6th Workshop on Insurance Mathematics (WIM)

Friday, February 7, 2020
Great Hall, Western University

Schedule

8:00am – 8:50am	Registration
8:50am – 9:00am	Opening Remarks by Dr. Kristina Sendova (Chair, Department of Statistical and Actuarial Sciences, Western University) & Mr. Ravin Lathigra (Actuarial Associate, Canada Life Assurance Company)

Session 1: Risk Measures and their Applications

9:00 – 10:00	Keynote I: Dr. Jun Cai (University of Waterloo)
10:00 – 10:30	Dr. Silvana Pesenti (University of Toronto)
10:30 – 11:00	*Coffee Break*

Session 2: Optimal Reinsurance, Insurance Valuation and Risk Theory

11:00 – 11:30	Dr. Mario Ghossoub (University of Waterloo)
11:30 – 12:00	Dr. Maciej Augustyniak (University of Montreal)
12:00 – 12:30	Dr. Hélène Guérin (UQAM)
12:30 – 14:00	*Lunch Break*

Session 3: Risk Aggregation and Capital Allocation

14:00 – 15:00	Keynote II: Dr. Edward Furman (York University)
15:00 – 15:30	Dr. Wing Fung (Alfred) Chong (University of Illinois at Urbana-Champaign)
15:30 – 16:00	*Coffee Break*

Session 4: Data Analysis in Insurance and Finance

16:00 – 16:30	Dr. Katsuichiro Goda (Western University)
16:30 – 17:00	Dr. Hyukjun (Jay) Gweon (Western University)
18:00 – 21:00	*Banquet*

Abstracts

Keynote Speaker: Dr. Jun Cai (University of Waterloo)

Title: Recent Advances in the Study of Risk Measures and their Applications in Actuarial Science

Risk measures play a key role in quantitative risk management. A variety of risk measures have been proposed from different perspectives. Many tools and techniques of risk management are based on risk measures. In this talk, we present the recent advances in the study of risk measures and their applications in actuarial science. We show how to create practical risk measures from the behavioural economics theory; how to manage insurance risks by reinsurance and risk measures; and how to evaluate risk measures when the dependence and models of risks are uncertain.

Keynote Speaker: Dr. Edward Furman (York University)

Title: A Reconciliation of the Top-Down and Bottom-Up Approaches to Risk Capital Allocations: Proportional Allocations Revisited

Two overarching approaches to allocate the aggregate risk capital are common nowadays. These are the top-down approach that entails that the allocation exercise is imposed by the corporate centre, and the bottom-up approach that implies that the allocation of the aggregate risk to business units is informed by these units. Briefly, the top-down allocations start with the aggregate risk capital that is then replenished among business units according to the views of the centre, thus limiting the inputs from the business units. The bottom-up approach does start with the business units, but it is, as a rule, too granular, and so may lead to missing the wood for the trees.

In this talk, I will revisit the proportional allocation rule that is often used in applications with the aim to unify the aforementioned top-down and the bottom-up approaches to allocating the aggregate risk capital into one encompassing method. In order to do so, I will start by revealing a connection between the bottom-up approach to allocate the aggregate risk capital and a general class of Dirichlet distributions defined on the n-dimensional simplex. I will then proceed to discussing in detail the implications of such a connection in quantitative risk management, and, somewhat surprisingly, in mathematical statistics via the celebrated Lukacs theorem. [This is a joint work with Jianxi Su of Purdue University and Yisub Kye of York University.]

Speaker: Dr. Maciej Augustyniak (University of Montreal)

Title: A mixed bond and equity fund model for the valuation of segregated fund policies

Segregated fund and variable annuity policies are typically issued on mutual funds invested in both fixed income and equity asset classes. However, due to the lack of specialized models to

represent the dynamics of fixed income fund returns, the literature has primarily focused on studying long-term investment guarantees on single-asset equity funds. This article develops a mixed bond and equity fund model in which the fund return is linked to movements of the yield curve. Theoretical motivation for our proposed specification is provided through an analogy with a portfolio of rolling horizon bonds. Moreover, basis risk between the portfolio return and its risk drivers is naturally incorporated into our framework. Numerical results show that the fit of our model to segregated fund data is adequate. Finally, the valuation of segregated fund policies is illustrated and it is found that the interest rate environment can have a substantial impact on guarantee costs.

Speaker: Dr. Wing Fung (Alfred) Chong (University of Illinois at Urbana-Champaign)

Title: Tug-of-War: Holistic Principle for Risk Aggregation and Capital Allocation

This talk challenges the state-of-the-art two-step procedure of risk aggregation and capital allocation, due to its three pitfalls, namely, lack of consistency, negligence of cost of capital, and disentanglement of allocated capital from standalone capital requirement. A novel holistic capital allocation principle is proposed to address these issues. The proposed principle is particularly utilitarian to strike a balance among the competing interests and conflicting priorities in a corporate hierarchy. Most notably, for a large family of regulatory risk measurements, the holistic principle provides a structural relationship among standalone capital requirement, aggregate capital, allocated capital, and diversification benefit. This talk also demonstrates fundamental flaws in the classical variance-covariance risk aggregation approach and the Euler capital allocation principle, and shows that the holistic principle does not suffer from these curses. This talk is based on a joint work with Runhuan Feng and Longhao Jin.

Speaker: Dr. Mario Ghossoub (University of Waterloo)

Title: Optimal Reinsurance with Multiple Reinsurers: Distortion Risk Measures, Distortion Premium Principles, and Heterogeneous Beliefs

An insurer minimizes a distortion risk measure, while seeking reinsurance from finitely many reinsurers. The reinsurers use distortion premium principles, and they are allowed to have heterogeneous beliefs regarding the underlying probability distribution. We provide a characterization of optimal reinsurance indemnities, and we show that they are of a layer-insurance type. This is done both with and without a budget constraint, i.e., an upper bound constraint on the aggregate premium. Moreover, the optimal reinsurance indemnities enable us to identify a representative reinsurer in both situations. The existence of a representative reinsurer means that all reinsurers can be treated collectively by means of a hypothetical premium principle in order to determine the optimal total risk that is ceded to all reinsurers. The optimal total ceded risk is then allocated to the reinsurers by means of an explicit solution.

Speaker: Dr. Katsuichiro Goda (Western University)

Title: Empirical Analysis of Canadian Earthquake Insurance Data: Why Earthquake Insurance Take-up Rates in the West and East Differ?

This study investigates the risk attitudes of Canadian households towards earthquakes by conducting statistical analysis of the Canadian insurance data and spatial mapping of earthquake insurance take-up rates and objective seismic hazard/risk indicators at the resolution of the 2016 Census' Forward Sortation Areas. The results clearly show that the households in British Columbia and Quebec respond to earthquake hazards and risks differently. The take-up rates for British Columbia residents are proportional to exposed hazard and risk levels (increasing from 10% to 70%), whereas those for Quebec residents are consistently low irrespective of exposed hazard and risk levels (3% to 4%). Following that, possible solutions to the low earthquake insurance take-up rates are discussed by referring to recent surveys and public campaigns that were conducted in Quebec and British Columbia as well as the literature in cognitive and behavioral sciences. This is a joint work with Khristopher Wilhelm and Jiandong Ren.

Speaker: Dr. Hélène Guérin (UQAM)

Title: Omega models and Parisian Ruin

I will present Omega models in ruin theory. Ruin times from Omega models are expressed in term of an integral of a functional of the surplus process. Recently, new results on Omega models killed by the classical ruin time have been obtained by Palmowski and Li in the case of a spectrally negative Lévy process and by Li and Zhou in the case of a refracted spectrally negative Lévy process. With I. Czarna, we have been interested by Omega models killed by a Parisian ruin time. During this presentation I will highlight the complexity of working with a process killed by a Parisian ruin time instead of classical ruin. This is a joint work withs I. Czarna (Poland).

Speaker: Dr. Hyukjun (Jay) Gweon (Western University)

Title: An effective bias-corrected bagging method for the valuation of large variable annuity portfolios

To evaluate a large portfolio of variable annuity contracts, many insurance companies rely on Monte Carlo simulation, which is computationally intensive. To address this computational challenge, several machine learning techniques have been used in recent years to estimate the fair market values of a large number of contracts. It is known that bootstrapped aggregation (bagging), one of the most popular machine learning algorithms, is highly effective in the valuation of a large variable annuity portfolio using other attributes. In this article, we highlight the presence of the prediction bias of bagging and use the bias-corrected bagging approach to resolve the issue. Experimental results demonstrate the effectiveness of bias-corrected bagging in terms of accuracy and speed, as compared with bagging and boosting.

Speaker: Dr. Silvana Pesenti (University of Toronto)

Title: Robust Distortion Risk Measures

In the presence of distributional uncertainty, robustness of risk measures, which are prominent tools for the assessment of financial risks, is of crucial importance. Distributional uncertainty may be accounted for by providing bounds on the values of a risk measure, so-called worst- and best-case risk measures. Worst (best)-case risk measures are determined as the maximal (minimal) value a risk measure can attain when the underlying distribution is unknown - usually up to its first moments. However, these bounds and the distributions which attain the worst- and best-case risk measures are too large to be practically relevant.

We provide sharp bounds for the class of distortion risk measures with constraints on the first two moments combined with a constraint on the Wasserstein distance with respect to a reference distribution. Adding the Wasserstein distance constraint, leads to significantly improved bounds and more ``realistic'' worst-case distributions. Specifically, the worst-case distribution of the two most widely used risk measures, the Value-at-Risk and the Tail-Value-at-Risk, depend on the reference distribution and thus, are no longer two-point distributions.