

ASTIN AFIR/ERM COLLOQUIA

JUNE 21-23, 2022

PARALLEL SESSION INFORMATION

(Document will be updated as more information becomes available.)

Each presentation is 30 minutes.

Wednesday, Parallel Sessions 1, 10:00-11:00 a.m. EDT

Session Start: 06/22/2022 10:00 AM, Session End: 06/22/2022 11:00 AM

Section: ASTIN

Title: An aggregate trend renewal micro model for loss reserves, with inflation and discount

This paper addresses new issues in the loss reserving literature, that mainly reside in incorporating trend effects, inflation, and discount factors for macro- and micro- level loss reserving models. This is very important for pricing and reserving considerations, as well as for decision making regarding risk capital, and more importantly for some guarantees for which the settlement of a claim takes more time, as in medical malpractice, which is the insurance coverage we focus on in our research.

We propose to use an aggregate trend renewal model as an individual claims generating process, from which we study the differences between the micro-level and macro-level reserving methods. Some important theoretical results to both reserving schools of thoughts will be derived throughout this work. An empirical illustration is also performed on a real database and under practical considerations, where our model is calibrated for micro- and macro-level loss reserving methods.

Speakers: Anas Abdallah, Assistant Professor, McMaster University

Wednesday, Parallel Sessions 1, 10:00-11:00 a.m. EDT

Session Start: 06/22/2022 10:00 AM, Session End: 06/22/2022 11:00 AM

Section: ASTIN

Title: Contingent Claim, Lender of Last Resort (LoLR), Helicopter Money in the Era of LIBOR Conversion

There is a social efficiency frontier. It is likely to be different from the usual private efficiency frontier. It is for the government and central banks to put projects out there and auction them. Although the LoLR operations today tend to be collateralised, the quality of collateral available in times of crisis is at least questionable and central banks have been known to declare that

they will “do whatever needed” to address a crisis. Such loans are collateralised, at varying degrees of haircut. Of course, this collateralised customer loans, which in light of Covid-19 recession impact will be lower and lower credit quality over time. The actual capital base of central banks is not high – certainly if one applied Basel III or Solvency II capital rules to them they would be undercapitalised. In theory the risk mitigation is the collateral they obtain, often at high haircut, but as you say the credit quality of this collateral is not always high and the form of lending will be pro-cyc

Speakers: Chitro Majumdar, ,

Wednesday, Parallel Sessions 1, 10:00-11:00 a.m. EDT

Session Start: 06/22/2022 10:00 AM, Session End: 06/22/2022 11:00 AM

Section: ASTIN

Title: Risk model with dependent frequency and severity, premium and ruin probability calculation

"A common assumption made in risk theory with application in insurance modelling is that the “claim frequency” and the “claim severity” are independent. It may not be the case in many situations. Recently, there have been authors working with models with dependence, like Li et al. (2015), Garrido et al. (2016) and Ni et al. (2020) with application in motor insurance. Also, Albrecher et al. (2011), Andrade e Silva and Centeno (2017) and Moura and Centeno (2020), where the first and last use copulas and the second uses GLM’s to capture dependence.

This work wants to consider dependence between claim counts and severity of claims, as well as among individual severities, and/or claim sizes, in order to calculate subsequent premiums and corresponding ruin probabilities. We work formulae and numerical results for both ruin probabilities and adjusted premiums in some sort of models. We start from Poisson models by mixing random parameter following ideas from Li et al. (2015) and Ni et al. (20

Speakers: Renata Alcoforado, ,

Wednesday, Parallel Sessions 1, 10:00-11:00 a.m. EDT

Session Start: 06/22/2022 10:00 AM, Session End: 06/22/2022 11:00 AM

Section: ASTIN

Title: Scenario Testing for Large Fleets during the yearly price adjustment process - a practical example

"In the yearly price adjustment process, it's important to

- determine the profitability of the future large fleet portfolio and at the same time
- ensuring the envisaged growth in gross written premium.

In this context the lapse analysis plays a crucial role to identify the segments which are more or less price-sensitive.

There the technical premium (or TP) comes into play.

It guarantees that the effect of a client's reaction (renewal or lapse) can be quantified, thus preventing an unnecessary lapse of a (highly) profitable account respectively a suboptimal premium increase.

This presentation will represent a kind of combination of the following two presentations:

first presentation, held during the IAA 2019 in Capetown (in person),

second presentation held during the IAA Online Colloquium 2021.

The following 3 points will be covered:

- (1) Modelling of the probability that the fleets are manually renewed by the Underwriters (e. g. so as to avoid the increase in premi

Speakers: Michael Klamser, Senior Actuary, Allianz Versicherungs AG

Wednesday, Parallel Sessions 2, 11:30-12:30 EDT

Session Start: 06/22/2022 11:30 AM, Session End: 06/22/2022 12:30 PM

Section: AFIR/ERM

Title: An Asset-Liability Model for Stable Value Fund Wraps (Guaranteed Retirement Plans)

This paper introduces the first of a kind comprehensive mathematical framework for the asset-liability management of stable value fund wraps. Stable value funds are employee benefit investment options guaranteed through wraps at a crediting rate of return currently approximately

\$ 400B of the US retirement market. We first make an introduction to the stable value fund synthetization mechanism that buffers short-term market fluctuation and transforms a volatile fund return into a more stable one. Using twenty years of historical data from 288

funds gathered through various sources, we study the behavioral and statistical properties of the cash flows and propose a regime switching model for the liabilities adapted to and fitted to this behavioral study. We also propose a novel asset model that captures the primary risk factor of fixed income funds.

Speakers: Behzad Alimoradian, ,

Wednesday, Parallel Sessions 2, 11:30-12:30 EDT

Session Start: 06/22/2022 11:30 AM, Session End: 06/22/2022 12:30 PM

Section: AFIR/ERM

Title: Analysis threshold portfolio return of Swiss pension funds based on nested simulation engine

"According to the FRP5 Guidelines of the Swiss Chamber of pension fund experts (SKPE), the threshold portfolio return (TPR) corresponds to the annual portfolio return which the pension fund requires to keep the funding ratio constant. The difference between the expected return on assets and the threshold portfolio return plays a key role in determining whether the current benefits can be financed. The future threshold portfolio return depends not only on interest credits, reserving and benefit policies but on HR policies as well.

In our forecasting approach, the future threshold portfolio return over different periods is determined based on the nested stochastic modelling for pension fund membership and their liabilities implemented with different HR policies to quantify their impacts. Future development of the assets will be implemented with the stochastic regime-switching portfolio return model.

Speakers: Mauro Triulzi, Head of IT Service, Software Developer, allea Ltd

Wednesday, Parallel Sessions 2, 11:30-12:30 EDT

Session Start: 06/22/2022 11:30 AM, Session End: 06/22/2022 12:30 PM

Section: ASTIN

Title: Cyber risk: An analysis of self-protection and the prediction of claims

For a set of Brazilian companies, we studied the occurrence of claims by analyzing the impact of self protection and the prediction of their occurrence. We bring a new perspective to the study of cyber risk analyzing the probabilities of acquiring protection against this type of risk by using propensity scores. We consider the problem of whether acquiring cyber protection improves network security using a matching method that allows a fair comparison among companies with similar characteristics. Our analysis, assisted with Brazilian data, shows that despite informal arguments that favor protection against cyber risks as a tool to improve network

security, we observed that in the presence of protection against cyber risks, the incidence of claims is higher than if there were no protection. Regarding the prediction of the occurrence of a claim, a system considering a feedforward multilayer perceptron neural network was created, and its performance was measured.

Speakers: Alana Azevedo, ,

Wednesday, Parallel Sessions 2, 11:30-12:30 EDT

Session Start: 06/22/2022 11:30 AM, Session End: 06/22/2022 12:30 PM

Section: ASTIN

Title: Efficient computation of expected allocations

Consider a risk portfolio with aggregate loss random variable $S=X_1+\dots+X_n$ defined as the sum of the n individual losses X_1, \dots, X_n . The expected allocation, $E[X_i * 1(S = k)]$, $i = 1, \dots, n$, is a vital quantity for capital allocation and peer-to-peer insurance. For example, one uses this value to compute peer-to-peer contributions under the conditional mean risk-sharing rule and performs TVaR-based capital allocation under the Euler risk allocation rule. This paper introduces the expected allocation generating function, a power series representation of the expected allocation of an individual risk given the total risks in the portfolio when all risks are discrete, even in the presence of dependence. First, we provide a simple relationship between the expected allocation generating function and the probability generating function.

Speakers: Christopher Blier-Wong, PhD Student, Laval University

Wednesday, Parallel Sessions 2, 11:30-12:30 EDT

Session Start: 06/22/2022 11:30 AM, Session End: 06/22/2022 12:30 PM

Section: ASTIN

Title: Enhancing Claims Triage with Dynamic Data

In property insurance claims triage, insurers often use static information to assess the severity of a claim and identify the subsequent actions. We hypothesize that the pattern of weather conditions throughout the course of the loss event is predictive of insured losses and hence appropriate use of weather dynamics improve the operation of insurer's claim management. To test this hypothesis, we propose a deep learning method to incorporate the dynamic weather data in the predictive modeling of insured losses for reported claims. The proposed method features a hierarchical network architecture to address the challenges introduced into claims triage by weather dynamics.

In the empirical analysis, we examine a portfolio of hail damage property insurance claims obtained from a major U.S. insurance carrier. When supplemented by the dynamic weather information, the deep learning method exhibits substantial improvement in the hold-out predictive performance.

Speakers: Peng Shi, Associate Professor, University of Wisconsin - Madison

Wednesday, Parallel Sessions 2, 11:30-12:30 EDT

Session Start: 06/22/2022 11:30 AM, Session End: 06/22/2022 12:30 PM

Section: ASTIN

Title: Rebalancing the off-Balance Factor Using the Complement of Credibility

The ratemaking algorithms used to calculate class factors, territory factors, allocations of rate changes to coverages and other types of rating values often require either an off-balance factor (off-balance correction), or, when capping is involved, a test correction factor. The current approach is to multiply a common off-balance or test correction factor by all the post-credibility rates, so that the weighted average of the final rates matches the overall rate indication. The present correction algorithm appears to have disparate impacts on some classes, though. For example, when correction factors are applied uniformly to the post-credibility rates, rates for already fully credible classes may be artificially raised or lowered. Spreading the off-balance across the complement of credibility terms creates end rates that are both more credible and in many circumstances, more accurate depictions of the loss costs.

Speakers: Joe Boor

Wednesday, Parallel Sessions 3, 13:30-14:30 EDT

Session Start: 06/22/2022 01:30 PM, Session End: 06/22/2022 02:30 PM

Section: AFIR/ERM

Title: COVID-19 Mitigations in the U.S

Modeling of a pandemic requires assumptions regarding mitigation behaviors. This presentation provides highlights of a weekly survey of practices regarding the mitigation of the spread of COVID-19 in the U.S. during the final four months of 2020 and the first four months of 2021. The survey asks about the degree to which the respondents perceive that people in their community are following 21 common mitigation practices. The responses are separated by state and compared to state level statistics regarding the level of COVID-19 infections from the Johns Hopkins COVID database for the same time period.

Speakers: David Ingram, , Semi-Retired
Daniel Ingram, Revenue Analyst, American Airlines

Wednesday, Parallel Sessions 3, 13:30-14:30 EDT

Session Start: 06/22/2022 01:30 PM, Session End: 06/22/2022 02:30 PM

Section: AFIR/ERM

Title: Pandemic effects on investors behaviour: Tesla valuation with Holt-Winters and fundamental analysis

Commencing the Covid-19 back in March 2020, it is apparent that stock market conditions have changed investors' behaviour in financial markets. The pandemic provoked investors to fear, leading them to quickly search for alternative options to safeguard their resources, seeing that many stocks were declining in value. As a result, investors closed their positions on those enterprises significantly affected by the crisis and relocated their funds to high tech companies with the expectation of earning substantial future returns. This research analyzes an apparent overvalue of Tesla's Stock era to test the hypothesis of the presence of a stock market bubble caused by investors irrationality, first applying a Holt-Winters methodology to forecast Tesla's stock price and compare the results with a fundamental approach to define if the stock is under or overvalued.

Speakers: JUAN CARLOS BRIBIESCA, PhD, Tec de Monterrey
Luciana Ehrsam, Management, University of Essex
Fernando Marine, Research, Universidad Anahuac

Wednesday, Parallel Sessions 3, 13:30-14:30 EDT

Session Start: 06/22/2022 01:30 PM, Session End: 06/22/2022 02:30 PM

Section: ASTIN

Title: Monte Carlo Simulation, Dependence, and Risk Accumulation

A framework for generating Monte Carlo simulations for a portfolio of risk variables exhibiting interdependence is presented. The framework's structure is versatile, allowing the user to opt between dependence structure sophistication and computational efficiency. Consideration for underlying variable dependence is especially important for the quantification of extreme value statistics of financial and insurance portfolios. To build the methodology, copula theory, factor modeling techniques, and the Julia programming language are leveraged. The methodology is widely applicable and agnostic to the underlying risk variable distributions. The presentation will explore how to incorporate both numerical and categorical factor inputs into the dependence modeling paradigm. Although there are many potential applications of

dependency modeling and Monte Carlo simulation, the presentation will focus on the application to risk accumulation.

Speakers: Katherine Dalis, Senior Staff Actuarial Solutions Strategist, One Concern

Wednesday, Parallel Sessions 3, 13:30-14:30 EDT

Session Start: 06/22/2022 01:30 PM, Session End: 06/22/2022 02:30 PM

Section: ASTIN

Title: Capturing the dependence among large losses using extreme-value copulas

One possibility of dependence modeling among losses is using copulas, a technique that has been extensively used since the 1990s. However, the empirical literature about this is limited, and articles using real-world microdata are rarer. Our purpose is to estimate dependence structure among large losses from a single event that generated multiple claims in different lines of business using extreme-value copulas(EVC) applying to real-world insurance data and comparing to other families of copulas. The study is divided into two parts: (i)adjustment of dependence on simulated data, whose dependence structure is known, and (ii)capture of the dependence structure in real-world dataset of 13,734 losses belonging to different lines of business, incurred by a single event, whose dependence is unknown. Overall, the non-parametric method performed better than the parametric ones, producing more consistent estimates. In several real situations, EVC were more adequate to capture the dependence amo

Speakers: João Vinícius Carvalho, Assistant Professor, University of São Paulo
Thiago Araujo, , University of São Paulo

Wednesday, Parallel Sessions 3, 13:30-14:30 EDT

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Section: ASTIN

Title: Modeling the Reserving Cycle with the Discrete Fourier Transform

The paper will demonstrate an application of the discrete Fourier transform in reserving by presenting a distribution free model of the reserving cycle. A parallelogram of data is organized as a periodic sequence, which is interpolated by a Fourier series. A simple criteria is given for separating the signal from the noise, revealing the loss emergence pattern. Finding the least squares trend takes a slightly different form in Fourier analysis, where Parseval's theorem relates the total sum of squares to the sum of the squared Fourier coefficients. The reserving cycle is identified as being generated by the lowest frequencies in the remaining noise. This presents the actuary with the interesting choice of finding the trend that minimizes either the systemic risk (reserving cycle) or the total risk.

Speakers: James Ely, President, Convolved, Inc

Wednesday, Parallel Sessions 3, 13:30-14:30 EDT

Session Start: 06/22/2022 01:30 PM, Session End: 06/22/2022 02:30 PM

Section: ASTIN

Title: The predictive power of the multinomial distribution - 2 practical examples

In my last two presentations for the IAA (2019 in Capetown and 2021 during the Virtual IAA) I dealt with the premium adjustment process for the flatrated fleet model

"bonus-malus", especially with regard to heightening the profitability of the flatrated fleet portfolio. One open point remains: To predict the loss ratio at the end of the year (on the basis of June figures) which is crucial in predicting the top-line for automatically renewed fleets in this segment.

Here, the multinomial distribution (with GLM) comes into play. I intend to showcase how well this approach functions to predict the premium volume next year and, at the same time, to demonstrate how the worsening pandemic in November/December 2020 in Germany almost derailed the predictive power of my model (still, it showed a pretty amazing robustness).

This gave me the motivation to apply the same "philosophy" for another flatrated fleet model (new calc) where each year each fleet has to be calculated anew.

Speakers: Michael Klamser, Senior Actuary, Allianz Versicherungs AG

Wednesday, Parallel Sessions 4, 15:00-16:00 EDT

Session Start: 06/22/2022 03:00 PM, Session End: 06/22/2022 04:00 PM

Section: ASTIN

Title: Peer-to-Peer Multi-Risk Insurance and Mutual Aid

"Peer-to-peer (P2P) insurance is a decentralized network in which participants pool their resources together to compensate those who suffer losses. It is a revival of a centuries-old practice in many ancient societies. With the aid of internet technology, P2P insurance is becoming a transparent, high-tech and low-cost alternative to traditional insurance and is viewed by many as a huge disruptor to the traditional insurance industry in the same way Uber is to the taxi industry.

This paper presents an effort to build the framework for the design of mutual aid and P2P insurance. Most of existing business models in practice, whether traditional or P2P, are

developed to insure against a particular risk, such as critical illness, accidental deaths, property damage, etc. However, even with the same type of risk, not all peers can be of the same loss distribution due to different age cohort, health status, or property conditions, etc.

Speakers: Runhuan Feng, Professor and Director of Actuarial Science Program, University of Illinois

Wednesday, Parallel Sessions 4, 15:00-16:00 EDT

Session Start: 06/22/2022 03:00 PM, Session End: 06/22/2022 04:00 PM

Section: ASTIN

Title: Required Sample Size in Capital Modeling

Capital modeling requires very large samples. We use the normal approximation to derive relationships between sample sizes and error ranges for estimating VaR and TVaR. We focus on one-year capital models. In a one-year model, investments and catastrophes are the greatest risk sources. We show how the shape and tail behavior of their probability distributions lead to different requirements in sample sizes. Related mathematical theories are also reviewed.

Speakers: Kevin Zhang, Assistant Vice President, Cincinnati Insurance Companies

Wednesday, Parallel Sessions 4, 15:00-16:00 EDT

Session Start: 06/22/2022 03:00 PM, Session End: 06/22/2022 04:00 PM

Section: ASTIN

Title: Simulation-based Earthquake Insurance Risk Calculation

Insurance risk arising from catastrophes such as earthquakes is one of the components of the Minimum Capital Test for federally regulated property and casualty insurance companies. The Office of the Superintendent of Financial Institutions (OSFI) in Canada currently determines capital adequacy based on the 500-year return period of the country-wide earthquake risk, which is computed using a simple function of the probable maximum loss of Eastern and Western Canada. In this paper, a simulation-based approach is used in which losses and insurance claim payments are calculated by relying on earthquake hazard maps of Canada. Building occupancy classifications and their respective damage probability matrices are combined with the earthquake insurance market penetration and policy terms to calculate the earthquake risk for each Canadian municipality. As an alternative to the current guidelines of OSFI, a formula to calculate the country-wide minimum capital test is proposed based on the corr

Speakers: Roba Bairakdar, , Concordia University

Wednesday, Parallel Sessions 4, 15:00-16:00 EDT

Session Start: 06/22/2022 03:00 PM, Session End: 06/22/2022 04:00 PM

Section: ASTIN

Title: Update on Actuarial Density and Actuarial Penetration

Actuarial density and actuarial penetration are measures that can provide useful insights in study of the actuarial profession in countries, regions, or actuarial associations around the world. A critical component of the measures is the count of actuaries, which is then related to certain bases. Previous analyses of actuarial density and penetration have used the concept of “fully qualified actuary (FQA)” as the count, but the International Actuarial Association (IAA) is now collecting data and relying on a more inclusive measure, “member with an actuarial credential (MWAC)” for some of its organizational purposes. Besides the change in definition, there has been more than 30% growth in the number of “full member associations (FMAs)” of the IAA in the last decade. The current analysis updates previous analysis by the authors using MWAC rather than FQA and provides comparison where possible and explanatory.

Speakers: Michael Smith, , XCEEDANCE

Cristina Mano, Partner Director, Cantanhede Mano Consultoria em Atuarial