over the 10 years we examined.

This method likely understates the impact of social inflation for at least two reasons:

1. It does not consider any inflation in losses reported or paid within the first 12 months of an accident year, so in that sense it could be considered an underestimation.
2. It does not consider any potential deficiency in the booked amounts as of December 31, 2019.

In our paper, we estimated that booked net ultimates were understated by $1.9 billion to $3.9 billion. In the years since 2019, commercial auto liability booked losses for 2010 to 2019 have risen $3.2 billion, consistent with our analysis.

Actuaries who believe they are encountering social inflation should take care when selecting link ratios and methods on which to rely. If using the loss development method, actuaries should consider selecting link ratios from the most recent development year or even extrapolating link ratios instead of any multiyear average. They should consider giving greater weight to the methods that are performing better in an actual versus expected analysis.

Actuaries should also be sure to communicate with other stakeholders — claims and management — the nature of what they are seeing and how they are addressing it. Actuaries at larger companies should look for similar phenomena in their books of business. Those at smaller companies, where lower volume results in greater variability in LDFs, should consider analyzing countrywide data to track the phenomenon.

We want to thank again the Casualty Actuarial Society and the Insurance Information Institute for supporting our work. We are working on a follow-up study looking at the COVID years and the current high-inflation environment.

Jim Lynch, FCAS, MAAA, recently retired from his position as chief actuary at Triple-I and has his own consulting firm. Dave Moore, FCAS, MAAA, CERA is head of Moore Actuarial Consulting.

[2] It should be noted that, although these metrics do not show social inflation for some lines of business, it does not necessarily mean there is no social inflation. Other liability (claims made) is an example. We believe social inflation is having a significant impact on other liability (claims made); however, we do not see evidence of that in these link ratios. It may be that the risks in these are so heterogeneous that the noise of random variation across many different products overwhelms any signal of inflation that could show itself in development factors.

BUILDING SKILLS FOR THE FUTURE

Reserves Working Group Releases Call Papers

By JULIE LEDERER, MEMBER, CAS RESERVES WORKING GROUP

The CAS Reserves Working Group recently sponsored its annual call for papers. The goal of the program is to facilitate the publication of practical and accessible papers on reserving topics. Over the past few months, members of the Reserves Working Group reviewed drafts, provided feedback and assisted authors as they worked toward producing a final paper for publication. Six strong papers that cover a range of topics will appear on the *E-Forum* microsite (https://eforum.casact.org/).

Below is a brief summary of each paper.

"Making Bootstrap Reserve Ranges More Realistic" by David R. Clark, FCAS; Hang Ding; and Lianmin Zhou, FCAS, Ph.D.

Back testing suggests that bootstrapping approaches lead to reserve ranges that may be too narrow. To improve the current methods, Clark, Ding and Zhou relax England and Verrall's assumption that each cell in the incremental development triangle is independent by introducing a correlation structure in the resampling of the bootstrap. Back testing with Schedule P data suggests that this approach yields reserve ranges that are more reasonable.

"Ultimate Loss Reserve Forecasting Using Bidirectional LSTMs" by Lahiru H. Somaratne

Somaratne explores the application of machine learning to the estimation of ultimate losses using long short-term memory (LSTM), a form of deep learning that finds patterns in temporal data. The author compares results using LSTM and the chain ladder method, with illustrations and examples to make this paper useful to actuaries who want to understand machine learning and how it can be applied to reserving.

"Quantifying Reserve Risk Based on Volatility in Triangles of Estimated Ultimate Losses" by Yu Shi "Andy" Feng, FCAS and Ira Robbin, Ph.D., ACAS

Building on work performed by Rehman, Klugman and Seigenthaler, the authors measure reserve volatility using triangles of estimated ultimate losses instead of paid or incurred loss data; changes in estimated ultimates from evaluation to evaluation give insight into reserve variability. Feng and Robbin present formulas for one-year and ultimate reserve risk while also comparing reserve variability estimated under the Feng-Robbin approach to reserve variability under existing methodologies. An Excel workbook is provided to help readers put the paper to practical use.

"A Behavioral Approach to Understanding Loss Reserves" by Uri Korn, FCAS

Korn uses Schedule P data to perform an empirical study of how insurers set and update loss reserves. He develops a unique "R" parameter to measure the weight given to emerging experience. His work shows that booked reserves are slow to react to loss information. Korn uses behavioral economic theory to explore this phenomenon.

"Unifying Triangle-Based Actuarial Reserving Methods" by Rajesh Sahasrabuddhe, FCAS

Sahasrabuddhe shows how to express common triangle-based reserving methods as univariate linear models. He then introduces a multivariate linear model in which the actuary can choose from a variety of predictors. This multivariate model represents a combination of triangle-based methods. By combining predictors in a linear model instead of blending method results using judgment, the actuary can combine methods in a statistically rigorous way. The author provides R code that makes his paper amenable to implementation.

"The LaPlace Transform as Stochastic Present Value" by James Ely, FCAS

The LaPlace transform can be described as a method of finding the cyclical

patterns around an exponential trend. Ely shows that the actuary can use the LaPlace transform to model stochastic cash flows and discount those cash flows with a stochastic discount rate. His use of LaPlace transforms to study insurance and economic cycles within the P&C space is new and innovative.

The CAS Reserves Working Group encourages participation in its next call paper program. Authors of accepted papers are eligible for prize money and may be invited to present their work at the CLRS. Look for more information on the CAS website.

Julie Lederer, FCAS, MAAA, is a property & casualty actuary for the Missouri Department of Commerce and Insurance. She is a long-time AR *Working Group member and was recently elected to the CAS Board of Directors*

Are You 35 or Younger? Compete in the Young Actuaries World Cup!

Are you ready to compete with some of the best and brightest young minds in the industry? The International Actuarial Association (IAA) Young Actuaries World Cup (YAWC) is a friendly global competition that provides young actuaries with an opportunity to showcase their skills under the framework of the profession's premier global event: the International Congress of Actuaries (ICA). The competition aims to ensure that younger generations see themselves represented within the IAA and its member associations.

The competition is seeking actuaries under 35 years old who are making a difference in the industry. Interested participants should submit a video of no more than seven minutes on the theme "Bridge to Tomorrow," and should showcase their actuarial interpretation of the theme. Videos should showcase how actuaries can contribute to a better society, the future roles of the actuarial profession, and any innovative ways of solving big issues.

The finals will be held at the International Congress of Actuaries Meeting in May 2023 in Sydney, Australia. The four finalists will win round trip airfare and hotel accommodations to the 2023 meeting. Information about submissions and a full set of regulations can be found on the IAA website. Submissions must be made by October 31!

IN MY OPINION By GROVER EDIE, *AR* EDITOR IN CHIEF

Cancelled Business Trip

I am surprised how many times I learn something for the second time.

At a CAS meeting several years ago, Dr. Fred Ray Lybrand made a presentation about motivation. The thrust of his speech was that a plan needs to include a time limit or a deadline in order to instill motivation. If you think you will have all the time in the world to do something, you'll not be very motivated to do it. Over time, I had forgotten that concept, until a cancelled business trip brought it to mind.

I had been preparing for a business trip that was to take me out of town for a week. My wife, Diane, wanted me to wrap up a lot of unfinished tasks before I left. I thought I had all summer to get them done. She wanted me to fertilize the grass (spring weed and feed), stock up on some grocery items, take care of our leaking dishwasher (that's another story!) and finish our income taxes (that's another story as well!). I also had to get my suit cleaned, get a haircut and start packing.

One of the other things I needed to do before I left was getting a new mobile phone; the old one wouldn't hold a charge for very long. I didn't want to be half-way across the country with an unreliable phone, so I spent the obligatory half day purchasing a new one and having the information transferred from the old to new phone. The new phone had a different operating system, and many of the settings were in new places. It didn't even have the same buttons as the old one. Some of the applications needed the passwords reloaded. (How do I freeze the orientation of the screen? I didn't realize how much customization I did on my old phone until I got the new one.)

You have likely encountered the

days-long learning process, and I got my new phone only days before I was to travel. I don't change phones until I have to because of all the new things I have to learn on the new one. I trade "learn a little frequently" for "learn a lot infrequently" when it comes to cell phones. Now I was paying the price.

I got my suit cleaned and a haircut and started packing.

On the Friday before I was to travel, I got an email informing me that the meeting was postponed for a few months. In the week before the trip, I had finished a lot of tasks I wasn't expecting to get taken care of until "whenever."

I had a lot of loose ends I wasn't expecting to get taken care of that soon.

And it made me think.

The only thing about the week before my trip was the deadline for some undone tasks. I was just as busy, and completing them made me work harder and longer. I got more done in that week than in many of the weeks leading up to it.

I also wondered how many tasks got bigger as I delayed doing them. When I cut the lawn in the backyard, I don't use the bagger if the grass is short. But if I wait too long, I bag it to keep the cut grass from piling up on the lawn. Waiting to cut the yard makes the task take longer.

I picked up Lybrand's book, *The One Success Habit (You Can't Do Without)*,[1] and found on page 37 that motivation includes a time limit: If you think you will have all the time in the world to do something, you'll not be very motivated to do it. My list of items had a time limit, and it motivated me.

I have tried to set my own deadlines for things, but it is too easy to simply move the deadline as it approaches. I am not a very good person for me to be accountable to. A hard deadline, like a business trip, works better, as it is immovable. The fact that Diane wanted me to do some of those chores before I traveled added another level of finality to the deadline.

It seems funny that we "learn" things only to later allow those learnings to lapse into forgetfulness. I had read Lybrand's book years ago and applied his "motivation-requires-a-deadline" concept for quite some time. But I had allowed that idea to fade, only to rediscover it after a trip was cancelled.

Deadlines help motivate, and rereading notes and books can help renew useful habits.

Postscripts

Leaky dishwasher. When our dishwasher started leaking, we looked for a replacement. Unfortunately, we could not find one to our satisfaction that would be delivered before my trip. My interim solution for the leak was to place a jelly roll pan below the dishwasher that I emptied after each wash. But I didn't want Diane to get down on her hands and knees to do that while I was gone. I needed an alternative solution. I cut a hole in the side of the pan, ran a hose through the floor to a bucket in the basement and had a temporary, although ugly, solution. Sometimes, you need to be creative and make unconventional fixes, both at home and at work. We now have the replacement dishwasher installed and have removed the drip pan. How many times have we had to continue to use an old process or program while we waited for the "new and improved" one to be completed? Omitted or inaccurate data must be contended with until the new program (dishwasher) gets installed.

Income taxes. I used to do our income taxes, but several years ago they became so complicated that I hired a tax accountant to do them. I still have to get all of the materials together, however. Having done that, I needed to pick up our returns and review them before my trip. It should have been a simple thing for me, but Diane found a significant error in the returns. So, I had to go back to the accountant for a revision. That reinforced what we actuaries do — always have a qualified person check our work before sending to the client. Diane was the qualified peer reviewer and the IRS was the client.

[1] Fred Ray Lybrand, *The One Success Habit (You Can't Do Without)*, Kauffman Burgess Press, 2012.

IN MY OPINION By MICHAEL R. LARSEN

A Proposed New Direction for the CAS Syllabus and Exams

Editor's note: A longer version of this article that gives a more complete explanation of the proposal is available at https://ar.casact.org/a-proposed-new-direction-for-the-cas-syllabus-and-exams.

Executive Summary

The goal of this open letter to the CAS membership is to start a dialogue between the membership and our leadership on the direction that the CAS syllabus and exam process should take.

The CAS syllabus has not kept up with the rapidly changing software, computing power and modeling tools that are now commonly available. In the past, we had to devise our own methods to solve ratemaking and reserving problems, since the tools that statisticians provided were based on assumptions that were violated by our data. If you use a modeling tool when the assumptions behind that tool are not met, the results are unreliable. Today, we can use the expanded tools available from the work of statisticians and data and computer scientists and match the tool to the task at hand if we have the training to make use of those tools. The section "Proposed CAS Syllabus" outlines a path forward to improve our training on how to use commonly available, open-source modeling tools and integrates that material across exams.

At the same time that we are making material alterations in the syllabus by dropping old material and adding new material, we need to recognize that there will be limits on available volunteer grading time and that candidates will need clear feedback on their exam performance as well as lots of new practice problems on new material. The section "Proposed Changes to Exam Process" explains how moving to a universal multiple-choice exam format over

Figure 1. Current Exam Syllabus.

1: Probability	General Probability Univariate Random Variables Multivariate Random Variables
2: Financial Mathematics	Interest Theory Financial Economics
3F: Financial Economics	Investment Markets Corporate Finance Financial Derivatives: Forwards and Futures Financial Derivatives: Options
MAS-I	Probability Models Statistics Extended Linear Models Time Series with Constant Variance
MAS-II	Introduction to Credibility Linear Mixed Effects Models Bayesian MCMC Statistical Learning
5: Basic Techniques for Ratemaking and Estimating Claim Liabilities	Basic Techniques for Ratemaking Estimating Claim Liabilities
6: Regulation and Financial Reporting	Regulation of Insurance and United States Insurance Law Government and Industry Insurance Programs Financial Reporting and Taxation Professional Responsibilities of the Actuary in Financial Reporting Reinsurance Accounting Principles
7: Estimation of Policy Liabilities, Insurance Company Valuation, and ERM	Estimation of Policy Liabilities Insurance Company Valuation Enterprise Risk Management
8: Advanced Ratemaking	Classification Ratemaking Excess, Deductible and Individual Risk Rating Catastrophe and Reinsurance Pricing
9: Financial Risk and Rate of Return	Portfolio Theory and Equilibrium in Capital Markets Asset-Liability Management Financial Risk Management

time would address those concerns.

Proposed CAS Syllabus

Going forward, our candidates must be able to make informed use of the results of a wide range of open-source, currently available predictive analytics tools when issuing a statement of actuarial opinion on ratemaking or reserving issues for internal clients and insurance regulators. That means expanding syllabus coverage on both the theory and application of current, commonly available predictive analytics tools. Candidates must be familiar with core historical methods commonly used today, and they must have a good understanding of the regulatory environment (currently tested for on Exam 6). Candidates should be able to speak the language of insurance and finance as well as have some basic programming skills. There are limits on the total travel time that candidates and employers will tolerate, which means balancing those competing needs will be an ongoing discussion since adding new material means prior material will have to be condensed or eliminated.

The general plan for the proposed exams is as follows:

- Preliminary Exams 1-3 will cover the mathematically oriented topics we could expect candidates to cover in undergraduate coursework.
- Associateship exams (MAS I & II, 5, 6) will introduce commonly used techniques and vocabulary needed to work as a P&C actuary and cover advanced predictive analytics beyond what are covered in the preliminary exams.
- Fellowship Exams 7 and 8 will join the mathematics and P&C insurance knowledge from the earlier exams and test candidates on their ability to apply predictive analytics to reserving and ratemaking problems. The final Fellowship exam, Exam 9, consolidates risk manage-

Figure 2. Proposed Syllabus Exams.

1: Probability	General Probability Univariate Random Variables Multivariate Random Variables
2: Financial Mathematics	Interest Theory Financial Economics
3: Introduction to Modeling	Statistics Extended Linear Models Times Series with Constant Variance
MAS-I	Probability Models Linear Mixed Effects Bayesian MCMC
MAS-II	Application of Parametric Distributions Clustering Trees Advanced Trees (Random Forest & Gradient Boosting) Neural Networks
5: Basic Techniques for Ratemaking and Estimating Claim Liabilities	Introduction to Credibility Basic Techniques for Ratemaking Estimating Claim Liabilities
6: Regulation and Financial Reporting	Regulation of Insurance and United States Insurance Law Government and Industry Insurance Programs Financial Reporting and Taxation Professional Responsibilities of the Actuary in Financial Reporting Reinsurance Accounting Principles
7: Advanced Estimation of Policy Liabilities	Limits of link ratio methodology Primary unpaid loss estimates for direct, ceded reinsurance, salvage & subrogation Reinsurance assumed and Excess unpaid losses Effect of correlation on loss estimates between lines and measurement of correlation Effect of varying loss cost inflation on unpaid loss estimates Total Company Unpaid Loss Distribution Premium Liabilities
8: Advanced Direct Ratemaking	Classification Plans Territorial Ratemaking State Level Base Rates Issue Rate & Retention Models Excess & Deductible Pricing Individual Risk Rating
9: Insurance Risk and Rate of Return	Enterprise Risk Management Reinsurance Catastrophe Pricing Insurance Company Valuation Economic Capital Rate of Return, Risk Loads and Contingency Provisions

ment topics.

- Retain the current set of Validation by Education requirements.
- Retain the Professionalism Course requirement.
- Use online courses to cover material that is relevant to actuarial work, yet we do not need to test that material at the level we require to pass our exams.

The changes included from the 2022 syllabus to the proposed syllabus would:

- Use the open space created by the SOA dropping Exam 3/IFM in 2023 to move a good portion of the current MAS I Exam into a new Exam 3, putting basic modeling concepts into the preliminary exams.
- Compress the two online courses from The Institutes into one course that covers policy forms and coverage with a limited introduction to company operations.
- Introduce online course requirements for open-source programming languages from commercial vendors or universities with online courses that provide R or Python training.
- Expand the coverage of machine learning (random forests, gradient boosting and neural networks) as well as application of distributions on the MAS Exams.
- Reduce coverage of some of our historical reserving and ratemaking techniques.
- Focus the proposed advanced reserving Exam 7 and proposed advanced ratemaking Exam 8 on the application of predictive analytics to P&C reserving and ratemaking problem solving.
- Drop the finance section of current Exam 9 and focus the proposed Exam 9 on P&C insurance risk management topics.

Figure 3. Current Syllabus – Validation by Education (VEE) and Online Courses.

VEE	Introduction to Financial Accounting Introduction to Cost Accounting Introduction to Finance Introduction to Microeconomics Introduction to Macroeconomics
Online Courses from The Institutes	Risk Mgmt. & Insurance Ops Insurance Accounting, Coverage, Analysis, Insurance Law & Insurance Regulation

Figure 4. Proposed Syllabus – Validation by Education and Online Courses.

VEE	Introduction to Financial Accounting Introduction to Cost Accounting Introduction to Finance Introduction to Microeconomics Introduction to Macroeconomics
Online Course from The Institutes	Policy Forms and coverage & Insurance Operations
Online Courses Leading to certificates from vendors like COURSERA	Introduction to R Introduction to Python Introduction to SQL

In 2023, the CAS currently plans to introduce a new online course, Data Concepts, to replace Exam 3/IFM. I suggest we drop that course in favor of introducing modeling topics earlier in our syllabus. The basic modeling concepts covered in the proposed Exam 3 would likely be covered in courses available to undergraduates (course offerings may vary by school), but the topics in the Data Concepts exam would not be. Exploratory data analytics and insurance data concepts are best covered as part of the application of predictive analytics examples, which I included in the proposed advanced reserving and ratemaking exams (see the full proposal online at INSERT URL). The model bias topic (bias as in personal bias or societal bias affecting protected classes) would best be covered in the Professionalism Course, assuming that we have papers that have passed peer review on that topic.

Wherever possible, we should use the same textbooks as our data science colleagues when covering predictive analytics, so we can speak the same language and make use of the extensive literature available. We should cover the predictive analytics material at an upper-level undergraduate level of difficulty. Our predictive analytics exams should include a requirement that candidates turn in homework by uploading code to complete simple modeling assignments tied to the topics on the exam, in addition to achieving a passing score to receive credit for that exam. We would mechanically execute the code to verify it works before granting credit for the homework.

For the advanced ratemaking and reserving exams, we will need to create our own material to link insurance vocabulary and predictive analytics terms and tools. Considering the age of some of the current readings from Exams 7 and 8, we should drop all but the Meyers and Shapland monographs and create two general parts to the new syllabus readings for both the advanced ratemaking and reserving exams as follows:

1. Develop a consolidated summary of the existing readings for each exam that focuses on the problem description in those readings, supplementing them where necessary, e.g., older readings may need to be supplemented to illustrate the thinking behind performing exploratory data analysis for a given specific reserving or ratemaking problem.
2. Write study notes for each exam, consisting of open-source code and comments that use R Markdown; this would give a candidate a hands-on experience applying predictive analytics in a controlled, step-by-step environment, going from start to finish in modeling exercises of varying levels of difficulty in reserving and ratemaking problems. Candidates would not be expected to write the code used in those examples for an exam, but some hands-on learning experience is necessary to link general modeling concepts to P&C ratemaking and reserving problem applications.

I believe it will take at least two years to bring the new advanced ratemaking and reserving exams online, which means the earliest the proposed Fellowship exams could go live would be 2025. I would allow a year to create the new exam material, assuming we can send out requests for proposals within a couple of months of agreeing to go this route. We need to allow a year for item writers to create the first batch of questions using that new material and then peer review and edit the questions to put them into exam ready condition.

We have the material on hand today to bring the proposed Exam 3 on Introduction to Modeling online in Spring 2023. The existing MAS I & MAS II syllabus would stay in place during 2023 to allow time to identify the new machine learning and application of distribution material, then new questions would be written for 2024. The existing Exam 5 would stay in place until 2024, which would give time to rewrite some portion of the material and recognize that the Introduction to Credibility material currently on MAS II moves to the proposed Exam 5.

Our proposed exams on predictive analytic topics, Exams 3, MAS I, MAS II, and application of predictive analytics to ratemaking and reserving, Exams 7 and 8, should not require coding during the exam. Not all candidates will go the hands-on modeling route in their careers, but all our candidates must be able to safely use the results of predictive modeling when writing a statement of actuarial opinion. The exams related to predictive analytics should focus on:

- Understanding the underlying assumptions behind different modeling tools and when they can be applied.
- Knowing how to set up a model structure to meet a given modeling problem.
- Interpreting the modeling results.

A summarized view of the 2022 CAS Syllabus versus the proposed syllabus is shown in Figures 1-4. Please note that the proposal is shown at a high level, since creating the details of a new syllabus would be the work of many people.

Proposed Changes to Exam Process

I suggest the following changes to the current exam policies as we move to update the syllabus over the next couple of years:

- Release all multiple-choice exam questions at the close of the exam window.
- Move all exams to a multiple-choice format over the next two years.
- Release the multiple-choice exam answer key at the close of the exam window.
- Give candidates a file showing their multiple-choice answer selections at the close of the exam window.
- Allow candidates a limited time (maybe two weeks) to challenge multiple-choice exam questions and answers after the close of the exam window.
- Release the pass list to candidates three weeks after the close of the challenge period for those exams that have been converted to multiple-choice.
- Instruct question writers to explicitly write questions with a range of difficulty, the intent of which is to spread candidate exam scores.

Moving to a multiple-choice exam format for all exams would be a material change in practice, with the following advantages:

- It makes it practical to give the candidates the answers they gave during the exam, which, combined with the questions and the answer

key, are invaluable tools for those candidates who failed the exam to diagnose where they need to improve.

- Candidates could write challenges after they have finished writing the exam and have the time and material to formulate an effective challenge.
- If we update our syllabus to reflect current predictive analytics applications on the advanced reserving and ratemaking exams, the potential grading volunteer pool will shrink noticeably.
- We can use machine grading to arrive at the raw individual candidate score that makes it possible to give the candidates, the Exam Committee and senior exam officers the raw scores within a day of the exam window closing.

We have used multiple-choice questions on the MAS Exams for years and have demonstrated that we can write questions that test the candidate's in-depth knowledge of a given topic. We can use case studies like we have on the current MAS II Exam to present an extended or integrated problem as the basis for exam questions. I have heard many comments about the MAS Exams over the years, but I do not recall anyone saying the questions were too simplistic.

For more on my reasoning in regard to multiple-choice format, please see the online proposal.

Conclusion

Once again, the goal of this open letter to the CAS membership is to begin a dialogue between the membership and our leadership on the direction we should take in our syllabus and exam process. I anticipate a wide range of responses to this article's proposals, and I ask that you share your views with the CAS Leadership. Updating our syllabus is a material investment in time and money, and a fair amount of membership input at this point seems necessary before setting our course of action.

Some of you may recall filling out surveys related to your work as part of a Job Task Analysis (JTA) that the CAS launched in 2020 with the intent of making it the primary source to drive our syllabus and exam questions. The JTA is a commonly used tool to set credentialling standards using information gathered from members of a profession or trade, which makes using it appealing when talking to either the National Association of Insurance Commissioners (NAIC) or employers about our syllabus and exam process. Unfortunately, that tool assumes a static environment that does not match the world we live in today. The results were not useful. I would not recommend using it as the primary source to change our syllabus again, which is part of the motivation for this article.

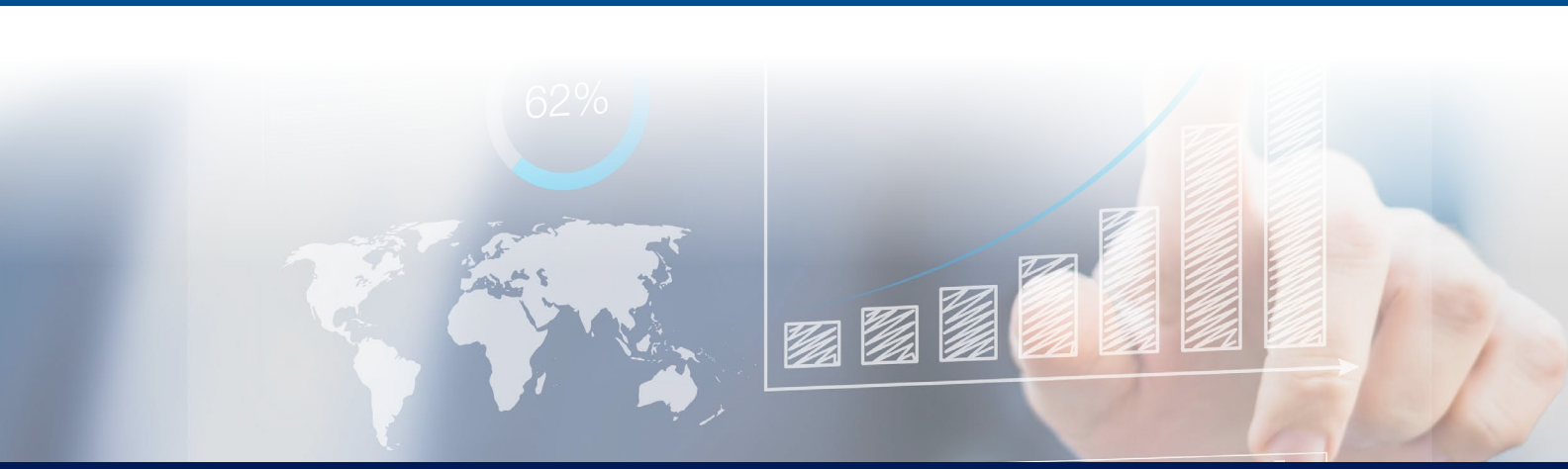
We need a coherent story for the NAIC and employers that explains why our syllabus and exam process meet their needs. I suggest that we develop some broad operating principles on what we want the syllabus and exam process to do that will serve as that story's foundation. Feedback to our leadership on this article could be used as the starting point for those operating principles. We would have an exposure and comment period on those operating principles similar to the American Academy of Actuaries' process when creating new Actuarial Standards of Practice.

The Society of Actuaries' change to their syllabus is a potential benefit to us. Moving some of the material on the current MAS I Exam to replace Exam 3/IFM means that we can move modeling material commonly available at the undergraduate level to an earlier exam. The candidates pick up valuable skills earlier than they would otherwise, and space is freed up on the MAS Exams to cover additional material on topics like random forests. I do not believe it is in our best interests to fill the opening created by the SOA, dropping Exam 3/IFM, with the Data Concepts online course that was recently announced.

The scope of these proposed changes is substantial. Shifting the emphasis from internally generated techniques to applying commonly used predictive analytics modeling tools may be difficult to accept. Failure to adapt our syllabus to a rapidly changing applied modeling environment, however, is unlikely to work well for us. Moving to multiple-choice as the universal exam format is likely to be controversial. That is not the environment that we all came up through to achieve our designations, but consider how practical it is to continue with the constructed response format given the demands it places on volunteer grader time.

Michael R Larsen, FCAS, MAAA, retired from The Hartford in June 2019. He served for about 25 years on various CAS Exam Committees and left the Exam Working Group in June 2021 as the general officer for the MAS Exams.

Obtain Your Credentials in Predictive Analytics and Catastrophe Risk Management From The CAS Institute



Certified Catastrophe Risk Management Professional (CCRMP) and Certified Specialist in Catastrophe Risk (CSCR)

The International Society of Catastrophe Managers (ISCM) and The CAS Institute (iCAS) have joined together to offer two credentials in catastrophe risk management. The Certified Catastrophe Risk Management Professional (CCRMP) credential is available to experienced practitioners in the field through an Experienced Industry Professional (EIP) pathway. The Certified Specialist in Catastrophe Risk (CSCR) credential is available both through an EIP pathway and an examination path.

Required assessments and courses for earning the CSCR include:

- Property Insurance Fundamentals
- Catastrophe Risk in the Insurance Industry
- Introduction to Catastrophe Modeling Methodologies
- The Cat Modeling Process
- Online Course on Ethics and Professionalism

Some exam waivers are available for specific prior courses and exams.

For more information, visit CatRiskCredentials.org.

Certified Specialist in Predictive Analytics (CSPA)

The CAS Institute's Certified Specialist in Predictive Analytics (CSPA) credential offers analytics professionals and their employers the opportunity to certify the analytics skills specifically as applied to property-casualty insurance. The program focuses on insurance as well as technical knowledge and includes a hands-on modeling project that challenges candidates to apply what they have learned throughout their studies to address a real-world scenario.

Required assessments and courses for earning the CSPA include:

- Property-Casualty Insurance Fundamentals
- Data Concepts and Visualization
- Predictive Modeling — Methods and Techniques
- Case Study Project
- Online Course on Ethics and Professionalism

Some exam waivers are available for specific prior courses and exams.

For more information, visit TheCASInstitute.org.

IT'S A PUZZLEMENT By JON EVANS

The Length of Days and Nights

At location A, when the time is half-way between the spring equinox and the summer solstice, the day is about 14 hours long. About how long will the night be at A during the summer solstice? What about during the winter solstice?

A Game of Coins

In this puzzle from *AR* January-February 2022, two players take turns on a sequence of adjacent squares that extends without bound to the right. Initially, a finite number of coins are placed, each on one square (example shown on the right). No more than one coin may occupy a square. The rightmost coin is silver and the rest are copper. Each player in turn may either:

1. Move any coin any number of spaces to the left without jumping over another coin, or
2. Capture and remove the leftmost coin.

Whichever player captures the silver coin, wins. This question is: Under what initial conditions (number and placement of coins) does a player, either the player who takes the first turn or the other, have a winning strategy?

There does not appear to be an easier solution than what is presented in Chapter 7 of *Proof and the Art of Mathematics* by Joel David Hamkins. The solution is outlined below and readers are encouraged to consult the book for a more complete explanation.

In the Hamkins book, the game is referred to as the "Gold Coin game" and is shown to be more or less equivalent to the ancient Chinese game of Nim. In Nim, a finite number of stacks of coins are presented. The players take turns removing any number of coins from one of the stacks. At least one coin must be removed. The player whose last move leaves no coins wins. The game hinges around the condition of the stacks being *balanced*, meaning that when the number of coins in each stack is represented as a binary number, the sum across stacks of any of the binary digits is even. For example, three stacks of height 8, 14 and 6 are balanced because their

binary representations — 1000, 1110, and 110 — total 2, an even number, for each binary digit. In contrast, 8, 12 and 6 are not balanced because from their binary representations — 1000, 1100 and 110 — do not all sum to an even number (specifically, 1000 sums to 1, which is odd).

It can be proven that any move on a set of stacks that is balanced will leave the set unbalanced. Similarly, for any non-empty unbalanced set of stacks, there is a move that will leave it balanced. The key to winning is to be the player who always leaves a balanced stack to the opponent, since the final move will leave an empty, but balanced, set of stacks. Consequently, the player making the final winning move must inherit an unbalanced set of stacks.

Any state of the coin game corresponds to a state of a game of Nim. This is done by associating the coins in sequential pairs. The heights of the Nim stacks correspond to the number of empty spaces between two paired coins. If there is an odd number of coins, the number of empty spaces to the left of the leftmost coin plus one is taken as a stack. The distance between one pair of coins and another adjacent pair of coins is irrelevant. For any move in the corresponding game of Nim, there is a move in the coin game. Some moves in the coin game do not correspond to Nim moves. Specifically, moving the leftmost coin in a pair leftward would correspond to adding coins to a stack. However, this move can only unbalance a balanced stack or offer an additional unnecessary option for balancing an unbalanced stack.

If the initial coin layout is unbalanced, then the player with the first move can force a win by always maintaining balance. If the initial layout is balanced, then the player who moves second can force a win similarly.

Solutions were submitted by John Berglund, Olivier Guillot-Lafrance, Dave Oakden and Andrew Yuhasz.

Shyam Bihari Agarwal also submitted a solution to the puzzle "An Equitable Pass Curve."

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

Elevate Your Insurance Industry Research

Strengthen your assessment of public and private insurer performance and industry trends with *Best's Financial Suite*—the source for unparalleled ratings, data and analytics covering the insurance industry worldwide.

Learn more: sales@ambest.com

21.FIN001C

Our Insight, Your Advantage™

AM BEST SINCE 1899 ®

Casualty Actuarial Society
4350 North Fairfax Drive, Suite 250
Arlington, Virginia 22203 USA
Phone: 703-276-3100, Fax: 703-276-3108
www.casact.org