

TheActuary™

The magazine of the Institute and Faculty of Actuaries

ODD NUMBER

Probably the most eccentric mathematician in history:

Paul Erdős

INTERVIEW

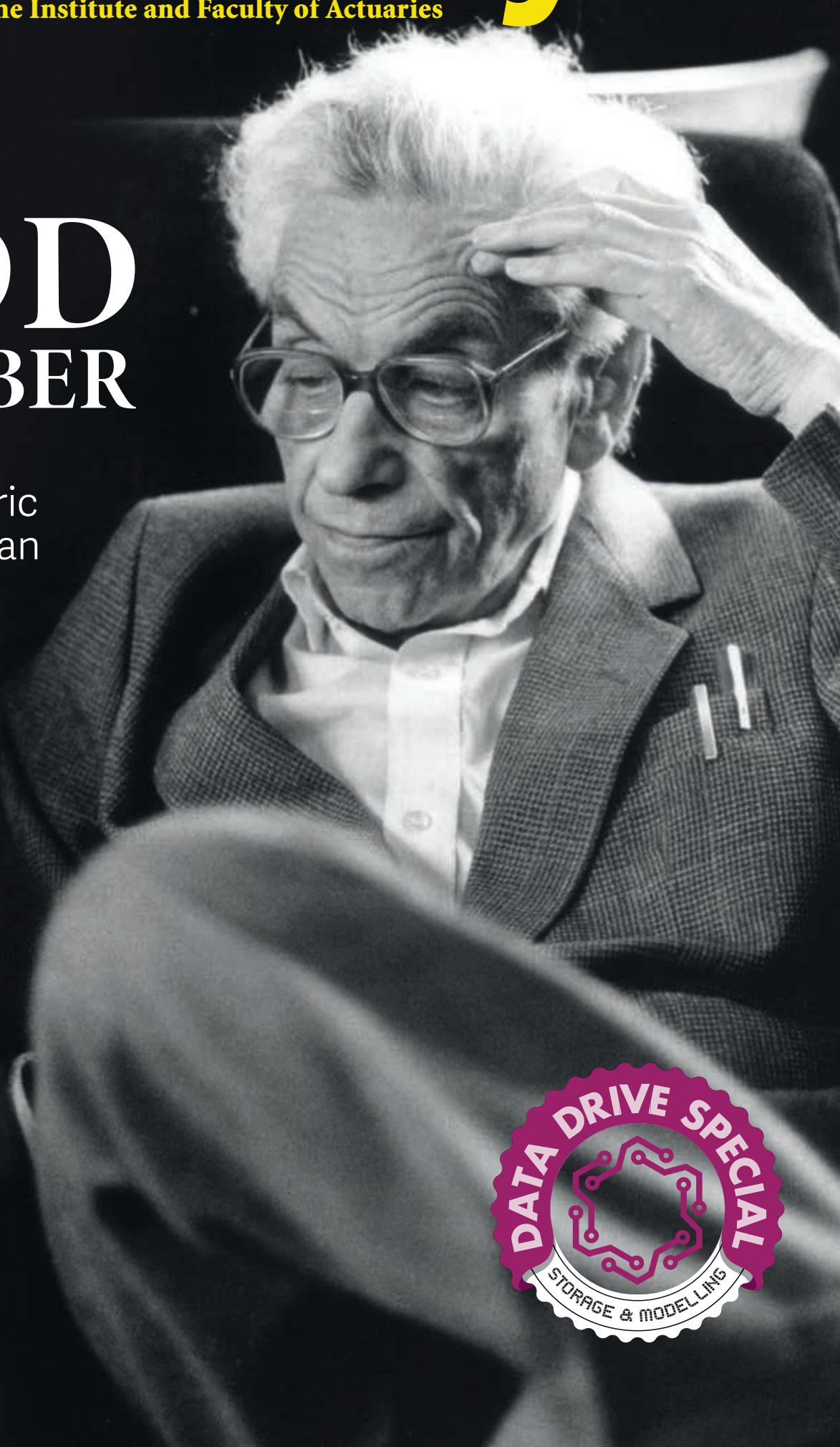
Banking's worst enemy/best friend
Anat Admati

HEALTH

Why the NHS needs more actuaries, as well as doctors

ECONOMICS

Universal Basic Income. Is it really workable?



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TheActuary Contents



A

Up Front

12

4 Editorial

This issue focuses on progress and a drive for change, says Yiannis Parizas

5 President comment

New president Kalpana Shah calls for actuaries to be courageous and raise our profession's voice

6 IFoA news

The latest IFoA updates and events

10 News focus: Grey matter

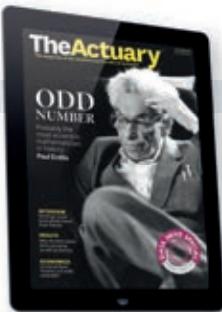
On the RAAC concrete scandal

B

Features

12 Interview: Anat Admati

The outspoken Stanford economist and author on her role debunking the badly behaving banks



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16 Health: Doctoring the approach

Why a modern NHS needs more actuaries – David McDwyer explains

19 Economics:

All for one and one for all

Universal Basic Income. Is it workable, asks Pedro Medford?

22 Reinsurance: Structural support

Tanya Sethi's step-by-step guide to having a better reinsurance back-up

24 Health: Age old questions

Social care approaches vary between countries; we compare six of them

26 Maths: How do you solve a problem like Erdős?

Andrew Treglown salutes legendary mathematician Paul Erdős

28 Data drive: Datasets and match

What are SQL and NoSQL, and why do actuaries need to know? Yiannis Parizas and Phanis Ioannou explain

30 Data drive: The credible journey

Juan Ignacio de Oyarbide and Federico Chiacchiarini apply credibility theory to pricing

33 Data drive: Cloud cover

Is the cloud the host with the most? Aristides Zenenos on data storage

36 Data drive: Planting the seeds

Jack Harrington tackles the issue of reproducibility in neural networks



C

At the Back

41 Extra-curricular

Young actuary Namir Chowdhury's passion for campaigning

42 Soft skills: The valley of fear

Risk management for life – how you can boost your resilience

44 Puzzles

45 People and society news

News from the actuarial community

46 Student

Newly qualified Ciara Izuchukwu reflects on her journey to Fellow

Must-read

Climate risk paper

Find the IFoA's major new research *The Emperor's New Climate Scenarios*, published with Exeter University, at bit.ly/Emperors_climate_scenarios

+ See additional content, including actuarial news, at www.theactuary.com

+ Sign up for our weekly email newsletter at bit.ly/1MN3bXK



**Upfront
Welcome**

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2021
MEMBERSHIP
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WINNER
Best Website



The Association
Excellence
Awards 2021

Gold

Best Association Magazine > 25,000



The Association
Excellence
Awards 2022

Silver

Best Association Digital Transformation



On the edge

In this month's issue, we explore the multifaceted world of data science and its transformative influence on our industry. While this area of actuarial work won't necessarily apply to you in your job (our field is vast and varied, after all), it affects us all, ultimately. Technological advances change the profession, our lives, the world.

Our special 'Data drive' themed section comprises four features. On page 28, I team up with Phanis Ioannou to compare database options for insurers: the traditional SQL (structured query language) and the trendier NoSQL (not-only structured query language). On page 33, Aristides Zenonos sticks his head in the cloud to outline the benefits of off-premises IT hosting for a data-heavy organisation. In the arena of modelling, Jack Harrington (*p36*) tackles the issue of reproducibility in using cutting-edge neural networks, and Juan Oyarbide and Federico Chiacchiarini explain how to better implement geographical factors in pricing (*p30*). Plenty of 'tech-spertise'.

We always talk in terms of IT 'solutions'. One person who needed no technology whatsoever to solve complex problems – just his brain and a notebook, not even a fixed abode – was Hungarian mathematician Paul Erdős, our cover star (*p26*). He broke the mould in many ways and his insatiable curiosity and drive are inspirational, still, to this day.

Another incredibly driven person, banging the drum for change, is US-based academic Anat Admati. We talk to her (*p12*) about her ballsy debunking of the global banking sector, ahead of the publication of a new edition of her seminal book on the subject.

Without drive – to change, to improve – we wouldn't have innovation. And without innovation, where would we be?

Y Parizas

YIANNIS PARIZAS

EDITOR

editor@theactuary.com



Upfront

KALPANA SHAH

It takes courage

As I begin my term as the IFoA's president, I am humbled by the trust and confidence that Council and our members have placed in me. I am proud to be a part of this organisation, which was the first to serve as the voice of the actuary.

The IFoA has a rich heritage and, this year, we celebrate our 175th anniversary. While we first formed in the UK, we have grown to become a truly global professional body, with more of our membership now based outside the UK. As we consider the opportunities that this presents for our members, we recognise that the wider organisation must continue to adapt to ensure its long-term health and vitality.

As I shared in my presidential address at the AGM in September, my focus during my term will be to help the IFoA become an easier organisation with which to do business, help it embark on a cultural transformation, and help to raise the profile of both actuaries and the institute to make it one that members are proud to join and don't want to leave.

I am keen to improve the IFoA member experience and to promote a more accurate and nuanced understanding of the profession – one that represents the modern actuary's breadth and diversity by refreshing our ways of engaging with and listening to each other. I am looking forward to meeting as many of you as possible over my presidential term to contribute towards



'I want to help the IFoA become easier to do business with, help it embark on a cultural transformation, and help to raise the profile of both actuaries and the IFoA'

achieving this. My commitment is to ensure that our stakeholders experience informed, transparent decision-making and enhanced governance.

I know these aims will require courage in me, and I likewise encourage it in all of you: the courage to go out of your comfort zone, to have a voice and express your opinion, the courage to listen and the courage to make yourself heard.

I look forward to meeting many of you and serving the IFoA this year.



KALPANA SHAH
is the president
of the Institute
and Faculty of
Actuaries

DIVERSITY

Expert speakers attend first DEI Employer Network session

The IFoA Diversity, Equity and Inclusion (DEI) Employer Network launched in June with its first roundtable event. It brought together 16 employers to share knowledge and best practice. It marked a milestone in our journey towards creating a more inclusive and diverse profession in which individuals can thrive and contribute their perspectives, regardless of background.

Tamar Hughes, group head of talent development and inclusion at Phoenix Group, highlighted the importance of creating a fair environment for individuals from lower socio-economic backgrounds. Aon's Phil Sartain, early careers leader, and Amaka Achike, work insights programme manager, discussed strategies for attracting, developing and retaining diverse talent through early-careers programmes. And Simon Reichwald, chief progression officer at Connectr, explored technology's role in tracking impact and progress.

One attendee, Ruth Hollick, talent and acquisition lead at L&G, called it "an insightful session with excellent speakers and well thought-out content".

> If you are an employer and would like to take part in future, email richard.scott@actuaries.org.uk

QUALIFICATIONS

New online exams roll-out

We are pleased to announce that we are on target to introduce a new online exam system and begin the delivery of some online objective-based assessments (OBAs) for our April exam session.

We have made good progress implementing identified improvements and continue to refine the system following feedback from candidates who tested it in June. After a final test later this month, we will formally confirm in November that we are ready to deliver our April 2024 exams on the new system while continuing to deliver a high standard exam experience.

We are publishing a range of resources for candidates over the coming months, to support their preparations for this change; we are also publishing resources to help candidates prepare for OBA format exams for our CB1 and CB2 subjects.

> Find out more: bit.ly/OBA_exam_update

MP MENTION

Jerome Mayhew, MP for Broadland in Norfolk, cited the IFoA's Great Risk Transfer campaign on 6 September, in a parliamentary debate on financial education in schools. Great Risk Transfer report: bit.ly/GRT_Recs

FOUNDATION

New scholarship Actuaries of Tomorrow

The IFoA Foundation and the Worshipful Company of Actuaries (WCA) Charity have joined forces to offer a new scholarship.

Actuaries of Tomorrow – the fourth scholarship created by the IFoA Foundation – is worth £3,000 per year and will support recipients from their second year until the end of their degree. It is available to two students per year on IFoA-accredited courses at UK universities.

Applications were received from across the UK. Actuaries Masimba Zata, Simon Dudley and Lyndon Jones assessed them on academic achievement, commitment to the profession and financial need. Candidates also had to submit a tutor's recommendation and a short personal video. The 2023 winners are Jenna Kane and Tegan Banks, both at Heriot-Watt University.

Jenna said: "The scholarship will help me to succeed in my studies while immersing myself in all aspects of university life."



Tegan said:
"The support means a lot to me as I continue to pursue

my academic goals in actuarial science – thank you for believing in my potential!"

The IFoA Foundation and the WCA Charity look forward to deepening their collaboration and following the progress of these promising future actuaries.



The IFoA Foundation is fundraising to increase access to online group mentoring for graduates (170 graduates applied for places on our 2022 programme). Research shows that mentoring helps aspiring actuaries grow in confidence, build networks, get jobs, navigate the workplace, balance work and study, and qualify. The more money we can raise by the end of October, the more graduates we can support.

> To find out more and to donate, visit bit.ly/IFoA_Found_donate



IN BRIEF...

Education volunteers wanted

We're looking for volunteers to join the Management Board sub-committee responsible for education and lifelong learning. It's not to design individual courses but to help shape our learning offer and provide strategic oversight of our qualifications. The role will involve around four meetings per year.

> **For details and to apply, visit bit.ly/IFoA_get_involved. For queries, email voluteervacancies@actuaries.org.uk**

Join the IFoA 400 Club

Want to belong to the 400 Club? Volunteer members of this IFoA online feedback group complete around six surveys each year on a range of topics – from mentoring to skills requirements. The responses are a valuable source of information for the IFoA. It's open to all members to join, and all views are personal and confidential.

> **If you're interested, email engagement.team@actuaries.org.uk**

Practising Certificate: consultation

The IFoA is consulting on proposals to remove the requirement for reviewing actuaries of a life firm to hold a Practising Certificate (PC). The consultation, which closes on 17 November, includes corresponding revisions to Actuarial Profession Standard L1, the PC Scheme and the PC Handbook.

> **It's outlined at bit.ly/Revised_APS1**

Election results

The results of the recent IFoA Council election were announced at our AGM on 6 September. There were elections in both the General and Scottish constituencies. Those elected were: **General** – Nico Aspinall, Cherry Chan, Matthew Edwards, Richard Galbraith, Janet Moss, Mukami Njeru, Katie Sokolowski, Peter Tompkins; **Scottish** – Simon Jones, Melanie Puri, Alan Rae, Sandy Trust.

> **Find the full results at bit.ly/Council_elections23**

Life-long learning

The latest issue of the Longevity Bulletin focuses on machine learning. Bulletin editor **Matthew Edwards** looks at its potential benefits for mortality modelling

What is machine learning, as opposed to artificial intelligence?

There's considerable confusion about the various terms, even more so now that we also have 'generative AI'. For the purposes of this issue of the *Longevity Bulletin*, we took a fairly narrow view of machine learning (ML) to mean very iterative techniques applied to large numerical (including categorical) datasets, whereby the 'machine' gradually 'learns' what underlying patterns are present in the modelled data. Artificial intelligence (AI) is much broader, generally used to mean techniques that allow machines to emulate human intelligence across a wide range of applications (such as image analysis).

ML models have been widely used for some time – why consider them for mortality now?

Non-life actuaries have used ML for a decade or more, following the earlier introduction of generalised linear models (GLMs). They have more of a commercial imperative to derive the most predictive models than life and pensions actuaries do, and have much richer datasets.

Life and pensions have had more than 10 years to get used to GLMs for mortality and some behavioural aspects, with different commercial priorities and datasets to those in non-life. We've only recently started to feel around for ways to make the most of ML, where it offers a clear advantage. Mortality modelling could be one such area but the datasets need to be large if we are to see much gain over GLMs.

What are the key benefits?

The main advantage of ML is simply that you can derive a more predictive model than is possible with GLMs. This relates largely to the ability of most ML methods to automatically find interactions between factors – including, for instance, three or four-way interactions. They can also find patterns that might not fit the structure of a GLM. (We've been lucky that mortality has generally exhibited properties that are conducive to a GLM approach.)

What are the drawbacks?

There are several disadvantages. To see major predictive benefits from ML compared with a GLM you would need a much larger dataset – in terms of both overall data volumes (for example number of policyholders or pensioners) and data richness (the number of potentially predictive factors). There are then interpretability issues: while the canonical GLMs used most often for mortality have a relatively intuitive multiplicative structure, and can be written down on a page, most ML approaches are not conducive to this 'structure in one formula' exposition, let alone 'results on one page'. The results are much harder to interpret and implement (for instance, to import them into a cashflow model).

What sorts of problems are these approaches best for?

ML and GLMs are well suited to finding highly predictive models of mortality (or morbidity) 'now' – for instance, identifying which factors are predictive of mortality and how best to 'cut up' those factors. However, there is little success in helping with longevity actuaries' two other main concerns: the pattern of longevity improvements over time, and the extent of variability we must consider in capital modelling contexts.

For longevity trends, it's hard to find underlying time trends that feel plausibly 'extrapolatable' once you start cutting the data by more than a couple of dimensions – even with whole populations. And in terms of the risk aspect, the analytics discussed here can help to some extent with better appreciating model risk for base (level) mortality, but will be of no use when it comes to the variability of longevity trends.

> **Find the new issue of the Longevity Bulletin at bit.ly/IFoA_publications**



MATTHEW EDWARDS

is UK&I Life proposition/
innovation lead within WTW's
insurance consulting and
technology practice

Join us at landmark GIRO50 conference

This year's GIRO conference is a special one for the IFoA – it's the 50th anniversary of the event, marking half a century of great general-insurance intelligence and professional networking. The conference runs from **1 to 3 November** and you can choose to attend in person in Edinburgh or via live streaming online. Either way, we look forward to welcoming you to enjoy a packed schedule of plenaries, workshops and topical debates.

Leading experts will be giving insight into key issues, emerging ideas and new research across the GI sector. Topics will include geopolitical risk; diversity, equity and inclusion; artificial intelligence; cyber risk; social inflation; microinsurance; Solvency II; and climate change's impact on the sector. There will also be plenty of advice on offer, around workplace skills and professionalism.

Our celebrity speakers



This conference, we welcome **Dr Marcus du Sautoy** as one of our key speakers. A professor of mathematics at the University of Oxford, he holds the prestigious Simonyi Chair for the Public Understanding of Science and is a Fellow of New College.

Du Sautoy has received a number of awards for his work, including the London Mathematical Society's Berwick Prize for outstanding mathematical research and the Royal Society of London's Michael Faraday Prize for excellence in communicating science. He has been awarded an OBE for his services to science and was recently elected a Fellow of the Royal Society.

His research has covered a great many areas, including group theory, number theory and model theory. He is also known for his promotion of maths to the public, having published a number of bestselling books and appeared regularly on television and radio.



Also speaking at the event is **Dr Tara Shine**, a climate change and climate justice expert who has a passion for communicating science.

Shine has advised world leaders, governments and civil organisations on climate change, environmental policy and development assistance. Formerly a climate negotiator at the UN, a special adviser to the Mary Robinson Foundation and an adviser to Nelson Mandela's The Elders, Shine is co-founder and director of award-winning sustainability business Change by Degrees.

She is also chair of the board of trustees of the International Institute for Environment and Development and co-facilitator of a science-policy dialogue under the UN Climate Convention. Her book *How to Save Your Planet One Object at a Time*, a guide to sustainable living told through everyday objects, was published by Simon & Schuster in 2020.

Shine enjoys getting out into the wild to explore environmental issues first hand, from the deserts of Mauritania to the rainforests of Borneo. She enjoys meeting people to hear their stories and experiences and to champion the solutions they need. Most recently she travelled to Antarctica with 90 women scientists as part of Homeward Bound, a global leadership programme for women in science that aims to find better ways to care for our global home.

Session highlights

PRA UPDATE

The Prudential Regulatory Authority will provide an update on its key regulatory focuses and points of engagement with the general insurance industry.

Richard Chalk, Nylesh Shah and Daniel Curtis, Bank of England

CURRENT ISSUES IN CAPITAL MODELLING

This session is a follow-up to the one the speakers held at the 2022 General Insurance Spring Conference. They will cover some of the recent discussion points and conclusions, taking in topics such as:

- Recent changes in market risk, including inflation, interest rates, and correlation between market risk and insurance risk
- External models, including economic scenario generators, cyber models and climate change in nat cat models

- Risk metrics, alignment with plan and one-year risk.

Members of the Capital Research Group

LLOYD'S UPDATE

An overview from Lloyd's on hot topics relevant to the Lloyd's market.

Mirjam Spies, Louise Bennett, Rebecca Soraghan and Taraash Gautam, Lloyd's of London

HOW CAN ACTUARIES BEST

ADD VALUE TO CLAIMS?

Claims and actuarial teams often end up working together – but finding a middle ground can be a challenge. The speakers will unpack the role of working within claims as a claims actuary, answering:

- What differences are there in the way that claims teams and actuaries think?
- Where might claims benefit most from an actuary's input?
- What can actuaries do to improve their appreciation of the challenges that claims face when it comes to understanding actuarial information?

The speakers will also share their research into using analytics to better understand claims experience, including:

- Using an 'index of case reserving strength'
- Using machine learning with individual claims data to efficiently identify and quantify the impact of specific known claims initiatives, and identify and investigate unexpected changes in claims' experience.

Charlie Stone and Melissa Tam, LCP

THE STATE OF PRICING – WHAT'S GOING ON IN THE LONDON MARKET?

Sponsored by Hyperexponential

By combining insights from a recent industry-wide survey of actuaries and underwriters, alongside benchmarking work with numerous insurers on pricing capabilities, the speakers will discuss the current and evolving state of pricing within the London market. Key themes covered will include:

- What are insurers worrying about?
- How well are actuaries and underwriters actually collaborating?

- What are some of the perceived key barriers to progress in London market pricing?
- What focus areas and common challenges are insurers facing when undertaking pricing transformation?
- Where are some insurers really breaking out from the wider pack with regards to pricing capabilities?

Tom Chamberlain, Amrit Santhirasenan and Jamie Wilson, Hyperexponential

TWO WORLDS COLLIDING – THE ROLE OF PRICING ACTUARIES AMONG DATA SCIENTISTS: INDUSTRY PERSPECTIVE

As expert modellers, pricing actuaries over the last few years have been keen to upskill in various coding languages and study alternative modelling algorithms for predicting claims' experience, especially in personal lines insurance.

This is all well and good in an analytical, research and development environment. But what if you want to implement all this knowledge into live pricing?

The speakers will showcase how actuaries and data scientists can collaborate to produce

market-leading pricing algorithms. They will celebrate diversity in pricing teams, leveraging their own experiences (from actuaries in the business and data scientists), elements of research around data-driven culture, and parts of The Actuaries' Code.

Topics will range from the tech stack to team structure, with everything in between.

Kristina Hegarty and Tom Beckett, Hastings Direct

WHEN YOU TALK, MAKE IT COUNT

Building relationships and communicating effectively is a skill like any other: it can be learned, developed and fine-tuned. This session will explore simple adjustments that will allow you to be more effective and more productive in your meetings, conversations and professional relationships.

Sarah Hanson, Interactifs UK

REVOLUTIONISING UNDERWRITING AND INVESTMENT: ADVANCED NON-LIFE BALANCE SHEET OPTIMISATION TECHNIQUES

This presentation will reveal a holistic approach to risk and capital management

of non-life insurance balance sheets. It will explore the synergy between underwriting and investments, and how modern techniques can optimise the balance sheet, improving financial stability and maximising return on equity. Specific topics will include:

- Setting up an analytical framework for the full insurance balance sheet, providing a holistic view of accounting profitability, risk and capital
- Integrating risk and capital metrics across non-life insurance and investments
- Optimisation techniques to improve risk and capital metrics for the balance sheet and maximise return on equity from both underwriting and investments.

Gareth Haslip, JP Morgan Asset Management

DON'T MISS OUT

To view the full GIRO 50 programme and buy tickets, go to bit.ly/GIRO23 – or scan this QR code



Institute
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IFoA Life Conference 2023

22–24 November, ICC, Birmingham

Join us at this year's Life Conference!

Our programme of 63 workshops covers topics from generative AI to public trust, from inflation to climate risks, from Solvency II to IFRS17. In addition, we will be joined by guest speakers **Andrew Sentance**, former member of the Monetary Policy Committee for the Bank of England and **Professor Lord Robert Winston**, Professor of Science and Society at Imperial College.

If you're unable to join us in Birmingham, plenary speakers and six workshop sessions are offered as part of our online programme.



Conference sponsor:



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To find out more and to book your place visit: actuaries.org.uk/Life23

Grey matter

Chris Lewin
considers the
implications
for actuaries
of the RAAC
concrete debacle

R AAC stands for reinforced autoclaved aerated concrete, a lightweight cellular material that is only expected to last for about 30 years. It is made by adding aluminium into a lime or cement-based concrete mix, causing the formation of millions of tiny bubbles that make up most of the material. Steel reinforcement meshes are coated with a latex or cement mix to prevent corrosion, before the concrete is cast around it in a factory to form precast panels, used in roofs, floors and walls.

RAAC is cheaper than ordinary reinforced concrete, as well as being quicker and easier to install. It also has relatively good fire-resistance properties. For all these reasons, it was used extensively in the many public buildings constructed in the UK during the Fifties, Sixties and Seventies, when massive reconstruction was taking place after the Second World War. It was also used in Australia, Ireland, New Zealand, South Africa, Czechoslovakia, Japan, Poland and the Soviet Union.

What's the issue?

The problem emerging is that structures based on RAAC panels are now liable to collapse suddenly – sometimes without obvious warnings, such as sagging roofs or cracking. For example, in 2018, a roof collapsed without warning at Singlewell Primary School in Gravesend, Kent. Even one or two buildings recently certified as safe by structural engineers have partially collapsed. Where there are warning signs, engineers have mitigated the problem to some extent by installing props, but this is



a temporary solution. It is thought that the collapses are usually triggered by weakening of the RAAC material following prolonged water ingress, often because of inadequate roof maintenance.

In September 2022, the British government sent out a notice to property owners: "RAAC is now life expired and liable to collapse." The problem could affect many types of building, including schools, hospitals, court buildings, prisons and – of particular concern – homes. Many of these will have been designed and constructed on

behalf of public bodies, some for private businesses and investors. No one seems to have a clear idea of the scale of the problem.

How does this affect actuaries?

Many actuaries participate in managing the investment of funds that include property portfolios, and we should now insist that every building in a portfolio that was constructed after 1950 must be inspected as soon as possible for signs that it may contain RAAC. The original specifications, if available, may be of assistance here.



It might be possible in future for insurance companies to offer additional long-term products for buildings known to have limited lives

In buildings that do or might contain RAAC, roof inspections should be undertaken, leaks repaired urgently and consideration given to better and more regular roof maintenance in future. Internal inspections should also be carried out to look for tell-tale signs of deterioration. Where signs are found, urgent mitigation must be put in place. It will often be the case that maintenance matters have been delegated to a property firm, but property owners have a responsibility to ensure that sufficient action is being undertaken on their behalf, and should call for regular reports.

A further aspect in which actuaries may become involved is whether and when a building that does or may contain RAAC should be replaced. If replacement is decided upon, should it be rebuilt with RAAC or some other material? From a public sector viewpoint there may be some justification in using RAAC because of its cost advantage. This would mean more facilities could be constructed than if traditional materials were used, bringing greater social benefit.

RAAC is apparently still manufactured and installed all over the world, but it is now widely recognised that it must be properly designed, manufactured, installed and

maintained. Cost-benefit analysis using discounted flow techniques, taking maintenance costs into account, may be used to determine the best solution. Such analyses should consider not only expected deterioration in building materials but also damage that may occur to buildings in future due to a greater frequency of storms and floods, caused by climate change.

All affected buildings will have insurance against fire and other incidents, but I wonder if it might be possible in future for insurance companies to offer additional long-term products for buildings known to have limited lives. For example, if a building has an expected future life of 30 years, could an insurance company offer a sinking fund that would meet the whole or part of the replacement cost at the end of that time?

If the building cost £1m originally, a sinking fund to meet the cost of replacing it in 30 years' time would cost £21,000 per annum, assuming the fund could earn 3% per annum net interest throughout that period (where net interest is the gross interest rate less the price inflation rate for structural materials). The progress of the sinking fund would be monitored throughout the period and the sums paid in each year adjusted in light of interest earnings and new estimates of replacement costs.

If building collapses become more common in future – and there is no indication of this at present – there could be impacts on mortality rates and health costs, which actuaries might have to consider. However, with public concern awakened, the mitigations now starting to be put in place will hopefully prevent injury and loss of life.



CHRIS LEWIN

is an actuary and retired pensions director, and chair of the IFoA's Infrastructure Working Party



IMAGES: ALAMY/ISTOCK



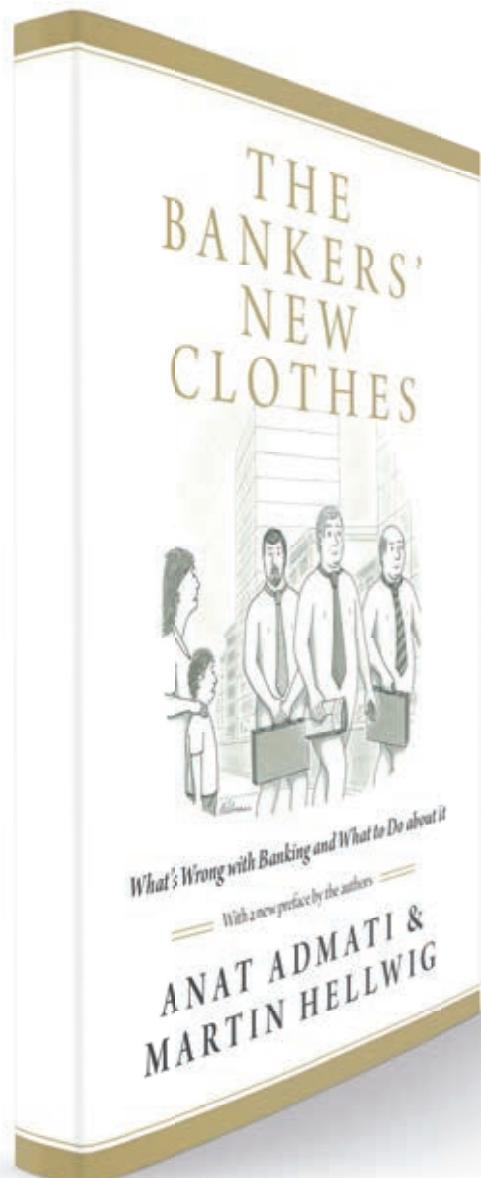
Features

‘Most of the time, even if banks break the law, nothing terrible happens’

She literally wrote the book on banks behaving badly. A decade on, it’s more relevant than ever. Now with a new edition on the presses, US academic **Anat Admati** tells Nico Aspinall why the industry continues to learn nothing from history



A



nat Admati, co-author (with Martin Hellwig) of *The Bankers' New Clothes: What's Wrong with Banking and What to Do About It*, was going to submit the draft for a new 10th anniversary edition of the book in March when Silicon Valley Bank (SVB), Credit Suisse and First Republic Bank all collapsed in quick succession. "We had to scramble to rewrite a lot," remembers the professor of finance and economics at Stanford University.

"Among other things," she expands, "the new edition will explain more about central banks and their role in dealing with panics and stepping in to bail out. It's quite timely... but it's been a lot of work."

A cost to society

Admati and Hellwig explain bail outs in some detail, as well as the complexities of banking in the clearest terms. They explore how low equity ratios, guaranteed deposits and poorly designed regulations distort banks' decisions and lead them to take excessively risky investment and funding routes – which end up costing society through subsidies, bail outs, and boom and bust cycles. They also discuss the pervasive issues of poor governance and rule violations, and laser in on necessary improvements.

Credit Suisse's troubles were already on the radar. "I teach a course at Stanford called Power in Finance and gave my MBA students a homework project about Credit Suisse back in February, to dig into its problems.

"Credit Suisse was as dangerous as Lehman Brothers – but Lehman was allowed to go into bankruptcy in September 2008. We were promised that reforms made it possible for big banks to go into some 'resolution' procedure that would prevent them from causing harm or needing bail outs – yet the Swiss authorities did not use their own procedures to deal with Credit Suisse! Instead, when the problems caused a lot of depositor and customer withdrawals, they intervened and put taxpayers' money behind the forced merger with UBS. Authorities often do this when they are afraid to let banks, small and large, fail."

Short on equity

I ask Admati about her main recommendation that banks should hold more equity, and she cuts in immediately. "I just hate that 'hold' word! It's misleading

because it suggests that equity is like cash reserves, and this immediately throws the discussion off course – we are not even on the proper side of the balance sheet.

"The issue is whether banks have enough equity funding, funds that are not in the form of debt – in other words, legal promises to make payments to creditors."

Banking is the only industry where having so little equity is permanent, she points out. "For most healthy non-bank corporations, the market value of equity overwhelms the amounts owed. Banks are funded by debt to an extreme degree by any standards – including historical banking standards.

"With so much debt and so little equity funding, assessing ability to pay becomes sensitive to the way assets are valued, accounting rules, market valuations and so on. Because banks have so little equity, they are always in what would normally be considered a state of distress, often bordering on insolvency – but we may not recognise it if their loans and other investments are not always reflecting fair market values. More equity would enable banks to repay their deposits and other debts without needing support from governments or central banks, or defaulting on their obligations."

Admati and Hellwig argue that banks should fund loans and other investments with more equity, relative to deposits or other liabilities, than they do at present. They say this would not interfere with banks' ability to be useful to society but would reduce their likelihood of failure. The same shareholders who benefit from the upside will absorb losses. In this way, distortive government subsidies would be reduced and banks would be able to serve people better.

The wrong lessons

The Bankers' New Clothes aims to dismantle the arguments and obfuscation often used to defend banking's status quo. The authors are excellent at explaining the things that banks would rather weren't explained. Confusion around the issues helps banks to keep things as they are – at the expense of everyone else.

There is an endemic misunderstanding around the fact that deposits are debt obligations for banks. Depositors do not behave like normal creditors because they assume that the money is always there to be withdrawn or used for payment. Admati recalls an interview that the CEO of Wells

Fargo Bank gave shortly after *The Bankers' New Clothes* first came out in March 2013.

"He said: 'We in West Fargo have a lot of retail deposits and therefore we don't have a lot of debt.' It is a shocking statement from a bank CEO, who obviously knows that deposits are legal liabilities the bank owes – but it shows that the passivity of depositors can allow a banker to forget he owes them the money. Martin and I have been collecting a list of flawed claims that we have kept revising. As of 2019, we have 34 such claims that we debunk briefly and refer to other writings." They are about to revise this list, add at least four more claims and post it on their website, bankersnewclothes.com.

They want to build public understanding of banks and improve regulations. Did we not learn anything from the 2008 financial crisis? Admati quotes journalist Joris Luyendijk, author of *Swimming With Sharks: My Journey into the World of the Bankers*. He believes the main lesson from the crisis was for big banks, who learned that "there is very little they will not get away with".

"Most of the time, even if banks break the law, nothing terrible happens to those involved – particularly people at the top," Admati elaborates. "They can benefit from taking excessive risks that endanger others. Other violations are also pervasive, including deception, fraud and money laundering."

What sort of risks are banks taking?

"The approach to capital regulation is risk-based, which means there are a set of weights applied to different assets," she explains. "These are determined by a process that is often arbitrary and political, sometimes allowing banks to use their own models of credit risk. If the weight is zero or very small, the asset can be funded with virtually no equity to absorb potential losses. There's research showing that banks using the 'advanced approach' engage in 'risk weight optimisation' and take more risk, funded by ever-more debt."

Another Lehman moment?

The risk from interest rate increases is often ignored in accounting disclosures. US

regulators have made new proposals, known as Basel III Endgame, again fine-tuning the risk weights. However, the document is more than 1,000 pages long and, according to Admati, not based on sound analysis.

Are interest rate increases part of what went wrong at SVB? "Definitely," says Admati. "Accounting conventions and ineffective regulation and supervision enabled the bank to hide its problems until everyone woke up to them. Government bonds are considered riskless and have zero risk weight in the regulations, so SVB would need no equity funding to buy them. But the bonds lost market value when interest rates increased, and the bank had to sell some of them and raise equity to cover deposit withdrawal and having to pay more to attract depositors. When the losses were evident and the bank could not raise equity, its insolvency became obvious and uninsured investors had good reasons to withdraw."

"Correlations also matter greatly," she continues, "but are often ignored. The 2008 crisis showed that it is possible for a bunch of mortgages to default at the same time, particularly when homeowners themselves are highly indebted. A relatively small house price downturn turned into a global crisis."

The fear of another 'Lehman moment' is still with us, Admati says. "Policymakers do not have good control over, or even a full

understanding of, the risk in the entire interconnected system and the largest and most complex institutions – and regulators do not have workable mechanisms to let mega-global banks fail. Political pressures often lead

to bail outs. After the SVB failure, the Federal Reserve started lending programmes that are a replay of the forbearance of the savings and loan scandals of the Eighties, where insolvent 'zombies' were allowed to persist. Such kicking the can down the road is a bad idea. Often, procrastination is the name of the game in banking and banking regulation.

"The Federal Reserve went from \$900bn and just running basic central bank operations to \$4trn after the financial crisis and nearly \$9trn after the Covid pandemic.

Central banks in many places became not only 'market makers of last resort' but also 'asset buyers of last resort', accumulating all sorts of assets on their balance sheets. Banks, governments and asset owners generally benefit most, both directly and indirectly, from central bank support. In the book's new edition we explain in more detail how bail outs work and why they persist."

Crypto-scepticism

Some have reacted to financial system corruption by proposing unregulated digital currency systems but Admati is sceptical about cryptocurrency. "Before we had central banks, there were metal coins issued by kings or banknotes issued by private-sector institutions, and it did not work well."

"There are many 'currencies' we use in different contexts. In a casino you change your central bank money into chips. Frequent flyer miles or credit card points pay for tickets or hotels. Private money is common but is only as good as its issuer and what it can be used for. Digital technology does not change the basic issues in banking or finance – and we saw how fraud and excessive risk-taking led to some spectacular bankruptcies in the crypto world."

So why would central banks want to issue digital currencies? "Already, much of banking takes place digitally. Cash is not used much but remains the basis of so-called central bank money – official currencies. Central banks have monopolies on issuing their specific banknotes. The question is whether central banks will engage in retail banking, where we all have accounts with a central bank. There are logistical issues and privacy concerns around the idea, but possibly some advantages relative to the current system."

Such system would not mean the end of mortgages, she says. "Mortgages and loans can be made with any money – you can raise equity, you can raise debt funding through bonds. A lot of non-banks are already providing mortgages. In fact, non-bank lenders have much more equity funding, such as 20-30%, and they don't use deposits to fund mortgages."

Our time is up. It's been a fascinating hour, in which I've only managed to touch the surface of the issue and Admati's vast expertise. I just hope the banks read her revised book, published by Princeton University Press and due out in January.

Doctoring the approach



NHS England's year-old Integrated Care Systems aim to make it more preventative, less reactive. Now, alongside the cry for more health professionals, there's one for more actuaries – **David McDwyer** explains

Historically, the NHS model was reactive, treating illnesses as they arose rather than maintaining health. This was successful for much of its history but has been challenged by recent demographic changes: people are living longer, and more have long-term conditions. This places additional demands on the NHS, which still primarily focuses on treating the consequences of long-term conditions in hospital, rather than preventing them or managing them outside hospital.

There is also a growing appreciation that health is not just determined by the level of healthcare available – wider factors such as environment, housing, education, (wealth) inequalities and wider care arrangements also play a role.

The establishment of ICSs provides the first legal basis of a structure in which relevant organisations can collaborate with one another to tackle health problems.

What difference could ICSs make?

To understand this more collaborative approach, let's look at an example problem and how it might be addressed before and after the formation of the ICS.

Let's say System A has an issue: many elderly members of its population have respiratory conditions and live in old houses with poor insulation. They experience health exacerbations in winter, and mainly access care via A&E. A limited number are successfully looked after by a small respiratory nursing team.

Before ICS

The **hospital** within System A wants to make sure it receives enough money to fund staff so it can look after these people when they arrive at A&E. It knows that the problem could be managed before this point but as an organisation it is focused on meeting immediate pressures.

The **local authority** knows the condition of different houses within its geography, as well as who might be



In July 2022, the NHS in England underwent one of the largest system reorganisations in its history with the establishment of integrated care systems (ICS). In November, the UK government commissioned the Hewitt Review to perform a review of ICSs. This was published in April 2023, with one of its recommendations being a requirement to “recruit more specialists in fields such as [...] actuarial modelling”.

What can actuaries learn about ICSs, and why might actuarial skills be required to improve them?

What are ICSs and why are they needed?

An ICS provides a partnership structure that allows for closer integration between NHS providers (such as hospitals and GPs), NHS commissioners (who decide how the NHS budget is spent in each area), local authorities, social care providers, and voluntary, community, faith and social enterprise organisations.

Part of this reorganisation includes the formation of integrated care boards (ICBs) – statutory NHS organisations that are responsible for bringing together the NHS and other partners, to improve the health of their populations.

living alone and particularly vulnerable. It does not have clinical staff who can manage respiratory conditions but does have a large domiciliary care team. It can also provide advice and support around home insulation and grants but, as this is limited, it doesn't know whom specifically to target.

An **NHS community team** has a small number of nurses trained to manage respiratory conditions but can only manage a caseload of 40 patients. Its time is often taken up by these vulnerable patients' other needs, such as washing and dressing, rather than managing the respiratory condition. As a small organisation, it doesn't have much experience in capturing data.

The **commissioner** manages how money is spent within the system but has a traditional purchaser-provider relationship with the organisations listed. It receives limited information from each provider and does not have a joined-up picture of how its population is using healthcare. This makes it challenging to change the way healthcare is delivered.

After ICS

All members are now part of the ICS, removing the emphasis on traditional purchaser-provider relationships. Consequently, the **commissioning organisation** (the ICB) now has a linked dataset, so it can understand which patients receive care and support from different settings.

The **ICB** identifies the cost associated with people who attend A&E and are not supported by the community team. In year one, it invests additional money to double the size of the community nursing team and provides a joint grant with the local authority to fund community groups that act as 'warm places'.

The **local authority** shares data with the community nursing team about people who could be at risk, for example due to their housing conditions. It also offers joined-up support from its domiciliary care team, which can help with some of the non-healthcare demands currently

Actuaries are well placed to set appropriate assumptions that indicate the present-day benefit of a change that may not materialise immediately

placed on the nursing team. Through financial support from the ICB, it sets up 'warm places' that target vulnerable people who live alone in poorly insulated homes.

These changes mean the **NHS community team** can now manage a caseload of 160 patients. Fewer people attend A&E, as their conditions are being managed, and the cost savings from the reduced demand are greater than the commissioner's initial investment. The hospital provider agrees to a future reduction in its contract value to maintain this investment in the community and focus on prevention. Despite the reduction in contract value, the reduction in A&E demand puts the **hospital** in a better financial position and enables it to reduce its waiting list more quickly.

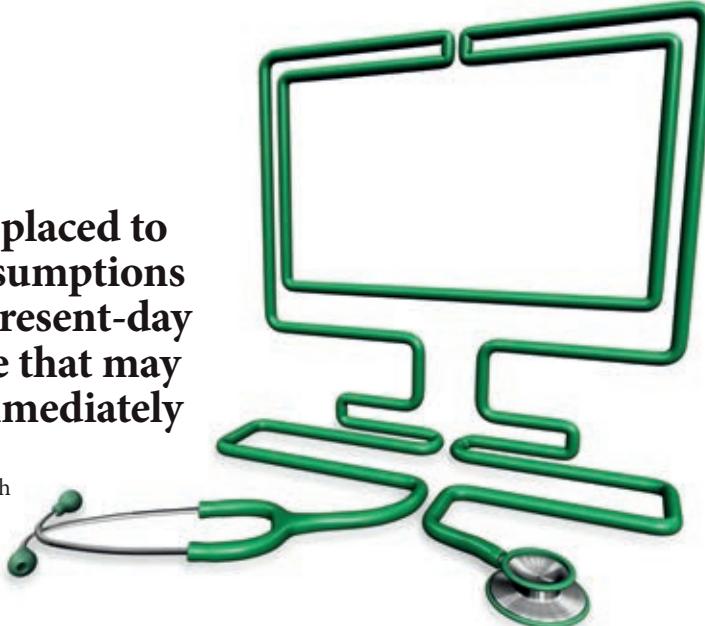
Why actuaries?

All of this sounds sensible but how does it lead to the Hewitt Review recommending that ICSs recruit actuarial modelling specialists?

As a profession, actuaries can help to set expectations around what actuarial analysis could mean in an NHS context. It is clear that the establishment of ICSs creates challenges that the actuarial skillset is well positioned to support.

First, ICSs need to take a long-term view of their populations' needs and how they will develop over time with demographic and morbidity changes. This is essential in a preventive, rather than reactive, model of care. Actuaries' ability to understand the business impact of population changes and to model possible scenarios is key here.

Second, it is likely that ICSs will require changes in the way finances are allocated. The benefits



from this may not be realised for several years. Robust financial business cases are required to justify alternative care models, and actuaries are well placed to set appropriate assumptions that indicate the present-day benefit of a change that may not materialise immediately.

Finally, for ICSs to work effectively, they will have to collate data from several different providers, some of which will be more data mature than others. Data collection can be improved but judgment and assumptions will be required in the interim to ensure business decisions can be made. Actuaries' ability to set appropriate assumptions and communicate their relevance to a business will help in this context.

Where next?

NHS England's new multi-partnership approach should shift it to a model of care that maintains long-term health, rather than reacting to illnesses as they arise. This long-term view aligns well with the actuarial skillset of modelling future demographic and morbidity changes, and will require an understanding of future healthcare requirements and associated costs. Actuarial skills could be used to help provide cases for delivering care differently, and forecast their associated financial impacts.

More collaboration is needed with NHS colleagues to shape how actuarial modelling skills could be useful. If you have any ideas or comments, I would love to hear from you – email david.mcdwyer@nhs.net



Universal Basic Income: back in favour around the world, as a potential way to address poverty and inequality. It's not without its risks, though. **Pedro Medford** explains his research model for Barbados

ALL FOR ONE AND ONE FOR ALL

The concept of a Universal Basic Income (UBI) – a regular cash payment that every individual in the country would receive, without conditions – has been proposed and experimented with, in various forms over the decades. It has recently resurfaced as a popular idea, with several countries considering pilot programmes.

In particular, UBI is gaining momentum as a potential solution to economic challenges and social inequalities. It represents an innovative and potentially transformative way to reduce poverty, stimulate economic growth and enhance social welfare, especially in small developing countries. However, successful implementation would require careful planning, sustainable financing, and a comprehensive approach that considers a country's specific needs and circumstances.

A brief history

British Quaker couple Dennis and Mabel Milner were two early proponents of UBI, publishing *Scheme for a State Bonus* in 1919. They wanted to create a rational way to solve income inequity by providing unconditional financial support to all citizens. The government would

fund this through income tax collection, redistributed equally between everyone in society.

In the late Sixties, Heather Ross, an economics graduate student at MIT university in the US, proposed that the national Office of Economic Opportunity carry out a UBI experiment in the state of New Jersey, testing the impact of a guaranteed income on low-income families. This was taken up and, between 1968 and 1972, 1,357 families received unconditional cash payments to meet their basic needs. The results were promising, demonstrating positive effects on poverty reduction and social welfare.

In the 1970s, the Canadian government conducted a pilot programme called Mincome in the town of Dauphin, Manitoba, giving every adult in the town a guaranteed yearly income. The results were mixed but some studies found that it led to decreased poverty and improved mental health.

Now, after decades of hibernation, UBI discussions are resurging around the world. During the 2020 US presidential election, candidate Andrew Yang championed the idea. The Covid pandemic further accelerated UBI discourse as governments sought ways to support citizens during the crisis. (A public poll by YouGov in the UK

in 2020 found that 51% supported UBI; 24% didn't support it.) Pilot UBI programmes have been launched in countries such as Kenya, while other nations have debated the merits of implementing the concept on a larger scale.

A powerful alliance

A UBI's design and complexity can vary widely based on the proposing entity. Some advocate for a flat amount for all citizens, others suggest means-tested approaches that adjust the benefit based on socioeconomics and other factors such as health status and geography.

Another method involves incorporating UBI-like principles into the tax system through negative income tax.

Actuaries can play a crucial role in designing and evaluating UBI models that align with a country's specific needs. Our expertise in financial modelling, demographic analysis and risk assessment would be crucial in ensuring a programme's viability and effectiveness.

In 2022, Shubhash Gosine and I, both members of the Caribbean Actuarial Association, embarked on an actuarial research project to assess the feasibility of UBI schemes for small developing states. We haven't published our research yet but we presented our initial findings at the 2023 International Congress of Actuaries in Sydney, Australia.

The research was prompted by the Barbados government's consideration of UBI, which it would introduce as a citizen's dividend. The UN's Economic Commission for Latin America and the Caribbean has also suggested UBI as a possible way of meeting people's basic needs beyond the Covid era in that region.

The reaction in Barbados to the government's idea was mixed, with a few influential citizens, officials and MPs highlighting the potential long-term financial pressures, high costs and unsustainability of such a programme.

Underlying our research is a dynamic actuarial model: using demographic and census data, actuarial mortality tables and economic data, we can project potential costs for non-means-tested UBI schemes under various scenarios. This involves using actuarial techniques to price inflation-indexed immediate and deferred life annuities over any time horizon, based on population forecasts for Barbados.

Informed decisions

The decision to implement a UBI is a complex one, given the balance policymakers must achieve between benefiting society's most vulnerable and the potential drawbacks. Such drawbacks could include funding



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is actuarial manager
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Actuaries' expertise in financial modelling, demographic analysis and risk assessment would be crucial in ensuring viability and effectiveness

challenges during financial recessions, revenue disruptions due to natural catastrophes, inflation risk

to a scheme's sustainability, and unfavourable perceptions among the country's citizens.

One example of a pseudo-UBI with observable data in Barbados is free tertiary education for all undergraduate students at the University of the West Indies. This was withdrawn by a previous government as it was deemed unaffordable and unsustainable, but was reintroduced in 2018 by the current administration.

To mimic this benefit in the actuarial model, we consider an inflation-indexed non-means tested benefit to cover tuition fees, issued annually to all young adults aged 18 to 23 and calibrated by university enrolment rates. The Barbados government's actual 2018–22 tuition fee expenditure aligned reasonably well with the actuarially predicted results.

In the short term, the benefit to this cohort seems affordable. However, long-term model forecasts highlighted some vulnerabilities – especially due to inflation risk, which could see the cost nominally increase by more than 32% within the next 10 years. The real-terms cost is equally high as Barbados recovers from more than a decade of low GDP growth, low tourism revenues and climate-related losses. In 2021, for example, the country suffered \$200m in natural disaster losses alone – equivalent to around 4% of its GDP.

In addition, for the programme to be equitable and truly universal, it could be argued that it should be extended to young adults who do not pursue formal education or who attend other colleges or vocational schools. Should this occur, or should tertiary enrolment rates increase, the benefit could cease to be

sustainable or affordable in the short term without tax rises or spending cuts in other areas.

In the 2023–24 budget, the prime minister of Barbados outlined that the country anticipated revenues of \$3.5bn and expenditures of \$4.2bn – a deficit of approximately \$750m, to be financed during the upcoming fiscal year. Approximately \$97.5m was allocated to the Ministry of People Empowerment and Elder Affairs. This welfare budget provides support to approximately 11,500 families in abject poverty (those with a family income of \$8,500 or less per annum). Scaling the actuarial model results to proxy the population living in abject poverty, this means-based benefit seems reasonable and feasible in the short term. However, as with the tertiary education scenario, the model predicts that the nominal cost could rise by more than 30% over the next 10 years, assuming Barbados' socio-economic conditions remain unchanged. This is mainly due to inflation risks, as cost-of-living increases are expected to continue outpacing nominal wage increases.

The long-term funding mechanism and fiscal capacity for a citizen dividend must be carefully considered. This should include sensitivity analysis to economic shocks such as stagflation, climate-related risks and demographic shifts (for example declining birth rates and ageing populations), and exploration of mitigation strategies such as progressive eligibility requirements for benefits, funding increases through marginal taxation, and so on.

Balancing act

The ongoing research into UBIs for small developing countries such as Barbados provides valuable insights into the advantages and disadvantages. While UBI seems beneficial in theory, implementing it in a country already experiencing fiscal restraints comes with unique funding challenges. However, it deserves serious consideration for its potential to meaningfully reduce abject poverty, stimulate economic activity and simplify welfare systems.

Governments interested in implementing a UBI must carefully assess and continuously monitor their long-term fiscal capacities and explore innovative funding mechanisms to ensure such schemes would be sustainable.

STRUCTURAL SUPPORT

Is your reinsurance as effective as it could be? **Tanya Sethi** explains how to build a solid framework

Reinsurance is a crucial risk management tool for insurers, protecting them against volatility or catastrophes in their underlying business. An optimal reinsurance structure leads to effective risk management, enhanced financial stability and maximised operational efficiency. With carefully designed reinsurance structures, insurers can strike a balance between risk transfer and risk retention while aligning with their specific objectives and risk appetite.

1 Understand the risk profile

The first step in designing an optimal reinsurance structure is to gain a deep understanding of the insurer's risk profile. This would include analysing the types of risks underwritten, the historical loss experience, the geographical exposure and some key risk metrics. By assessing the frequency, severity and correlation of the risks they face, insurers can identify their vulnerability and tailor the reinsurance structure accordingly.

For example, for classes with high severity such as property, excess of loss treaties are considered. Insurers need financial support to manage the volatility caused by catastrophic events such as hurricanes, earthquakes and wildfires.

2 Set objectives

Clear objectives are crucial if an insurer is to achieve its goals. They may include protecting against catastrophic losses, stabilising underwriting results, optimising capital use, accessing specialised expertise from a reinsurer, or meeting regulatory requirements.



Reinsurance is a crucial part of an insurer's business strategy. It helps them to manage risk, expand their capacity to underwrite more significant risks or expand into new lines of business. It can also open doors for high-risk markets that might not otherwise be possible, and may provide a competitive advantage in the marketplace. Insurers with the appropriate reinsurance in place might be able to attract and retain more clients. Throughout all this, insurers can align their reinsurance strategies with broader business goals and risk management priorities.

3 Explore reinsurance options

Traditionally, there have been two types of reinsurance covers to choose from: facultative and treaty.

Treaty reinsurance can be structured as a proportional treaty or a non-proportional treaty. Proportional reinsurance, such as quota share, allows for risk sharing between the insurer and reinsurer based on predetermined terms. Non-proportional reinsurance, such as excess of loss and stop loss, provides coverage for losses that exceed specific thresholds. The main differences between proportional and non-proportional reinsurance are best explained using an example.

Suppose an insurance company provides insurance cover against fire and explosion on a property. It charges a premium of £10,000 for a sum insured of £10m. To choose one of the reinsurance options, the insurer needs to consider how different reinsurance covers would work if the insured property suffered damage. Let's assume there was damage of £5m due to a fire:

- 50% proportional reinsurance
- A non-proportional (excess of loss) reinsurance arrangement where the reinsurer assumes £3m of cover above a deductible of £2m – in other words, £3m xs £2m.

INSURANCE	50% quota share		£3m xs £2m	
	Issuer	Reinsurer	Issuer	Reinsurer
PREMIUM: 10,000	5,000	5,000	6,000	4,000
			Premium to reinsurer is based on an agreement with the insurer	
LIABILITY: 10M	5m	5m	Total liability is not apportioned: 5m	
CLAIM: 5M	2.5m	2.5m	2m	3m

Catastrophe reinsurance specifically addresses losses arising from natural disasters or catastrophic events. Furthermore, different classes of business will have different needs for reinsurance contracts. For example, casualty covers the likes of general liability, professional liability, and directors' and officers' liability. Insurers may use proportional reinsurance (such as quota share) to share liability risks with the reinsurer on a percentage basis. Likewise, speciality lines provide niche coverages such as aviation, marine or energy, so they will need solutions that are tailored to the unique risks covered. The reinsurance arrangements may include facultative reinsurance to address specific risks effectively, or excess of loss to protect against high volatility of losses.

Assessing these options and their implications is essential when selecting the most suitable structure for the risk in question.

4 Optimise risk transfer and retention

Taking on risk is insurers' core business but it is crucial that they understand how much risk they can and should retain to maximise the returns. Insurers should carefully assess their risk appetite and tolerance, along with the financial capacity to strike the right balance between risk retention and risk transfer. They also need to ascertain the types of risk that they want to retain, based on their expertise, regulatory requirements and so on. This can be achieved

through actuarial analysis or risk modelling. By combining analytical approaches and factors, insurers can analyse different retention levels and coverage limits that align with their risk appetite and long-term business objectives.

5 Select reinsurers

Choosing the right reinsurers is crucial to the success of a reinsurance programme. Insurers should thoroughly evaluate potential reinsurers based on their financial strength, claims-paying ability, expertise, reputation and willingness to provide tailored solutions. It is essential to establish strong relationships with reinsurers and/or brokers that align with the insurer's objectives and risk management philosophy. Most of the time there are several reinsurers involved in providing coverage, and choosing the right lead reinsurer could make a significant difference to the terms and conditions that insurers get through the arrangement.

6 Negotiate pricing and contract terms

A pricing strategy should consider factors such as expected loss ratios, profit margins, expense ratios and the cost of capital. The negotiation of contract terms and conditions should strike a balance between the insurer's needs and competitive pricing. Market conditions also play an important role in determining a contract's price and terms. Collaboration with reinsurers can help insurers to find mutually beneficial solutions that maximise value and effectiveness.

7 Continuous monitoring

Insurance is cyclical, which means it is important to monitor and evaluate the reinsurance programme's performance. An optimal reinsurance structure this year could become sub-optimal in future as the market evolves. Monitoring includes reviewing claims experience, loss development and the programme's financial impact. By regularly assessing the structure's effectiveness, insurers can make adjustments to ensure it aligns with evolving risk profiles and market conditions when the contract is renewed.

An optimal
reinsurance structure
this year could become
sub-optimal in future
as the market evolves

By selecting the right reinsurers, negotiating favourable contracts and continuously monitoring the programme's performance, insurers can enhance risk management and financial stability.

With a well-designed reinsurance structure, insurers can navigate uncertainties, protect against catastrophic losses, ensure sustainable business growth and venture into new products in an increasingly complex and competitive insurance landscape.



TANYA SETHI
is a reinsurance
pricing actuary
at Aspen Re



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ow do you care for the elderly? This is an urgent question for developed nations, whose populations are increasingly ageing. In the April 2023 issue of *The Actuary*, the IFoA Social Care Working Party explored the UK's recent reforms to social care (bit.ly/Social_care_reforms). Here, we examine the approaches currently used by six developed nations: the UK, the US, France, Germany, Japan and Singapore.

Differing attitudes

Adult social care supports people of all ages who have certain physical, cognitive or age-related conditions, helping them to carry out personal care or domestic routines – essential if they are to live happy and independent lives. Demands on adult social care are expected to increase in nations with ageing populations. State involvement in meeting social care needs, in terms of both funding and delivery, varies between countries.

Some nations view social care as an individual responsibility, others as a societal one. Provision is complex, and each country will have nuances around who can receive support and how it is funded – particularly for society's most vulnerable members. Social care

FIGURE 1: The proportion of projected population aged 85 and over in six developed nations



Source: United States Census Bureau

expenditure can cover a range of needs. In 2021-22, in England, gross expenditure on social care for people aged 65 and over was £8.87bn and primarily related to physical support, according to NHS Digital England. A further £8.46bn was spent on those aged 18-64, primarily to provide support for people with learning disabilities.

With most social care expenditure being driven by elderly members of the population, the cost is expected to increase as populations age. Figure 1 shows the proportion of the population expected to be aged 85 and over by 2060 for the six countries we are reviewing. All six are expected to experience significant

Age old questions

Every country has its own system for providing social care within an ageing population – does any one have the answer?

Tom Kenny, Sue Elliott and David McDwyer compare how six currently approach it



TABLE 1: Comparison of social care provision in six developed countries

COUNTRY	LEVEL OF STATE INTERVENTION	HOW IS IT FUNDED?	WHO CAN RECEIVE STATE SUPPORT?	HOW ARE BENEFITS PAID?
France	Medium	Intrinsically linked to healthcare and funded through statutory social insurance paid by employees and employers. This is supplemented by a mature private long-term care insurance market	Most public benefits aimed at those aged over 60, with the level of benefit scaled based on income and need	Generally cash benefits direct to the person
Germany	Medium-high	Mandatory state social insurance scheme to which all working-age adults contribute, which covers some care needs. People also need to top up themselves at the point of needing care through direct charges	Any adult aged 18 and over based on needs assessment of activities of daily living (ADLs)	Generally direct to the person, who then needs to top up to meet remaining care costs
Japan	High	Combination of general taxation for working age population, social insurance premiums for those aged 65 and over (from pension payments), and a means-tested co-payment	Adults aged 40 and over, with most support from age 65. Available to all, regardless of income	Directly to care providers from the state long-term care insurance system
Singapore	High	Auto-enrolment at age 40 into state long-term care insurance product, funded through combination of the person's 'health savings account' accrued based on salary deductions and out-of-pocket expenses. This is often supplemented by individual long-term care insurance, providing further coverage. Means testing component financed through grants to voluntary organisations and government subsidies	Those aged 40 and over, based on assessment of ADLs. Means testing component based on household income	Cash benefits dependent on underlying insurance policy
US	Low	Combination of general taxation and ringfenced taxation (Medicaid contributions). State support is limited, so most people experience direct charges at point of need, which deplete their assets until they qualify for state support. For those who can afford it, an established private long-term care insurance market mitigates this risk	Means tested, based on income and integrated with wider health insurance needs	Direct to providers, which deliver a managed care service that those eligible can access
UK	Low-medium	Combination of general taxation and local taxation (council tax) to support means-tested individuals. Those with higher assets are charged directly at the point of needing care	Any adult over the age of 18 based on a needs assessment from their local authority	Generally direct to the care provider or a management organisation. In some cases, payments are direct to the person

growth in this proportion, with the highest proportions expected in Japan (12.7%) and Singapore (9%).

Social care around the world

There are five broad approaches to funding a country's social care system:

- **General taxation** – using general funds raised within a nation for a variety of uses; the allocation a use case receives could vary year to year. This tax can be collected across income, wealth and expenditure
- **Ringfenced taxation** – funds are raised through taxation on a promise to be spent only on a given purpose
- **Social insurance scheme** – the contribution of premiums into an insurance scheme is nationally mandated
 - **Voluntary insurance** – people are expected to take out insurance with private companies, either individually or through their employer
 - **Direct charges to the user** – people pay at the point of needing care; timing and amounts can be uncertain.

Having decided how it will raise funds, a country then needs to decide who is eligible to receive benefits and how these benefits should be distributed. *Table 1* captures broad themes within each country; the reality is more complex.

What can we learn?

It is interesting to look at different countries' attitudes towards intergenerational fairness. The UK and Germany rely on the working-age population to subsidise current social care costs on a pay-as-you-go basis, while Singapore

Some nations view social care as an individual responsibility, others as a societal one

and Japan weight payments towards older members of the populations. France, the US and Singapore give individuals a high degree of responsibility in managing their future social care needs, which has created mature long-term care insurance markets. The individual's responsibility to procure their own coverage indirectly improves intergenerational fairness. You could argue that, as populations age, the sustainability of funding is improved when a greater proportion of care cost funding is met by older people within the population.

All countries acknowledge the significant role played by informal carers in supporting social care needs. Without this 'hidden workforce', most state provision would be unable to offer appropriate coverage, and private insurance arrangements could become unaffordable. Despite this, there is little explicit recognition or reward for those who perform this informal carer role across any of the nations surveyed in this article.

Fit for purpose?

Even from the small number of countries covered here, we can see that no single approach could be considered best practice. As the ticking time bomb of an ageing population draws ever nearer, all these countries are continually reviewing their current approaches and whether they are still fit for purpose.



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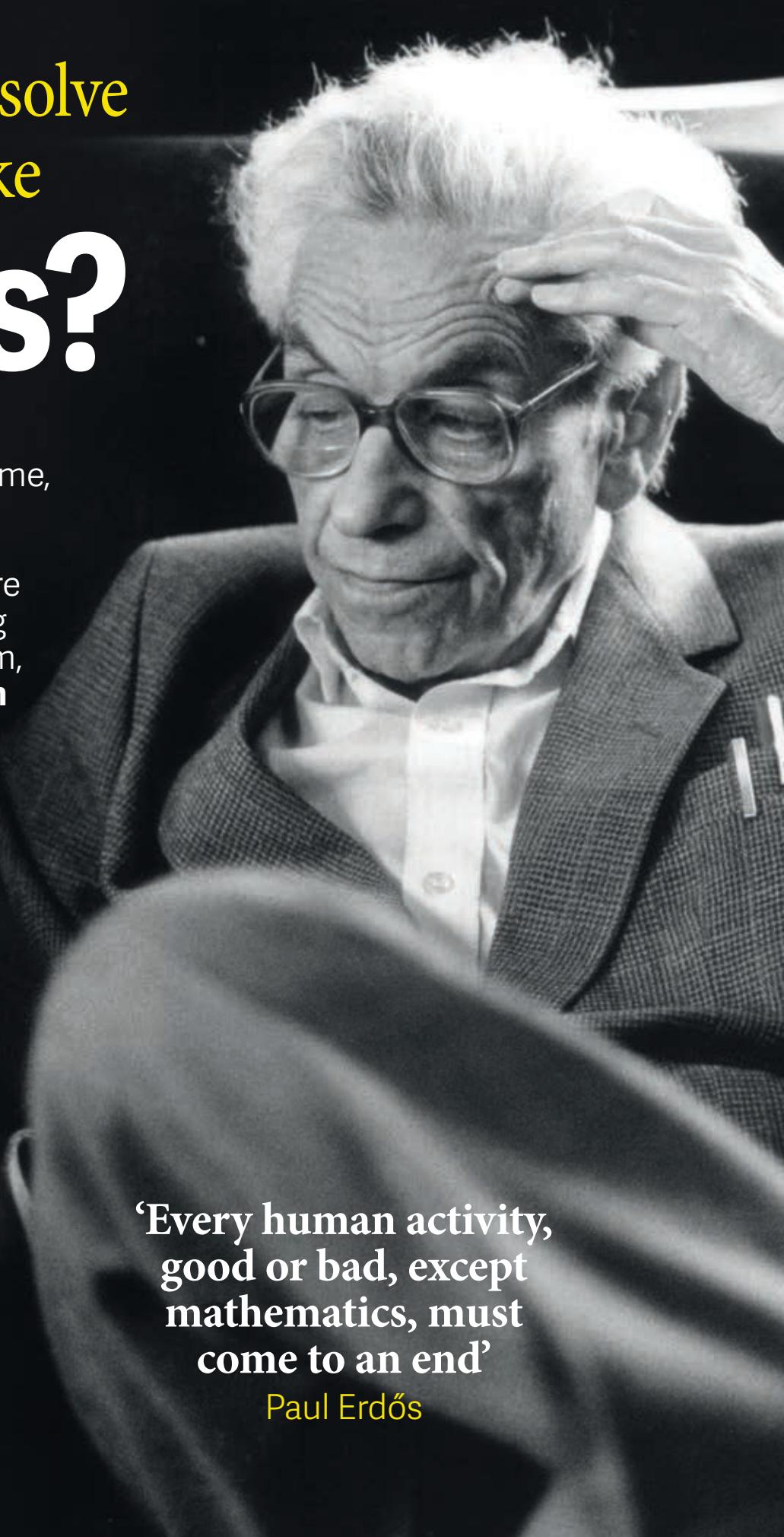
How do you solve a problem like **Erdős?**

The most prolific mathematician of all time, Hungarian Paul Erdős was stereotypically eccentric – in that there was absolutely nothing stereotypical about him, says **Andrew Treglown**

Iwonder what passers-by made of him: a slightly hunched figure, bespectacled, carrying his worldly possessions in a battered old suitcase. If you were to see him queuing for one of his frequent flights across the world, you wouldn't know that he was one of his generation's greatest mathematicians.

Then again, you might have spotted something different about him. Maybe you would have noticed his special passport, which gave him the rare freedom to travel in and out of Communist Hungary. Or perhaps you would have been drawn to his unique style of speaking English, learnt from his father Lajos, who taught himself the language while in captivity in Siberia.

Paul Erdős was born in Budapest in 1913 to two Jewish maths teachers. Tragedy struck his family just days before his birth – both of his sisters died of scarlet fever, a trauma that deeply affected his mother, Anna. She was extremely



'Every human activity, good or bad, except mathematics, must come to an end'

Paul Erdős

protective of her son, and he spent much of his childhood being home-schooled. It was also during his early years that his father was held as a prisoner in Russia during the First World War.

In his solitude – and with a house full of maths books – Erdős became a prodigy. When he was four, he would tell his mother's friends how many seconds for which they had been alive. As a teenager, he regularly provided solutions to problems posed in school maths magazines. He began to make a name for himself while at university in Budapest, giving an elegant new proof of Chebyshev's theorem, which asserts that there is a prime number between any whole number bigger than one and its double.

A nomadic life

After obtaining his PhD in 1934, Erdős moved to the UK, to Manchester, for a post-doctoral fellowship – in part due to the worsening situation for Jews in Hungary. This was followed by temporary positions in the US, at Princeton University and other institutions. Despite offers, he never took up a permanent post at a university, and his lifestyle became increasingly nomadic as the years passed. Most of it was spent travelling from place to place, working with more than 500 different mathematicians across the world. This suited him: he considered private property a nuisance and did not want the constraints and responsibilities of an academic job.

While visiting a fellow mathematician, Erdős would usually stay with them and their family. He hadn't picked up some of the basic skills in life (he was an adult when he first buttered his own bread) and was therefore an extremely demanding house guest: his co-authors would have to chauffeur him around, wash his clothes, cook his meals, buy his plane tickets, manage his finances and so on.

Delegating these day-to-day tasks meant he could devote most of his waking hours to mathematics. He often spent 19 hours a day on research, fuelled

ERDŐS SAID...

"It is not enough to be in the right place at the right time. You should also have an open mind at the right time"

"I could probably boil an egg, but I've never tried"

"Finally, I am becoming stupider no more" – the epitaph he wrote for himself

by copious amounts of coffee and, to his friends' concern, amphetamines. He continued to work frenetically until the day he died in September 1996, at the age of 83.

In theory

Paul Erdős' legacy is vast. Not only was he the most productive mathematician of all time, writing more than 1,500 mathematics papers, but the range of areas he worked in was also extraordinary,

including graph theory, number theory, analysis, probability and set theory.

Erdős was a problem solver rather than a theory builder. He was drawn to finding solutions to problems that were often simple to state, as well as posing new mathematical questions of his own.

One of his favourite subjects was Ramsey theory, which studies the phenomenon that 'complete disorder is impossible' in large-enough mathematical structures. Consider, for example, the whole numbers 1 to 10. However you order them, you will always find a sub-sequence of four numbers that form an increasing or decreasing sequence. For example, in the sequence 3 2 1 6 5 4 9 8 7 10, the bold numbers (1, 4, 7, 10) form an increasing sequence. Notice, however, that no five numbers in this sequence form an increasing or decreasing sequence.

This example is a special case of a more general result, proved by Erdős and his compatriot George Szekeres: if you take a large enough sequence of numbers, you can find long sequences that are either increasing or decreasing, however you order them.

Ramsey theory appears in unexpected places. In a group of six people, whoever they are, there are always three who have met before – or, failing that, three who have never previously met. This is not necessarily the case for a group of five people, though! Meanwhile, groups of 18 people always contain four who have met before or four who have never met; this is not true for some groups of 17 people.

What about the corresponding problem of five people who have all met or never met? Six people? Seven? Remarkably, no one knows how large the group needs to be in these cases. Mathematicians have shown that in a group of any 48 people there will be five who have all met before, or, failing that, five who have never met. We do not know if that is the case in all groups of 47 people.

How can mathematicians not know the answer to this question? The problem lies in the fact that we need to know if every group of 47 people has this property or not; there are simply too many parties to consider. The number would be hundreds of digits long, too many to easily check even using a computer.

Despite the difficulty of this problem, one of Erdős' major contributions was to provide a lower bound for the size of group needed in general. His ingenious idea was to attack the problem with probability theory – a concept now called the probabilistic method.

What's your number?

Although Erdős was a problem solver, whole theories have emerged from his work; for example, there is now an entire textbook dedicated to the probabilistic method. The scope of his research was so extensive that mathematicians like to measure their distance to him through 'Erdős numbers': if you have written a mathematical paper with Erdős, you have an Erdős number of 1; if you have written a paper with someone who has written a paper with him, you have an Erdős number of 2; and so on.

While I am delighted to have an Erdős number of 2, his reach was such that you would be hard pressed to find a mathematician with an Erdős number of much above 5. Even today, hundreds of the problems he posed remain open and many mathematicians have dedicated years of their lives to solving them. For these reasons, in my mind, Paul Erdős is undoubtedly the mathematical icon of the 20th century.



ANDREW TREGLOWN
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Effective data management plays a pivotal role in handling extensive volumes of information, such as customer information, policy information, risk evaluations and claims records. This is more pronounced in direct personal lines, where there is a huge amount of data and effective business management requires a database solution.

Database selection has a significant influence on data processing, analytics and modelling when making data-driven decisions. Here, we compare structured query language (SQL) and not-only-SQL (NoSQL) databases in the context of the insurance industry.

SQL and NoSQL

SQL databases have long been the preference in the insurance sector due to their proficiency in managing structured data. They offer robust data integrity and enforce rigid schemas, making them highly suitable for tasks such as policy administration, pricing calculations and ensuring regulatory compliance. Their adeptness at handling intricate relationships and providing strong transactional capabilities makes them ideal for claims processing and financial reporting.

IMAGE: SHUTTERSTOCK

Well-known SQL databases include MySQL (open source), PostgreSQL (open source), Microsoft SQL and Oracle. Common SQL editors are DbVisualizer (open source) and Microsoft's SQL Management Studio. Many programming languages, such as R and Python, can also operate SQL databases through commands and external packages.

An SQL table looks like an Excel table (see *Table 1*).

TABLE 1: Example SQL table

Policy_ID	Sum_Insured	Postcode	...
1	1000	E1 6AN	...
2	5000	SO14 7DW	...
...

However, the insurance sector is increasingly adopting the use of NoSQL databases, especially when handling unstructured and semi-structured data. These are good for storing application programming interface responses, such as pricing requests, because the output data structure constantly changes as the pricing infrastructure evolves. This output data structure is usually in the form of JavaScript Object Notation (JSON) and eXtensible Markup Language (XML).

NoSQL databases provide remarkable levels of flexibility, scalability and

performance, allowing insurers to efficiently store and analyse various data types, such as sensor data from connected devices, sentiment analysis from social media and telematics information for usage-based insurance. Prominent NoSQL databases include MongoDB, Cassandra and Redis, while NoSQL Editors include MongoDB Compass and NoSQLBooster. Like SQL, NoSQL can be operated using programming languages. It can be connected to SQL servers and queried from them in SQL format, or saved directly in a column and queried as NoSQL.

A NoSQL file looks like a Python dictionary. *Figure 1* shows the data from *Table 1* as a NoSQL file:

FIGURE 1: Example NoSQL file

```
{
  "Policy_ID":1,
  "Sum_Insured":1000,
  "Postcode": "E1 6AN",
  ...
},
{
  "Policy_ID":2,
  "Sum_Insured":2000,
  "Postcode": "SO14 7DW",
  ...
}
```

Datasets and match

When you're dealing with data volumes on an insurers' scale, what's the best way to manage them? **Yiannis Parizas** and **Phanis Ioannou** serve up the newer NoSQL against the tried-and-tested SQL



A major difference between the two is that SQL would need a unique join to a second table to store sub-items, while NoSQL offers nested tables (*Figure 2*).

FIGURE 2: An example of nested tables in NoSQL

```
{
  "Policy_ID":1,
  "Items":[
    {"Item_Type": "Painting", "Sum_insured": 500},
    {"Item_Type": "Jewellery", "Sum_insured": 2000}
  ],
  ...
  {
    "Policy_ID":2,
    "Items":[
      {"Item_Type": "Bicycle", "Sum_insured": 300}
    ],
    ...
  }
}
```

JSON versus XML

Both JSON and XML bring unique benefits and factors when used in NoSQL databases. JSON is widely favoured because of its compatibility with JavaScript, which makes it a natural fit for contemporary web development and enables effortless integration with JavaScript-based applications. Its compact

syntax and ability to handle nested structures make it well-suited for managing intricate data hierarchies.

FIGURE 3: An example of JSON data

```
{"authors": [
  {"firstName": "Yiannis", "lastName": "Parizas"},
  {"firstName": "Phanis", "lastName": "Ioannou"}]
```

On the other hand, XML's adaptability in creating custom data types and intricate data structures renders it a suitable choice for specific NoSQL applications. It provides comprehensive metadata (a set of data that describes and gives information about other data, such as the version of the pricing model that produced the data) capabilities, proving advantageous in situations that demand detailed data descriptions.

FIGURE 4: An example of XML data

```
<authors>
  <author>
    <firstName>Yiannis</firstName>
    <lastName>Parizas</lastName>
  </author>
  <author>
    <firstName>Phanis</firstName>
    <lastName>Ioannou</lastName>
  </author>
</authors>
```

JSON usually exhibits better results than XML in NoSQL databases because of its simpler structure and lower data weight, leading to faster parsing and reduced storage overhead. However, when deciding between the two for NoSQL databases, the choice should rest on what it is being used for. JSON is favoured for its simplicity and compatibility with modern web development, while XML may be preferred when dealing with complex data structures and extensive metadata requirements.

Comparing SQL and NoSQL

SQL databases offer a robust framework with which insurance companies can maintain data consistency, accuracy and adherence to compliance requirements. The relational model and SQL querying language facilitate seamless execution of complex joins, aggregations and reporting tasks. With robust transactional support, SQL databases guarantee the reliability of crucial insurance processes such as policy management and claims processing. Additionally, SQL

databases boast mature security features, making them a good choice for safeguarding sensitive customer data.

NoSQL databases offer horizontal scalability and distributed architectures, enabling seamless management of extensive datasets – useful in the insurance sector, with its substantial and dynamic data volumes. For instance, insurers can leverage columnar databases for efficient storage and querying of large claims data, or opt for document databases to store policy documents and associated information.

Selecting the best solution

NoSQL databases offer distinct advantages for insurers with specific needs. They are continuously evolving, and benefit from a growing community and specialisation for specific use cases. They excel in performance and scalability, allowing high-performance data processing, real-time analytics and horizontal scaling through their distributed architectures and sharing capabilities. In addition, NoSQL databases make the management of unstructured and semi-structured data more efficient, with their ability to handle diverse data types such as customer profiles, telematics and weather data.

SQL databases, meanwhile, maintain their position in the industry due to their maturity and ecosystem. With a well-established history, they come with extensive support in the form of widely available tools, frameworks and expertise. Additionally, SQL databases are preferred for ensuring compliance and data integrity, as their rigid schemas and robust data integrity features provide a suitable solution for enforcing regulatory standards and maintaining consistency in critical operations.

Choose wisely

Selecting the appropriate database solution is paramount for efficient data management, analytics and modelling. Insurers must assess their specific needs, considering data variety, performance, compliance requirements and ecosystem support, to make an informed decision that aligns with their goals and objectives. If we can strike the right balance between SQL's foundation for structured data and NoSQL's flexibility and scalability, we can unlock the true potential of data in the insurance industry.



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The credible journey

Juan Ignacio de Oyarbide and **Federico Chiacchiarini** explain how credibility theory can smooth geographical risk factors in pricing

The geographical risk factor is often one of the most predictive and discriminative variables used in actuarial pricing.

Generally, rate spread ratios between low and high-risk areas could reach 3:1 in a standard motor third-party liability business. Actuarial professionals, underwriters and regulators pay special attention to this factor due to its high impact on rates.

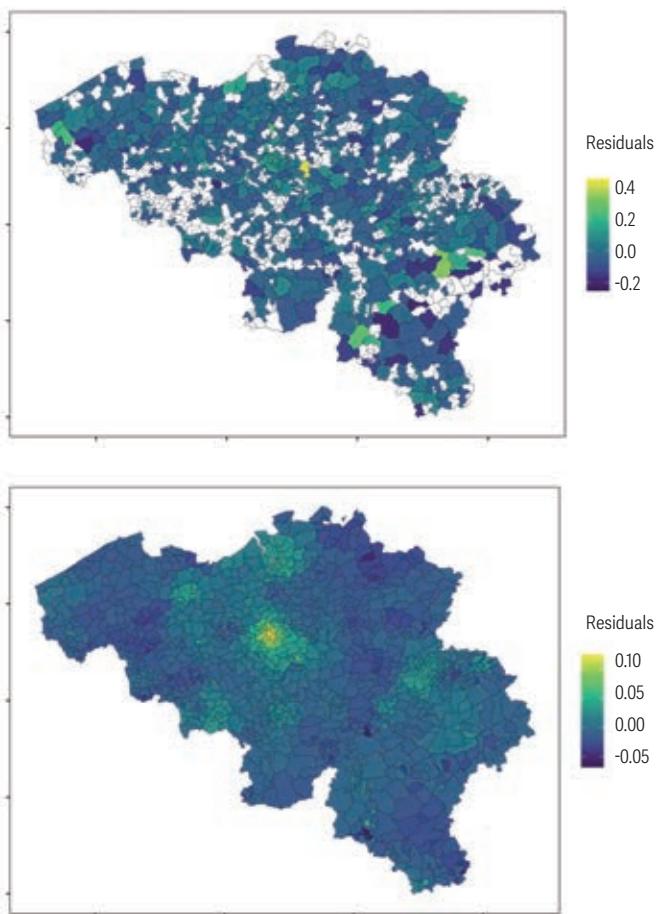
Traditionally, pricing practitioners would get consistent loss estimates by pooling a large group of insureds, for example by regions or provinces; this did not involve any major actuarial modelling challenges. In recent years, however,



postcode or Lower-layer Super Output Area. A credibility estimate is simply the weighted average between a territory's own experience and that of its neighbours. Its application allows the identification of geographical risk patterns that would otherwise be hard to visualise. With these estimates as a starting point, insurers can build a geographical rating strategy.

Nowadays, the use of this framework has been extended to model residuals generated by multivariate techniques such as generalised linear models, accounting for the correlation between geographical

FIGURE 1: Raw frequency residuals (top) and smoothed residuals (below)



increased competition and computational resources have led to the implementation of advanced geographical classification systems. Insurers try to avoid the adverse selection generated by pooling low and high-risk areas.

Although there are several classification techniques in the actuarial literature, it is important to effectively assess and communicate the impact of pricing decisions in terms of geographical risk mutualisation and business performance. Credibility theory is a framework that allows analytical choices to be effectively assessed and communicated.

Credibility theory in geographical pricing

Credibility theory provides a consistent way to smooth randomness due to a lack of exposure in any risk group. This quality often occurs when working with granular geographical segmentation such as

and other risk factors. *Figure 1* shows an example of the application of credibility-based smoothing on a frequency residuals map from a Belgian motor third-party liability dataset.

The smoothed map shows that high-risk zones (high residual values) are found in Brussels and other central cities. Territories without exposure (white areas in the map) now have estimates from using neighbours' information. Another important aspect is the degree of smoothing reflected in the residuals' colour scale. This characteristic is fully dependent on the selection of credibility parameters.

Impact on risk mutualisation

Two important dimensions must be considered during the smoothing:

- **Area of influence** – how far the risk is spread, determined by a distance-adjustment parameter

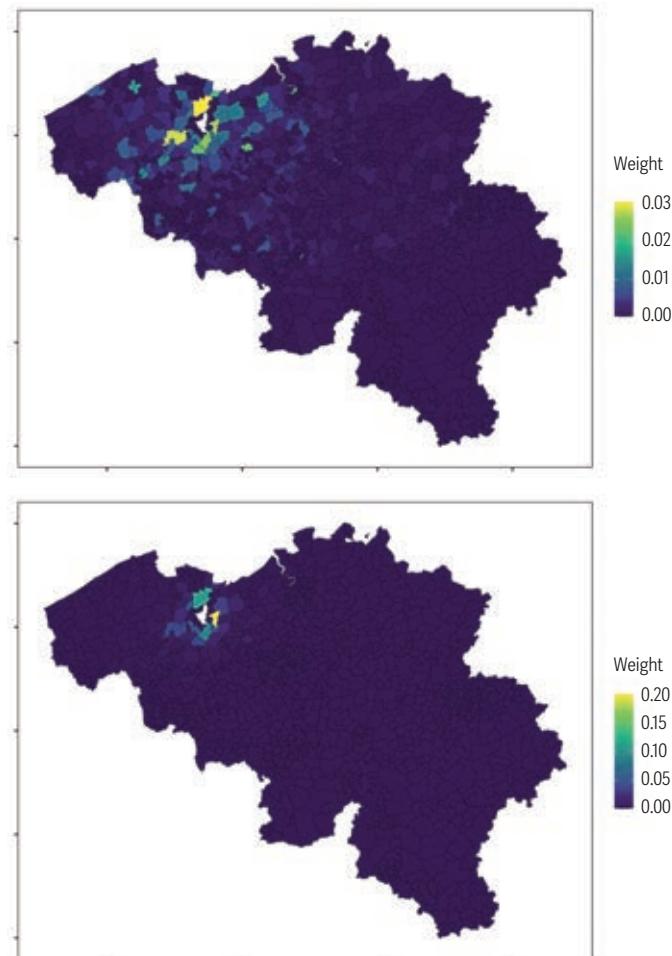
- **Risk mutualisation** – how much the area of influence's neighbours participate in risk estimation, determined by the well-known Bühlmann credibility parameter.

Defining these parameters requires expert actuarial judgment. Candidate values can be obtained by optimising an error function such as the smoothed map presented in *Figure 1*, proposed according to pricing and underwriting policies, or a mix of both. In either case, it is necessary to disclose the chosen parameters and ensure you clearly understand their impact on risk mutualisation. Rating territories do rely on decisions made during the smoothing process.

Several motor insurers optimise an error function and then focus on clustering and delimiting; some improve performance by creating map partitions before optimising. This practice has improved substantially in portfolios that are extended over different geographies, such as that of an insurer whose business spans three states on the US West Coast. A partition between Wallonia and Flanders in the Belgian dataset has also improved predictive accuracy, due to the two regions' differences in factors such as altitude, road quality and population density.

However, the area of influence and risk mutualisation factors are rarely discussed. For instance, to show the implications of the area of influence amplitude, you can simulate scenarios using different distance-adjustment parameters. *Figure 2* shows the

FIGURE 2: Ghent neighbours' weights: wide area of influence (top) and concentrated (below)



Credibility theory, with its simple interpretation, offers a bridge between parameters and concepts such as risk mutualisation

resulting weights for a territory in the Belgian motor insurance dataset using two extreme parameter values.

The distance-adjustment parameter determines the extent to which risk is mutualised. Wide areas of influence with a high Bühlmann's credibility parameter lead to less geographical variation, fewer rating territories and greater risk mutualisation.

When creating new rating territories, it is important to discuss the impact of credibility parameters. Moreover, connecting their selection to other statistical and business performance measures improves pricing decision-making and increases the chances of success for the insurer.

Tools for assessing geographical pricing

Lift curves are useful for measuring a model's performance with a new geographical classification system. The steepness of the curve shows how much a model differentiates between low and high-risk individuals, and the curve also provides a goodness of fit for ranked segments. More simply, the Gini index can summarise predictive performance gains.

Another aspect to consider is the consistency of rating variables when a new geographical segmentation has been implemented. Increasing granularity can provoke undesired results in some areas – for example, on average, pick-ups are less risky in one small territory than in the rest. With overall performance gains, there might be offsetting effects in some portfolio segments.

A fair and transparent strategy

The creation and implementation of new rating territories is complex and time-consuming, requiring agreement among pricing practitioners, underwriters and decision-makers. The actuarial literature includes various advanced methodologies for developing tailored geographical segmentations but it is challenging to translate the insurer's strategy into the maths and explain the reasoning behind smoothing or clustering decisions.

Credibility theory, with its simple interpretation, offers a bridge between parameters and concepts such as risk mutualisation. Remarkably, there are clear connections between credibility parameters and the degree of smoothing, which, in turn, controls geographical cross-subsidies. The resulting smoothing plays a central role in defining rating territories.

Some practical tools are valuable in ensuring sound geographical pricing decisions. Disclosing credibility parameters, lift, Gini or consistency measures can be helpful both within and outside the organisation. These tools can contribute to the development of a fair and transparent rating strategy for insurers, supported by a solid actuarial base.



Host with the most – the cloud hosts the IT you want; it also offers a host of knock-on benefits. **Aristides Zenonos** describes the key choices, and the latest developments

The concept of digital transformation has gained significant attention recently. It involves integrating digital technologies across an organisation's operations, reshaping how they deliver value to customers, optimise internal processes and maintain competitiveness.

One essential aspect of it is the migration of data from traditional storage systems to a centralised 'data lake' that is hosted on the cloud, while leveraging the powerful processing capabilities offered by cloud platforms. This opens up opportunities for data-driven solutions and the optimisation of business processes, enabling organisations to modernise their systems and adopt new software applications.

In the actuarial sector, motor and health insurance stand out for their handling of substantial data volumes. Today, as insurers seek enhanced precision, flexibility and efficiency from their digital tools and ecosystems, cloud computing is redefining the actuarial profession and enabling a wealth of new possibilities.

What are the definitions?

Cloud environments encompass the flexible provision of computing power, databases, storage, applications and other IT resources through the internet; delivery of these services is referred to as cloud computing. An on-premises environment involves the deployment of resources within an organisation's internal IT infrastructure.

In simpler terms, on-premises refers to the physical servers and infrastructure on an organisation's literal site, while the cloud refers to remote resources that are managed by a cloud provider somewhere else.

The three major players in cloud computing are Amazon Web Services (AWS), Microsoft Azure and Google Cloud Platform (GCP), which currently have market shares of around 32%, 23% and 10% respectively.

Control

On-premises environments give organisations complete control, ensuring the infrastructure is self-contained and eliminating the need for third-party involvement. This offers a sense of security and mitigates issues around internet connectivity or remote servers. They can also be advantageous in situations where organisations rely on legacy systems that are particularly difficult to migrate to the cloud.

Cloud environments obviously offer less control, as they rely on third-party providers. One significant advantage, though, is the flexibility. There are three main categories of cloud services: Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).

IaaS essentially forms the foundation, providing the building blocks for network access, computing power and data storage. It offers maximum flexibility and control over IT resources, which can be tailored to an organisation's needs.

PaaS is in the next level up. It removes the burden of overseeing the underlying infrastructure, enabling users to develop and manage applications without worrying about operating-system updates or hardware maintenance. Fully managed services such as data warehousing and machine learning modelling options fall under PaaS, such as AWS Redshift or GCP BigQuery and AWS SageMaker and GCP Vertex AI.

At the top is SaaS, which offers complete, ready-to-use applications that eliminate the

need for installation, configuration or maintenance on users' own systems. With SaaS, users can directly access fully functional cloud-based products, such as Gmail and Google Drive, without concerns about the underlying infrastructure.

By leveraging different cloud service models, particularly SaaS, end users can direct their attention to their primary tasks and actuaries can change the way they deliver value to clients. They can exploit machine learning and artificial intelligence (AI) to achieve higher accuracy in reserving, ratemaking, pricing and capital modelling. By analysing new data points, actuaries could address changing dynamics in life and pensions and understand emerging risks such as ESG (environmental, social and governance) – and even AI itself.

Deployment

Rapid deployment is essential for meeting user expectations in today's competitive market, making it critical when comparing environments. A benefit of cloud computing is its speed and agility. With cloud resources instantly available, they can be accessible to practitioners in just minutes.

On-premises environments, on the other hand, must be configured and maintained by the organisation so that they are accessible for practitioners. These set-ups often need more time, due to having to configure their own systems.

Cloud solutions excel at speed; data-driven solutions can be effortlessly deployed in multiple regions worldwide with just a few clicks, allowing organisations to deliver solutions with low latency and back-up options. However, it's important to note that on-premises environments can offer lower latency and faster response times in some cases, especially when cloud providers do not host resources in locations close to end-users.

Cost

Cost is where the two environments show significant differences. Cloud computing offers a 'pay as you go' model, which provides flexibility and cost optimisation. On-premises infrastructure, meanwhile, often involves a significant upfront cost but provides long-term cost predictability. Organisations can plan their expenses more accurately over time without worrying about things like potential price increases.



One of cloud computing's key advantages is its economy of scale. Cloud providers aggregate the usage of hundreds of thousands of customers, enabling them to offer lower prices. On-premises environments typically serve a single organisation, limiting the potential for cost optimisation through shared resources.

By adopting cloud computing, organisations can shift their focus away from managing and maintaining costly data centres and towards core business projects. This allows them to allocate resources to customer-centric initiatives and strategic endeavours, reducing overheads associated with physical infrastructure management.

Cloud computing is redefining the actuarial profession and enabling new possibilities

diverse actuarial workflow needs, ensuring compliance with global insurance industry regulations such as Solvency II and IFRS 17.

Hybrid solutions

All this said, there is another option: the hybrid cloud. This offers businesses the ability to host resources both locally and remotely. Simply put, it combines different computing environments to support application deployment and data management. It allows organisations to leverage the benefits of both on-premises infrastructure and cloud computing.

This approach is widely adopted because it provides flexibility and enables businesses to continue using their existing on-premises services while taking advantage of the possibilities offered by cloud computing. It offers a balance between control, security and scalability, allowing organisations to optimise their own IT infrastructure.

Positioning for success

Cloud computing has emerged as a leading force that is driving innovation. To stay competitive, an increasing number of companies are embracing digital transformation, and actuarial professionals are recognising the role of data readiness in leveraging the potential of data-driven solutions and AI. They understand that access to high-quality and abundant data is essential for optimising business processes.

Deciding between on-premise or cloud environments requires a thorough understanding of your organisation's circumstances. By considering factors such as data sensitivity, budget and resource requirements, businesses can make an informed choice. The goal is to create an infrastructure that supports operations, maximises efficiency, and positions the business for success in the technological era.



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Security

Many organisations place their trust in on-premises environments because the data remains on local machines, providing a sense of control and ownership. This is particularly crucial for industries with strict regulatory requirements or sensitive data that cannot be stored or processed in a public cloud environment. Industries such as healthcare and finance often have strict compliance and security requirements that necessitate maintaining data this way.

However, cloud providers' extensive network of data centres ensures high

availability, redundancy and disaster-recovery capabilities, which can be beneficial in ensuring business continuity. In addition, cloud providers nowadays follow strict protocols such as encryption, user and group permissions, and firewall components to ensure the safety of their data against malicious attacks.

It's true that an on-premises environment without direct internet connectivity provides more data security than the cloud. However, such isolated on-premises systems may lack a cloud-based solution's flexibility, scalability and collaborative features. Using the power of the cloud and tools such as version control and shared platforms promotes collaboration among staff.

In recent years, new approaches such as federated learning have emerged to foster collaboration while addressing data privacy concerns. Federated learning is a distributed method for training machine learning models; it operates in a decentralised manner, eliminating the need to transfer data from client devices to central servers. Cloud solutions also provide easily configurable functionalities and user permissions to meet

Brain-like neural networks are at the forefront of data modelling – but the results are like humans: no two are the same. **Jack Harrington** says initialisation is key to dealing with this problem of reproducibility

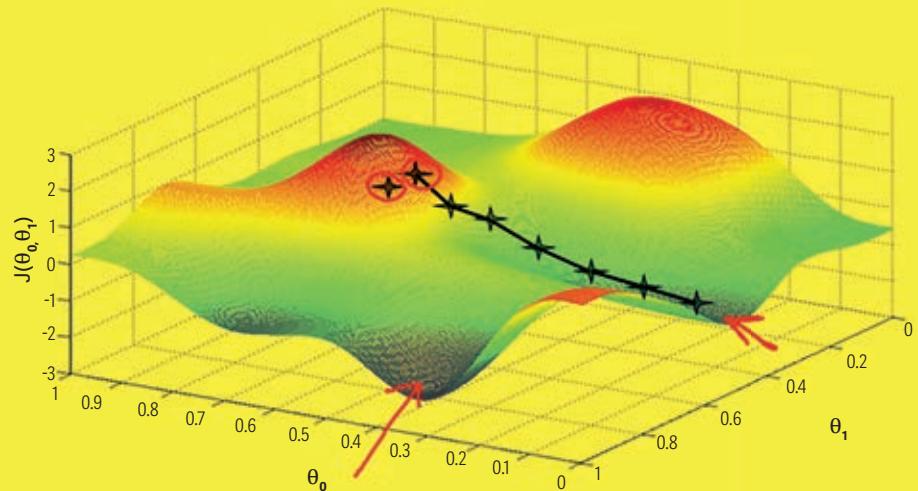


PLANTING

In the realm of cutting-edge innovations, neural networks – algorithms that mimic how our brains function in order to find data patterns – have emerged as powerful tools that could revolutionise various domains. While the prevailing discussions around machine learning often centre on issues such as bias, discrimination, privacy and transparency, one critical facet that merits deeper examination is the challenge of reproducibility.

Unlike many traditional statistical methods, neural networks may yield divergent outcomes even if identical inputs and parameters are used. Addressing this reproducibility issue requires us to delve into the role of initialisation values – a topic that remains somewhat underexplored.

FIGURE 1: Loss function Vs a model's feature weights



Unpredictable and inconsistent

In the pursuit of replicating results in neural network modelling, an unexpected hurdle arises. Following a standardised methodology guarantees identical outcomes when using a generalised linear model (GLM); neural networks, on the other hand, inherently lack this assurance. Even with consistent data, minimisation algorithms, stopping criteria and step sizes, the output may vary significantly between modellers. Achieving replicability entails employing the same initialisation values or seeds, but this practice, though helpful, is fundamentally arbitrary.

It's worth noting that the variation seen in GLMs often arises from methodological differences, such as polynomial choices or level groupings, rather than the optimisation process. Neural networks, however, present a distinct challenge due to the non-convex nature of their optimisation landscape.

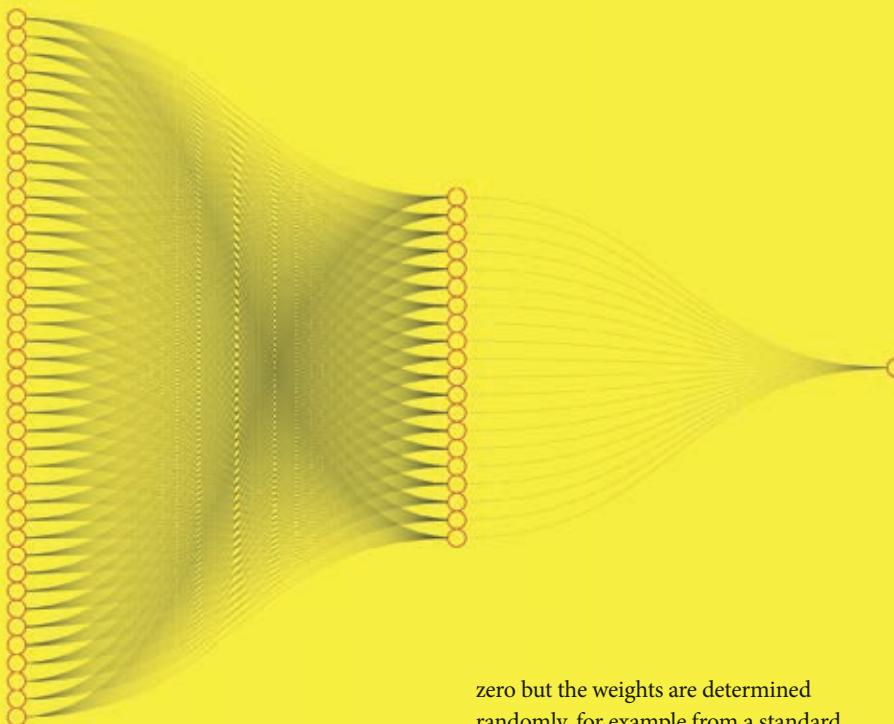
The initialisation challenge

A juxtaposition of neural networks and GLMs in the context of optimisation provides

insight into the crux of the issue. While both methodologies share the goal of minimising an objective loss function, their optimisation landscapes diverge significantly. GLMs, under the condition of a full-rank design matrix, have a convex optimisation problem, ensuring a unique solution. Neural networks, in contrast, often grapple with non-convex optimisation – particularly pronounced in high-dimensional scenarios. This complexity makes identifying the global minimum a formidable task, typically resulting in many well-fitting models rather than a single solution. To illustrate this let us examine a plot of a loss function against a model's feature weights (Figure 1).

Darker areas show where the loss function is minimised and red areas where it is maximised. The two red circles are different initialisation values (different seeds), the red arrows are the final values after optimisation. The black crosses chart the path under gradient descent for one of the initialisation values. A slight change in initialisation value results in a very different path.

THE SEEDS

FIGURE 2: Shallow neural network architecture

As we can see, a seemingly infinite area of suitably good models minimises the loss function sufficiently. We need to strike a balance whereby we avoid underfitting the model (red areas) but also avoid overfitting and losing the ability to generalise and predict well on unseen data (the extremely dark areas).

Initialisation effects in practice

To demonstrate the real-world implications of initialisation values, consider an application on the French Cars dataset predicting frequency. An exploration of a shallow neural network reveals the impact of different seeds on model outcomes (*Figure 2*).

In our neural network, the input layer has dimensions $q_0 = 40$ and the only hidden layer has $q_1 = 20$.

We fit two models, keeping everything the same except for the chosen seed. The biases in a neural network are often set to

zero but the weights are determined randomly, for example from a standard normal distribution, which will be influenced by the seed.

The two choices of seed produce comparably good models when using the Poisson deviance for our objective loss function (*Table 1*).

TABLE 1: Seed choice impact on loss (units 10^{-2})

	IN SAMPLE LOSS	OUT OF SAMPLE LOSS
SEED 1	23.9249	24.1259
SEED 100	23.9121	24.1293

While the overall differences in the predicted frequencies may appear acceptable – a median value of 1% and a mean of 1.8% – scrutinising individual policy levels reveals substantial fluctuations. We can see in *Table 2* that there is a maximum difference of 182% for an individual policy's predicted frequency.

TABLE 2: Differences in predicted frequencies

MIN	Q1	MEDIAN	MEAN	Q3	MAX
-60.0%	-6.3%	1.0%	1.8%	8.9%	182.0%

Consequences for actuaries

The variances observed in predicted frequencies due to different initialisation values present a significant challenge for actuaries. Instances where a different seed leads to nearly triple the predicted frequency underscore the potential for substantial discrepancies in premiums. Justifying such fluctuations to policyholders becomes an intricate endeavour, as the arbitrary nature of seed selection raises questions of fairness. The actuarial industry's aspiration for consistent and equitable customer treatment thus faces hurdles when incorporating neural networks into live rating practices.

Things to consider

When adopting neural networks, it is critical to consider the issue of reproducibility and the influence of initialisation values. As actuaries explore such networks' potential in refining rating models, it will become crucial to address these challenges. The industry needs to engage in further research to devise strategies that ensure fair and consistent customer treatment within the neural network framework. One consideration could be the introduction of a standard seed initialisation approach across the industry.

It could also be helpful to conduct sensitivity analysis to assess the stability of model outputs under varying initialisation values; this will help to identify the range of premium estimates, and provide insurers with a clearer understanding of the potential variability. Alternatively, implement model averaging techniques or ensemble methods that consider a range of models generated from different initialisations. This will allow insurers to obtain an aggregated estimate that reflects the average performance of multiple models.

Ultimately, it is important to have a comprehensive understanding of initialisation values' implications if we are to build a robust and trustworthy actuarial foundation in the age of neural networks.

Unlike many statistical methods, neural networks may yield divergent outcomes even if identical inputs and parameters are used



JACK HARRINGTON
is a member of the
IFoA Data Science
Working Party

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Moody's Analytics'
knowledge portal on
The Actuary website at:
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Broadening our modelling vision

In the fourth in a series of six articles on climate risk for insurers, Nick Jessop, senior director – research at Moody's Analytics, stresses the importance of knowing the modelling pitfalls and casting a wide net

It looks as though scenario analysis is here to stay as a preferred method for understanding climate risks. Already an important part of Task Force on Climate-related Financial Disclosures reporting, it is increasingly becoming an own risk and solvency assessment (ORSA) requirement. Climate scenario analysis has also formed the basis of regulatory exploratory (stress) testing, and looks likely to be incorporated into non-financial accounting disclosures.

A significant part of the work to leverage climate scenarios is acknowledging the limitations and omissions, and the model risks and uncertainties. How do we broaden our scenario sets and analysis, and therefore our interpretations and recommendations?

To do this well, risk managers are faced with a new lexicon to master: scientific uncertainty, environmental externalities, extreme outcomes like tipping points, green growth and socio-economic impacts.

1 The first limitation of any scenario analysis is to recognise that any one scenario will usually be overly precise – and precisely wrong. Scenarios are not forecasts and you can't capture adequately the expectations, risks and uncertainties without a range of scenarios.

In climate modelling, one parameter in particular, the 'climate sensitivity', is poorly constrained by science. Given the central role of it in driving impacts and physical outcomes, all climate work is best quantified in a probabilistic framework.

Doing this will also align the scenario analysis with broader approaches like Intergovernment Panel on Climate Change reports, which have uncertainty and consensus at their core.

2 The second limitation of any scenario analysis is what is missing; a large set of environmental, ecological and social impacts, known as 'externalities'. Most economic and financial scenario work focuses on the impacts that are monetised and shorter-term: productivity, damages and the social cost of carbon. But these don't capture a number of broader representative key risks; ecosystem damage, ocean acidification, deglaciation and sea level rises, and social/political upheaval. Given the significance of these, it is important to factor them into any scenario narrative.

3 The third limitation is closely related to the first two. If climate change occurs more quickly than expected, and the broader impacts trigger extreme 'tipping points', then outcomes could be much worse than expected. Several tipping points have likely occurred already – for example, the bleaching and die-off of sea corals, and the loss of summer sea ice in the Arctic. More extreme outcomes are expected as climate change continues, such as loss of ice sheets and slowdowns in the natural carbon cycle.

4 The fourth limitation is to recognise not just the downsides of transition scenarios (for example, stranded assets and inflation) but also the possible upsides. In climate

scenario modelling, it has become increasingly common to incorporate broader socio-economic trends. For example, associating a socio-economic move towards sustainability with lower emissions pathways. In particular, an assumption about green growth is commonly made, such as in the Shared Socioeconomic Pathway 1 and by the Glasgow Financial Alliance for Net Zero. More challenging scenarios would be to look at political economic responses like a move towards degrowth politics.

Conclusion

Identifying the missing components in climate scenarios is a critical step when interpreting the results and relevance to businesses. Factoring in the broader externalities and the associated 'tragedy of the horizon' should stop anyone from treating the exercise as a cost-benefit analysis to identify the 'optimal' pathway for their business. Likewise, consideration of extreme tipping points should generally caution against interpreting the scenario modelling as 'worst case' analysis.

Importantly, it can also help to suggest a broader set of scenarios to examine. Some of these, such as climate sensitivity or green growth, can be explored by building on existing modelling (for example, the Network for Greening the Financial System scenario database). Others, like tipping points and shared socio-economic pathways, will require a wider set of scenarios as their basis.

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I'M AN ACTUARY AND... CAMPAIGNER

At the back

Namir Chowdhury, a 25-year-old sustainable finance consultant at EY, is no stranger to promoting good causes on the world stage

How did you become a youth campaigner?

When I was 15, a girl my age posted something concerning on her Facebook page. I reached out and mentored her through a mental health crisis – nothing formal, just friendly conversation. It was eye-opening. If this was happening to a young girl in a small town, what about throughout the world? I wanted to do something helpful in a systemic capacity, so I joined my local youth cabinet. After that, I was elected as a member of the UK Youth Parliament, then a Regional Representative, and I now hold the Europe and Americas role for the Commonwealth Youth Council – the first person to do so from the UK. I'm proud of it and enjoy it but next year I'll leave it to someone else – it's crucial for new people to offer a fresh perspective.

What's your proudest moment?

I've spoken about the refugee crisis in the House of Lords, been invited to countries all over the world, and held discussions with King Charles, prime ministers and presidents. However, my proudest moment was during a public speaking workshop I delivered. One participant was a young girl with selective mutism. I spent some time coaching her and at the end she spoke her first word in eight years. Unforgettable.

What issues do you champion?

Early on, it was mental health – I spearheaded the Youth Parliament's mental

health campaign, which culminated in more than 100 schools implementing counsellors. I've since worked on a range of topics, from racial discrimination to voting rights for 16-year-olds. However, climate change is the defining issue of our time. I saw the impact of climate change-induced flooding on my family over in Bangladesh and it truly hit home that we need to act.

A lot of that action lies with governments and large corporates but young people can play a crucial role by presenting a compelling vision for the future. This is why I've been working on climate education and green jobs; preparing young people for the world they will inherit. As part of this, I co-led a movement during COP26 that convinced more than 20 countries to mandate climate education in their national curricula.

What impact does it all have?

Young people often hear: "That's a nice idea but what can you really do?" The answer, in short, is: a lot. Greta Thunberg's school strikes pushed climate further onto the agenda, Pacific students compelled the UN General Assembly to request an international court opinion on countries' climate obligations, and the climate education policy we advocated will change the education landscape forever.



Young people don't just carry influence – they mobilise. This summer, we convinced the Nigerian government to host a pan-African summit to bring young people together and relay their priorities to senior ministers.

What drives you to do it?

Every conversation you have is valuable because it brings you a new perspective, and every person is valuable because of their unique blend of experience and skill. We have a responsibility to use that for good. I've been lucky to have done everything I've done, met the people I've met and seen the places I've seen – it's essential not just to give back but also to use everything you've learnt to make a positive contribution. Of course, I'm spurred on by real-life events such as my friend's mental health crisis or floods in Bangladesh, but I do also feel an innate desire to act.

How do you find time for everything?

In many ways, it is like a second (but very fulfilling!) job. There's one particular project management tool I use, which is a lifesaver; it has everything I need to do for my job, my social action and my life admin. Sometimes things do fall through the cracks but I think that when you really want to do something, you'll make time for it and get it done.

You may all be actuaries but life is not about measuring risk and uncertainty in future events. It is about dealing well with risk and uncertainty in life – at least, it is if you want to cope well, experiencing less stress, less self-doubt and less self-flagellation. I write about this at some length in my books, particularly in *The Significance Delusion*.

Society has become very risk averse, largely because of our unreasonably positive expectations. We believe life should be wonderful, we're all 'worth it', and we are all entitled to happiness

and instant gratification. All the psychological, emotional and behavioural difficulties I have encountered during my work as a therapist and resilience consultant stem from one attitude: that 'I, Myself and Me' is at the centre of the universe.

With approximately eight billion people in the world, that can't be true. And the outcome is that there are more frustrated, disappointed and unhappy people than ever before.

I have come up with eight principles that should mitigate that solipsistic tendency, and have the effect of making you more mentally healthy, resilient and functionally efficient:

- See yourself as part of a bigger picture and feel connected to the rest of the world
- Recognise and value the past to help you predict the future
- Have confidence in life itself
- Have curiosity about the world
- Prioritise things other than personal feelings or emotions (although it's

important to understand them)

- Exercise self-discipline
- Be open to people, ideas and emotions
- Be able to let go.

How do these principles work in action? It's a human need to believe that things are personally significant to us (indeed, this is my thesis in *The Significance Delusion*), so let's look at a few situations that may be relevant to you as actuaries.

Think stakeholder, not transplant donor

Failure is a terrible word and a common fear – but does it have to be? It only has this power over us if we believe our significance as a person lies mainly in our work and workplace status: as chief operating officer at Boggs International, for example.

If we define ourselves as an individual first – 'I work as chief operating officer at Boggs International' – then that is a whole other

While wanting to manage risk in your actuarial work is clearly a good thing, it shouldn't be your approach to life. Braving the unknowns, says **Gillian Bridge**, helps us to become more resilient

THE VALLEY OF FEAR



ballgame. We are no longer defining our whole persona, and our success or failure as a person, in the same way.

Simply by redefining our relationship with the role, we can be committed to work but not too invested in it. Think stakeholder, not transplant donor. It then becomes possible to stand back, note any errors of thinking or performance, and take pragmatic action without the situation being clouded by self-doubt.

Failure should never be life defining, except when it leads to a creative solution. And those will be more likely when you see yourself as a rounded person who learns from experience, rather than a failed functionary.

Similarly, if a work model fails or doesn't perform as expected, take a leaf out of Sherlock Holmes's book: "When you have eliminated the impossible, whatever remains, however improbable,

IMAGE:ISTOCK



must be the truth." Sometimes you have to take things as you find them, and you may find what you're looking for.

It boils down to keeping an open mind and remaining curious about why things turn out the way they do. The usual protocols may not always apply. Don't forget the 'wise words' of former US defence secretary Donald Rumsfeld regarding known unknowns and unknown unknowns! We are constantly learning, so take the long view and think about how you will look back on a newly acquired experience.

See yourself as software that needs updating

When adapting to new regulations or ways of working, or acquiring new skills, it helps if you look at yourself as a tool or piece of software that has to be updated. You will perform better if you know you still have it in you to learn, rather than fearing or begrudging change. Keep your curiosity alive – as I explain in my books, curious minds are at the root of good mental health and resilience. Be interested in change itself, not in how you feel about it. Being over-emotional can block open-mindedness and even lead to cognitive impairment.

And should your performance be criticised at work, how do you bounce back? First, ask yourself, is the criticism justified? Is your main reaction hurt feelings? If so, remember that you are a fully rounded person who is not defined by their job, so you cannot be destroyed by criticism; you learn from it and perform better. You may even learn something from the critic – about their style of leadership, for example, and how you don't wish to emulate it with others. Step out of your feelings and into the shoes of a good strategist.

Similarly, if you don't get that promotion you felt you deserved, step back. Take a hard look at yourself, own any shortfalls in your personal or functional spheres, and take responsibility for learning from this outcome. Feeling oppressed by expectations can ruin your motivation, especially if those expectations are thwarted; understanding what you can do better is motivating.



GILLIAN BRIDGE
is a resilience specialist, therapist and executive coach. Her latest book is *Sweet Distress: How our Love Affair with Feelings Has Fuelled the Current Mental Health Crisis*



Harness those stress hormones

Mineworkers of the 19th century almost certainly endured more 'real' pressure and worked a lot harder and longer than most workers today – but did they feel the same pressure to perform? It's hard to say, but many workers today do say they feel pressure much of the time.

How should we deal with it? It's really a case of following the above advice, plus a few positive practicalities:

- Set short-term, practical and achievable goals, as well as long-term ones that are not easily fulfilled. Getting 100 words onto your screen is one thing, finishing your PhD is another
- Break a big task into bite-sized components and visualise progress by ticking them off
- Do something unrelated that has a result and provides satisfaction – clean a window, tidy a drawer
- Take a break and buy something nice, or go for a short run – do something as off-task as possible
- Look at the bigger picture – many people have it far worse than you
- Harness those hormones. Stress is essential and serves an evolutionary purpose – who wants to be relaxed in the face of a sabre-toothed tiger? Recognise the benefits of that stress energy and make use of it. Literally take charge and thank nature for being on your side
- Exercise, talk to people when you're out and about (even on the stairs and corridors at work), eat sensibly, sleep well, avoid too much alcohol and nicotine, and

express appreciation for some aspect of your working life every day, at least inwardly.

In the actuarial line of work, it's sensible to be relatively risk averse. However, if some of your risk aversion is related to putting yourself at the centre of everything – as in, 'I feel', 'I must', 'I need' – in order to feel or function better, then you may need to consider becoming more of a risk taker when it comes to the self. Don't protect its feelings too much, send it out into the world to adventure more, and let it be guided by a spirit of curiosity. You will be more resilient, and your mental world will be safer.

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Three to tango

Member puzzle 33

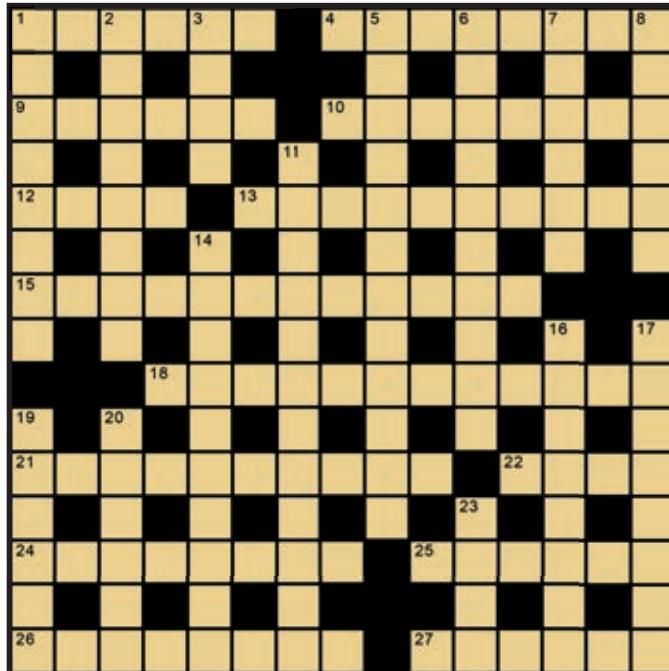
Courtesy of Prime

Down

- 1 Merit fee for working outside of office hours? (4,4)
- 2 Scout can change books (8)
- 3 Some incredible picture? (4)
- 5 Grief at error, shattering milk container? (12)
- 6 Poet with strong line supporting hot, aromatic plant (10)
- 7 King retained by segment in referendum result (6)
- 8 Manuscript covered in bear symbols (6)
- 11 Painful grunt, chewing nuts (3-9)
- 14 Worn-out dear struggling with breath (10)
- 16 Mocking father turned up in disreputable bar (8)
- 17 Sad time for singer (8)
- 19 Leaves without second book of the Bible (6)
- 20 What's inside grub is troubling restaurant (6)
- 23 Auditor's top dog (4)

Across

- 1 Imperfect rule accepted by US agent (6)
- 4 Ban for one bishop involved in strike (8)
- 9 Mathematician's cryptic clue I solved at last (6)
- 10 Fateful night's beginning to rattle rich (8)
- 12 Time to regret being accurate (4)
- 13 After KPMG, say, I'm touring university hall (10)
- 15 Actor's happy to drink at the worst pubs, initially (7,5)
- 18 Actress rejected smooth party ring (4,8)
- 21 Expert in twisting (PR, not disco dancing) (4,6)
- 22 Story containing loud sentence (4)
- 24 Lover of cloth, a riot when stripped (8)
- 25 Twins, for example, reversing car (6)
- 26 Old time rock and roll, extremely lacking (5,3)
- 27 Inscription on object (6)



Mensa

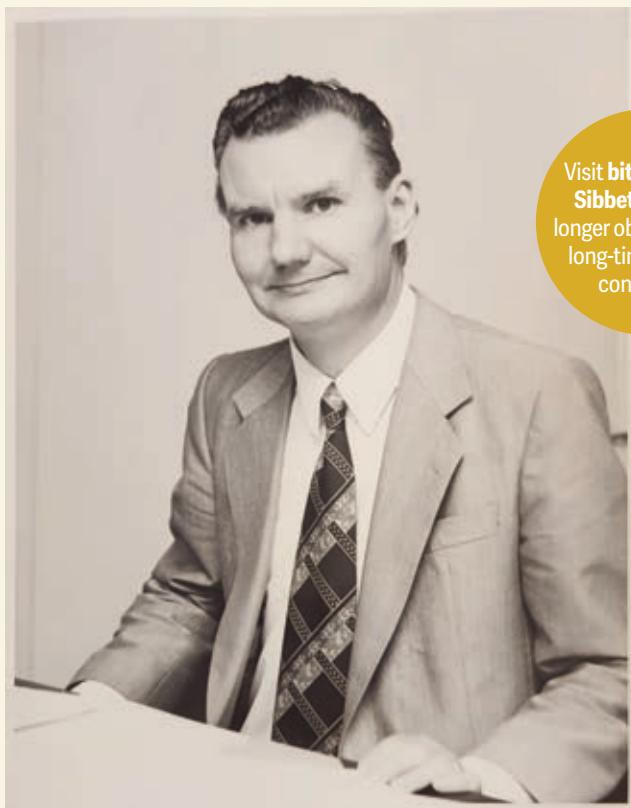
Drip, drip

Mensa puzzle 858

A car has travelled 50 miles at 70mph. It started its journey with eight gallons of fuel but the tank has been leaking throughout the journey and is now dry. The car completes 30 miles per gallon.

How many gallons of fuel does the car leak per hour?





Visit bit.ly/Trevor_Sibbett to read a longer obituary of the long-time Actuary contributor

DEATHS

It is with great regret that we announce the death of the following members. We offer our condolences to their families, friends and colleagues.

Raymond Anderson, a Fellow who joined in 1957

Peter Croucher, a Fellow who joined in 1967

George Harbitz, a Fellow who joined in 1988

Warren McGillivray, an Associate who joined in 1973

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> Read our article at bit.ly/PS_Sept23 or contact Ian Farr, a trustee of the Worshipful Company of Actuaries Charity, at ianafarr@gmail.com

OBITUARY

Trevor Sibbett

BY DAVID RAYMONT,
IFIoA LIBRARIAN

Trevor Sibbett died this summer on 1 July at the age of 87, having bravely battled aggressive cancer in his later years. Alongside his career as an actuary, he has been described as 'a leading light' of actuarial history, his contribution previously unsung.

Trevor was born in Walthamstow in November 1935, joining Guardian Assurance Company in 1952. He did his national service at Aldershot and then in Germany with the British Army of the Rhine's statistical department, from 1954-56. He was admitted as a student member of the Institute of Actuaries in March 1958, achieving Fellowship in September 1963. In a published Sibbett family history, Trevor's entry for himself is succinct: he 'worked as a life and sickness underwriter, marketing manager and actuary'.

A longer career note records his 'learning the ropes as a junior actuary' during the Sixties, revaluing policies following the Guardian's merger as the Guardian Royal

Exchange Group (GRE) in 1968. During the Seventies, Trevor collaborated with underwriters and medics to innovate GRE's permanent health insurance business, setting up GRE's linked life assurance in 1979. The following year, with David Graham, he outlined a template for a mortgage protection insurance policy that became an industry standard.

Trevor worked for Guardian and GRE for more than 40 years before retiring in 1997. His career was set against a backdrop of severe family health challenges at home, as his wife Pat was diagnosed with multiple sclerosis two years after they married.

Trevor's fascination with actuarial history grew from his interest in Guardian's archives; so began his collection of books on the science of insurances. His historical work was self-taught – reading secondary histories and making a forensic study of original primary source evidence of provident schemes. After his first article on the bicentenary of Griffith Davies (1788-1855, actuary for

Guardian and founding member of the Institute), Trevor would go on to contribute some 30 articles to *Fiasco* and *The Actuary* magazines. In 1985, he co-curated the exhibition *Some Landmarks in Actuarial Science* for Staple Inn Actuarial Society's 75th anniversary.

Publisher William Pickering approached Trevor to co-edit a facsimile presentation of key actuarial texts, resulting in 1995's 10-volume *History of Actuarial Science*. Co-editor professor Steven Haberman remembers: "He had an extraordinary knowledge of the history of actuarial science and of insurance, and I brought to the partnership a good understanding of the key theoretical developments and how these were followed up subsequently." Trevor, Chris Lewin, Derek Renn and Alex McKinnell formed an Advisory Panel to the Institute Library, raising the historical collection of pioneering actuarial texts to its current renown.

Pat's death in 1998 came soon after those of Trevor's parents, and he sought his way through grief by pursuing new activities – developing the German he knew well and enjoyed, learning other European languages, taking helicopter lessons (including a solo flight), dancing, walking, and travelling to countries across the globe. He was also a trustee for Colon Cancer Concern.

Trevor's funeral in July was well attended, with his Rambler Association friends leading the cortège, following his request for a positive and cheerful note at his passing. He is survived by his sons, Nigel and Nick, and his grandchildren.

Student Leap of faith



It's important to continually challenge yourself, reflects newly qualified **Ciara Izuchukwu**

Life is a journey of continuous growth and self-discovery. For me, the path to becoming a qualified actuary in the UK has been an adventure marked by embracing change and testing myself. From bidding farewell to Dublin to embarking on an exciting opportunity in Bermuda, and transitioning from life insurance to non-life actuarial science, my experience has taught me valuable lessons that have shaped my career and character.

Early on, I was fuelled by a passion for mathematics and the desire to apply quantitative techniques to real-world problems. Pursuing a degree in actuarial science laid the groundwork for my future. The academic curriculum exposed me to the core principles of mathematics, statistics and finance, providing me with a strong analytical foundation.

However, the true test began when an opportunity arose to work in the renowned insurance-industry hub of Bermuda. The move halfway across the world demanded courage, as it meant leaving behind the comfort and familiarity of my home city, Dublin. Nonetheless, I embraced the unknown and embarked on a new adventure. It was both thrilling and daunting, requiring me to adapt to a new culture and work environment. By embracing change, I gained a broader perspective and insights into actuarial practices on a global scale.

In Bermuda, I found myself drawn to the complexities of non-life insurance. The transition from life insurance to non-life actuarial science presented its share of hurdles: I needed to expand my skillset and delve into new methodologies to assess and manage risks in this domain. With this challenge, I learned to adapt again, further, and grow, broadening my knowledge base and immersing myself in a new area of expertise.

Welcoming change is not without its difficulties. The road to qualification demanded perseverance and resilience. There were moments of self-doubt, of course, and times when I felt overwhelmed by my profession's demands. However, even if it didn't necessarily feel it at the time, each obstacle was an opportunity to learn and

Each twist and turn in our journey can lead to personal and professional growth, shaping the actuary we become

grow. Support from colleagues and mentors allowed me to navigate uncertainties and build my confidence.

Actuarial science is a dynamic field, so personal and professional development (PPD) is crucial. Engaging in ongoing learning became an integral part of my journey. Embracing change meant challenging myself further, attending seminars and workshops, and staying updated with industry trends. PPD not only expanded my knowledge but also equipped me with the skills needed to thrive in a rapidly changing landscape.

Looking back, I can confidently say that accepting change and challenging myself has been the cornerstone of my PPD. Each decision to step out of my comfort zone has opened doors to unforeseen opportunities. I have grown as an individual and as an actuary, and become able to tackle the intricacies of my work with confidence.

Taking on change and challenging oneself is not merely a one-time decision but a continuous journey. From Dublin to Bermuda, and from life insurance to non-life actuarial science, my path has been filled with transformation. Aspiring actuaries should embrace change as an opportunity to learn and thrive. Each twist and turn in our journey can lead to personal and professional growth, shaping the actuary we become.

I urge all aspiring actuarial students to say yes to change and push their limits. Embracing the unfamiliar is where we unearth our complete capabilities, fostering development. Change is the driving force behind advancement and a gateway to a gratifying expedition in the ever-changing realm of actuarial science.



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RESERVING ACTUARIAL ANALYST

London, £55,000 + bonus

I'm currently working with a leading P&C insurer, who's looking to grow its commercial reserving team. Specifically seeking a commercially astute part qualified actuary, who's comfortable presenting to director level stakeholders. This role will cover all LoB's under commercial motor, primarily focusing on the quarterly reserving process. You'll additionally support ad-hoc internal modelling requirements, including reserving risk and loss forecasting. The ideal candidate has started progressing through the IFoA exams, has an actuarial background in general insurance, and a strong ability to adapt to new areas of the business.

Contact: sam.baker@eamesconsulting.com | 0207 092 3230

SENIOR R&D ACTUARY

South West/hybrid, up to £85,000

A leading wealth management organisation is looking for a qualified actuary to join their Research & Development function to take ownership of product development/pricing. Traditional pricing experience would be useful but there is flexibility - including wider commercial backgrounds or actuaries currently working in pensions. This is a visible team, with good exposure to senior partners and stakeholders and a rare opportunity for creative input into new solutions. It's also a chance to escape city life and enjoy a brilliant work-life balance in a stunning location. Our client offers a very flexible, hybrid-working model and are very open to candidates returning after a career break or parental leave.

Contact: jo.frankham@eamesconsulting.com | 0207 092 3263

OPPORTUNITIES FOR PENSIONS ACTUARIES

Nationwide, salary £depending on experience

Are you a pensions actuary looking for a new challenge? We currently have a wide range of opportunities - at a range of levels - for candidates from a pensions consulting background who are looking to broaden their horizons. Whether you are considering a move to another DB or DC consulting team, or if you're keen to expand your exposure to de-risking projects, or are targeting a transition into insurance - be that within bulk annuities, or wider life insurance roles, or even general insurance then we would love to hear from you! Please get in touch for a confidential discussion about current options in the market.

Contact: jo.frankham@eamesconsulting.com | 0207 092 3263

ACTUARIAL MANAGER

London/South Coast, £95,000 + bonus

I'm partnered with a leading home & motor insurer who are investing significantly in the growth of its actuarial team. This opportunity will sit within the motor team, taking ownership over various aspects of the reserving process and advising on longer term plans for pricing. You'll manage a small group of analysts, oversee elements of the quarterly and monthly reserve reviews, provide insight to a range of key stakeholders, and steer the actuarial teams strategy. The ideal candidate is a nearly/fully qualified actuary with a strong background in reserving. Management experience is preferred but not essential.

Contact: sam.baker@eamesconsulting.com | 0207 092 3230

SENIOR RESERVING ANALYST

London, up to £70,000

A Lloyd's/London Market insurer is hiring within their reserving department and they are looking to speak to those who have between 3-5 years' of experience. In this role you will gain exposure to a wide range of lines of business and work closely with senior actuaries on quarterly reserving. Key requirements include making good progress in the actuarial exams and ResQ experience.

Contact: hannah.turner@eamesconsulting.com | 0207 092 3249

ACTUARY (MIXED OF PRICING & RESERVING)

London, up to £85,000

New mixed opportunity! One of those rare ones, offering a blend of pricing and reserving. If you are a nearly/newly qualified actuary sitting final exams, this would be the perfect role to get you exposure to a new area in a mixed role. Our client is a forward-thinking MGA looking for an actuary, who will play a pivotal role in quarterly reserving, profitability reviews, pricing strategy investigations, and the development/maintenance of MI, rate monitoring, and pricing models. This role is integral to refining pricing parameters, enhancing profitability drivers, and ensuring compliance with regulations.

Contact: rafaela.fakhre@eamesconsulting.com | 0203 846 5909

CASE PRICING ACTUARY

London, £95,000 + bonus

A leading London Market insurer is looking to expand its corporate pricing team, hiring two nearly-newly qualified actuaries with a strong background in pricing. These positions will be case pricing focused, initially covering P&C, although quickly expanding to Energy and Specialty LoB's. Typical cases will be cross class deals involving multiple classes of business and participation in multiple layers of the tower. Candidates ideally have a strong commercial lines or London market pricing background.

Contact: sam.baker@eamesconsulting.com | 0207 092 3230

LONGEVITY RISK LEAD

Scotland/hybrid, up to £140,000

We are working on behalf of a leading insurance group with an exciting opportunity for a senior candidate with extensive experience in longevity. Leading a team of technical experts, you will apply your specialist knowledge in this field along with your ability to make high level judgements, building positive relationships with senior stakeholders in order to enrich and drive forward an industry-leading longevity function. This is an excellent opportunity to join an innovative organisation that reflects diversity and flexibility and play a key role in supporting the success of their growing bulk annuity business.

Contact: jo.frankham@eamesconsulting.com | 0207 092 3263

HEAD OF CAPITAL MODELLING

London, c.£160,000 (with flexibility)

This position requires you to lead the calculation of internal model capital requirements for the group. Reporting to the international CRO, you will have the support of a senior capital actuary and a senior analyst. The ideal candidate will be FIA with a strong academic record, significant general insurance capital modelling experience, preferably within the Lloyd's market. Strong knowledge of Solvency II, Lloyd's, and factor-based models would be advantageous. Knowledge of ReMetrica and Python would be a plus. This is the perfect opportunity for candidates who are looking to take up into a head of role!

Contact: rafaela.fakhre@eamesconsulting.com | 0203 846 5909

ACTUARIAL PRICING MANAGER

Surrey, £90,000 + bonus

I'm currently partnered with a leading home and motor insurer who are looking to grow their actuarial pricing team. This is a broad pricing position, shaping the direction of pricing across the business. You'll define and deliver pricing analysis, overseeing a team of 2-3. This will involve the integration of new pricing tools, moving into next-gen (opensource) pricing models over time. You will have close ties to the entire business, including pricing, portfolio, actuarial, and finance. In turn, you'll have exceptional career growth opportunities. The ideal candidate is a nearly/fully qualified actuary with a strong background in personal/commercial lines pricing and a strong commercial acumen.

Contact: sam.baker@eamesconsulting.com | 0207 092 3230

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OUR CURRENT ROLES

Non-Life Consultancy Capital Specialist

Location: London

Salary: Up to £120k + Bonus & Benefits

We are working with a boutique consultancy who are looking for a capital specialist to join their General Insurance team. You will be responsible for the delivery on projects in the capital space working with clients within the Lloyds and London Market. If you are looking for a role where you can see the effect of your work within a close-knit actuarial function, where work-life balance is a priority, then please reach out to learn more about this fantastic opportunity!

c.wright@gravitasgroup.com | 07765 134 727

Non-Life Global Insurer Pricing Actuary

Location: London

Salary: Up to £100k + Bonus & Benefits

Reporting to the Head of Pricing in Consumer Lines, the ideal candidate will have significant experience in technical pricing, and sound actuarial skills. The role also entails reviewing and creating pricing models, as well as participating in pricing and underwriting decisions. Get in-touch to learn more!

Life Insurer Risk Actuary

Location: London

Salary: Up to £150k + Bonus & Benefits

A well renowned Insurer is looking for a qualified Actuary to join as a Risk Actuary and work alongside the Chief Actuary. You will play a key role in decision making on all matters risk and engage with senior stakeholders on a regular basis. For this position you must have a strong ability to take on responsibilities and deliver in a timely manner

Location: Multiple locations

Salary: Up to £70k + Bonus & Benefits

Join a Life Consultancy firm that prioritises your work-life balance and advocates for employee wellbeing, while also providing you with exposure to a broad range of interesting and challenging work. As part of a new team, you are looking at new markets, working on credit and internal modelling and gaining a solid understanding of regulatory requirements. Actuarial analyst with a minimum of 2 years' experience.

a.gryson@gravitasgroup.com | 07523 342 006

e.nicholson@gravitasgroup.com | 07496 755 470

Non-Life Re-Insurance & Speciality Reserving Manager

Location: London

Salary: Up to £130k + Bonus & Benefits

The role reports into the Chief Actuary, who then reports to the CFO of this large, established company. The key interfaces offer the opportunity to interact with a range of stakeholders, including senior management, auditors, underwriters and underwriting management, and reinsurance teams, facilitating a broader understanding of the business landscape.

Life Big 4 Consultancy Risk Transfer Actuary

Location: Multiple locations

Salary: Up to £95k + Bonus & Benefits

Not wanting to be pigeonholed early on in your career? At this Big 4 consultancy you can get involved in a broad range of work across corporate, trustee and risk transfer! Further diversify your actuarial skill set and knowledge, whilst having access to an impressive portfolio of clientele. Reach out today to find out how this company can accommodate your career ambitions

Non-Life Contractors

Location: Hybrid/Remote

Rate: £750 - £1,600/day, Inside/Outside

FTC: £150k - £250k + Benefits

The demand for interim general insurance actuaries has seen a rise over the years and shows no sign of slowing down. We continuously receive high volume of requests across, actuarial transformation, temporary coverage for maternity/leave, and ongoing support for regular business operations, across Reserving, Pricing, Capital, and Risk functions. If you are nearing the end of your contract or considering transitioning to the interim market, feel free to reach out for a confidential discussion.

rupa@gravitasgroup.com | 07543 176 000



Rupa Pithiya



Alyssa Gryson



Max Hartley



Charlotte Wright



Emma Nicholson



Sam Cramp

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STAR ACTUARIAL FUTURES



HEAD OF BPA BUSINESS DEVELOPMENT Qualified LIFE SOUTH EAST / AGILE	SENIOR ACTUARY - BPA PRICING Qualified LIFE LONDON / HYBRID	SENIOR COMMERCIAL ACTUARY Qualified LIFE LONDON / HYBRID
SENIOR CAPITAL MANAGEMENT Qualified LIFE FLEXIBLE / HYBRID	SENIOR PROJECT ACTUARY Qualified LIFE FLEXIBLE / EDINBURGH	SENIOR RESEARCH ACTUARY Qualified / Part-Qualified LIFE LONDON / HYBRID
SENIOR MANAGER - LIFE MODELLING Qualified LIFE LONDON / HYBRID	ACTUARIAL PROJECTS SPECIALIST Qualified HEALTH LONDON / S.E. / HYBRID	INTERNATIONAL CONSULTING Qualified LIFE BERMUDA
PRODUCT PRICING MANAGER Qualified LIFE LONDON / HYBRID	COMMERCIAL PRICING - ANNUITIES Qualified LIFE LONDON / HYBRID	ANNUITIES REINSURANCE ACTUARY Qualified LIFE FLEXIBLE / HYBRID
STRESS & SCENARIO TESTING ACTUARY Qualified LIFE SOUTH WEST / YORKSHIRE / HYBRID	SEEKING CREATIVE THINKERS Qualified LIFE LONDON / HYBRID	CLIENT MANAGER Qualified / Part-Qualified LIFE FLEXIBLE / REMOTE
VARIED LIFE CONSULTANCY Qualified / Part-Qualified LIFE REMOTE	LEAD ACTUARY - START-UP Qualified LIFE PENSIONS NORTH WEST / HYBRID	COMMERCIAL LONGEVITY ACTUARY Qualified LIFE PENSIONS LONDON / HYBRID
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