

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.

Thursday, Parallel Sessions 1, 10:00-11:00 CEST

Session Start: 06/23/2022 10:00 AM, Session End: 06/23/2022 11:00 AM

Section: AFIR/ERM

Title: Selling life insurance in Africa and Modeling Loss Reserving for surrounding in Micro saving Product

"The marketing of life insurance products must incorporate the principle that life insurance cannot be bought but sold. In our opinion, it must be completed to integrate new distribution channels that take into account the socio-economic realities of our populations and the competitive environment in which the life insurer's business is carried out today. After the IT migration to the new software system, the database had many contracts in the process of Termination.

The goal of this study is how to constitute the DJIGUI Reserving- non-refundable savings contracts which, however, for commercial reasons are redeemed slowly. To Find an auditable and logical actuarial method. We note with insurance classic accounts; we therefore arrive with a maximum annual premium of 12,600 GNF per account to cover an annual death capital of 8,000,000 GNF NEAR 1000 Dollars for a number of accounts of approximately 150,000 insured. S / P ratios have been below 40/100 for years.

Speakers: , ,

Thursday, Parallel Sessions 1, 10:00-11:00 CEST

Session Start: 06/23/2022 10:00 AM, Session End: 06/23/2022 11:00 AM

Section: AFIR/ERM

Title: Taxation treatment of retirement income products in Australia focusing on variable annuity contracts

This paper develops a comprehensive framework for the valuation and assessment of retirement income products in Australia with particular focus on variable annuity (VA) contracts currently offered in the market. We consider VA contracts imbedded with guaranteed minimum

accumulation benefit and guaranteed minimum death benefit riders when policyholder's proceeds are subject to taxation if accessed before the preservation age as currently specified by the Australian Taxation Office. The contribution of this research is two-fold: firstly, we consider and incorporate several features of the Australian superannuation (pension) taxation regime including the treatment of benefits before and after the preservation age. Secondly, we consider a product design structured around a two-account setting where management fees and related costs are deducted from the investment account whilst guarantee fees are deducted from a separate cash account both of which are owned by the policyholder.

Speakers: Jonathan Ziveyi, Associate Professor, University of New South Wales

Thursday, Parallel Sessions 1, 10:00-11:00 CEST

Session Start: 06/23/2022 10:00 AM, Session End: 06/23/2022 11:00 AM

Section: ASTIN

Title: Fraud detection in insurance using generative adversarial networks for data imbalance

Fraud detection in the insurance business is a supervised learning classification problem where either a claim is fraudulent or non-fraudulent. A number of models were developed to address this such as random forests, neural networks, and many others. However, the critical issue in building these models is – how to tackle the inherent data imbalance in the given dataset, which is more prominent in the case of insurance frauds. Popular data-imbalance techniques such as SMOTE, MWMOTE, ADASYN, etc. would help address this issue but are not adequate enough to apply in health insurance data. In this work, we are presenting an innovative way of using Generative Adversarial Networks (GANs) to handle the data-imbalance issue. GANs are widely used in the field of image processing. Exploration of GANs on insurance fraud is a unique contribution in this work. We also worked on the relative performance of other data-imbalance techniques in comparison to GANs.

Speakers: Rohan Yashraj Gupta, Actuarial Research, Sri Sathya Sai Institute of Higher Learning

Thursday, Parallel Sessions 1, 10:00-11:00 CEST

Session Start: 06/23/2022 10:00 AM, Session End: 06/23/2022 11:00 AM

Section: ASTIN

Title: Integrating hidden markov model with machine learning for fraud detection in health insurance

Fraud, anomaly or intrusion detection are terms used to define the problem of finding unusual patterns or activities in the data. Researchers are constantly finding better ways to tackle this

problem and in this pursuit, many methods have been developed in numerous domains such as server systems, network, electronic systems, insurance, banking sector, and others. In this work, we will be presenting two approaches – a Hidden Markov Model (HMM) and an improved Hidden Markov Model using Gradient Boosting Method (GBM) applied to health insurance claims dataset. HMM has rarely been used in the insurance datasets. The use of HMM brings better explainability in comparison to a pure machine learning model. In this work, we have built an innovative HMM-based model for fraud detection in health insurance and achieved good results. The dataset has 382,587 claims of which 38,082 claims are fraudulent. The model and its performance were evaluated using various standard metrics.

Speakers: Phani Kandala, ,

Thursday, Parallel Sessions 1, 10:00-11:00 CEST

Session Start: 06/23/2022 10:00 AM, Session End: 06/23/2022 11:00 AM

Section: ASTIN

Title: Optimal prevention strategies in the classical risk model

In this talk, we propose and study a first risk model in which the insurer may invest into a prevention plan which decreases claim intensity. We determine the optimal prevention investment for different risk indicators. In particular, we show that the prevention amount minimizing the ruin probability maximizes the adjustment coefficient in the classical ruin model with prevention, as well as the expected dividends until ruin in the model with dividends. We also show that the optimal prevention strategy is different if one aims at maximizing the average surplus at a fixed time horizon. A sensitivity analysis is carried out. We also prove that our results can be extended to the case where prevention starts to work only after a minimum prevention level threshold. We then study the case where prevention only works for severe claims. At the end of the talk, we shall explain how to target prevention towards the right policyholders in health insurance using some data analytics techniques.

Speakers: Stephane Loisel, Professor, Université Claude Bernard Lyon 1

Thursday, Parallel Sessions 1, 10:00-11:00 CEST

Session Start: 06/23/2022 10:00 AM, Session End: 06/23/2022 11:00 AM

Section: ASTIN

Title: Optimal reinsurance under terminal value constraints

Optimal reinsurance is a perennial problem in insurance. The problem formulation considered in this paper is closely connected to the optimal portfolio problem in finance, with some important distinctions. In particular, the surplus of an insurance company is routinely approximated by a Brownian motion, as opposed to the geometric Brownian motion to model

assets in finance. Furthermore, exposure to risk is controlled via reinsurance, rather than risky investments. This leads to interesting qualitative differences in the optimal solutions.

In this paper, using the martingale method, we derive the optimal proportional, non cheap reinsurance control that maximises the quadratic utility of the terminal value of the insurance surplus. We also consider a number of realistic constraints on the terminal value: the strict lower boundary, the probability (Value at Risk) constraint, and the expected shortfall (conditional Value at Risk) constraints under the P and Q measures, respectively.

Speakers: Benjamin Avanzi, Professor, University of Melbourne

Thursday, Parallel Sessions 2, 11:30-12:30 CEST

Session Start: 06/23/2022 11:30 AM, Session End: 06/23/2022 12:30 PM

Section: AFIR/ERM

Title: Computation of bonus in multi-state life insurance

"We consider computation of market values of bonus payments in multi-state with-profit life insurance. The bonus scheme consists of additional benefits bought according to a dividend strategy that depends on the past realization of financial risk, the current individual insurance risk, the number of additional benefits currently held, and so-called portfolio-wide means describing the shape of the insurance business. We formulate numerical procedures that efficiently combine simulation of financial risk with more analytical methods for the outstanding insurance risk. Special attention is given to the case where the number of additional benefits bought only depends on the financial risk.

Keywords: Market consistent valuation; With-profit life insurance; Participating life insurance; Economic scenarios; Portfolio-wide means"

Speakers: Jamaal Ahmad, ,

Thursday, Parallel Sessions 2, 11:30-12:30 CEST

Session Start: 06/23/2022 11:30 AM, Session End: 06/23/2022 12:30 PM

Section: AFIR/ERM

Title: Impact of management actions such as policyholder dividends on solvency ratio

Enterprise Risk Management for Insurers gets more practical stage. Management should make actions in order to achieve risk management objective. In this paper, we treat and perform simulations regarding Solvency and management actions. ICS and Solvency II allow insurers to take "management actions" into account, those actions including changes of dividend for policyholders, actuarial assumption, condition for claims paid, investment portfolio, reinsurance

strategy. The management actions affect both net asset value of insurers (capital) and their total risks. In this presentation, setting the model for the effect of management actions, how the changes of dividend for policyholders reduce or increase the solvency ratio, both reduce of the capital and total risks considered. The model where dividend for policyholders increases in proportion to its solvency ratio, the action makes the ratio increase in a short term, and decrease in a long run.

Speakers: Miwaka Yamashita, ,

Thursday, Parallel Sessions 2, 11:30-12:30 CEST

Session Start: 06/23/2022 11:30 AM, Session End: 06/23/2022 12:30 PM

Section: ASTIN

Title: Generating unfavorable VaR scenarios with patchwork copulas

The central idea of the paper is to present a general simple patchwork construction principle for multivariate copulas that create unfavourable VaR (i.e. Value at Risk) scenarios while maintaining given marginal distributions. This is of particular interest for the construction of Internal Models in the insurance industry under Solvency II in the European Union.

Speakers: Dietmar Pfeifer, university professor (retires), University of Oldenburg, Germany

Thursday, Parallel Sessions 2, 11:30-12:30 CEST

Session Start: 06/23/2022 11:30 AM, Session End: 06/23/2022 12:30 PM

Section: ASTIN

Title: Internal Modeling without copulas: the beauty of multivariate Thorin classes

The generalized gamma convolutions class of distributions appeared in Thorin's work while looking for the infinite divisibility of the log-Normal and Pareto distributions. Although these distributions have been extensively studied in the univariate case, the multivariate case and the dependence structures that can arise from it have received little interest in the literature. Furthermore, only one projection procedure for the univariate case was recently constructed, and no estimation procedures are available. By expanding the densities of multivariate generalized gamma convolutions into a tensorized Laguerre basis, we bridge the gap and provide performant estimation procedures for both the univariate and multivariate cases. We provide some insights about performance of these procedures, and a convergent series for the density of multivariate gamma convolutions, which is shown to be more stable than Moschopoulos's and Mathai's univariate series. We furthermore discuss some examples.

Speakers: Oskar Laverny, P.h.d, SCOR SE

Thursday, Parallel Sessions 2, 11:30-12:30 CEST

Session Start: 06/23/2022 11:30 AM, Session End: 06/23/2022 12:30 PM

Section: ASTIN

Title: Predicting Region-Specific Seismic Losses and Tail Risk – DFA with Learning Algorithms

The seismic risk assessment and resiliency of the urban city requires the robust procedure by reflecting multidisciplinary research aspects into the loss modeling. The analysis requires regional data such as seismicity, geological setting, structural materials\conditions, and infrastructure networks even though some geospatial data are available such as satellite imagery and digital elevation models. Therefore, inputs from public authorities and local experts are important to adjust global risk prediction models to region-specific ones. The output of seismic risk assessment substantially ranges depending on the available data and modelling. This study presents an automated platform to update the global seismic risk models to region-specific ones by incorporating spatial temporal input variables. The prediction models such as ground motion attenuations, fragility curves, loss estimations are developed by updating global ones with region-specific data using artificial intelligence. The

Speakers: Chitro Majumdar, ,
Rita Sousa, ,

Thursday, Parallel Sessions 2, 11:30-12:30 CEST

Session Start: 06/23/2022 11:30 AM, Session End: 06/23/2022 12:30 PM

Section: ASTIN

Title: Seismic Risk Assessment in UAE by the Large-Magnitude Offshore Shallow Crustal Earthquake

The seismic risk assessment and resiliency of the urban city requires the robust procedure by reflecting multidisciplinary research aspects into the loss modeling. However, the risk study in the United Arab Emirates (UAE) is limited because the regional data and hazard models are limited. Moreover, the platform is required that combines these regional models into the loss estimations. Since large uncertainties exist in the hazard models for multiple aspects such as ground motion attenuations, site amplification, regional structural fragility, and the loss modeling related to the regional network, it is important to understand the impact of uncertainties on loss estimation to effectively conduct the future researches. This study presents a seismic loss estimation by the scenario earthquakes occurred in Iran, which is approximately 100-km offshore in UAE. The impact of the uncertainties related to the regional modeling is illustrated to understand how important to integrate the local stud

Speakers: Tadahiro Kishida, Dr., Khalifa University

Thursday, Parallel Sessions 3, 13:30-14:30 CEST

Session Start: 06/23/2022 01:30 PM, Session End: 06/23/2022 02:30 PM

Section: AFIR/ERM

Title: Cyber Risk Management

The objective of our research is to contribute to the actuarial literature on cyber risk assessment in order to provide possible solutions for the reduction of the gap between supply and demand of cyber insurance.

In particular, the aim is to achieve a better understanding in quantifying, managing and pricing cyber risk by means of:

- a) a deeper awareness of cyber risks and of the economic damages they produce;
- b) the introduction and validation of new actuarial techniques to allow insurers a more efficient management of this new class of risk;
- c) The design of innovative insurance contracts and alternative ways of risk transfers to reduce the costs of insurance premiums.

To this end, we will make use of actuarial models based on statistical techniques: starting from the classical Generalized Linear Model for actuarial pricing, we will then introduce a more sophisticated Integer Valued GARCH model to introduce time-dependent effects.

Speakers: Marco Pirra, ,

Thursday, Parallel Sessions 3, 13:30-14:30 CEST

Session Start: 06/23/2022 01:30 PM, Session End: 06/23/2022 02:30 PM

Section: AFIR/ERM

Title: Regulation risk: the case of Solvency II

This paper is a piece for introducing the idea that unsustainability could result from the regulation itself. There would be a risk created by regulation, a “regulation risk”, which could make regulation unsustainable. It is argued that a part of the observed unsustainable short-termism on financial markets is due to a regulation risk based on a hazardous way to understand the randomness in the case of long-term horizons and sustainability. The argument makes a detour via philosophy of science, exhibiting the Leibniz “principle of continuity”: change is continuous. It is argued that short-termism created by regulation is the visible result of the choice of continuous randomness itself the outcome of the principle of continuity. The “Absence of Opportunity of Arbitrage” (AOA) which represents the intellectual cornerstone of the dominant contemporary financial approaches derives from the principle of continuity.

Speakers: Christian WALTER, Professor, Kedge Business School

Thursday, Parallel Sessions 3, 13:30-14:30 CEST

Session Start: 06/23/2022 01:30 PM, Session End: 06/23/2022 02:30 PM

Section: ASTIN

Title: A copula estimation through recursive partitioning of the unit hypercube

We construct a flexible, consistent, piecewise linear estimator for a copula, leveraging the patchwork copula formalization and various piecewise constant density estimators. While the patchwork structure imposes the grid, our estimator is data-driven and constructs the grid recursively from the data, minimizing a chosen distance on the copula space. Furthermore, while the addition of the copula constraints may make the available solutions for density estimation unusable, our estimator is only concerned with dependence and guarantees the uniformity of margins. Refinements such as localized dimension reduction and bagging are developed, analyzed, and tested through applications on simulated data.

Speakers: Oskar Laverny, P.h.d, SCOR SE

Thursday, Parallel Sessions 3, 13:30-14:30 CEST

Session Start: 06/23/2022 01:30 PM, Session End: 06/23/2022 02:30 PM

Section: ASTIN

Title: Gamma Mixture Density Networks and their application to modelling insurance claim amounts

We discuss how mixtures of Gamma distributions with mixing probabilities, shape and rate parameters depending on features can be fitted with neural networks. We develop two versions of the EM algorithm for fitting so-called Gamma Mixture Density Networks, which we call the EM network boosting algorithm and the EM forward network algorithm, and we test their implementation together with the choices of hyperparameters. A simulation study shows that our algorithms perform very well on synthetic data sets. We further illustrate the application of the Gamma Mixture Density Network on a real data set of motor insurance claim amounts and conclude that Gamma Mixture Density Networks can improve the fit of the regression model and the predictions of the claim severities used for rate-making compared to classical actuarial techniques. This is a joint work with Mathias Lindholm and Mario Wüthrich.

Speakers: Łukasz Delong, Professor, SGH Warsaw School of Economics

Thursday, Parallel Sessions 3, 13:30-14:30 CEST

Session Start: 06/23/2022 01:30 PM, Session End: 06/23/2022 02:30 PM

Section: ASTIN

Title: Longevity and mortality risk management post-Covid

The pandemic gave rise to unprecedented high levels of mortality. But the pattern of excess mortality has been quite different in different populations. We will review this experience and discuss its implications for mortality and longevity risk management.

Speakers: Andrew Cairns, , Heriot-Watt University

Thursday, Parallel Sessions 3, 13:30-14:30 CEST

Session Start: 06/23/2022 01:30 PM, Session End: 06/23/2022 02:30 PM

Section: ASTIN

Title: Mental health and insurance cover

In many countries individuals with mental health problems have difficulties in getting insurance as they are thought too risky with higher mortality and accident etc. risk.

I am currently working with a professor of psychiatry on this topic. Our initial findings are:

- mental health problems come in many varieties with only few of them resulting in substantially higher risk
- modern therapies and medicines work well by reducing dramatically the number of suicides - in many cases one can say that people who have undergone therapy are better risks than the average
- while mortality linked directly to mental issues is going down, longitudinal studies show higher mortality due to, e.g., cardiovascular diseases among those who have at some point of life had mental problems - but a more probable reason might be the lower socioeconomic status of these persons (and they have ended into this status due their mental problems, with one stress factor being denial of insurance cover).

Speakers: Esko Kivisaari, Deputy Managing Director, Finance Finland

Thursday, Parallel Sessions 4, 15:00-16:00 CEST

Session Start: 06/23/2022 03:00 PM, Session End: 06/23/2022 04:00 PM

Section: AFIR/ERM

Title: Covering pandemic risk: insurance or smart saving?

The insurability of pandemic risk by the private sector is questioned by many parties, the main concerns being lack of diversification and of insurance capacity. We want to look at the

problem from the perspective of a pricing actuary. Loss severity is an issue, of course, at least in the aggregate. Yet, it could ultimately depend more on the loss frequency, to what extent, and how, pandemic risk could be covered.

We focus on Non-Damage Business Interruption and illustrate that frequency and risk premium for pandemic BI are likely far higher than many people think. Yet, this is possibly not totally bad news. If pandemics are more frequent, it may be easier to design reasonable ways to cover the risk. Solutions could involve a kind of equalization reserve.

Speakers: Michael Fackler, consulting actuary, self-employed

Thursday, Parallel Sessions 4, 15:00-16:00 CEST

Session Start: 06/23/2022 03:00 PM, Session End: 06/23/2022 04:00 PM

Section: AFIR/ERM

Title: Insurability and Pandemic (or More Generally, Shared Resilience) Risk

I was the main author of the paper with the title above, published by the Actuarial Association of Europe, see: <https://actuary.eu/memos/insurability-and-pandemic-or-more-generally-shared-resilience-risk/>. I would present the thoughts of the paper

Speakers: Esko Kivisaari, Deputy Managing Director, Finance Finland

Thursday, Parallel Sessions 4, 15:00-16:00 CEST

Session Start: 06/23/2022 03:00 PM, Session End: 06/23/2022 04:00 PM

Section: ASTIN

Title: Actuarial and IT (R)evolutions

New Solvency regimes, new Accounting Standards, new ERM/ORSA frameworks put high modeling challenges to actuaries in insurance companies. In parallel IT and data science / AI are evolving at a huge pace. After reminding of the past evolution since antiquity, this session will focus on the present Actuarial & IT needs and trends and list the different options for the future: traditional actuarial software? Python? C#? Other?...

Speakers: Pierre Miehe, ,

Thursday, Parallel Sessions 4, 15:00-16:00 CEST

Session Start: 06/23/2022 03:00 PM, Session End: 06/23/2022 04:00 PM

Section: ASTIN

Title: Bootstrap Consistency for the Mack Bootstrap

The distribution-free chain ladder reserving model by Mack (1993) belongs to the most popular approach in non-life insurance mathematics to determine the first two moments of the reserve. But it does not allow to identify the whole distribution of the reserve. To estimate also quantiles of the reserve, e.g. to determine the value-at-risk and tail value-at-risk, Mack's model is usually equipped with a tailor-made bootstrap procedure. For this purpose, the resulting Mack bootstrap proposal requires additional parametric assumptions and postulates a normal distribution for the individual development factors. Although the Mack bootstrap is widely used in applications, no rigorous bootstrap consistency results exist that justify this approach.

Based on a general stochastic framework we investigate several parametric and non-parametric bootstrap procedures for estimators of the development factors and derive their properties. Further, by splitting the reserve risk into two random parts, t

Speakers: Julia Steinmetz, PhD student, TU Dortmund University

Thursday, Parallel Sessions 4, 15:00-16:00 CEST

Session Start: 06/23/2022 03:00 PM, Session End: 06/23/2022 04:00 PM

Section: ASTIN

Title: Capital requirements modeling for market and non-life premium risk in a dynamic insurance portfolio

Solvency II requires for some years that EU insurance companies calculate minimum capital requirements to face the risk of insolvency, either in accordance with the Standard Formula or using a full or partial Internal Model. An Internal Model must be based on a market consistent valuation of assets and liabilities at a one-year time span, where a real-world probabilistic structure is used for the first year of projection. In this paper, we describe the major risks of a non-life insurance company, i.e. the non-life underwriting risk and market risk, focusing on the non-life premium risk, equity risk and interest rate risk. This analysis is made using some well-known stochastic models in both the financial-actuarial literature and practical insurance business, i.e. the collective risk model for the non-life premium risk, the geometric Brownian motion for the equity risk and the G2++ model for the interest rate risk, where parameters are calibrated on current and real market data. We thus

Speakers: Stefano Cotticelli, Fully Qualified Actuary, Sapienza Università di Roma

Thursday, Parallel Sessions 4, 15:00-16:00 CEST

Session Start: 06/23/2022 03:00 PM, Session End: 06/23/2022 04:00 PM

Section: ASTIN

Title: Continuous partition-of-unity copulas and their application to risk management and other fields

In this paper we discuss a natural extension of discrete partition-of-unity copulas to continuous partition of copulas with possible applications in risk management and other fields of insurance. We present a general simple algorithm to generate such copulas on the basis of the empirical copula from high-dimensional data sets. In particular, our constructions also allow for an implementation of positive tail dependence which sometimes is a desirable property of copula modelling, in particular for internal models under Solvency II.

Speakers: Dietmar Pfeifer, university professor (retires), University of Oldenburg, Germany