



Centre for Actuarial Studies

ANNUAL REPORT 2014

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The Year in Review

INTRODUCTION

The Centre for Actuarial Studies is a teaching and research unit located within the Department of Economics. The majority of undergraduate and Masters students study to become actuaries, but a number of our students find employment in banking or investments; in particular, a number of our PhD students have research topics in financial mathematics. The Centre attracts high achieving students; many of the faculty's participants in the prestigious Chancellor's Scholars Program (admission to which is based on university entrance score) are students majoring in actuarial studies.

The Centre for Actuarial Studies is fully accredited by the Actuaries Institute, meaning that its students can obtain exemptions from all of Parts I and II of the Institute's examinations. With regard to research, members of the Centre are experts in their fields and are internationally recognised for their work in actuarial science, financial mathematics, probability and statistics. The Centre has eight full-time academic staff and several part-time lecturers from the Melbourne actuarial community.

The Centre for Actuarial Studies continues to be the focal point for actuarial education in Victoria. It has the support of the actuarial profession in Australia and produces research of high quality. It also maintains strong international links and contributes to the local actuarial community.

Centre staff publish in top journals and present their research at seminars and conferences in Australia and overseas. Details of publications and additions to the Centre's Research Paper Series can be found later in this report, as well as a list of conference and seminar presentations.

STAFF NEWS RESEARCH AND GRANTS

Professor David Dickson was Director of the Centre for 2014. Professor Mark Joshi will be Director in 2015. Professor Dickson was also Deputy Head of the Department of Economics.

Dr Zhuo Jin qualified as an Associate of the Society of Actuaries. Dr Jin was Editor of the Newsletter of the SIAM Activity Group on Control and Systems Theory, and is one of the chief investigators who were awarded a research grant of 80,000 yuan by the Fundamental Research Funds for the Central Universities (China) for a collaborative research project with Huazhong University of Science and Technology entitled "Regime Switching".

Deans' certificates for research excellence for 2013 were awarded to Dr Ping Chen, Professor David Dickson, Dr Zhuo Jin and Associate Professor Shuanming Li. These awards were based on publications in 2013.

Professor David Dickson is an editor of ASTIN Bulletin, an

associate editor of *Insurance: Mathematics & Economics* and *Annals of Actuarial Science*, a member of the editorial board of *North American Actuarial Journal*, and an Adjunct Professor at the University of Waterloo.

Associate Professor Shuanming Li was a member of the Organising Committee for the 18th International Congress on *Insurance: Mathematics & Economics*, held in Shanghai in July. He was also an External Reviewer for the journal *Insurance Markets and Companies: Analyses and Actuarial Computations*.

After consultation with internal and external parties, it was decided to disband the Centre's Advisory Board as the Centre has changed considerably since the establishment of the Advisory Board in 1992. Many thanks to all members of the Advisory Board, past and present, who have generously given their time to the Centre. The strategic direction of the Centre will now be an internal matter for the Faculty of Business and Economics.

TEACHING

Overall enrolments dropped slightly from the level in previous years. This was largely due to a much smaller intake into the honours year compared with recent years. Enrolments at Masters level remain steady. The Centre introduced the M.Com (Actuarial Studies) degree as an alternative to honours for students completing the B.Com degree. Students on this degree can complete advanced subjects in actuarial studies and related disciplines.

Dr Enrique Calderín completed the Melbourne Teaching Certificate in the second semester. This is a professional development course dealing with practical issues in teaching.

Teaching was supported by a number of external lecturers including Mr Richard Fitzherbert (Actuarial Practice and Control III), Dr Jules Gribble, Mr David Heath, Mr Andrew Gale and Mr Donald Campbell (Actuarial Practice and Control I and II).

KNOWLEDGE TRANSFER

Professor Mark Joshi produced a new release of the Kooderive open-source project for pricing derivative products using GPU technology. He also continued to support the xlw open source project for interfacing EXCEL with C++.

PROFESSIONAL ACTIVITIES

Professor David Dickson and Dr Enrique Calderín both attended and presented at the 6th Australasian Actuarial Education and Research Symposium at Curtin University in December.

Mr Richard Fitzherbert is a member of the Research Council Committee of the Actuaries Institute.

The Year in Review / Teaching

VISITORS

Ms Başak Bulut Karageyik, a research student from Hacettepe University in Turkey, visited for 6 months from March.

Professor Felisa Vázquez-Abad, from City University of New York, visited the Centre in January and February.

Associate Professor Hongmei Zhang, from Huazhong Agricultural University, China, was a visitor from January until September.

Professor Emilio Gómez-Déniz, from Universidad de Las Palmas de Gran Canaria, visited in July.

Associate Professor Hui Meng, from the Central University of Finance and Economics, Beijing, visited from August to November.

Dr. Chi Chung Siu, from the University of Technology in Sydney, visited during September and October.

Associate Professor Yi Lu, from Simon Fraser University, Canada, visited in October and November.

Seminars were given as follows:

Dr Benjamin Avanzi (UNSW): *On optimal periodic dividend strategies in the dual model with diffusion*

Professor Emilio Gómez-Déniz: *Bivariate regression models for studying the number of crashes and fatalities in Spanish road blackspots*

Dr. Chi Chung Siu: *A class of nonzero-sum stochastic differential investment and reinsurance games*

Associate Professor Yi Lu: *Multidimensional Bühlmann-Straub credibility models with spatial dependence among risks*

Honours Grades over the Last Five Years

	H1	H2A	H2B	H3	N	Total
2010	17	14	15	6	0	52
2011	18	14	13	8	0	53
2012	12	12	15	6	0	45
2013	10	9	13	2	4	38
2014	5	6	4	2	0	17

TEACHING

Undergraduate & Honours Class Sizes

Subject	Name	2012	2013	2014
ACTL10001	Introduction to Actuarial Studies	169	178	173
ACTL20001	Financial Mathematics I	124	136	117
ACTL20002	Financial Mathematics II	108	123	96
ACTL30001	Actuarial Modelling I	95	88	110
ACTL30002	Actuarial Modelling II	94	87	110
ACTL30003	Contingencies	85	80	84
ACTL30004	Actuarial Statistics	84	83	93
ACTL30005	Models for Insurance and Finance	79	77	85
ACTL30006	Financial Mathematics III	87	80	100
ACTL40001	Actuarial Studies Research Essay	7	8	3
ACTL40002	Risk Theory I	45	37	18
ACTL40003	Risk Theory II	23	27	11
ACTL40004	Advanced Financial Mathematics I	45	37	17
ACTL40005	Actuarial Studies Projects	39	30	14
ACTL40006	Actuarial Practice and Control I	45	53	36
ACTL40007	Actuarial Practice and Control II	40	32	30
ACTL40008	Advanced Financial Mathematics II	7	9	8
ACTL40009	Actuarial Practice and Control III	43	33	27
Total Enrolments		1219	1216	1132

Honours Essay And Project Topics

The following students successfully completed a Bachelor of Commerce (Honours) with a specialisation in Actuarial Studies

Beatrice Chan, Jessica Dimovski, Mengxiao Feng, Lili Guo, Vernon Hu, Sibin Huang, Pham Le, Charlie Li, Qin Liu, Rongbin Ou, Kenny Quach, Richard Sin, Xin Tian, Hongzhu Zha, Xueting Zhang, Ying Zhang, Ruoyu Zhao

Teaching

An Honours research essay has about 10,000 words and counts for 25% of the final assessment for a student's Honours grade. Three Honours students wrote an essay in 2014, and the topics were:

- Regime switching with time-varying transition probabilities on stock returns
- Some studies of the no claims discount and ruin probability
- On the convergence of European vanilla and digital option prices in the multinomial tree model

The majority of Honours students do three research projects instead of the essay. In 2014 the topics of those projects were:

- Application of regime switching models
- Ruin probability and no claims discount
- Stochastic mortality models

Masters Class Sizes

Subject	Name	2012	2013	2014
ACTL90001	Mathematics of Finance I	18	16	15
ACTL90002	Mathematics of Finance II	16	16	13
ACTL90003	Mathematics of Finance III	14	10	16
ACTL90004	Insurance Risk Models	15	11	17
ACTL90005	Life contingencies	15	15	12
ACTL90006	Life Insurance Models 1	14	14	15
ACTL90007	Life Insurance Models 2	14	13	15
ACTL90008	Statistical Techniques in Insurance	15	10	15
ACTL90009	Actuarial Practice and Control III	2	18	3
ACTL90010	Actuarial Practice and Control I	1	2	3
ACTL90010	Actuarial Practice and Control II	0	0	3
Total Enrolments		124	125	127



Student Prize Winners

Actuaries Institute Prize

for Research Essay and Projects

Pham Le

Comminsure Prize

for Introduction to Actuarial Studies

Huiwen Shen

Deloitte Actuaries & Consulting Prize

for Actuarial Practice and Control I and II

Beatrice Chan

Honours Medal in Actuarial Studies

Beatrice Chan, Pham Le (shared)

Trimantium Capital Award

for Financial Mathematics III

Yaozhong Qiu

Martin Jilovsky Prize

for best third year results by an Australian student

Yaozhong Qiu

Taylor Fry Prize

for Actuarial Statistics

Annie Chen, Chengyue Meng (shared)

Towers Watson Prize

for Risk Theory I and II

Beatrice Chan

PhD Students and Research Topics

Xiang Cheng

Optimal control and Monte Carlo

Can Jin

On some generalisations of the expected discounted penalty function in some insurance risk models

Joan Nakoto

Superannuation: Its challenges and recommendations

Navin Ranasinghe

Volatility derivatives

Marjan Qazvini

Risk models with capital injections

Miao Zhang

Continuous time mean-variance model for portfolio selection

Nan Zhang

Some optimal reinsurance problems

Dan Zhu

On fast and efficient computations of second order Greeks for financial products

Completed their PhDs:**Evan Hariyanto**

Mortality and disability modelling with an application to the pricing of a reverse mortgage contract

Jingchao Li

Ruin related quantities in insurance risk models

Publications and Other Research Activities

REFEREED JOURNAL ARTICLES

Beveridge, C.J., Joshi, M.S. – The efficient computation of prices and Greeks for callable range accruals using the displaced diffusion LMM. *International Journal of Theoretical and Applied Finance* **17**, 1.

Chen, M., Guo, J., Wu, X. – Expected discounted dividends in a discrete semi-Markov risk model. *Journal of Computational and Applied Mathematics* **266**, 1-17.

Gómez-Déniz, E., Sordo, M.A., Calderín, E. – The Log-Lindley distribution as an alternative to the beta regression model with applications in insurance. *Insurance: Mathematics and Economics* **54**, 49–57.

Gómez-Déniz, E., Calderín, E. – A suitable alternative to the Pareto distribution. *Hacetatepe Journal of Mathematics and Statistics* **43**, 843–860.

Gómez-Déniz, E., Calderín, E. – Unconditional distributions obtained from conditional specifications models with applications in risk theory. *Scandinavian Actuarial Journal* **7**, 602–619.

Hariyanto, E.A., Dickson, D.C.M., Pitt, D.G.W. – Estimation of disability transition probabilities in Australia I: Preliminary. *Annals of Actuarial Science* **8**, 131-155.

Hariyanto, E.A., Dickson, D.C.M., Pitt, D.G.W. – Estimation of disability transition probabilities in Australia II: Implementation. *Annals of Actuarial Science* **8**, 156-175.

Jin, Z., Yin, G. – Capital injections with negative surplus and delays: models and analysis. *Control Theory and Technology* **12**, 163-172.

Joshi, M.S., Tang, R. – Effective sub-simulation-free upper bounds for the Monte Carlo pricing of callable derivatives and various improvements to existing methodologies. *Journal of Economic Dynamics and Control* **40**, 25-45.

Li, S, Lu, Y. – Some finite-time ruin probabilities in the classical risk model with barriers. *Annals of Actuarial Science* **8**, 63-78.

Liu, Q., Pitt, D.G.W, Wu, X. – On the prediction of claim duration for income protection insurance policyholders. *Annals of Actuarial Science* **8**, 42-62.

Zong, X., Wu, F., Yin, G., Jin, Z. – Stochastic stabilization of regime-switching jump diffusion systems. *SIAM Journal on Control and Optimization* **52**, 2595-2622.

OTHER PUBLICATIONS

Dickson, D.C.M. – Journal rankings: do they matter? Guest editorial in *Annals of Actuarial Science* **8**, 215-216.

Jin, Z., Yin, G. – Numerical methods for singular and impulse controls of regime-switching insurance models. Proceedings of the 21st International Symposium on Mathematical Theory of Networks and Systems, 1862-1869.

Dufresne, D., Vázquez-Abad, F.J., Chin, S. (2014). Change of measure for the square root process. *Proceedings of the 2014 Winter Simulation Conference*. A. Tolk, S. D. Diallo, I. O. Ryzhov, L. Yilmaz, S. Buckley, and J. A. Miller, eds, Savannah, Georgia: 465-475.

CONFERENCE AND SEMINAR PRESENTATIONS

Calderín, Enrique

“Modeling claims data with composite Stoppa models”. 6th Australasian Actuarial Education and Research Symposium. Curtin University, December.

“Computing skills taught by Accredited Universities”. 6th Australasian Actuarial Education and Research Symposium. Curtin University, December.

Chen, Ping

“A revisit to the mean-variance portfolio selection with no-shorting constraint by the Riccati equation approach”. The 18th International Conference on Insurance: Mathematics & Economics, Shanghai, July.

Dickson, David

“Better together”. 6th Australasian Actuarial Education and Research Symposium, Curtin University, December.

“Aggregate claims distributions in a Markov-modulated risk model”. The 18th International Conference on Insurance: Mathematics & Economics, Shanghai, July.

Dufresne, Daniel

“Gram-Charlier distributions in option pricing”. Mathematical Finance Days 2014. École des Hautes Études Commerciales, Montreal, March.

“Change of measure for the square-root process”. Hunter College, New York, November.

“A two-dimensional extension of Bougerol’s identity and a tribute to Marc Yor”. Concordia University, Montreal, November.

“Series formulas for option prices”. Hunter College, New York, November.

“A new method for simulating the Heston process”. Morgan Stanley, New York Derivatives Team, November.

Jin, Zhuo

“Numerical methods for optimal investment and dividend payment strategies with capital injections”. International Workshop on Risk Analysis, Ruin and Extremes, Nankai University, Tianjin, July.

“A numerical approach for optimal investment and dividend payment strategies with capital injections”. The 18th International Congress on Insurance: Mathematics & Economics, Shanghai, July.

Publications and Other Research Activities

Joshi, Mark

“Upper bounds for early exercisable products without sub-simulations”. UNSW, May.

“Flipping the classroom when teaching financial mathematics”. The Innovations and Excellence in Learning and Teaching Conference, University of Melbourne, December.

Li, Shuanming

“The duration of surplus in a certain state before ruin in a Markov-modulated risk model”. International Workshop on Risk Analysis, Ruin and Extremes, Nankai University, Tianjin, July.

Wu, Xueyuan

“On a discrete-time risk model with claim correlated premiums”. International Workshop on Risk Analysis, Ruin and Extremes, Nankai University, Tianjin, July.

Other Activities

Staff of the Centre examined a PhD thesis submitted at Macquarie University, and acted as reviewers of research grant applications for the Israel Science Foundation and the Natural Sciences and Engineering Research Council of Canada (NSERC). Three members of the Centre, Dr Zhuo Jin, Associate Professor Shuanming Li and Dr Xueyuan Wu, were reviewers for American Mathematical Reviews.

Involvement as Referees

Staff of the Centre acted as referees for the following journals:

Abstract and Applied Analysis
Acta Mathematica Scientia

Acta Mathematica Applicatae Sinica
Annals of Actuarial Science
Applied Stochastic Models in Business and Industry
Asia-Pacific Journal of Risk and Insurance
ASTIN Bulletin
Colombian Journal of Statistics
Communications in Statistics – Theory and Methods
Economic Modelling
Expert Review of Pharmacoeconomics & Outcomes Research
Finance and Stochastics
Frontiers of Mathematics in China
Haceteppe Journal of Mathematics and Statistics
IMA Journal of Management Mathematics
Insurance: Mathematics & Economics
Journal of Applied Mathematics
Journal of Applied Statistics
Journal of Computational and Applied Mathematics
Journal of Economic Dynamics and Control
Journal of Industrial and Management Optimization
Journal of Systems Science and Complexity
Mathematical Methods of Operations Research
Methodology and Computing in Applied Probability
North American Actuarial Journal
Operations Research
Scandinavian Actuarial Journal
Science in China Mathematics
Statistical Methodology
Statistics and Probability Letters

Research Paper Series

The Centre has an established Research Paper Series. Titles of the papers added in 2014 are given below. Electronic versions of all papers are available at the following address: <http://fbe.unimelb.edu.au/economics/ACT/workingpapers>

No. 236: Joshi, M.S. – Kooderive: multi-core graphics cards, the LIBOR market model, least-squares Monte Carlo and the pricing of cancellable swaps.

No. 237: Joshi, M.S. – Analyzing the bias in the primal-dual upper bound method for early exercisable derivatives: bounds, estimation and removal.

No. 238: Li, J., Dickson, D.C.M., Li, S. – A note on the distribution of the aggregate claim amount at ruin.

No. 239: Li, J., Dickson, D.C.M., Li, S. – Finite time ruin problems for the Markov-modulated risk model.

No. 240: Wu, X., Chen, M., Guo, J. – On a discrete-time two level NCD risk model.

No. 241: Li, S., Lu, Y. – On the time and number of claims when the surplus drops below a certain level.

No. 242: Calderín, E., Kwok, C.F. – Modelling large claims with composite Stoppa models.

Staff and Advisory Board

STAFF

Professors of Actuarial Studies

DAVID DICKSON: BSc (Hons), PhD (Heriot-Watt), FFA, FIAA

Research interests: Aggregate claims distributions, renewal risk processes, recursive methods in risk theory.

DANIEL DUFRESNE: BSc (Hons) (Montreal), PhD (The City University), FSA

Research interests: Financial mathematics, actuarial science, probability.

MARK JOSHI: BA (Hons) (Oxford), PhD (MIT)

Research interests: Financial mathematics

Associate Professor in Actuarial Studies

SHUANMING LI: BSc (Tianjin), MEd (Renmin), PhD (Concordia)

Research interests: Risk and ruin theory, stochastic modelling in insurance and finance, actuarial science.

Senior Lecturer in Actuarial Studies

XUEYUAN WU: BS, MS (Nankai), PhD (Hong Kong)

Research interests: Risk and ruin theory, discrete-time risk models, phase-type distribution in risk theory

Lecturers in Actuarial Studies

PING CHEN: BAM (Qufu), MSc (CAS), PhD (Hong Kong)

Research interests: Actuarial science, financial mathematics, statistics and information

ENRIQUE JAVIER CALDERIN: BS, MS (UNED, Spain), PhD (ULPGC, Spain)

Research interests: Bayesian inference, statistical robustness, distribution theory, actuarial statistics

ZHUO JIN: BS, MS (HUST), MA, PhD (WSU)

Research interests: Numerical methods for stochastic systems, mathematical finance, actuarial science

Honorary Senior Fellows

RICHARD FITZHERBERT: BSc (Sydney), FIAA, FFin

JULES GRIBBLE: BSc (Hons), PhD St Andrews, FIAA, FCIA, FSA

DAVID HEATH: BEc (Hons) (Monash), FIAA, CPA, FFin

External Lecturers

ANDREW BROWN: BSc, DipEd (Melbourne), FIAA, FFin

DONALD CAMPBELL: BCom (Melbourne), FIAA

ANDREW GALE: BSc (Melbourne), FIAA

External Examiners for Part II

MARTIN FRY and ANDREW GALE (Actuarial Practice and Control I and II)

MIKE BARKER (Actuarial Practice and Control III)

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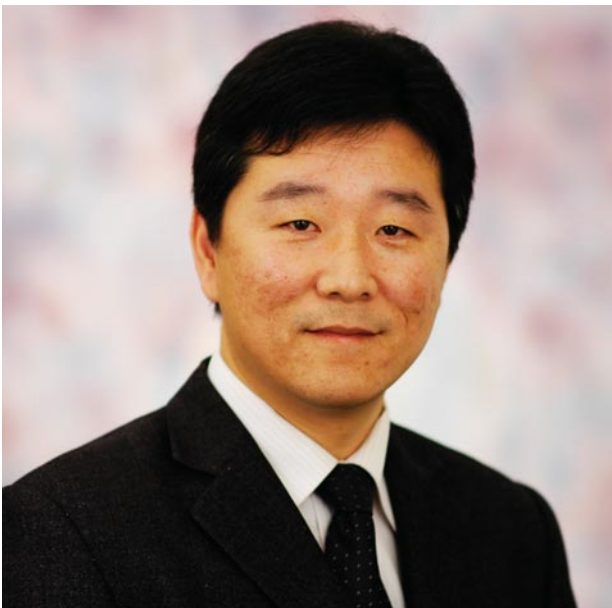
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