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### **ACQuFRR Report for 2014**

The establishment of ACQuFRR has integrated teaching and research in quantitative/mathematical finance and its allied disciplines at UCT. The unit was afforded a three-year, provisional accreditation by the University Research Committee in October 2012. We will be reviewed in June 2015. ACQuFRR coordinates the research dissertations for the MPhil and the projects for Research Master's and PhD students in quantitative finance and risk. It also provides a forum for collaboration and discussion between its academic members, students, and industry associates and collaborators.

ACQuFRR has a website: [www.acqufrr.co.za](http://www.acqufrr.co.za), which contains comprehensive information about our activities, projects and interests, as well as details of our Executive, Advisors and Research Associates.

The ACQuFRR Advisory Board convened in February 2014 for its second annual meeting. The minutes from this meeting were circulated in April. RMB and Standard Bank are represented on the board. The third annual meeting is scheduled for February 2015. The Board plays a vital role in maintaining contact between industry and our research activities to fulfil the mandate of the unit and justify its industry funding.

#### **Students**

ACQuFRR has five full-time PhD students – Mr Obeid Mahomed, Mr Alex Backwell, Mr Ralph Rudd, Mr Michael Kataregga, and Mr Mario Giuricich – and one part-time PhD student – Mr Daniel Acres. Mr Mahomed is well known to all, and Mr Backwell, Mr Rudd and Mr Giuricich are 2013 graduates of the MPhil. Mr Kataregga is in his final year, and Mr Acres in his second.

Mr Mahomed converted his registration to a PhD this year, and taught and tutored on the MPhil. He co-taught the Stochastic Calculus for Finance II course, and was responsible for Risk Management of Financial Instruments. His thesis is entitled, "Alternative Asset Pricing Models: Information and Calibration", and he is supervised by A/Prof David Taylor. We are confident that Mr Mahomed will be appointed as a full-time lecturer in 2015, and that he will complete his PhD towards December. He is financially supported by ACQuFRR and RMB.

Mr Backwell spent the first four months of 2014 attending classes in the Mathematical Finance Master's programme at the Université d'Évry-Val-d'Essonne in Paris with Prof Stephane Crépey – a long-time colleague and collaborator of ours. Mr Backwell is jointly supervised by A/Prof Taylor and Dr Andrea Macrina of University College London (UCL). He has successfully defended his thesis proposal entitled, "Pricing Kernels and Financial Modelling", and plans to spend part of 2015 in the UK at UCL with Dr Macrina. Dr Macrina is an ACQuFRR Advisor and an Adjunct Associate Professor in Actuarial Science at UCT. Mr Backwell tutored on the MPhil during 2014 and taught undergraduate Actuarial Science. He is financially supported by ACQuFRR, the NRF and UCT.

Mr Rudd was appointed in January as ACQuFRR's Research Administrator and also tutored on the MPhil. Mr Rudd is jointly supervised by A/Prof Tom McWalter, Prof Eckhard Platen of the University of Technology, Sydney and UCT, and Dr Jörg Kienitz of Deloitte, Germany. Prof Platen is an Honorary Professor at UCT. Mr Rudd has successfully defended his thesis proposal entitled, "Benchmarked Trees", and plans to spend parts of 2015 in Germany with Dr Kienitz, and in Australia with Prof Platen and A/Prof Taylor. He is financially supported by ACQuFRR and RMB.

Mr Kataregga successfully defended his thesis proposal entitled, "Generalised Models for Hedging Market Securities using the Malliavin Derivative & Donsker's Delta Function", earlier this year. He is jointly supervised by Dr Sure Mataramvura and A/Prof Taylor. Mr Kataregga plans to complete his thesis in 2015. He is financially supported by ACQuFRR and the NRF.

Mr Giuricich initially left UCT in January to work at EY, but returned later in the year to register for a PhD. He will defend his thesis proposal in March next year, and is currently supervised by A/Prof David Taylor. Mr Giuricich tutored on the MPhil during 2014 and taught undergraduate Actuarial Science. He is financially supported by ACQuFRR and BankSETA.

Mr Acres is the CEO of Prescient Life, has an undergraduate degree in Actuarial Science and a Master's degree in Finance. He successfully defended his thesis proposal entitled, "Optimal Dynamic Asset Allocation and Annuitisation Strategies in Retirement", in 2013. He is co-supervised by A/Prof Ryan Kruger and A/Prof Taylor. A/Prof Kruger is in the Dept. of Finance & Tax and is on the Executive of ACQuFRR.

All of our MPhil and PhD students are housed in the RMB Loft on the 6<sup>th</sup> floor of the Leslie Commerce Building at UCT.

## **Publications**

In addition to various conference presentations and proceedings, ACQuFRR produced 16 research publications this year. The titles and publication details appear on our website ([http://acqufrr.co.za/res\\_journals.aspx](http://acqufrr.co.za/res_journals.aspx)), which was launched late last year. The website also hosts our new Working Paper Series ([http://acqufrr.co.za/wrk\\_about.aspx](http://acqufrr.co.za/wrk_about.aspx)), an exciting development that is attracting collaborators to the unit and disseminating some of our (and their) early research results.

## **Seminars, Workshops, Masterclasses, Retreats & Conferences**

Hosting and attending seminars, workshops and conferences are part of the normal activities of a research unit. However, the industry alignment of ACQuFRR means that we have an obligation to offer our research and discussion to a wider audience. These events help to create awareness of the unit and to publicise its contribution to the broader conversation.

A weekly seminar series was held throughout 2014 during term-time. The MPhil students are required to attend these, along with the Research Master's and PhD students affiliated with the unit. We also invited Cape Town based practitioners. Each seminar is hosted jointly by ACQuFRR and the Department of Finance and Tax, and held in the Department of Finance and Tax's seminar room on Tuesdays at lunchtime. It brings together research-minded academics in Finance and Actuarial Science with students and industry participants. Students are also expected to present dissertation and thesis work in this forum. The series underwent a shift in focus in 2014. We asked most of our associated members to present a sequence of talks in the first semester in which they outlined and discussed their current research projects. This allowed the MPhil students to identify potential dissertation supervisors and topics, to gain a view of what ACQuFRR is achieving, and to

see what PhD studies can offer. During the second semester, the staff and research students presented some of their research results.

ACQuFRR hosted eight guest seminars in 2014 - two from Prof Uwe Schmock of the Vienna University of Technology, Austria, one from Dr Luca Capriotti (see below), one from Mr Valeri Sokolovski of the Stockholm School of Economics, Sweden, one from Prof Peter Ritchken of Case Western Reserve University, USA, one from Prof Michael McAleer of Erasmus University, Netherlands, and one from Prof Chialin Chang of National Tsing Hua University, Taiwan. We were delighted to host Prof Emanuel Derman of Columbia University, USA in August for a special public seminar entitled, "Understanding the World". For details, see [http://acqfrr.co.za/sem\\_special.aspx](http://acqfrr.co.za/sem_special.aspx)

Two ACQuFRR Masterclasses took place in January and February. Masterclasses are intended to provide expert tuition from ACQuFRR visitors on technical subjects to professionals in the financial services industry. The first Masterclass took place at UCT in January and was presented by Prof Eckhard Platen. It was entitled, "A Benchmark Approach to Investing, Pricing and Hedging", and 42 students and practitioners registered. The second Masterclass was hosted at RMB in Johannesburg in February and was presented by Prof Platen and Dr Jörg Kienitz. It was entitled, "Current Numerical Methods and Stochastic Volatility Modelling in Quantitative Finance", and 57 students and practitioners registered. Despite minimal advertising for the events we were very satisfied with the turn out, and the feedback from the participants was extremely positive.

The Second Prescient Securities/ACQuFRR Quant Conference took place in Cape Town in April. This is an annual, non-academic event and attendance is by invitation only. Members and students of ACQuFRR are naturally included in this invitation. ACQuFRR sources and invites prominent academics to deliver a two-day series of lectures on a topic pertinent to quantitative professionals in the investment industry. This year's conference was presented by Prof Lionel Martellini of EDHEC Business School in France, and was very well attended.

ACQuFRR is involved in the annual Summer School in Mathematical Finance held at the African Institute for Mathematical Sciences (AIMS) in Muizenberg. This year saw the seventh edition of the Summer School. The Director of ACQuFRR plays a key role in inviting the three speakers for this event and uses this opportunity to create and strengthen ties with leading international academic figures. It is often possible to persuade the presenters to extend their stay in South Africa and to offer further research seminars at UCT. This was the case in 2014, and Dr Luca Capriotti of Credit Suisse, UK, gave a talk at UCT the day before AIMS. Prof Platen also presented at AIMS during his one-month stay at UCT. The third speaker was Prof Daniel Bauer from Georgia State University (GSU). The Dept. of Risk Management and Insurance at GSU is one of ACQuFRR's academic partners. ACQuFRR research students are encouraged to attend the Summer School. The Summer School is free for full-time students at South African universities and AIMS. There were 45 students, academics and practitioners registered this year. 2014's Summer School was particularly successful because of the integrated connection between the topics offered by the three speakers.

We held our first one-day research retreat in June for the PhD students. We had an off-campus meeting during which we worked on a variety of problems and discussed progress on their PhD projects. The time away affords uninterrupted focus on research and was extremely productive. We will repeat the exercise as frequently as possible in the future.

## **The Fifth International Mathematics in Finance Conference in the Kruger National Park**

From the 24<sup>th</sup> to the 29<sup>th</sup> of August 2014, the Fifth International Conference on Mathematics in Finance was held at the Skukuza Rest Camp in the Kruger National Park. This conference is held every three years. Details can be found at: <http://www.nwu.ac.za/content/mif-2014-landing-page>

The conference was co-organised by North-West University (NWU), UCT and the University of Johannesburg (UJ), and hosted by NWU. The programme included plenary and invited talks, as well as contributed talks. Participants came from local and international universities and financial institutions. The conference was sponsored by Barclays Africa Group, Rand Merchant Bank and Standard Bank. Momentum Manager of Managers also contributed to the expenses of one of the invited plenary speakers. A list of plenary and special invited speakers can be found on the website.

In addition to the plenary speakers, 130 delegates, including 29 students, and 28 accompanying people attended the conference. Many of the speakers were attending the conference for the second or third time. A record number of 63 abstract submissions were received. The Skukuza conference facilities made possible parallel sessions, and in total 48 contributed talks were delivered. More than half of the speakers were from outside South Africa, mainly from Europe.

The plenary speakers gave reviews of current developments in the following areas: contemporary portfolio construction, asset price dynamics, counterparty-risk, stochastic volatility for option pricing, credit default swaps, finite mixture models, model uncertainty and risk measures, macroeconomic variables for credit cards, and multivariate stress-testing. These were very well received and generated extensive discussion during and after the seminars.

The shorter talks gave young researchers and students the opportunity to present their work for discussion and criticism. It also afforded some of the more established researchers a platform to discuss their current ideas, and featured some outstanding new work. Our PhD students, Mr Backwell and Mr Rudd presented talks entitled, "The Recovery Theorem: Expounded and Applied" and "Commodity Futures Spread Options", respectively. Mr Backwell submitted his research to the conference proceedings.

## **The First Financial Mathematics Team Challenge**

The Financial Mathematics Team Challenge (FMTC) was conceived in February 2013. Dr Macrina and I were mulling over a few ideas for an event for South African postgraduate students in Financial and Insurance Mathematics where they could focus on a topical research project with industry relevance while simultaneously developing links to international students and academics in the field. We had been inspired in part by Nadim Sah of TU Berlin drawing our attention to the MITACS Industrial Math Summer School. We also wanted the event to serve as an opportunity to bring international researchers to South Africa, and to give them a glimpse of the dynamic environment that is developing at the University of Cape Town in the African Institute for Financial Markets and Risk Management. A final, indispensable ingredient had to be that the participating students would work in teams and be exposed to a healthy dose of fair competition.

The First FMTC was held from the 3<sup>rd</sup> to the 13<sup>th</sup> of July 2014 at UCT. The Challenge brought together Masters and PhD students from UCT, University of Johannesburg, University College London, Université d'Évry-Val-d'Essonne and the African Institute of Mathematical Sciences to pursue intensive research in Financial Mathematics. Four teams of students worked on separate research problems during the ten days. Professional and academic experts from France, South

Africa and the UK individually mentored the teams, fostering teamwork and providing guidance. The students applied themselves with incredible dedication and exemplary vigour.

The research included topical projects on multi-curve interest rate modelling and counterparty risk valuation adjustments, pricing and hedging of commodity gap options, and portfolio diversification measures. The problems were either proposed directly by our industry partners or chosen from areas of current relevance to the finance industry. In order to prepare the teams, guidance and preliminary reading was given to them a month before the meeting in Cape Town. During the final two days of the challenge, the teams presented their conclusions and solutions in extended seminar talks. The team whose research findings were voted the best won a cash prize and was awarded a floating trophy.

The teams were then asked to write a report containing a critical analysis of their research problems and the results that they had obtained. We collated and edited these four reports into a single volume, which will be available to future FMTC participants. It may also be of use and inspiration to Masters and PhD students in Financial and Insurance Mathematics.

The first Financial Mathematics Team Challenge was a wonderful opportunity for students to interact and collaborate on research in Risk, Investments, Insurance and Financial Mathematics. Motivated by its success, we are already planning its second edition.

## Visitors

Prof Jaksa Cvitanic, the Richard N Merkin Professor of Mathematical Finance at Caltech, visited UCT in April. Prof Cvitanic previously visited South Africa in 1999. While he was here, he gave a short course entitled, "Portfolio Optimization in Continuous Time" to the Master's and PhD students.

Prof Coenraad Labuschagne is one of ACQuFRR's advisors and an external examiner for the MPhil. He attended the Advisory Board meeting in February, and the AIMS Summer School. He also gave a series of lectures to the PhD students throughout the year on Functional Analysis.

One of ACQuFRR's goals is to initiate research with African academics working broadly in Quantitative Finance or Risk research. After our extensive participation in the 2012 and 2013 Strathmore University International Mathematics research meetings in Nairobi (which was covered in detail in our 2013 report), we invited Dr Philip Ngare of Nairobi University to UCT. ACQuFRR funded his visit. Dr Ngare arrived in February and attended the Masterclass in Johannesburg and the Seventh AIMS Summer School in Cape Town.

## Prof Eckhard Platen

Prof Platen holds the Chair in Quantitative Finance at the University of Technology Sydney. He is the President of the Bachelier Finance Society - the professional organization for Mathematical Finance and Quantitative Finance. He initiated, and has been chairing, one of the leading annual international conferences - Quantitative Methods in Finance - for 23 years. He founded and headed the Centre for Financial Mathematics in the Institute of Advanced Studies at the Australian National University (ANU), and is an Adjunct Professor at ANU. He is co-author of three books on simulation methods, a fourth book on his innovative benchmark approach, and a fifth book on functionals of multidimensional diffusions with applications to finance. He has authored more than 170 papers in finance, insurance and applied mathematics, and serves on the editorial boards of six international journals, including Mathematical Finance and Quantitative Finance, and a Springer book series.



Prof Platen is a great supporter of Mathematical Finance in South Africa and has visited us on a number of occasions over the past six years. At the time of his first visit in 2008, he was a plenary speaker at the Third International Mathematics in Finance Conference in the Kruger National Park. This year he spent one month at UCT.

Prof Platen has shown his commitment to our endeavours by attending and speaking at the triennial MiF conferences in the Kruger Park, co-supervising our PhD students, initiating research, and funding his visits to Johannesburg and Cape Town. He regularly and enthusiastically promotes our work and facilitates contact with a variety of international academics. In February, (for the second time) he was one of the three presenters at the AIMS Summer School. We have scheduled another, month-long visit to South Africa for him in 2015.

Prof Platen affords us access to the community of cutting-edge Financial Mathematicians in Australia, the UK, the USA and Europe. In recognition of his contribution to UCT, he was appointed as an Honorary Professor this year. This is the highest award of its type at UCT and is decided at Senate level.

### **Honorary and Adjunct Positions**

One of the ways to strengthen quantitative finance at UCT is through appointing adjunct staff. This is a process where candidates are nominated and selected in a rigorous fashion for (usually unpaid) academic posts that hold all the benefits of rank. Payment and support of adjunct staff is normally funded through external sources. Adjunct staff are allowed to access UCT research funding and often perform the normal duties of a member of staff including research supervision and teaching.

Dr Tom McWalter and Dr Andrea Macrina are both Adjunct Associate Professors in Actuarial Science, and carry the title of Associate Professor while they are working at UCT. Prof Eckhard Platen is an Honorary Professor. We have nominated Dr Jörg Kienitz as an Adjunct Associate Professor and Prof Peter Ritchken as an Adjunct Professor.

Dr Kienitz is a well-known mathematical finance practitioner who regularly presents at industry conferences and workshops throughout the world. He previously worked for Deutsche Postbank and has presented at the AIMS Summer School. Prof Ritchken is also a well-known finance academic with a world-wide reputation. He graduated from UCT in the 1970s and has been at Case Western Reserve since then. If he is appointed as an Adjunct Professor in December, we will nominate him as an Honorary Professor in 2015.

Quantitative finance at UCT is in a strong position. The MPhil in Mathematical Finance attracts some outstanding students each year, bearing testament to our reputation for quality and rigour. The addition of new staff members through honorary, adjunct and full-time appointments, and the variety of visitors that we host, augments the profile of the area in the university and (South) Africa, and inspires the students. We have a strong presence on the Commerce Faculty Facebook page: <https://www.facebook.com/UCTCommerce>. Additional staff and research students help create a “critical mass” that allows the programme to expand and flourish in its activities.



A/Prof David R Taylor