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UME / IAM

RECENT DEVELOPMENTS IN ACTUARIAL SCIENCE WORKSHOP

Institute of Applied Mathematics
METU, Ankara

PROGRAM

Morning Session – Moderator: Büşra Z. Temoçin

09:00 – 10:00 Registration and Opening Remarks
10:00 – 10:30 Hamza Hanbali
10:30 – 11:00 Uğur Karabey
11:00 – 11:15 Coffee break
11:15 – 11:45 Oytun Haçarız
11:45 – 12:15 Ozan Evkaya (online)

12:15 – 13:30 Lunch (At the venue)

Afternoon Session – Moderator: Zarina Oflaz

13:30 – 14:00 Sevtap Kestel
14:00 – 14:15 Coffee break
14:15 – 14:45 Selin Özen
14:45 – 15:30 Closing Remarks and Reception

Cryptology Laboratory, Institute of Applied Mathematics, Middle East Technical University

SOMPO

Recent Developments in Actuarial Science Workshop

The academic event Recent Developments in Actuarial Science Workshop will take place on 25 June 2024. The event will be hosted by the Institute of Applied Mathematics, Middle East Technical University.

The purpose of this workshop is:

- to bring together researchers and professionals worldwide who work in Actuarial Science in a broad sense as well as graduate students entering this exciting area, and
- to create a stimulating atmosphere where participants can meet and hear about each other's work, hold discussions, share ideas and hopefully initiate future collaborations

This workshop is supported by SOMPO Insurance.

Topics of the workshop include but are not restricted to:

- Artificial Intelligence in Actuarial Science
- IFRS 17 and solvency II
- Optimal premium
- Reinsurance
- Loss modeling
- Climate change in actuarial valuation
- Extreme value modeling
- Data analytics and predictive models in actuarial science

Committees
Steering Committee
Büşra Z. Temoçin
A. Sevtap Selçuk-Kestel
Local Organizing Committee
Büşra Z. Temoçin
A. Sevtap Selçuk-Kestel
Technical Assistance
H. Bartu Yünüak
İlkyaz Aslanöz

Hamza Hanbali

Monash University, Econometrics & Business Statistics Dept.

Title

Mean-variance longevity risk-sharing for annuity contracts

Abstract

This paper investigates longevity risk-sharing as a solution to the sustainability and affordability problems in the annuity market, and in particular how much longevity risk could be transferred back to policyholders assuming mean-variance preference functions. First, it provides dynamic risk-sharing rules for annuities. Second, it studies the contract properties from the perspectives of both the provider and individual policyholders. Third, it highlights and accounts for two levels of uncertainty and two levels of correlation induced by systematic longevity risk. Fourth, it provides necessary and sufficient conditions on the premium loading and the share of transferred risk, such that both parties prefer risk-sharing. The analytical and numerical results of the paper offer a deeper understanding of the effects of systematic and diversifiable risks on those preferences, and show that the products presented in this paper are suitable retirement solutions.

Uğur Karabey

Hacettepe University, Actuarial Sciences Dept.

Title

Analyzing Mortality Rate Jumps within the IFRS 17 Framework

Abstract

The financial performance of insurance companies hinges on the balance between incomes and costs. This balance becomes more complex compounded by uncertainties inherent in insurance contracts regarding the timing and amount of benefits. Traditional accounting practices often fail to capture these nuances accurately, leading to misleading representations of profit and loss. To address this, the International Accounting Standards Board (IASB) introduced the IFRS 17 Insurance Contracts standard in 2017. While the actuarial community is still in the nascent stages of grappling with the implications of IFRS 17, recent studies have made significant improvements. This paper investigates the financial ramifications of unexpected mortality rate jumps within the IFRS 17 framework, coupled with an analysis of cash flows over time, a pivotal aspect of the standard. The study integrates both a permanent and a temporary mortality jump model, to capture the dynamic nature of mortality rates. Utilizing data from the United States, parameter estimations are conducted, and simulations are generated to examine the impact of mortality rate jumps, particularly in light of the COVID-19 pandemic.

Oytun Haçarız

Karabuk University, Actuarial Sciences Dept.

Title

Recent developments in prediction power of GWAS and insurance

Abstract

Since DNA-based genetic testing has become available in the 1990s, insurance has become one of the most contentious fields on the usage of the results of the genetic testing. Individuals and patient groups have often worried that they will be declined or not even afford on access of insurance due the fact that their genetic test results would be so highly predictive of greatly increased risk related to their morbidity and mortality. Insurers have often worried that, if genetic test results are not disclosed to them, adverse selection, i.e., information asymmetry between applicants and insurers in underwriting, will occur. At early stage, the insurance industry's focus was on economically relevant monogenic disorders (such as Huntington's Disease, Hypertrophic Cardiomyopathy, etc.), caused by rare but highly penetrant genetic variants. Necessary premium increases (due to unknown test results of these disorders) were estimated to be low under 'realistic' adverse selection scenarios. Recently, (a) the cost of testing whole human genome has dramatically decreased, which led insurers to expect genetic testing to become widespread and (b) genome-wide association studies (GWAS) using large biobank data have promised a potential to identify genetic substrate of many common disorders, caused by a combination of slight variants in many genes and environmental factors. In this talk, we will be discussing recent developments in prediction power of genetic material alone in predicting common disorders, and the future course of the disorders, and its impact, with the expansion in genetic testing and technological innovations in future, on insurance under adverse selection.

Ozan Evkaya

University of Edinburgh, School of Mathematics

Title

Importance of LLMs and their potential usage for Actuarial Science

Abstract

Under the impact of fast-evolving AI technologies, recently, Large Language Models (LLMs) have emerged, and spurred public interest since November 2022. Regarding its ongoing development in the last couple of

years, various research fields including actuarial science show various potential with certain implementation risks using LLMs. Specifically, the concept of multi-modality and multi-agents have immense potential how practitioners from different fields can communicate with machines. Under the light of these recent advancements, this talk aims to explore the significance of LLMs today, emphasizing their transformative potential in actuarial practices. Based on some pioneering LLM based tools applied to finance, one can argue that these advanced models enhance traditional actuarial functions such as risk assessment, policy design, and claims processing by leveraging vast datasets to predict outcomes and automate complex decision-making processes. With the ethical and responsible integration of LLMs, actuarial science (finance in a broader setting) may expose to new upcoming innovations and potential risks. Practically, this talk will include some background information regarding the history and enhancement of LLMs in the last couple of years. By referring to some recent papers and implementations, the discussion will be enriched by case studies that illustrate the practical applications and benefits of LLMs in real-world actuarial tasks.

Sevtap Kestel

Middle East Technical University, Institute of Applied Mathematics

Title

Premium share between insurer and reinsurer in Stop-loss under stochastic loss behavior

Abstract

The pricing in the stop-loss contracts is an important consideration of insurer and reinsurer. Based on historical loss amounts a stochastic model with the time-varying parameters to capture the time-dependent structure is developed. The analytical derivations of costs associated with reinsurance contract for reinsurer and insurer with constraints on time, loss amount, retention, and both retention and cap levels are made in the course of the claim payments. Along with these, the analytical forms of exposure curves are derived for determining the premium share between reinsurer and insurer under prescribed constraints. An illustrative case study is given at which the calibration of time-varying parameters is made using dynamic maximum likelihood estimator The findings depict that implementation of a stochastic model with time-varying parameters improves the prediction power and ascertains a fair risk share between insurer and reinsurer.

Selin Özen

Ankara University, Actuarial Sciences Dept.

Title

Mortality Models in the Wake of COVID-19: Jumps, Forecasts, and Insurance Pricing

Abstract

Population events such as natural disasters, pandemics, extreme weather, and wars might cause jumps that have an immediate impact on mortality rates. The recent COVID-19 pandemic has demonstrated that these events should not be treated as nonrepetitive exogenous interventions. Therefore, mortality models incorporating jump effects are particularly important to capture the adverse mortality shocks. The mortality models with jumps, which we consider in this study, differ in terms of the duration of the jumps–transitory or permanent–the frequency of the jumps, and the size of the jumps. To illustrate the effect of the jumps, we also consider benchmark mortality models without jump effects, such as the Lee-Carter model, Renshaw and Haberman model and Cairns-Blake-Dowd model. We discuss the performance of all the models by analysing their ability to capture the mortality deterioration caused by COVID-19. We use data from different countries to simulate the mortality rates for the pandemic and post-pandemic years and examine their accuracy in forecasting the mortality jumps due to the pandemic. Moreover, we also examine the jump-free and jump models in terms of their impact on insurance pricing, specifically term annuity and life insurance present values calibrated for both pre- and post-COVID data.