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The Year in Review / Teaching

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 the banking or investment sector. Our PhD students have research topics in risk theory, investment models, survival analysis, financial mathematics, derivative pricing and applied probability. 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 Australian Institute of Actuaries, 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 nine full-time academic staff and several part-time lecturers from the Melbourne actuarial community (the complete list is at the end of this report).

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.

In December 2015, the Society of Actuaries (SOA) named the University of Melbourne’s actuarial studies program as an SOA Center of Actuarial Excellence (CAE). Actuarial science school programs must meet eight rigorous criteria and specific CAE requirements to qualify for the CAE designation. These criteria involve the degree, curriculum, graduate count, faculty composition, graduate quality, appropriate integration, and connection to industry and research/scholarships. Only 32 colleges and universities around the world have attained the CAE designation. The CAE designation for the Centre was renewed successfully for 2016 and 2017.

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

2017 is the 25th anniversary of the Centre for Actuarial Studies. A celebration was held on Wednesday 22 November. Jenny Lyon, President of the Actuaries Institute and Professor Ross Williams, a former Dean of the Faculty of Business and Economics, spoke at the event to reflect on their career journeys and the history of the Centre. Around 70 current students, academics and alumni attended the event. The Centre for Actuarial Studies would like to thank all alumni, professional and academic staff past and present for their outstanding contributions and continued support which have made the Centre what it is today.

STAFF NEWS, RESEARCH AND GRANTS
Professor David Dickson was the Head of Department of Economics for 2017.

Professor Daniel Dufresne resigned from the Centre in 2016 and left the University in late February 2017.

Professor Mark Joshi had been Director of the Centre from the beginning on 2015 passed away suddenly on 8 October 2017. Mark joined the Centre for Actuarial Studies in November 2005, and he taught the theory of financial mathematics with a slant based on his own career and experiences in the financial sector. Mark made great contributions in teaching, research and research supervision, leadership and engagement. Beyond the University, Mark made a real impact with a series of well-known papers in both pure mathematics and financial mathematics fields. Mark’s untimely passing leaves a huge gap in the Centre for Actuarial Studies, but he has left a lasting impression on those fortunate enough to have known him as a teacher, supervisor or colleague.

Associate Professor Shuanming Li was the Acting Director from 9 October 2017 to the end of the year. Dr Ping Chen was promoted to Level C (Senior Lecturer) in September. Dr Rui Zhou accepted an offer as a Senior Lecturer and will start in January 2018. Dr Xueyuan Wu was on a study leave from 3rd July to 22nd December. Dr Zhuo Jin was on a study leave from 1st July to 31st December.

Professor David Dickson is an editor of ASTIN Bulletin, a member of the editorial board of Insurance: Mathematics & Economics, Annals of Actuarial Science and North American Actuarial Journal, and an Adjunct Professor at the University of Waterloo.

Associate Professor Shuanming Li is a member of the Editorial board of Insurance: Mathematics & Economics, Annals of Actuarial Science and North American Actuarial Journal, and an Adjunct Professor at the University of Waterloo.

Associate Professor Shuanming Li is a member of the Editorial Board for the Journal of Insurance Markets and Companies. He is also a Reviewer for American Mathematical Reviews (AMR).

Dr Zhuo Jin is an editor of SIAM Activity Group on Control and Systems Theory Newsletter and a member of the editorial board of Journal of Systems Science and Complexity. He is also a reviewer for Mathematical Reviews.
Dr Enrique Calderin was awarded a research grant on “Ignacio H. de Larramendi (Insurance and Social Protection, € 15,000)” with Fundación MAPFRE entitled “Analysis of Microbiome Information in Risk Quantification.”

Dr Kevin Fergusson, Dr Enrique Calderin and Dr Xueyuan Wu received their 2017 Faculty Research Grant ($17,108) for their project entitled “Predicting Floods and Claims for Insurers using Hierarchical Spatial Regression”.

TEACHING
Overall enrolments dropped slightly from the level in previous years, in particular, the enrolment in Introduction to Actuarial Studies (ACTL 10001) dropped from 267 to 224. There were 11 enrolments in the new 1.5-year M.Com. (Actuarial Science) degree. The M.Com. (Actuarial Science) degree has a ‘practice’ pathway, which focuses on advanced professional training, and a ‘research’ pathway, which prepares students for a PhD in Actuarial Studies. Enrolments at Honours level dropped from 15 in 2016 to 4 in 2017 as a result.

Teaching was supported by a few external lecturers including Dr Jane Joshi (Financial Mathematics III, Mathematics of Finance II), Mr David Heath, Mr Andrew Brown, Mr Donald Campbell, and Mr Andrew Gale (Actuarial Practice and Control I and II).

ENGAGEMENT
Shuanming Li visited Nankai University to promote the Nankai-Melbourne dual masters program in March and September.

Kevin Fergusson wrote an article in the magazine Pursuit entitled “Extreme weather and why the impact will be felt more widely” in April.

Shuanming Li and the Faculty’s Associate Dean Jennifer Grafton visited Renmin University of China in May. They met with a delegation of 5 academic staff including the Associate Dean (International) from the School of Economics at Renmin University. After the mutual visits between FBE and Renmin University, the two sides agreed to deepen the exchange and cooperation.

Kevin Fergusson and Shuanming Li attended the Annual Accredited Universities Meeting 2017 hosted by the Australian Institute of Actuaries in October.

PROFESSIONAL ACTIVITIES
Professor David Dickson and Dr Kevin Fergusson attended the Actuaries Institute webinar “Education Strategy Review - Potential Education Model” presented by Members of the Education Strategy Review Committee in May. Dr Fergusson also attended the Actuaries Institute seminar “Risk Management Capability + Strong Leadership = Effective Risk” presented by Tim Gorst, in September.

VISITORS AND SEMINARS
Dr Yulin Deng from the Business School of Hohai University, China, visited the Centre from 30th March to 31st December.

Ms Yaming Yang from the School of Finance, Nankai University, China, visited the Centre under the University’s Research Study Abroad program from 30th October 2017 to 1st November 2018.

Associate Professor Chaolin Liu, from the Department of Statistics and Actuarial Science, Chongqing University, visited the Centre from 20th February 2016 to 20th February 2017 and gave a talk on 10th February 2017 entitled “Moments of Discounted Dividend Payments in a Risk Model with Randomized Dividend-decision Times”.

Dr Dan Zhu from Monash University, visited the Centre on 26th May and gave a talk entitled “Automated Sensitivity Computations for MCMC Gibbs Output”.

Dr Rui Zhou from the Warren Centre for Actuarial Studies Research visited the Centre from 27th May to 29th May and give a talk on 29th May entitled “Changes of Long-term Relation in Multi-population Mortality Modelling”.

Dr Kevin Fergusson gave a talk on 29th June entitled “Application of the Double Pareto Lognormal Distribution to Rainfall Events”, and a further talk on 13th October entitled “Less Expensive Pricing and Hedging of Extreme-Maturity Interest Rate Derivatives and Equity Index Options under the Real-World Measure”.

Dr Enrique Calderin gave a talk on 29th June entitled “Fat-Tailed Regression with the Double Pareto Lognormal Distribution Applied to Bodily Claims Data”.

Mr Jin Sun from the University of Technology Sydney visited the Centre on 11th August and gave a talk entitled “Impact of Management Fees on the Pricing of Variable Annuity Guarantees”.

Mr Ning Wang from the East China Normal University visited the Centre from 1st April to 1st September and gave a talk on 18th August entitled “A Class of Non-zero-sum Stochastic Differential Investment and Reinsurance Games with Nonlinear Risk Process and VaR Constraints”.

Dr Jinxia Zhu, from the School of Business at the University of New South Wales, visited the Centre from 25th to 30th September and gave a talk entitled “Optimal Impulse Dividend Control for a Regime-switching Linear Diffusion”.

Dr Peter Jevtic from the Arizona State University visited the Centre on 17th November and gave a talk entitled “A Partial Equilibrium Model for Pricing a Longevity Bond”.

Dr Catherine Donnelly from Heriot-Watt University visited the Centre on 24th November and gave a talk entitled “Simplifying Retirement”.

The Year in Review / Teaching
UNDERGRADUATE AND HONOURS CLASS SIZES

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HONOURS GRADES OVER THE LAST FIVE YEARS

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MASTERS CLASS SIZES

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<td>Total Enrolments</td>
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<td>167</td>
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ESSAY AND PROJECT TOPICS

There are 4 students who successfully completed a Bachelor of Commerce (Honours) with a specialisation in Actuarial Studies. In 2017, all the 4 students did three research projects:

On the dependence risk model:
- Modelling dependent data with copulas: application to insurance claim data;
- The Monte Carlo simulation of the multi-dimensional Black-Scholes model.

A research essay has about 10,000 words and counts for 25 subject credits for a student’s Honours grade or Masters grade. Three Masters students wrote an essay in 2017, and the topics were:

- Application of power numeraire on a Fourier-Cosine expansion based option pricing method;
- An actuarial application of Copula methods to cyber risk modelling;
- Pricing discretely-monitored barrier options when the underlying is discontinuous.
Student Prize Winners

**Actuaries Institute Prize**  
for Research Essay and Projects  
Jiani Chen

**Deloitte Actuaries & Consulting Prize**  
for Actuarial Practice and Control I and II  
Jiani Chen

**Honours Medal in Actuarial Studies**  
Jiani Chen

**KPMG Prize**  
for Financial Mathematics I and II  
Yuanzhen Chen

**KPMG Prize**  
for Second Year Actuarial Studies  
Yuanzhen Chen

**Martin Jilovsky Prize**  
for best third year results by an Australian student  
Atibhav Chaudhry

**Taylor Fry Prize**  
for Actuarial Statistics  
Jiheng Xu

**Trimantium Capital Award**  
for Financial Mathematics III  
Wesley Wai Kiat Wong

**Willis Towers Watson Prize**  
for Risk Theory I and II  
Jiani Chen

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PhD Students and Research Topics

**Xiang Cheng**  
Monte Carlo Methods for Pricing Early-Exercise Financial Derivatives

**Pham Le**  
On non-arbitrage theory in markets with transactions costs and associated processes

**Joan Nakato**  
Essays on Retirement Funding

**Navin Ranasinghe**  
Pricing Long-dated Equity Derivatives under Stochastic Interest Rates

**Miao Zhang**  
Continuous-time Mean-variance Models of Stochastic Parameters

**Nan Zhang**  
Some Optimal Reinsurance Problems with Risk Management

**Zhehao Zhang**  
The Distribution of the Discounted Claims under Renewal Sums

Three new PhD students were admitted to the Centre: Dhiti Osatakul, Jiannan Zhang, and Pengcheng Zhang.

Three PhD students, Nan Zhang, Navin Ranasinghe and Miao Zhang, completed their PhD theses. Nan Zhang joined the School of Statistics, Faculty of Economics and Management, East China Normal University as an assistant professor.

Navin Ranasinghe joined UBS Investment Bank in London as a quantitative analyst.

Miao Zhang was admitted in a PhD program in Finance at Tilburg University in Netherlands.
**REFEREED JOURNAL ARTICLES**


Zhang, M., Chen, P., Yao, H. Mean-variance portfolio selection with only risky assets under regime switching, *Economic Modelling*, 62, 35-42.


**CONFERENCE AND SEMINAR PRESENTATIONS**

Calderin, Enrique

“Analytic Expressions of Risk Quantities for Composite Models”. University of New South Wales, Sydney, Australia, April.

“An EM algorithm for double-Pareto-Lognormal generalised linear model applied to heavy-tailed insurance claims”. Australasian Actuarial Education and Research Symposium, Sydney, Australia, December.

Jin, Zhuo

“Liability and Dividend Management for Insurance Companies”. SIAM Conference on Control and Its Applications (CT17), Pittsburgh, PA, July.

“Investment and Reinsurance Non-Zero-Sum Games with Value-at-Risk Constraints”. Probability/ Applied Mathematics Seminar, Wayne State University, Detroit, MI, August.

“Dividend Management with Liability Constraints for Insurance Companies” Colloquium talk at Ball State University, Muncie, IN, August.

“Dividend Optimization with Delayed Capital Injections”, East China Normal University, Shanghai, November.


Cheng, Xiang

“Sub-simulation-free Upper Bounds for Bermudan Derivatives”. The Quantitative Methods in Finance (QMF) 2017 Conference, University of Technology Sydney, December.

Fergusson, Kevin

“Application of the Double Pareto Lognormal Distribution to Rainfall Events”, invited seminar, University of Melbourne, June.


“Less Expensive Pricing and Hedging of Extreme-Maturity Interest Rate Derivatives and Equity Index Options under the Real-World Measure”, University of Melbourne, October.

“Less Expensive Pricing and Hedging of Extreme-Maturity Interest Rate Derivatives and Equity Index Options under the Real-World Measure”, University of Technology, Sydney, November.


Li, Shuanming
The distribution of the time of ruin in the perturbed risk model. The 6-th IMS-China International Conference on Statistics and Probability, Nanning, China, June.
“The expected discounted penalty function: from infinite-time to finite time”. Department of Mathematics and Statistics, Chongqing University, China, July.
“The expected discounted penalty function: from infinite-time to finite time”. School of Mathematical Science, Nankai University, Tianjin, China, September.

Wu, Xueyuan
“On aggregate claims model with dependence”. Invited seminar, College of Mathematics and Statistics, Shenzhen University, Shenzhen, China, September.
“On aggregate claims model with dependence”. Invited seminar, School of Mathematical Sciences, University of Electronic Science and Technology of China, Chengdu, China, September.
“On aggregate claims model with dependence”. Invited seminar, School of Mathematical Sciences, Nankai University, Tianjin, China, October.
“On joint occupation times of spectrally negative Levy processes with a general tax structure”. DSA Seminars, Department of Actuarial Science, University of Lausanne, Lausanne, Switzerland, November.

INVolvEMenT AS REFEREES
Staff of the Centre acted as referees for the following journals:
American Journal of Mathematical and Management Sciences
Applicable Analysis
Applied Mathematics and Computation
ASTIN Bulletin
Communication in Statistics: Theory and Methods
European Journal of Operational Research
Frontiers of Mathematics in China
Insurance Markets and Companies
Insurance: Mathematics and Economics
International Journal of Decision Sciences, Risk and Management (UDSRM)
Journal of Applied Statistics
Journal of Computational and Applied Mathematics
Journal of Risk and Financial Management
Journal of Risk Model Validation
Methodology & Computing in Applied Probability
Physica A: Statistical Mechanics and its Applications
Risks
Scandinavian Actuarial Journal
Statistics and Probability Letters
The International Journal of Financial Studies
Staff

**Director of the Centre for Actuarial Studies**
Professor MARK JOSHI:
BA (Hons) (Oxford), PhD (MIT)
Research interests: Financial mathematics

**Acting Director of the Centre for Actuarial Studies (8th October to 31st December)**
Associate Professor SHUANMING LI:
BSc (Tianjin), MSc (Renmin), PhD (Concordia)
Research interests: Risk and ruin theory, stochastic modelling in insurance and finance, actuarial science

**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.

**Senior Lecturer in Actuarial Studies**
ENRIQUE CALDERIN:
BS, MS (UNED, Spain), PhD (ULPGC, Spain)
Research interests: Bayesian inference, statistical robustness, distribution theory, actuarial statistics

PING CHEN:
BAM (Qufu), MSc (CAS), PhD (Hong Kong)
Research interests: Actuarial science, financial mathematics, statistics and information

KEVIN FERGUSSON:
BSc (Hons), MSc, PhD, FIAA, CERA
Research interests: Stochastic analysis and modelling, superannuation and insurance services

ZHOUO JIN:
BS, MS (HUST), MA, PhD (WSU), ASA
Research interests: Numerical methods for stochastic systems, mathematical finance, actuarial science

XUEYUAN WU:
BS, MS (Nankai), PhD (Hong Kong), AIAA
Research interests: Risk and ruin theory, discrete-time risk models, phase-type distributions in risk theory

**Honorary Senior Fellows**
RICHARD FITZHERBERT:
BSc (Sydney), FIAA, FFin

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

JANE JOSHI:
BSc (Hons) (Monash), PhD (Melbourne)

**External Examiners for Part II**
NIKI APPLETON:
BSc, FIAA

(Actuarial Practice and Control I and II)

PETER WORCESTER:
BA, BSc, FIAA

(Actuarial Practice and Control III)
Staff

Dr. Ping Chen

Dr. Zhuo Jin

Dr. Xueyuan Wu