



## 21<sup>st</sup> International Congress on Insurance: Mathematics and Economics - IME 2017

Vienna, Mon–Wed, July 3–5, 2017

### IME Educational Workshop

Vienna, Thu–Fri, July 6–7, 2017

<https://fam.tuwien.ac.at/ime2017/>

## General Information

The 21<sup>st</sup> International Congress on Insurance: Mathematics and Economics (IME 2017), scheduled July 3-5 2017, is one of the largest international meeting series in actuarial science.

The aim of the conference is "to strengthen communication between individuals and groups who produce and apply research results in insurance and finance, aiming to integrate the currently fragmented research in both fields".

The conference deliberations will be on the following themes:

- Life Insurance;
- Non-Life Insurance;
- Reinsurance and Other Risk-Sharing Arrangements;
- Risk Management;
- Financial Modeling.

In the framework of the *Panel Discussion* (July 3, 2017) with the topic "Ultra-low interest rates in insurance business" we offer the conference participants a platform for discussions with a number of renowned experts.

The *IME Educational Workshop* (July 6-7, 2017) is a satellite event of the IME 2017, aimed at both academics and practitioners and providing a general overview over the past and current research results and their practical applications.

The topics of the workshop are:

- Life Insurance,
- Non-Life Insurance,
- Claims Reserving Methods,
- Computational Actuarial Science with R.

### Organisers / Hosts:

Actuarial Association of Austria (AVÖ) / Aktuarvereinigung Österreichs  
Financial and Actuarial Mathematics (FAM), TU Wien / Technische Universität Wien

### Location

TU Wien, Wiedner Hauptstraße 8-10, 1040 Vienna, Austria

## Invited Speakers

### Invited Plenary Speakers at Congress

- Corina **Constantinescu-Loeffen** (University of Liverpool, UK)
- Catherine **Donnelly** (Heriot-Watt University, UK)
- Paul **Embrechts** (ETH Zurich, CH)

### Panel Discussion at Congress

- Paul **Embrechts** (ETH Zurich, CH)
- Eva **Fels** (Austrian Association of Insurance Companies, AT)
- Rüdiger **Frey** (WU Wien, AT)
- Axel **Helmert** (msg life central europe & Austria, DE & AT)
- Reinhold **Kainhofer** (Generali Versicherung, AT)
- Ralf **Korn** (TU Kaiserslautern, DE)
- Werner **Matula** (Vienna Insurance Group, AT)

### Invited Plenary Lecturers at Workshop

- Anna Rita **Bacinello** (University of Trieste, IT)
- René **Dahms** (ETH Zurich, CH)
- Vincent **Goulet** (Université Laval, Québec, CA)
- Stefan **Thonhauser** (Graz University of Technology, AT)

## Scientific and Organizing Committee

### Scientific Committee

- Hansjörg **Albrecher** (University of Lausanne, CH)
- Phelim P. **Boyle** (University of Waterloo, CA)
- Jan **Dhaene** (KU Leuven, BE)
- Boualem **Djehiche** (KTH Royal Institute of Technology, Stockholm, SE)
- Jose **Garrido** (Concordia University, Montreal, US)
- Marc **Goovaerts** (KU Leuven, BE)
- Rob **Kaas** (University of Amsterdam, NL)
- Stéphane **Loisel** (Université Lyon 1, FR)
- Thorsten **Rheinländer** (TU Wien, AT)
- Uwe **Schmock** (TU Wien, AT)
- Arnold **Shapiro** (Pennsylvania State University, USA)
- Elias **Shiu** (University of Iowa, USA)
- Mogens **Steffensen** (University of Copenhagen, DK)
- Qihe **Tang** (University of Iowa, US)
- Gordon **Willmot** (University of Waterloo, CA)
- Hailiang **Yang** (University of Hong Kong, HK)

### Local Organizing Committee

- Julia **Eisenberg** (University of Graz)
- Peter **Grandits** (TU Wien)
- Karin **Hirhager** (Actuarial Association of Austria)
- Manfred **Rapf** (Actuarial Association of Austria)
- Thorsten **Rheinländer** (TU Wien)
- Uwe **Schmock** (TU Wien)
- Sandra **Trenovatz** (TU Wien)

### Conference Secretariat

- Sandra **Trenovatz** (TU Wien)

## Plenary Talks at IME Congress

### Corina Constantinescu-Loeffen

(Department of Mathematical Sciences, University of Liverpool, United Kingdom)

#### Ruin probabilities in insurance risk models

Abstract: Starting from the classical compound Poisson collective risk model of Cramér and Lundberg, more complex models have been proposed to account for real phenomena in insurance business, such as the impact of financial investments or the dependence among events. We present some exact and asymptotic ruin probabilities results in different insurance risk models. For their derivation we advance both probabilistic and analytical arguments, employing differential equations, Laplace transforms, fractional calculus and regular variation theory.

### Catherine Donnelly

(Department of Actuarial Mathematics and Statistics, Heriot-Watt University, United Kingdom)

#### What is the future of pensions?

The pensions industry is leaving what looks like a golden age. What is it leaving behind? Where does the industry appear to be heading? What could it offer an individual, to help them plan, save and invest for a decent retirement?

We hope to stimulate discussion on what we as academic researchers can do to improve the retirement outcomes of our society.

### Paul Embrechts

(Department of Mathematics, ETH Zurich, Switzerland)

#### Quantile-Based Risk Sharing and Equilibria

We address the problem of risk sharing among agents using a two-parameter class of quantile-based risk measures, the so-called Range-Value-at-Risk (RVaR), as their preferences. The family of RVaR includes the Value-at-Risk (VaR) and the Expected Shortfall (ES), the two popular and competing regulatory risk measures, as special cases. We first establish an inequality for RVaR-based risk aggregation, showing that RVaR satisfies a special form of subadditivity. Then, the Pareto-optimal risk sharing problem is solved through explicit construction. To study risk sharing in a competitive market, an Arrow-Debreu equilibrium is established for some simple, yet natural settings. Further, we investigate the problem of model uncertainty in risk sharing, and show that, generally, a robust optimal allocation exists if and only if none of the underlying risk measures is a VaR. Practical implications of our main results for risk management and policy makers are discussed, and several novel advantages of ES over VaR from the perspective of a regulator are thereby revealed.

This talk is based on joint work with Hailian Liu and Ruodu Wang (University of Waterloo).

## Panel Discussion

### "Ultra-low interest rates in insurance business"

#### Panelists:

- Paul **Embrechts**  
Full professor for Mathematics, ETH Zurich, CH
- Eva **Fels**  
Austrian Association of Insurance Companies, AT
- Rüdiger **Frey**  
Full professor for Mathematics and Finance, WU Wien, AT
- Axel **Helmert**  
Managing Director of msg life central europe and msg life Austria, DE & AT
- Ralf **Korn**  
Full professor at the Financial Mathematics Group, TU Kaiserslautern, DE
- Werner **Matula**  
Head of the Actuarial Department, Vienna Insurance Group, AT

#### Moderator:

- Reinhold **Kainhofer**  
since April 2016: Deputy responsible actuary (Life), Generali Versicherung AG, AT,  
before: Financial and actuarial analyst in insurance supervision, Austrian Financial Market Authority, AT

#### Abstract:

In the past, economists traditionally assumed that the nominal interest rates are bounded below at zero. However, in the last 7-8 years the interest rates have been falling significantly, becoming even negative in some countries. As a matter of fact, the European Central Bank cut the fixed rate to zero and the deposit facility to -0.40 on the 16th of March 2016. The ultra-low interest rate environment remains a key concern for insurance business. For instance, life insurers' income from investments might be insufficient to meet guaranteed obligations, and non-life insurers might have to rise the insurance prices to compensate the reduction in investment income.

The anticipated rising of interest rates should improve the situation but is not free of dangers.

In the panel discussion, the problem of ultra-low interest rates and various tools to address it will be reviewed from different angles. Panelists will also discuss the general implications of the ultra-low interest rate environment on industry trends and regulatory demands.

## Plenary Lectures at IME Educational Workshop

### Anna Rita Bacinello

(Department of Economics, Business, Mathematics and Statistics "Bruno de Finetti", University of Trieste, Italy)

#### Market-Consistent Valuation of Life Insurance Liabilities

Providers of life insurance and pension benefits have always had to deal with a number of risks involving their business of various nature: financial-economic, biometric, behavioural, ... . Nevertheless, the increasing competition led them to offer more and more complex products, in order to tailor as much as possible the needs of their customers. This implied that modern life and pension products are designed as packages of various riders, that can be either included or not in the insurance contract, along with its basic element. A typical example of this is constituted by the variable annuities, that package several types of options and guarantees, at the policyholder's discretion. Therefore appropriate modelling tools are necessary in order to value such products. The aim of this course is to provide a market-consistent valuation framework of life and pension insurance liabilities, with a special focus on variable annuities.

### René Dahms

(Department of Mathematics, ETH Zurich, Switzerland)

#### Stochastic reserving in P&C insurance

Usually, claim reserves are the largest balance sheet item on the liability site of P&C (re)insurers. Therefore, their estimation is very important. Moreover, under Solvency II, SST (the Swiss way of Solvency II) or the forthcoming accounting standard IFRS 17 it is essential to estimate beside the expected value corresponding uncertainties. In this mini-course we will give a short introduction in reserving of P&C liabilities and different types of reserving methods used in practice. We will discuss the concept of best estimate reserves and different concepts of corresponding uncertainties at the example of Mack's Chain-Ladder model, probably the most used method in practice. Finally, we will have a short look at Linear-Stochastic-Reserving methods, a huge class of reserving methods which includes many classical methods used in practice.

### Vincent Goulet

(École d'actuariat, Université Laval, Québec, Canada)

#### Computational Actuarial Science with R

The numerical and computational aspects play an ever increasing role in the risk modeling and evaluation process. Participants to the workshop will improve their general programming skills and expand their knowledge of R for quantitative risk analysis. The workshop focuses on best practices and adopts a hands on approach with lots of demonstrations and exercises. We will first review the basic notions of R programming from an actuarial perspective, study the most important tools and learn to be efficient with the language. Because it is an important topic for any programmer, we will devote some time to floating point numbers and roundoff error. Based on a case study, the second part of the workshop will follow a typical risk analysis process: manipulation and modeling of insurance data, estimation, measuring of risk, evaluation and simulation. In closing, participants will learn to do more and be more effective in their work with literate programming and version control. A base knowledge of R and standard statistical and actuarial procedures is assumed.

#### Technical requirements:

Laptop computer with the [most recent version of R](#) installed and either a good R programmer editor or R IDE. We recommend:

- GNU Emacs with ESS ([macOS](#), [Windows](#));
- [RStudio](#).

#### Short bio:

Vincent Goulet is professor at the School of Actuarial Science of Université Laval, Québec, Canada. He began using R when the version number still started with a 0. Vincent is the maintainer of [actuar](#), the first R package specifically devoted to actuarial science and extreme value distributions. He has been teaching R programming to future actuaries for more than 12 years, an experience he distilled into the open document [Introduction à la programmation en R](#) (in French).

### Stefan Thonhauser

(Institute of Analysis and Number Theory, Graz University of Technology, Austria)

#### Optimization problems in risk theory

A large share of research in risk theory dealt with stochastic optimization problems in recent years. Classical contributions put the main focus on the minimization of the ruin probability and the maximization of expected dividend payments, which are inconsistent with one another in terms of the valuation of an insurer's portfolio. In this lecture we will recap the basic theory on stochastic optimal control and review the classical risk theoretic results. Subsequently, we will meet different variations of classical value functions and underlying surplus processes. These modifications typically change the nature of the optimization problems and explicit solutions are hardly available. Exemplary we will discuss the introduction of transaction costs in the problem of minimizing the ruin probability by investment and parameter uncertainty in the dividend problem. Finally, we will survey further extensions and solution techniques.