actuarial REVIEW

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INFLATION NATION

Escalating inflation adds another layer atop rising losses

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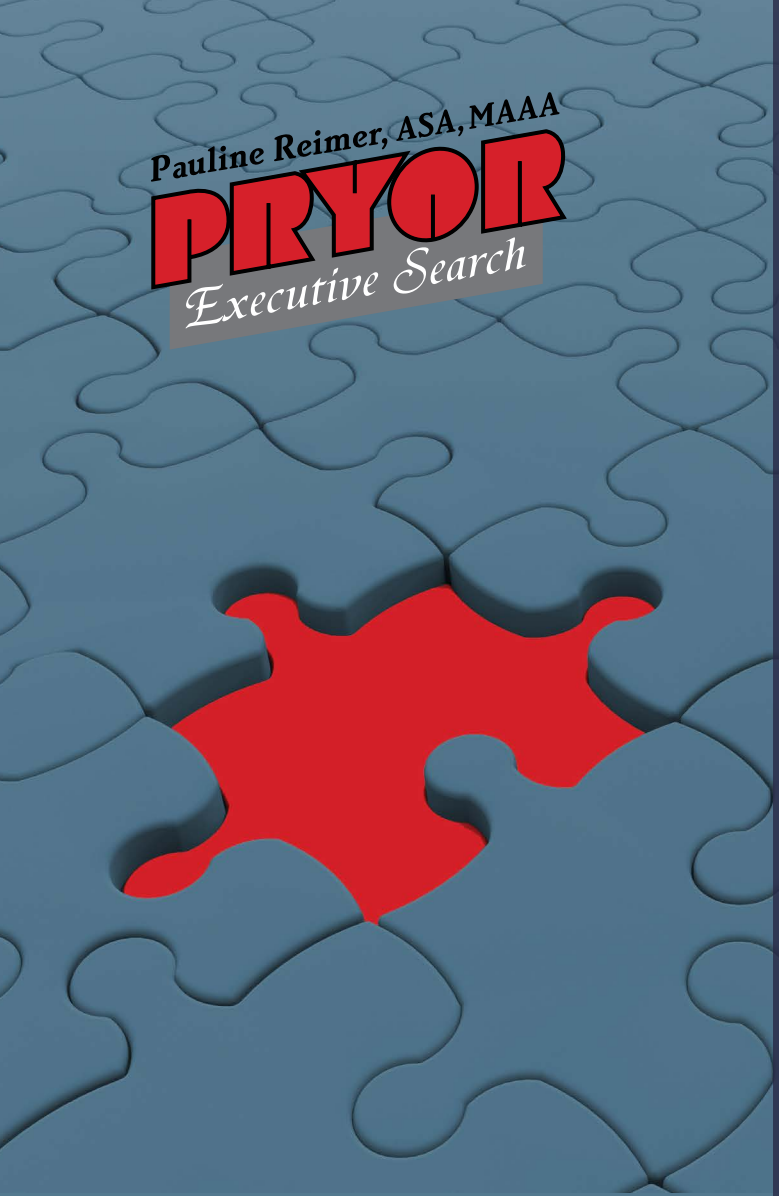

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May-June 2022

departments

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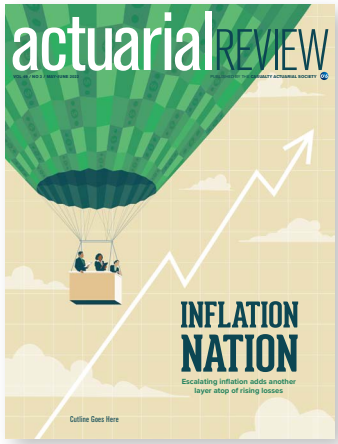

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By JESSICA LEONG

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Losses and Gains

Inflation takes top billing in this issue of *AR*. Many factors have contributed to it, including COVID lockdowns, supply chain issues and Russia's war on Ukraine. Several P&C insurance experts predicted this inflationary period more than a year ago, when they were feeling the pinch of rising repair and preplacement costs. Annmarie Geddes Baribeau delves into this topic and its effects on the insurance industry in one of her last stories for *AR*. Annmarie has been one of *AR*'s primary contributors. It's with mixed feelings that I announce that she is leaving the freelance world for one of steady paychecks — in other words, an exciting new job at a new company. Annmarie truly knows insurance and actuaries, and her love of the profession has guided her career, writing and presentations for many years. She has been a tremendous asset to *Actuarial Review*. I will miss her dearly but am heartened to report that she lives nearby. Lunch plans are definitely on the agenda.

I have some very welcome news in the form of a new CAS employee, Sarah Sapp, who is taking on the newly created role of editorial/production manager for CAS publications. In just her first week, Sarah has jumped right into this *Actuarial Review* issue and other CAS publications. I am so happy to be collaborating with her!

This issue also features stories from RPM Seminar held this March. Dale Porfilio's stories are all nonfiction, but one article, "The Computer Knows Your Secrets," could easily classify as a horror story for the modern age. After you read it, I encourage you to view the session video recording on UCAS, the association's portal to conference recordings and other CAS microlearning content offerings. Warning: Be wary of smartphone apps.

Last April our *AR* family suffered the tragic loss of Don Mango, a frequent *AR* contributor who wrote mainly for the Explorations and Brainstorms columns. He was a brilliant, yet humble man. He always made the effort to say hello to me at in-person events. I would tease him about his resemblance to *Mad Men*'s Don Draper and his penchant for wearing pink and blue gingham button-down shirts that his wife had picked out for him. He left this world far too soon and will be sorely missed. Deepest condolences to his family, friends and colleagues.

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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The Best Way to Engage

The two most engaging moments for me at the CAS Spring Meeting in May were the ACAS and FCAS New Member Receptions. Along with other CAS leaders, I had the opportunity to speak directly with the next generation of actuaries and hear what's top of mind for them. While we celebrated our new member's significant achievement, we also listened to how we can make the CAS even better. This was a fitting example of how the CAS Board is leading with engagement in mind, and here are a few of the other things we are doing.

Town halls

Town Halls allow members to ask tough questions and CAS leaders are committed to continuing this tradition. During the Spring Meeting, we were on stage to talk about the CAS Strategic Plan and answer live questions from those attending in-person and online. I was happy to see so many members step up to the mic to share their thoughts with us. Similar question and answer opportunities occur when CAS Board members speak at Regional Affiliate meetings.

Member attendance at board meetings

Our revised policy on member attendance at CAS Board meetings supports our efforts towards greater transparency of board deliberations and offers members additional opportunities to gain insights into the workings of our board. Members are invited to attend and observe all virtual board meetings. The schedule and draft agendas are on the CAS website calendar. Members are also invited to connect virtually to the in-person board meetings (provided a virtual option for remote participation by board members has already been prearranged). In-person board meetings are typically held quarterly, and those held in conjunction with the Spring and Annual Meetings give members the opportunity to conveniently attend a board meeting in-person.

Focus groups

At the end of 2021, the CAS conducted focus group discussions with new CAS Fellows and Associates who were asked questions on engagement, volunteerism, communication vehicles and DE&I. We specifically asked new Associates about the candidate experience and how we can improve the credentialing and onboarding experience. We took this information and put together an action plan to implement the members' recommendations. For example, just prior to this year's Spring Meeting, we hosted a new members' virtual networking event, which received positive reviews. Happily, we discovered that some ideas were already in progress, validated certain projects that were underway. Encouraged by how much we learn from focus groups, our Member Engagement Advisory Working Group is planning future focus groups with various cohorts of members, such as those working outside North America.

Surveys

Surveys can be highly effective in learning our membership's wants and needs. Our Member Advisory Panel, or MAP, has been in practice for several years now and has surveyed everything from soft skills to the 2021 proposed constitution and bylaws changes. We also conduct surveys on certain topics (e.g., job tasks) or with groups (e.g., candidates). Most recently we conducted surveys of volunteers and volunteer chairs.

The Volunteer Interest and Participation (VIP) Survey is one of our most valuable tools for matching up members with meaningful volunteer opportunities. We are also now engaging with members who only have a little time to spare by offering micro-volunteering opportunities, which require minimal time but have a big payoff in terms of giving back.

Exposure periods for new initiatives

For years, the Actuarial Standards Board and other organizations have used this approach to ensure that policies under consideration are exposed and receive comments from all interested parties. In 2021, the CAS exposed a revision of its diversity, equity and inclusion (DE&I) strategy to the membership. The member feedback resulted in the adoption of an updated strategic approach to DE&I in February 2022. Exposure and comment periods are open and transparent methods of engaging members in the development of CAS policies and we are committed to continuing this practice.

Our representative form of governance

Finally, the CAS has a representative form of governance, and voting is the primary means for members to engage. Once a year, CAS Fellows and members who have been Associates for at least five years elect four new directors.

President's Message, page 8

President's Message

from page 6

They are charged with listening to the members and making decisions based on what is good for the entire membership. Our board, which consists of 12 member-elected directors and three appointed directors who come from non-actuarial backgrounds, takes its job very seriously.

So, if you really want to be engaged, consider representing the membership by joining the CAS Board of Directors. Any Fellow can run for the CAS Board by petitioning to be placed on the ballot.

The CAS Board is focused on engagement with members, and we just had a robust discussion on this topic at our last meeting. We recognize that members have different desires on how and how much to engage. It's important that we meet all of our members where they want to engage, and we are committed to this effort.

Visit casact.org/article/2022-cas-elections-kick-call-nominations for information on election petitioning.

ACTUARIAL REVIEW *LETTERS POLICIES*

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

"Undivided" Support

Dear Editor:

Stan Khury wrote a wonderful article about major board initiatives that they tried to effect without first obtaining the "consent of the governed" ("Undivided," *Actuarial Review*, November-December 2021). The two most important were the proposed merger with the SOA and the recent effort to increase the role of the executive staff. As it happened, the board did wisely poll the membership before voting on the proposed CAS-SOA merger, only to discover that the membership was broadly against the proposed merger. In fact, a merger between the CAS and the SOA would have been horrific. The recent effort to increase the role of the executive staff without input from the membership was especially troubling. When a few members rose up and presented valid arguments against the proposal, they did the right thing and turned out to be successful. The board should have solicited comments beforehand. I was on the board of directors twice, and I can attest that there were sometimes differences between the views of the board and my perspective as an insurance regulator. My point is that Khury's article was very insightful and well written. The board avoided two serious mistakes when the "consent of the governed" was revealed. The problem is not with the board election procedures. The problem is with common group dynamics in psychology, in which members are too eager to come to a consensus. This can be corrected by following Khury's suggested comparison with the Actuarial Standards Board's procedures.

—Richard J. Roth Jr., FCAS

Dear Editor:

I am writing to share my support for the ideas in Stan Khury's article, "Undivided," and the specific suggestion he put forth: "That the board of directors adopt an explicit procedure that any major changes to policy, organization or other important aspects of life of the CAS be subject to an exposure process similar to that the ASB successfully has used for many years." Two of the reasons for my support are, firstly, that the CAS Board of Directors has correctly been looking for ways to improve member engagement; adopting Khury's specific suggestion would be one effective way to do this. Secondly, Khury's example of the re-scinding/reinstatement of the Ratemaking Statement of Principles resonated with me. At that time, I remember reading the email telling me that the board had rescinded it. I remember feeling surprised and disappointed that I was not included in this decision, which affected me professionally, and concerned when reading about the frustrations of CAS stakeholders for whom the rescinding presented challenges. I believe this situation could likely have been avoided if a process like that suggested by Khury had been in place at the time. The one suggestion I would like to offer to Khury's proposal is to clarify what defines "major changes" to which the procedure applies. I hope that sharing my support for Khury's proposal will spur further discussion by the CAS membership and appropriate consideration by the board.

—Michael Baznik, FCAS, MAAA

Dear Editor:

It is sadly true that the CAS leadership has lost touch with the membership, as evidenced by the remarkable string of blunders that we have been led into

in recent years — seeing them laid out side-by-side in his article was really something. It was like watching someone jump out of an airplane without a parachute and then watching them do it again and again. Khury is also absolutely correct that with respect to DEI: "The ideas advocated by those policies are not self-evident truths." But therein lies the rub, as the advocates of these policies don't see it that way, but rather view any disagreement with them as proof of so-called "white privilege" if not outright racism, sexism, etc., etc., ad infinitum. The suggestion to adopt the ASB model for major policy changes seems to me to be an excellent one, as it would serve to have the leadership and the membership in alignment before anything actually happens, instead of constantly having to clean up the mess after the fact.

—Eric Clymer, FCAS, MAAA

Race and Insurance Pricing

Dear Editor:

There is a lot of information in the article "Race and Insurance Pricing Session Defines Terms and Advises on Next Steps" (*Actuarial Review*, January-February 2022), but I'm afraid I found much of it gobbledygook. As far as I can tell, the article never acknowledges the elephant in the room, namely, should the rate follow the risk, even if that means members of (insert protected class here) might disproportionately have characteristics (age, driving experience, drive times, litigious territories, etc.) that correlate predictably with claims activity? If it is concluded that rate should not follow the risk, I can't imagine the world really needs very many pricing actuaries — simply project total losses for the state, divide by number of insured vehicles and call it a day. I don't imagine the roads would be very safe, though.

—Mark R. Proska, FCAS

Dear Editor:

In response to "Race and Insurance Pricing Session Defines Terms and Advises on Next Steps," I have some questions that center on how the methods proposed in that session appear to be inconsistent with the "Statement of Principles Regarding Property and Casualty Ratemaking" and ASOP #12 "Risk Classification." It seems that the article is proposing a different standard to define unfairly discriminatory rating plans other than having equal expected loss ratios across risk classifications, which in turn means the article is advocating disregarding our ratemaking principles guidelines (Principle 4). Is that correct? Does this, at least partially, explain why the CAS Board dropped those principles earlier before reinstating them? Can the authors reconcile their proposals to our current ratemaking standards? This leaves open the possibility that to comply with the methods as proposed in that article, one would knowingly create a risk classification scheme with unequal loss ratios. Unless all companies in a state step away from the equal loss ratio standard for risk classification to comply with statutory restrictions, this would expose the company to adverse selection and the actuary would not be in compliance with ASOP #12. ASOP #12 speaks to the actuary's duty to protect the client from the effects of adverse selection when designing a risk classification system subject to statutory constraints. Are the authors advocating that state insurance laws be amended to move away from our ratemaking statement of principles and towards the methods proposed in that session?

—Michael R. Larsen, FCAS

CAS Fellows Mallika Bender, Roosevelt Moseley and Kuda Chibanda respond:

It's important to recognize that rating plans are not entirely risk-based currently. For example, modifications are often made to risk-based indications for the youngest and oldest drivers. The system continues to function because actuaries are there to find a balance between all the different types of risk that insurers face. Proska's points illustrate exactly why we need actuaries to be active participants in the industry discussion on race and insurance. Who better than actuaries to explore new approaches to identify and address bias that still maintain the integrity of risk-based pricing? The all-or-nothing outcome that Proska fears is less likely to occur if actuaries are engaged in the discussion. Many states prohibit the explicit use of certain protected classes in rating, and regulators are now asking whether proxies exist such that you don't need to use protected class characteristics to achieve a biased outcome for that protected class. Actuaries who are responsible for insurance pricing may benefit from a deeper understanding of the issues, including the topics covered in the Annual Meeting session — key terms being used in the industry debate and statistical methods to enhance our actuarial toolkit. The focus of the session was not to opine on the way things *should be*, but rather the way things are now and how they could go in the future. I'm glad that our profession is applying our expertise to continue to evolve and advance actuarial practice in this space.

COMINGS AND GOINGS

Scott Rosenthal, FCAS, has been promoted to executive vice president at Holborn Corporation, a U.S.-based independent reinsurance broker. He is the head of the analytical services unit, which includes actuarial services and catastrophe modeling. He joined Holborn in 2007 with over a decade of industry experience.

Sanjay Godhwani, FCAS, has been named president of North America region at Berkshire Hathaway Specialty Insurance (BHSI). Godhwani will be responsible for all North America region underwriting and underwriting support groups, customer and broker engagement, and BHSI's global catastrophe engineering and analytics group. He has over 25 years of industry experience.

Sam LaDuca, FCAS, MAAA, has been appointed chief actuary at Concert Group Holdings. LaDuca joins Concert after 25 years with Merchants Insurance Group, where he held several senior positions, most recently executive vice president for product, underwriting and actuarial. Before Merchants, he worked for three years at PwC as a senior consultant in the firm's casualty actuarial and risk management practice.

Amy Fournier, FCAS, MAAA, has been appointed vice president and chief actuary at AF Group, a holding company whose affiliated brands provide workers' compensation and other specialty insurance solutions. Across the U.S., Fournier's responsibilities include oversight of AF Group's actuarial and data science, along with pricing and rate functions.

Jonathan Summers, ACAS, has been promoted to senior vice president, Head of Hedging Strategy, and he is responsible for Venerable's hedge strategy, derivatives trading and associated risk monitoring and reporting. Summers has experience with variable and fixed annuities, as well as retirement plan business. He previously held roles in hedging, risk reporting, financial reporting, product development, and modeling with Voya Financial, ING Group, and Fidelity and Guaranty Life.

Doug Nation, FCAS, has been promoted to vice president-actuary at Society Insurance. Nation works closely with Society's teams to complete reserve estimates, rate indications, predictive analytics, management reporting and special projects to balance profitability and growth. He was previously the actuarial manager for National Interstate, where he worked on developing reserve estimates, internal performance monitoring, and pricing and structure development for large accounts.

James Wencil, ACAS, MAAA, has been promoted to consulting actuary at Pinnacle Actuarial Resources. Wencil has been in the property-casualty industry with Pinnacle since 2016. The focus of his assignments has been loss reserving, loss cost projections, funding studies, predictive analytics and ratemaking. He is a member of the CAS University Liaison Committee.

Megan Baker, FCAS, MAAA, has joined Pinnacle Actuarial Resources from Farm Bureau Insurance of Michigan, where she was the manager of the company's property-casualty commercial lines actuarial team. In that role, she managed and prepared commercial lines filings and completed rate reviews and pricing analyses. She served as the company's subject matter expert in matters associated with business owners, personal and commercial umbrella, and commercial package policy ratings.

CAS Board Chair Jessica Leong, FCAS, has founded the consulting firm Octagram, which will be focused on making data and analytics a competitive advantage for companies in the property-casualty commercial insurance space. Prior to Octagram, Leong led the data science team at Zurich North America, where she brought measurable business impact across underwriting and claims for the customer.

Patrick Newell, FCAS, has been named a consulting actuary for Pinnacle Actuarial Resources in Bloomington, Illinois. Newell worked with Pinnacle before as an actuarial analyst from 2012 to 2015. He rejoins from the United Services Automobile Association (USAA), where he was a financial analyst lead, managing a team that supervised all financial management reporting on a $16 billion auto insurance book of business.

Joey Sveda, FCAS, has been promoted to consulting actuary from associate actuary for Pinnacle Actuarial Resources. Sveda joined Pinnacle in 2018 and is a member of its predictive analytics team. He has experience in commercial and personal lines pricing plans, actuarial studies for captives involving loss reserving and commercial lines rate making.

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

Join the Network of Actuarial Women

The Network of Actuarial Women and Allies (NAWA) is an organization dedicated to improving female representation in the actuarial profession through education, events, initiatives, projects and networking opportunities. NAWA is an organization focused on connecting and empowering women across the industry and is a strategic partner of the CAS. For more information about NAWA, visit https://www.nawaactuaries.org/ or connect with them through LinkedIn, Instagram or YouTube.

Subtitles Added to On-Demand Recordings

The CAS is providing a new service to add automated closed captions to our on-demand offerings. English subtitles have been added to our 2022 webinars, 2022 seminar recordings, microlearning courses, and our complimentary DE&I and Race and Insurance bundles. We will add subtitles to offerings from 2022 forward and work to add them to offerings from previous years.

We are actively seeking volunteers who can review the English subtitles for accuracy to better serve their fellow members. To volunteer or for more information, please contact swolff@casact.org.

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

New Associates Admitted in 2020 and 2021

In November 2021, the CAS met for its first in-person meeting since the beginning of the COVID-19 pandemic. At the 2021 Annual Meeting in San Diego, the CAS honored all the people who earned their designations during this remarkable time in history. Following are the new Associates of 2020 and 2021. *AR* will feature the new Fellows of 2020 and 2021 in an upcoming issue.

CALENDAR OF EVENTS

July 19-21, 2022
Climate Risk Seminar
Virtual

August 10-11 2022
Crash Course Seminar
IIHS/HLDI Vehicle Research Center
Charlottesville, Virginia

September 19–21, 2022
Casualty Loss Reserve Seminar
Marriott St. Louis Grand
St. Louis, Missouri

October 13, 2022
In Focus Seminar
Virtual

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

Visit casact.org for updates on meeting locations.

IN MEMORIAM

Robert Phillip "Bob" Irvan (FCAS 1978)
1937-2021

Donald F. Mango (FCAS 1994)
1963-2022

NEW ASSOCIATES ADMITTED IN 2020 AND 2021

Row 1, left to right: *Eryn Howard, Avleen Badwal,* ***2021 CAS President Jessica Leong, 2020 CAS President Steven Armstrong,*** *Tiffany R. Daley, Alexandra Walker.*
Row 2, left to right: *Daniel Paine, Paul Richard Davis, Joshua M. Collier, Daniel McFadden.*
Row 3, left to right: *Ryan James Whiting, Justin Peter Whitney, Thomas Jordan Phillips.*

Row 1, left to right: *Jie Hou, Qian Li,* ***2021 CAS President Jessica Leong, 2020 CAS President Steven Armstrong,*** *Clara Yam, David Ryan Brooks.*
Row 2, left to right: *Kenneth G. Smart, Dan Sui, Brittani J. Drent, Zhantao Xu, Jasmine Zhang, Jordan Lastnik.*
Row 3, left to right: *Jackson Philip Myers, Michael Joseph Raminski, Johnny Chang, Carter Burns, Payton Ebelherr.*

Row 1, left to right: *Dustin Wilke, Reese Walker Mularz,* ***2021 CAS President Jessica Leong, 2020 CAS President Steve Armstrong,*** *Eva Zhang, Jaime Danko.*
Row 2, left to right: *Robert Daniel Jurgens, Lily Faye Cook, Sara Ann Cahill, Hunter Hicks, Zachary Kevin Poole, Casey Grosshauser, Amanda Lynn Rearick, Katherine M. Zmyslowski.*
Row 3, left to right: *Ryan Bradley Frank, John Michael Soltys, Connor John Bohl, James Peter Arns, Joseph Di Schiavi, Russell James Harmening, Eric Alan Gerwin.*

Row 1, left to right: *Cal Wila, Christina Gavin Winter,* ***2021 CAS President Jessica Leong, 2020 CAS President Steve Armstrong,*** *Brittney Sheldon, Michael Joseph Sokol.*
Row 2, left to right: *Gina Lee Celia, Michael Ryan Caputo, Yang (Sylvia) Xu, Negar Jaberansari, Katelyn Elizabeth Sue Evans, Sarah L. Burns.*
Row 3, left to right: *Zachary Zhu, Bo Zhao, Ian Andrew Hamilton, Scott C. Sutton, Douglas Hung.*

NEW ASSOCIATES ADMITTED IN 2020 AND 2021

Row 1, left to right: *Joseph Anthony Sveda, Danqi Xiang,* ***2021 CAS President Jessica Leong, 2020 CAS President Steve Armstrong,*** *Jinghui Li, Victoria Ann Zeilor.*
Row 2, left to right: *Mahsa Moallempour, Xiaoying (Shawn) Zhu, Anna Maglio, Alison Wilkman, James B. Coon, David I. Towne, Farnaz Ziaee, Shuang Zhao.*
Row 3, left to right: *Dongdong Liu, Donaldson Miles Peay, Zachary Michael Smith, Billy Cheng, Trevor A. Mooneyhan, Tova Baharlias, Sky Wong, Nicole L. Esquivel.*

Row 1, left to right: *Duncan A. Bishop, Shannon Erin Dempsey,* ***2021 CAS President Jessica Leong, 2020 CAS President Steve Armstrong,*** *Eileen Wang, Drew Thomas Thatcher.*
Row 2, left to right: *Daniel William Terry, Daniel K. Jacobson, Philip J. Richied, Julia Giefer, Caleb Fitzgerald, Eric Shawn Liddle.*
Row 3, left to right: *Yuxian Ma, Alessandro Markovic, Emmanuel Davis, Charles Henry Jenkins, Derrick R. Duzan, Bradley Hazelwood.*

Row 1, left to right: *Morgan Marie Butz, Madelynne H. Deloach,* ***2021 CAS President Jessica Leong, 2020 CAS President Steve Armstrong,*** *Matthew Milless, Christina J. DeSalva.*
Row 2, left to right: *Brittany Henrich, Nicole McArdle, Daniel Mora, Eve Naomie Morissette, Emily Marie Spiteri, Juan Ramon Sancen-Bravo, Bradley S. Goldstoff.*
Row 3, left to right: *Theodore Lawrence Bowie, Thomas L. McRann, Daniel Ryan Koldin, John Andrew Seymour, Eliezer Lowenstein, Jessica Rebischke.*

New 2020/2021 Associates not shown: *Spencer D. Adams, Imran Ahmed, Jacob Alexander Akstins, Gabriel Alepin, Donald Glenn Allan, Kevin Appenzoller, Nicholas Araujo, Kathryn R. Ardinger, Neha Arya, Jarred Matthew Bakker, Ildiko Ban, David Barmore, Frank R. Bartoszak, John Bautista, Matthew C. Beamon, Mehdi Ben Hamouda, David S. Benusa, Rafael Bergerman, Zachary F. Bergstrom, Samuel J. Bermke, Krystin Bernacki, Joseph Robert Bernard, Dylan Bernklau, Lukas Bertsch, Michael Jonathon Blake, Kevin Blessing, Diana Bochnik, Jordan C. Bonner, David Thomas Boon, Kyle Christopher Borgman, Benjamin Kent Bostick, Benjamin Paul Bradley, Jonathan Brand, Michael Casey Branson, Erin Bretzman, William Britt, Timothy Brown, Samuel A. Bruning, Kathryn Elizabeth Burke, Jacob Burns, Michael Gary Byndas, Antoine Cabrera, ChongMei Cai, Ningxi Cai, Connor R. Cain, Agatha Siobhan Caleo, Daniel Camargo, Jacob Alan Carter, Kyle Casalla, Emma Casehart, Michael Thomas Cathcart, Alexandre Chabot, Haskell Chai, Veronica Chan, Marcella A. Chandler, Chin Chang, Hsuan Wei Chang, Waleed A. Cheema, Mengna Chen, Mingyang Chen, Shibo Chen, Wei Chen, Gengsheng Cheng, Timothy Cheng, Aleksandr Chertok, Chor Kit Cheung, Raj Chittal, Albert B. Choi, Angela S. Chokran, Meng Xuan Chu, Yen Wei Chu, David Chung-Chum-Lam, Christopher Charles Clickner, Colin Closson, Matthew Colagreco, Andrew Adams Colella, Caylie Connelly, Cameron Luke Cooper, Jasper R. Cooper, Alexa Cosenza, Francis Costanzo, Alyssa Coulson, Andreea Cretu, Stephanie A. Crowe, Jessica L. Crumrine, Katherine Ann Curran, Emel Dalgic, Patrick William Darcy, Joseph DeCapua, Dominic Defuria, Alex David Denfeld, John M. Denterlein, Lalith Devireddy, Stephen DiCillo, Ryan R. Diedrich, Connor Louis Dietrich, Louisa M. Diggins, Emilie Dionne, Katelynn Doherty, Ryne Logan Dolney, Fan Dong, Ji Cheng Dong, Kayleigh Donnelly, Andrew K. Douglas, Joseph P. Drennan, Yingjun Du, Joseph W. Dunham, Rebecca Ann Dunn, Mario R. Edwards, Jacob Francis Eilerman, Enxhi Elezi, Kristen Endrizzi, Alana Ergui, Olivia I. Esterlis, Philip David Etheridge, Casey Evans, Jamie Alison Eversdyke, Shuyuan Fang, Elizabeth Faucher, Shihui Feng, Cristina Marie Fernandez, Janeth Fernandez Ramos, Thomas Ferrigno, Alex Filiakov, Timothy Edmond Fischer, John Alexander Floden, Matthew Alan Ford, Molly April Frantz, Raphaelle Freniere, Matthew Friend, Brandon Funk, Frederick E. Galloway, Matthew Garabed, Sassnios A. Gebrai, Nicholas Arthur Geiger, Jessica Lynn Gerdes, Ali Ghazi, Andreea Gheorghita, Sunghee Gill, Samuel Thomas Gilmour, Dana Gionfriddo, Drew Gordon, Stacie R. Gorecki, Jacob R Gottier, Brandon A. Grangruth, Benjamin P. Griffith, Ian Grosso, Long Gu, Charles M. Hale II, Andrew Hancock, Brent Anthony Hanson, Hiromasa Alex Harada, Joenathan Ferio Hardi, Gregory Philip Harris, Jason Tucker Hartman, Keven He, Shelby Heinemann, James A. Henry, Bailey Michelle Hescock, Gayle Lynn Hilyard, Kristen Hoffman, Cory Hogan, Bryan Hong, Frederick Martin Horsman, Heather Howes, Hsin-Haw Hsu, David Hu, Jia Hu, Po Hu, Yiqun Huang, Yu-ping Huang, Meredyth Gwynn Hurlbert, Shiraz Hussain, Ismet Ibadullayev, David D. Idoux, Nicholas Iwan, David Jacobson, Bobby Jaegers, Preamini Jeevaharan, Emily Sarah Jeffrey, Bailey E. Jenson, Kihoon Jeong, Li Jiang, Jessica E. Joyce, Jennifer Jung, Thitiwat Kaewwattanaborworn, Stephen Paul Kallenbach, Uktamjan Kamilov, Stephen Kane, Daniel Kang, Huiying Kang, Chad D. Karczewski, Daniel Michael Karr, Helen Karsiotis, Bakeeshan Kathirchelvan, Michael Anthony Kelch, Jeffrey Lyle Kessin, Andrew J. Kiel, Sean Kirwan, Brian Knapp, Erica Knoll, Benyamin Kosofsky, Julia Kosta, Daniel Z. Kozlowski, Hannah Kramlik, Brian Paul Krawczynski, Nicolas Lai, Ting Hei Adrian Lai, Guillaume Lallemand, Matthew T. Lam, Christopher J. Lambert, Benjamin Jay Landes, Ethan Michael Lange, Joel David Lara, Andrew Michael Lear, Soo-Jin Lee, Rhys P. Leonard, Mengyi Li, Raymond Li, Shanshan Li, Shushangxuan Li, Ziru Li, Jonathan Lim, Michelle Chu Luan Lim, Chenze Lin, Kevin Ka-wing Lin, Qianhui Lin, Si Wei Lin, Siyu Lin, Nathan Patrick Lindsay, Yun Ling, Alvin Liu, Luyin Liu, Shujun Liu, Sijun Liu, Xiaoxia Liu, Yiqun Liu, Ian Michael Long, Walter Erik Loteczka, Jeremy Loukas, Hoi Ching Lu, Karen Lu, Benson Chek-Long Lung, Yan Luo, Sovanna Ly, Susan Melissa Mace, Mark A. Maenche,*

New 2020/2021 Associates, page 16

NEW ASSOCIATES ADMITTED IN 2020 AND 2021

Madeline Elizabeth Main, Justo Steven Maldonado, Kyle Joseph Malec, Kristen Marshall, Tiffany Marthin, Alec Martini, Alexis Linn Martini, Thomas McCarthy, Clinton James McCullough, Isabelle McCullough, Benjamin G. McGonegal, Stephen A. McMillan, Thomas Joseph McNamara, Lisa Danielle McSharry, Jeremy D. Medina, Arya Mehta, William Joseph Meidenbauer, Benjamin B. Mesick, Joshua Meyers, Hayden H. Mierl, Matthew D. Miles, Lawrence G. Miley, Christopher John Millelot, Raleigh Rebecca Miller, William Floyd Miller, Nigel L. Millick, Mark Miresse, Michael Mirrione, Maria Raluca Morosan, Justin William Morris, Nicholas P. Mosur, Andrew M. Moulakis, Pearwa Mukyangkoon, Victoria Mullane, Matthew John Murray, Annika Sofia Nebe, Courtney Nelson, Stephanie L. Nemerofsky, Philip Nenni, Kasey Ka-Chuen Ng, Ngoc Thuy Anh Nguyen, Jiajing Ni, Skylar Nicol, Robert Noehammer, Joseph Michael O'Connor, Suna J. Oh, Wei Lai Oh, Michael Olczyk, Samuel R O'Neill, Florina Or, Allan Ouyang, Justin M. Panther, Daniel Youngjin Park, Youngok Park, Genevieve Allyn Parks, Ben William Parrish, Kevin L. Pascal, Arpita Patel, Daniela Paykin, Long Peng, Jacqueline C. Perfetti, Kevin Jacob Perlitsh, Vijay T. Persaud, Destin Michael Peterson, Max Nathaniel Peterson, Christopher A. Petty, Colin Charles Piscitello, Matthew Edwin Pittard, Joshua M. Pomerantz, Mitchell Post, Sabina Preda, Keith Quigley, Maxime Quimpere, Nicholas James Ranallo, Kethan Reddy, Ashley Ann Reilly, Tsirel Rennert, Tristan Rhodeside, Robert Ryan Riesenberg, Simon Rivard, Emily Elizabeth Roche, Erin Catherine Rodgers, Craig Dennis Rossiter, Marc Roulier, Patrick Rozgonyi-Schwartz, Evan Rudibaugh, Thomas Alan Ruetz, Chipo Runesu, Josef Walter Rutkowski, Woodrow Sabroske, Konstantin Sakherzon, Cameron Zaisser Salter, Angela Marie Sampson, David Allen Savoia, Desirae Alexandra Sawyer, Megan Schlosser, Hannah Schneider, Matthew W. Schoeller, David H. Schwartz, William Howard Schwartz, Jacob William Sechler, Yuliya Semibratova, Erin M. Sharkey, Aaron G. Shatz, Daniel Embra Shaw, Thomas Sheppard, Erin Sherman, Tingting Shi, Weisi Si, Brent Arthur Sianez, Jessica Smith, Patricia E. Smith, John Sobhanian, Betsy Southworth, Timothy Charles Specht, Elaine Michele St Germain, John David Stark, Thomas J. Stava, Julia Caitlin Stella, Logan Harris Stern, Robert Anthony Stiegemeyer, Christine Audrey Storms-Miller, Anthony Strazzara, Cameron Josef Studer, Sara Lynne Stull, Timothy Joseph Stump, Thamodaran Subramaniam, Lu Sun, Otto Sung, Hui Min Tan, Raymond Tan, Swarnima Taparia, Ryon M. Tartell, Christopher William Terrill, Noah Alexander Terry, Bradley Thompson, Steven Benedykt Tomala, Michael Peter Tomera, Neli Tomova, William Alberto Torres Amesty, Sonia Tougas, Alec William Trachtman, Issouf Traore, Daniel A. Traverso, Jennifer Leigh Tripp, Ming-Yen Tsai, Konstantinos Tsaousis, Danny Tshitumbu, Ashleigh Tufnell, Logan E. Turley, Patrick Alan Underhill, Emily Genereux Valcourt, German Valenzuela, Taylor Richard Van Laar, Michael Robert Vandertie, John P. Varnas, Sajid Suleman Virani, Nhat K. Vu, Joshua Waisgrus, Arianne Pardue Walker, Calvin Wang, Pei Wang, Qinliang Wang, Timothy Tian Tran Wang, Yun Zhi Wang, Wenzheng Wang, Philip Warner, Benjamin Nathan Welch, Patrick Wells, Steven Whalen, Kaitlin Marie Wheaton, John Timothy Wieland, Mitchell Owen Wiemer, Sarah Wiley, Brogan J. Williams, Brady Wallace Wilson, Leah Ann Windt, Nicky Inkrais Witras, Amanda M. Wolfgang, Erica Wong, Sebastian Mathew Wong Chi Jin, Katherine Wood, James Barrington Woolford, Frederick Wallace Wright, Han Xia, Chaoqin Xie, Xiaoyan Xie, Yaqi Xie, Fan Xu, Patricia Xu, Jia Xue, Alain Yaacoub, Haoxiu Yang, Qian Yang, Uk Yang, Wanyi Yang, Yabing Yang, Yi Yang, Jikai Yao, Annie H. Ye, Zhiyun Ye, Chase D. Yetter, Connie Yeung, Jiajia Yin, Chelsea Yost, Jia You, Xuan You, Jeron Young, Joshua B. Young, BinBin Yu, Brandon Ken-shing Yu, Guang Qu (Annie) Yu, Haoyang Yu, Jimmy Yu, Tony Ho Ching Yung, Nick Zaharopoulos, Stanley Michael Zalewski, Thomas Christopher Zdarsky, Edward Xiang Zeng, Huiru Zhang, Juntao Zhang, Ke Zhang, Mengqi Zhang, Nihui Zhang, Rui Zhang, Wenzheng Zhang, Weijing Zhao, Qin Mei Zheng, Yuqing Zheng, Yang Zhou, Chong Zhu, Adam Zimmerer, David Eric Zomber, Nabeel Saeed Zuberi, Danish Zulfiqar.

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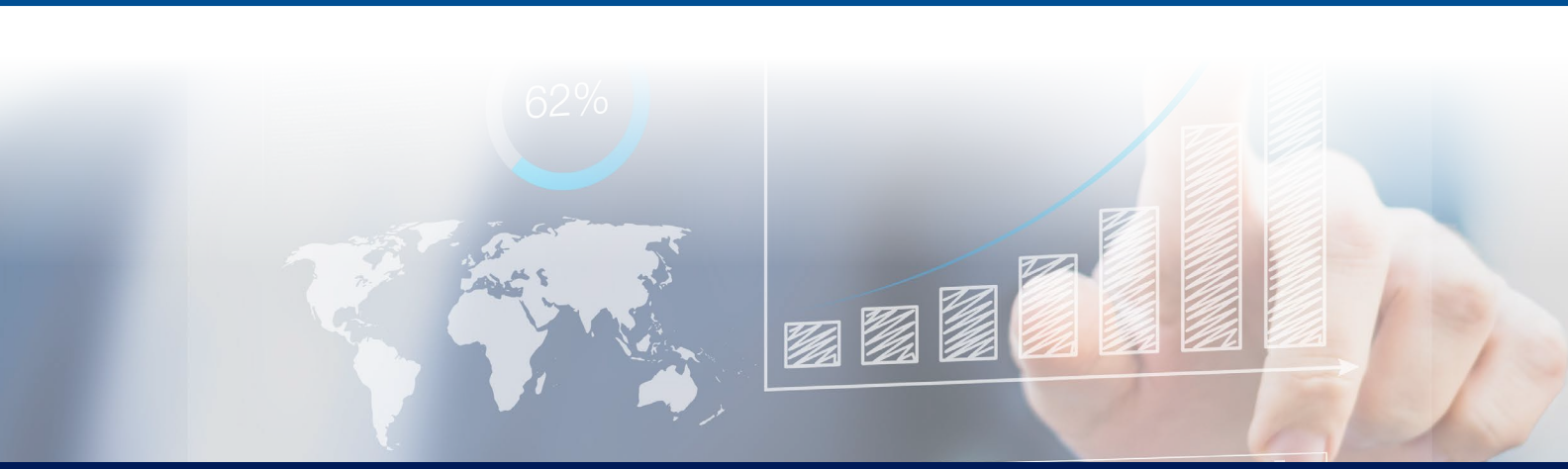

Certified Catastrophe Risk Management Professional (CCRMP) and Certified Specialist in Catastrophe Risk (CSCR)

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

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- Introduction to Catastrophe Modeling Methodologies
- The Cat Modeling Process
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Required assessments and courses for earning the CSPA include:

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- Predictive Modeling — Methods and Techniques
- Case Study Project
- Online Course on Ethics and Professionalism

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

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Graphical Representation and Regression Formulation of Link Ratios

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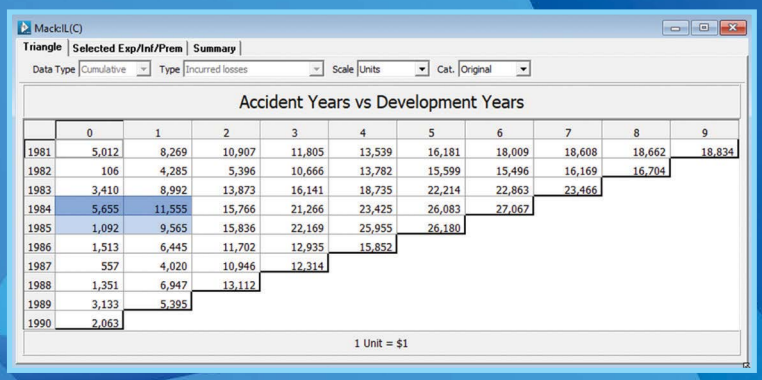
Thomas Mack identified the stochastic regression model that underlies volume weighted average link ratios. Other authors, including Murphy and Venter, have developed these ideas further. A graphical representation and regression formulation of link ratios makes it clear what assumptions underpin the methods and extensions thereof.



	0	1	2	3	4	5	6	7	8	9
1981	5,012	8,269	10,907	11,805	13,539	16,181	18,009	18,608	18,662	18,834
1982	106	4,285	5,396	10,666	13,782	15,599	15,496	16,169	16,704	
1983	3,410	8,992	13,873	16,141	18,735	22,214	22,863	23,466		
1984	5,655	11,555	15,766	21,266	23,425	26,083	27,067			
1985	1,092	9,565	15,836	22,169	25,955	26,180				
1986	1,513	6,445	11,702	12,935	15,852					
1987	557	4,020	10,946	12,314						
1988	1,351	6,947	13,112							
1989	3,133	5,395								
1990	2,063									

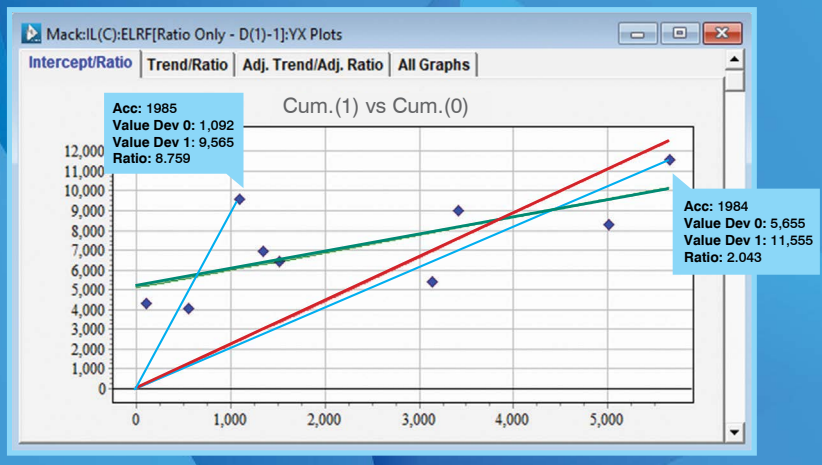
"There is pleasure in recognizing old things from a new viewpoint."
Richard Feynman

Consider the (diagonally opposite) Incurred Loss triangular data from the American Reinsurance Association.

In general, each link ratio (y/x) is the slope of the line from the number pair (x,y) to the origin.

The graph below plots the cumulatives in development year one versus the cumulatives in development year zero for accident years 1981 to 1989.

The caption on the right is for the point (5,655, 11,555) corresponding to accident year 1984. The caption on the left is for the point (1,092, 9,565) corresponding to accident year 1985. The slope of the blue lines represent the corresponding link ratios – which is 2.043 for 1984 and 8.759 for 1985.



Accordingly, an average link ratio, equivalently average trend, is an average slope through the origin.

This means that the method can be formulated as a regression (Mack (1993)).

Let y(w) denote the cumulative in development period j for accident year w and x(w) the cumulative in the previous development period, j-1.

We can write,

$$y(w) = b * x(w) + e(w), \ldots (1)$$

where b is the slope of the line (equivalently, the average link ratio), and e(w) is the difference between the actual value y(w) and the corresponding point on the average link ratio line (b * x(w)).

When actuaries use link ratios there are two critical assumptions:

- The expected value of the next cumulative is conditional on the previous cumulative multiplied by an unknown factor.
- The selected link ratio (factor) is optimal for prediction.

The optimum value of b is found by weighted least squares estimation according to the scale of the error terms e(w).

Let the variance of $e(w) = v * x(w)^{delta}$

For the following values of delta (0, 1, 2):

- 0, or constant variance, the weighted least squares estimated of b is the volume squared weighted average link ratio.
- 1, the weighted least squares estimate of b is the volume weighted average link ratio – sometimes called the chain ladder ratio.
- 2, the weighted least squares estimate of b is the arithmetic average link ratio.

In the graph (previous page), the red line is the best least squares line through the origin and the green line is the best least squares line that includes an intercept. The latter appears to be a better model.

Murphy (1994) extended the regression formulation to include an intercept term.

$y(w) = a + b * x(w) + e(w)$, … (2)

where a is the intercept term, but b is no longer the average link ratio.

Given that the intercept is positive in the previous graph, the slope of the line with an intercept term is less than any average link ratio (through the origin).

We can obtain visual indications of whether a line with an intercept (Murphy (1994) method) or a line through the origin (Mack (1993) method) is better.

Most importantly, the focus should be on the incremental model, Venter(1998), even if a = 0:

$y(w) - x(w) = a + (b-1)*x(w) + e(w)$, … (3)

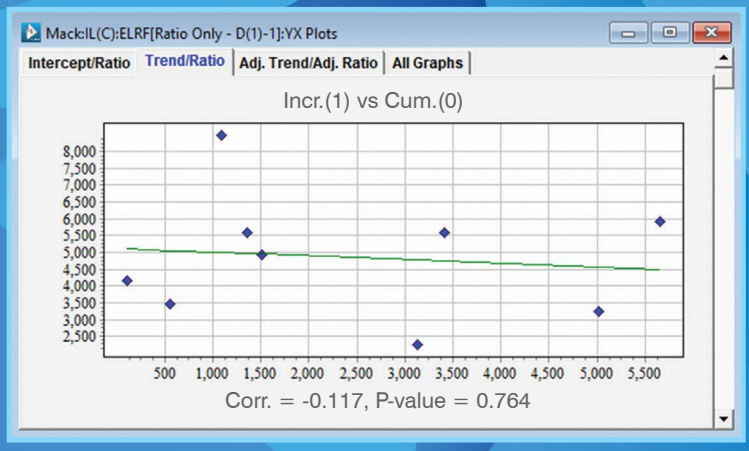
where y(w) – x(w) is the incremental data point.

When you use a link ratio to project the cumulative in the next period in essence you are only projecting the next incremental as you know the current cumulative. This is the reason all the focus should be on equation (3) not (2).

But what if b in equation (3) is statistically equal to 1, (Venter(1998))?

Then the incrementals in development periods (j) are not correlated to the cumulatives in the previous development period (j-1). That is, any ratio applied to the cumulatives does not predict the incrementals!

Here is a graph (right) of the incrementals in development year 1 versus the cumulatives in development year 0.



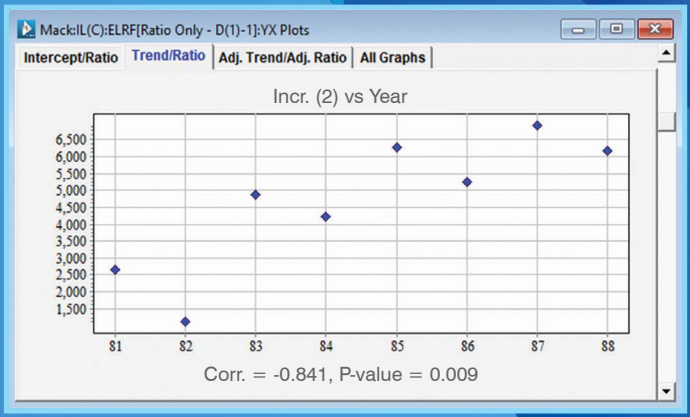
Note that the correlation is zero (slope not statistically significant). Equivalently b–1 = 0.

In this case, the reduced model only contains an intercept term.

$y(w) - x(w) = a + e(w)$ … (4)

In this model, the incrementals across the accident years are random numbers from a distribution with mean a, and variance, Var(e(w)). If e(w) has a constant variance, then the ordinary least squares estimate of a is the arithmetic average of the incrementals y(w) – x(w).

It turns out, if you graph the incrementals in any development period against the cumulatives in the previous period, you will note that there are no statistically significant correlations. All the b-1 parameters are statistically zero.



The assumption that the incrementals are random, might not be true. A case in point, is development period two. This suggests that we need to include an accident year trend parameter in model (3).

The equation that includes the intercept, accident year trend and slope can be written:

$$y(w) - x(w) = a_0 + a_1 * w + (b-1)*x(w) + e(w), \ldots (5)$$

where a_0 is the intercept, a_1 is the accident year trend parameter and b-1 is the incremental coefficient.

The family of models included in the **Extended Link Ratio Family (ELRF)** are represented by equation (5) between each two consecutive development years. The significance of the parameters is determined by the data.

Mack:IL(C):ELRF[Best dellta=0?1]:Regression Table

ELRF Parameter Estimates

Development Period	Intercept			Trend			Ratio			
	Est.	S.E.	P-Value	Est.	S.E.	P-Value	Est.	Ratio-1	S.E.	P-Value
0~1	4,849.33333	611.65863	0.00005	****	****	****	1.00000	0.00000	0.00000	0.00000
1~2	2,309.50000	744.19326	0.02103	678.00000	177.89622	0.00885	1.00000	0.00000	0.00000	0.00000
2~3	3,267.14286	883.07057	0.01009	****	****	****	1.00000	0.00000	0.00000	0.00000
3~4	2,717.66667	296.35234	0.00026	****	****	****	1.00000	0.00000	0.00000	0.00000
4~5	2,164.20000	551.44695	0.01718	****	****	****	1.00000	0.00000	0.00000	0.00000
5~6	839.50000	400.27168	0.12689	****	****	****	1.00000	0.00000	0.00000	0.00000
6~7	625.00000	24.02776	0.00147	****	****	****	1.00000	0.00000	0.00000	0.00000
7~8	294.50000	240.50000	0.43596	****	****	****	1.00000	0.00000	0.00000	0.00000
8~9	172.00000	0.00000	0.00000	****	****	****	1.00000	0.00000	****	****
To Ultimate							1.00000	0.00000	0.00000	****

Delta = 0, AIC = 738.5
If the test is to be conducted at an overall 5% level, a parameter
would be regarded as insignificant if the corresponding P-Value is greater than 0.005116

Link ratios have no predictive power for this incurred loss development array. The optimal combination of parameters uses simply an intercept term with the exception of the regression equation between development periods 1 and 2 where an accident year trend is also statistically significant.

Mack, T. (1993). Distribution-free calculation of the standard error of chain ladder reserve estimates. ASTIN Bulletin: The Journal of the IAA, 23(2), 213-225.

Murphy, D. M. (1994, March). Unbiased loss development factors. In CAS Forum (Vol. 1, p. 183).

Venter, G. G. (1998). Testing the assumptions of age-to-age factors.
In Proceedings of the Casualty Actuarial Society (Vol. 85, pp. 807-847).

Volume weighted average link ratios do not distinguish between accident years and development years

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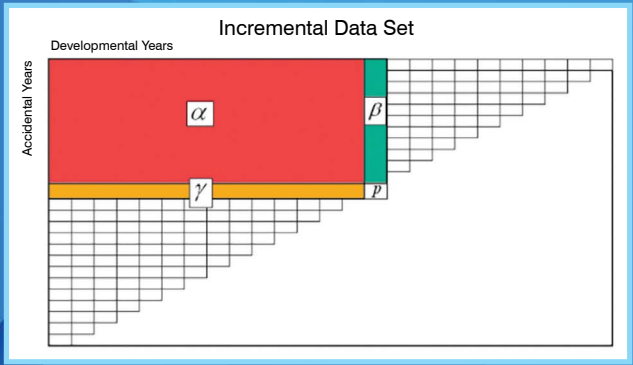


Consider any triangle with incremental values where:

- alpha denotes the sum of the values in the red rectangle,
- beta denotes the sum of the values in the green rectangle (one development year), and
- gamma is the sum of the values in the orange rectangle (one accident year).

Let p denote the incremental value projected for the accident year represented by the gamma values for the next development year.

The value alpha represents both the aggregate of the row sums in the red rectangle and the aggregate of the column sums.

The volume weighted average when you cumulate the triangle in the traditional way is (alpha + beta) / alpha. If you cumulate the triangle for each development year down the accident years, then the volume weighted average is (alpha + gamma) / alpha.

Accordingly:

$$p = \gamma\left(\frac{\alpha+\beta}{\alpha}-1\right)=\frac{\gamma\beta}{\alpha}$$

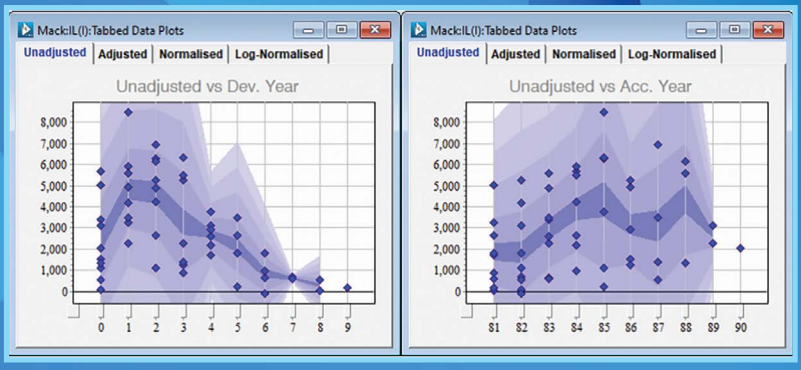
If you cumulate along the development years, and

$$p=\beta\left(\frac{\alpha+\gamma}{\alpha}-1\right)=\frac{\beta\gamma}{\alpha}$$

If you cumulate along the accident years. QED.

We know that development years are not like accident years.

CONCLUSION: Link ratios have got nothing to do with the structure of the data.



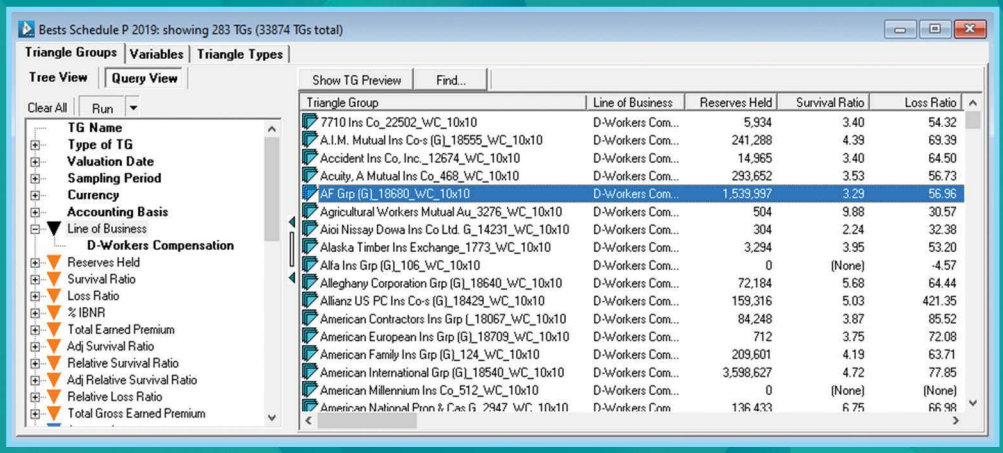
For the incurred array we plot the incremental values versus development year. We also plot the values versus accident year. Note the different structure.

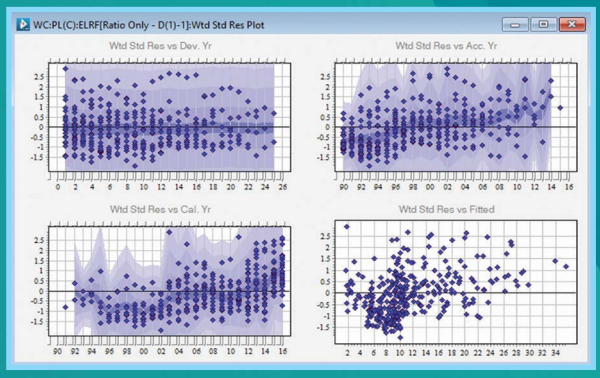
Clearly, we expect any incremental loss development array to decay to zero, but you would not expect the same pattern down the accident years.

ELRF™ 2020

ELRF™ 2020 is for P&C actuaries who want to take advantage of the graphical representation and regression formulation of link ratios, and extensions thereof.

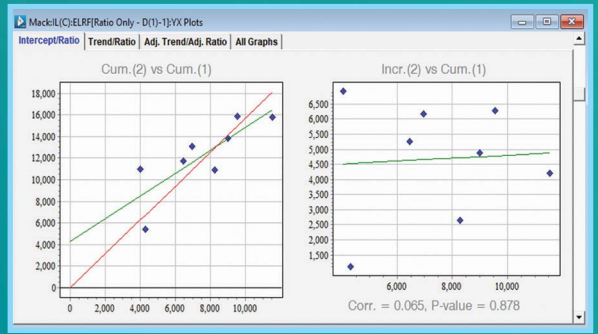
All this, coupled with the power of a relational database are included in ELRF™ 2020. All the information in the database including data, models, and results, are a mouse click away. Accessing data and information through the ELRF™ 2020 application is a pleasure.





The Extended Link Ratio Family (ELRF) modeling framework provides diagnostics for testing assumptions.

Residual plots versus development period, accident period and calendar period are also used to assess model specification error. Any patterns in the residual plots show features of the data that the method is not describing.



The Y versus X and Y - X versus X plots (left) provide diagnostic testing of the intercept and ratio minus one. Formal tests are provided in the regression tables.

Here there is no relationship between the incremental Incurred in development period 3 with the cumulative Incurred in development period 2. Link ratios do not have predictive power.

ELRF™ 2020 Standard:

- Over 144 link ratio methods including Bornhuetter-Ferguson and Expected Loss Ratio Methods
- Link ratio methods formulated as regression estimators
- Extensions including intercept (Murphy) and constant accident year trends for each development year
- Diagnostic tools
- Bootstrap distributions by accident year, calendar year and total

ELRF™ 2020 Professional:

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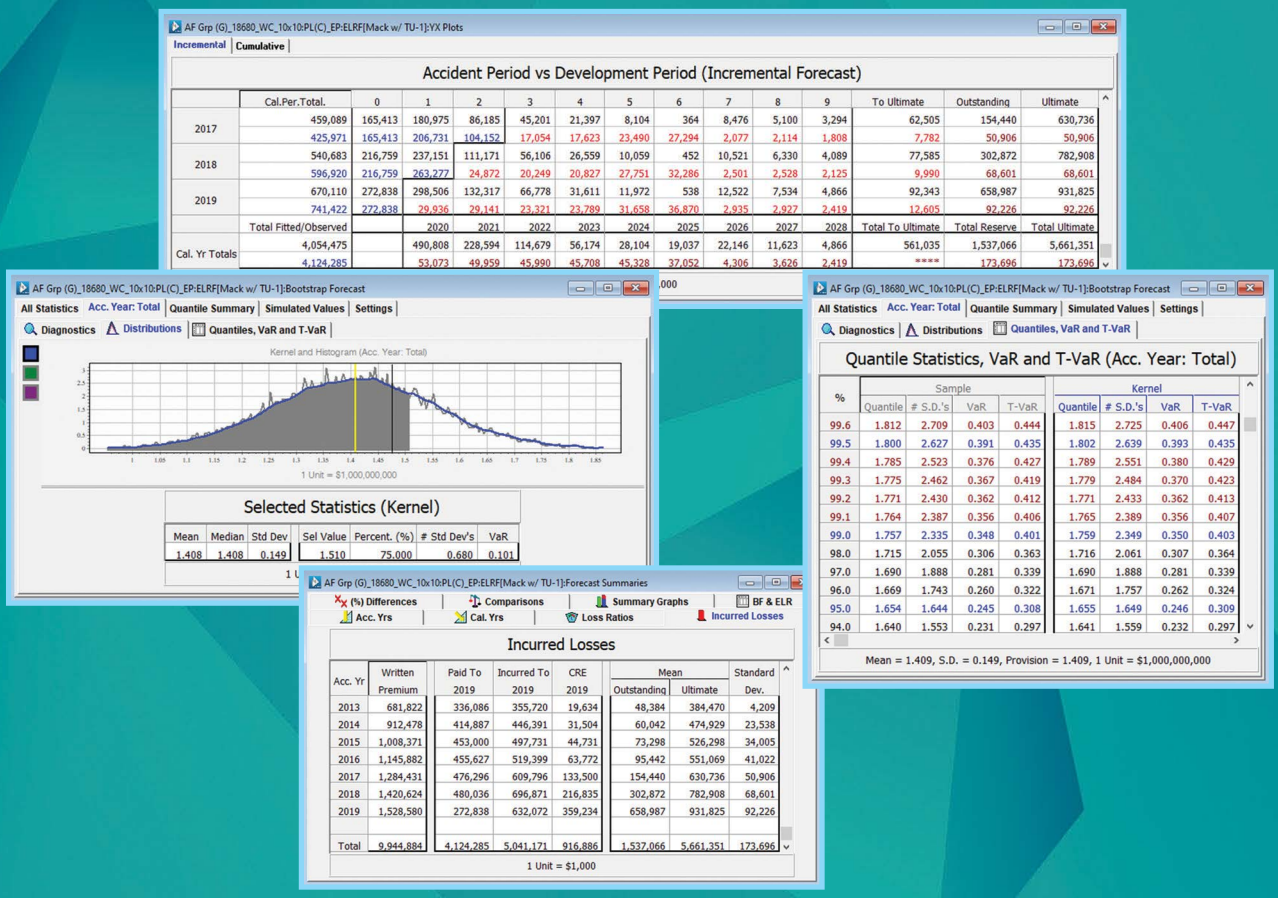
- Extended report templates
- Server database (Oracle & SQL Server)

ELRF™ 2020 affords benefits at warp speed unlike any other reserving product.



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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."

The Thalassophile

Richard D. Thomas (FCAS 1994)
1958-2020

Richard "Dick" David Thomas died suddenly on December 18, 2020, at the Jersey Shore University Medical Center in Neptune, New Jersey. He was 62 years old. He was born on Aug. 6, 1958, to Richard and Carole (Kilbourne) Thomas in Summit, New Jersey and earned his bachelor's degree in mathematics at Rutgers University before becoming a credentialled actuary in 1994. For most of his career, he worked at Berkeley Re, becoming the company's vice president of actuarial reserving. At the time of his passing, Thomas was actuarial reserving director for Arch Reinsurance Company in Morristown, New Jersey. His favorite things in life were his family, Florida, the beach, Bruce Springsteen and dogs. Dick Thomas was a die-hard New York Jets fan and enjoyed many trips to Disney. In the summer, he could always be found in his backyard mixing up boat drinks by the pool or tending to his flowers. He was a member of the Metedeconk River Yacht Club and Fleet 34 of the International Lightning Class Association. He is survived by his wife, Susan Jean Thomas; one daughter; one stepson; two stepdaughters; two sisters and two grandchildren.

The Actuarial Translator

Dale A. Nelson (FCAS 1965)
1935–2021

Dale A. Nelson had a knack for explaining auto insurance actuarial concepts to non-actuaries. From *The New York Times* to the halls of the United States Congress, Nelson did his part to explain the actuarial issues of the day. The beloved actuary, known for his intellect and humility, died in Peoria, Illinois, on July 21, 2021. He was 85 years old. He was born in Ottawa, Illinois, on Dec. 30, 1935, to Alfred M. Nelson, an auto shop supervisor who descended from Norwegian immigrants, and Ella (Holm) Nelson. Nelson graduated from Knox College with a bachelor's in mathematics in 1958 before moving on to Princeton University, where he earned a master's degree. After completing all of his classroom requirements for a doctorate, he accepted a job at State Farm Insurance. A committed volunteer to the actuarial profession, he received the Matthew Rodermund Memorial Service Award in 1995. Committed to the study of mathematics, he sponsored lectures through Knox University called MathTalks. One in particular covered, "America's Love-Hate Relationship with Mathematics." He is survived by his sister, Ellen Titus; his nieces and nephews; friends and colleagues. He was preceded in death by his parents and his sister, Ann Ritzius. Nelson's family would like to thank the staff at Lutheran Hillside Village for their wonderful care and kindness to him. Memorial contributions may be directed to the Salvation Army or Project Hope. An online guestbook is available at www.MuellerFH.com.

The *Actuarial Review* Reporter

Martin Adler (FCAS 1969)
1934-2021

Marty Adler was born August 12, 1934, and died Jul. 17, 2021. He was 86 years old. He was the beloved husband of Harriette Adler and devoted father of Jeff (Faith) Adler, Lorraine (Philip) Altschuler and Sharon (Ron) Gross. He is survived by sister Marilyn Stamberg and grandchildren, Jacob, Ethan, Evan, Sam, Amanda and Alex. Memorial contributions may be made in his memory to Congregation Har Shalom or Congregation Hevrat Shalom. Jaci Pasley, a fellow actuary and colleague of Adler's, wrote of him: "Professionally, he was extremely well respected and set a great example for younger actuaries. I probably learned more from him than everyone else combined. He could always laugh at himself. We would joke with him about his rigid formatting rules or his 'Mr. Rogers' cardigan or the sweets he hid from Harriet, and he laughed with us." Pasley noted, "he seemed like a different person when he became a grandfather. I know how much he loved his family." After retiring, Marty Adler worked for *Actuarial Review* for many years, finding and writing stories for the column "Nonactuarial Pursuits of Casualty Actuaries." Now called "Downtime," the column featured CAS members' outside activities, from the unusual — cheesemaking, roller coaster riding and sheep farming — to the common — running, biking or walking great distances. Adler thoroughly enjoyed his reporting job. "Marty's enthusiasm

was such a joy to me," said *AR* Managing Editor Elizabeth Smith. "I miss our conversations."

The Persistent Soul

Paul M. Wiegert (ACAS 1975)
1937-2020

When a car accident confined Paul M. Wiegert to a wheelchair in 1963, he did not allow his disability to interfere with his becoming an actuary. He had faced harrowing challenges before. Ten years earlier he served three years in the U.S. Army's 77th Special Forces as a Green Beret paratrooper in post-WW II Germany. The man who lived his life never holding back passed away on October 27, 2020, after a short hospital stay at Aspirus Wausau Hospital in Wisconsin. He was 83. Born Jun. 30, 1937, in Appleton, Wisconsin, he was the son of the late Melvin and Bertha (Beach) Wiegert. On April 25, 1959, he married Luella Leick, and together the couple had three children. In 1970 he earned his master's degree in mathematics from the University of Illinois. He retired as the director of homeowners and auto pricing for Sentry Insurance in Stevens Point, Wisconsin, in 1994. Despite being a paraplegic for 58 years, he lived a full life. He enjoyed boating, woodworking, flying radio-controlled airplanes, pampering his lawn and traveling with his wife. The couple also lived in the home they built on Lake Dubay, Wisconsin and spent 23 retirement winters in Panama City Beach, Florida. He is survived by his wife, three children, eight grandchildren, eight great grandchildren, five siblings and many nieces and nephews. Please send donations to a charity of your choice. To express online condolences, please visit www.petersonkraemer.com.

The Airplane Instructor

James T. French (ACAS 1968)
1931–2021

James T. French died at home in Osceola, Wisconsin, on July 9, 2021, surrounded by family after two years of declining health. He was 90 years old. He was born January 11, 1931, in Peterson, Iowa, to Clifford DuBois and Annie Marie (Tumler) French. He had one brother, Jerre. French attended high school in Spencer, Iowa, and graduated from Iowa State University in 1953 with a bachelor's degree in industrial economics. Upon graduation, he enlisted in the U.S. Army and was assigned to counterintelligence. After receiving basic conversational training in Japanese, he served an 18-month tour in Korea. He was immensely proud of his military service and regarded it as life-enriching. Afterwards, he worked for the Continental Casualty Company in Chicago for 19 years as an actuary, later accepting a position at Mutual of Omaha. He retired from ITT Life Insurance Company as senior vice president and CFO in 1996. In 1982 he married his wife Judy (Greer) in Hennepin, Minnesota. During retirement, the couple moved to the St. Croix River Valley, Wisconsin, area in 2001. French loved airplanes and obtained his private pilot's license while living in Chicago, eventually becoming certified as a flight instructor. He loved his dogs, country living, classical music and the Nutcracker Fantasy, as well as having a project to tinker on. He is survived by his wife, two children, two stepchildren, three grandchildren and two great-grandchildren. Donations in his memory may be given to Arnell Memorial Humane Society in Amery, Wisconsin, or the Nature Conservancy.

The Coach

Ronald J. "Ron" Zaleski Jr. (FCAS 2005)
1979-2021

Ronald J. "Ron" Zaleski Jr. passed away unexpectedly on September 3, 2021, in Huntingdon, Pennsylvania. A youth baseball, basketball and football coach, Zaleski was a firm believer that everyone should put their best effort into everything they do, learn the rules of the game, play fair and ask questions. Born on November 13, 1979, in Baltimore to Ronald and Carla (Gardner) Zaleski, he graduated with a mathematics degree from Loyola University, Maryland, in 2021. Before his death, he was vice president of insurance analytics at Mutual Benefit Group, which he started in 2016. During his career, he worked for the Bankers Insurance Group, the Hanover Insurance Group, Liberty Mutual Insurance and Farmers Insurance. Zaleski served on the implementation task force for the CAS Educational Paper on Ratemaking from 2007 to 2009 and was a member of the CAS Ratemaking Committee from 2007 to 2015. When Zaleski wasn't working or coaching, he loved playing video or tabletop games. He also enjoyed cooking. The Baltimore native was a faithful fan of the Orioles and the Ravens. He is survived by his wife of more than 16 years, Kelly (Taggart) Zaleski; their children, Joshua, Michael and Megan; his parents, Ronald Zaleski Sr. (retired actuary) and Carla (Gardner) Zaleski; and his sisters. Memorial contributions should be made to Huntingdon youth organizations, the Huntingdon Community Center or Huntingdon Regional Fire and Rescue. To sign an online guest book and express condolences, visit www.johnbbrownfuneralhome.com.

INFLATION NATION

Escalating inflation adds another layer atop rising losses

By Annmarie Geddes Baribeau

The year-end loss reserving season was a bit different this year for Chris Gross, CEO of Gross Consulting. For the first time in a decade, he added an explicit adjustment to reserve estimates to reflect higher inflation expectations. Although the adjustment is subjective, he said, it will help prepare his clients for the future. At the very least, he offered, reserving actuaries should acknowledge the changing inflation environment in their actuarial reports.

From loss reserving to pricing and rating, changing inflation trends are having an impact on property-casualty insurance. "Inflation leaves its imprint on practically every aspect of the insurance industry," said Jeremy P. Pecora, who spearheads the Willis Towers Watson Claim Cost Index.

For property-casualty insurers, soaring inflation is exacerbating already-escalating loss trends. Although economists in early 2022 were optimistic that accelerating inflation would subside by the end of the year, the fallout from recent world events is likely to pressure inflation upwards into 2023. Russia's war against Ukraine and major COVID-19 lockdowns in China are affecting prices and global supply chains, fanning the flames of inflation and slowing the pace of economic growth in the U.S.

Said James Auden, managing director and P&C sector head for Fitch Ratings' North American insurance rating group, "For actuaries, previous claims and loss payment experience may be less helpful in projecting future losses going forward in this environment." Auden added that both economic uncertainty and inflation concerns "are key factors promoting demand for coverage and [the] likelihood that rising premium rates in many lines will continue into 2023."

An economy in flux

P&C insurance experts began ringing inflation alarm bells about a year ago. While consumers started to tighten their belts in response to rising food and energy costs, insurers were already experiencing rising repair and replacement costs.

When inflation rates are stable and predictable, insurers can easily adjust. During transition periods when inflation shifts dramatically, factoring for inflation is like chasing a moving target. A shift in monthly inflation can be temporary or it could be a sign of more to come.

Inflation began climbing as the U.S. economy quickly recovered from the pandemic-driven recession in 2020 and intensified in 2021, said Robert P. Hartwig, clinical associate professor at the finance department and director of the Center for Risk and Uncertainty Management at the University of South Carolina. The Consumer Price Index (CPI) from 2019 to 2020 rose a barely perceptible 1.4%, but then jumped to 4.7% in 2021, according to the U.S. Bureau of Labor Statistics (BLS). The development marked the fastest pace of increase in the general price level since the Great Recession of 2008.

Property Coverage — Homeowners and Commercial

Like auto insurance, loss trends for property coverage were rising before COVID-19 disrupted the economy. "Property insurance costs, in particular lumber and construction wages, are where the headline inflation is," said Conning's Bill Burns.

After five years of record-breaking weather events, property insurers were rethinking deductibles and coverage limits before the COVID-19 pandemic lockdowns began in March 2020. Commercial property insurers then were also encouraging customers to take risk management more seriously while raising deductibles and tightening underwriting.

While Mother Nature continues to be relentless, the COVID-19 pandemic ushered in multifold complications to repairing and replacing property. From December 2019 through December 2021, the price of construction materials rose by 44.1%, with some lumber prices in mid-2021 up 400%, said Robert P. Hartwig.

The high cost of lumber is not just due to growing demand, he said. But the lack of truck drivers impacting the supply chain, fewer mills, and tariffs imposed by the U.S. on Canadian lumber are contributing to higher building costs. The cost increases contribute to higher costs reflected in the shelter category in the CPI, which includes owned and rented dwellings.

Shelter costs, which cover overall housing prices, make up 32% of the CPI. According to the BLS, costs within the shelter category increased 1.8% in 2020 and 4.1% in 2021. "We see housing going up with inflation through 2022," said Molly Boesel, principal economist at CoreLogic, explaining that actual rents are higher than what the CPI is showing because it takes nine to 12 months for market change to appear in the CPI.

From December 2020 to December 2021, Boesel said that rent and housing prices combined went up across the board quickly by 11% to 12%. The CoreLogic HPI shows an 18.8% gain. "Higher rents are linked to the continuing rise in home prices," she added.

From the post-Great Recession period until a year ago, a decade of tepid but predictable U.S. Treasury note and bond returns have challenged insurers' capacity to bridge the gap between rising losses and collected premium.

The first two months of 2022 ushered in the fastest inflation growth since the early 1980s. Month over month, the CPI rose by 0.8% in February after a 0.6% increase in January, according to the BLS. In March, the CPI rose an additional 1.2%, fueled by the gasoline index, which rose 18.3% in March, along with other increasing energy component indexes. For the 12-month period ending March 2022, the all-items index escalated to 8.5%, marking the largest increase since the period ending December 1981, according to the BLS.

Much of the inflation surge stems from the fallout of the COVID-19 pandemic and associated lockdowns that began in March 2020. Hartwig said that the $5.7 trillion in relief and stimulus dollars, supply chain disruptions, labor shortages and energy market disruptions are all contributing factors. The Federal Reserve Board's recent rate hike — with many more expected to come — represents the Fed's primary response tool for combating rising prices, he added.

From the post-Great Recession period until a year ago, a decade of tepid but predictable U.S. Treasury note and bond returns have challenged insurers' capacity to bridge the gap between rising losses and collected premium.

Anticipating the impact of future inflation is tough. Past high inflationary periods took place in different economic circumstances. For example, high unemployment and double-digit inflation defined a decade of misery from 1974 to 1983, Hartwig said. However, U.S. Treasury yields — pushed into the double digits by actual and anticipated inflation — allowed insurers to materially increase investment income. During the 1990s, the CPI hovered around 5% and was steady.

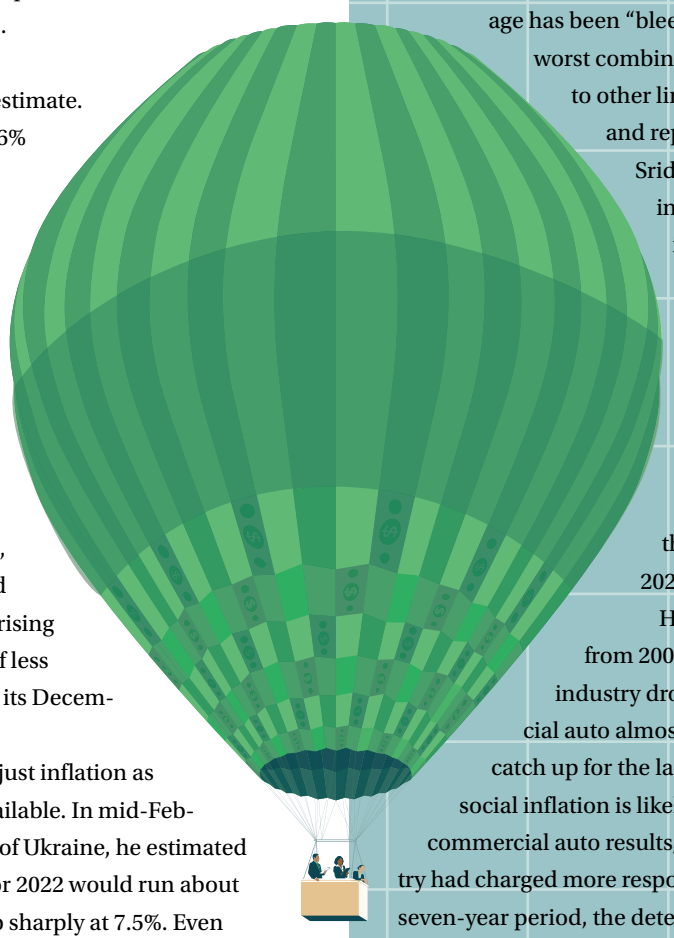
Globalization and the offshoring of production during the past 40 years resulted in increased efficiency. At the same

time, U.S. dependence on other countries for raw materials and production capacity increased. Supply chains were stretched thin, assuring that major disruptions outside the United States would produce ripple effects on the U.S. economy. The Russian attack on Ukraine and renewed lockdowns in China are two recent examples; both have been pressuring prices in the U.S. by disrupting supplies of oil, grain, fertilizer and other materials that are necessary for everything from growing food to manufacturing semiconductors. The looming potential for World War III makes investors more nervous.

Such conditions make it more difficult to anticipate future inflation. Earlier this year, insurance economists were assuming that reinvigorated supply chains, higher interest rates and low unemployment rates would pressure inflation downward in the second half of 2022.

But that is changing.

Fitch revised its inflation estimate. Instead of inflation falling to 2.6% at the end of 2022, the rating company is now forecasting that inflation will decelerate to 4.5% by year's end, eventually declining to 2.6% in 2023, according to the organization's "Global Economic Outlook — March 2022." The report noted that the forecast adjustment is due to "faster Fed rate hikes than anticipated, tighter financial conditions and the drag on real incomes from rising inflation," and the likelihood of less fiscal support than assumed in its December report.



Hartwig continues to readjust inflation as more information becomes available. In mid-February, before Russia's invasion of Ukraine, he estimated that the annual inflation rate for 2022 would run about 5.5%. Today, that estimate is up sharply at 7.5%. Even before 2022's inflationary surge, the insurance industry was already paying more for some specific vital goods and services, he said.

Rather than boost interest rates by 50 basis points in March as initially anticipated, the Fed prescribed a lower increase of 25 basis points with promises of six more rate hikes.

Auto — Personal and Commercial

Before COVID-19 adversely affected the U.S. economy, auto insurers had already started to replace newer vehicles rather than repair them because it was less expensive (see "Moving Parts," *AR* November-December 2019). Upgrading to a new or newer car has become more costly due to COVID-19-associated supply chain shortages, particularly those involving computer shortages. Sanctions against Russia for its attack on Ukraine means nickel and palladium, essential for building electric vehicles, could be harder to procure.[1]

More expensive repair and replacement costs are not the only influences on losses. Commercial auto coverage has been "bleeding a lot," suffering the worst combined ratio results compared to other lines, partially due to repair and replacement costs, said Sridhar Manyem, director of industry research & analytics at A.M. Best. "Before COVID-19 arrived, social inflation, rather than economic inflation, was pressuring the line," he added (see "Commercial Auto Woes," *AR* May-June 2019 and "Tipping the Scales," *AR* July-August 2020).

However, Bill Burns said that from 2004 to 2011, the insurance industry dropped prices for commercial auto almost 35% and has been playing catch up for the last several years. While social inflation is likely having some effect on commercial auto results, he observed, if the industry had charged more responsible prices during this seven-year period, the deterioration in results would have been less severe.

[1] https://www.forbes.com/sites/laurendebter/2022/02/02/russia-sanctions-palladium-car-manufacturing/?sh=2f25a8b3c376

This is where inflation comes into play as part of the actuary's assessment of future average costs of claims; even if inflation is low, the average cost of claims generally goes up.

The Fed anticipates that fighting inflation is becoming more complex,[1] marking the first interest rate increase since 2018.

Growing Losses

Citing BLS data, Hartwig noted that from January 2020 to January 2022, the cost of new and used vehicles surged by 54.6%, putting significant pressure on the CPI. Auto manufacturer supply chain issues are expected to linger well into 2022. Personal auto insurance premiums, he said, which make up 1.57% of the CPI, are expected to rise by 3.5% to 5% in 2022 (see sidebar, "Auto — Personal and Commercial"). Property insurance costs have also risen significantly (see sidebar, "Property Coverage — Homeowners and Commercial").

From 2015 to 2020, eight P&C lines measured by the Willis Towers Watson Claim Cost Index were above the CPI. The index, which Pecora said is frequently used in reserving analyses to adjust losses to present value, can be used as an indicator of the rate of change in claim severity. The index is based on several sources, including the CPI and producer price index (PPI), to reflect "insurance inflation."

General inflation adds a layer of about 1.25% to 1.50% to insurance inflation, Pecora said. The index's composite insurance inflation rate has been outpacing the overall inflation rate for each year from 2013 to 2021 (preliminary), excluding 2018.

Actuarial Adjustments

In ratemaking, claims severity is estimated by looking at a variety of internal and external data to make actuarially appropriate selections, said Steven D. Armstrong, FCAS, past president of the Casualty Actuarial Society. "This is where inflation comes into play as part of the actuary's assessment of future average costs of claims," he said, adding that even if inflation is low, the average cost of claims generally goes up.

Armstrong said that the actuarially justified rate increases in personal auto in this current environment can reach double digits. "Not all companies willfully act on these actuarial projections because the impact of the consumer needs to be considered," he added. This is especially true when inflation is already weighing on customers due to higher food, gas and energy costs. Armstrong adds that this is part of the continuous balance of achieving needed premium and maintaining customer growth and retention.

Underestimating inflation leads to higher-than-expected future liabilities, said Bill Burns, ACAS, insurance research director of Conning. Depending on the line of business, a 1% increase in inflation, he added, could result in an average 2% to 3% increase on the calendar-year loss ratio.

"If inflation is expected to rise 3% a year, but actual inflation is 4%, future losses will rise in varying amounts by line of business, based on the duration of the liabilities," Burns said. For example, a 1% unexpected increase in inflation would affect the combined ratio for short-tailed lines, such as auto and property coverage, by around 1%. However, for a long-tailed line of business such as medical malpractice, Burns said, the same 1% higher-than-expected inflation hike may increase the combined ratio by more than five points (see sidebar, "Inflation Poised to Impact Workers' Compensation").

"Development factors are influenced by inflation," Gross

[1] https://www.cnbc.com/2022/03/16/why-feds-first-rate-hike-since-2018-isnt-the-key-to-economys-future.html

said, but the impact of a shift in inflation can take years to be fully reflected in selected development patterns. "There are external predictions of future inflation levels available, but at the end of the day, those are estimates as well," he added. Actuaries should consider several predictions of inflation, Gross said. "The difference between a treasury yield and a TIPS (Treasury Inflation-Protected Securities) yield is one example," he advised.

While working as a life actuary early in his career, Gross learned to pay attention to demographics. A significant change in demographics in China, for instance, will impact inflation in the U.S.. "China has helped keep inflation down in the United States," he said, because its citizens worked for low wages. However, China's workforce is no longer growing, he said, which could allow prices to rise more in the future.

Actuaries should consider new processes. "Reserving and pricing," he added, "need to be linked." By developing individual claim reserves based on actuarial principles rather than claim department case reserves, actuaries can watch and measure the impact of inflation on claims much more quickly and respond in reserving and pricing.

Development factors are influenced by inflation, but the impact of a shift in inflation can take years to be fully reflected in selected development patterns.

Conclusion

Accounting for inflation is tricky, whether the actuary is pricing premium or setting reserves. The past can be forward-predictive in some potential ways. At the same time, the insurance industry is facing never-before-seen circumstances. As Gross said, actuaries must at least mention inflation in their reports to prepare regulators, the C-suite, investors and others that inflation could intensify already-challenging circumstances. Looking for new ways to detect inflation's influence will make a big difference as well. ●

Annmarie Geddes Baribeau has been covering insurance and actuarial topics for more than 30 years. You can reach her by writing annmarie@insurancecommunicators.com.

Inflation Poised to Impact Workers' Compensation

Workers' compensation, which can cover injured employees' wage replacement and medical benefits for decades until death, is a classic long-tailed line.

Medical costs, which typically make up about 50% of loss costs, have held steady overall. Year over year, the medical cost category of the consumer price index (M-CPI) rose 2.4% from February 2021 to 2022, said John W. Ruser, president of the Workers' Compensation Research Institute (WCRI).

WCRI publishes an annual medical price index (MPI) for professional services in workers' compensation based on 31 states. From 2008 to 2020, the MPI increased by 19% in the median state, or about 1.5% per year, according to the most recent report released in May 2021. "This is lower than the 1.9% per year increase in the CPI-M Professional Services," said Ruser, who worked for the U.S. Bureau of Labor Statistics, which publishes the CPI.

Fee schedules are helping to quell medical inflation, Ruser said, adding containing medical costs with provider networks are also seeing promising results. Meanwhile, wage inflation is starting to appear in the most recent BLS data, he said. "Wage increases in the range of 5% are being seen in average weekly wages — higher than any time in the past two decades," he observed.

Workers' compensation "is the one line with flat to declining pricing currently in response to strong profits," said James Auden, managing director and P&C sector head for Fitch Ratings' North American insurance rating group. Past experience shows workers' compensation and general liability are more vulnerable to persistent high inflation due to compounding effects and difficulty in estimating losses in these segments," he added.

Jeremy P. Pecora said specific medical components within the CPI are on the rise, including hospital costs, drugs and rehabilitation. "The CPI for drugs seems understated given all the press we read about for increasing drug cost," he added.

How to Make Data and Analytics a Competitive Advantage — from Someone with a Proven Track Record

By JESSICA LEONG, CAS IMMEDIATE PAST PRESIDENT

Many people talk about turning data and analytics into a competitive advantage. Mike Parsons is the rare leader who has actually achieved this across several industries. He did this as the chief operations officer at Bartercard, a trade exchange, and as the general manager at Earthwise, a consumer goods company. Now, Parsons is delivering value at scale through his data and analytics team at Air New Zealand.

Parsons is not from the insurance world, but his knowledge on how to transform companies with data and analytics is relevant for all industries. That's why I was excited to sit down to interview him. Parsons described three key pain points in getting business value at scale from data and analytics:

1. In place of a true analytics strategy, an organization only has a list of projects that people deemed good ideas.
2. Often in an organization there will be one or two examples where the company benefited from analytics, but the consensus becomes: "That was so good, but it was so hard. We never want to do it again."
3. People often get enamored with the technology, and they forget that in real life it has to change a process.

Let's dive into each of these pain points and how to overcome them.

Parsons found that the data and analytics "strategy" at a company was often a list of projects that some people thought were good ideas. But executing a list of random projects is not a strategy.

Instead, he advised that to get to the work that results in true competitive advantage, raise the conversation to a more senior level in the organization. You want to find problems that cut across multiple parts of the business. Parsons explains, "If you've got 30 projects, maybe there's one or two or three big themes. For example, take workforce planning at Air New Zealand. You can do different projects for ground handling, for crew and pilots and for the contact center. Or you can take this up one level and say to leadership — there's a theme here — 'Should we be better at workforce planning?'"

Mike Parsons

Parsons continued stating, "If the leadership are willing to tackle the problem more holistically, you can approach the solution more strategically, and the cost-benefit of the data and analytics project improves."

Executing a list of random projects is not a strategy.

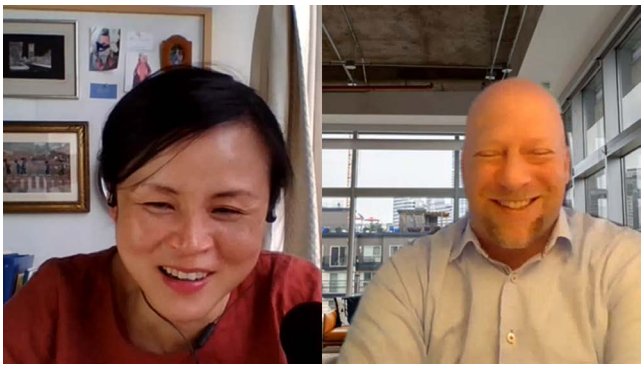
Parsons found that it was common for an organization to experience success, but with practices that took a lot of effort and were hard to replicate. To create a situation where it becomes easier and easier to achieve success, Parsons advocates understanding the plans and clearing roadblocks.

Understanding all plans

It is essential to understand the technology and the business roadmap, not just the data and analytics roadmap. Unlocking data and analytics benefits usually requires a change in business processes and a change in technology. This makes understanding and collaborating on the business and technology roadmaps just as critical as developing the analytics roadmap.

Often in an organization there will be one or two examples where the company benefited from analytics, but the consensus becomes: "That was so good, but it was so hard. We never want to do it again."

Parsons provides an example. Let's say you have built a model that targets individual customers in-store, based on their buying behavior. But "if you've got a mobile app that can't provide dynamic content," Parsons says, "[then you can say to the technology team] hey, there's $50 million of revenue on the table that we cannot extract because we can't personalize this content dynamically." Then



***AR* Web Exclusive:** *Listen to Jessica Leong's interview with Mike Parsons, the current leader for GM Data and Analytics for Air New Zealand. In this interview (found on the CAS YouTube channel youtube.com/user/CASwebmaster), you will learn how to use data and analytics as a competitive advantage in any organization across myriad industries.*

the IT team might modify their roadmap to make the mobile app feature a priority.

Clear roadblocks

Identify obstacles that slow down or stop your data and analytics work. Often analytics teams bump up against invisible obstacles. For example, it might be bad data or overly restrictive policies. The job of the analytics leader is to identify and address these limitations. This seems obvious, but a problem like "bad data" is so large and complex that many leaders ignore it, and their teams continue to make slow progress.

Parsons believes that on analytics initiatives you should spend 10% of the time on the solution and 90% of the time on change management. Effective change management takes a lot of thought, effort and trust. In particular, Parsons provides two pieces of practical advice to bring about change:

1. **Build trust before tackling big change management efforts.**

When working with new business partners, Parsons warns, "Don't give them new data, because when you give them new data and insights, they have to change the way they're doing things. But if you start there, then you're showing up and saying, 'Hey, the way that you're used to doing things, it's no good.'" This is a very challenging place to start.

Instead, to build trust with new business partners, "give people faster data," advises Parsons. For example, let's say your business partners take a month to pull together data and produce a report. The analytics team can automate that process and deliver the report daily. The business partners will be happy; this builds trust, and they will be much more open to new conversations.

2. **Convince one person to change.**

When experiencing broad resistance to change, try finding a group of people, or even just one person, who has the motivation to change.

Parsons shares a story: "I was working with a supermarket chain, and I was producing these amazing category insights." He continues: "I thought these were gold insights. And they were going to make so much money off it. And you know what the category manager said to me? 'I don't care about that … I've been doing it the same way for 20 years. It's actually working pretty well.'"

In situations like this, find a subset of people or even one person more open to change. In this instance, Parsons found an up-and-coming manager who wanted to manage bigger stores. And after working with Parsons and his data-driven insights, that manager got some great results.

Parsons says, "Other people were kind of like, 'Oh, why are you getting those results?' Then you get a little bit of FOMO [fear of missing out]," and you have an internal advocate for change that can start the snowball rolling.

People often get enamored with the technology, and they forget that in real life it has to change a process.

Conclusion

Parsons' three major pain points have nothing to do with the technical aspects of analytics. The real challenge is to align strategy with senior business leaders and to change the behavior of end users. It turns out that getting value out of data and analytics is more of an art than a science.

Jessica Leong, FCAS, is a consultant at Octagram, where she is focused on making data and analytics a competitive advantage for companies in the P&C insurance space. Prior to Octagram, she led the data science team at Zurich North America, where she brought measurable business impact across underwriting, claims and for the customer. Leong is currently Chair of the CAS Board of Directors.

The Computer Knows Your Secrets: The Power, Challenge and Opportunities of AI and Personal Data

By DALE PORFILIO

Most practicing actuaries make a living by using data to solve business problems, so Jennifer Golbeck was invited to be the keynote speaker at the virtual 2022 CAS Ratemaking, Product and Modeling Seminar to share a deeper message about the risks and opportunities of Artificial Intelligence (AI). In her remarks, Golbeck sought to warn us about the invasiveness of AI and the difficulty of avoiding bias when building predictive models. She shared many stories from her own research and from other industries to reinforce her key messages.

Golbeck is a computer scientist, director of the Social Intelligence Lab and a professor in the College of Information Studies at the University of Maryland, College Park. Her research focuses on analyzing and computing with social media and creating usable privacy and security systems. She began her research in AI and social media while a Ph.D. student with a lab of undergraduate students, and she has continued to expand upon her work with social media.

Golbeck shared several examples about Facebook, given its pervasive data collection. A key underlying principle in AI studies is *homophily* — our tendency to connect with people like ourselves. Leveraging these connections, Facebook creates a profile for everyone it can identify in its environment, including those who have never created their own Facebook profiles. They are ready to greet you as soon as you consider becoming a member!

Cambridge University did deep AI modeling of Facebook's user "likes" (all in the public domain) to predict demographic and personality traits of users, including IQ. They found four leading likes that predict a high IQ — science, thunderstorms, *The Colbert Report* and curly fries. Golbeck made clear that it is not necessary to understand why something may be predictive, since we are merely studying correlations to make predictions.

Target built a model based on purchasing history to predict which customers may be pregnant. Its model identified the three strongest predictors for pregnancy — excess lotion, handbags (large enough to double as a diaper bag) and brightly colored rugs. Again, it's not essential to understand *why* anything is predictive. Target used this model to mail coupons for maternity and baby needs to its customers, including a 15-year-old young woman whose parents did not yet know she was pregnant.

Golbeck then emphasized that while AI has a veneer of objectivity, AI models can easily be used for adverse social purposes if we do not have sufficient regulations or controls in place. For example, she and her lab studied Alcoholics Anonymous participants to predict who would be successful at staying sober for 90 days after attending their first meeting. Golbeck's lab was able to achieve an 85% prediction rate, which is a great result for statisticians but leaves ample room for false results. If this model were used to decide sentencing following DUI convictions, the 15% error rate could allow many lives to be adversely impacted.

For those who may naively trust that all companies will respect our privacy settings, Golbeck transitioned to examples of the data collection happening all around us:

- The Spanish football league, La Liga, turning on smartphone microphones of La Liga app users and listening to determine whether users were watching La Liga matches in bars that had not paid for broadcast rights.
- Facebook performing photo matching and phone movement/orientation matching to suggest new connections in their "people you may know" feature.
- Apps on Golbeck's phone sending local ads by accessing Wi-Fi hotspots near her device, even though she was using VPN through a different state to mask her location.

After clearly conveying her message that we have ample reasons to be concerned with how much data is collected on us and how it is used, Golbeck shared her advice for how to use AI effectively and responsibly. This included a book recommendation for *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy* by Cathy O'Neil (see the *AR* November-December 2016 book review). In discussing the book, Golbeck focused on three key issues:

- Transparency — We should be prepared to disclose our algorithms and how we are using them.
- Consent — People want the right

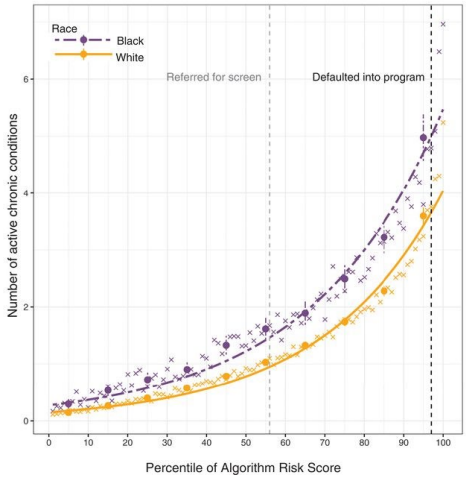
to give permission (or not) for how their data is used. This requires a company to exhibit a higher standard of care than merely being compliant with the terms and conditions (which we all accept without reading). She advocated for the U.S. adopting Europe's stronger privacy and consent rules for the use of personal data.

- Bias — Algorithms are not trustworthy for some applications. While 75%-90% prediction accuracy is great for science, we need to study the error rates for potential bias.

She shared two powerful examples of highly predictive AI applications with significant bias. The first was a Silicon Valley firm that built an AI model to assist with its recruitment of engineers. Many tech firms have a poor record of hiring, developing, promoting and retaining women engineers. This model was built using the firm's own experience, and the results ended up reinforcing its prior sexist behaviors.

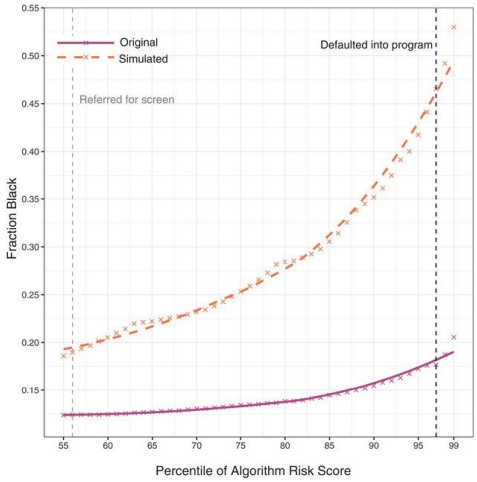
The second example involved a health care algorithm built using hospital records of patients with comorbidities. The algorithm indicated who should be referred to an expense mitigation program. The algorithm was trained to predict future health care costs (which it successfully did), but it was biased by race and referred too few Black patients because Black patients tend to have lower health care costs than whites. Once the bias was identified, the model was retrained to incorporate prediction of future health outcomes in addition to cost, which better balanced the referral rates between races. Two graphs capture the model outcomes before (Figure 1) and after (Figure 2) retraining for the racial bias.

Figure 1. Before Retraining for Racial Bias



Source: Obermeyer et al. "Dissecting Racial Bias in an Algorithm Used to Manage the Health of Populations." Science *366, no. 6464 (2019): 447–53. https://doi.org/10.1126/science.aax2342.*

Figure 2. After Retraining for Racial Bias



Source: Obermeyer et al., 2019. https://doi.org/10.1126/science.aax2342.

Golbeck concluded her remarks by summarizing her main points, then opened the virtual floor for Q&A. She wanted her audiences to be aware of the invasiveness of AI prediction technology and data collection, and what this means for our personal privacy. More specifically, she challenged the actuarial profession to test for bias in the results of our predictive models to ensure that we are providing high-quality and socially conscious work for the insurance industry.

Dale Porfilio, FCAS, MAAA, is chief insurance officer for the Insurance Information Institute.

ESG and What It Means for Actuaries By DALE PORFILIO

Environmental, social and governance (ESG) values have been at the core of the insurance industry's DNA for decades, but these principles have been more formally structured and institutionalized in the last decade. This has provided actuaries the opportunity to apply our innovation and expertise in new and expanded ways within and outside the insurance industry to help build a more resilient, sustainable and inclusive society.

The virtual 2022 CAS Ratemaking, Product and Modeling Seminar featured a concurrent session focusing on ESG and what it means for actuaries. Victor Bhagat of AM Best presented an overview of ESG and its impact on insurers' financial strength. Andy Tran, ACAS, of Swiss Re America then presented examples of how ESG can be embedded to help shape underwriting and product strategy.

Bhagat opened with a clear definition of ESG and the wide breadth of factors under this broad umbrella:

- Environmental factors relate to resource use, pollution, climate risk, energy use, waste management and other physical environmental challenges and opportunities.
- Social factors relate to how a company interacts with the communities in which it operates and with its suppliers, employees and broader stakeholders.
- Governance factors relate to policies and procedures such as corporate governance, corporate behavior, transparency, board composition and business ethics.

The United Nations Environment Programme Finance Initiative (UNEP FI) drafted the four Principles for Sustainable Insurance (PSI). This is the largest collaborative initiative between the U.N. and the insurance industry, with over 140 organizations worldwide adopting the Principles. The Principles serve as a global framework for the insurance industry to address ESG risks and opportunities. In March 2021, AM Best became a signatory of the PSI and adopted the four Principles for Sustainable Insurance listed below.

- Principle 1: We will embed in our decision-making environmental, social and governance issues relevant to our insurance business.
- Principle 2: We will work together with our clients and business partners to raise awareness of environmental, social and governance issues; manage risk; and develop solutions.
- Principle 3: We will work together with governments, regulators and other key stakeholders to promote widespread action across society on environmental, social and governance issues.
- Principle 4: We will demonstrate accountability and transparency in regularly disclosing publicly our progress in implementing the Principles.

ESG is important to the health and well-being of an insurance company in honoring its commitments to its stakeholders, including policyholders, employees, stockholders and regulators. In addition, rating agencies like AM Best consider ESG factors within the broad range of qualitative and quantitative criteria to perform credit analysis and financial credit ratings of insurance companies. Bhagat concluded his portion of the session by sharing multiple examples of the complexities and interactions AM Best must consider in assigning financial credit ratings across a wide range of scenarios.

Tran started his presentation by discussing how Swiss Re considers ESG alongside sustainability and sustainable development goals (SDGs) for their underwriting and product strategy. They begin from this sustainability mission statement:

> We aim to meet the needs of the present without compromising the ability of future generations to meet theirs. We do so by taking a strategic and forward-looking view, and by considering our economic, environmental and social impacts.

The mission is integrated alongside ESG and the 17 U.N. SDGs to identify areas for business opportunities while working to meet Swiss Re's commitment to net-zero greenhouse gas emissions in operations by 2030 and across the entire business by 2050.

Swiss Re integrates sustainability into underwriting at the deal and portfolio level, Tran explained. This includes ESG risk assessment and underwriting referral tools for new business applications, as well as policies on human rights and environmental protection. They must always ask themselves the question: "How does the business we write impact, support or detract from sustainability because sustainable business is good business in the long run?"

To perform their portfolio assessment, Swiss Re actively scores all

assumed business across the 17 SDGs, mapping its contribution and harm toward overall sustainability goals. Tran shared an illustrative product development example. E-bikes are growing in popularity in Japan, so Swiss Re developed an e-bike insurance product to meet the market demand. They quantified the sustainability for the individual product and how it contributed favorably to their overall metrics.

Tran closed by describing three ways actuaries can contribute to ESG and sustainability efforts:

1. Data — Challenge ourselves. Where can we find nontraditional sources?
2. Skill set evolution — We cannot do this alone. We need to work with a cross-functional mindset.
3. Model development — A faster feedback loop and responsive stakeholder engagement are crucial.

Together, we can successfully achieve our business goals, including ESG and sustainability objectives.

Parametric Insurance: From Need to Solution

By DALE PORFILIO

Many people view insurance as stodgy and boring, lacking the excitement and innovation of Silicon Valley technology industries. But the reality is that we have significant innovations happening — often behind the scenes and invisible to our policyholders — that ought to be celebrated and shared more broadly. "Parametric Insurance: From Need to Solution," a session at the virtual 2022 CAS Ratemaking, Product and Modeling Seminar, attempted to share one such story of insurance innovation.

The parametric insurance session covered the breadth of the topic, from defining the comparatively new product solution through the product development and design processes. Jonathan Charak, FCAS, of Zurich North America presented an overview of parametric insurance and the product development cycle. Daniel Seyyedi of Swiss Re took a deeper dive into the product design for parametric insurance solutions.

Parametric insurance is a variation on the traditional insurance contract with a couple of key twists. First, the contract settles on a pre-agreed, simple measure (commonly referred to as the parameter or index), which is fully transparent and indisputable by any party involved. Second, it pays out a pre-defined amount when the triggering event occurs, which simplifies estimating the severity of loss. Figure 1 captures how parametric insurance works and the key participants to the contract.

Charak's presentation walked through the product development life cycle as his company applied it to parametric insurance. The company starts from the reality that insurers need to develop insurance products that their distribution partners can sell and customers will buy as part of their complete risk management strategy. The process needs to be customer-led to ensure that the company is solving for a customer's needs, and the process needs to include a multidisciplinary team to ensure development of holistic product solutions.

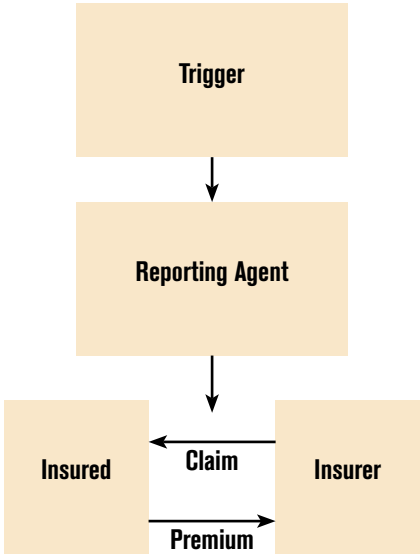
Parametric insurance was initially designed to narrow the protection gap. Charak defined this for natural catastrophes to be society's total economic loss minus the industry's insured loss. This gap commonly occurs because of the affordability and availability of insurance products that consumers will purchase. Over the last three decades, this gap has been significant for U.S. natural catastrophes, including non-damage business interruption (NDBI).

Similar insurance protection gaps can exist outside catastrophes, so companies can use parametric insurance for "exotic" risks like reduced foot traffic and cyber-reated risks across these offerings. The common denominator is a verifiable and objective trigger that both the insurer and the insured agree upon to measure an event.

Zurich North America announced its first parametric insurance proposition to the market in January 2021 to cover weather-related construction delays. They followed the product development cycle, evaluating modeling ability, the market opportunity, the insurer's risk appetite and the distribution model. Through experimentation, they launched an offering to help close the insurance gap; this helps the economic recovery of an impacted community after a catastrophic event.

Seyyedi then shared his presentation about Swiss Re's product design of parametric insurance solutions. Swiss Re asked what parametric insurance is best used for:

Figure 1. How parametric insurance works



Source: Daniel Seyyedi, Swiss Re, 2022.

- **Parametric insurance** is a type of insurance that settles on a pre-agreed, simple measure (the "parameter" or "index").
- Payout depends on the **occurrence of a triggering event**, regardless of the actual loss.
- An **independent third party** (e.g., the U.S. Geological Survey for earthquake) determines the intensity of the event and hence the impact on the claim.
- The insured purchases a **maximum payout cover** from the insurer. The premium depends on the chosen limit as well as exposure of the insured.
- The payout on a parametric product is unlikely to be exactly equal to the financial loss of an insured, and the difference is known as **"basis risk."**

- As emergency cash relief that pays out immediately (no waiting for claim adjusting process).
- When traditional insurance is not accessible or affordable.
- As a complement to traditional insurance.

ance product to mitigate the insured's basis risk. The company introduces a second trigger evaluation date for the insured to provide proof of loss beyond the insured's initial recovery.

Seyyedi shared two product design examples — one each for hurricane and earthquake. For both, the key components are:

- Triggers (e.g., certain windspeed measures or magnitude).
- Shape and size of box (defines the geographic boundary covered by the contract).
- Reporting agencies (e.g., National Hurricane Center, U.S. Geological Survey).

The platform is comprehensive and yet flexible enough to be used globally for a wide range of parametric products with expedited timelines.

In short, parametric insurance is fast, flexible and transparent, though with some offseting challenges.

One key challenge is the introduction of basis risk, defined as the deviation of the insurance payout from the actual financial loss. Swiss Re has developed a multi-trigger parametric insur-

Swiss Re has a modular parametric IT platform that is streamlined to provide end-to-end solutions, including product design, quoting and pricing, and policy and claim administration. The platform is both comprehensive and flexible enough to be used globally for a wide range of parametric products with expedited timelines.

This session was highly informative for people who have never worked with parametric insurance in their career. Charak and Seyyedi provided an excellent overview of the product and the many ways it can be used by insurers and reinsurers. They each went deeper to share applications from their respective companies — going from theory to practice in a single session.

ON THE SHELF

Insurance: A Singular Force Defining the Course of History

By LAURIE MCCLELLAN

Underwriters of the United States: How Insurance Shaped the American Founding

By Hannah Farber, Omohundro Institute and University of North Carolina Press, 2021, 352 pp, $34.95

It may be the most exciting insurance policy ever written. For a merchant ship's voyage from Boston to the Caribbean in 1800, this sample policy covers dangers including, "The seas, men of war, fire, enemies, pirates, rovers, assailing thieves, jettisons, letters of mart and counter-mart, surprisals, takings at sea, arrests, restraints, and detainments of all kings, princes or people."

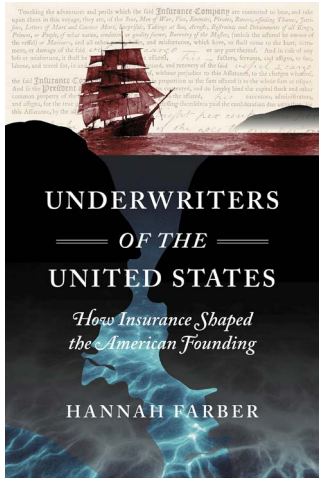
It may be hard to believe that these dramatic words belong to a standard business transaction, but that's the reality of the maritime world of shipping that Hannah Farber explores in her new book, *Underwriters of the United States: How Insurance Shaped the American Founding*. Farber, a historian who teaches at Columbia University, specializes in the economy of colonial North America. Although the exciting sample policy is simply boilerplate, Farber's archival research is showcased throughout the book in copies of historical documents, handwritten insurance policies, artwork and newspaper columns.

"I'm very much an academic," says Farber, "and I came to this project not from any background in the insurance industry. I just found it was fascinating." While researching the book, she says, "I was at first just astonished by the number of references to insurance that appeared in the paperwork of people who were going on these swashbuckling adventures … I was interested in maritime stuff because it seemed so dramatic. During the Napoleonic Wars, there were so many captures, there was smuggling, there were privateers, there was naughty merchant behavior happening all over the place."

For sheer drama, this in-depth look at how American shipping was insured from Colonial times to 1860 seems to offer more musical potential than the story of how Alexander Hamilton fought to found a national bank. The action encompasses the American Revolution, the French Revolutionary Wars, the Napoleonic Wars and the War of 1812, a tumultuous period when fortunes were easily made at sea and just as easily lost. And standing behind these risky and sometimes illegal adventures? The insurance policies that made them possible. Farber writes that marine insurance in this period was "an unusual business, that, for a time, had an extraordinary power to shape the course of events."

Insuring the "Wooden World"

That power came from a North American economy that existed before trains or paved roads or factories or income taxes. Farber points out that in the years just after the American Revolution, a



full 90% of the federal government's revenue came from the customs taxes on imported goods. Those goods traveled on ocean-going ships, which British and American merchants sometimes called "the wooden world."

Fifty years of near-constant wars in Europe and North America made crossing the ocean a dangerous business. Aside from the perils of storms and spoiled cargos, merchant ships could run afoul of pirates, foreign navies, or armed ships commissioned by enemy governments, known as privateers. But these same dangers also made shipping extremely profitable. "If you sneak goods past a blockade," says Farber, "or if you get weapons and food to a port that's been starved by war, you can charge really exorbitant rates."

Farber briefly traces the history of marine insurance, starting with its invention by Italian merchants in the Middle Ages who wanted to exchange

goods with other cities and countries ruled by different political regimes. In the early 1770s, the venerable company Lloyd's of London was just a group of merchants who met to do business at Lloyd's Coffee House on Lombard Street in London.

Insurance at the time was seen as close to gambling, sometimes for good reason. Farber writes that "death bets and other 'wager policies' continued to be commonplace at Lloyd's through the 1770s … whereas underwriters went to the coffeehouse to 'bet' that a merchant's vessel would not sink, others went to bet ('insure') that the pope would shortly die, that their lottery ticket would not be a winning one, or that the chevalier d'Eon was a woman in disguise."

Revolution: "The Policy Not Providing Against Rebels"

At the same time, the marine insurance business was taking root on North American soil, with an estimated 15 to 20 insurance brokers selling policies that would have previously been written in London. Those brokers soon had a role to play in the American Revolution. "Many of the voyages they insured were privateering ventures, which confiscated British wealth and inconvenienced and humiliated Britons by raising their own insurance rates," Farber writes. "American underwriting … was offense as well as defense." Underwriters based their rates on their in-depth, personal knowledge of dozens of factors, from the weather to recent events on the proposed route, the experience of the captain and the soundness of the ship.

Back in London, a broker at Lloyd's saw the war as just another complication of doing business, writing, "The Loss of a Ship taken by the Provincials is like to make work for the Lawyers, the Underwriters declaring that they are not Pirates, and the Policy not providing against Rebels."

But the cost of the policies told a more alarming story. In peacetime, a British merchant could insure a shipment of rum from Jamaica to Boston for about 3% of its value. In March 1776, the rate paid by contractors to the British army rose to 13%. By the summer of 1776, it hit 32% — a newsworthy event at the time. "American newspapers proudly reported when their privateers had raised insurance rates on British vessels," Farber writes.

Shaping business and law

As Farber researched the fledgling marine insurance business in North America, she was surprised to discover how much influence it exerted over the new nation and its politics. "I gradually realized marine insurance is a giant transnational business with a huge amount of money flowing through it, and it's organized," says Farber. "It's shaped in these ways that respond to politics, and that drive politics … and one way that you make money is by shaping the laws under which you run your business."

Insurance brokers also routinely shaped the way those involved in the shipping business behaved. During the French Revolutionary Wars, when merchant ships were at high risk of capture, many insurance policies specified that ships had to travel with a convoy, a group of other merchant ships protected by naval ships. Farber says that once at sea, waiting for the convoy "was often an issue because merchants are often trying to beat the markets, and the convoys are sometimes slow." But if ships left the convoy, "they either ran the risk of paying a higher insurance rate, if that's what they agreed on with their insurer, or they ran the risk of voiding their policy."

At other times, insurance brokers didn't want merchants to avoid risk, but to embrace it. Farber writes, "Merchants frequently solicited insurance policies on outright illegal voyages as a matter of course, and insurers frequently provided them." Together, merchants and brokers exploited the legal gray areas of the wartime years. For example, Farber says, "Are French ships allowed to capture American ships that are carrying British goods? Or vice versa? Are they allowed to bother Americans in order to get at their enemies? The merchants can make money, but they're taking a lot of risks, so they want to know if they can get insurance. And the insurers have some flexibility to decide how much sailing in the gray areas they're willing to tolerate."

"In spite of insurance's wide-ranging, inevitably political activities and the profit it generated during periods of upheaval, it retained an extraordinary aptitude for convincing Americans it was boring." —*Underwriters of the United States*

Investing in a new country

The Treaty of Paris officially ended

the American Revolutionary War in 1783. (In an interesting historical side note, the first copy of the treaty was brought to New York by an insurance broker named John Delafield — a testament to the crucial role insurance brokers often played in gathering information).

After the war, insurance companies shaped the American founding in a new way: by pouring capital into banks and financing the national debt. Farber writes that "the aggregated capital held by this host of marine and fire insurance companies reshaped the American financial landscape … for the earliest American insurance companies, the most appealing investment options were the stocks of state-chartered banks and American government securities, and new companies swiftly bought vast quantities of both."

Farber argues that these investments benefited the country as a whole. The key to the system was how investors purchased shares in a chartered insurance company. Unlike today, investors didn't purchase their shares with cash, but with government securities. The result was that in 1803, when the national debt totaled $70 million, Farber estimates that insurance companies owned most of the $10 million that was held by incorporated bodies.

Steamboats and pirates

The conclusion of the War of 1812 ended the lengthy period of wars that began with the American Revolution. But although the oceans were more peaceful, shipping was still far from safe. Newly invented steamships were navigating the Mississippi, but they were so prone to exploding that a fresh crop of marine insurance companies sprang up in New Orleans.

Pirates were also a continuing danger. Farber writes, "Napoleonic conflict had generated a cohort of sailors and privateersmen who were in the habit of taking goods from merchant vessels by force, and the end of hostilities threw many of them out of work. Some became followers of the smuggler Jean Lafitte, who, pardoned by U.S. President Andrew Jackson for his assistance against the British during the War of 1812, resumed smuggling, piracy, and privateering in the Gulf of Mexico after the war's conclusion."

Searching the archives

As she researched her book, Farber found a rich trove of primary source material. "A lot of the best material for this project was in historical societies in old East Coast cities, like the Massachusetts Historical Society in Boston, and the Rhode Island Historical Society in Providence," Farber explains. "They were founded by the new American elites who came to take their place at the forefront of American port cities, and that often means rich merchants … like merchants who made their money as war contractors during the American Revolution … or the people who made a lot of money in getting these ships to these war-starved ports in the French Revolutionary Wars and the Napoleonic Wars."

While Farber found the business documents illuminating, she notes that they've been overlooked in the past. "Political historians, cultural historians, have tended to write these papers off as, 'oh, this is just business. This is just the business side of this guy's life.' And in books about Alexander Hamilton or Daniel Webster, who are both big insurance guys, their biographers tend to hide this stuff about their business and put it in the background. That sort of misses the way in which the business itself is intensely political."

Farber also found evidence in archives showing that, as she writes, "the insuring of slave vessels after 1808 was not only a Southern sin." Even though the U.S. banned the importation of enslaved people after January 1, 1808, an incriminating letter from 1809 contains the detailed plans of two Northern merchants to send the schooner *Esperanza* to Portugal under the command of a Boston captain. There it would obtain a Portuguese flag, then sail to Africa to pick up slaves and then transport them to Havana. Farber writes, "Although it was risky for the merchants and their shipmaster to put their plans in writing, they demanded detailed updates from their captain because … they needed 'the necessary information, that we may make insurance in this place [Boston].'" The voyage of the *Esperanza* was far from an isolated incident, and according to Farber, "some American insurance corporations underwrote foreign-flagged slave voyages fairly openly through the 1810s."

Although Farber ends her book in 1860, she sees some parallels between the insurance business she describes and the present day. She writes, "The contemporary business of reinsurance — insuring the insurers — is perhaps easier to compare to the marine insurance of the Age of Revolution … a fundamentally transnational business of enormous size whose inevitably political bets attract little public attention."

Laurie McClellan is a freelance writer and photographer living in Arlington, Virginia.

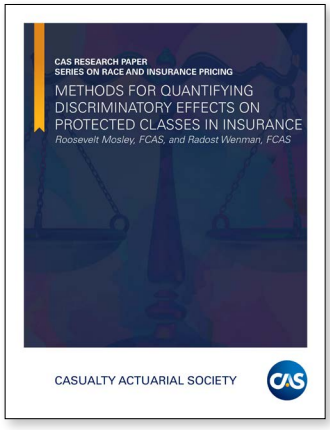
New CAS Research Series Explores Race and Insurance Pricing

BY KATE NISWANDER, CAS DIRECTOR OF MARKETING AND COMMUNICATIONS

In March 2022, the CAS released four new reports designed to guide the insurance industry toward proactive, quantitative solutions to identify, measure and address potential racial bias in insurance pricing. The CAS Research Paper Series on Race and Insurance Pricing features papers that address various aspects of race and insurance pricing as viewed through the lens of property and casualty insurance. The series supports the CAS Approach to Race and Insurance Pricing, adopted by the CAS Board of Directors in December 2020, which outlines four key areas of focus and goals: basic and continuing education; research; leadership and influence; and collaboration.

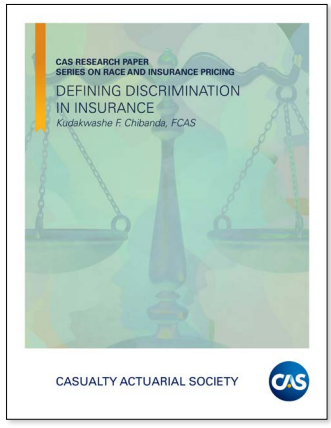
The four reports, available on the CAS website, are:

Methods for Quantifying Discriminatory Effects on Protected Classes in Insurance illustrates approaches to defining and measuring fairness in predictive models. It provides an overview



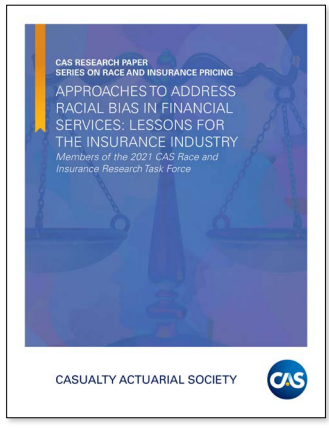
of bias mitigation techniques that can be performed during the input, modeling or output phase of a model, once a set of fairness criteria has been adopted.

Approaches to Address Racial Bias in Financial Services: Lessons for the Insurance Industry explores issues of racial bias in lending practice for mortgages, personal and commercial



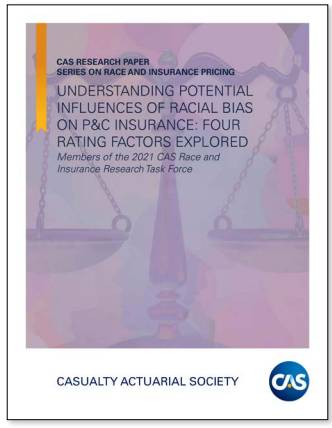
lending as well as credit-scoring. It looks at these four areas and describes solutions intended to address any potential bias, which may include government intervention, internal bias testing and monitoring measures, and new products development to mitigate bias.

Defining Discrimination in Insurance covers terms such as protected class, unfair discrimination, proxy discrimination, disparate impact,



disparate treatment and disproportionate impact. It provides historical and practical context for these terms and illustrates the inconsistencies in how different stakeholders define them; it also describes the potential impacts of these definitions on actuarial work.

Understanding Potential Influences of Racial Bias on P&C Insurance: Four Rating Factors Explored examines how credit-based insurance score (CBIS), geographic location, homeownership and motor vehicle records may be impacted by racially biased policies



and practices outside of insurance. The goal is to highlight the multidimensional impacts of systemic racial bias as it may relate to insurance pricing.

Each paper stands alone and does not need to be read in a specific order. Inquiries or feedback regarding the papers may be sent to diversity@casact.org. Anyone interested in contributing literature to the research on Race and Insurance Pricing should refer to the Submit Your Work page on the CAS website and review the guidance for submissions under *E-Forum* or Working Papers.

IT'S A PUZZLEMENT By JON EVANS

A Numerical Bar Game

Steve Mildenhall contributed this puzzle.

The nerdier regulars at the Bon Pint pub enjoy a peculiar number game. They start with an integer n and expand it in powers of 2. Then, they expand all the exponents in powers of 2, and so on, until n is written with just 1s and 2s. For example, $9 = 2^3 + 1 = 2^{(2^1+1)} + 1$. They then make a new number by replacing each 2 with 3 and subtracting 1 from the

result, carrying terms (like grade school math subtraction, see example below) to ensure all the coefficients in the base 3 representation are positive. Next, they replace 3 with 4 and subtract 1, and so on. They keep going until the pub closes or the sequence stops, whichever comes first.

How often do the sequences stop? If they stop, how long do the players play?

To get you started, here's the game for $n = 2$, $n = 3$, and the initial terms for $n = 4$.

- When $n = 2$, the game stops after 3 steps: $2^1 \to 3^1 - 1 = 2 \to 1 \to 0$.
- When $n = 3$, it stops after 5 steps: $2^1 + 1 \to 3^1 + 1 - 1 = 3^1 \to 4^1 - 1 = 3 \to 2 \to 1 \to 0$.
- When $n = 4$, the game starts: $2^2 \to 3^3 - 1 = 2 \times 3^2 = 2 \times 3 + 2 = 26$, which illustrates carrying (twice) to ensure all coefficients are positive. The sequence continues, $26 \to 2 \times 4^2 + 2 \times 4 + 1 = 41 \to 60 \to 83 \to 109 \to \ldots$.

First, decide the outcome for $n = 4$. Then try to generalize. Show your work for partial credit.

Follow-ups on solutions to previous puzzles

Proof of Crypto Mining Work

This puzzle was to find a number (a "nonce") that when appended to "Casualty Actuarial Society" results in a SHA-256 hash with at least 20 leading binary 0s (same as at least 5 leading 0s in hexadecimal representation), or equivalently smaller than 2236. Two solutions that should have been mentioned are below:

Dave Schofield should have been mentioned as also submitting the strongest nonce at previous publication time, 7180096807, which results in 9 leading hex 0s and 37 leading binary 0s in the hash value of: 0000000004e11d3163164d3485ad2588f56eda9630c71405acf23f004c9060f9.

More recently, Mike Convey submitted the nonce 1ff8640245, which results in 10 leading hex 0s and 42 leading binary 0s in the hash value of: 00000000026aa1c8ce977957f4dbf2e4b9951b61300eb996a555c0df47e8e2e.

Soon, a follow-up column is anticipated dealing with the ongoing search for a stronger (more leading binary 0s) Casualty Actuarial Society nonce.

Questionable Odds

Jeff Subeck pointed out a subtle logical deficiency in the wording of the original puzzle, something most readers would assume but should have been explicitly stated. This assumption should have been explicitly stated — something like the following: "The question must have a fixed answer for any given individual, independent of whether or not that individual is the randomly chosen person."

Without the clarification above, a trivial solution for part of the puzzle could be as follows:

"A question to ask to maximally improve your expected probability of correctly guessing is whether this person is in the set of persons such that, if it is guessed that they are the person who was randomly selected, the guess would be correct. The list of people having an answer of yes will be a list of the one selected person. This trivially results in 100% probability of correctly guessing this person."

A Game of Coins

Solutions were sent in by Shyam Bihari Agarwal, John Berglund, Olivier Guillot-Lafrance, Dave Oakden and Andrew Yuhasz. Stay tuned for the solution in an upcoming *AR*!

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

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