A Multifaceted Study of Risk Management for Insurance

Second Year Progress Report

Publications in Scientific Journals

This is the second year progress report for our three-year CAE research grant titled "A Multifaceted Study of Risk Management for Insurance" on the following three areas:

(a) Valuation of Equity-Linked Death Benefits;
(b) Quantitative Risk Management with Extreme Risks;
(c) Statistical Estimation of Risk Measures.

As stated in the agreement, we were expected to submit four papers and present the results in three conference presentations during 04/15/2014–04/14/2015.

We begin by listing 5 papers dealing with the three areas of study. Among these, two have been published, one revised and resubmitted, one submitted, and another to be submitted by 04/15/2015. All of these will appear in reputable journals in actuarial science or related broader fields.

(1) Ahn, J. Y.; Shyamalkumar, N. The least comonotonic distributions and measures of concordance. To be submitted by 4/15/2015.
(2) Gerber, H. U.; Shiu, E. S. W.; Yang, H. Geometric stopping of a random walk and its applications to valuing equity-linked death benefits. *Revised and resubmitted* (2015).
(3) He, J.; Tang, Q.; Zhang, H. Reducing risk in convex order. *Submitted* (2015).
(4) Li, B.; Tang, Q.; Wang, L.; Zhou, X. Liquidation risk in the presence of Chapters 7 and 11 of the US bankruptcy code. *Journal of Financial Engineering* **1** (2014), no. **3**, 1450023 (19 pages).
(5) Tang, Q.; Yang, F. Extreme value analysis of the Haezendonck–Goovaerts risk measure with a general Young function. *Insurance: Mathematics and Economics* **59** (2014), 311–320.

Paper (2) listed above contributes to area (a), papers (3)–(4) to area (b), and papers (1) and (4) to both areas of (b) and (c).

The following three papers, which were listed among main contributions in our first year report, have recently been published or accepted for publication:

(6) Ahn, J. Y.; Shyamalkumar, N. D. Asymptotic theory for the empirical Haezendonck-Goovaerts risk measure. *Insurance: Mathematics and Economics* **55** (2014), 78–90.
(7) Li, J.; Tang, Q. Interplay of insurance and financial risks in a discrete-time model with strongly regular variation. *Bernoulli* (2015), to appear.
(8) Tang, Q.; Yuan, Z. Randomly weighted sums of subexponential random variables with application to capital allocation. *Extremes* **17** (2014), no. **3**, 467–493.

In all of the papers listed above we have acknowledged the financial support of the CAE grant.

Dissemination of Research in Conferences

A progress report of our research was presented at the CAE Faculty Conference, June 13, 2014. During 04/15/2014–04/14/2015, we have presented our results at several conferences in which the financial support of the grant facilitated our participation.

Prof. Elias Shiu gave the following talk:

- "*Valuing Equity-Linked Death Benefits in Jump-Diffusion Models*" at The 18th International Congress on Insurance: Mathematics and Economics (IME), East China Normal University, Shanghai, China, July 10–12, 2014

Prof. N. D. Shyamalkumar gave the following talk and moderated the below given session:

- "*Flipping a Classroom – Novel Approach to Teaching Life Contingencies*" at The CAE Faculty Conference, Society of Actuaries, Chicago, USA, June 12–13, 2014
- "*Modelling Efficiency Workshop*" at The SOA Life and Annuity Meeting, Atlanta, May 20, 2014

Prof. Qihe Tang gave the following three talks:

- "*Multivariate Regular Variation in Insurance and Finance*" at The Workshop on Recent Developments in Dependence Modelling with Applications in Finance and Insurance, Vrije Universiteit Brussel, Brussels, Belgium, May 23, 2014
- "*The Sum-Product Structure as a Mechanism for Risk Management*" at The 8th Conference in Actuarial Science and Finance on Samos, University of the Aegean, Samos, Greece, May 29 – June 1, 2014
- "*Extreme Risks in Insurance and Finance*" at The 18th International Congress on Insurance: Mathematics and Economics (IME), East China Normal University, Shanghai, China, July 10–12, 2014

Graduate students gave the following three talks:

- Xiao Wang, "*Valuing Guaranteed Minimum Death Benefits in Variable Annuities Knock-out Options*" at The 49th Actuarial Research Conference (ARC), University of California, Santa Barbara, USA, July 13–16, 2014
- Huan Zhang, "*Risk Reducers in Convex Order*" at The 18th International Congress on Insurance: Mathematics and Economics (IME), East China Normal University, Shanghai, China, July 10–12, 2014
- Zhenhao Zhou, "*Valuing Equity-linked Death Benefits*" at The 49th Actuarial Research Conference (ARC), University of California, Santa Barbara, USA, July 13–16, 2014