

Table of Contents

- 4 **A Note from the Editor** *by Richard Gorvett*
- 6 **Contributors to this Issue**
- 11 **Discussion Paper: “The Mathematics of Excess Losses” by Halliwell**
Discussion by Liang Hong, response by Leigh Halliwell
- 20 **Advances in Common Shock Modeling** *by Z. Ming Li and Paul G. Ferrara*
In this paper we rigorously investigate the common shock, or contagion, model, for correlating insurance losses. In addition, we develop a theory which describes how the common shock model can be incorporated within a larger set of distributions. We also address the issue of calibrating contagion models to empirical data. To this end, we propose several procedures for calibrating contagion models using real-world industry data. Finally, we demonstrate the efficacy, and efficiency, of these calibration procedures by calibrating aggregate loss models which incorporate contagion. Further, the case study illustrates the power of contagion modeling by demonstrating how the introduction of contagion can correct for the shortcomings of traditional collective risk modeling.
- 36 **The Recent Review and Changes to the National Council on Compensation Insurance’s Individual Risk Experience Rating Plan** *by Jon Evans*
NCCI recently completed an extended review of its Experience Rating (ER) Plan. Although no major changes had been made for many years, testing indicated that ER Plan performance was still generally good. The primary cause of deteriorating performance was the use of a fixed split point between primary and excess losses while average claim severity increased dramatically. The review process uncovered many interesting facets of actuarial methodology related to experience rating, but the changes coming out of the review did not fundamentally change the structure of the plan. NCCI has implemented an increase in the split point from \$5,000 to \$15,000+ inflation (over three years), and subsequent procedures to periodically increase the split point in the future corresponding to an index of claim severity. Along with the split point increase, the maximum cap on modification factors was changed. As part of the review, NCCI also made changes to several components of the calculation of primary and excess experience period expected losses to conform to changes in NCCI’s class ratemaking procedures. A well-constructed experience rating plan can perform very well for a very long time with appropriate indexation applied to components. Simplicity, consistency, transparency, and an automatic indexation are particularly important for industry-wide bureau plans such as the NCCI Experience Rating Plan.

54 A Note on Parameter Risk *by Gary Venter and Rajesh Sahasrabudde*

Consideration of parameter risk is particularly important for actuarial models of uncertainty. That is because—unlike process risk—parameter risk does not diversify when modeling a large volume of independent exposures. Without consideration of parameter risk, decision makers may be tempted to underwrite higher volumes as a result of the apparent high degree of predictability in the mean outcome. However, the financial impact of parameter error is magnified by volume and doing so could have significant consequences for the firm. In this paper, we present an inventory of uncertainty models associated with various approaches that actuaries use in estimating model parameters.

64 A Survey of Approaches to a Changepoint Problem in an Actuarial Context

by Avraham Adler

A representative data set is used to provide an example comparing classical and Bayesian approaches to making inferences about the point in a sequence of random variables at which the underlying distribution may shift. Inferences about the underlying distributions themselves are also made. Most of the underlying ‘R’ code used in the analysis is shown in the appendix.

101 Judgmental Topics In P&C Companies: Findings from a Prediction Survey *by Joseph Lo, Nita Patel and Alan Calder*

Interaction with actuarial models by both actuaries and non-actuaries is inevitable and requires careful study so that these models may better serve their purpose. Yet empirical and scientific investigations into how experts make their judgments are rarely reported in actuarial science literature. This paper discusses findings from a prediction survey, whose 120 respondents in a global property and casualty (P&C) company were nearly evenly split between underwriters and analysts (e.g., actuaries, risk managers, and finance). The hypothesis that underwriters and analysts tend to give different quantitative judgments under similar levels of information and incentivization was tested. Of the four one-step prediction problems, none gave evidence to support this hypothesis.

114 Estimating the Parameter Risk of a Loss Ratio Distribution—Revisited

by Avraham Adler

When building statistical models to help estimate future results, actuaries need to be aware that not only is there uncertainty inherent in random events (process risk), there is also uncertainty inherent in using a finite sample to parameterize the models (parameter risk). This paper revisits Van Kampen (2003) in replicating its bootstrap method and compares it with measures of parameter uncertainty developed using maximum likelihood estimation and Bayesian MCMC analysis.

140 **Risk Classification for Claim Counts and Losses Using Regression Models for Location, Scale and Shape** *by George Tzougas, Spyridon Vrontos, and Nicholas Frangos*

This paper presents and compares different risk classification models for the frequency and severity of claims employing regression models for location, scale and shape. The differences between these models are analyzed through the mean and the variance of the annual number of claims and the costs of claims of the insureds, who belong to different risk classes and interesting results about claiming behavior are obtained. Furthermore, the resulting a priori premiums rates are calculated via the expected value and standard deviation principles with independence between the claim frequency and severity components assumed.

A Note from the Editor



Actuarial Science: “Traditional” versus “Non-Traditional”?

Welcome to another issue of *Variance*, the Casualty Actuarial Society’s peer-reviewed journal.

If you are interested in articles in the realm of “traditional” actuarial topics, you should find this a particularly satisfying and substantial issue. Look at the subject matter of these papers:

- Excess loss modeling and its underlying mathematics
- Contagion models and aggregate loss processes
- Workers compensation and the individual risk experience rating plan
- Parameter risk (*two* articles)
- Classical versus Bayesian approaches to inference
- Quantitative judgments by analysts versus underwriters
- Comparison of different risk classification models

A nice, basically “traditional” set of actuarial topics.

But then, after initially making this observation, I predictably stopped short and asked myself what I meant by “traditional.” Well, I responded to me, of course, I mean, well, er, well... not “*non*-traditional.” Raising to myself one querying eyebrow in Spock-like fashion, I proceeded to, if not define, at least provide examples of what I considered to be “non-traditional” actuarial papers. Which is hard: we inhabit a multidisciplinary and evolving profession, and one of its great attractions is its potential adoption of, and responsiveness to, developing quantitative techniques, changing socio-economic conditions, and emerging risks.

Early in my career, the use of financial insights and models in actuarial science seemed “non-traditional” — they really don’t anymore. Dynamic financial analysis was once non-traditional — it has since become naturally embedded in how we think and what we do. Predictive modeling and analytics may sometimes seem non-traditional — until one realizes that, as actuaries, we’ve been working in that space for decades.

And this thought stream ultimately led me to ponder, more generally, this journal and its mission. When you think about it, we are really asking *Variance* to do quite a lot. It’s a forum for research in traditional functions like ratemaking and reserving and all their relevant sub-topics, but *also* for the non-traditional, such as those mentioned in the prior paragraph and many others. It publishes both applied and more theoretical papers (with a definite desire that the vast majority have relevance and practical value for our

readership). It publishes both research-oriented and survey papers. It publishes both original papers and discussions of prior articles. And it's a potential outlet for the work of both practicing actuaries and academics.

And, thus, it's difficult, if not impossible, for an individual paper in, or a specific issue of, *Variance* to satisfy everyone equally.

I think that's OK — indeed, if each issue of *Variance* contains even one article of particular interest to a given CAS member, over time that's an impressive amount of research relevant and useful to that actuary. It does suggest a question, though: is the current *Variance* structure the best, or are there viable and preferable alternatives? Multiple sections of *Variance* each issue for different types of papers? Multiple journals rather than just *Variance*? Dedicated or special issues each year for different purposes? The status quo?

As always, your comments and opinions are welcome. This is *your* journal — it is our honor and duty to serve your needs.

Happy reading!

Rick Gorvett, editor in chief, *Variance*

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Avraham (Avi) Adler, FCAS, CERA, MAAA is a senior vice president and actuary for Guy Carpenter Analytics. Avi focuses on reinsurance pricing and structure analyses, loss models, optimization, and enterprise risk management. Avi's research interests include capital allocation, optimization, goodness-of-fit testing, and Bayesian analysis. Avi's CAS activities include serving on the Reinsurance Research, Open Source Software, Enterprise Risk Management, Yearbook/Proceedings, and Publications Management committees.



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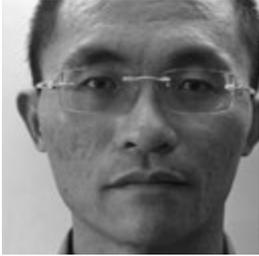
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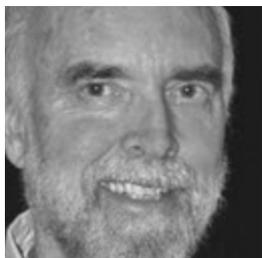


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