

THE YEAR IN REVIEW

INTRODUCTION

The Centre for Actuarial Studies continues to be the focal point for actuarial education in Victoria. It attracts the support of the actuarial profession in Australia and produces quality applied and theoretical research. It also maintains strong international links as well as contributing to the local actuarial community. The Centre is designated as a Centre of Excellence by the Institute of Actuaries of Australia.

STAFF NEWS

Daniel Dufresne rejoined the Centre from the University of Montreal in 2003 as a Professorial Fellow. Daniel has previously held academic appointments at the Universities of Laval and Montreal.

Ms Hye-Sun Lim completed the examination requirements for Fellowship of the Institute of Actuaries of Australia, and will obtain her Fellowship after attending the Institute's professionalism course.

Ms Challis Boland resigned as the Centre's Administrative Co-ordinator in October to take up a new appointment within the university.

RESEARCH ACTIVITIES

Research at the Centre during the year was in the areas of investment theory, long term care, applied probability, life office modelling, general insurance modelling and risk theory.

The Centre now has four full-time PhD students, working on a variety of topics.

Staff continue to publish in leading international journals, and to collaborate with academics overseas. Research is distributed through the Centre's Research Paper Series, details of which can be found on page 7.

Staff and research students attended a number of conferences in Australia and overseas. In particular, David Dickson was invited to speak at the conference "Risk Management in Insurance: Tools from Finance, Queueing, and Risk Theory" at the University of Waterloo in July, and Greg Taylor was an invited speaker at the ASTIN Colloquium in Berlin.

TEACHING ACTIVITIES

As detailed on page 10, student enrolments increased by around 37% over their 2002 level, with the most significant increases being at first and second year level. These increases meant that more teaching was done within the Centre by casual tutors than at any stage in the past.

Electronic assessment was introduced in first and second year level subjects. During semester students completed assignments online, receiving a mark for their work as soon as the work was submitted.

The Centre introduced a new subject 300-205 Introduction to Actuarial Practice at second year level. This is a non-technical subject whose main aim is to develop students' knowledge of basic actuarial principles applicable in different practice areas, with a particular focus on the Australian environment.

As in previous years, teaching activities were supported by a number of practitioners including Mr Iain Ross (Introduction to Actuarial Studies), Mr Andrew Gale (Actuarial Practice and Control I), Mr Andrew Matthews (Actuarial Practice and Control I), Mr Chris White (Actuarial Practice and Control II) and Mr Robert Thomson (Actuarial Practice and Control II).

VISITORS

Dr Steve Drekcic, University of Waterloo, visited the Centre in July and August for collaborative research with David Dickson.

The Centre again exchanged students with the Department of Actuarial Mathematics and Statistics, Heriot-Watt University, hosting three students and sending two.

PROFESSIONAL ACTIVITIES

David Dickson was a member of University Accreditation Panels of the Institute of Actuaries of Australia. The purpose of these panels is to assess applications for Institute accreditation and to ensure that accredited actuarial programs maintain appropriate standards.

Richard Fitzherbert presented his paper "The identification and measurement of speculative risk" at the September Horizons Meetings of the Institute of Actuaries of Australia.

Jules Gribble is a member of the International Committee of the Institute of Actuaries of Australia. He is also the Society of Actuaries ambassador in Australia.

Greg Taylor was appointed as a co-editor of the section on Direct Non-life Insurance in the Encyclopedia of Actuarial Science. This is a major reference work which will be published by John Wiley & Sons in 2004.

As detailed on page 5, three PhD students, Edward Leung, Peter Raymond and Manabu Sato gave presentations at the February Horizons Meeting of the Institute of Actuaries of Australia in Melbourne.

AWARDS

David Dickson and Howard Waters (Heriot-Watt University) were awarded a Research Prize by the Institute of Actuaries (London) for their paper "The distribution of the time to ruin in the classical risk model" which was published in ASTIN Bulletin 32.

Edward Leung who is a PhD student in the Centre became the inaugural holder of the A H Pollard PhD Scholarship, which is funded by the Institute of Actuaries of Australia.

ACADEMIC ACTIVITIES

PUBLICATIONS IN REFEREED JOURNALS

Cai, J. and Dickson, D.C.M., Upper bounds for ruin probabilities in the Sparre Andersen model with interest. *Insurance: Mathematics & Economics* 32, 61-71.

Fitzherbert, R.M., The identification and measurement of speculative risk. *Australian Actuarial Journal* 9, 445-476.

Sato, M., Dickson, D.C.M. and Fitzherbert, R.M., Initial capital and margins required to secure a Japanese life insurance portfolio under variable interest rates. *Australian Actuarial Journal* 9, 251-289.

Taylor, G.C., Chain ladder bias. *ASTIN Bulletin* 33, 313-330.

Willmot, G.E. and Dickson, D.C.M., The Gerber-Shiu discounted penalty function in the stationary renewal risk model. *Insurance: Mathematics & Economics* 32, 403-411.

OTHER PUBLICATIONS

Fitzherbert, R.M., Geometric and arithmetic mean rates of return. *Actuary Australia* 6, 20-21.

Gribble, J.D., The errors of our unitised ways. *SuperReview*, March.

Taylor, G.C., Guest Editorial, *British Actuarial Journal* 8, 835-841.

INVOLVEMENT AS REFEREES

During the year, members of the Centre acted as referees for the following journals:

- *Acta Mathematicae Applicatae Sinica*
- *Advances in Applied Probability*
- *Annals of Operations Research*
- *ASTIN Bulletin*
- *Australian Actuarial Journal*
- *British Actuarial Journal*
- *Insurance: Mathematics & Economics*
- *Journal of Actuarial Practice*
- *Luxembourg Economic Papers*
- *Mathematical Finance*
- *Quantitative Finance*

- *Scandinavian Actuarial Journal*
- *SIAM Journal on Applied Mathematics*
- *Statistics and Probability Letters*

Additionally, members of the Centre acted as referees for the Israel Science Foundation and for the National Science and Engineering Research Council (Canada).

OTHER ACTIVITIES

David Dickson is an associate editor of *Insurance: Mathematics & Economics* and of *British Actuarial Journal*, and is a member of the editorial board of the *ASTIN Bulletin*.

David Dickson is Adjunct Professor at the University of Waterloo.

Daniel Dufresne is a member of the scientific committee for *Luxembourg Economic Papers*.

Richard Fitzherbert is an associate editor of *Australian Actuarial Journal*.

Jules Gribble was academic co-ordinator of *Managing Regulatory Change in Life Insurance and Pensions Program* (APEC Finance Ministers endorsed regional capacity building program), *Training Programs and Symposium*.

Greg Taylor is an associate editor of *Insurance: Mathematics & Economics*.

CONFERENCE, SEMINAR & LECTURE PRESENTATIONS

PRESENTATIONS BY MEMBERS OF THE CENTRE

Dickson, D.C.M., "Some optimal dividends problems". Heriot-Watt University, April.

Dickson, D.C.M., "Some optimal dividends problems". Melbourne Seminar Series, June.

Dickson, D.C.M., "Some optimal dividends problems". University of Waterloo, June.

Dickson, D.C.M., "Some optimal dividends problems". University of Melbourne, September.

Dickson, D.C.M., "Some ruin related quantities in the classical risk model". Victoria University of Technology, November.

Dufresne, D., "Limit distributions of sums of lognormals". Concordia University, November.

Dufresne, D., "Asian and basket asymptotics". Quantitative Methods in Finance Conference, Sydney, December.

Fitzherbert, R.M., "Errors and misconceptions". Institute of Actuaries of Australia Biennial Convention, Coolumb, May.

Fitzherbert, R.M., "The identification and measurement of speculative risk". Institute of Actuaries of Australia Horizons Meetings, Sydney and Melbourne, September.

Fitzherbert, R.M., "The identification and measurement of speculative risk". Australian National University, October.

Leung, E., "Long term care in Australia". Institute of Actuaries of Australia Horizons Meeting, Melbourne, February.

Leung, E., "Projecting the needs and costs of long-term care in Australia". Actuarial Research Conference, University of Michigan, August.

McEllin, E.B., "Effects of environmental tobacco smoke on mortality and morbidity". University of Melbourne, May.

McEllin, E.B., "Credibility analysis of actual to expected claim ratios", The Hawaii international conference on statistics and related fields, July.

Raymond, P., "Analysis of a credit risk model". Institute of Actuaries of Australia Horizons Meeting, Melbourne, February.

Sato, M., "Initial capital and margins required to secure a Japanese life insurance policy portfolio under variable interest rates". Institute of Actuaries of Australia Horizons Meeting, Melbourne, February.

Taylor, G.C., "Financial economics and insurance pricing". Melbourne Seminar Series, April.

Taylor, G.C., "Loss reserving: past, present and future". Invited Speaker at ASTIN Colloquium, Berlin, August.

Taylor, G.C., "Financial economics". Institute of Actuaries of Australia Horizons Meetings, Sydney and Melbourne, November and December.

CONFERENCES ATTENDED

Dufresne, D., Mutinational Finance Society, Montreal, June.

Dufresne, D., Risk Energy Seminar, Houston, July.

Dufresne, D., Actuarial Day, Montreal, November.

Dufresne, D., Risk Quant Conference, New York, November.

Dufresne, D., NorthEast Probability Workshop, New York, November.

McEllin, E.B., Society of Actuaries Spring Meeting, Vancouver, June.

SEMINARS IN THE CENTRE

"Symbolic calculation of the moments of the time of ruin", by Steve Drekić (University of Waterloo), July.

"Forecasting general insurance liabilities", by Piet de Jong (Macquarie University), November.

RESEARCH PAPER SERIES

The Centre has an established Research Paper Series and abstracts of the papers published in 2003 are given below. Electronic forms of papers are available on the World Wide Web at:

<http://www.economics.unimelb.edu.au/actwww/papers.html>

No. 105: Actuarial practice and control: objectives and capabilities,
by J.D. Gribble

Abstract: In this paper a guiding philosophy for the development of an Actuarial Practice and Control (APC) subject is outlined. However, from this starting point, a more general view of what constitutes actuarial practice emerges.

This paper draws on work completed recently by the author who chaired an Institute of Actuaries of Australia committee established to review the syllabus of the Australian Part II professional actuarial education requirements – the so-called Actuarial Control Cycle - and to make recommendations regarding syllabus changes. Such a control cycle approach is a valuable tool in the development of actuarial education and practice.

An important element of this work is the recognition that there is more to successful actuarial work than the acquisition of a set of technical actuarial tools. A number of capabilities are identified as being pre-requisites for successful actuarial practice. Only a few of these capabilities specifically focus on technical issues. The implications of this recognition are important for the actuarial profession and its approach to its professional education.

A Mission Statement for an APC course is given: *“An Actuarial Practice and Control course provides a structured approach to understanding and then applying the principles of a generalised actuarial approach, leading to the resolution of a broad range of issues in a business and financial environment.”*

A specific Actuarial Practice and Control schematic outlining the structure of actuarial practice is provided and the place of an Actuarial Control Cycle within this structure is clarified. A consequence is that the generic steps involved in applying the Actuarial Control Cycle can be explicitly listed. It also provides a high level conceptual framework which can be used to integrate actuarial education and practice.

No. 106: The identification and measurement of speculative risk,
by R.M. Fitzherbert

Abstract: Recent falls in stock markets have once again exposed investors in superannuation and managed funds to negative rates of return. A common, and possibly self-interested, response from the managed funds industry is that such declines can only be anticipated in hindsight. While acknowledging that this is sometimes the case, stock market levels such as those reached in Australia in 1987, the UK in 1999 and the USA in 2000 can be shown to have involved a high degree of speculative risk – the chance that purchases at such levels were extremely unlikely to provide a reasonable return for long-term investors. Poor long-term performance from such levels could have been anticipated, even though the timing of any sharp decline could not. The thesis of this paper is that speculation can be identified using two quite different approaches to analysis. Given a definition that is relevant to investors with long-term objectives, speculative risk can then be measured. If speculation can be identified and speculative risk measured, then it can be avoided in investment decisions and taken into account when valuing actuarial liabilities. This

is particularly relevant for defined benefit funds as demonstrated recently in UK pension schemes.

No. 107: Some optimal dividends problems,
by D.C.M. Dickson and H.R. Waters

Abstract: We consider a situation originally discussed by De Finetti (1957) in which a surplus process is modified by the introduction of a constant dividend barrier. We extend some known results relating to the distribution of the present value of dividend payments until ruin in the classical risk model and show how a discrete time risk model can be used to provide approximations when analytic results are unavailable. We extend the analysis by allowing the process to continue after ruin.

No. 108: The joint distribution of the surplus prior to ruin and the deficit at ruin in some Sparre Andersen models,
by D.C.M. Dickson and S.Drekic

Abstract: For the Sparre Andersen risk model, we derive a general expression for $h(u, x, y)$, the joint density function of the surplus prior to ruin and the deficit at ruin when the initial surplus is u . This density function is expressed in terms of the corresponding density function when the initial surplus is 0. We apply a known result for $h(0, x, y)$ in the situation when inter-claim times follow a generalised Erlang distribution to derive expressions for $h(u, x, y)$ when individual claims have a phase-type(m) distribution, $m \in \mathbb{Z}^+$. We also consider the case when inter-claim times follow a phase-type(2) distribution and derive an expression for $h(0, x, y)$.

No. 109: Loss reserving: past, present and future,
by G.C. Taylor, G. McGuire and A Greenfield

Abstract: The paper reviews the development of loss reserving models over the past, classifying them according to an elementary taxonomy. The taxonomic components include (1) the algebraic structure of the model, (2) the form of its parameter estimation, (3) whether or not it is explicitly stochastic, and (4) whether or not its parameters evolve over time.

Particular attention is given to one of the higher species of model, involving complex structure, optimal estimation, and evolutionary parameters. A generalisation of the Kalman filter is considered as a basis of adaptive loss reserving in this case. Real life numerical examples are provided.

Some implications of this type of data analysis for loss reserving are discussed, with particular reference to the form of data set used. The use of triangular arrays is questioned, and alternatives examined. Again, real life numerical examples are provided.

No. 110: Projecting the needs and costs of long term care in Australia,
by E. Leung

Abstract: Considerable attention has been given in the recent past to the likely economic and social impact of Australia's ageing population. One particular aspect which continues to be the subject of increased commentary and conjecture, is the need and subsequent costs for Long Term Care (LTC). In this paper, a multiple state projection model based on a framework by Rickayzen and Walsh (2002) is constructed in order to project the number of people in Australia who are likely to require LTC.

No. 111: The density of the time to ruin for a Sparre Andersen process with Erlang arrivals and exponential claims,

by D.C.M. Dickson, B.D. Hughes and Z. Lianzeng.

Abstract: We derive expressions for the density of the time to ruin given that ruin occurs in a Sparre Andersen model in which individual claim amounts are exponentially distributed and inter-arrival times are distributed as Erlang(n, β). We provide numerical illustrations of finite time ruin probabilities, as well as illustrating features of the density functions.

No. 112: Quantifying and Assessing Learning Objectives,

by J.D. Gribble, L. Meyer and A.L. Jones

Abstract: A number of studies have been conducted which use the Bloom taxonomy to improve teaching and learning. However, to our knowledge, neither the Bloom taxonomy nor any other established learning taxonomy has been used as a basis to develop a quantifiable tool that will enable teachers to analyse the cognitive process embedded in the objectives and assessment of a subject, as well as provide a methodology to assess alignment of those objectives with the assessment tasks.

This paper presents the development of such a quantifiable tool. We discuss the assumptions, method and potential benefits of the outlined approach and in particular its value in providing a mechanism for comparison between subjects, both over time for a given subject and between subjects. The approach has been applied to a specific example in the education system of a profession, the Institute of Actuaries of Australia.

The approach is not mathematically difficult to develop. The model requires a number of parameters to be specified. Once these parameters are specified then the methodology is robust. Adjustments to results are made by explicit adjustments to the parameters and not the methodology. A key consequence of this is that once the methodology is accepted, results and any changes can be explicitly tracked and the causes unambiguously identified. In environments where subjective opinion may be pronounced, such an approach raises the level and quality of discussion significantly - from 'shooting the messenger' to 'addressing the message'.

We also comment on the potential for extensions of this work.

In an economic and educational environment where teachers are being held more accountable for the attainment of promised learning outcomes for their students the development of the tool proposed here is potentially powerful and widely applicable.

UNDERGRADUATE & HONOURS TEACHING

The numbers enrolled in each subject for the last three years are shown below.

Subject Name	2001	2002	2003
300-101 Introduction to Actuarial Studies	84	145	165
300-203 Financial Mathematics I	102	127	189
300-204 Financial Mathematics II	74	97	147
300-205 Introduction to Actuarial Practice	-	-	91
300-330 Survival Models: Theory and Applications	81	78	89
300-331 Modelling in Insurance and Finance I	69	67	85
300-332 Modelling in Insurance and Finance II	60	59	68
300-334 Financial Mathematics III	-	-	67
300-341 Actuarial Mathematics I	64	60	77
300-342 Actuarial Mathematics II	65	64	76
300-400 Actuarial Studies Research Essay	24	36	37
300-406 Risk Theory I	19	34	33
300-407 Risk Theory II	16	32	28
300-408 Advanced Financial Mathematics	25	34	34
300-410 Actuarial Practice and Control I	37	45	41
300-410 Actuarial Practice and Control I – Distance	13	16	9
300-411 Actuarial Practice and Control II	39	38	43
300-411 Actuarial Practice and Control II – Distance	6	11	10
Total Enrolments	778	943	1,289

The Distance students, in centres throughout South East Asia and Australia, received the lectures through cds and video streaming.

HONOURS RESULTS AND THESES TOPICS

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

Indula Abeykoon
Farah Billimoria
Budianto
Ming Yiu Chan
Ven Chee Chin
Hui Min Chong
Melissa Hui-Ping Chong
Kevin Wai-Ho Chor
Tomasz Dudek
Reuben Cruz Fernandes
Alexander Grinstein
Vishal Hargovan
Siew Yen Law
Harry Chun Foong Lee
Lai-Wah Jenny Leung
Justin Levi
Andrew Tse Yeow Loh
Henry Chun-Yu Lok
Nicole Mahemoff
Lev Margolin
Andrew David Mitchell
Deing Hung Ngu
Laam Lily Pang
Kent Gavin Rae Smith
Theresia Noviyanti Setia
Michael Mian Sheng
Henry Sunyoto
Yen Ni Tan
Yeu-Bing Tan
Oi-Yee Ting
Kwok Swan Wong
Wei Win Wong
Yi Simon Yan

The following list includes topics of honours essays submitted by honours students. An honours research essay is about 10,000 words and counts as 25% of the final assessment for a student's honours grade.

- Claim movement analysis in disability income insurance
- Performance of Australian listed investment companies
- Reserving for disability income insurance
- Longevity risk and allocated products
- Approximations to ruin probabilities
- Comparison of methods of calculating IBNR reserves
- Lévy processes as models for stock returns
- The Australian health care system
- Investment linked annuities
- Projecting long term care
- Capital requirements for annuities
- Pricing barrier options
- The distribution of the time to ruin
- The binomial-geometric risk model
- Poisson processes and pricing average options
- Term structure modelling and option pricing
- Market indexed annuities
- Investment guarantees in life assurance
- Option pricing with stochastic volatility
- Modelling credit risk
- Securitisation of insurance risk
- Fair valuation of unit-linked capital guarantee products

PRIZE WINNERS

ACTUARIAL SUBJECT PRIZES

The AXA Australia Prize for *Financial Mathematics I and II*
Kuang Chang

The Commisure Prize for *Introduction to Actuarial Studies*
Andrew Kwok

The NSP Buck Prize for *Survival Models: Theory and Applications*
Anthony Chan and Aaron McGovern (equal share)

The NSP Buck Prize for *Actuarial Mathematics I and II*
Anthony Chan

The Tillinghast Towers Perrin Prize for *Risk Theory I and II*
Yeu-Bing Tan

The Trowbridge Deloitte Prize for *Actuarial Practice and Control I and II*
Kee Leong Lum

The Institute of Actuaries of Australia Prize for research
Kwok Swan Wong

Actuarial Honours Prize
Kwok Swan Wong

FACULTY OF ECONOMICS AND COMMERCE AWARDS

The A.C. Morley Prize for the best first year student in the Bachelor of Commerce degree
Phylaktis Georgiou

The Paton Advertising Service Exhibition for the best student in the second year of the Bachelor of Commerce degree
Kwok Wai Nora Lam

The William Noall & Son Prize for the top honours graduate in the Faculty of Economics and Commerce
Kwok Swan Wong

STAFF

PROFESSOR OF ACTUARIAL STUDIES

David C.M. Dickson, BSc (Hons), PhD, FFA, FIAA

PROFESSORIAL FELLOW IN ACTUARIAL STUDIES

Daniel Dufresne, BSc (Hons), PhD, FSA

SENIOR LECTURER IN ACTUARIAL STUDIES

Richard M. Fitzherbert, BSc (Hons), FIA, FIAA, ASIA

LECTURERS IN ACTUARIAL STUDIES

Edward B. McEllin, BA, MA, FSA

Hye-Sun Lim, BSc, BCom (Hons), FIAA

PROFESSORIAL ASSOCIATE

Greg C. Taylor, BA, PhD, PhD, FIA, FIAA, FIMA, C Math, AO

HONORARY SENIOR FELLOWS

Julian D. Gribble, BSc (Hons), PhD, FIAA, FCIA, FSA

Grant Harslett, BSc (Hons), FIAA, FIA, ASA

Allen Truslove, BSc (Hons), PhD, MBA, FIAA, FIA

TUTORS

James Archer, MA, DPhil, FIA, FIAA

Benjamin Zher Yen Chan

Tomasz Dudek

Edward Leung, BCom (Hons), LLB (Hons), AIAA

Ka Ki Li, BCom, FIAA

Peter Raymond, BCom (Hons)

Manabu Sato, MCom(Hons), AIAA

Kent Smith

Yen Ni Tan

Marianne Watt, BSc, DipEd, FIAA

Ron Weatherhead, BSc, CertEd, FIAA

Kumaran Yogaranandan BCom (Hons), FIAA

RESEARCH STUDENTS

Edward Leung, BCom (Hons), LLB (Hons), AIAA

Ka Ki Li, BCom, FIAA

Peter Raymond, BCom (Hons)

Manabu Sato, MCom(Hons), AIAA

ADVISORY BOARD

The membership of the Advisory Board is as follows.

EXTERNAL MEMBERS

Mr Graham Rogers	Offley House
Professor Greg Taylor	Taylor-Fry Consulting Actuaries

UNIVERSITY MEMBERS

Professor Robert Brown	Department of Finance
Professor David Dickson	Centre for Actuarial Studies
Mr Richard Fitzherbert	Centre for Actuarial Studies
Professor John Freebairn	Department of Economics
Ms Hye-Sun Lim	Centre for Actuarial Studies
Mr Edward McEllin	Centre for Actuarial Studies
Professor Peter Dawkins (Chair)	Dean, Faculty of Economics and Commerce