Modeling, Measuring, and Managing Catastrophe Risks

First-Year Progress Report

This is the first-year progress report for our three-year CAE research grant titled "Modeling, Measuring, and Managing Catastrophe Risks" on the following three areas:

(a) Modeling Catastrophe Risks
(b) Measuring Catastrophe Risks
(c) Managing Catastrophe Risks

Publications in Scientific Journals

As stated in the agreement, we were expected to produce at least five research papers and present the results in at least two conferences during 06/01/2018–05/31/2019.

We begin by listing 12 papers dealing with the three areas of study. Among these 12 papers, three have been published, three are in press, two have been revised and resubmitted, three have been submitted, and one will be submitted by 03/31/2019. All of these papers will appear in reputable journals in actuarial science or related broader fields.

(1) Chen, Y. Comment on the work of Zhang et al. (2017). Submitted.
(2) Chen, Y. Precise large deviations of aggregate claims with an arbitrary dependence between claim sizes and their interarrival times. Submitted.
(3) Chen, Y.; Yang, Y. Bivariate regular variation among randomly weighted sums in general insurance. *European Actuarial Journal* (2019), in press.
(4) Cheung, K.C.; Chong W.F.; Lo, A. Budget-constrained optimal reinsurance design under coherent risk measures. Revised and resubmitted.
(5) Cheung, K.C.; Ling, H.K.; Tang, Q.; Yam, S.C.P.; Yuen, F.L. On cardinality of tail comonotonic risks. Submitted.
(6) Gerber, H. U.; Shiu, E. S. W.; Yang, H. A constraint-free approach to optimal reinsurance. *Scandinavian Actuarial Journal* **2019** (2019), 62–79.
(7) Li, H.; Tang, Q. Analyzing mortality bond indexes via hierarchical forecast reconciliation. Revised and resubmitted.
(8) Lo, A. Demystifying the integrated tail probability expectation formula. *The American Statistician* (2018), in press.
(9) Lo, A.; Tang, Q.; Tang, Z. Universally marketable insurance in a multivariate mixture model. Working paper.
(10) Lo, A.; Tang, Z. Pareto-optimal reinsurance policies in the presence of individual risk constraints. *Annals of Operations Research* **274** (2019), no. **1–2**, 395–423.
(11) Tang, Q.; Tang, Z.; Yang, Y. Sharp asymptotics for large portfolio losses under extreme risks. *European Journal of Operational Research* **276** (2019), no. **2**, 710–722.
(12) Tang, Q.; Yang, Y. Interplay of insurance and financial risks in a stochastic environment. *Scandinavian Actuarial Journal* (2019), in press.

Papers (1), (2), (3), and (5) contribute to area (a), papers (11) and (12) to areas (a) and (b), paper (8) to areas (a) and (c), and papers (4), (6), (7), (9), and (10) to area (c). In all of these papers, we have duly acknowledged the financial support of the CAE research grant.

Dissemination of Research Results in Conferences

During 06/01/2018–05/31/2019, we presented our research results at several conferences and workshops. Financial support of the research grant facilitated our participation in these events.

Professor Yiqing Chen gave the following talks:

- (Invited talk) "*Bivariate regular variation among randomly weighted sums in general insurance*" at The 4th International Workshop on Statistical Modeling of Heavy-Tail Phenomena with Applications, Xi'an Jiaotong-Liverpool University, Suzhou, China, June 1–4, 2018
- "*Bivariate regular variation among randomly weighted sums in general insurance*" at The 22nd International Congress on Insurance: Mathematics and Economics (IME), UNSW Sydney, Sydney, Australia, July 15–18, 2018
- (Invited talk) "*Bivariate regular variation among randomly weighted sums in general insurance*" at Colloquium at Center for Applied Mathematics, University of St. Thomas, September 14, 2018

Professor Ambrose Lo gave the following talks:

- (Invited talk) "*Constrained and Unconstrained Optimal Reinsurance*" at The 2nd International Workshop on Optimal (Re)Insurance, Central University of Finance and Economics, Beijing, China, July 12–14, 2018
- "*Universally Marketable Insurance in the Presence of Multiple Risks*" at The 22nd International Congress on Insurance: Mathematics and Economics (IME), UNSW Sydney, Sydney, Australia, July 15–18, 2018

Professor Qihe Tang gave the following talks:

- (Plenary talk) "*Sharp approximations for credit portfolio losses under extreme risks*" at The 4th International Workshop on Statistical Modeling of Heavy-Tail Phenomena with Applications, Xi'an Jiaotong-Liverpool University, Suzhou, China, June 1–4, 2018
- (Invited talk) "*Interplay of insurance and financial risks*" at the International Workshop on Risks in Insurance and Finance, Northwest Normal University, Lanzhou, China, June 7–9, 2018
- "*Interplay of insurance and financial risks*" at The 7th International Gerber–Shiu Workshop, University of Melbourne, Melbourne, Australia, July 10–11, 2018
- (Invited talk) "*Sharp asymptotics for large portfolio losses under extreme risks*" at the Actuarial and Financial Mathematics Conference on Interplay between Finance and Insurance, Brussels, Belgium, February 7–8, 2019

Graduate student Haibo Liu gave the following talk:

- "*Indifference Pricing of Bonds Linked to Actuarial and Interest Rate Risks*" at The 22nd International Congress on Insurance: Mathematics and Economics (IME), UNSW Sydney, Sydney, Australia, July 15–18, 2018

Graduate student Zhaofeng Tang gave the following talks:

- "*Large portfolio losses from defaults*" at The 7th International Gerber–Shiu Workshop, University of Melbourne, Melbourne, Australia, July 10-11, 2018
- "*Large portfolio losses from defaults*" at The 22nd International Congress on Insurance: Mathematics and Economics (IME), UNSW Sydney, Sydney, Australia, July 15–18, 2018

Grant Webpage

To help disseminate our research work, we have posted a list of publications and presentations partially supported by the CAE research grant at our grant webpage: http://www.stat.uiowa.edu/cae-grant/cae-grant-university-iowa. Manuscripts for accepted papers are provided. This webpage is available to the general public and will be updated on an ongoing basis over the course of the grant.