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Forward Thinking:

A Spotlight on CAS Research

Inclusive Insurance — A Different Game

Navigating New Urban Realities: Zoning, Housing Affordability and Insurance

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departments

FSC LOGO

on the cover

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editor'sNOTE By JIM WEISS, FCAS, EDITOR-IN-CHIEF

Giving Words to Ideas

The *AR* team remains fiercely committed to upping our game and providing you the most timely and relevant content we can. In that spirit, the astute reader may notice subtle but impactful enhancements this issue.

For a long time, we have relied heavily on volunteer contributors within and outside the *AR* Working Group, as well as CAS's intrepid staff and occasional paid freelancers, to develop content. This has typically operated rather extemporaneously (to great results), but our Editorial/Production Manager Sarah Sapp recently asked, "Could we achieve even greater impact with a content roadmap?" This gave birth to the writing subgroup, a motley crew of 14 citizen journalists coordinated by Sarah. The answer to her question is evident in this month's issue in the form of hard-hitting articles by Rob Kahn, Yuhan Zhao and DJ Falkson, and an insightful interview conducted by Sara Chen. *AR*'s writers also comprise a de facto editorial board, engaging John Divine for our July/August cover story and charting a content roadmap into 2025. We could not think of a better way to deliver relevance than by having volunteers moonlight as journalists.

Timeliness can be a challenge when publishing bimonthly, but actuaries know better than anyone that some matters take time to develop. P&C trade media are all over the news of today, but how often do we see the media dissect what it means for actuaries tomorrow and beyond? That was the question posed by News Editor Sara Chen. The answer was Developing News, a new column that digests a few news items that catch our attention. Sara ideated, blueprinted and recruited from the *AR* bullpen to deliver this exciting concept. We hope you enjoy the analyses (and clever titles) she, Yuhan Zhao, Xuan You and I drew up.

With all this writing, *AR* needs some serious proofing, so we remain ever grateful for the dozens of volunteers who pitch in as copy editors. Here is how you can contribute as a reader. All the enhancements I noted were the result of members of the CAS community giving words to ideas. Do you have a developing news item, hot take on an *AR* story or idea for a feature? Write it down and send it to ar@casact.org! ●

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.

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Or email us at AR@casact.org

Follow the CAS

Readings and Lectures for Career Growth

September is the month where a few of my children get ready to return to school, back to their learning and studies in preparation for a future career. In their preparation, they are choosing courses, buying books and brushing up on previous learnings. In a similar manner, I have been considering the skills and knowledge I will need to learn or brush up on to be successful this coming year. For those who may be doing the same, I'd like to share a book list along with activities I'm doing as part of my continuous learning. I'll then wrap up this message with some CAS updates.

Here's my categorized career-prep book list. I've marked the books that have had an outsized impact on my development as "highly recommended." Also, I've included a few books I'm currently reading because they may be of interest.

Communication and persuasion

Crucial Conversations, Grenny et al.

- **Highly recommended.** This book is a must-read and came from a friend's reading list, along with *Trusted Advisor* by Maister et al. and a few books from The Arbinger Institute. The book provides some foundational skills for high-stakes conversations, including avoiding victim or villain stories and expanding the pool of shared knowledge (i.e., listening) in conversations. I've re-read the book a few times and go over it every few years.

Getting More, Diamond et al.

- **Highly recommended.** This book was suggested by a leader at Google, and it covers a novel approach to negotiating and persuasion, with the view that nearly everything is a negotiation. If you need a teaser, the author has a [Talks at Google video][1] that covers a lot of the material.

I'd like to share a book list along with activities I'm doing as part of my continuous learning.

HBR Guide to Office Politics, Dillon et al.

- **Highly recommended, in particular for managers.** I found this book while browsing Harvard Business Review's recommendations — this book should be called *How to Simply Get Along at Work* and outlines basic strategies for diplomacy at work in many common situations.

Presentation

Back of the Napkin, Roam

- **Recommended (reading in progress).** A very creative actuary recommended this book, which covers thinking through sketches and pictures. It suggests visuals as a way to brainstorm ideas, develop them and persuasively communicate them. The author also has a [Talks at Google video][2] on this book and a [TED Talk][3] on the book. Roam is also the author of *Show and Tell*, a book on narrative for presentation that borrows heavily from Joseph Campbell's *The Power of Myth*.

Say it with Charts, Zelazny

- **Recommended.** A decade ago, my boss recommended this book because the charts in my presentations really annoyed him. This book covers what charts to use for what purpose and how to label them, with the goal of visuals that easily communicate the message without confusion. I would also recommend the [Model Systems Knowledge Translation Center website][4] for clarity of graphs. Both the book and the website are useful for managers to share with journeyman actuaries who could use help with their visuals.

Critical thinking, problem-solving and perspectives

What's Your Problem? Wedell-Wedellsborg et al.

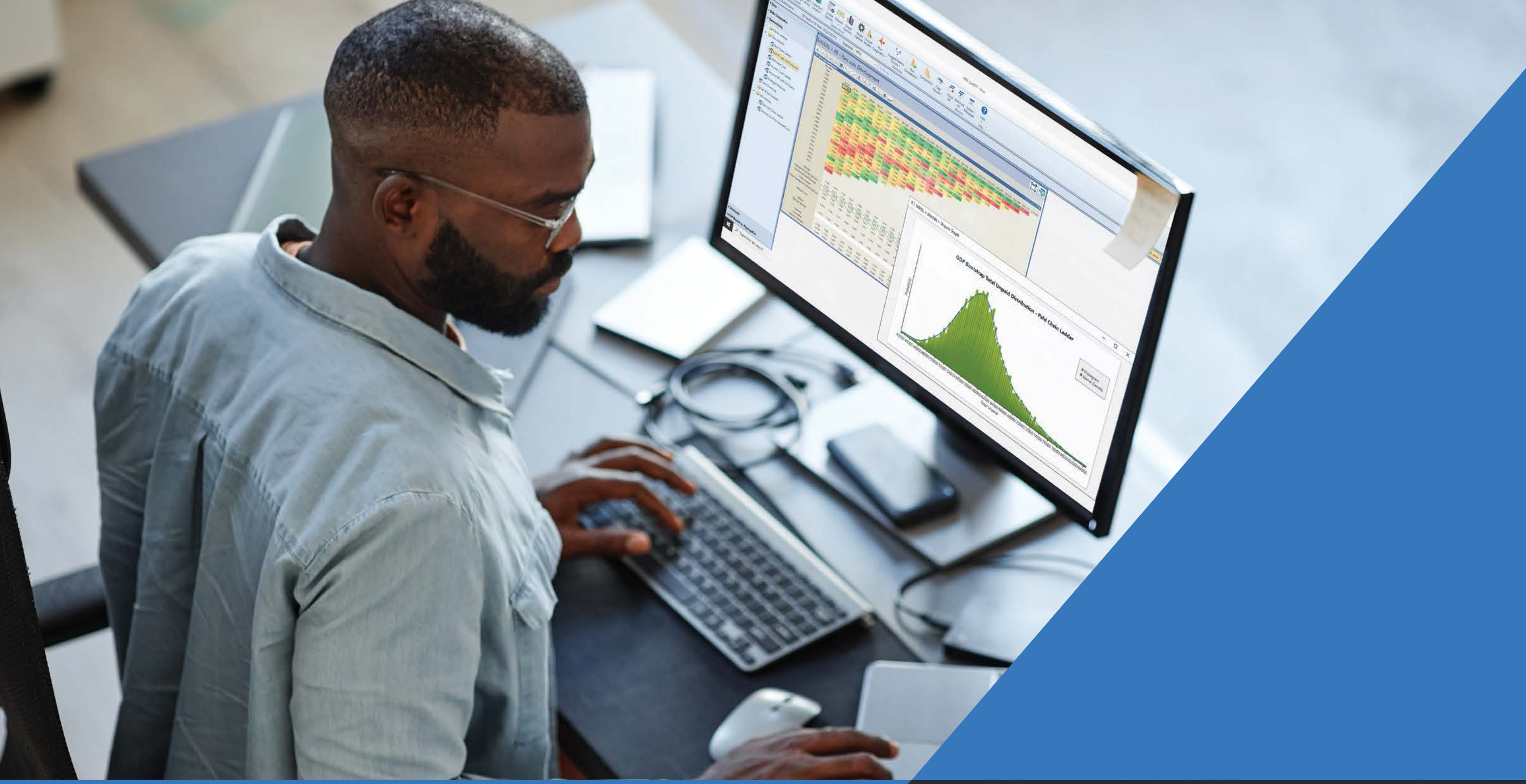
- **Highly recommended.** A colleague in strategy suggested this book. If you need help stepping outside the box, read this book. The premise is that you may not be solving the right problem.

Freakonomics, Levitt and Dubner et al.

- **Highly recommended.** This book is

President's Message, page 8

[1] Diamond, Stuart. "The Art of Negotiation." https://youtu.be/2QtZ-vObJrk?feature=shared.
[2] https://www.youtube.com/watch?v=kuA_yz7aTo0.
[3] https://www.youtube.com/watch?v=XEnrQqOHx3I.
[4] https://msktc.org/knowledge-translation/charts-and-graphs-findings.



President's Message

from page 6

famous and covers novel perspectives on some events from an economist's point of view. Dubner also hosts a Freakonomics podcast[5] that's worth listening to.

Nudge: The Final Edition, Thaler and Sunstein et al.

- **Highly recommended.** This behavioral economics book was mentioned on the Freakonomics podcast a few times, so I picked it up. The book talks about everyday choices from the perspective of a "paternalistic libertarian," encouraging choice architects to design choices that guide users to the right decisions.

Invisible Women: Data Bias in a World Designed for Men, Criado Perez

- **Highly recommended (reading in progress).** This book was recommended reading by a few women leaders, including one from my team. Similar to the previous books, this is an eye-opening book. The book provides a perspective on how our world wasn't designed with women in mind from health and medicine to work to public planning and policy.

Unwritten Laws of Engineering, Skakoon

- **Recommended.** A former star employee, now founder, gave me this book. It's older but covers basic principles of engineering that may apply to some of our technical work. The book is concise and an easy read.

Measure What Matters, Doerr

- **Recommended (reading in progress).** A few people in business recommended this book to me. It covers important considerations and examples that will help you pick and define the right metrics and set appropriate KPIs. This is on my to-finish list.

The Happiness Advantage, Achor

- **Recommended (reading in progress).** The former CFO of Google gave me this book. It's an easy premise and an easy read so far. Achor also has a TED Talk[6] on the subject.

Strategy (in progress)

Good Strategy, Bad Strategy, Rumelt et al.

- **Recommended for senior managers.** I overheard CAS Past Presidents Kathy Antonello and Jessica Leong talk about this book, so I bought and read it. The book covers a lot of examples of bad strategy and is useful for vetting strategies that are vague and, in short, useless.

Competitive Strategy: What is Strategy? Porter et al.

- **Recommended (reading in progress).** This book is one of the seminal works in strategy and shows up in many MBA and business courses. It was also on the Motley Fool's reading list at one point for those who invest based on fundamentals.

In addition to books, I'm reading a few papers every month to stay up on applied science. The latest ones include the 2023 Han et al. paper on interference detection for A/B testing[7] and Ding and VanderWheele's 2016 paper on assumption-less sensitivity testing for causal studies.[8] On the AI front, I find "The Pile: An 800GB Dataset of Diverse Text for Language Modeling"[9] interesting; indeed, Anthropic, Apple and a few other companies are using the open-source Pile modeling dataset to

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[5] https://freakonomics.com/podcasts/.

[6] https://www.youtube.com/watch?v=GXy__kBVq1M.

[7] Han, Kevin et al. https://doi.org/10.48550/arXiv.2211.03262.

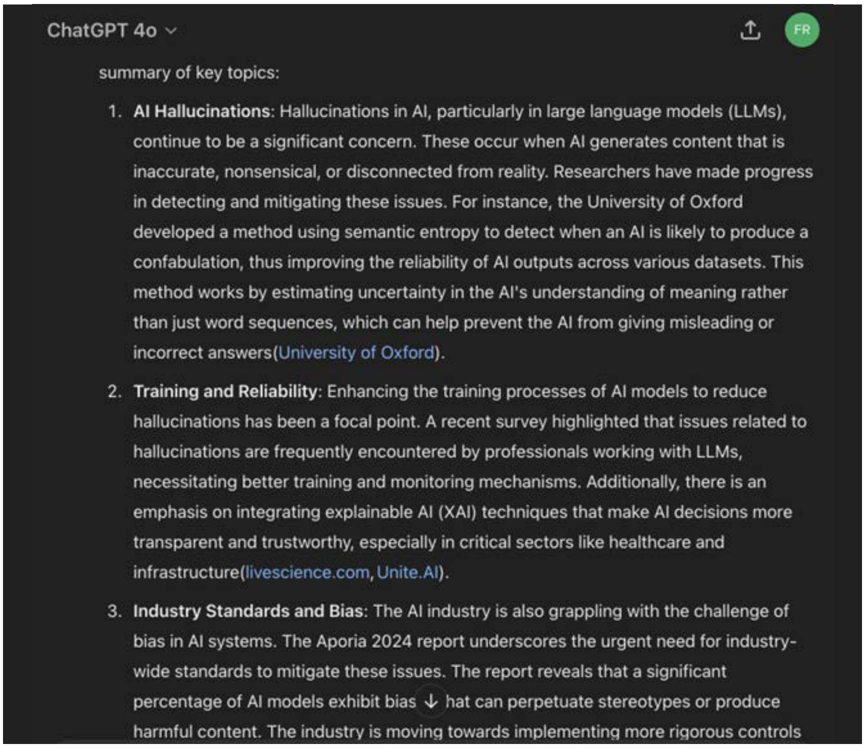
[8] Ding, Peng and Vanderweele, Tyler doi:10.1097/EDE.0000000000000457

[9] Gao, Leo et al. https://doi.org/10.48550/arXiv.2101.00027.

ACTUARIAL REVIEW *LETTERS POLICY*

Letters shall not contain personal attacks or statements directly or implicitly denigrating the characters of individuals or particular groups; false or unsubstantiated claims; or political rhetoric. Letters should be no more than 250 words and must include the author's name and phone number or email address, so the editorial staff can confirm the author. Anonymous letters will not be published. There shall be no recurrence of topics; issues previously addressed will not be the subject of continued letters to the editor, unless new and pertinent information is provided. No more than one letter from an individual can appear in every other issue. Letters should address content covered in AR. Content regarding the CAS Board of Directors or individual departmental policies should be directed to the appropriate staff and volunteer groups (e.g., board, working groups, committees, task forces or councils) instead of AR. No letter that attempts to use AR as a platform for an ulterior purpose will be published. Letters are subject to space limitations and are not guaranteed to be published. The AR editorial volunteer and staff team reserves the right to edit any submitted letter so that it conforms to this policy. Decisions to publish letters and make changes to submissions shall be made at the discretion of the AR Working Group and CAS staff.

For more information on AR *editorial policies, visit https://ar.casact.org/wp-content/uploads/2023/06/AR_Statement_of_Purpose.pdf* train large language models (LLMs). On jailbreaking LLMs, I would suggest "LLM Defenses Are Not Robust to Multi-Turn Human Jailbreaks Yet,"[10] which documents multiple exploits. If you are on the machine learning and data science platform Hugging Face,[11] the full set of multi-turn prompts are there, but please use them thoughtfully with the site's caveats in mind. Finally, if you want to keep up on AI, one interesting way is to ask ChatGPT directly for a summary of latest developments with links to papers and articles.



The results of Frank Chang's prompt to ChatGPT for a summary of the most recent developments in AI.

CAS updates

In August many of the CAS Board's committees and task forces met, culminating in an in-person Board weekend on August 17-18 that was dedicated to strategic planning and stakeholder engagement. The Strategic Planning Task Force presented a proposed three-year plan, incorporating feedback from the two Town Halls we held with CAS members. This feedback helped the task force refine the plan and made the board discussion more effective. In addition, the Membership Linkage Task Force, tasked by the Board to build stronger connections among the board and our members, presented a proposal for how to inform members on board topics, how the leadership structure works, what the committee charters are and how to engage with the Board. The proposal included a CAS Board Portal with assets made possible by the great work of the Governance Committee. Finally, over that same weekend, Board Chair Roosevelt Mosley and Director Steve Belden, who is also a member of the Board's Canada Task Force, met in person with a Canadian employer as part of our effort to engage and understand our Canadian members better. We hope to share more about the CAS Strategic Plan and the board's efforts in the coming months.

We also just wrapped up 2024 CAS Student Central Summer Program, which had 468 participants from 30 countries around the world. These students all finished with a certificate, a greater understanding of P&C insurance, as well as new friends in the CAS.

Finally, I hope you all are excited and planning on attending the Annual Meeting.[12] We've invited the incoming president of the International Actuarial Association (IAA), Bozenna Hinton, to join us at the Annual Meeting, where we'll be hosting a meet-and-greet roundtable on Tuesday for those who want to learn more about the IAA. CAS Board Director Wanchin Chou, FCAS, and I also met with Barbara Richardson, director of the Arizona Department of Insurance and Financial Institutions, who will be presenting an Annual Meeting session that Wanchin and I are moderating. We hope this session will give members a view into the efforts and concerns of our regulatory partners. The organizers and chair have prepared many exciting and interesting sessions (flying cars) focused on innovation, so please consider joining us in Phoenix.

Thank you for reading. I hope to see many of you in person soon. ●

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[10] Li, Nathaniel, et al. https://doi.org/10.48550/arXiv.2408.15221.
[11] https://huggingface.co/.
[12] https://annual.casact.org/.

COMINGS AND GOINGS

Charles Zhu, FCAS, has been promoted to vice president, underwriting and actuarial at Roamly. He has been with the company since 2021, where he has been responsible for underwriting, actuarial, product development and reinsurance.

James Bengtson, FCAS, has been appointed vice president, chief actuary at Society Insurance. Bengtson works closely with Society's teams to balance profitability and growth through product and rate changes, reinsurance programs, reserve estimates, data and predictive analytics. Previously, he served as vice president, chief actuary at Armed Forces Insurance, with leadership responsibilities in pricing, analytics, reserving, compliance and reinsurance.

Diana Liu, FCAS, MAAA, has been appointed U.S. cyber underwriting leader at TransRe. Liu started her career at TransRe in 2019 in the actuarial department and joined the U.S. Professional Liability underwriting team in 2022, focusing on cyber. She has been pivotal in integrating new cyber analytics and modelling capabilities into the underwriting process, in addition to her underwriting and marketing responsibilities.

Sara Chen, FCAS, MAAA, has been appointed consulting actuary at Pinnacle Actuarial Resources, Inc. (Pinnacle). Chen most recently served as an actuary for a major insurance company. She was the reserving lead for the company's business owners program, including managing substantial IBNR for the line of business. Chen was also responsible for setting the monthly catastrophe reserve estimates for the company's commercial lines division. She is currently the chair of the CAS Microlearning Working Group.

Juhyun Shin, FCAS, MAAA, has been appointed consulting actuary at Pinnacle. Shin has held positions with growing responsibility at large insurers providing coverage for commercial lines. Most recently, he served as an actuary for an insurer's commercial umbrella program, determining rates and calculating general liability rate indications. In prior roles, Shin has had experience with managing general underwriters and agencies as a business analyst and underwriter.

Nathan Dykstra, ACAS, has been appointed consulting actuary at Pinnacle. Dykstra has worked in the insurance industry since 2012. He joins Pinnacle from a national automobile insurer where he was a supervising assistant actuary responsible for regional personal automobile and homeowners products, rate revisions and special project implementations. He has extensive rating experience and has supervised the implementation of new rating plans for homeowners' and automotive policies in Florida.

Kelly Bellitti, FCAS, has been appointed as the new chief pricing and portfolio actuary at Vantage Group Holdings Ltd. In a newly expanded capacity, Bellitti is set to oversee the strategic direction of Vantage's insurance portfolio. Her focus will be on enhancing underwriting strategies across the board, aligning closely with the company's broader business objectives. Bellitti will continue to head the insurance pricing actuary team, leveraging data and technology to advance underwriting processes and portfolio management.

CALENDAR OF EVENTS

November 3–6, 2024
CAS Annual Meeting
Phoenix, Arizona

December 11, 2024
CAS Virtual Pricing/Underwriting Seminar
Online Event

March 9–12, 2025
Ratemaking, Product and Modeling Seminar (RPM)
Kissimmee, FL

May 4–7, 2025
CAS Spring Meeting
Toronto, Ontario, Canada

Visit casact.org for updates on meeting locations.

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

See real-time news on our social media channels. Follow us on Facebook, Instagram and LinkedIn.

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."

Actuary and Pastor

Jeff Lange (FCAS 1964)

1940-2024

Lange was born and raised and lived most of his life in New York City. He was the first of two children born to LeRoy and Bertha Miller Lange, to be followed five years later by his sister Kathleen with whom he always shared a close bond. Both loved reading and taking really long walks on the sands of Jones Beach near their home in Bellmore, Long Island. In 1961 Lange received a bachelor of arts from Wagner College and a master of science from New York University two years later before spending nearly 18 years as an applied mathematician. In 1973 he and coauthor Wayne Fisher, FCAS, published "Loss Reseve Testing: a Report Year Approach." Dubbed the "Fisher-Lange" paper, this paper was important enough that it was on the CAS Exam Syllabus for a number of years. During that time, Lange married his college sweetheart and had a son. The marriage didn't last, but Jeff's love for his son grew stronger with every passing year. Lange decided to take a different path and began taking night classes at General Theological Seminary in Manhattan. While teaching a new members' class at Saint Peter's Church in 1981, he met his future wife, Marilyn. They married in 1984. After graduating in 1983 with a master of divinity, Lange served in varying capacities at several churches until 2017. Lange was preceded in death by his parents, his son Philip Gregory Lange and Philip's mother Doris Mueller Lange. He is survived by his wife Marilyn Gallaway Lowther Lange; his sister Kathleen Lange Kugler and her husband Richard; and nephews Christopher Scott (Stephanie) Kugler and Matthew Brett (Amancay) Kugler and their children.

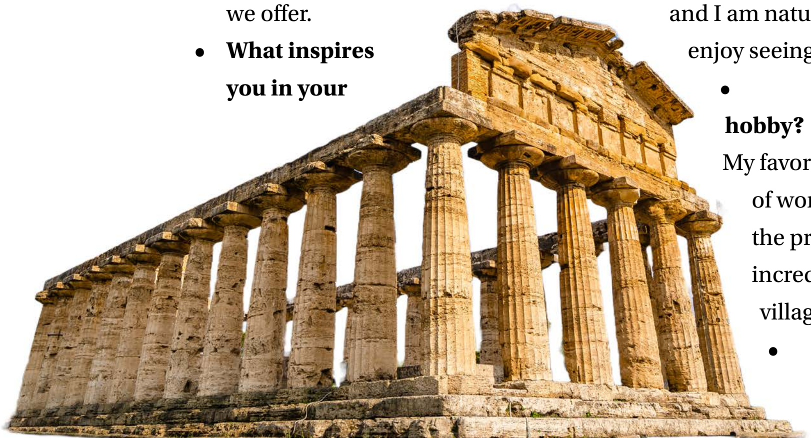

CAS
2024 Annual Meeting
WHERE INNOVATION TAKES FLIGHT
November 3–6, 2024 • Phoenix, AZ
casact.org/annual

CAS STAFF SPOTLIGHT

Meet Meredith Burke, Student Engagement Coordinator

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

- **What do you do at the CAS? How does your role support the strategic plan/envisioned future?**
  As the CAS student engagement coordinator, I support students in the earliest stages of our pipeline, through programs such as the Student Central Summer Program, to become acquainted with the CAS, prepare for exams and more. I help develop our social media and other communications geared toward students, through which I am always trying to extend our outreach to as many students and future actuaries as possible. I also work to strengthen students' ties with the CAS by promoting the various opportunities for technical development, career advancement and other resources we offer.
- **What inspires you in your job? What do you most love about your job?**
  I truly enjoy interacting with our actuarial students and hearing about how our programs have made a difference in their lives. Knowing we are helping so many people start bright futures in the actuarial profession is what inspires me in my work each day. I also feel incredibly lucky to work with a team of talented, amazing people both in my department and beyond.
- **Describe your educational and professional background. What do you bring to the organization?**
  I studied creative writing and history throughout college, which I like to think has given me a keen eye for detail and strong communication abilities. Having been in the disability services field before this, in both administrative and communications-oriented roles, I am an empathetic listener who is quick to build a rapport with just about anyone. In college I also worked as a journalist, and I am naturally investigative and enjoy seeing things through.
- **What is your favorite hobby?**
  My favorite thing to do outside of work is to read. I am also the proud steward of an incredibly mediocre island village in Animal Crossing.



Meredith Burke

- **If you could visit any place in the world, where would you go and why?**
  It is difficult to choose just one, but Athens, Greece. I am a huge history nerd and have always wanted to see the ruins in person.
- **What would your colleagues find surprising about you?**
  I am currently working on writing my own series of novels. This is less surprising because we seem to have a lot of writers at the CAS. I am also a twin.
- **How would your friends and family describe you?**
  Those who are important to me know I will always have their back, even if I can be a little spacey at times. I love fun facts on a wide variety of topics with little rhyme or reason, so I can also always be counted on to be a vessel of lots of useless information.

CAS SPOTLIGHT ON DIVERSITY 2023
LATINO COMMUNITY IN THE CAS

United States Membership and Candidate Data as of December 2023

The CAS is sharing demographic data of members and candidates to be transparent about our diversity efforts and to hold ourselves accountable.

CAS Community Today

- **2.0%** All CAS Members
- **2.6%** New Members 2014-2023
- **4.8%** ACAS Exam Candidates 2023
- **5.5%** MAS-I Exam Candidates 2023

80% of US members, 91% of US members in the last 10 years, 93% of US candidates in 2023 and 92% of US MAS-I Candidates in 2023 voluntarily reported their race ethnicity.

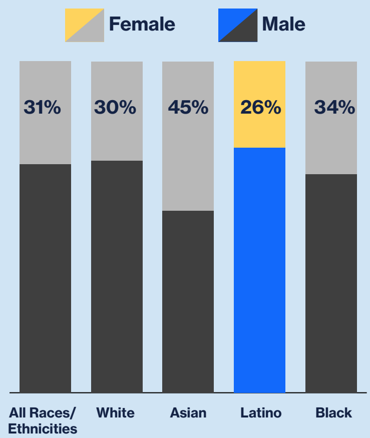
Comparison to External Benchmarks

Latinos make up 16% of the US population Ages 25 & Up

- **12%** Insurance Industry Employees
- **8%** Mathematics Employees
- **13%** STEM Bachelors Degrees
- **15%** Business Bachelors Degrees

US population, Ages 25 and up, estimated for 2022 by US Census Bureau, Population Division.
Insurance Industry Employees in 2022 based on Bureau of Labor Statistics Current Population Survery.
Mathematics Employees from 2017-2019 based on Pew Research Center analysis of American Community Survey.
Science, Technology, Engineering and Math (STEM) and Business Bachelors Degree Conferred in 2020-2021 based on National Center for Education Statistics Digest of Education Statistics.

Gender Breakdown of Worldwide Latino Members Compared to All Members



Percent of Worldwide Latino CAS Members in Leadership Roles

- **2.1%** **Volunteers** in the latest year compared to 2.2% in 2022
- **2.5%** **Conference Presenters** in 2021-2023 compared to 2.8% in 2020-2022
- **4.1%** **Committee Chairs** in 2021-2023 compared to 4.4% in 2020-2022
- **4.3%** **Executive Council/Board** in 2019-2023 compared to 4.9% in 2018-2022

GET INVOLVED

OLA ORGANIZATION OF LATINO ACTUARIES

SUPPORT THE ORGANIZATION OF LATINO ACTUARIES
AT LATINOACTUARIES.ORG

JOIN THE DIVERSITY IMPACT GROUP TO VOLUNTEER AND SHARE YOUR IDEAS
AT COMMUNITY.CASACT.ORG

If you want to make sure that your demographic information is included in these metrics, please log on to the CAS website and update your membership profile.

MEET THE VEEP

Morgan Bugbee, Vice President-Research & Development

By ANNMARIE GEDDES BARIBEAU

Morgan Bugbee loves CAS research! He started volunteering in 2007 when he earned his FCAS designation and has continued ever since. After serving on the now-defunct Dynamic Risk Modeling Committee, he later became chair of the CAS Ratemaking Working Group.

Bugbee, who also holds a CSPA from The CAS Institute, earned a bachelor of music in performance studies and bachelor of arts in mathematics at Northwestern University. After 17 years at Farmers Insurance, he joined the insurtech scene. A native of Montana and a resident of Los Angeles, Bugbee is the director of data science at Quanata LLC, an internal startup of State Farm Insurance.

"As my appetite for reviewing research papers grew, I also became a reviewer for *Variance* and am now one of its associate editors," he said. "Engaging in CAS research has been a driving force behind my professional growth and increasing passion for research over the years." He also serves on the Board of the Southern California Casualty Actuarial Club.

Being involved with CAS research has multi-fold advantages, he said. "It has not only allowed me to contribute to the advancement of our field, but has also propelled my own education, affording me a front-row seat to the latest developments and innovations in actuarial methods." This unique vantage point, he added, has been incredibly enriching, fueling his desire to lead and shape the direction of CAS research.

Bugbee became vice president-research & development in November 2023 to expand CAS research in new ways (see our cover story). "I am enthusiastic about the opportunity to leverage my experience and passion to lead our research initiatives, ensuring that we continue to push the boundaries of actuarial science and provide valuable insights to our members and the broader industry," he added.

When Bugbee is not thinking about research, doing his paid job or encouraging his middle school children towards math and science, he can be found grilling *picanha* (also known as beef sirloin cap) and baking *pão de queijo* (Brazilian cheese bread balls) on the weekends. Beyond the Brazillian culinary influence, he also makes Asian food including *kalbi* and *yang rou chuan* (Chinese cumin lamb kabobs) or, for a spur of the moment dessert, he makes

Morgan Bugbee

tang yuan (black sesame rice ball soup). To offset his cooking hobby, he lifts weights in his home gym.

Inspiring others to also become leaders, he sees leadership as fundamentally about taking initiative. "Volunteering to lead a task force, offering up ideas and suggestions when the question arises; if you do these consistently enough, then you're leading." Of course, he notes, leaders also deliver what they have promised. ●

Some of Bugbee's favorite dishes to prepare: Brazilian cheese bread balls, Chinese cumin lamb kabobs and black sesame rice ball soup. Sorry, readers. There is no scratch and sniff in this issue.


CV
Manager
OBJECTIVE
EXPERIENCE
2020 - 2020
2018 - 2020
EDUCATION
2012-2018
SKILLS
HOBBIES

MAKING THINGS HAPPEN

Double Duty: Researcher and Editor

By DR. SARAH SAPP, CAS EDITORIAL/PRODUCTION MANAGER

The "Making Things Happen" column features CAS and iCAS members who serve the associations in many capacities and enrich the volunteer experience for all.

In the complex world of property and casualty insurance, actuaries play a pivotal role in ensuring the financial stability and solvency of insurance companies. One of these dedicated professionals is Julie Lederer, FCAS, MAAA, a P&C actuary working for the Missouri Department of Commerce and Insurance. Lederer's journey through the actuarial field is marked by her impressive professional achievements, extensive volunteer work with the CAS and a commitment to fostering research and development in actuarial science. In this article, we explore Lederer's contributions, her role within the CAS and the passion that drives her to volunteer and excel in her profession.

Lederer holds several volunteer roles within the CAS, including membership in the Reserves Working Group and a copy editor for *Actuarial Review* in the *AR* Working Group.

As a member of the Reserves Working Group, Lederer reviews papers submitted in response to call paper programs. This involves a rigorous evaluation process to ensure the research is relevant and beneficial to actuaries. She and the other working group members are crucial for advancing reserving research that helps actuaries track changes in reserves and collaborate effectively with peers from other departments such as pricing and underwriting.

As an *Actuarial Review* copy editor, Lederer ensures that the articles published are clear, grammatically correct and compliant with AP style.

For the *Actuarial Review*, Lederer is passionate about making actuarial writing accessible and encourages her colleagues to contribute. "Over one-fifth of respondents to the 2023 quinquennial survey said that they are unsure whether they're qualified to write papers sufficient for CAS publication. This is a concern. Readers, you are qualified," Lederer says. Her message is clear: The CAS supports authors and offers resources to help them succeed.

Lederer has clear and ambitious goals for her volunteer roles. In the Reserves Working Group, she aims to foster research that is both theoretically sound and easy to implement. "As a regulator who focuses on solvency monitoring, I value the contributions of reserving actuaries and would like to play a small part in moving reserving research forward," she says. Lederer emphasizes the importance of practical tools, such as code or spreadsheets, accompanying research papers to enhance their usability.

She also highlights the need for clear documentation of actuarial work to comply with relevant actuarial standards of practice and to be understood by management, boards and regulators. Lederer also encourages research paper authors to present their work through various channels that cater to differ-

Julie Lederer

ent learning preferences, including webinars, seminars, conferences and microlearning courses.

The Reserves Working Group is currently wrapping up its 2024 call paper program on technology and the reserving actuary. "We received a great collection of timely papers, and working group members have been hard at work over the past few months reviewing drafts and helping authors finalize their papers," she says. These papers will be published in the *E-Forum*, and several authors will present their work at the CLRS in September.

Lederer takes pride in the accomplishments of her working group, particularly in fostering high-quality research that addresses contemporary issues in the actuarial field. Her dedication to advancing the profession through rigorous research and practical applications is evident in the initiatives she supports.

Lederer's journey as a CAS volunteer began in 2014, shortly after she

Lederer with her cat KK.

earned her Fellowship. “At this point, it’s safe to say that I might be a lifer. There’s always something fresh and new to explore in publications and research, so I could happily stay with these groups forever,” she reflects.

In addition to her roles in these groups, Lederer serves on the CAS Board of Directors, with her term ending in November 2025. She particularly enjoys her involvement with the board’s Audit Committee, where she reviews the CAS’s audited financial statements and annual tax returns. “As a regulator, I spend a lot of time reviewing annual statements, so this committee is a natural fit for me,” she explains. Lederer's expertise in solvency monitoring and financial analysis makes her a valuable asset to the committee.

Lederer holds a BS in mathematics and an MBA from the University of Notre Dame, as well as a master’s in statistics from Stanford University. She got her career started at a consulting firm in Chicago, where she worked for four years before returning to her hometown of Kansas City in 2013.

In her current role at the Missouri Department of Commerce and Insurance, Lederer's work centers around solvency monitoring. She reviews statements of actuarial opinion and ORSA filings and assists with financial analysis and exams. Missouri's active participation in the NAIC’s Actuarial Opinion Working Group and the NAIC’s Casualty Actuarial and Statistical Task Force further highlights Lederer's significant contributions to the field.

Lederer's dedication to her profession and volunteer work has not gone unnoticed. She recently received a Professional and Leadership Development Award from her department, which provides funding for professional development opportunities. This award allows Lederer to attend additional CAS seminars and further her knowledge in actuarial research.

For Lederer, volunteering is about more than just contributing to the CAS; it is about strengthening the profession and providing valuable opportunities for personal and professional growth. “The spirit of volunteerism is what makes the CAS unique. From the board and executive council downwards, volunteers determine and drive the initiatives that move the CAS forward,” she says.

Lederer believes that volunteering offers younger actuaries early leadership opportunities and a chance to connect with colleagues and make lasting friendships. It also allows her to engage in areas beyond her day-to-day job as a regulator, broadening her perspective, network and skills.

Outside of her professional and volunteer work, Lederer enjoys a variety of hobbies. She loves reading, taking ballet lessons and going to the climbing gym. She also ushers at her church and knits clothing for her cat, despite his apparent lack of enthusiasm for his wardrobe.

Lederer at the rock climbing gym.

The CAS Trust Awards Scholarship to Nine Students in 2024

The CAS is excited to announce the winners of the 2024 CAS Trust Scholarship! This honor was created to further students' interest in the property and casualty actuarial profession and encourage the pursuit of the CAS designations. This year, the CAS received a historic number of qualified applicants from around the world, leading to an additional scholarship to be awarded. These nine recipients have showcased remarkable achievements, both academically and professionally, throughout their P&C actuarial journey.

$5,000 CAS Trust Scholarship Recipients

Avani Agarwala is a fourth-year undergraduate student at Canada's University of Waterloo in Ontario, where she is majoring in mathematics/financial analysis and risk management, along with a professional risk management specialization and minors in actuarial science and computing. She spent the summer of 2024 interning at Aviva in their personal insurance pricing department. She has completed previous co-ops at Intact Financial Corporation in their specialty line actuarial team and at KPMG Canada in their P&C actuarial team. Agarwala has also been the CAS Student Ambassador at the University of Waterloo since August 2023.

Avani Agarwala

"Being awarded the CAS Trust Scholarship is a significant honor for me, and I am deeply grateful to those who have supported me along my journey. This award continues to motivate me to excel in my actuarial studies and contribute to the field with passion and dedication."

Long Nguyen is a junior at the National Economics University in Hanoi, where he is studying actuarial science. After interning at FWD Life Insurance last summer, Nguyen joined Vietnibank Insurance at the beginning of this year to pursue his dream career in the P&C sector. Although Vietnam's P&C market is still unfamiliar with actuarial roles, he has been entrusted with developing both ratemaking and reserving models for his company. Nguyen is committed to pioneering actuarial practices in the region, integrating the knowledge acquired from Exam 5 into his work.

Long Nguyen

"It's an honor to be recognized as a scholarship recipient and I am deeply grateful for the opportunities the CAS provides. This award not only supports my educational endeavors but also inspires me to expand the boundaries of the actuarial profession within our evolving industry."

Srikar Sunil is a senior at Pennsylvania State University in State College, Pennsylvania, where he is studying actuarial science and minoring in statistics. He has previously interned with CVS Health, Erie Insurance, Liberty Mutual and Milliman. This summer, he is working as an actuarial advisory services intern at Ernst & Young, LLP. Srikar is heavily involved with the Penn State Actuarial Science Club, where he has held several leadership positions and currently serves as president.

Srikar Sunil

"I'm incredibly honored to receive this recognition from the CAS. I'm excited to push the boundaries of our profession and inspire others by striving for innovation and excellence."

Thu Nguyen Hai is a senior at Vietnam's National Economics University in Hanoi, where she is studying actuarial science and risk management. She spent the summer of 2023 interning at Decent Actuarial Consultants Co. and spent the summer of 2024 as a research assistant at her university's Operations Research Lab. Her research focuses on machine learning applications in reserving techniques and portfolio optimization.

Thu Nguyen Hai

"Receiving the Trust Scholarship from the CAS is an incredible honor and fills me with gratitude. This recognition fuels my determination to pursue my dream career, with the aspiration of giving back to the actuarial community. My heartfelt thanks goes to everyone who has supported me along the way, especially my family, mentors, and friends."

$2,500 CAS Trust Scholarship Recipients

Austin Do is a fourth-year student at Western University in London, Ontario, Canada, where he is studying actuarial science. He spent the summer of 2023 at Echelon Insurance, CAA Club Group, interning with their personal lines auto pricing team, and the summer of 2024 working on the Rate Revolution Commercial Lines team at Intact Financial Corporation, where he helped develop machine learning solutions to segment and rate commercial insurance policies. Do has held leadership positions on both the Actuarial National Students' Association (ANSA) and Western's Actuarial & Statistical Undergrad Association (ASUA).

Austin Do

"I am honored to receive this prestigious award from the CAS and very grateful for the support of my mentors, friends, and family. With the gracious support from the CAS, I hope to further my passion in the field and give back to the actuarial community in meaningful ways."

Bren Hutchinson is a senior at Louisiana State University (LSU) in Baton Rouge, Louisiana, where they are pursuing dual degrees in mathematics and actuarial science, and interdisciplinary studies in statistics, computer science and business. Hutchinson conducted research in swarm intelligence in 2023, interned at Louisiana's Workers' Compensation Corporation throughout the 2023-2024 school year, and spent this summer interning with Edgewater Actuarial Insights. Hutchinson is also the co-president of LSU's Actuarial Student Association.

Bren Hutchinson

"I would like to express my sincere gratitude for the Casualty Actuarial Society's confidence in my potential as an aspiring actuary. I am deeply motivated to contribute to the growth of diversity within the field."

Katie Johnson is a senior at Illinois State University (ISU) in Normal, Illinois, where she is studying actuarial science with minors in computer science and Spanish. She spent summer 2023 as an actuarial intern at Zurich Insurance in workers' compensation pricing and began summer 2024 with a three-week international internship in Switzerland through the Katie School of Insurance, followed by her role as an actuarial intern at Travelers in international lines pricing. Johnson will serve as the president of the ISU Actuarial Club for the 2024-2025 school year and is an active member of the executive board for Gamma Iota Sigma.

Katie Johnson

"I am incredibly honored and deeply grateful to be a recipient of this award. The support of the CAS has played an invaluable role in my development as a student and professional. Thank you to everyone who has supported me along the way."

Quynh Nguyen is a senior at University of St. Thomas in Minneapolis, Minnesota, where she is studying actuarial science. In summer 2023 she worked as an underwriting intern at RLI Corp, which transitioned into an actuarial internship during her 2023-2024 school year. This past summer, she interned at Voya Financial as a pricing actuary. Nguyen is actively involved in many insurance conferences and committees, such as the In2Risk Conference, RISE Professional Student Committee, and the CPCU Student Committee.

Quynh Nguyen

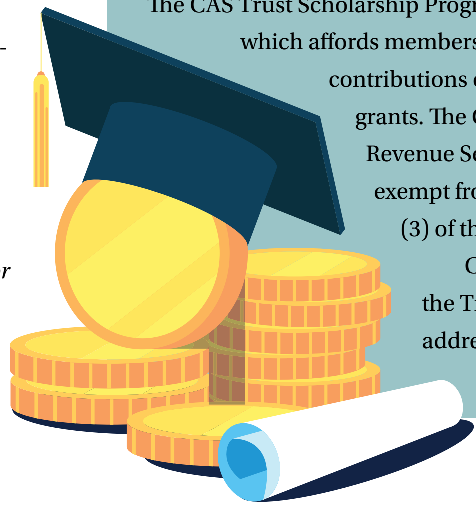
"As an actuarial student from Vietnam, it is my honor to be recognized and supported by the Casualty Actuarial Society. This scholarship not only provides me with financial support but also motivation and encouragement to continue pursuing the career path I am passionate about. Thanks to the CAS and their generous donors who made this scholarship possible!"

Raelyn Stiller is a senior at the University of Minnesota-Twin Cities in Minneapolis, Minnesota, where she is studying mathematics with a specialization in actuarial science. In summer 2023 she interned in

Raelyn Stiller

the actuarial leadership development program at Travelers and returned for the summer of 2024. Stiller serves as the president of her university's actuary club and enjoys tutoring with Math Motivators.

"I am honored and grateful to receive this recognition from the CAS. I would like to thank my family, professors, and mentors for supporting me on my academic and actuarial journey."



Learn More About Our CAS Trust Scholarship Program

The CAS Trust Scholarship Program is funded by donations to the CAS Trust, which affords members and others an income tax deduction for contributions of funds used for scholarships and research grants. The CAS Trust was qualified by the Internal Revenue Service in 1979 as a non-profit organization exempt from federal income tax under section 503(c)(3) of the Internal Revenue Code.

CAS members are invited to contribute to the Trust; inquiries and contributions should be addressed to CAS Chief Business Officer Joyce Warner at JWarner@casact.org.

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CAS Marks Return to In-Person Asia COP

In May the CAS had the pleasure of hosting our first in-person Asia Course on Professionalism since 2019. The event took place at Sunway University in Kuala Lumpur, Malaysia, and drew in 38 candidates from Australia, China, Hong Kong, India, Malaysia, the Philippines, Singapore and Taiwan. In addition to gaining in-depth knowledge of actuarial professional standards, participants also had the opportunity to engage with Sunway's actuarial science students, fostering meaningful connections and professional growth.

A special thanks to our outstanding facilitation team: CAS Fellows Ran Guo, Cathy Hwang, Jimmy Molyneux, Marcus Yamashiro, Chor Leong Aw Yong, Jasmine Lim and Chee Hou Tan. Your expertise and dedication made this event a resounding success.

It was an exciting and enriching experience for all involved!

Registration.

Networking lunch with Sunway actuarial science students and CAS members.

CAS country manager for China, Ran Guo, kicks off the Course on Professionalism.

Sunway actuarial science students have lunch and network.

Soon-to-be CAS members take a class photo with COP facilitators.Seated in the front row are COP facilitators (from left to right): Marucs Yamashiro, Jimmy Molyneux, Chee Hou Tan, Jasmine Lim, Chor Leong Aw Yong. Ran Guo (left) and Cathy Hwang stand in the back holding the welcome banner.

Candidates huddle to discuss.

Facilitators Jimmy Molyneux (left) and Jasmine Lim address the class.

Candidates prepare for their presentation.

Inclusive Insurance — A Different Game

By JULES GRIBBLE WITH CONTRIBUTIONS By ESPERANZA BORJA MEAD, EDUARDO ESTEVA AND RAFAEL COSTA

Through our role as a member of the International Actuarial Association, the CAS engages in many collaborative efforts to elevate the actuarial profession around the globe. This article is the result of partnerships built through this engagement. In an effort to bolster inclusivity and share our activities with a wider group of international stakeholders, this article is available on the AR website in Spanish and Portuguese, courtesy of members of the Latin America Regional Working Group. Esperanza Borja Mead translated this article to Spanish and Rafael Costa translated to Portuguese.

About four billion of the world's current population may benefit from inclusive insurance initiatives, but this potential market may not be easy to access from a traditional insurance perspective. Without inclusive insurance, we create the risk of leaving perhaps half the world's population without access to insurance.

The usual indemnity perspective on insurance (for either individuals or businesses) focuses on financial recompense for specific losses incurred by the insureds. A broader perspective of insurance can also be taken. That is, the role of insurance is to mitigate the adverse impacts of risk events at both an individual and group/societal level. Mitigation, providing some form of safety net, and specific indemnity can be very different things.

The concept of risk sharing, as often formalized by insurance, is crucial to providing individuals and businesses with the confidence to take risks to advance economic growth. This positive economic role of insurance is encapsulated in the following, attributed to Henry Ford on the building of the Empire State Building:

> The whole world relies on insurance. Without it, every person would keep their money without investing it anywhere for fear of losing it, and civilization would have ground to a halt a little past the Stone Age.

Rephrased, the basic objective of insurance is to provide confidence to take on risks by shifting the impact of specific risk events from being individually catastrophic to being manageable by a larger group. The usual, but not only, means to achieving this end is an indemnity focus for individual insureds.

The development of parametric, or index-based, insurance and disaster recovery programs, primarily in developing countries in an inclusive insurance context, provides an alternate path to social and ongoing economic benefit by moving away from a focus on individual indemnity to a broader group or societal focus. In other contexts, subsidizing (fully or partially) the costs of providing insurance can be validated by the longer-term societal and economic benefits reaped.

It is well established that access to insurance enhances economic growth, supports trade and provides other societal benefits. It is also well established that increased access to inclusive financial services, including insurance, helps to reduce poverty and can leverage social and economic development. These supports are especially valuable to those living near the poverty line, where one adverse event risks pushing them permanently below the poverty line.

Inclusive insurance

The International Actuarial Association (IAA)'s Risk Book chapter on Inclusive Insurance, IAA 2023, defines inclusive insurance as:

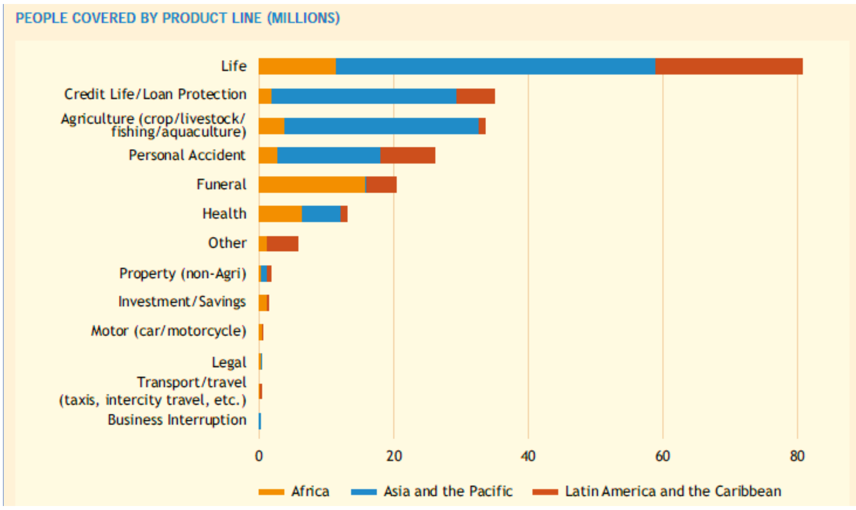
> Insurance products through which adults have effective access to insurance and savings products offered by insurers through formal providers.

Effective access is explained as the involvement of convenient and responsible service delivery, at a cost affordable to the customer and sustainable for the provider, resulting in financially unserved or underserved customers being able to more effectively access and benefit from formal financial services in preference to other existing informal options.

Inclusive insurance products include all insurance products, indemnity-based or more broadly based, that are aimed at unserved or underserved markets. These markets typically are found in developing countries (from an insurance perspective) but are not restricted to such countries.

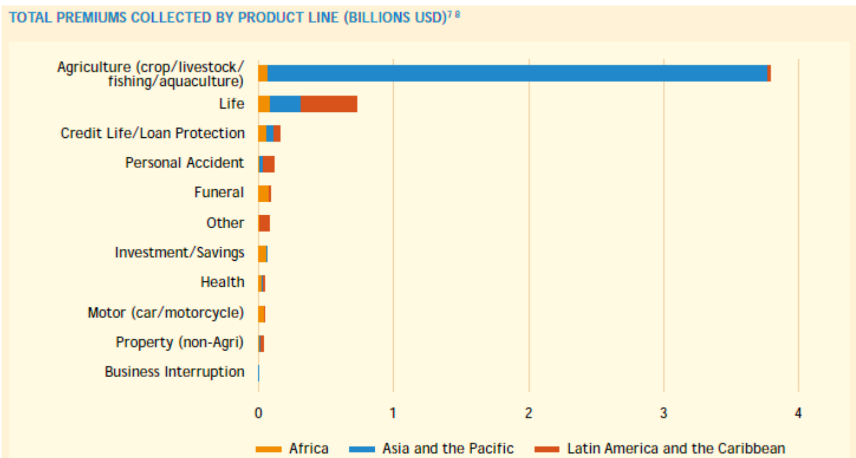
Microinsurance is a subset of inclusive insurance focusing on lower income populations. These large groups may be more vulnerable due to the nature of their activities, the environment where they live and their lack of resilience. The effects of climate change may exacerbate the hazards these populations face.

Table 1. Coverage by number of insured in developing countries



Source: MIN 2023. Used with permission.

Table 2. Coverage by total premium in developing countries



Source: MIN 2023. Used with permission.

Scale of the challenge

The overall scale of the underinsurance challenge is highlighted by MAPFRE 2023, which states:

> The world insurance deficit grows by 14.3% and comes to USD 7.8 trillion (equivalent to about 7.8% of global GDP) …
>
> More than 77.6% of the current insurance gap is in emerging markets, a reflection of their great potential for growth.
>
> Currently, China, the United States and India are once again leading the ranking of the countries with the greatest insurance potential in both the life and non-life segments.

More specifically in Latin America, McKinsey & Company 2023 report that:

> Despite seeing the fastest growth in Gross Written Premiums (GWP) in the world, Latin America still has a low share of global premiums, at just 2% — versus 43% in North America, 28% in Asia, and 24% in Europe.
>
> This is put into context by noting that insurance premiums in Latin America represent just 3.1% of GDP — versus 10.5% in North America, 6.2% in Asia, and 5.1% in Europe.

Inclusive insurance in developing countries

The inclusive insurance landscape is evolving rapidly. The most recent Micro Insurance Network (MIN) annual global survey reviewing inclusive insurance in developing countries, MIN 2023, highlights both the extent of coverage and the scope for expansion.

MIN 2023 notes that, in the countries included, about 330 million people are covered by microinsurance products. This is only perhaps one ninth of the population that could benefit from these products.

This supports the commentary that "results of this study point to a significant market opportunity for insurers, alongside a pressing need for governments to consider the need to close this substantial protection gap as a key enabler to meet wider development agendas."

One overall measure of insurance coverage is number of policyholders (see Table 1).

Another overall measure of insurance coverage is total premiums collected (see Table 2).

Care should be taken when comparing regions (as in Tables 1 and 2) as product mixes may well vary, both between

Diagram 1. The value chain for traditional insurance

Source: IAA 2023, page 20. Used with permission.

regions (on average) and between countries within those regions. Also, different aspects of insurance coverage are highlighted by different measures. For example, agriculture is the third largest product in terms of people covered but is responsible for more collected premiums than all other products combined. It is not uncommon for agriculture insurance premiums to be subsidized by governments.

There are also significant regional differences to be investigated in more detail, and these averages may vary significantly relative to the experience in individual countries in a region for a range of reasons. For example, in Latin America and the Caribbean, life insurance is the largest line of insurance by both premium and number of insureds. This pattern is not the case in the other two (developing) regions reported.

MIN 2023 introduces some measures for assessing inclusive insurance: market size and evolution, distribution and payments, social performance (relating to claims), women's access to insurance, and climate risk and health. These measures vary markedly between regions, and this can be attributed, at least in part, to differences in products offered (both type and volume).

Inclusive and traditional insurance differences

At a high level, there are three key roles in the insurance value chain:

- ***Distribution partner:*** Any player that has a role in the distribution of insurance. Several distribution partners may be working together or sequentially to distribute insurance to the customer.
- ***Insurer or risk carrier:*** Any party that accepts financial risk in return for payment of the insurance premium.
- ***Technical services provider (TSP):*** Provides technical services to a distribution partner, insurer or any other party in the insurance value chain. These can include actuarial, technology and data and international development services, or country- and market-specific knowledge on how to reach a type of consumer. TSPs are often the glue that holds the multiple partners of an inclusive insurance initiative together.

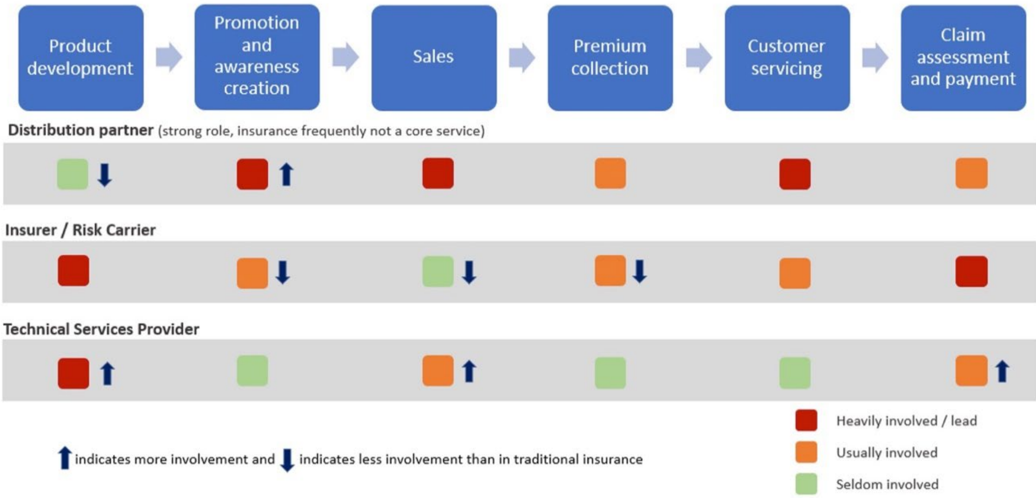
Diagrams 1 and 2 are taken from IAA 2023 and summarize the significant differences between traditional and inclusive insurance. As these value chains indicate, there will be variations in practice reflecting local conditions. The differences and the changes in the importance of various players are highlighted by the arrows in Diagram 2.

TSPs typically play a significantly stronger role in inclusive insurance than in traditional insurance, bringing skills and experience to inclusive insurance that more traditional insurers and distributors may not have. Multiple stakeholders are often involved in delivering key aspects of inclusive insurance, and some of these stakeholders (such as telecommunication companies) may be outside the insurance industry, something that differentiates inclusive and traditional insurance and often complicates effective inclusive insurance delivery.

Actuarial preconditions

From an actuarial perspective, the differences noted above

Diagram 2. The value chain for inclusive insurance



Source: IAA 2023, page 21. Used with permission.

reflect the context of actuarial work. In traditional, well-developed insurance markets, a number of pre-conditions are typically presumed:

- A ready supply of actuaries, the availability of actuarial education and the presence of robust professional standards.
- The availability of relevant, timely and appropriate data.
- Access to systems through which data can be collected and analyzed by providers, the industry and at the national level.
- A regulatory framework that is reasonably well-developed and understood by market participants.

We note that the above pre-conditions implicitly assume that coverages are available. With the increasing impacts of climate change emerging, compounded by increasing levels of material wealth to be protected, this assumption may be called into question. This may present more systemic issues to be addressed.

In many inclusive insurance markets, the reality may well be different, and one or more traditional pre-conditions are frequently not met:

- The supply of actuaries and the actuarial profession may be limited or nonexistent. The same applies to other insurance skills.
- Data may not be available or readily collectible. This may lead to country-specific mortality or morbidity tables or both not being available.
- Systems for collecting and analyzing data may not be well-developed or integrated.
- Customer understanding of insurance may be limited, especially for first-time customers of inclusive insurance.
- Trust in insurance may be lacking.
- Regulation that is appropriate for inclusive insurance may not be in place or, conversely, existing regulation may act as a barrier to inclusive insurance.

These issues are discussed further in IAA 2014, and some examples of how these issues could be addressed are given in Blacker 2015. A recent, high -level, structured approach to assessing the extent to which key success factors of inclusive insurance are addressed is given in Swiss Re 2023b. Many of these drivers are not directly related to traditional actuarial considerations or to specific lines of insurance but need to be addressed if inclusive insurance initiatives are to succeed.

There is a risk that standard tools and approaches may not be appropriate in inclusive insurance markets, and that their application may lead to unintended outcomes, such as inappropriate premiums or claims processing.

For more information on the Risk Book Inclusive Insurance chapter, you can review the chapter itself (see IAA 2023), or you can watch two webinars delivered in February 2023 (see IAA 2023b) that reflect on the findings from this chapter.

The challenge ahead

Globally, there is a great need for inclusive insurance products, both based on indemnity and more broadly. Actuaries can play an important role in the efficient, effective and sustainable delivery of these products. To achieve this, actuaries need to be aware of the differences between traditional and inclusive insurance products that reflect their environments and their consumers. They also should apply a flexible and holistic approach to achieve their ultimate objectives of providing consumers with confidence and protection when significant adverse risk events occur. An example of this flexibility is the development of index-based insurance.

The challenge for actuaries is how to take traditional actuarial knowledge and transfer it into an environment in which traditionally expected pre-conditions, actuarial and more broadly, are not met. This will require flexibility and resilience from actuaries and the capacity to apply underlying principles, as distinct from standardized "textbook" traditional practices. This challenge is compounded by the need to reflect the specific circumstances in specific countries. IAA 2017 provides some more insights that may assist actuaries considering pursuing inclusive insurance further.

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Navigating New Urban Realities: Zoning, Housing Affordability and Insurance

By DJ FALKSON

The U.S. faces a growing crisis of housing affordability. Homeownership and rental costs have skyrocketed in recent years, making it increasingly difficult for many Americans to secure affordable housing. Home insurance costs have contributed to unaffordability, as insurers have seen steep losses and filed for significant rate increases while tightening underwriting guidelines. These issues are intricately linked to zoning laws and urban planning policies that have shaped the built environment for decades. As municipalities grapple with these challenges, the insurance industry must also adapt to the changing landscape.

This article explores the historical context of zoning in the U.S., examines recent changes in major cities and discusses the implications of these changes for the insurance industry. By understanding the connection between zoning, housing affordability and insurance needs, actuaries and insurance product managers can better prepare for the challenges and opportunities ahead.

Overview

Zoning codes, which dictate land use and building density, have significantly shaped the landscape of American cities and continue to do so today, often with harmful impacts. Restrictive zoning laws and local resistance to new construction have led to a significant undersupply of housing nationwide, driving up prices and making it harder for low- and middle-income families to find affordable housing. Single-family zoning pushes new construction into areas that are vulnerable to natural disasters. If it's illegal to densify existing neighborhoods naturally, then necessary new housing will be constructed in the wildland-urban interface (WUI). The expansion of suburban sprawl into these areas prone to wildfires and severe storms has led to higher insurance costs. This sprawl also increases car dependency and traffic congestion, as well as contributing to environmental degradation.

As many cities reconsider their zoning policies to allow for greater density and reduced reliance on automobiles, the insurance industry must prepare for the ripple effects by adapting to new risks and opportunities. Increased density can lead to more walkable, sustainable communities that address housing shortages, reduce environmental impact and enhance urban livability. Higher density correlates with reduced sprawl and lower automobile ownership, as residents of dense urban areas are more likely to use public transit, walk or bike, reducing car dependency and traffic congestion.[1] As certain cities relax zoning and promote public transit, some inhabitants may choose to go without a car, gradually affecting car insurance demand over time. Consequently, the need for auto insurance may diminish in specific urban areas, while demand for other types of coverage, such as liability and property insurance for multi-family housing units, is likely to increase. Additionally, the rise of micromobility options, such as electric scooters and bikes, and the expansion of public transit systems like buses and light rail, will create new insurance needs and opportunities for coverage in these areas. Conversely, the risks associated with sprawl, such as higher

[1] "Automobile Dependency: Transportation and Land Use Patterns That Cause High Levels of Automobile Use and Reduced Transport Options." *Online TDM Encyclopedia*, Victoria Transport Policy Institute, updated 6 Sep. 2019, https://www.vtpi.org/tdm/tdm100.htm.

exposure to natural disasters, will continue to impact insurance models and pricing strategies.

Historical context of zoning laws in the U.S.

Zoning laws in the U.S. date back to the early 20th century, with significant developments occurring in New York City and Berkeley, California. New York City introduced the first comprehensive zoning ordinance in 1916 to separate incompatible land uses, such as industrial facilities from residential neighborhoods, to protect the health and safety of residents. Berkeley was the first city to enact single-family zoning, and at the time this regulation had an explicit exclusionary intent to maintain neighborhood character and racial homogeneity.[2]

To promote the adoption of zoning laws nationwide, the federal government introduced the Standard State Zoning Enabling Act (SZEA) of 1922. This act enabled states to develop zoning laws and devolve the power to municipalities, facilitating widespread implementation of zoning regulations. The SZEA provided a model for states to follow, encouraging uniformity and standardization in zoning practices. Early zoning faced challenges that led to significant legal battles. One notable case was *Euclid v. Ambler* (1926), where the U.S. Supreme Court upheld the constitutionality of zoning laws. This landmark decision validated the use of zoning as a tool for urban planning, setting a precedent for future zoning regulations across the country.

From redlining to exclusionary practices

In the post-war era, policies favored (and often required) single-family homes and large lots, encouraging the development of sprawling suburban neighborhoods. The Federal Housing Administration (FHA) and the GI Bill provided financial incentives for homeownership, which further fueled suburban growth. However, these policies were not equally accessible to all. The FHA engaged in redlining, a practice that denied mortgages and insurance to residents in predominantly minority neighborhoods, exacerbating racial segregation and economic disparity.

Redlining created restrictive boundaries that prevented minorities from accessing the same financial opportunities as white Americans. Although the Fair Housing Act of 1968 later banned explicit redlining, many commentators believe that exclusionary zoning practices continue to perpetuate the legacy of redlining to this day.[3] This is because exclusionary zoning restricts where people can live based on economic status, which often correlates with race. Zoning codes, originally designed to separate different types of land uses, have shifted towards enforcing arbitrary rules that often stifle development and opportunity, maintaining segregation and limiting housing affordability. More affordable housing types like duplexes and apartments are explicitly banned in much of the land in cities and suburbs.

Modern zoning, at its worst, has become more of a tool to restrict development than to encourage it. Expensive and time-consuming permitting and variance application processes can dissuade development.[4] Increased administrative costs are passed on to homebuyers and renters, a distinct inflationary pressure. Communities have also weaponized zoning to block new developments, a phenomenon commonly referred to as NIMBYism (Not In My Back Yard). This resistance to new housing has contributed to the significant undersupply of housing, driving up prices and creating scarcity, homelessness and overcrowding.

Understanding the historical context of zoning is crucial for addressing today's housing affordability crisis and planning for future urban development. For insurance professionals, recognizing the impact of past redlining practices on current market dynamics is essential for developing equitable and effective insurance products. The property risk landscape is often informed by the location and quality of housing, which in turn is dictated by zoning codes and the legacy of redlining. Insurers must be aware of this history as regulators increasingly look to validate risk cost models for bias, ensuring fair and unbiased practices in the industry.

Zoning elements and their impact on the built environment

Zoning regulations have played a crucial role in shaping the

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[2] Yelimeli, Supriya. "Berkeley Denounces Racist History of Single-Family Zoning, Begins 2-Year Process to Change General Plan." *Berkeleyside*, 24 Feb. 2021, https://www.berkeleyside.org/2021/02/24/berkeley-denounces-racist-history-of-single-family-zoning-begins-2-year-process-to-change-general-plan.

[3] Rigsby, Elliott Anne. "Understanding Exclusionary Zoning and Its Impact on Concentrated Poverty." *The Century Foundation*, 23 Jun. 2016, https://tcf.org/content/facts/understanding-exclusionary-zoning-impact-concentrated-poverty/.

[4] Demsas, Jerusalem. "Community Input Is Bad, Actually." *The Atlantic*, 29 Apr. 2022, https://www.theatlantic.com/ideas/archive/2022/04/local-government-community-input-housing-public-transportation/629625/.

built environment and, by extension, the patterns of housing and transportation in the U.S. Single-family zoning, minimum lot sizes, parking minimums and bulk regulations have each contributed to the current landscape in significant ways.

Single-family zoning: This restricts large areas to single-family homes only, severely limiting the availability of more affordable housing types like duplexes, triplexes and apartment buildings. Housing costs are driven up by the limited supply, contributing to the affordability crisis, which in turn raises home insurance costs as property values increase.

Minimum lot sizes: Mandating minimum lot sizes for homes further restricts the number of houses that can be built in a given area, exacerbating the issues of low density and high housing costs. Larger lot sizes mean fewer homes and higher prices, making housing less affordable. This restricts the overall housing supply and increases the cost of available properties.

Parking minimums: Requirements for a specific number of parking spaces in new developments increase construction costs and reduce the land available for housing or community spaces. Parking lots and structures dominate landscapes, contributing to urban heat islands and costly flooding while reducing green spaces. Higher construction costs and land dedicated to parking limit the space available for additional housing, exacerbating housing shortages.

Bulk regulations: Regulations, such as height restrictions and floor area ratios, limit the amount of usable space within buildings. Even in areas where denser housing is permitted, these regulations can prevent the construction of sufficient housing units to meet demand, driving up rents and property prices. This affects housing affordability by restricting the supply of housing units in high-demand areas.

Challenges of Suburban Sprawl and Benefits of Dense, Walkable Neighborhoods

Residents in sprawling suburbs often face challenges accessing amenities and services without a vehicle, increasing reliance on cars for everyday needs. This reliance contributes to traffic congestion and longer travel times, and people can spend significant time in traffic. This not only reduces quality of life but also increases carbon emissions, contributing to climate change. Sprawl also paves over vast areas for parking lots and roads contributing to habitat destruction and increased stormwater runoff. This extensive land use is inefficient and environmentally damaging, with higher per capita resource consumption compared to denser urban areas. The COVID-19 pandemic exacerbated these issues, as it accelerated migra-

Case studies: Minneapolis and Austin

Minneapolis, Minnesota, became the first major U.S. city to eliminate single-family zoning in 2018 through its comprehensive plan, Minneapolis 2040. This plan allowed for the construction of duplexes and triplexes in areas previously zoned for single-family homes, aiming to increase housing affordability, reduce racial segregation and promote more walkable communities. The plan also included significant reforms such as eliminating parking minimums and encouraging higher-density development along transit corridors.

From 2019 to 2022, the Minneapolis area saw a substantial increase in housing supply, exceeding targets with more than 20,000 new housing units added per year. The increased housing supply helped moderate rent increases, with Minneapolis experiencing only a 4% rise in one-bedroom rents since the start of 2020, compared to the national increase of 24% over the same period.[1]

Austin, Texas, has implemented various zoning changes through its revised zoning code, known as CodeNEXT. This initiative aims to create walkable neighborhoods with access to public transit, reducing car dependency and promoting sustainable growth. Key changes include increasing housing density, eliminating parking minimums and encouraging mixed-use developments.

Austin has seen a significant increase in apartment construction since the start of the pandemic. By the end of 2023, just over 26,700 new apartments were delivered in the Austin metro area, contributing to a 12.5% year-over-year decline in average monthly rents by December 2023. This was the second-largest rent decrease among major U.S. metros.[2]

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[1] McVan, Madison. "Twin Cities Met New Housing Targets in Recent Years, But Growth Slowed in 2023." *Minnesota Reformer*, 16 Jan. 2024, https://minnesotareformer.com/2024/01/16/twin-cities-met-new-housing-targets-in-recent-years-but-growth-slowed-in-2023/.

[2] "Austin rents nosedive 12.5% in December." *The Real Deal*, 12 Feb. 2024, https://therealdeal.com/texas/2024/02/12/austin-multifamily-rent-prices-drop-by-12-5/.

tion from urban to suburban areas. People sought more living space and adapted to remote work, increasing demand for suburban housing, pushing up prices and worsening the housing affordability crisis.

Suburban sprawl often leads to “stroads” — thoroughfares that try to combine the functions of streets and roads but fail at both. Stroads are wide, multi-lane corridors encouraging high speeds, like roads, but feature many access points and businesses along their edges as streets do. This design makes them particularly unsafe for pedestrians and cyclists due to the combination of fast-moving traffic and frequent intersections, increasing accident risks. Additionally, stroads are often lined with strip malls characterized by large parking lots and a lack of pedestrian-friendly infrastructure, making them unattractive and unsafe for walking or cycling. Transforming stroads involves reducing lane widths, adding pedestrian crossings, and incorporating bike lanes, enhancing safety, and making these areas more vibrant and economically productive.[5]

Many cities are beginning to confront the supply constraints associated with traditional zoning regimes. Urban planners and pro-growth policy makers are increasingly prioritizing dense, walkable communities filled with mixed-use development. These communities reduce reliance on cars, lower carbon footprints and preserve green spaces. They also enhance livability by providing residents with better access to amenities, public transportation and parks. By offering a variety of housing options, these neighborhoods can be more inclusive and affordable. Dense, walkable neighborhoods can support a higher concentration of businesses and services, which can thrive due to increased foot traffic. These communities can foster a sense of community and social interaction, as people are more likely to walk and engage with their surroundings. The shift towards such neighborhoods reflects a broader trend towards sustainable urban development that prioritizes environmental health, economic vitality and social well-being.

Implications for the insurance industry

The evolving landscape of urban development, driven by changes in zoning policies, has significant implications for the insurance industry. As communities shift toward higher density, mixed-use and walkable neighborhoods, insurers must adapt their products and models to address new risks and opportunities. Additionally, insurers should closely monitor state and local jurisdictions that implement zoning reforms and relax construction restrictions. By staying informed of these changes, insurers can strategically adjust their marketing efforts to capture the growth in insurance needs unlocked by such developments. This proactive approach will enable insurers to capitalize on the expanding market for diverse coverage options.

Property insurance: The continued growth of suburban sprawl into areas prone to natural disasters has significant implications for the insurance industry. Expansion into wildfire-prone areas in states like California and Colorado increases the risk of catastrophic losses from wildfires. Similarly, suburban expansion into hail-prone regions in the central U.S. increases exposure to severe weather events that may have previously only hit agricultural buildings, driving up insurance claims and costs. Relaxed zoning that allows more building closer to urban cores may relieve some of these sprawl-driven pressures.

In addition to relief from geographic and weather-driven pressures, zoning changes may significantly shift the countrywide mix of housing, affecting loss propensity. With the removal of single-family zoning, which allows the construction of more multi-family housing, risk profiles will change. There will be an increase in renters and condominium policies relative to homeowner’s policies. Additionally, as duplexes, triplexes and fourplexes become more common in previously single-family home areas, insurers should ensure they have appropriate products for landlords and renters of these property types.

If zoning is relaxed and building becomes easier, the average age of properties will decrease. New properties tend to present better risks for insurers because they adhere to modern building codes, utilize improved materials and construction methods, and incorporate advanced safety features such as seismic-resistant design, fire-resistant materials, smart sensors and energy-efficient systems. Additionally, newer roofs and other infrastructure components reduce the likelihood of damage or defects. This can result in lower maintenance costs and fewer claims, making these properties more favorable for insurers and promoting a healthier insurance market. Insurers should ensure that their risk cost models and underwriting

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[5] "What Is a Stroad, and Why Is It Dangerous?" *StreetLight Data*, 29 Mar. 2024, https://www.streetlightdata.com/what-is-a-stroad/.

strategies are forward-looking, allowing them to capture this growth of newer, less risky buildings.

Auto insurance: Continued suburban sprawl has led to increased driving as people migrate to less dense areas, resulting in higher traffic congestion and more accidents as well as depressed auto insurance profitability. However, if municipalities turn towards density, the reliance on personal vehicles decreases. Consumers who choose to own a car but drive less may be more attracted to usage-based or pay-per-mile insurance options that promise lower rates with less driving. Over the long term, reduced reliance on personal vehicles may mean a significant shift in the revenue makeup of the industry.

Commercial auto insurance needs may shift as ride-sharing, car-sharing, and delivery services continue to grow. Insurers must develop new products tailored to these emerging markets.

Micromobility and public transit: The rise of micromobility options, such as electric scooters and e-bikes, as well as the expansion of public transit systems, may introduce new insurance needs. Coverage for theft and liability related to micromobility devices will become increasingly important. As cities revamp or expand their transportation networks with more buses, light rail and even subways, there will be increased needs for construction insurance to cover the building phase and operational insurance to cover these systems once they are in use. This includes liability coverage for accidents, property coverage for transit infrastructure, and workers' compensation for expanded transit workforces.

Commercial insurance: The shift towards mixed-use buildings reduces segregation between residential and commercial spaces and may include light manufacturing such as maker spaces. This trend creates opportunities for insurers to offer commercial property, general liability and small business package policies. Insurers may need to develop new commercial property policies tailored to the unique risks of mixed-use buildings, covering exposures like property damage, liability and business interruption for both residential and commercial tenants.

Easier construction permitting will increase building projects, creating a need for more builders' risk, construction liability and contractor's policies. Builders' risk insurance will cover damage to buildings under construction, while construction liability policies protect against claims of injury or property damage during the building process. Contractors will require specialized insurance for their operations and potential liabilities. Insurers must offer these policies to meet the growing demand and ensure comprehensive coverage for the expanding construction industry.

Environmental and climate risks and community resilience: Denser, more walkable communities can reduce environmental impact and mitigate climate risks by decreasing reliance on cars and promoting sustainable practices. However, the transition period might see increased risks as infrastructure is updated and new buildings are constructed. Urban areas with higher density and mixed-use developments may exhibit greater resilience to natural disasters due to better infrastructure and community planning. Insurers can support disaster preparedness by offering products that incentivize resilience measures, such as flood-resistant construction and community-based risk reduction initiatives. Additionally, insurers can collaborate with municipalities to improve risk mitigation strategies, ensuring that new developments adhere to the highest safety and environmental standards.

Understanding and adapting

The insurance industry stands at a pivotal point as urban development shifts in response to changing zoning policies. By understanding these changes, insurers can adapt their products and models to address new risks and opportunities. Embracing innovation and promoting community resilience are essential for thriving in this dynamic landscape. Through these efforts, the insurance industry can contribute to the creation of sustainable, livable and equitable communities, benefiting both insurers and policyholders. This proactive approach will ensure that insurers remain relevant and effective in meeting the evolving needs of urban populations.

Further reading

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DJ Falkson, FCAS, is an actuarial director at Lemonade. He is a member of the Actuarial Review *Working Group and Writing Subgroup.*

Forward Thinking:

A Spotlight on CAS Research

By ANNMARIE GEDDES BARIBEAU, CAS RESEARCH MANAGER

CAS research evolves to meet the changing needs of property-casualty actuaries.

The CAS — the premier property-casualty actuarial research organization worldwide — is evolving to meet the changing needs of P&C actuaries and the insurance industry they serve.

Thanks to new research initiatives by CAS Vice President-Research & Development Morgan Bugbee, along with the support of volunteers and staff, fiscal year 2024 represents a new chapter in the CAS's proud 110-year history of providing research to further actuarial practice.

To expand CAS research, Bugbee is building upon initiatives by previous past vice presidents-research & development and deploying some new ones as well. For instance, Bugbee's predecessor, Jim Weiss, the current editor-in-chief of *Actuarial Review*, suggested that the CAS offer funds to support research when inspiration strikes.

In response, last summer, the CAS launched its new [Quick Start Research Grant Program] to give researchers the opportunity to submit a proposal at any time. The proposal is directed to the appropriate research working group with the goal of notifying researchers within six weeks of submission. Awards can be up to $50,000.

Another initiative to include open-source code in CAS projects, suggested by Weiss's predecessor, Avi Adler, is now a regular requirement for CAS-funded research. Including code along with traditional research papers is where quantitative research is heading, Bugbee says. Terry Robinson, chair of the Reinsurance Working Group, shares Bugbee's enthusiasm. "GitHub repositories, code samples, attached spreadsheets, and illustrative walk-throughs fill in a vital step in converting research to appli-

A succession of vice presidents-research and development: Current vice president, Morgan Bugbee (center), who followed James Weiss (left), who held the position after Avraham Adler (right).

Research Working Group chairs talk CAS research

Ask CAS research working group chairs why they are CAS research volunteers, and they point out the advantage of being able to suggest research ideas and stay current with the latest thinking to further their career knowledge.

"I wanted to advance my area of interest in insurance risk quantification," said Andy Feng, chair of the Risk Working Group.

The CAS currently offers four working groups with associated task forces. Besides the Risk Working Group, there is also the Reinsurance, Reserves, and Ratemaking Working Groups along with the Actuaries Climate Index Task Force, which operates in collaboration with the Society of Actuaries, the American Academy of Actuaries and the Canadian Institute of Actuaries.

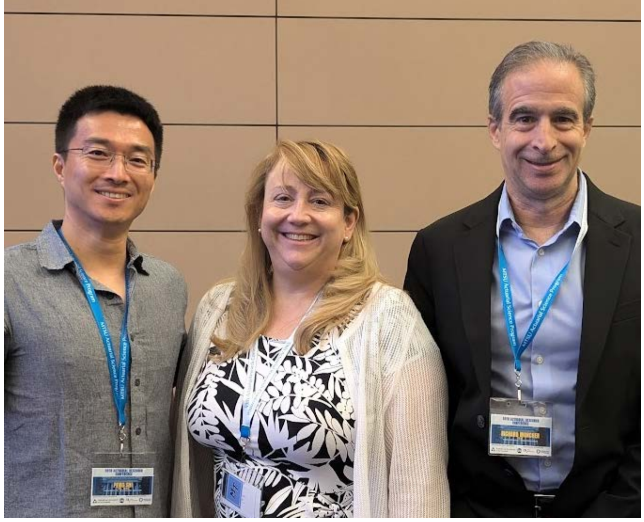
Each working group offers research opportunities through call papers, calls for essays and RFPs. Some groups, such as the Risk Working Group chaired by Feng, are currently doing their own research projects. The Race and Insurance Research Task Force reviewed five different research projects and conducted its own research for an additional paper. Three of the papers are available at casact.org/raceandinsuranceresearch.

Efforts by the Reserves Working Group led to publishing nine papers in fiscal year 2024. The working group, led by Chandu Patel, formed teams that guided authors and provided peer review to produce practical ways technology can be applied to reserving. "Researching and publishing on a new topic is very rewarding," Patel said. Researchers who wrote award-winning papers were asked to present at the CAS's Casualty Loss Reserve Seminar.

cation," he said. "I'm pleased to see that many requests for proposals (RFPs) now require this step."

Open-source code fueled the machine learning community to accelerate its progress, Bugbee observes, and he believes the actuarial field can benefit in the same manner. "We need to take copious notes and learn how to create a similar virtuous cycle flourishing within actuarial work," he adds.

Further, providing code also enables researchers to more



The author Annmarie Geddes Baribeau (center) with Dr. Peng Shi (left) and Richard Moncher (right).

easily build on the prior work of others. "The only way to verify the accuracy and validity of a piece of research is to be able to review the code that accompanies the paper," Bugbee explains. Code addresses the current reproducibility crisis taking place in research and academia. "Sharing a project's code goes a long way to solving this crisis," he adds.

Bugbee is also challenging the organization's research working groups to develop RFPs that encourage researchers outside the actuarial domain, such as economists or social scientists, to offer solutions and perspectives to facilitate knowledge transfer for actuarial applications. Another type of RFP encourages research working groups to identify large-scale research projects to garner new insights.

Per the request of Canadian members, the CAS is also encouraging researchers to provide Canadian-specific research, when possible, in projects that apply to North America. Beyond the continent, the CAS is conducting research for issues CAS international members are facing, such as analyzing the implications of IFRS-17 accounting standards and the impact of climate change.

"The CAS is uniquely positioned to give direction to research that is instrumental in raising the profile and the usefulness of the actuarial profession in the property and casualty insurance industry," observes Alp Can, FCAS, chair of the Climate Index Task Force, which produces the Actuaries Climate Index (ACI). Currently, the task force, which is jointly sponsored by the CAS, Society of Actuaries, American Academy of Actuaries and the Canadian Institute of Actuaries, is working on the ACI's Version 2.0 to provide even greater insight to aid actuaries and the general public.

According to the most recent CAS Quinquennial Survey, released in April, CAS members are clamoring for more information about artificial intelligence, macroeconomic trends and climate risk. "CAS members have voiced their desire for more climate risk education in the quinquennial survey. We are getting up to speed on a myriad of climate-related issues, from risk assessment techniques like scenario analysis to how we can contribute to the building of climate-resilient infrastructure," Can said.

The interest in artificial intelligence research has sparked a new artificial intelligence working group, which the CAS Executive Council approved in August. Mario DiCaro, FCAS, is the working group's first chair.

CAS members can also expect to see more research on these topics in the future, along with additional papers regarding race and insurance pricing, reserving and technology, rating scalability, cyber insurance, machine learning and social inflation.

The CAS is also making process improvements to expedite research from ideation to publication. Specifically, the CAS has streamlined calls for papers and RFPs. When the research description and objectives are listed first, researchers can find out what they need to know more quickly. The CAS is also revamping the search capacity on the CAS website so members can locate vital CAS research and researchers can build on past work.

The CAS continues to support researchers by providing new data for research purposes and several opportunities for publishing their work. Stressing the value of the CAS's highly respected, scholarly journal *Variance*, Bugbee says, "If a researcher publishes a paper outside the CAS, the likelihood that it will be adopted by a practicing P&C actuary goes down by an order of magnitude, if not more."

And because *Variance*, along with all research published by the CAS since 1914, is publicly available, readers have easy access to other research publications including the *E-Forum* and other CAS papers and reports. The CAS is also stepping up its efforts to encourage more scholarly actuarial research that is easier for actuaries to apply.

Turning to the 59th Annual Actuarial Research Conference in July, Reserves Working Group Chair Chandu Patel, FCAS, and I spoke at a plenary session. Patel discussed the working group's successful call paper program on reserving and technology after I described the unique benefits that the CAS offers to researchers.

During a session on Phase II of the Research Paper Series on Race and Insurance Pricing, I provided a sneak peek into all papers within the series. Richard Moncher, CAS Vice President-Administration, who co-authored the paper, "A Practical Guide to Navigating Fairness in Insurance Pricing," gave the audience more details about that paper. Dr. Peng Shi, a professor in the risk and insurance department at the Wisconsin School of Business, also spoke of the advantages of performing research with the CAS and being published in the CAS's peer-reviewed, scholarly journal *Variance*. Moncher also provided a CAS update at the ARC's banquet.

The CAS is also mobilizing a multipronged communications plan to promote new research opportunities and finished works. So far, the CAS is spreading the word through the weekly CAS E-Bulletin, social media, the CAS website, videos, flyers and other communication channels. Look for more changes to the research section of the CAS website and a research update column in an upcoming *Actuarial Review*.

Research update

As the world's premier property-casualty research organization, the CAS offers thousands of online research projects. Currently, the CAS manages more than 60 research projects from concept to completion. Dozens of papers are also in the publishing pipeline.

So far in the year 2024, the CAS has published about three dozen research projects. Highlights include:

- The long-anticipated Phase II of Race and Insurance Pricing Research Papers. At press time, three papers have been published and the other three should be available by the end of the year.
- Nine call papers about reserving and technology.
- Three papers on artificial intelligence.
- Twenty papers in *Variance*, the CAS's highly regarded scholarly online research publication.

Additional topics include cyber coverage, machine learning, social inflation and auto insurance pricing.

Dedicated to research

The CAS's commitment to actuarial research continues to grow and expand to support P&C actuaries worldwide. Expect more research on cyber risk and insurance, artificial intelligence, climate concerns, new frontiers in modeling and so much more. Supplying insightful research to support actuarial practice, however, requires the commitment of volunteers who want to contribute their time and expertise to this endeavor. If you want to volunteer or have any questions, please feel free to contact me at abaribeau@casact. ●

DEVELOPING NEWS

Introducing a new AR *column, Developing News, that distills complex developments into actionable knowledge, helping actuaries adapt to shifts in regulation, technology and risk management.*

Is It Hot in Here, or Is It Climate Change? By YUHAN ZHAO

A recent report from the World Meteorological Organization (WMO) confirmed that "2023 was the warmest year on record, with the global average near-surface temperature at 1.45 degrees Celsius (34.6 degrees Fahrenheit) with a margin of uncertainty of ± 0.12 degrees Celsius (± 0.22 degrees Fahrenheit) above the pre-industrial baseline. It was the warmest ten-year period on record." A couple of headline stories released by WMO early this year also covered the extreme weather patterns during 2023 across the world. According to WMO's State of the Climate report, in Europe, "2023 was the joint warmest or second warmest year on record depending on the dataset." Meanwhile, "Asia remained the world's most disaster-hit region from weather, climate and water-related hazards in 2023," with floods and storms leading the way in casualties and damages. Across North America, CNN reported that dozens of U.S. cities experienced "record-mild" winters in 2023, while CBC described Toronto's winter as "absolutely tropical."

What this means for actuaries: Based on the 17th Annual Survey of Emerging Risks results, climate change remains far ahead as the top emerging risk. Given what we have experienced , this is no longer an emerging trend but the new reality we are currently living through.

As actuaries, we need to be ready to respond to potential CAT events and more frequent tropical storms during the upcoming hurricane season.

A couple of questions to consider and review include:

- What are the overall CAT exposures in the current business portfolio?
- What is the current CAT loading in the premium reflecting latest CAT loss trend?
- Are there any strategies or mitigation actions in place to cope with upcoming hurricane seasons?
- Are we comfortable with the level of CAT loss reserve holding to absolve the upcoming losses?

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Coming and Going is Staying By JIM WEISS

The Virginia Workers' Compensation Commission (VWC) recently upheld a denial of coverage in a case where a woman slipped on ice when crossing the street between a parking garage and her work location. This is generally consistent with traditional interpretations of the "Coming and Going Rule," according to which workers' compensation generally does not cover travel to and from the place of employment. There are a handful of exceptions in different jurisdictions, such as the "extended premises doctrine" that brings locations that are "in practical effect, a part of the employer's premises" within the scope of workers' compensation. The VWC did not view the street in front of the workplace as extended premises. However, other recent challenges to the Coming and Going Rule have been more successful. For example, the New Jersey Supreme Court recently judged an injured technician eligible for wokers' compensation coverage. The technician's injury happened when he was traveling to his workplace to pick up supplies.

What this means for actuaries: Workers' compensation generally has been a profitable line for the U.S. property and casualty industry for many years, returning combined ratios in the 80s. Auto and premises general liability have not been nearly as profitable recently. U.S. health insurance generally has returned combined ratios in the high 90s in recent years. If challenges to the Coming and Going Rule blur the line between all these coverages, actuaries may be the ones called upon to help sort out coverage primacy and resulting profitability implications.

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DEVELOPING NEWS

California Dreamin' CAT Models Into Reality By SARA CHEN

California Insurance Commissioner Ricardo Lara has unveiled a proposal to take effect in December 2024 that would allow the use of catastrophe modeling for more perils. This will be the state's largest insurance reform in over 30 years and comes as a response to an increase in climate-intensified disasters, rising costs of repair and rebuilding , and global economic forces. Not being able to fully account for these growing risks has led to rate spikes and balloon premiums following major wildfire disasters in recent years. Currently, the Department of Insurance allows the use of catastrophe models for earthquake losses and fire losses following earthquakes only. The proposed regulation expands the allowable use of catastrophe models to cover wildfire, terrorism and flood lines for homeowners and commercial insurance lines.

What this means for actuaries: With this proposal, California will join the rest of the country in using catastrophe modeling when setting their premiums. There is an ongoing conversation on whether the Department of Insurance will release a base catastrophe model template for insurers to use, instead of insurers submitting their own models for approval. If a model template were to be approved, it would not only uphold consumer transparency of the models but expedite the approval process as well.

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CAS Webinar – Conversation with California Industry Leaders

Intersecting AI and Actuarial Science: The Interview By SARA CHEN

Late last year, the CAS sent out a call for essays exploring the topic of the intersection of actuarial science and artificial intelligence (AI). The aim was to seek insightful perspectives that delve into the challenges, opportunities, and ethical considerations that actuaries face in this evolving era. Five essayists responded to the call and you can read their essays in *AR* and the summer *E-Forum* . Each brings a unique perspective, and we had the great opportunity to interview them to share their insights on this topic.

1. Tell us a little about yourself and how you currently use AI in your work.

Ronald Richman (RR): I'm the chief actuary of Old Mutual Insure, a large P&C firm in South Africa. I use AI in several different ways: as a coding assistant when writing R or Python code, to help create meeting minutes and to critique written work outputs. We also use several machine-learning (ML)/AI-inspired processes in our review work, for example, running many different reserving models and selecting the best of these based on out-of-sample performance.

Paul Kutter (PK): I am currently the senior director of actuarial and data science at Citizens Property Insurance Corporation, Florida's residual property insurer. Currently, I am heavily involved with predictive modeling, pricing, catastrophe modeling and geographical information systems at Citizens. How I currently use AI in my work depends on what is meant by "AI". I use a variety of predictive models; however, my use of deep neural nets is more limited. We've started some tests on large language models, and I am a member of an inter-departmental team focused on AI governance.

Betsy Wellington (BW): I am retired from company work but take occasional consulting work. Throughout my career, I've worked in reserving, national accounts pricing, reinsurance, and medical professional liability. Just before retirement, I did consulting work (mostly with Swiss Re) for 12 years, followed by employment with Swiss Re for six years. During the pandemic, I enrolled in a data science bootcamp, which helped my team and me develop an underwriting pricing model that directly incorporates web-based data. I have since been learning and developing more applications to streamline actuarial data analytics.

Sergey FIlimonov (SF): I am the CTO at Three Sigma, a startup that uses AI to analyze insurance regulatory filings. Previously, I worked closely with research scientists to develop and maintain ML models designed to optimize production at Honda. At Three Sigma, we build AI tools as well as use them — tools like GitHub Copilot and ChatGPT are extensively utilized in our development, and we find them invaluable. For example, we use GitHub copilot to easily make changes to our front end while only having limited typescript experience, to writing tests for our back-end code. It's a huge asset.

Mario DiCaro (MD): I've been at Tokio Marine HCC for the past 11 years and lead the capital modeling and predictive analytics teams here. Prior to HCC, I was at URS (a capital modeling software company), Towers Watson, and Tokio Millenium Re. We are actively developing AI tools for others to use, and I use AI on a daily basis such as for my own coding needs and research.

2. What regulatory or ethical considerations are associated with integrating AI into insurance practices?

BW: The experiences that people have had using ChatGPT have revealed that the programmer's own biases can enter into the AI results. That is going to be a clear problem with AI solutions. Even when we want to develop a web-scraping technique to get data and then analyze it, the programmer or actuary is the one determining the parameters for the web-scraping. This by itself introduces biases into the process.

MD: In terms of pricing, the variables used are of supreme importance. With AI, particularly neural net-based models, you don't really know which variables are used for the predictions. You just know which ones were thrown into the machine. Current regulatory practices make it so the benefits of using such models outweigh the costs. AI will revolutionize other areas and processes such as automating workflows, improving coding practices, documentation, information retrieval and trend analysis.

PK: There are probably too many considerations to list here. As a model becomes more complicated, its performance tends to depend more strongly on the data used to calibrate it. These new deep neural nets powering computer vision and natural language processing are extremely flexible, having billions or even trillions of parameters. There must be enough training data to optimize all those parameters, and then future data must be similar enough to the training data for the parameters to be reasonably optimal for the new data, too.

RR: There are several considerations. First is explainability and transparency. AI models used in actuarial work should be understandable to comply with professional standards. Next, AI models may inadvertently lead to bias and discriminate against certain protected classes, so actuaries need to ensure models avoid unfair bias and indirect discrimination. Lastly, the results of AI models should not lead to unfair pricing or limited access to necessary insurance products for consumers, so fairness and consumer outcomes are an important consideration. Actuaries have an ethical obligation to maintain up-to-date knowledge and skills related to AI techniques to ensure their competent application; this will ensure that the actuarial value proposition will be strong in coming years.

SF: It's critical to choose the appropriate use case for AI. LLMs (large language models) are black boxes and how they work is an open research question. As a result, it's critical to use them in areas where verifying their output accuracy is possible. It's also valuable to ask what is the cost of being wrong? LLMs are stochastic and sometimes they will make mistakes, so it's important to quantify the potential impact of those mistakes. With that said, humans also make mistakes, so it's important to compare LLMs to human accuracy, not "perfect" accuracy.

3. How is AI reshaping traditional actuarial roles such as pricing and reserving? What skills do future actuaries need, especially in the context of AI and automation?

SF: An educated guess: AI will likely increase the level of abstraction at which actuaries operate. Interpersonal skills will be more valuable than ever. Actuaries will have access to a suite of "assistants" specializing in different tasks. In addition, specific skills to produce a baseline familiarity with LLMs will be very useful. LLMs are stochastic and working with them is a fundamentally different paradigm since similar inputs can return very different outputs.

PK: More sophisticated models continue to become more available. I have in mind those models that work similarly to generalized linear models but incorporate automatic variable selection and transformation (such as gradient-boosting machines), or automatically adjust their flexibility based on data (such as regularized generalized models or mixed models). These newer deep neural net-based models also seem poised to allow actuaries better access to unstructured data. A skill needed could be eventually learning a full programming language, such as R or Python.

RR: AI can enable the building of large-scale predictive models across multiple lines of businesses, enhancing the credibility of assumptions. It can also incorporate new data sources (e.g., telematics) directly into pricing models, enabling more personalized and granular risk assessments. Finally, AI can streamline and automate routine tasks, allowing actuaries to focus on higher-level strategic decision-making.

To thrive in the evolving landscape of actuarial science, both now and in the future, actuaries will need to develop a comprehensive skill set. This includes knowledge of machine learning, deep learning and AI methodologies, and their specific applications within actuarial contexts. Proficiency in programming languages, such as R or Python, is essential for effectively implementing and manipulating AI models. Additionally, actuaries must be able to adapt AI models to ensure compliance with professional and regulatory requirements.

BW: I believe it is important that actuaries become trained in the methodologies used to create an AI model and to use AI in their methods. This is a normal progression of the actuarial profession. I know in my 30 years in the field, I have gone from learning Fortran on punch cards, PL/I and SAS to becoming an expert in Lotus 1-2-3. Over the last 15 years, actuaries have become very reliant on Excel because it is easy to use to create models and run analyses. However, there is now so much more technology available that can make our jobs more efficient once we get over the learning curve of the new technology.

MD: The skill actuaries most need is awareness. Second, they need to use it for research and coding assistance. Then they can start to learn how to use it to improve the work they deliver. As AI is trusted more and more by people, it will take over areas such as reserving. If you are a reserving actuary, you should be learning how to use AI tools in your processes. Pricing is trickier mainly because of the regulations around allowed variables. So in that space AI will help underwriters research and digest information at speeds completely unheard of.

4. How can AI be applied to areas such as operations, underwriting, or fraud detection within the insurance domain?

RR: Anything involving text is currently a natural target of AI automation, whether


Mario DiCaro


Sergey FIlimonov


Paul Kutter


Ronald Richman


Betsy Wellington

processing insurance schedules, making sense of risk engineering reports, or drafting communications to policyholders. Emerging AI capabilities, such as the ability to review and draw conclusions from images, videos and sound files offer promising solutions to automatic damage quantification and loss adjusting, as well as review of customer communications to ensure compliance with regulation.

PK: My understanding is that there is great potential to use these newer deep neural net models to automate (at least partially) parts of operations, underwriting and fraud detection. Examples might include identifying property damage from photos, summarizing emails, etc. I am unsure whether these models will ever be accurate enough that they do not require review from a person. But even if they have to be reviewed, they should be able to speed up the process.

SF: AI can be applied to operations, such as intelligent email routing, matching claims to policy coverage, ingestion of loss assessors' notes, and new loss control measures that are currently too expensive to deploy at scale.

Examples of how AI can be applied to underwriting include: incorporating new data sources, pre-extracting information from documents, cross-referencing information automatically, and having better research tools for learning about an insured.

In terms of fraud detection, AI can help by flagging inconsistencies and automating human heuristics.

BW: The value of AI technology is that it can run through very large amounts of data quickly. Creative management will be able to see how this technology can help the various functions within the insurance company. But the most important thing is that companies have people who both know insurance and are educated in the technology of AI and how it can be used — before management goes out and hires a department of programmers.

5. Imagine the future of the actuarial profession and risk management products in a world dominated by AI and automation. What changes do you foresee?

PK: My guess is that the major change will be with respect to unstructured data, such as pictures and most text. I think we will start to be able to treat them more like we are already treating structured data. It is unclear to me how much this will improve the accuracy of actuarial calculations, but it seems like we should see some improvement.

RR: I envision many changes. First are "AI-enhanced actuaries," where actuaries will embrace AI tools and techniques to augment their traditional skillset. Actuaries proficient in AI techniques will be well-positioned to take on leadership roles and drive innovation within their organizations. There will likely be new insurance products as AI will enable the development of personalized and customized insurance products that will cater to the individual policyholder needs and risk profiles. AI and automation will also lead to more efficient operations where it will streamline various aspects of the insurance value chain, from underwriting to claim processing.

BW: I see the actuaries becoming even more important to the insurance industry as the go-between for AI, automation and insurance problems that need to be solved. Because the actuaries do not have incentives for writing business like the underwriters and management do, and they understand the whole insurance product development, they are the ones who have the foresight to see how AI and technology can be used appropriately. This also means that actuaries must keep up with current innovations and that companies need to invest in that training.

MD: Every bot you talk to needs to be connected to old systems built by real people. I've been using the LLMs to help with my coding for a while now and I can tell you — right now they will not be able to improve themselves. Far from it. I played a lot of Minecraft when my children were young. Voyager (https://voyager.minedojo.org) is an example of what can happen when you teach a program the ability to learn new skills. Our internal legacy networks are wrapped with many APIs. I think we will build agents that can learn to traverse these APIs with the goal of helping the user ingest information faster.

6. Any parting words to actuaries as we traverse this new landscape of AI in our work?

MD: Don't be afraid or dismissive. Be excited and get engaged.

RR: I hope actuaries will play a key role in building, maintaining, risk managing and debiasing AI systems. The time for the actuarial profession to incorporate machine learning and deep learning topics into its curriculum is now, so that these emerging opportunities can be acted on by the next generation of actuaries in training. Moreover, ensuring that our more experienced actuaries have great opportunities to learn about these emerging fields should be a priority.

Homeowner Pricing Actuary Explains: Why Are Homeowners Premiums So Much Higher and When Will It End? By ROB KAHN

Most of you are aware that the cost of homeowners insurance for many has substantially increased over the past two years. I happen to know something about this. Between 2016 and 2023, I worked as a homeowners pricing actuary at two different insurance companies. My sole purpose at each respective company was to ensure that homeowners rate levels were adequate, not excessive and not unfairly discriminatory — with adequacy being the most significant challenge in the current environment. To be even clearer on this point, my main responsibilities could be summarized as follows:

1. Provide up-to-date state rate level indications and recommended rate increases for each of the upcoming state rate filings.
2. Work with several other teams at each company to file and execute the agreed-upon pricing targets.

That said, I fully recognize that my team's analysis, as well as analyses performed by other homeowners pricing actuaries scattered across the country, shoulders some of the responsibility for the large increases to homeowners insurance bills.

With all of this in mind, the purpose of this article is to succinctly share some of my observations and experiences over the past several years which will help to explain the large recent homeowners premium increases affecting many of us. I will support most assertions with data from publicly available rate filings, U.S. Bureau of Labor Statistics (BLS) and S&P Global. For what it's worth, I will also offer up a few thoughts at the end regarding how I anticipate industry rate activity playing out over the next two years. With that in mind, let's dive in!

Amount of insurance year (AIY) trend

On a countrywide level, one observation I can offer that generally applies across most states has to do with something called "Coverage A," which is simply insurance jargon for the insured value of your home. In most years before 2021, many insurance companies automatically increased everyone's Coverage A by roughly 2.5%-4% per year, commensurate with typical inflation in home values. Another bit of insurance jargon is called the "Coverage A inflation factor" or "AIY Trend." This means that even if insurance companies left rates alone, homeowners premiums would automatically increase by roughly 2%-3% simply due to the limit of the policy increasing. That is not a typo — premiums do not increase linearly with Coverage A. A little over two years ago, many companies recognized higher levels of inflation and increased their Coverage A inflation factor to something between 7% and 10%. That means that over the past two years, roughly 5%-7% of the annual premium increases homeowners have experienced have been due to this larger than usual Coverage A factor. One can empirically validate or refute this assertion by reviewing premium and/or Amount of Insurance Year (AIY) trends of carrier filings submitted in SERFF[1] over the past 12 months. Generally speaking, the main

[1] Systems For Electronic Rates & Forms Filing

driver of homeowner premium trends is the Coverage A inflation. Table 1 shows premium and AIY trends for a few recent filings from large carriers with substantial market share.

As you can see, Allstate and State Farm reported recent Coverage A inflation of between 8.3% and 10.9%. Farmers and Safeco reported premium trends near 5%, which is quite a bit higher than a more typical 2%-3% longer-term premium trend.

In summary, over the past two years, homeowners are seeing their premiums go up by three additional percentage points over and above most years. This is due in substantial part to the regularly scheduled, but larger than typical, increases in Coverage A.

However, as most of us are all too keenly aware, our homeowners premiums have been increasing by substantially more than just the 5% to 7% due to the higher Coverage A inflation. Most of us have been experiencing abnormally large annual premium increases of over 15%. So, what else has been driving the recent large increases? To answer that, we'll need to explore the rate at which losses have been increasing coupled with something known in the industry as "disruption management."

Table 1. Filed Carrier AIY and Premium Trends

Carrier	Allstate	Allstate	Farmers	Safeco	State Farm	State Farm
State	PA	WI	TN	MO	IN	WI
SERFF #	ALSE-133905016	ALSE-133925477	FARM-133917667	LBPM-133919828	SFMA-133973752	SFMA-133995459
Submitted	11/29/2023	12/15/2023	12/8/2023	12/13/2023	2/1/2024	2/27/2024
Rate Achieved	+14.1%	+11.7%	+6.7%	+27.3%	+11.9%	+15.7%
Premium or AIY Trends						
Shortest Hist. Fit	+8.3%	8.7%	+4.4%	+5.8%	+9.4%	+10.9%
Premium or AIY	A	A	P	P	A	A
Fit	1 yr.	1 yr.	12 pt.	1 yr.	3 yr.	3 yr.

Table 2. Filed Carrier Loss Trends

Carrier	Allstate	Allstate	Farmers	Safeco	State Farm	State Farm
State	PA	WI	TN	MO	IN	WI
Pure Premium (i.e., Loss) Trends (Fitted and Prospective Selections)						
Fire (4 yr or 5yr)	+9.4%	+8.9%	36.7%	8.9%	+11.4%	+13.8%
Fire (Prosp.)	+12.0%	+7.0%	15.4%	15.0%	+8.3%	+4.6%
All Other (24 pt)	+10.4%	+16.8%	n/a	n/a	n/a	n/a
All Other (Prosp.)	+8.0%	+15.0%	n/a	n/a	n/a	n/a
Wind & Hail (5 yr)	+15.4%	+9.3%	n/a	n/a	-2.6%	+8.7%
Wind & Hail (Prosp.)	n/a	n/a	n/a	n/a	+8.5%	+11.1%

Loss trend

Let's start by reviewing the same random sampling of filings and see what different insurers are seeing in terms of recent loss trends.

Table 2 shows that average historical and anticipated prospective annualized homeowner loss trends for the selected filings are all generally in the 7%-15% range. That means that losses have generally, year after year, been increasing at an average rate of roughly 10% over the past five years. Table 3a shows us that overall, homeowners rates climbed by roughly 3% per year between 2018 and 2020, and Table 3b shows us that homeowners rates at most individual carriers climbed between 2% and 5% per year between 2018 and 2020. With the exception of Progressive, homeowner rate activity only started to pick up several months after the start of COVID; we can see this with the increases in 2021 and 2022. Little by little, those ~3% pre-COVID rate increases were not keeping pace with the 7%-15% loss trends and the insurance industry appears to have realized that conditions had inflected, requiring them to take more than their customary approximately 3% annual increases in order to achieve adequacy. The industry had no choice but to rethink their long-held disruption management strategy.

Disruption management

So, what is "disruption management?" Managing disruption is a strategy that companies have in place to keep operations running smoothly when unforeseen situations emerge. As an example, for many (many, many) years, carriers generally attempted to take single-digit rate increases per year to avoid disrupting their book of business. Put more simply, carriers did not want to lose their existing customers. In general, insurers want to avoid double-digit rate increases whenever possible. So, if a carrier indicated a 30% rate need in a given state

Table 3a. Average Homeowner Rate Taken — Overall

Homeowners effective rate change since 2018 (%)

State	2018	2019	2020	2021	2022	2023
Countrywide	3.2%	2.5%	3.0%	3.8%	6.1%	11.3%

Source: www.insurance.com citing S&P Global Market Intelligence. Data compiled Jan. 11, 2024, year to date as of Dec. 29, 2023.

Table 3b. Average Homeowner Rate Taken — Top Carriers

Top 10 homeowner insurers' effective rate change since 2018 (%)

	Effective rate change						Cumulative change	
Insurer	2018	2019	2020	2021	2022	YTD 2023	2022–YTD 2023	2018–YTD 2023
State Farm	1.3	-1.1	0.4	2.2	2.5	7.8	10.5	13.7
Allstate Corp.	2.6	4.5	2.8	4.1	4.3	10.2	14.9	31.8
Liberty Mutual	3.5	1.4	2.0	3.0	10.7	17.2	29.7	43.0
USAA	6.2	4.0	1.4	1.4	3.4	14.7	18.6	34.7
Farmers Insurance	4.5	3.3	2.7	3.1	13.3	19.4	35.2	54.6
Travelers	2.6	4.5	4.9	5.3	6.5	10.0	17.1	38.7
American Family Insurance	4.6	6.2	3.9	5.7	8.5	12.2	21.8	48.4
Nationwide	3.8	1.9	4.8	6.3	8.8	10.6	20.4	41.9
Chubb	4.1	7.9	4.7	8.4	4.8	6.9	12.1	42.8
Progressive	6.4	4.4	15.0	7.1	2.9	10.4	13.5	55.3

Data compiled Jan. 11, 2024.

Year to date as of Dec. 29, 2023.

Includes owner occupied homeowners filings disposed or approved by regulators for the country's 10 largest homeowners underwriters. Excludes mobile homes, renters and condo coverage.

Effective rate change is the average of the cumulative changes by renewal business effective date for each insurer weighted against respective calendar year direct premiums written reported within the NAIC property and casualty regulatory statements. For year-to-date 2023 figures, 2022 direct premiums written were used.

Rate filing information is sourced from System for Electronic Rate and Form Filing documents.

Source: S&P Global Market Intelligence.

Source: S&P Global, https://www.spglobal.com.

instead of requesting 15 or more points of rate, in many cases that carrier would elect to take rate increases just under 10% every year and hope that loss trends subsided over the subsequent five years so they would get to rate adequacy in about five years. One might be inclined to ask, "What's so magical about 10%?"

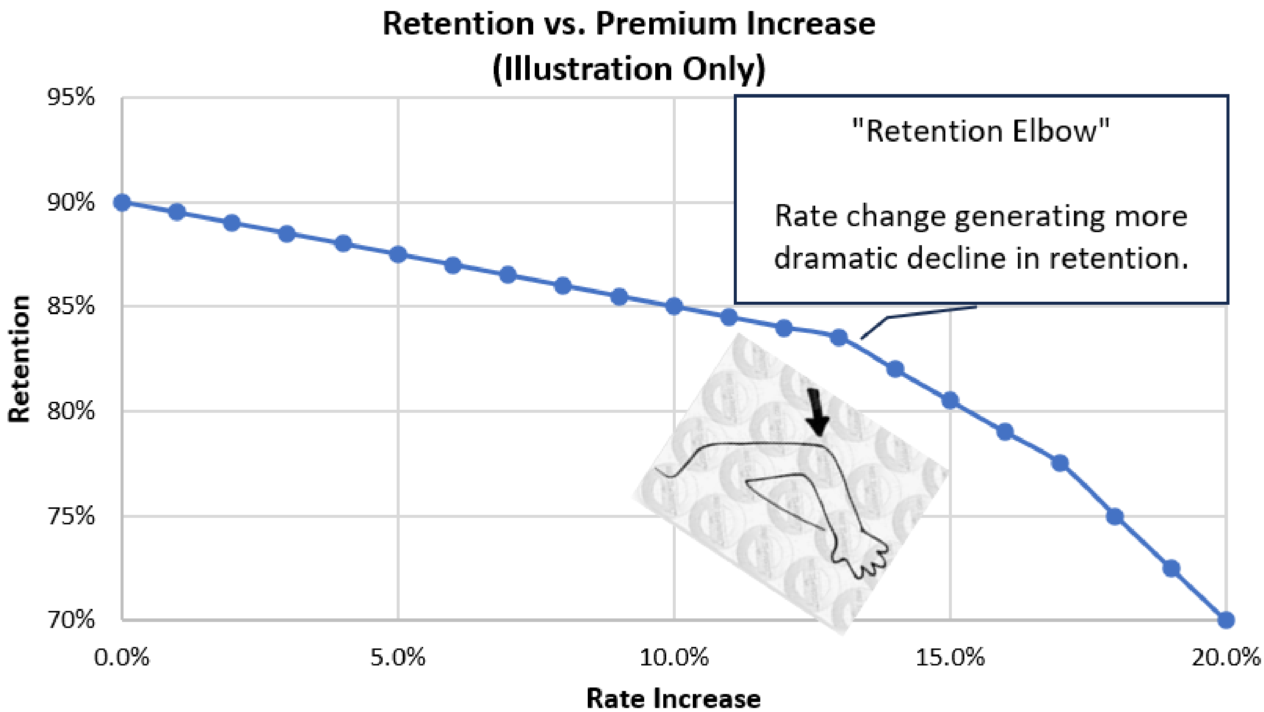
Retention

Part of the reluctance towards taking larger indicated rate increases was driven by anticipated regulatory pushback or delay related to pursuing the indicated rate need. Several states have written or unwritten rules that limit how much rate they will approve in a given rate filing. Another very considerable part of the reluctance dealt with carriers' wanting to retain as many of their existing customers as possible. That second point brings us to an extremely interesting and very relevant sidetrack: Retention! The Statement of Principles Regarding Property and Casualty Insurance Ratemaking does not mention retention as a consideration, and demand modeling has been a cause of significant consternation in recent years and decades — to the point where several states have explicitly forbidden "price optimization." For clarity, I would like to make a distinction between portfolio level retention considerations and price optimization at the individual account level. In my experience, when making decisions regarding state-specific rate filings, the potential retention impact at the overall book level is a consideration, but the potential retention impact at the individual account level is not.

Retention is generally thought to not decline linearly with rate across the board. Customers may not tend to shop for another carrier if their rate change is in line with traditional levels of inflation. Simply put, inflation is generally a well and broadly understood concept and customers likely have a reasonable tolerance of price increases on any product including insurance, up to a certain point. There is not a consensus on what that precise inflection point is, but in a traditional inflationary environment single-digit rate increases were in many cases a prudent long-term retention strategy, regardless of ebbs and flows in the indication from year to year. The hypothetical chart (Figure 1) illustrates the general concept of how retention might behave in light of different rate increases in the not-too-distant past. There is debate as to the position and magnitude of the retention elbow, however, rate increases in excess of 10% were outside of the historical inflationary norms, and any insurers actually measuring (experiencing) the slope of the curve out to the far right likely were none too pleased with their retentions!

Back to the balance of stability versus responsiveness. Carriers abiding by the historical norm of consistently taking 3%-5% rate increases despite mounting evidence to the contrary reversed course roughly two to three years ago as the entire industry recognized the need to catch up to the true level of homeowners insurance costs. Based on Table 3b, Progressive appears to have been the first company to reach the realization that the 2010s inflationary environment was not coming back anytime soon and

Figure 1.



in the following 12–18 months, most of the industry appeared to follow suit and, in turn, many companies started taking relatively larger rate increases right around late 2021.

An extremely interesting aspect to this very unusual rate environment is that despite these large industrywide rate increases, retentions have remained significantly higher than expected. The prevailing wisdom is that retention isn't necessarily a function of absolute rate, but rather of relative rate. In other words, when projecting the retention outcomes of rate selections, actuaries shouldn't be measuring historical known retentions against the actual rate taken by their company, but rather against how much more or less rate their company took compared to the competitors and inflationary pressures at that point in time. Unfortunately, accurately measuring relative rate action is extraordinarily challenging. In any event, since the entire industry has been taking double-digit rate increases, the retention elbow appears to have drifted much further to the right since a 10% rate increase today "ain't what it used to be."

Drivers of increased costs

What exactly is driving the increased costs? To answer that key question, one can review publicly available pricing data on bls.gov to get a sense as to the key drivers. The table below summarizes several key trends from a few pertinent data sets.

Regarding the pricing statistics shown in Table 4, we offer the following observations.

1. The price of all building materials reviewed skyrocketed after March 2020. The largest year-over-year trend numbers are in the 20–21 and 21–22 rows. We all would have guessed that prices increased the most right after COVID and the pricing data available from BLS clearly supports that hypothesis.
2. Excluding lumber, everything measured had three consecutive years of price increases.
   a. Gypsum had average annual increases of over 13%.
   b. Raw materials for roofs and floors had average annual increases of over 7%.
   c. Paint had average annual increases of over 11%.
3. Lumber absolutely skyrocketed between January 2020 and January 2022 but recovered slightly during 2022. Those very large lumber prices in 2020 and 2021 would have adversely impacted insurance losses in those two years.
4. The last row (23-24) shows minimal year-over-year increases in the measured commodities. Should we dare be so optimistic as to believe the worst of the inflation monster is

Table 4. Pricing Trends of Home Building Supplies

BLS Series ID:	PCU3274203274201	WPS081107	WPS081	CES2023610001	PCU32739032739011	PCU325510325510
	Gypsum building materials	Softwood lumber, made from purchased lumber	Lumber	Employees: Residential Building Construction	Precast concrete slabs and tile, roof and floor units	Paint and coating manufacturing
January 2020	240.50	173.40	209.50	827.00	305.90	300.40
January 2021	252.40	224.40	329.30	841.00	318.70	304.10
January 2022	315.52	311.10	403.46	899.90	355.62	370.53
January 2023	350.71	256.59	262.88	929.90	382.54	417.46
January 2024	343.91	259.44	245.97	938.40	393.01	414.54
20 - 21	4.9%	29.4%	57.2%	1.7%	4.2%	1.2%
21 - 22	25.0%	38.6%	22.5%	7.0%	11.6%	21.8%
22 - 23	11.2%	-17.5%	-34.8%	3.3%	7.6%	12.7%
23 - 24	-1.9%	1.1%	-6.4%	0.9%	2.7%	-0.7%
Avg Annual (20 - 24)	**9.4%**	**10.6%**	**4.1%**	**3.2%**	**6.5%**	**8.4%**
Avg Annual (20 - 23)	**13.4%**	**14.0%**	**7.9%**	**4.0%**	**7.7%**	**11.6%**

Source: U.S. Bureau of Labor Statistics, https://www.bls.gov/.

behind us?

So where does all of this leave us?

Underwriting experience

We have heard much of this before — everything became much more expensive right after COVID. What we all really want to know is when will the large premium increases come to an end (or at least settle down to the good old days of low- to mid-single-digit increases)? Excellent question! To answer that, we'll first need to take a quick peek at some industry-wide combined ratios to see exactly how inadequately priced the industry has been. As a quick level set, a combined ratio is the ratio of loss and expense as a ratio to earned premium. A 108% combined ratio means an insurance company paid out $108 in losses and expenses on every $100 of premium they earned during the year.

We can see from Table 5a that industrywide net written premiums increased by approximately 10% between 2021 and 2022 and then are projected to increase by approximately an additional 12% between 2022 and 2023. In Table 5b we see that 2022 and 2023 had combined ratios of 104.4% and 110.9%, respectively. We can also see that writing homeowner insurance has been unprofitable in six of the past seven years! What meaningful information can we glean from these tables?

Connecting the dots between Tables 3a and 5b, the industry was only taking three points of rate each year between 2018 and 2020, which was nowhere near enough to make a meaningful dent on the over 100% combined ratios. With such horrible results, why was the industry only taking three points of rate? We have already mentioned the disruption management part of the answer. Another meaningful part of the answer is that the industry did not want to overreact to recent worse-than-average catastrophe experience. Estimating a fair, reasonable and adequate catastrophe loss provision is a major component of the rate level decision-making process. In the homeowners line of business, this particular pricing component is especially challenging to estimate. Let's explore this a bit further.

In Table 6, we show the annual catastrophe losses impacting the homeowner insurance industry. Imagine that you are a pricing actuary in January 2020 and you see the catastrophe losses between 2014 and 2019. When setting rates, you might make a catastrophe provision assuming $55 billion–$60 billion would be an adequate provision. You might be thinking that $35 billion–$40 billion is a typical catastrophe year, but you need to account for outlier years like 2017, so you add a cushion to your catastrophe provision and call it $60 billion. The very next year (2020), catastrophe losses are worse than your estimate and you increase your catastrophe provision to $65 billion. The next year after that (2021), catastrophe losses are still worse than your estimate and you increase your catastrophe provision to $70 billion. The main point here is that ever since 2017, catastrophe losses have suddenly and dramatically increased to a new much higher level and pricing actuaries (like me) have been or are trying our very best to make a fair, reasonable and adequate provision for this volatile result based upon the latest information available. The year 2020 was the third in a four-year stretch where industry catastrophe losses exceeded $50 billion, which was enough evidence for many pricing actuaries to insist on taking far more substantial rate increases.

Back to the question at hand. When will the large premium increases come to an end? The answer to that question depends largely on the degree to which catastrophe losses and overall loss trends level out.

A "fair and reasonable profit"

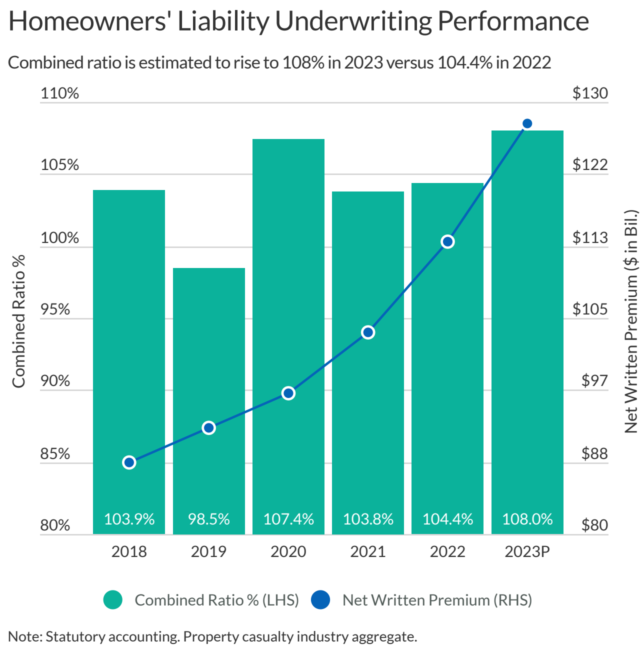
All of this data still doesn't answer the question of exactly how inadequately priced the homeowner industry is. Well, that depends. As discussed in the prior section, part of the answer depends on accurately assessing the expected value of catastrophe losses. In addition to this, one also needs to address a different question: What "should" the homeowner insurance industry be targeting for a fair and reasonable return on capital? Based on my experiences at three different insurance carriers over a 20+ year period and my review of hundreds of competitor filings over the years, the general historical consensus seems to be that a return on capital between 10% and 15% is appropriate for the P&C insurance industry. Does that mean that the homeowner industry "should" be targeting a combined ratio between 85% and 90%? No, that would be conflating return on capital with return on premium.

To move forward, we'll need a quick level set on the two separate components of P&C insurance profit (underwriting and investments) and how these two pieces contribute to the overall return on capital. However, before jumping into that, Table 7 summarizes the target return on capital and profit provisions for our six sample filings.

At a high level, when insurance works as designed, insurance companies (in essence) receive a loan from customers (the premium) and only pay back a fraction of the loan (the loss ratio). In order to write these policies, insurance companies must have capital set aside to ensure all claims will be paid. Insurance companies invest both the premium and the capital and earn investment income on both. Assuming an insurance company consistently targets the same return on capital every year, then the required underwriting profit (or the target combined ratio (TCR), if you prefer since U/W Profit = 100% – TCR) should be inversely related to investment yields. When yields are more favorable, smaller underwriting margins are needed and vice versa.

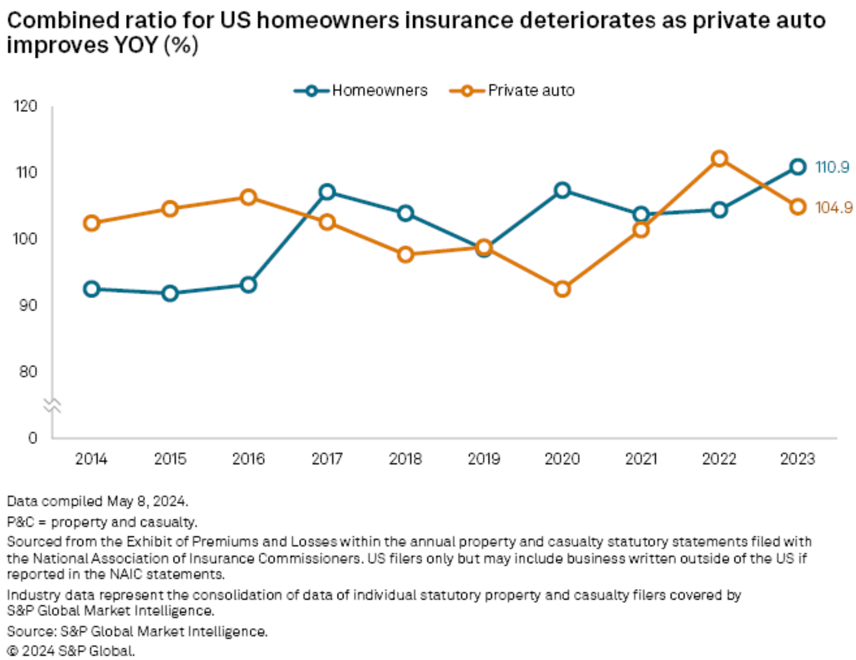
Reviewing Table 7, we see that most carriers anticipate investment returns to provide roughly one-third of the cost of capital and the rest to be gained from the amount by which insurance

Table 5a. Homeowners Combined Ratios and Net Written Premiums



Source: Fitch Ratings, https://www.fitchratings.com.

Table 5b. Auto and Homeowners Combined Ratios (updated)



Source: S&P Global, https://www.spglobal.com.

Table 6: Homeowners Catastrophe Losses by Year

Estimated Insured Property Losses, U.S. Natural Catastrophes, 2014-2023 (1)

($ billions)

Year	In dollars when occurred	In 2023 dollars	Rank
2014	$23.4	$30.5	9
2015	$23.0	$29.9	10
2016	$31.9	$40.9	8
2017	$131.0	$163.9	1
2018	$60.9	$74.5	6
2019	$39.2	$47.2	7
2020	$81.5	$96.9	4
2021	$93.3	$106.0	3
2022	$109.6	$114.0	2
2023	$78.8	$79.6	5

(1) Natural disasters that cause at least $25 million in insured losses; or 10 deaths; or 50 people injured; or 2,000 filed claims or homes and structures damaged. Includes Puerto Rico and the U.S. Virgin Islands. Includes losses sustained by private insurers and government-sponsored programs such as the National Flood Insurance Program. Subject to change as loss estimates are further developed. As of January 2024. Adjusted for inflation by Aon using the U.S. Consumer Price Index. Source: Aon.

Source: Insurance Information Institute, https://www.iii.org, citing Aon.

Table 7. Filed Carrier Cost of Capital and Profit & Contingency

Carrier	Allstate	Allstate	Farmers	Safeco	State Farm	State Farm
State	PA	WI	TN	MO	IN	WI
Cost of Capital	14.0%	14.0%	15.0%	15.0%	9.4%	8.7%
UW Profit & Contingency	9.4%	8.6%	11.0%	14.3%	5.0%	5.0%

premiums exceed losses and expenses. As an example, the Allstate Pennsylvania filing shows that 9.4% of the 14% target return (67%) will be gained by profits on the insurance written, which means the remaining 33% will be provided by investment returns on invested capital and invested premium. Based on our small sample above (and on the author's experience), we cautiously assert that an industrywide required underwriting profit load between 6% and 12% is appropriate. For the sake of argument, if we were to agree that 8% is the theoretically "right" underwriting profit load, then the 2023 combined ratio of 110.9% shown in Table 5b would hint that (all else equal) the industry needs total premiums to grow by over 20% in 2024 to have a reasonable chance of achieving a 92% target combined ratio.

Speculations on the road ahead

We've covered a lot of ground now — where does this leave us? What can we take away from all of this and what can we expect to see over the next year or two?

When inflation picked up a few years ago, insurance companies appropriately started increasing everyone's Coverage A to ensure that everyone would be adequately insured, and this larger-than-typical Coverage A increase pushed premiums higher than usual. Inflation has subsided in the recent past and this component of premium increases will likely temper in the coming months.

The commodity price trends from BLS also appear to have subsided a bit in the latest year, so there is reason to be optimistic that loss trends will level out somewhat. The big unknown is catastrophe losses. Based upon the last seven years, one might reasonably infer that, in the longer term, the industry should be expecting close to $100 billion in catastrophe losses. However, if 2024 catastrophe results wind up looking anything like 2017, then we would have to adjust our estimates and continue to increase rates once again.

I speculate that industry written premiums will rise by more than 12% in 2024 and then in 2025, the written premiums will increase by a mid-single-digit amount. I also speculate that homeowner industry combined ratios will not dip below 100% in 2024 but will finally drop the leading "1" in 2025 once most of the rate activity finally has an opportunity to earn into the results. Time will tell.

Rob Kahn, FCAS, is an AVP & actuary with Horace Mann Insurance. He is also a member of the AR *Working Group.*

Insurance at Your Service

By YUHAN ZHAO

Insurance professionals should assist in improving the public understanding of insurance and risk management.

—Canon 7 in the CPCU's Code of Professionals Conduct

Sometimes it is frustrating to see that the public does not seem to appreciate the critical role insurance plays in everyday lives. This is especially true as increasing numbers of catastrophe events lead to rate increases and reserve uptakes. The public needs to know that the gloomiest night will give way to morning, and good things such as insurance will endure. And sometimes we need to remember what we truly bring to society as risk professionals.

"Insurance is far more than just a financial institution; It affects every aspect of people's lives," said Michel Dionne, the chief actuary of my employer, Aviva Canada. The following are several ways insurance currently contributes to society in recent years.

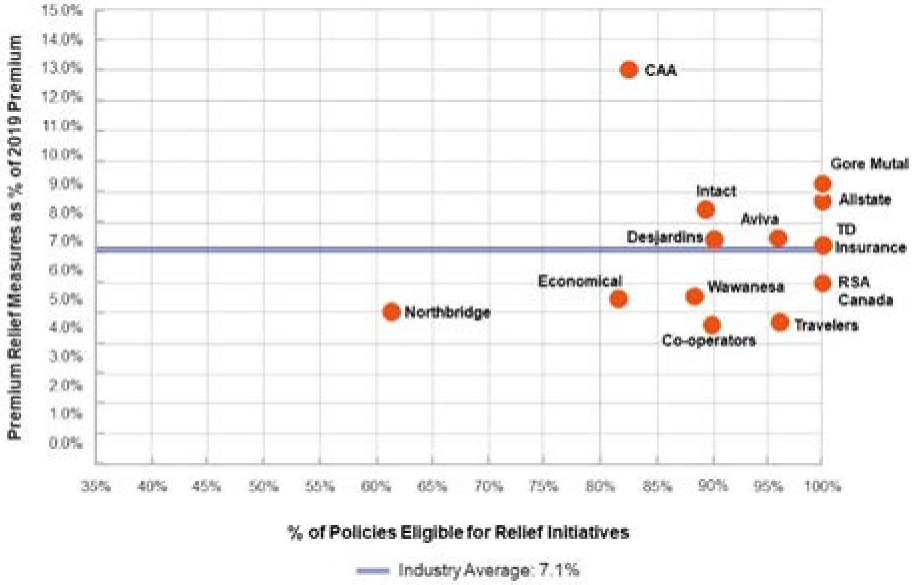
Catastrophe coverage

Looking through a macro lens, insurance takes its social responsibility seriously, ensuring its availability and affordability to the public.

At first glance, CAT coverage seems to go against the law of large numbers, making it an uninsurable risk. Infrequent by nature, CATs are difficult to predict accurately based on the mean estimation. There is a clear geographical concentration once a CAT occurs.Therefore, only people who live in risk-prone areas would be willing to purchase CAT coverages. Lacking a risk-sharing mechanism due to adverse selection would seem to make it close to impossible to diversify risks across a larger book.

But insurance does not just turn away and shut the door on offering disaster coverage. Take flood risk: In Canada, the insurance industry has been collaborating with the government over the years through the Task Force

Figure 1. Premium Relief Measures as % of 2019 Premium — July 2020



Source: Financial Services Regulatory Authority of Ontario, https://www.fsrao.ca/consumers/auto-insurance/understanding-auto-insurance-rates/consumer-relief-provided-ontario-auto-insurers#insurers

of Flood Insurance and Relocation to address rising flood risk. In the United States, private homeowners insurers are offering flood coverage to some homeowners traditionally covered by the National Flood Insurance Program and private carriers cover homes worth more than $250,000.[1]

In addition, the insurance industry has been quite vocal on the core issue around flood risk and continues to be a strong advocate, calling out emerging issues such as sea level rise and risk control approaches (updating flood maps with a fair level of accuracy and details, refining CAT modeling, and leveraging data from other sources).

Usage-based insurance

The insurance industry stands firmly for providing a fair rate for our customers at individual levels. Usage-based insurance (UBI) is a good example of how the insurance industry improves rate fairness by leveraging ongoing innovation and cutting-edge techniques.

As the Statement of Principles Regarding Property and Casualty Ratemaking says: A rate is reasonable and not excessive, inadequate, or unfairly discriminatory if it is an actuarially sound estimate of the expected value of all future costs associated with an individual risk transfer.

UBI technology allows insurance companies to track driving behaviors such as speeding and acceleration patterns, hard-brake habits, mileage and the time of day driving. Once policyholders download the app in their smartphones or install a small device in an insured vehicle, data collected will be directly fed back to insurance companies and taken into consideration while determining their insurance premiums.

UBI benefits society in various ways. It speaks to the heart of rate fairness by bringing in additional useful risk characteristics to identify good versus bad driving habits and by minimizing subsidization across risk classes. UBI also rewards good driving behaviors by offering premium discounts as immediate financial benefits to qualified insureds. And it encourages safe driving behaviors and promotes road safety in the long run, which, in turn, benefits society overall.

COVID-19 consumer relief

During the COVID-19 pandemic, public health officials around the world implemented lockdowns and other measures

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[1] For more about the flood risk, see these *AR* articles:
- "Modeling Flood Risks: Opportunities and Challenges" by Lucian McMahon, *AR* January/February 2019.
- "The SLR Factor" by Annmarie Geddes Baribeau, *AR* March/April 2018.

to reduce the chances of infection.

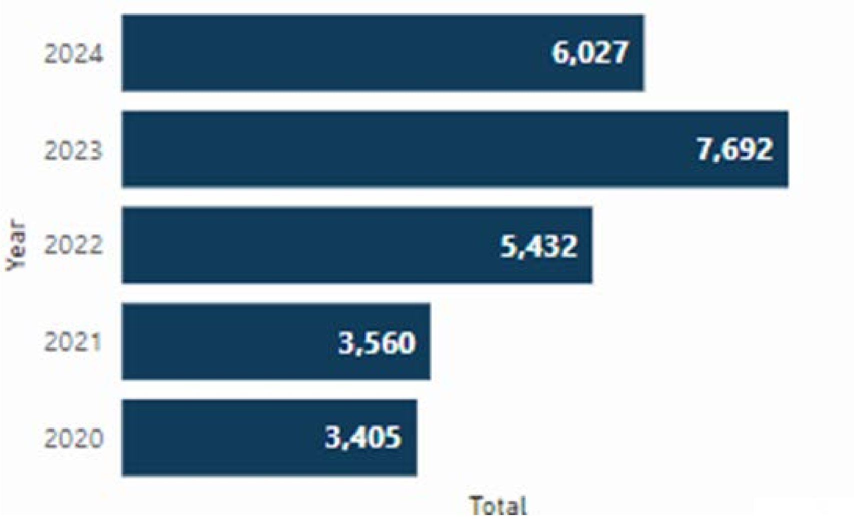
Massive lockdowns led to reduced auto claim frequency. Ontario auto insurers responded quickly with consumer relief actions at the onset of the emergency. From April 1, 2020, to April 1, 2022, the Financial Services Regulatory Authority of Ontario (FSRA) approved 108 emergency rate reductions and 45 emergency premium rebates in which 55 insurance companies participated.[2] Under FSRA's supervision, auto insurers voluntarily provided over $1.8 billion in consumer benefits, including rate reductions and rebates.[3] Savings were returned to policyholders and helped ease financial pressures (see Figure 1).

In response to the changing driving patterns due to the stay-at-home orders, the insurance industry took initiatives to address auto rate fairness and ensure premium rates remained equitable to serve our customers during a challenging times.

Combating auto thefts

Many living in Ontario know someone who has recently experienced auto theft. Police data indicates that from 2021 to 2023 auto theft reports in Toronto alone were up more than 40% (see Figure 2).

Figure 2. Total MCI by Year



Source: Toronto Police Service [Major Crime Indicators Last Five Years as of August 11, 2024](). (MCI: Major Crime Indicator – Auto Theft)

A chain reaction of events during the pandemic led to the rise in auto theft. Supply-chain issues with elevated inflation led to the shortage of new car production, fueling a booming second-hand vehicle market including the re-selling of car engines. Tempted by its attractive profit margin, organized crime groups — professional criminals — came into the picture.

Higher auto theft rates led to higher frequency for auto comprehensive coverage, which in turn, burdened all auto insurance policyholders with higher premiums.

To combat this crime-turned-national crisis, the insurance industry has been actively working with government and other key stakeholders to better protect consumers and their vehicles. Some auto insurers are offering Ontario customers an "approved anti-theft tracking system" known as TAG, at little to no cost for high-risk vehicle owners living in theft hotspots.[4]

As TAG becomes more widely used, its benefits could go beyond recovering stolen vehicles by further lowering theft claims frequency.

The problem of this type of auto theft will not be solved soon. Solutions, however, do require various parties working together to combat auto thefts. Insurance companies are helping to influence and equip society with a risk prevention and mitigation mindset.

Our duties

Working in the insurance industry gives us both the opportunity and responsibility to identify emerging risks and potential hazards, serving as the risk and control manager of the corporate world and society as a whole. As insurers, we never shy away from doing our part.

Yuhan Zhao, FCAS, is a senior actuarial manager for Aviva Insurance Company of Canada. She is a member of the AR *Working Group and its Writing Subgroup.*

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[2] Financial Services Regulatory Authority of Ontario: Regulation of Private Passenger Automobile Insurance, Credit Union and Pension Plan Sectors (auditor.on.ca)
[3] Consumer Relief Provided by Ontario Auto Insurers | Financial Services Regulatory Authority of Ontario (fsrao.ca)
[4] https://www.ratehub.ca/blog/auto-theft-tracking-devices-and-car-insurance/

IT'S A PUZZLEMENT By JON EVANS

Surface Volume Mismatch

If it is possible, then define a simply connected set in 3-dimensional Euclidean space that has volume 1 and infinite surface area. Alternately, if it is impossible then prove that such a set is impossible.

Rolling a Long String of Ones

In this puzzle, a die with k sides, numbered from 1 to k, has an equal probability ($1/k$) of landing with any one of these numbers up whenever it is thrown. The questions were: On average, how many times do you have to throw the die to generate n sequential outcomes of the number 1? Which takes more throws on average, k and n or k-1 and n+1 ?

Following is an outline for a solution that was verified independently by Bob Conger.

Let $AWT(k,n)$ be the average "waiting" time it takes to roll n sequential 1s given k.

$AWT(k,1)=p(1+2q+3q^2+\ldots)=p/(1-q)^2$

where $p = 1/k$ and $q = 1 - p$ and hence $AWT(k,1)=k$.

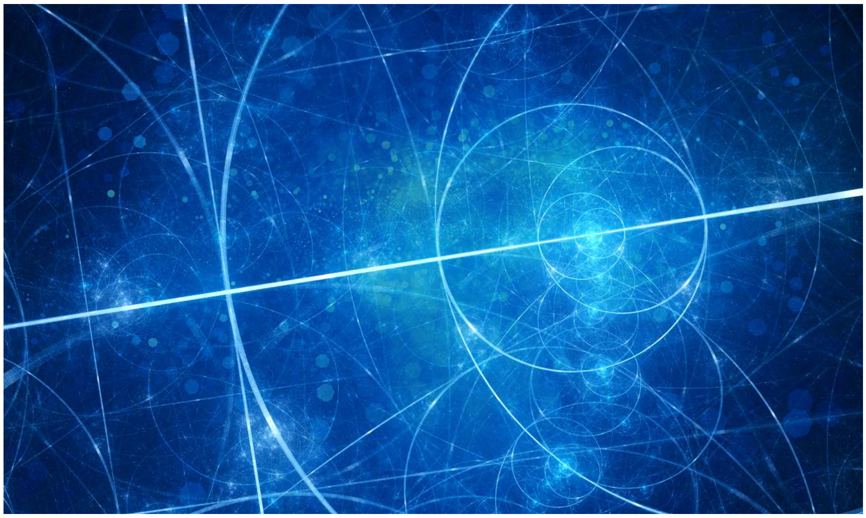
Immediately prior to rolling n+1 consecutive 1s first n consecutive 1s must be rolled. However, there could be any number of failed attempts to roll the n+1 consecutive 1. In each of these cases, after failure is like starting over. Therefore:

$AWT(k,n+1)=(AWT(k,n)+1)$
$p(1+2q+3q^2+\ldots)=(AWT(k,n)+1)\ k$.

The solution to this recursion is:

$AWT(k,n)=k+k^2+\ldots+k^n=(k-k^{n+1})/(1-k)$.

Obviously, for the second question to be meaningful, $k\geq2$.



***k*=2**

$AWT(2,n)=2^{n+1}-2$

$AWT(1,n+1)=n+1$

- $n=1$, $AWT(2,1)=2= AWT(1,2)$
- $n\geq2$, , $AWT(2,n)>2^n>$
  $AWT(1,n+1)=n+1$

***k*≥3**

Denote the difference between $AWT(k,n)$ and $AWT(k-1,n+1)$ to be $D(k,n)$.

$D(k,n)=AWT(k,n)-AWT(k-1,n+1)$
$=((k-k^{n+1})/(1-k))-(((k-1)-(k-1)^{n+2})/(1-(k-1)))$.

After putting the fractions above under a common positive denominator, we get the numerator. Let it be $N(k,n)$:

$N(k,n)=(2-k)(k-k^{n+1})+(1-k)^2-(k-1)^{n+3}$
$=-2k^{n+1}+k^{n+2}+1-(k-1)^{n+3}$
$=(k-2)\ k^{n+1}+1-(k-1)^{n+3}$.

Whether $AWT(k,n)$ is greater than, equal to, or less than, respectively, $AWT(k-1,n+1)$ is dependent on whether the numerator above is greater than, equal to, or less than 0, respectively.

For n=1, note that $AWT(k-1,2)=(k-1)+(k-1)^2=k(k-1)>k=AWT(k,1)$.

As n becomes larger, eventually $(k-2)\ k^{n+1}$ becomes arbitrarily larger than $(k-1)^{n+3}$.

Consequently, although $D(k,1) < 0$, eventually, for large enough n, $N(k,n)>0$.

Solutions were also submitted by Eamonn Long, Jerry Miccolis, John Noble, Anthony Salis and Chris Terrill.

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

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