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ACQuFRR Report for 2015

The establishment of ACQuFRR has integrated postgraduate teaching and research in quantitative and mathematical finance and some of its allied disciplines in the Commerce Faculty at UCT. ACQuFRR now houses the research students and academic members of the African Institute of Financial Markets and Risk Management (AIFMRM). ACQuFRR's website: www.acqufrr.co.za contains comprehensive information about its activities, events, projects, and interests; as well as details of its Executive, Advisors and Research Associates.

ACQuFRR was afforded a three-year, provisional accreditation by the University Research Committee in October 2012, and will be submitting an application for full accreditation in January 2016. The unit coordinates the minor research dissertations for the MPhil in Mathematical Finance and the projects for Research Master's and PhD students in quantitative finance and risk, as well as AIFMRM PhD and Post-Doc scholarship holders. In 2016, it will also coordinate the minor research dissertations for the MPhil in Risk Management of Financial Markets. ACQuFRR also provides a forum for collaboration and discussion between its academic members, students, and industry associates and collaborators through weekly seminars and a series of special seminars.

The ACQuFRR Advisory Board convened in February 2015 for its third annual meeting. The minutes from this meeting were circulated in August. Representatives from RMB, Riscura, Avior, the Banking Association of South Africa, and Standard Bank are represented on the board. The fourth annual meeting is scheduled for February 2016. 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.

Publications

In addition to various conference presentations and proceedings, ACQuFRR produced eleven research publications this year. The titles and publication details appear on our website (http://acqufrr.co.za/res_journals.aspx).

ACQuFRR Advisor, Associate and Adjunct Associate Professor in Actuarial Science, Daniel Polakow, with his co-authors Emlyn Flint and Edru Ochse, won the RGA Prize for the Best Published Research in 2014. The paper was entitled *Estimating Long-term Volatility Parameters for Market-consistent Models*, published in the South African Actuarial Journal.

Seminars, Workshops, Masterclasses, Retreats & Conferences

Hosting and attending seminars, workshops and conferences form part of the ongoing 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 2015 during term-time. The MPhil in Mathematical Finance students and the PhD students affiliated with the unit and AIFMRM are required to attend these. We also invite Johannesburg and Cape Town-based practitioners. Each seminar is hosted jointly by ACQuFRR and the Department of Finance and Tax, and is (mostly) held in the Department of Finance and Tax's seminar room on Tuesdays at lunchtime. The series brings together research-minded academics in AIFMRM, Finance and Actuarial Science with students and industry participants. Students are also expected to present dissertation and thesis work in this forum.

ACQuFRR hosted three guest seminars in 2015 – one from Ms Leanne Parsons of the JSE, one from Dr Helen Solomon of De Montfort University, UK, and one from Dr Philipp Koenig of DIW: The German Institute for Economic Research. For details, see http://acqufrr.co.za/sem_special.aspx

Two ACQuFRR Masterclasses took place in April and November. 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 the Graduate School of Business, UCT in April and was presented by Prof Ben Jacobsen (University of Edinburgh Business School). It was entitled *The Art and Science of Forecasting Financial Markets*, and 66 students and practitioners registered. The masterclass introduced the notion of market efficiency and the random walk model, and then built on these benchmarks to show why, when and how financial markets may be partially forecastable. Prof Jacobsen then discussed and illustrated the art and science of building quantitative forecasting systems based on recent academic research.

The second Masterclass was jointly hosted by ACQuFRR and Deloitte, South Africa in November and was presented by Dr Jörg Kienitz. It was entitled *Models - Challenges and Risk, A Quantitative Finance Perspective*, and was based on the course "Models - Challenges and Risks" presented at WBS Fixed Income 2015, Paris. 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, has presented at the AIMS Summer School, and holds an Adjunct Associate Professor position with us at UCT. The masterclass focussed on practical issues regarding interest rate markets - the new interest rate paradigm, modelling interest rates, the advent of negative rates as well as modelling exposures for regulatory capital purposes. It was well attended by various financial services sectors professionals, as well as members and students of ACQuFRR.

The Third Annual 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. For the previous two editions, ACQuFRR sourced and invited 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, however, was presented by ACQuFRR's team of Mathematical Finance PhDs (Alex Backwell, Mario Giuricich, Obeid Mahomed and Ralph Rudd). The team delivered a one-day series of lectures on fixed income related topics within the context of the South African market. This was an excellent opportunity for ACQuFRR's PhDs to gain exposure, as

well as demonstrate their capability, to the investment management industry. The conference was very well attended and received.

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 eighth 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 2015, and Prof Ajay Subramanian of Georgia State University (GSU) gave a talk at UCT the day before AIMS. The Dept. of Risk Management and Insurance at GSU is one of ACQuFRR's academic partners. Prof Peter Ritchken also presented at AIMS during his one-month stay with us at UCT. The third speaker was Dr Massimo Morini from IMI Bank of Intesa, San Paolo. 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. 2015's Summer School was surprisingly successful because of the unintended connection between the topics offered by the three speakers.

We held two four-day research retreats in March and October in the Cederberg for the PhD students and some of the academic staff, during which we worked on a variety of problems and discussed progress on their PhD projects with the students. The venue was perfect because of the quiet and the lack of internet. The time away afforded uninterrupted focus on research and was extremely productive. We will repeat the exercise as frequently as possible in the future. Three collaborative working papers have resulted.

The Second Financial Mathematics Team Challenge

The First Financial Mathematics Team Challenge (FMTC) took place in the June-July Winter Break at the University of Cape Town in 2014. Since it was the first time we had attempted it, we had little idea of what to expect. Fortunately, the event proved to be much more successful than we had hoped for, so we decided to forge on with a second edition in 2015. Our vision had always been to see if we could create an annual event. A short video can be viewed [here](#).

The purpose of the FMTC is for South African postgraduate students in Financial and Insurance Mathematics to have the opportunity to focus (ostensibly without distraction) on a topical, industry relevant research project, while simultaneously developing links with international students and academics in the field. An allied aim we have is to bring a variety of international researchers to South Africa to give them a glimpse of the dynamic environment that is developing at UCT in the African Institute of Financial Markets & Risk Management. One of the goals of the FMTC is for students to learn to work in diverse teams and to be exposed to a healthy dose of fair competition.

The Second Financial Mathematics Team Challenge was held from the 2nd to the 14th of July 2015. The challenge brought together five teams of Master's and PhD students from Switzerland, South Africa and the United Kingdom to pursue intensive research in Financial Mathematics. Each team worked on a distinct research problem during the twelve days. Professional and academic experts from France, Switzerland, South Africa, and the United Kingdom individually mentored the teams; fostering teamwork and providing guidance. Once again, the students applied themselves with incredible dedication and exemplary vigour.

This year's research included topical projects on *expected shortfall in a multi-currency framework, the accuracy of the Rebonato formula for swap rates and swaption volatilities in single and multi-curve models, linear commodity models with unspanned stochastic volatility, Basel III Tier 2 capital pricing models, and multivariate risk measures for margin computations*. These 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 adjudged to be the best was awarded a floating trophy.

Each team wrote a report containing a critical analysis of their research problem and the results that they obtained. This [volume](#) will be available to future FMTC participants. It may also be of use and inspiration to Master's and PhD students in Financial and Insurance Mathematics.

The Second Financial Mathematics Team Challenge added to the success of the First, and we are already planning its third version.

Post-Doctoral Research Fellows

ACQuFRR/AIFMRM has two full-time, post-doctoral research fellows – Dr Pawel Fiedor and Dr Hylton Hollander.

Dr Fiedor joined AIFMRM/ACQuFRR in July 2015. His Principal Investigator is Dr Co-Pierre Georg. Dr Fiedor's research concentrates on agent-based models of financial and interbank markets, connecting agent-based models with dynamic stochastic general equilibrium models, and analysing the efficiency of the commodity markets. He also collaborates on creating a standard library for agent-based simulations of financial systems. He was a speaker at the 2015 Financial Networks and Theory Conference hosted by the Centre for Risk Studies in September at Cambridge University. He also presented at the Eight Polish Symposium on Econo- and Socio-Physics, organised by the Polish Physical Society in November in Rzeszów, Poland. Finally, he was a presenter at the 2015 IEEE Symposium on Computational Intelligence for Financial Engineering & Economics hosted by the IEEE in December in Cape Town.

Dr Hollander joined AIFMRM/ACQuFRR in June 2015. His Principal Investigator is Dr Co-Pierre Georg. Dr Hollander received his PhD in Dynamic Macroeconomics from Stellenbosch University for a thesis entitled *Financial Frictions and the Business Cycle*. Since June, he has submitted a paper for review to Macroeconomic Dynamics entitled *Forecasting Output Growth using a DSGE-Based Decomposition of the South African Yield Curve* (with R Gupta and M Steinbach), presented at two local conferences, and attended the sought-after CEMFI Summer School in Madrid, Spain. In July and August, he published two ERSA research briefs with Dr Georg and Mr Rose. On 16 October, AIFMRM hosted the International Seminar on Financial Consumer Protection, which was co-organized by Dr Hollander, Ms Ross and Dr Georg. The event was attended by representatives from regulatory authorities of the G20 countries. In continuation of his ongoing PhD research outputs, Dr Hollander will be re-submitting two papers by December 31 at the Journal of Banking and Finance and Economic Modelling. He has recently accepted a permanent position in the Faculty of Economic and Management Sciences at Stellenbosch University.

Research Students

ACQuFRR has six full-time PhD students – Mr Obeid Mahomed, Mr Alex Backwell, Mr Ralph Rudd, Mr Michael Kateregga, Mr Mario Giuricich, and Mr Michael Rose. Mr Lameck Odada completed his Master's research during 2015.

Mr Mahomed was appointed as a full-time lecturer in AIFMRM this January. He also registered as a full-time PhD student, having upgraded his Master's degree in 2014. His thesis is entitled *Alternative Asset Pricing: Information and Calibration*, and he is co-supervised by Associate Profs David Taylor and Thomas McWalter. His research has resulted in three potential research papers: *Information-Based Numeraire Portfolios (IBNPs)*, *IBNP Derivative Pricing and Calibration*, and *Economic Risk Premia and IBNP Asset Pricing Models*. The results from these papers will constitute his thesis. During 2015 he represented ACQuFRR at the following conferences: SAFA Conference 2015 (Cape Town, South Africa), The First Paris-South East Asia Conference in Mathematical Finance (Siem Reap, Cambodia), The Third Annual Prescient Securities/ACQuFRR Quant Conference (Cape Town, South Africa), The Second Annual CEAR-Huebner Summer Risk Institute (Atlanta, USA), HSBC Emerging Markets Conference (Cape Town, South Africa), and the 2015 IRMSA Annual Conference (Johannesburg, South Africa). His PhD is financially supported by ACQuFRR.

Mr Backwell has completed the second year of his PhD. He is supervised by Associate Profs David Taylor, Peter Ouwehand and Adjunct Associate Prof Andrea Macrina. His primary research interest is term structure modelling. In October 2014, he defended his thesis proposal, which outlines more specific term structure themes; including real-world parameter estimation and alternative modelling methodologies. His empirical work relating term structure stochastic volatility was presented at the ACQuFRR seminar series in September. This will be submitted to a journal in early 2016. He presented his developing work on generalised Gaussian models at ERSA's Third Economic Theory Workshop in November. This should result in a further publication. Mr Backwell's other research activities included leading a team at the 2015 Financial Mathematics Team Challenge (FMTC), as well as presenting on interest-rate models and bond portfolio optimisation at the Third Annual Prescient Securities/ACQuFRR Quant Conference. He has also been involved in teaching – both tutoring in the MPhil in Mathematical Finance and lecturing undergraduates in Actuarial Science – and is supervising two minor dissertations. He is financially supported by ACQuFRR, UCT and the NRF.

Mr Rudd graduated from the MPhil in Mathematical Finance in 2013 and commenced his PhD in 2014. He is co-supervised by Adjunct Associate Profs Tom McWalter and Jörg Kienitz (Deloitte, Germany and UCT) and Honorary Prof Eckhard Platen (University of Technology, Sydney (UTS) and UCT). At the Southern African Finance Association Conference in January, Mr Rudd presented his team's work from the first FMTC in 2014 entitled *Commodity Futures Spread Options*. In April, along with Messrs Backwell, Mahomed and Giuricich, Mr Rudd presented *Simulation, Calibration and Risk Management*, specifically with reference to fixed-income markets, at the Third Annual Prescient Securities/ACQuFRR Quant Conference. In July, he again led a team in the second Financial Mathematics Team Challenge under the supervision of Assistant Prof Martin Larsson from ETH Zurich. The resulting work, entitled *Linear Commodity Models with Unspanned Stochastic Volatility*, forms part of the final FMTC report. Mr Rudd spent three months abroad in 2015 working on his doctorate. One month was spent in Germany, working with Profs McWalter and Kienitz. During this time he presented on

his PhD progress at the Universities of Wuppertal and Bonn. He spent a further two months at UTS working with Prof Platen. Mr Rudd lectured the Mathematical Computing Skills pre-course for the MPhil in Mathematical Finance in 2015, and will do so again in 2016. He was involved in tutoring the Numerical Methods in Finance courses, and is currently internally supervising three minor dissertations. He is financially supported by ACQuFRR, BANKSETA and RMB.

Mr Kateregga is jointly supervised by Dr Sure Mataramvura and Associate Prof David Taylor. His PhD is in the field of risk modelling with a specific interest in the financial derivatives market. His thesis is entitled *Generalized Models for Hedging Market Securities*. Mr Kateregga's research has led to two research papers, one has been submitted for review in the Journal of Optimization Theory and Applications under the title *Bismut-Elworthy-Li Formula for Subordinated Brownian motion with Application to Hedging*. His second paper entitled *Hedging Commodity Futures in a Jump Schwartz-Smith Model* is still in progress, and is intended for submission in December, 2015. In June, 2015, Michael had the opportunity to present his research findings at the annual Quantitative Finance and Risk Analysis (QFRA) workshop in Santorini, Greece and at a number of local seminars and workshops including the African Institute for Mathematical Sciences (AIMS) and the University of Cape Town. Michael will be submitting his thesis in November, 2016. He is financially supported by ACQuFRR, AIMS and the NRF.

Mr Giuricich has completed his first year of his PhD. He is supervised by Associate Professor Peter Ouwehand, Professor Krzysztof Burnecki (Wroclaw University of Technology, Poland) and Professor Eckhard Platen (University of Technology Sydney, Australia). His area of research interest lies in insurance-linked securities and specifically catastrophe bonds. In March 2015, he successfully defended his PhD proposal, which outlined an approach to pricing index-linked catastrophe bonds based on a left-truncated loss index. Currently, he is working on weak approximations to insurance-related stochastic processes, and it is envisaged that this will lead to a publication in 2016. Mr. Giuricich's other research activities during 2015 included actively participating in the 2015 Financial Mathematics Team Challenge, as well as presenting on the new interest-rate paradigm (involving counterparty credit risk) at the Third Annual Prescient Securities/ACQuFRR Quant Conference. He has also been extensively involved in teaching – both tutoring on the MPhil in Mathematical Finance and the South African Actuarial Development Programme, the latter being a bursary scheme that academically and financially supports underprivileged students in Actuarial Science at UCT. He is also supervising a minor dissertation. He is currently supported by ACQuFRR, BANKSETA and the NRF.

Mr Rose joined ACQuFRR in April this year. He holds an MSc in Quantitative Economics from Kiel University and visited the Kiel Institute for the World Economy's Advanced Studies Program prior to joining UCT. Under the supervision of Dr Georg, he works on *Peer Effects in Financial Networks*. He has presented his work at UCT's School of Economics, as well as two research conferences: The biannual ESSA conference and ERSA's 3rd Economic Theory program. With Dr Georg and Dr Hollander, he published two research briefs related to the Greek sovereign debt crisis. In 2016, he plans to spend two months at the Dutch Central Bank DNB in Amsterdam as a research intern. Upon his return, he will defend his thesis in March. He is financially supported by ACQuFRR.

Mr Odada completed his dissertation on *The Impact of the Change in Definition of Bank Capital According to Basel III* during 2015. He will graduate in December, and benefited from the ACQFRR space and funding.

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

Visitors

Prof Vikas Agarwal is the H. Talmage Dobbs, Jr. Chair and Professor of Finance at J. Mack Robinson College of Business, Georgia State University (GSU). ACQuFRR has a research cooperation with GSU. Prof Agarwal visited us in January to present the first Colin Firer Memorial Lecture at the Southern African Finance Associations annual conference at the GSB. ACQuFRR co-hosted the conference.

Prof Ajay Subramanian is the Bruce A. Palmer Professor in the Departments of Finance and Risk Management & Insurance at GSU. Prof Subramanian visited us in February as one of the three presenters at the AIMS Summer School in Mathematical Finance. He also gave a seminar in the weekly series at UCT.

Dr Andrea Macrina is the Program Director of the MSc in Financial Mathematics at University College London and an Adjunct Associate Professor in Actuarial Science at UCT. He visits Cape Town at least twice a year, is co-supervising Alex Backwell's PhD, and is the co-organiser of the FMTC. This year he attended both research retreats.

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.

Prof Sascha Steffen is a Professor of Economics at the University of Mannheim and an internationally recognized expert in empirical banking research. He has repeatedly published in the top international finance journals and visited Cape Town from 15 to 29 March to work with Dr Co-Pierre Georg on a joint research project with Prof Viral Acharya from NYU on "Wholesale Funding and Liquidity Risk". The paper uses proprietary data on all US money market funds to show the existence of a novel externality arising from the similarity of wholesale investors. This externality gives rise to a new channel of liquidity risk.

Prof Falko Fecht holds the DZ Bank Chair in Financial Economics at the Frankfurt School of Management and Finance. He has published widely on empirical and theoretical microeconomics of banking. He visited Cape Town from 05 to 26 November to work with Dr Co-Pierre Georg on a joint project with Christian Bittner and Patrick Weber (both at Deutsche Bundesbank) on "Allocative Efficiency". In this project, the authors study the distortionary effects of excessive central bank liquidity provision.

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, Dr Jörg Kienitz and Dr Andrea Macrina are all Adjunct Associate Profs in Actuarial Science, and carry the title of Associate Prof while they are working at UCT. Prof Eckhard Platen and Prof Peter Ritchken are Honorary Professors.

Research Funding

Some of our students and members were very successful in attracting funding this year:

Beneficiary	Source	Value
ACQuFRR	AIFMRM Annual Funding	R400,000
ACQuFRR	RMB Donor Funding	R 50,000
ACQuFRR	NWU-DST-ABSA Directed Risk Research	R115,000
Kanshu Rajaratnam	NRF Unrated Researcher Award	R561,000
Phillip de Jager	British Academy Newton Grant	GBP10,000
Chun-Sung Huang	Thuthuka PhD track	R146,000
Alex Backwell	NRF Scarce Skills Scholarship	R100,000
Mario Giuricich	NRF Scarce Skills Scholarship	R100,000
	BANKSETA	R 50,000
Ralph Rudd	RMB	R120,000
	BANKSETA	R 50,000
Co-Pierre Georg	Volkswagen Foundation (Joint)	EUR110,000
	Institut Louis Bachelier (Joint)	EUR10,000

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 in AIFMRM, 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.



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