



Institute
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of Actuaries

A celebration of the ARC

Chaired by Colin Wilson

President-elect of the Institute
and Faculty of Actuaries





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An Overview of the Actuarial Research Centre



Andrew Cairns
ARC Director



About the ARC

- Established in 2012
- Significant contribution from the Faculty of Actuaries Endowment Fund



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Objectives (Faculty Endowment Perspective!)

- To enhance Scotland's position as a world class centre for applicable actuarial research
- To support the training of PhD students – tomorrow's research specialists
- To use Endowment funds to leverage funds from elsewhere
- Knowledge exchange in Scotland, UK and worldwide
- Not part of IFoA business as usual
- To create a lasting legacy for the Scottish community



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PhD students

- Seven students starting in 2012, 2013, 2014, 2015
- From: UK, Netherlands, China, Bulgaria, Malaysia, Italy
- Backgrounds: Actuarial; Statistics; Applied Maths
- Full-time study in Scotland (Heriot-Watt University)
- Projects
 - Liquidity risk in corporate bonds
 - Banking liquidity risk
 - Mortality and longevity
 - Pensions
 - Risk model validation and solvency



Measures of Success and Benefits

- A new and successful venture for the IFoA
- Regular flow of high quality, international PhD applicants
- Enabled a strong working relationship to be built up between Heriot-Watt University and the IFoA research support team
- Endowment fund contribution more than 50% matched by other funds from
 - IFoA central funds
 - **Hymans Robertson**
 - **Partnership Insurance**
 - Heriot-Watt University



Measures of Success and Benefits

- All outputs are Open Access
- A best paper prize at the International Congress of Actuaries
- Offers businesses the opportunity to tackle medium-term business problems in collaboration with leading, outward looking academics and PhD students
- Offers the chance to step back and develop the thinking behind longer-term actuarial problems



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Measures of Success and Benefits

- **Growing** programme of talks and conference presentations
 - Local IFoA events such as KSS
 - IFoA Sessional Research meetings
 - National IFoA conferences (Investment, Longevity, etc.)
 - International conferences (ICA 2014, IAA-AFIR)
 - More academic conferences (ATRC, PARTY)
 - In-house CPD seminars (Moody's, Partnership, ...)
- Potential for impact
 - Illiquidity premia; illiquid corporate bond investment strategies
 - CMI tables and projections
 - Proxy functions in internal models



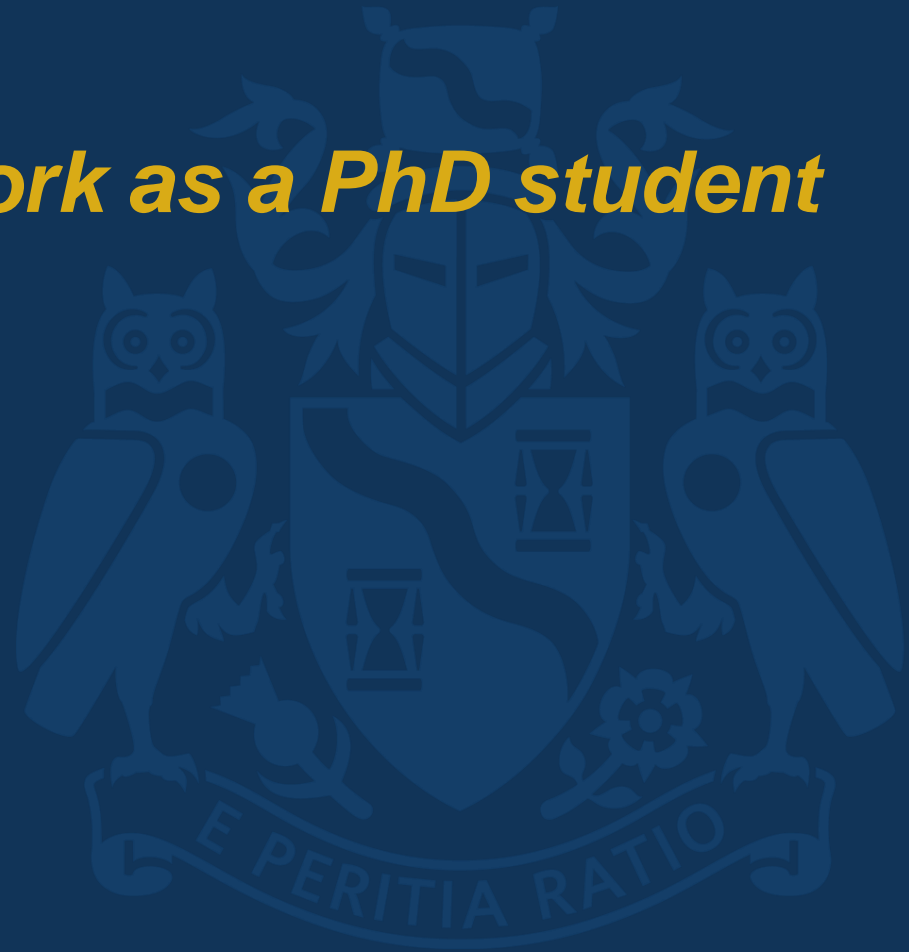


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A celebration of the Actuarial Research Centre: *A brief account of my work as a PhD student*



Paul van Loon
ARC PhD student





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My ARC project

Started in November 2012

Supervision:

Andrew Cairns, Alexander McNeil & Alex Veys

Initial Focus:

data driven methods for establishing liquidity
premiums on corporate bonds

Support from IFoA to present and discuss my work at
many events

Overview

Liquidity Premia on Corporate Bonds

Quantitative Factor Investing in Corporate Bonds

Many smaller projects and on-going work



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Liquidity Premium on Corporate Bonds

- The work is an attempt to extract liquidity premia on the single issue level, with high frequency (daily), using readily available information about bonds.
- Winner best paper award at the International Congress of Actuaries 2014, Washington
- Published in Annals of Actuarial Science, September 2015
- Presented work at ICA (2014), Risk & Investment IFoA conference (2014), CISI bond group (2014), IFoA sessional research event (2014)



Liquidity Premium on Corporate Bonds:

Paper in a nutshell

- What is a Liquidity Premium?
- Illiquidity Premium of Liquidity Premium?
- Why do we care about Liquidity Premium Estimates?
- What is the liquidity of financial instruments / markets?
 - Theory & empirical proxies
 - Recently: Bank inventories? Regulation? Liquidity?
- Previous modelling efforts:
 - Structural models (→ Bank of England)
 - CDS-based approach, model-free
 - Statistical models



Liquidity Premium on Corporate Bonds:

Paper in a nutshell (ii)

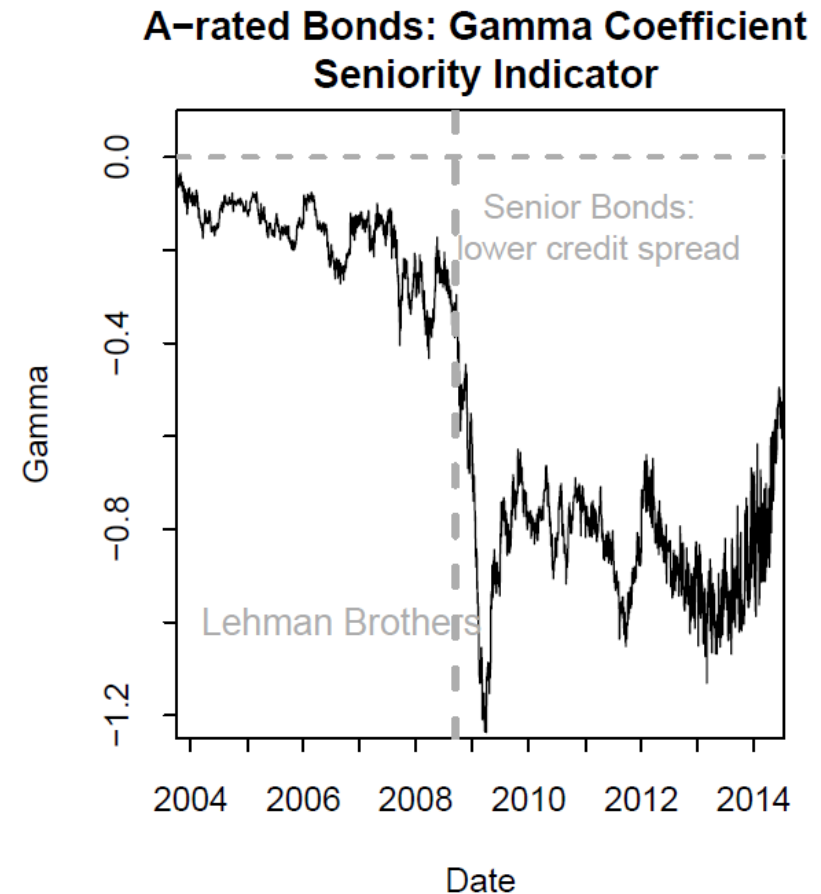
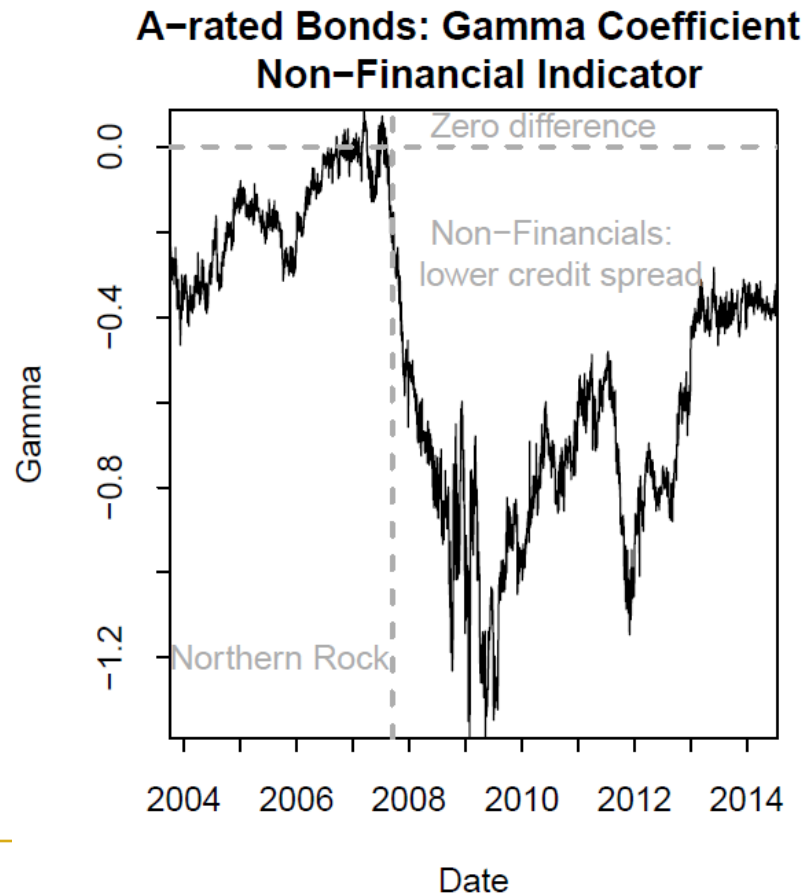
- Extensive, yet accessible Markit Iboxx IG GBP dataset
 - Daily data for ~1500 bonds, from 2003 - now
- Two stage statistical modelling using just linear regression:
 - Derive a relative liquidity proxy, related to the bid-ask spread
 - Model credit spread as a function of bond characteristics, including RBAS
 - Derive liquidity premium estimate
- We fit daily cross-sectional regression models, no explicit time component
- Stitching the estimated coefficients together, we get an interesting and intuitive picture of model dynamics



Liquidity Premium on Corporate Bonds:

Paper in a nutshell (iii)

- Ultimately, we have an estimate of Liquidity Premium for each bond, on each day, based on a model which is both robust and intuitive. An example of model dynamics;



Liquidity Premium on Corporate Bonds:

Paper in a nutshell (iv)

- What is so useful?
 - Frequent estimates
 - Daily distributions of premia, rather than market-wide (point) estimates
 - Robust extrapolation; in the regression, RBAS is, by definition, uncorrelated to other covariates, which allows the perfectly liquid equivalent to be estimated
 - Only readily available, bond-only, information is used, but can be extended if needed



Liquidity Premium on Corporate Bonds:

Current work

- Exploring the extent to which structural models can be used in a similar way
- Complex, subjective, parameterisation in a 'model of the firm' to arrive at a fair credit spread
- Liquidity Premium simplified to be the difference between observed spread and fair spread (model estimate)
- 'Re-creating' the Bank of England's implementation of the Leland & Toft model
 - Update estimates on the Markit Iboxx dataset
 - Sensitivity analysis
 - Extend to bond level analysis



Liquidity Premium on Corporate Bonds:

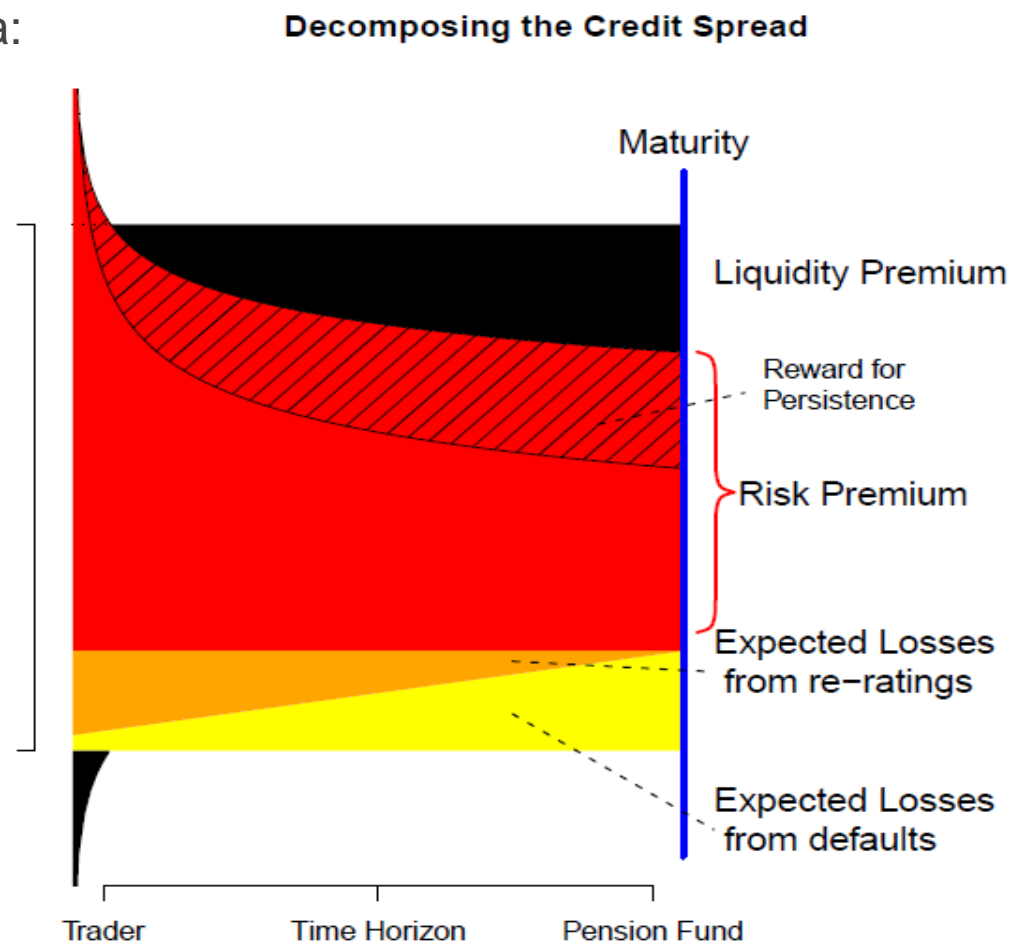
Future work?

- Holding period effect and Liquidity Premia:

- What is the expected value of the liquidity premium?
- Considers turnover of a portfolio
- Considers stochastic evolution of premium estimates
- Considers premium accrual over time

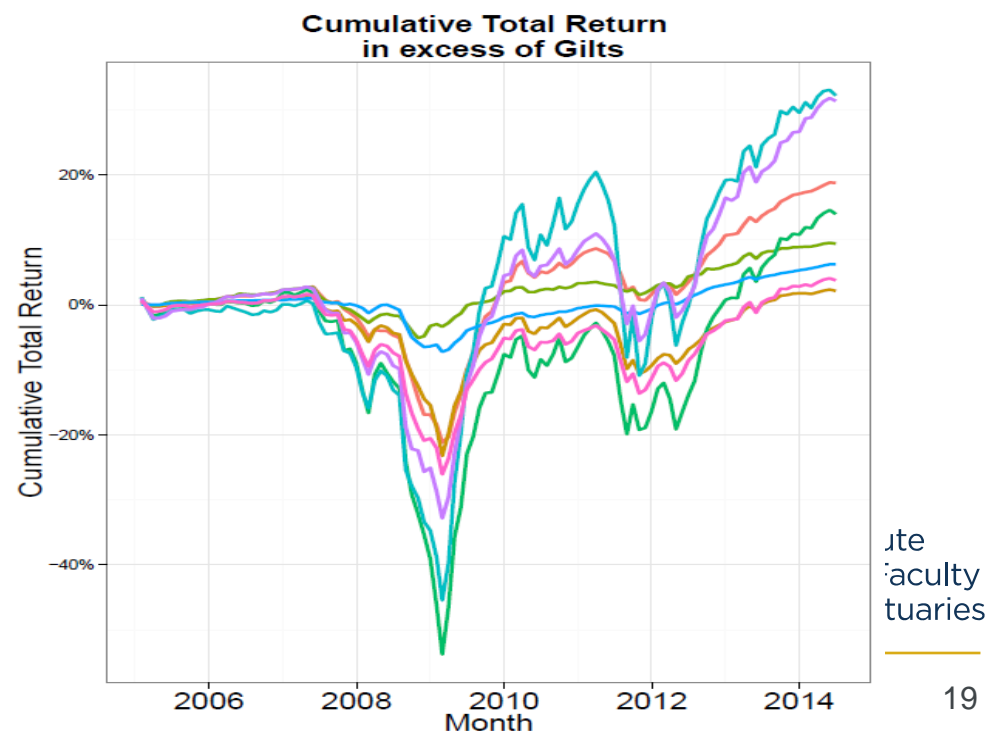
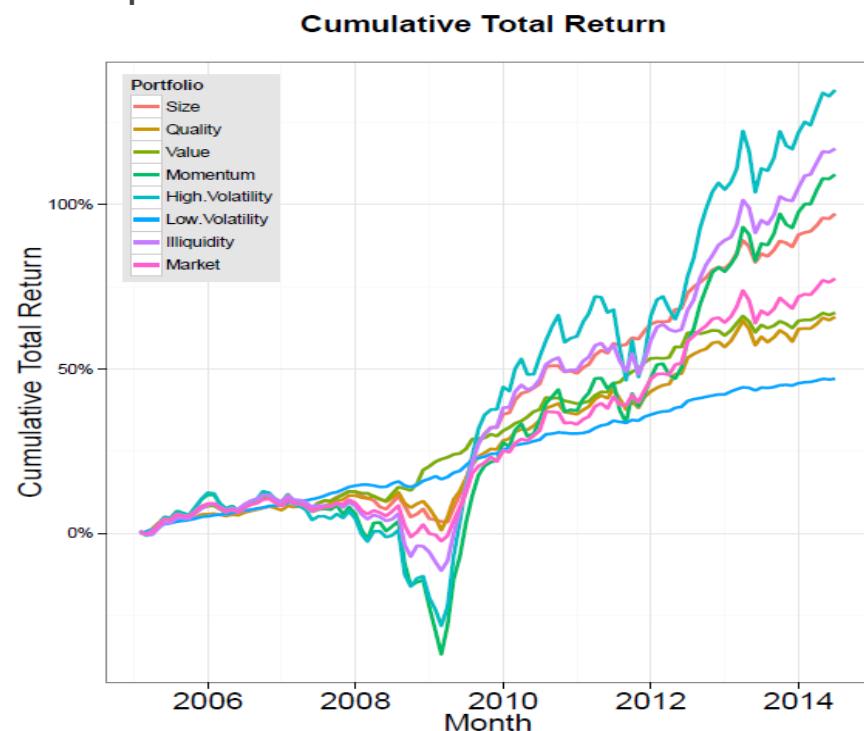
- Explicitly model a liquidity term structure

- Not imposing a functional form



Quantitative Factor Investing in Corporate Bonds

- Investigate whether we can define factor portfolios, common in equity markets, using bond-only information, that have attractive features
- Presented as work in progress at the Actuarial Teachers and Researchers Conference (2015)
- Paper in submission



Many smaller projects

- Currently finishing a paper that look at stochastic credit models and model risks embedded in rating migration matrices
- Most of my time spent, did not make this very short presentation
- Most of my time spent, did not 'amount to anything'
- An opportunity and obligation to explore subjects (only loosely) related to the outlined PhD project





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Funding Liquidity Risk

Supervisors: Karen Brolly, Prof Andrew Cairns,
Prof Alex McNeil and Garry Smith

Sponsors: Hymans Robertson and ARC



Iain Ritchie
ARC PhD student

Motivation



FSA

BASEL III



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Funding Liquidity Risk



Deposits



Loans



Wholesale
funding

3	9.65%	248.36	4.58	65.36	74.36	745.3	0.30%	230
9	2.36%	388.24	6.36	44.55	89.33	81.4	4.25%	7
		545.32	5.36	76.76	7.35	88.9	2.38%	
	1.20%	282.80	2.17	83.88	80.25	132.10	1.20%	
	9.33%	256.36	2.78	56.39	74.36	745.3	0.30%	230
	6.35%	375.69	9.56	24.35	45.23	82.5	6.35%	
	4.25%	248.36	4.58	65.36	74.36	745.3	0.30%	230
	5.36%	896.33	3.54	32.23	5.33	3.35	5.36%	
	8.35%	896.33	7.63	44.45	2.55	6.35	8.35%	
	2.56%	323.24	2.33	42.36	56.35	234.6	2.56%	
	1.23%	236.58	6.35	78.96	24.36	96.3	1.23%	
	6.35%	596.33	7.98	33.33	72.65	44	6.35%	



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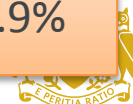
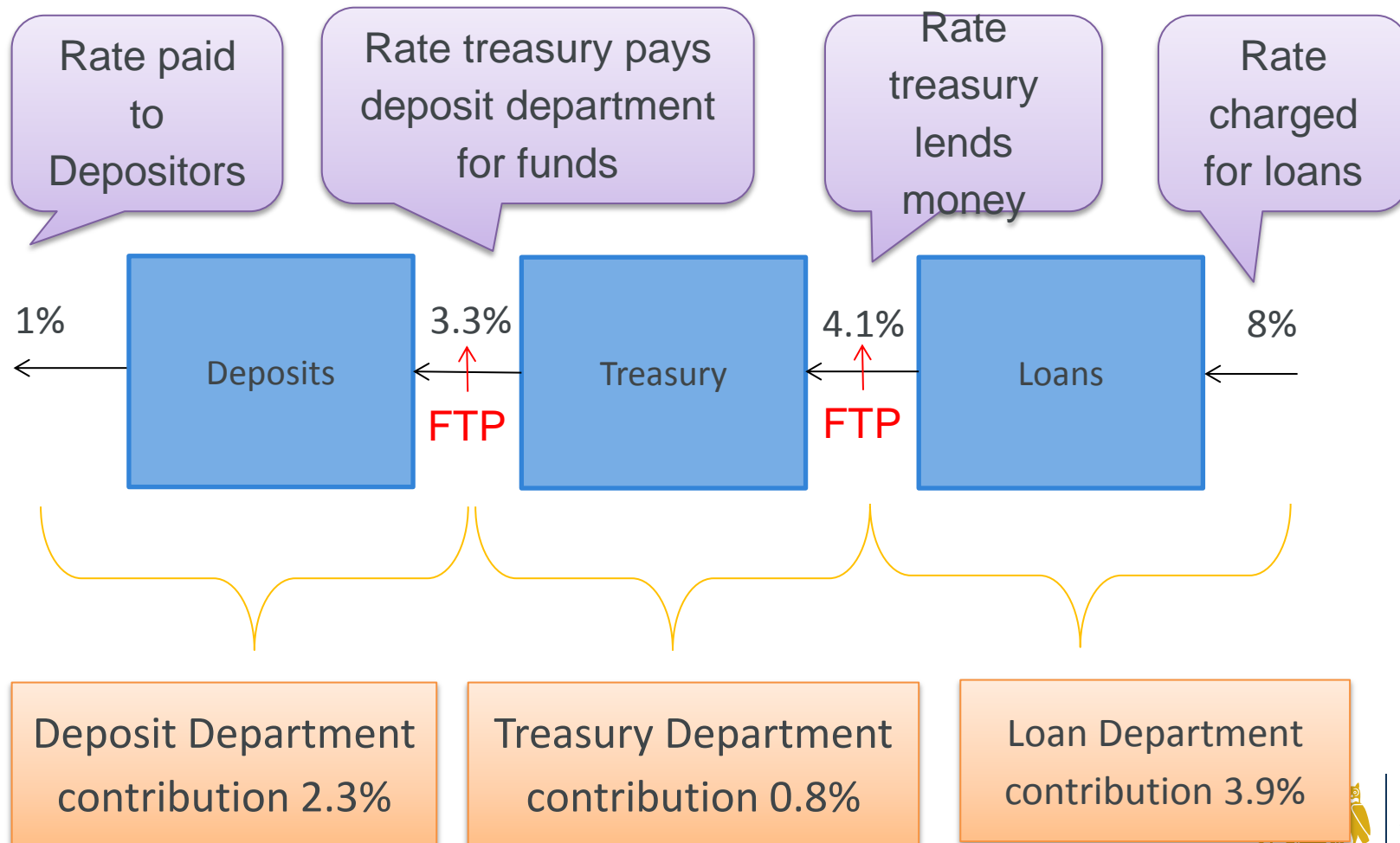
Fund Transfer Pricing (FTP)

Objectives

- Motivate profitable decisions in line with the bank's goals
- Allocate profits between different business units
- Transfer interest rate risk and funding liquidity risk to a separate centralised department
- Allow the business units to work independently from each other



FTP



FTP and Funding Liquidity Risk

Holistic Approach v Individual Business units

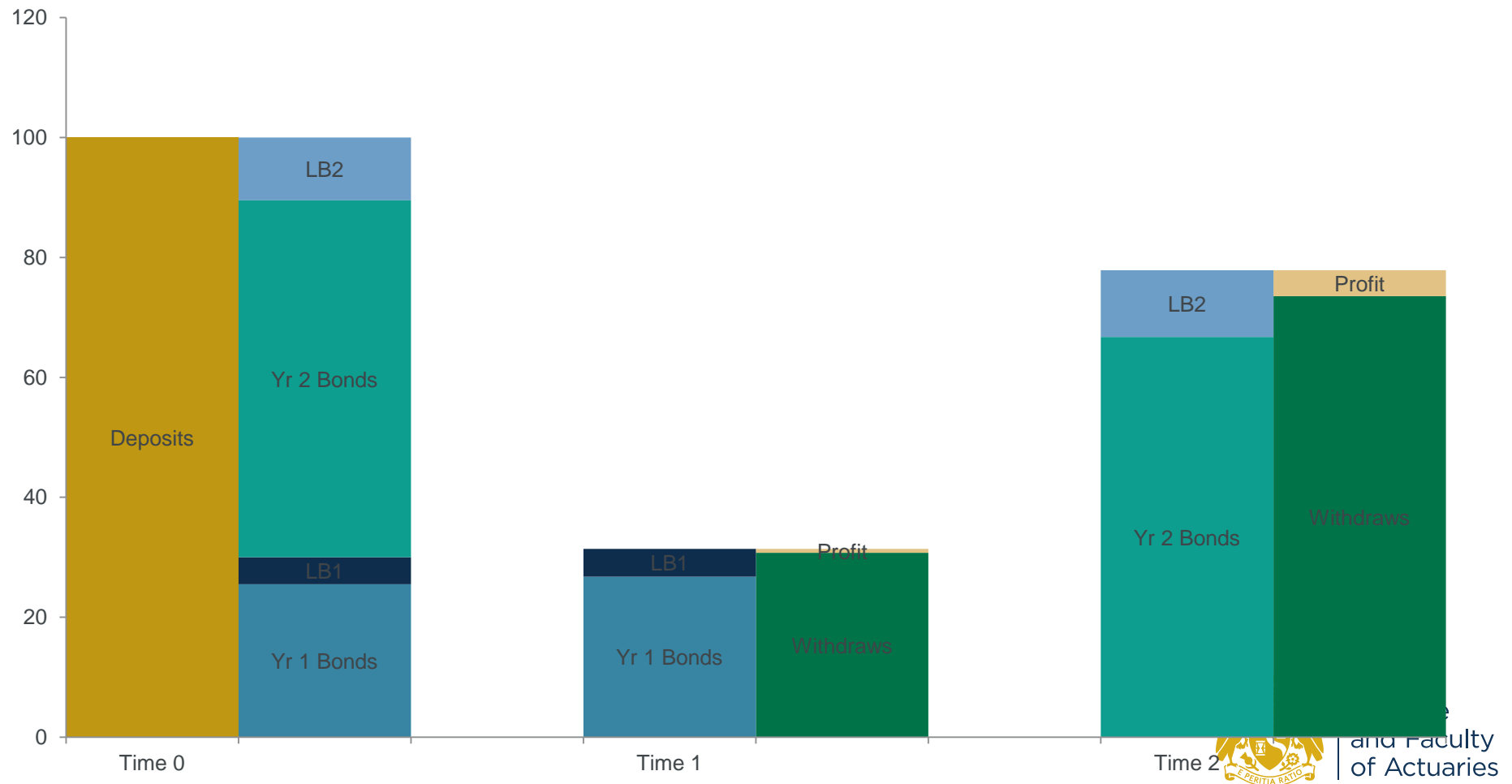
- In simple situations the holistic approach can produce similar results to the individual business using the FTP system
- FTP rates need to be set appropriately

Multi-Period

- FTP can adapted to multi-period settings
- It is not perfect but does produce reasonable results and allows business units to operate at arms length

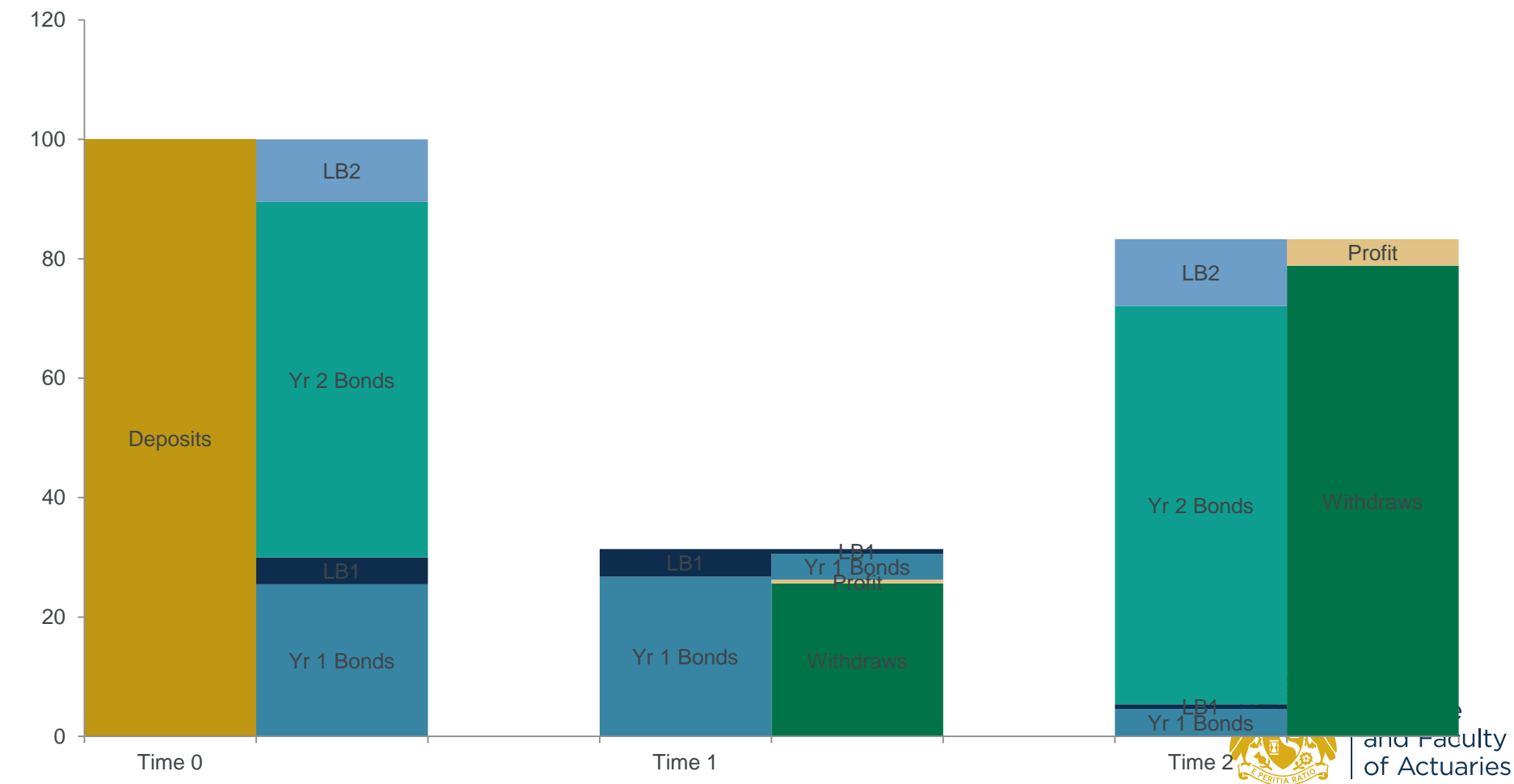
Multi-period Cashflows

Expected Cashflows



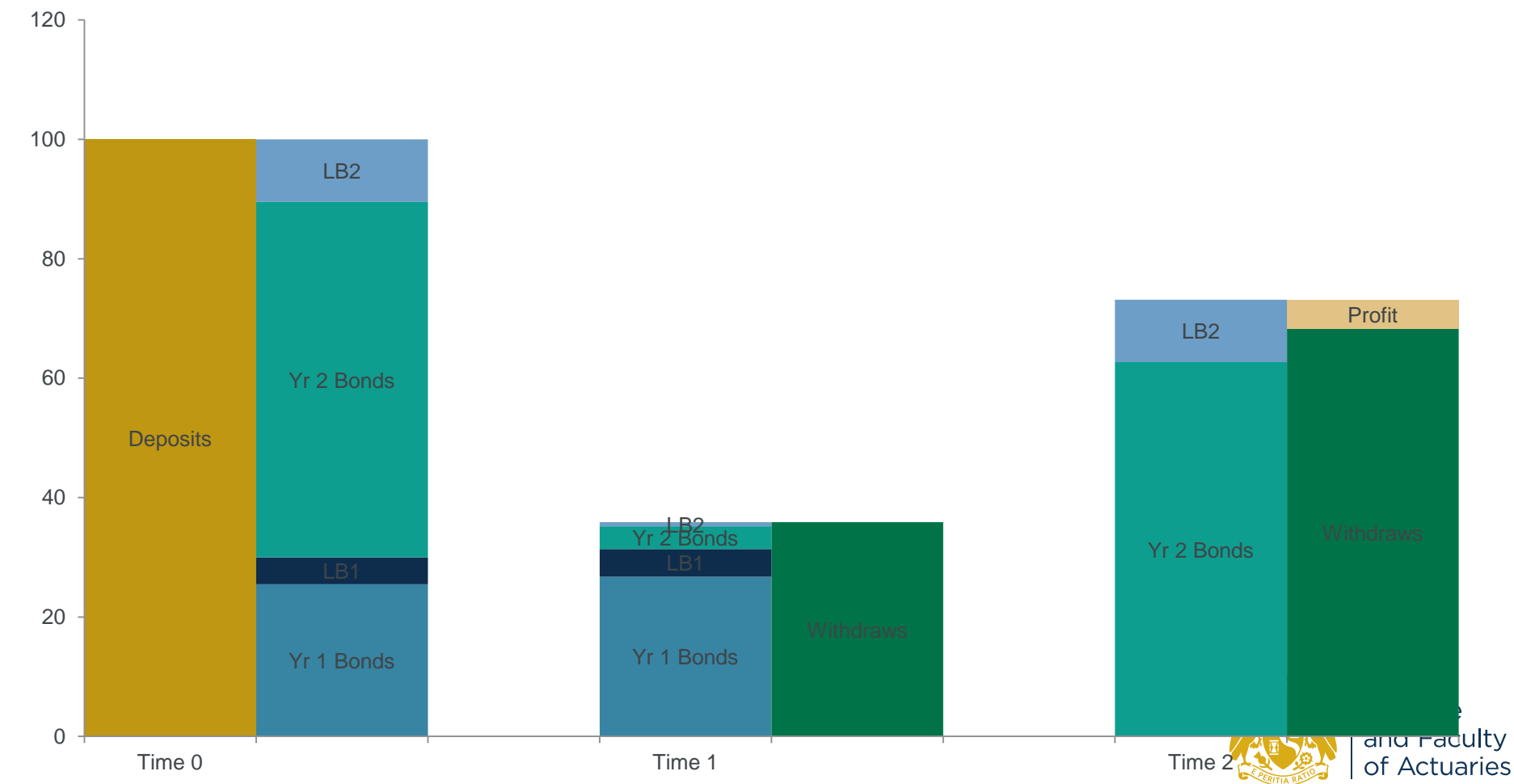
Multi-period Cashflows

Expected Cashflows



Multi-period Cashflows

Expected Cashflows



Conclusion

- Funding Liquidity Risk is important risk for the bank
- It can be included within FTP framework
- Can be used to maximise the bank's profits in a simple situation
- Multi-period situation FTP will produce reasonable results
- Can be used to help the bank to understand funding liquidity risk and ensure it is appropriately priced within their products





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Actuarial Research Centre: Expanding to an international network



Mark Cross

Chair, Research and Thought
Leadership Committee

About the IFoA's Research and Thought Leadership Committee (RTLCL)

- IFoA's Royal Charter "...to advance all matters relevant to actuarial science"
- IFoA's Council established RTLCL in 2013 to ensure that gaps in research are addressed by the Profession
- Oversees coverage, dissemination, quality and funding of research and thought leadership activity
- Reports direct to Council, representation from all the Practice Boards and the IFoA's two journals (BAJ/AAS)
- Council took decision to bringing in external expertise to RTLCL through appointment of Lay Chair



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Introduction

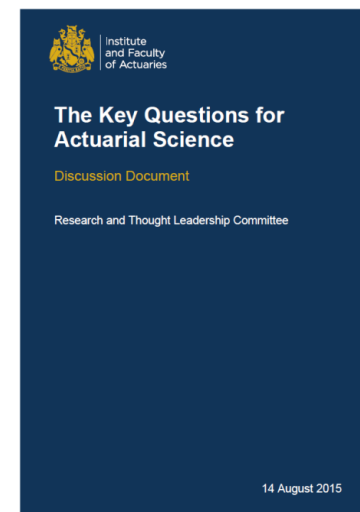
- Traditionally, research in actuarial science at the IFoA has been delivered by practising actuaries, as volunteers in working parties
- The IFoA also has a history of commissioning smaller, shorter term research projects, sometimes in partnership with others
- However, there are some big questions to be formulated and addressed
- Volunteers alone not adequate as a resource to address such questions



RTLRC recent activity

Complementing working party model . . .

- Consulted community about the major challenges to profession
- Led to **Key Questions** document*
- Two key issues:
 - People ageing
 - Financial health



with a broader theme of understanding future risk and complex uncertainty underpinning the whole picture.



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* <http://www.actuaries.org.uk/documents/rtlc-key-questions-document-august-2015>

Key questions – key themes

- What is optimal risk bearing?
- What are the actuarial consequences of changes in how people age?

Issues involved in estimating mortality/longevity and morbidity leading to questions on:

- Care costs
- Pensions and retirement
- Health and life insurance
- How do we manage investment strategies in a changing environment?



Call for research programme proposals

- Looking for 4-5 major multi-themed collaborative projects to deliver on challenges
- 4-5 years length and each around £1m in cost
- Delivered by a multi-skilled profession and academic team
- Results in the open – available, any software open source and databases open access
- **Key feature** – profession & academia bound together
- RTALC published the Call in August*



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* <http://www.actuaries.org.uk/learn-and-develop/research-and-knowledge/calls-research/closed-calls/2015-call-research-proposals>

Response to Call

- 25 proposals from over 20 Countries, involving over 100 institutions, including around 60 universities. £17m+ funds requested.
- Hugely oversubscribed!
- Carefully reviewed against two key criteria:
 - academically and technically sound
 - priority for the Profession
- Shortlisted set voted by actuarial members of RTALC to prioritise against community needs!
- In negotiation with shortlisted set to revise proposals to deliver what RTALC needs!
- Final selection stage now – expect to select 3 / 4 projects in December



How to deliver this programme?

- Actuarial research community distributed across a number of universities and countries
- IFoA has 17 accredited universities to teach approved programmes
- Many actuarial activities in universities are small scale and isolated – any PhD students are often on their own!
- To support international interaction and collaboration need an effective network of academics and researchers more broadly
- How to do?



Extending the Actuarial Research Centre

- ARC formed in HWU 5 years ago by IFoA's Scottish Board
- Foundation funding for a research programme and training the next generation of researchers in actuarial science
- Plan is to extend the ARC to cover all universities who are accredited to teach IFoA approved courses to underwrite actuarial training, and:
 - use as basis of an international research network
 - basis of an informal **doctoral training centre**
 - a community of researchers to mutually support and interact
 - working with sister organisations, for example, the N American actuarial associations
- All our major research programmes will be run through “E-ARC”



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Where are we now?

- ARC Director and Associate Directors to be recruited from IFoA-accredited universities
- Setting up support arrangements
- Finalising the selection of programmes to be funded in this round
- Clearly a huge demand – also clearly substantial challenges to be addressed
- We need to consider the ways forward here – not least how to fund the whole operation as it develops



Expanded ARC

- A **Director** to provide leadership
- 2/3 **Assoc Directors** to cover international regions
- Supported from Edinburgh office of IFoA
- Develop a community of researchers to collaborate with industry and do the research that's needed
- **Key role** – a framework to coordinate all major IFoA funded research programmes
- A quality assurance role for sponsored projects and programmes on behalf of IFoA



Questions

Comments



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