

# THE EUROPEAN

European  
Congress of  
Actuaries 2022



# ACTUARY

QUARTERLY MAGAZINE OF THE ACTUARIAL ASSOCIATION OF EUROPE

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# European Congress of Actuaries 2022

On 2 and 3 June 2022, the Actuarial Association of Europe and the Instituto de Actuarios Españoles will hold the 4th European Congress of Actuaries (ECA 2022) in Madrid, Spain.

In total, more than 250 experts and executives from Europe and beyond are expected to join this year's congress. Given the remote experience of the Corona pandemic in the past two years, the ECA will be an excellent opportunity to meet with many peers of the European community of actuaries.

The onsite congress will feature a varied and inspiring program with excellent keynote sessions by renowned guest speakers as well as parallel sessions with experts presenting on the full scope of actuarial subject areas. Additionally, there will be the chance for networking after the regular congress hours as part of a typical Spanish evening event on the first evening.

And all of this in the vibrant, historical and cosmopolitan city of Madrid – the ideal conference host city and an attractive destination for actuaries from all over Europe thanks to its unique blend of history, art, culture, music, lifestyle and entertainment.

Find all information on the general information page.

# ASSESSING THE CYBERSECURITY RISK

Bart Groothuis is a Dutch politician serving as a Member of the European Parliament since 2020. He is a member of the Dutch conservative-liberal People's Party for Freedom and Democracy and is the Rapporteur on Europe's cybersecurity directive, NIS putting his years of experience in cyber security into legislative practice.

INTERVIEW BY  
**JENNIFER BAKER**

*What are the most prominent cybersecurity threats? Have these changed as a result of the war in Ukraine?*

'Well, it's always good to start with Adam and Eve, because the cyber threat is always evolving. I think that the cyber threat has actually evolved significantly because of COVID already. We saw a doubling of the number of incidents in my home country in 2019, and according to the FBI, a tripling in ransomware worldwide in 2020.

In 2021, we saw new spikes, and now, in 2022, we are being overloaded by the numbers of incidents across the Western economies. Worryingly, a majority of the ransomware gangs have their activity or are being nurtured

by the masterminds in Russia. It is not just a criminal problem therefore, it is also a foreign policy instrument for the Russian state: weakening the Western societal infrastructure. Weakening the way we earn our money. And that is not just a technical problem. It is not just a problem of insurance or cybersecurity measures. It is also a diplomatic effort that we should lay on the table and that, I think, is the phase that we're in right now.

Now, the security factor has evolved significantly in Europe. We see companies across sectors being attacked significantly, with demands of between 1.4% and 2% of their yearly revenue. So it's a significant threat by only a couple of gangs costing billions! As a politician, I must say it is just

unacceptable that we tolerate this, that a couple of gangs are getting into our economic structure and making us bleed every day. That's why I'm in Brussels making new legislation as a rapporteur on Europe's new cybersecurity legislation.'

*How has demand for cyber-related insurance coverage changed since the start of this year?*

'Well, I see insurance as a top up, as something extra, as a dessert in a good dinner. But as a basis, of course, you need a good meal. And the good meal is of course, good cybersecurity measures such as basic hygiene, password hygiene, two factor authentication, good >



## ***the actuary has a crucial function in protecting and guarding our society***

backups, etc. That's what will be demanding for the majority of the 160,000 new entities across Europe that will be assigned in this new legislation that I'm drafting. And these 160,000 entities will be heightening their cybersecurity posture in general. But there's also liability being introduced in this legislation. And guess what – the liability is 1.4% to 2% of their yearly revenue!

The philosophy is, you either give in to ransomware gangs because your cybersecurity wasn't that good. You pay a fine because your cybersecurity wasn't that good. Or, guess what, you invest in cybersecurity, because that's what we want – it's a waterbed effect. In the US, which is now introducing new emergency legislation, we can see a waterbed effect, so the hackers would rather go to Europe than to the US if you would heighten the posture there.

Now, back to the question on insurance. What I see in US insurance is that through legislation, CEOs are ensuring their cybersecurity posture. I think we could have something similar in Europe. I encourage companies to look at that because insurance companies don't have a large risk appetite – I guess that risk appetite is even much smaller than the legislation I'm drafting. So I see insurance as a dessert on a good

meal and I therefore encourage companies to do it. Meanwhile with this new legislation, the liability to the CEO is also about encouraging entities – those 160,000 entities – to do something with insurance. Ask yourself, what are my crown jewels? How can I segment my networks? How can I monitor this? How can I lower the risk appetite and therefore lower the amount of money I spend on my insurance? That's very important.'

### ***Are insurance policies appropriate or do we need to see more evolution as cyber activity grows? Are war and terrorism exclusions still common?***

'Let me first start with the duality of the security legislation in general that Brussels is working on. We have two main directives coming through in the next month. The first is the Network and Information Security (NIS) Directive, which is in the digital domain, and I'm the rapporteur on that one. But there's also the Critical Entities Directive, and that is about the physical security of critical infrastructure. But the annexes, or let's say the entities, overlap 100%. So it's very interesting to see that Brussels is working both on the digital and the physical security of these entities. Now, I think that in general, you could say that whenever there's

an act of God, an act of terror, an act of nature, that there is a certain responsibility there for governments to backfill that risk.'

### ***Looking to the future, the so-called NIS2 Directive is an overhaul of what was the original NIS. What are your expectations and hopes for the outcome looking to the medium or longer term? What would you like to see as the legacy of these new instruments?***

'Well, that's the best question. If you ask me, we're in a new phase. We used to be more reactive. An incident would occur and you would see how we could share information. Evaluate how you could share it among the community and see what you can do to support others. Now, what I want to see in this new legislation is a more *pro-active* ecosystem. If you have knowledge on new domains or IP addresses that could be used by threat actors, then you have to have something in place to thwart it. You must operationally work with the information to do something including outside of your own network. I want us to move from reactive, seeing what incidents are there, and how can we prevent repeats, to asking how can we even prevent incidents from occurring in the first place with more preventive action, >



***I think governments have been too lazy, to be honest***



**BART GROOTHUIS**

better servicing our entities, and especially thwarting those attacks before they even occur. We must do more to protect our entities and our businesses than we do now.

I think governments have been too lazy, to be honest. And I think that we're demanding a lot more from our entities and vital infrastructure to share information. I want that ecosystem to work. And unfortunately, it has to have teeth, so the CEO is now liable for the cybersecurity in their company, or entity, and this is very important, because otherwise nothing will happen. I've seen it and we've tried it before, and what we want now is to make sure that CEOs feel comfortable with cybersecurity because they have control. We can do it! It's not that hard, and we can

do so much more to thwart about 90% of the incidents. I think we are in a new phase and will have the best legislation this continent has ever seen – we'll do our best.'

***Finally, within that future, do you see a role for the European actuary as the risk manager of society?***

'Well, first of all, if for example, an entity would say 'I don't feel comfortable with the liability I currently am exposed to,' then you need the actuary as a sort of middleman to come as an expert and say, what are your crown jewels? How did you segment? What is the policy that you have? If I were an attacker, I would do this or this or this. Because you want to

be sure that you segment it, that you do something extra on top of the measures that I'm asking for in the new legislation being put forward.

So the actuarial advice is an extra, it's an add on, and it's very important to do so. And you can really reduce the bounties that people pay every month to the insurance companies. If you really look carefully at your network and work out what it is you actually want to protect, that is a very, very important job. So the actuary has a crucial function in protecting and guarding our society. And I wish you all the best and good luck with that because we're on the same page. We're fighting the same war. So let's make the best out of it.' <

# ENVIRONMENTAL REGULATIONS

## AN OPPORTUNITY NOT TO BE MISSED

BY **CHLOÉ COURSAGET** AND **LÉONORA LE QUANG HUY**

The number of environmental regulations is on the rise in Europe. The European Actuary talked to Chloé Coursaget and Léonora Le Quang Huy about their view that environmental regulations represent a strong lever for change in the insurance sector – rather like GDPR a few years ago.

*You're convinced that there is great transformational power in environmental legislation. Which laws are you talking about?*

Chloé: The Green Deal illustrates the ambitiousness of the transformation Europe is determined to make, and its aim of meeting environmental challenges and leading the world in this area. Regulatory change is the main tool, and this is of particular relevance to insurance as a strategic sector.

This is for two reasons: growing risk of course (unless insurers adapt, the consequences will be systemic); but also and most importantly, because of the sector's powerful ability to transform, both in an investor role and as the driver of prevention through changing the habits of insured parties. Non-life insurance >



**CHLOÉ COURSAGET**

is identified (in the first European taxonomy section, which came into force on 1 January 2022) as contributing to the mitigation of, or adjustment to, climate change and – in terms of cover, monitoring and prevention – must be aligned with environmental performance and not significantly harm technical criteria.

Another relevant point is the evolution of Solvency II, first through the delegated act published last August and effective August 2022, which covers sustainability risk within governance, and then through the planned revision of Solvency II. The challenges of this are in ensuring that climate and environmental risk management are more effectively built into the prudential framework and facilitating investment in a sustainable economy.

At the heart of the change, EIOPA has two tasks: to assess the specifically prudential treatment of assets linked to environmental objectives, and to regularly reassess the parameters of the standard formula relating to natural disaster risk.

As managers, issuers and distributors, insurers are also directly affected by all financial legislation, especially the standardisation of ESG reporting.

### *Is this an insurance revolution?*

Léonora: Definitely. The accelerated change in sustainability regulations will have an impact across the board and is set to reshuffle some competition cards. How can this not be an opportunity to create value? Everyone's results will eventually be open to comparison – particularly on taxonomy as they will be published in the same register.

Taxonomy, ESG standardisation and the new CSRD are all moving in the same direction, funnelling investment towards pro-transition activities. This rejigs the fundamentals by potentially differentiating insurers in terms of their attractiveness. As legal entities subject to the taxonomy, insurers need to keep their shareholders (who want ESG) and/or financiers (who are encouraged to prefer taxonomy-compatible projects) happy. The new rules on transparent non-

financial information and its standardisation will quantify their performance and make it directly comparable.

The impact of this will be felt in core strategy and so logically in all activities: asset management, the issue and distribution of financial products and also product design, pricing, prevention and client portfolio valuation, etc.

### *An opportunity for the sector?*

Chloé: Clearly yes. It's a major image opportunity to present insurers as the leaders of change, meeting the environmental challenge. This is a unique chance to move from being an unloved sector to winning the public over; from passively providing compensation to proactively being involved in a shared concern. It's also an opportunity to accelerate organisational transformation towards greater resilience, as the economy and risk undergo major upheaval.

### *What disciplines are affected?*

Léonora: From August 2022 internal audit, actuary, compliance and risk management responsibilities will include sustainability risk. But really all departments are affected. Everything will have to change: governance, subscription, legal, compliance, asset management, CFO, investor relations, HR, etc. Everyone, without exception, will have a part to play. And in recruitment, given that we have a very tough market where talented candidates demand a lot and compare potential employers, non-financial performance will certainly include employer brand policy and internal communications intended to motivate staff and activate their loyalty.

### *And actuaries?*

Chloé: Although actuaries could of course just apply the new requirements, why not look further ahead? Our coronavirus actuarial monitoring for the *Institut des Actuaires Français* demonstrated that teaching about risk and a culture of scientific approach are really important for improving society's perception of the sector. The actuaries we interviewed emphasised >

that actuaries need to work transversally with other scientific and operating fields. There was also personal questioning about the direction of work: couldn't environmental issues cover these topics too?

We believe actuaries are now being offered a rare opportunity for considering, developing scenarios, working and thinking differently, together with other players, to imagine what is possible in a complex, non-linear way. This is also the time to reconcile the long and short term as the present situation and disciplines require. Work on Solvency II changes has also revealed a wish to bring together annual standard formula management with an integrated multi-year approach (to investments and provisions).

### ***How can actuaries be part of the transformation?***

Léonora: Actuaries are well-placed to be closely involved in the change and to be real drivers of it. They know how to present risk from different time viewpoints, and how to assess it in terms of the action it requires from their company as well as the anticipated opportunities it presents for their company. Given the challenges and scale of this project and the actions required, we are offering advice to help those involved engage with teams so that they work and act together. This means creating a will, a conviction and the wish to work transversally, and also showing potential value. Depending on circumstances, motivation may come from the common good, the understanding of transition risk or competitive impulse. But wherever it comes from, the transformation challenge must be shared and must be the objective – for companies as well as for individuals.

*About Accroche-com': In the context of changing conditions, the agency is supporting executives with information about macro-trends and the spirit of regulations that could affect their strategies and business models. It provides strategic advice as well as research and economic intelligence to help them consider and make decisions. [www.accroche-com.fr](http://www.accroche-com.fr) <*



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# THE IMPACT OF CYBER RISK ON RISK MANAGEMENT

BY **CLEMENS FREY**

The market for cyber insurance is growing steadily, not least because of the Corona pandemic. Although insurers are currently underwriting cyber risks more restrictively, the German Association of Actuaries (DAV) believes that the economic importance of this line of business will continue to grow. For this reason, further work should be done to better understand these risks and to tailor management to their specific characteristics.

**A**ccording to a representative enterprise survey in Germany, two-fifths of companies said they had been the target of a cyber-attack in the past twelve months. In Germany, there were already nearly 100,000 cases of cyber-crime in 2018, and global damages amounted to one trillion, or 1,000 billion US dollars, at the end of 2020, according to a study by McAfee, almost doubling since 2018. The need for cyber insurance is growing accordingly. Current estimates of the market for cyber policies indicate a global premium volume of more than seven billion US dollars for 2020. By 2025, it is expected to grow to more than 20 billion US dollars, with annual growth rates of more than 20 percent.

## **CYBER INSURANCE RISKS**

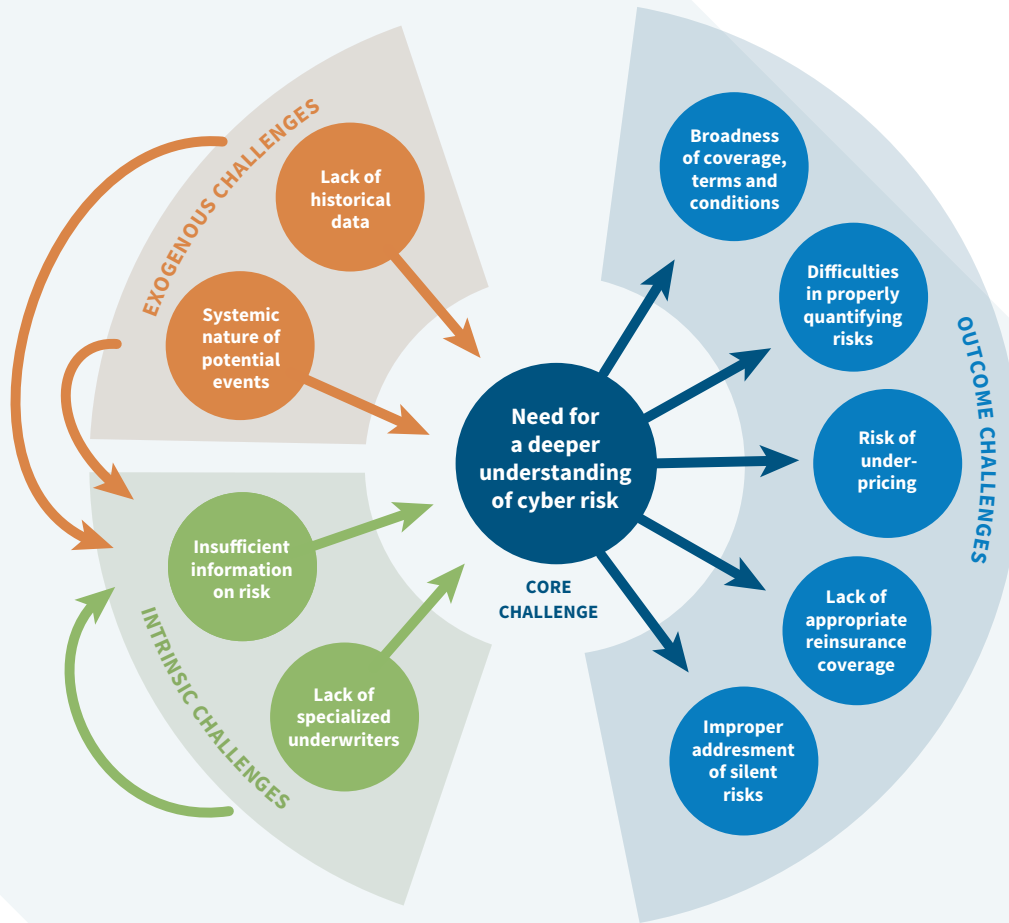
Managing a cyber insurance portfolio poses several special challenges. Cyber risks tend to be different

from other, classic insurance lines. They arise from three sources: from the insurance company's own business activities, from specially developed cyber policies and from classic insurance products where losses are also caused by cyber events – so-called silent cyber.

Cyber risks themselves are subject to strong dynamics in terms of the product landscape, the legal situation, and the risk situation. It can be assumed that the first two will continue to consolidate over time, but the risk situation will remain dynamic due to constantly new attack and defence mechanisms.

Furthermore, cyber risks have a high accumulation potential: a single cyber event can cause an enormous number of individual losses and hit insurers on both sides of the balance sheet. This potentially leads to a large overall loss that is not geographically limited - unlike storms or earthquakes. >

FIGURE1: CHALLENGES OF CYBER RISKS (ACCORDING TO EIOPA, 2018)



Finally, insurers face the challenge of measuring cyber risks with appropriate mathematical models, pricing cyber products appropriately and managing the overall risk situation. There are several challenges at all points in this process - most notably the issue of insufficient data. The European Insurance and Occupational Pensions Authority (EIOPA) has already summarised the relevant challenges in 2018 (see Figure 1).

**DYNAMICS AND ACCUMULATION RISK**

How can insurance companies deal with the special challenges of cyber risks? In order to be able to react to the dynamics of cyber risks and new risk scenarios, an active management of covers and exclusions is necessary. This should be based on current loss scenarios as well as industry benchmarks.

At the same time, constant monitoring of the risk situation in terms of the ‘gap’ between the threat situation and the available defence measures is

necessary. Technological expertise, such as IT/cyber expertise, is also increasingly anchored in risk management, similarly to legal expertise. Only experts can provide an immediate assessment of impacts as well as suggest measures, for example in product design. Accumulation management for cyber risks requires detailed and flexible analysis options of the existing cyber exposure. As part of the analyses, comprehensive extreme scenarios should be considered that test the impact of cyber events on the entire balance sheet.

Frequently, assistance is part of cyber policies, providing post-claim support and reducing the overall financial loss. In the case of accumulation, however, the loss-reducing might fade due to the mass of claims. This effect should be considered in risk measurement. Finally, insurers themselves might be seen as primary targets due to their data treasures, so they should protect their own operations against cyber damage accordingly.



## DATA AND MODELLING

The basis for cyber risk management measures are comprehensive, up-to-date, and detailed information - both about past claims and about current and potential future threats. The required data should be collected in a structured manner and made available for prompt and flexible analyses.

Data citizenship – i.e. broad access to available data – is particularly important in the context of cyber risks due to the large number of experts involved. As there is often a lack of reliable data on cyber risks, insurance companies will continue to rely on external data pools.

Insurers often use mathematical models developed by external third parties to measure risk; however, due to the large number of model variants used, it is essential for insurers to also develop their own understanding of the specific risk scenarios and modelling approaches.

## MANAGEMENT OF CYBER RISKS

Due to the dynamic nature of cyber risks, it should be possible to make portfolio-wide adjustments to cyber policies at short notice. Therefore, shortening coverage periods could be conceivable as well as adjusting coverage or price during the year.

In the context of risk management, the fit of the primary product side and reinsurance coverage is of particular importance. Especially regarding silent cyber, it should be ensured that any exclusions in reinsurance contracts match the original risk to avoid unexpected coverage gaps.

## CONCLUSION: CYBER REMAINS A MAJOR CHALLENGE

IT and cyber are increasingly perceived as risks by the general public. The overall economic demand for cyber insurance will continue to rise, so insurance companies have to manage special challenges. To this end, all elements of the value chain must be included, from product design to risk management and claims settlement. In addition, it is necessary to think beyond the boundaries of lines of business, functions, and areas of expertise. In this context,



the integration of technological know-how is just as important as monitoring developments in cyber-specific liability law. At the same time, the collection and use of data must be intensified, for example by capturing cyber claims and silent cyber data. Overall, insurers are about to improve their data situation and risk management, since for cyber, a flexible and timely reaction to emerging risk scenarios is essential. <

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# A VIEW ON INSURTECH

BY **ALBERTO MINALI**

If we consider the insurance sector and the experience made by our clients, we need to improve the customer journey and the overall level of product satisfaction enjoyed by them. Insurance managers have debated a lot about the quality of the industry service. Most of the surveys highlight that the customer experience is poor, if compared it with the one of other industries, because products are inadequate, opaque, difficult to understand and service is slow and cumbersome.

For this reason, if the insurance industry does want to prosper, it needs to quickly reconsider its relationship with clients and need to put the customer at the center of the stage. Essentially we – as managers of this industry – should understand that the quality of service and the customer satisfaction are key for the long-lasting success of our business. No industry has survived without them!

Technology can help in this journey. Being an insurance entrepreneur, I have seen how technology – if well thought and brought about - can bring innovation both in terms of processes and products which ultimately become ‘customer satisfaction’. These two kinds of innovation are deeply connected to each other. In order to improve the customer journey and to create adequate products, standardisation of covers seems to be not the right answer, maybe the cheapest one but only for the short term. While in the retail business we can enrich a standard cover with additional guarantees/services (for example by introducing assistance rider in a motor cover or by using black boxes for pricing purposes or IoT for claim management), in the corporate and commercial business the challenge is the ‘*industrial creation of tailor-made insurance solutions*’ matching the clients’ needs. This is achievable only via scalable, flexible, natively digital and cloud-based operating platforms that can use vast mass of data and information efficiently.

The advent of technology in the insurance industry has never been a fast process; it requires vision, commitment and ultimately disruptive choices. The industry still enjoys good returns on risk-adjusted capital and an overall performance that is not correlated with the quality of the service rendered to the customers. This deep pool of profitability will eventually attract newcomers, start-ups and other players.

Insurtech could become an important, perhaps essential, component of any modernization/digitalisation programme for an insurance company but we run the risk of just scrapping the surface if we don’t adopt a tech mindset. While most insurance companies use it to make their processes more efficient and more digital, very few are natively digital and featured by an insurtech mindset; even less are born techinsurance. >

The adoption of technology solutions in the industry will progressively increase the sophistication of products, improve the efficiency of distribution and enhance the capability of using data. Let us think for example at the impact of the Natural Language Processing for the cognitive underwriting leading to fast quoting of risks submitted by intermediaries; let us consider the use of cloud-based technology to scale up the business size by transforming fixed costs into variable ones; let us imagine the use of data and information for profiling the customers which will lead to the offering of tailor-made products; let us look at the possibility of a flexible operational platform that can create products by combining insurance guarantees. All these dimensions are possible only thanks to the technology and to its wise use/ impact on the IT/operational infrastructure.

***‘Industrial creation of tailor-made solutions’ seems an oxymoron, but it is not according to my current experience!***

In terms of investments, according to the Italian Insurtech Association (IIA) the 2021 investments in insurtech by European insurance companies reached about 5bn Euro. Italy is not particularly well positioned in this ranking, if we consider that is the last-but-one, just before Spain but very distant

from France and Germany. During 2021 Italy invested in insurtech about 280M Euro versus 50M Euro of 2020: we are on the move.

From a financial angle Italy is lagging behind in terms of insurtech companies’ access to private funding roundings (none of the top in 2021) as well as to the public IPO market. According to Equita Special Report on Fintech<sup>1</sup> the P/E of insurtech companies was 24.9X in 2022, with a projected CAGR 2021-2024 of 23.3% and EPS CAGR 2021-2024 in excess of 15%.

All these positive figures refer to the insurtech subset of the market. To make them true for the rest, we need investments in insurtech, ability to execute ambitious plan and commitment by top management and shareholders for changing the landscape we are working in. <

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**ALBERTO MINALI,**  
CFA is Founder  
and CEO of REVO

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<sup>1</sup> Fintech Conference  
by Equita, Milan,  
April 2022

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RUSS BOWDREY

# DO YOU KNOW WHAT YOUR **CLIMATE MODEL** IS MADE FROM?

BY **RUSS BOWDREY**  
**AND JÁNOS HIDI**

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© The Institute and Faculty  
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The climate scenario modelling ecosystem has changed considerably over the last 5 years. As the adoption of Task Force on Climate-Related Financial Disclosures TCFD guidance becomes widespread, and in places mandatory, it is arguably a natural point to pause to consider whether models used thus far remain appropriate, or whether there are more suitable alternatives. >

The TCFD Guidance was first published across 2016 and 2017; it sought to set out recommendations for more effective climate related disclosures. In 2017 climate scenario modelling was a nascent field, with very few early movers looking to adopt the then brand-new TCFD guidance and a small field of start-ups and progressive established data providers.

At the time, Russ Bowdrey was deeply involved in a major international insurer’s TCFD project and recognised the need to leverage any established modelling or data and to be realistic. The aim for his team was to build a ‘good enough’ picture

of the risks and opportunities, as robustly as possible, but pragmatically, recognising the shortcomings in their approach. Russ’s article published in the **May 2020 issue of *The Actuary*** expands on this experience and discusses some of the use cases.

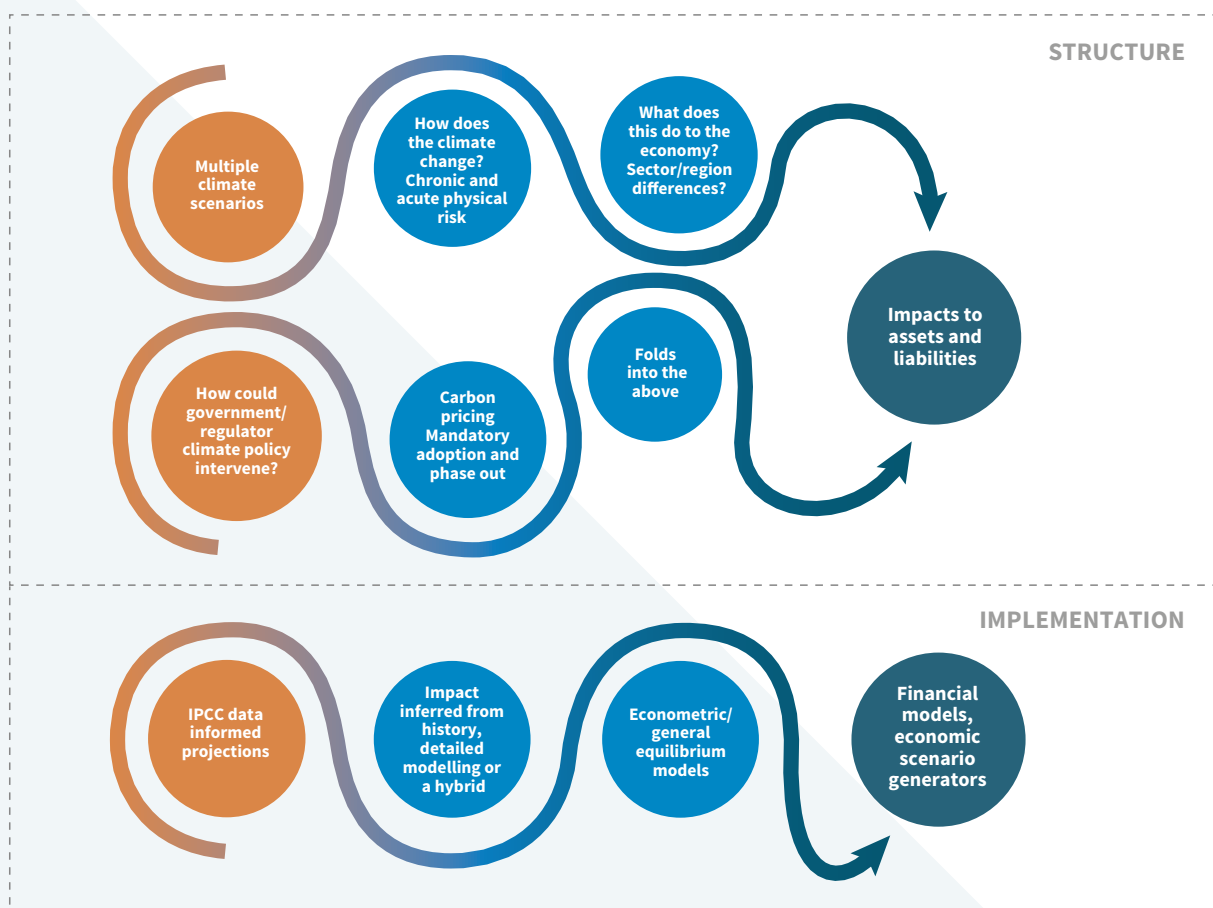
### AN OVERVIEW OF CLIMATE SCENARIO MODELS

In a nutshell, asset owners (such as insurers or pension schemes) and asset managers use climate scenario models to understand how the interplay of climate change, and the attempts to mitigate it, will affect their balance sheets. *Figure 1* summarises the key components and interactions.

The results of climate models support strategic and investment decision making, risk management and disclosures. An effective climate model should incorporate realistic and plausible dynamics, such that impacts at an economy and asset level are consistent and explainable. As you may have intuited, this is far from trivial.

This complexity typically lends itself to ensemble models. Trying to tackle all aspects in one model would result in a large and cumbersome model, with all the challenges of developing, checking and maintaining it. So instead, we typically use models that are well suited to each stage. The most pivotal, arguably, being >

FIGURE 1: THE KEY COMPONENTS AND INTERACTIONS OF CLIMATE SCENARIO MODELS



the model layer that translates climate impacts and policies into economic impacts. For brevity, we refer to this as the ‘economic translation layer’, or ETL.

### WHAT IS UNDER THE HOOD OF YOUR CLIMATE MODEL?

Two broad classes of model have been used for ETLs: general equilibrium models (GEM, or sometimes known as Computable General Equilibrium, CGE, models) and non-equilibrium models. This article highlights the differences between the two and assesses their relative merits and drawbacks.

GEMs are currently more widely used in the ELTs underlying climate models. For example, a range of GEMs underly the Network for Greening the Financial System (NGFS) climate

model. The popularity of GEMs is arguably partly attributable to familiarity – equilibrium models are associated with neoclassical economics, which is the current mainstream economic thinking. Most economists are trained in this framework, understand its logic.

Non-equilibrium models have an interesting history, arising from the rapidly changing world of the 1960s, where the world seemed anything but in a steady state. This led to the development of macroeconomic models that were better equipped to capture the transitioning world. However, their development outstripped the computing power available at the time, and difficulties with parameterisation and calibration led to outputs which were sometimes counterintuitive or difficult to explain. These challenges undermined confidence

in non-equilibrium models and the end result was that more research effort (and funding) went to more traditional equilibrium models, which in turn became established.

Whilst not as widely used as GEMs, non-equilibrium models are increasingly being reconsidered and adopted, especially in fields that require projections for non-equilibrium phenomena such as the low-carbon transition, where it is not clear that the continuation of current trends moves towards a long-term optimum.

### WHAT DIFFERENTIATES GEMS AND NON-EQUILIBRIUM MODELS?

Equilibrium models are based on neoclassical microeconomic assumptions and consider the interaction of multiple rational >

FIGURE 2:  
EQUILIBRIUM VS NON-EQ. MODELS: THE CHOICE OF MODEL TYPE INFLUENCES THE OUTCOMES OF POLICY ASSESSMENTS

#### Equilibrium models (GEM-E3, GTAP, PRIMES etc.)

Neoclassical microeconomic assumptions

Rational agents optimise their behaviour to maximize personal gains/profits

Efficient Markets Hypothesis broadly consistent with the CGE model assumptions

- Prices reflect all available information

Money supply determined by central banks (exogenous)

- If money demand goes up, interest rates adjust, money supply does not
- If nominal money supply increases it generate inflation, not real economic changes
  - Same optimal use of real assets (neutrality of money)
  - Crowding out of investments

#### Non-equilibrium (E3ME non-eq., post-Keynesian)

Does not assume optimising behaviour

Derive behavioural parameters from historical relationships using econometric equations

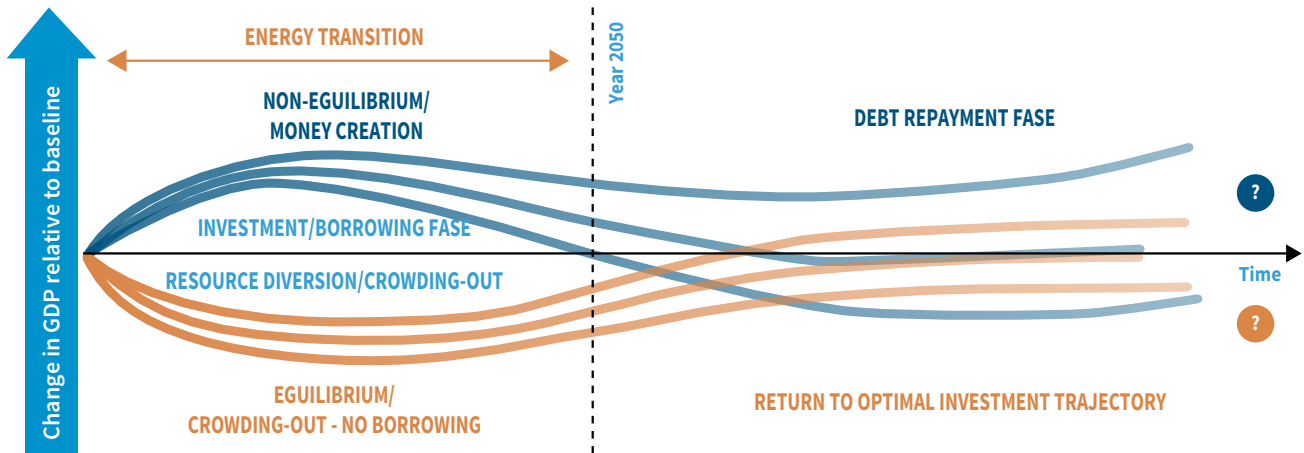
More realistic real-world assumptions, e.g. bounded rationality; uncertainty; path dependence; learning effects

Endogenous money

- Money is created by banks through new loans
- No crowding out of investments
- New investments are financed by new bank loans (if banks have confidence that those investments are profitable)
- Higher debt will be paid back later from higher receipts from consumers



FIGURE 3: FINAL RESULT REFLECTS THE CHOICE OF MODEL TYPE



**KEY TAKEAWAY:**

- Final result reflects the choice of model type
- In non-equilibrium models the macroeconomic benefits arise first, and costs are incurred later due to debt financing and no investment full crowding out

agents that optimise their behaviour, resulting in a general market equilibrium.

By contrast, post-Keynesian non-equilibrium models, like E3ME—a non-equilibrium model built and maintained by Cambridge Econometrics, does not assume optimising of behaviour or full utilisation of resources, and allow for real-world inefficiencies such as involuntary unemployment. *Figure 2* summarises the key differences between the models.

In terms of the practical modelling outcome for climate scenario modelling, the key difference is that for non-equilibrium models, we see typically see economic growth resulting from the energy transition, while equilibrium models usually exhibit an initial hit to growth during the transition, followed by recovery. This follows from investment not being

constrained by savings, which is a key tenet of GEMs. *Figure 3* shows various illustrative pathways for each model.

The adverse economic impact of the transition in equilibrium models intuitively makes sense because it is assumed that real assets are utilised in an optimal way, hence any regulatory enforcement will divert the economy from its competitive optimum.

In practice, we often experience that there are idle resources in the economy, as well as market failures due to institutional constraints, uncertainties or externalities. Under such circumstances, additional green investments triggered by regulatory intervention can push the economy towards fuller utilisation of existing assets in

the short term, and to extending the required assets through new investments in the long term. Non-equilibrium models aim to capture these real-world behaviours and relationships. As a result, the outcomes of each type of model can be fundamentally different in direction as well as magnitude.

**BOUNDED RATIONALITY, AND THE ADVANTAGES OF ABANDONING OPTIMALITY**

A final element of non-equilibrium models worth exploring further is that they explicitly do not assume optimising behaviour. In order to understand how economies adapt to changes we therefore need a mechanism to capture how climate impacts, policies to mitigate them and adoption of the technology to support the green transition. A key advantage of non-equilibrium models is that >

the transition can be implemented in a way that arguably better reflects real-world decision making (e.g. satisficing, bounded rationality, imperfect information).

For example, E3ME a non-equilibrium model built and maintained by Cambridge Econometrics, uses an evolutionary innovation model to capture the diffusion of the technology used to support the green transition. This approach gives more flexibility to reflect the typical uptake and adoption of technology (e.g. early adopters through to laggards) and how that uptake responds to influences from regulation and interactions with other sectors and global economies. This last point becomes particularly important when then translating to impact to assets, such as the equity investments in different sectors and regions around the world as part of a portfolio level climate scenario analysis.



**JÁNOS HIDI**

## CLOSING THOUGHTS

All models wrong, some are useful, but it is important to consider carefully if the model you are using is appropriate for the purpose you are putting it to. This decision should be considered carefully when choosing a modelling suite for climate scenarios.

On the one hand the NGFS scenarios (which are based on 3 GEMs) provide a much-needed consistent basis for reporting; without it TCFD may go the same

way as European Embedded Value (EEV), Market Consistent Embedded Value (MCEV) and other reporting standards that failed to gain traction due to (ironically) a lack of standardisation in their implementation. On the other hand, if the use case is investment decision making based on climate scenario analysis, it is vital that users fully appreciate what the clockwork inside their models is capable of emulating in the real world.

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# FROM LABOUR SUPPLY TO LABOUR PRODUCTIVITY

BY **MARIA ECONOMOU**

**T**he EU's working age population has been shrinking for a decade and this is projected to continue.

The population at working age (20–64 years of age), would shrink in all Member States as a proportion of the overall population. Whereas in 2019 people of working age represented 59% of the EU population, this share would fall to 51% by 2070.

The drivers include a) the increasing shares of the population in the higher age cohorts due to the combination impact of the large cohorts of those born in the 1950s and 1960s together with continuing gains in life expectancy and b) the changing patterns of fertility (in comparison with the natural replacement rate), and shrinking cohorts of women in childbearing ages.

The overall picture is one in which total employment is expected to decline steadily in the next 50 years, and the contribution of labour input to output growth to decline accordingly, at a slightly higher annual average rate in the EU than in the wider euro area.

**Labour productivity growth, driven by Total Factor of Productivity growth, is projected to become the sole source of potential output growth in both the EU and the Euro Area.**

As populations, societies, and markets change in a dynamic way it is essential that the issues of why to defend and how to defend the public pension systems be considered jointly, not separately. The contribution of Social Security systems is crucial to a well-functioning and just society.

*In this light, the important question to be asked is not: ‘where do we think we will be in the year 2070?’, but ‘where would we like the world to be in 2070?’*

This expresses our primary concern, as Social Security Actuaries, for the wellbeing of people; we would wish to see that sufficient pension benefits will be provided to all European

citizens, to ensure, first and unconditionally, the prevention of poverty, but beyond that retirement incomes sufficient to assure human dignity in old age.

Moving, accordingly, along this 50-year time path we envisage the need to face a range of challenges, which are not necessarily ‘actuarial’ in a narrow sense, but which do impact on the objectives which actuaries seek to address. In particular: >



**MARIA ECONOMOU**

## LIFELONG LEARNING

The skills and knowledge acquired by individuals over time can and should be seen as representing productive assets, but this is a perspective that has not until recently been given sufficiently weight. Policymakers should consider the distribution of educational resources across the life course as a whole. Adverse stereotypes could be challenged through communication campaigns, aiming to increase knowledge about and understanding of the process of ageing, among the general public, policy-makers, teachers and service providers and as reflected in the media.

## ACCESS OF CITIZENS TO THEIR PENSION INFORMATION

The access of an individual information on his/her own pension is expected to become a necessity in the near future. The development of digital pension tracking systems may be seen as a valuable starting point in this regard, enabling the provision of insights into the current and future patterns of an individual's income and expenses.

## THE AUTONOMY OF OLDER PEOPLE AND THEIR PARTICIPATION IN SOCIETY

According to the World Health Organisation, physical and social environments are key determinants of whether people can remain healthy, independent and autonomous long into their old age.

An 'age-friendly' environment should be created, to allow greater numbers of older people to remain active and so reduce the prospective costs of social care; one approach is through choosing the optimal location of, and investing in, specialised housing and other facilities for older adults.

## ENSURING SUSTAINABILITY OF SOCIAL SECURITY PENSION PROMISES

Among the factors which contribute to maintaining pension promises in the future is effective tracking, monitoring and evaluation of the implementation of pension schemes; an important aspect here is the frequency of scheme reviews to facilitate discussions and advance planning, between governments and specialist advisers. Member States should be encouraged to implement a statutory requirement for regular actuarial reporting on the long-term finances of social security. It should be also highlighted the importance of following international guidelines for analytical reporting on social security pensions and other benefits, both for actuarial work in individual Member States and for EU level exercises.

## COMMUNICATION

The more people understand the world of pensions, the more possibilities they see for their future. Raising public awareness of pension issues, to help people to avoid old-age poverty, is an important, but difficult task.

At the present time, as with any crisis, social security systems face many and serious challenges, and these may impact on benefit levels. A conceivable and regrettable long-term consequence may be that those who feel they have been unfairly disadvantaged, may dissociate themselves from orderly social dialogue.

To face the challenges of realities 'on the ground' we, as Social Security Actuaries, seek to strengthen our problem-solving approaches. This includes steps to define as clearly as possible the requirements for recognising and measuring social benefits. We recognize that any problems, are susceptible to a variety of feasible solutions. The actuarial approach should [help to] identify those solutions which are optimal.

*Our over-arching objective is, in the long run, to guide the provision of pension benefits sufficient at least to prevent poverty, to all European citizens. Before we actually translate it into reality, we must be able to dream about it.*

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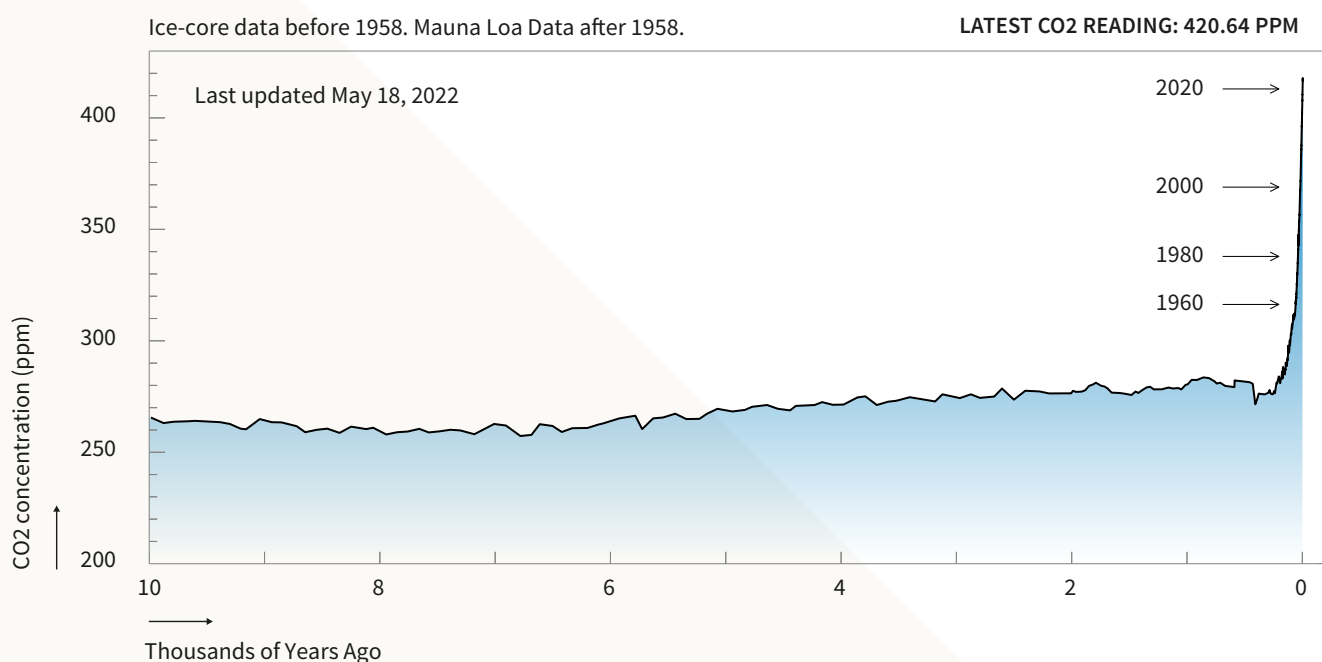
# CLIMATE-RELATED RISK SCENARIOS

BY **ANDRÉ CHOQUET**

**A**s I write these lines, the latest CO2 reading on the Keeling Curve stands at 419.27 ppm, the result of more than a century of an exponential growth since the start of the industrial revolution. The Keeling Curve is a daily record of global atmospheric carbon dioxide concentration maintained by Scripps Institution of Oceanography at UC San Diego. And that's not even

including the rest of the greenhouse gas emissions in the atmosphere. It is one of many metrics actuaries should become accustomed to as the 200 signatory countries to the 2016 Paris Agreement are trying to create the policies, finance the innovation and incite markets to remove Green House Gas emissions from our economies and to limit global warming to 1.5C, at most 2.0C. >

FIGURE 1: THE KEELING CURVE



The International Actuarial Association (IAA) paper on the application of climate-related risk scenarios to asset portfolios is the fourth in a series of IAA papers on the integration of physical, transition, legal and reputational climate risks into the work of actuaries ([https://www.actuaries.org/iaa/IAA/Publications/Papers/Climate\\_Issues/IAA/Publications/Climate\\_Issues.aspx](https://www.actuaries.org/iaa/IAA/Publications/Papers/Climate_Issues/IAA/Publications/Climate_Issues.aspx)).

### WHAT'S THE IMPETUS FOR THIS ASSET-RELATED PAPER?

- Most actuaries will agree that climate-related risks will impact assets and liabilities of financial institutions, some of which are our employers or clients.
- Although a lot of actuaries may not be involved in security analysis or portfolio management, they are often the ones certifying the long term viability of pension plans or insurance companies which depend on the performance of their assets.
- And therefore actuaries have an interest in leading or at least contributing to climate risk assessments, scenario analysis or stress testing to quantify the impact of future climate pathways on asset portfolios.
- There is also the risk of stranded assets that all asset owners face. If currently some companies' value in the oil sector is based on their oil reserve, such value will gradually or suddenly decline because a big chunk of the fossil fuel reserve on the planet will need to remain underground for the planet to stay at 1.5 or 2.0 degrees. Albeit some of these energy companies will gradually diversify into sustainable sources of energies.
- More and more pension fund fiduciaries, insurers and other financial institutions have a legal, business or moral duty to take climate-

related risks into account in the management of their entities and these are our employers or clients.

- Finally, on the liability side, the discount rate used by actuaries to discount long term obligations is based on the expected long term returns on assets.
- The paper speaks to the importance for actuaries to understand the work of at least the following three global NGO's: (1) the IPCC Intergovernmental Panel on Climate Change a UN agency, (2) the International Energy Agency (IEA) and (3) the Network for Greening the Financial System Scenarios (NGFS).
- The IPCC is the most credible NGO on climate science. The IPCC AR6 report from Working Group 1 issued in August 2021 revealed stark realities:
  - 'It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred'
  - '...limiting human-induced global warming to a specific level requires limiting cumulative CO2 emissions, reaching at least net zero CO2 emissions, along with strong reductions in other greenhouse gas emissions.'

*Source: [IPCC\\_AR6\\_WGI\\_SPM\\_final.pdf](#)*

There are no probabilities assigned to any of the future climate scenarios developed by the IPCC because the global warming path society will follow is highly dependent on the actions we take over the next decades, especially this one. That's why actuaries need to familiarize themselves with these pathways as they will form the basis for climate scenario analysis. >

A portfolio may be examined as the collection of individual assets (bottom-up approach) or from its overall composition (top-down) all of which are impacted by climate-related risks (physical, transition, legal and reputational).

The methods used to assess climate-related risk at the individual security level are still developing, and practice may vary from one geographical region to another but at a minimum, portfolio managers who use a Discounted Cash Flow model to value securities will stress test their portfolio against future carbon pricing policies.

A good example of a top-down analysis is the 2020 Institute & Faculty of Actuaries-Ortec Finance Climate scenario analysis for pension schemes **Climate scenario analysis for pension schemes - UK Case Study.pdf ([actuaries.org.uk](https://actuaries.org.uk))**. When it comes to the transition risk to the economy and the financial institutions within it, there's a threesome dance between:

1. Government policies to incite corporations to move away from fossil-fuel towards more sustainable energies
2. New technologies and their financing by the private and/or public sector
3. Market response to both new technologies and to the slow withdrawal of old fossil-fuel related technologies

Ideally, these three will move more or less in tandem towards net-zero pledges but it may not happen in an orderly fashion. Hence most climate scenario analysis include a mix of orderly and disorderly scenarios.

- Paris Orderly (coordinated action to limit global average temperature rises to 2°C which financial markets price in gradually)
- Paris Disorderly (same real-world outcomes as the Paris Orderly pathway, but financial markets' reaction is delayed and abrupt)
- Net-zero 2050 scenario: a more ambitious immediate policy action scenario to limit average global warming to 1.5°C that includes current net-zero commitments by some countries
- Failed Transition (no additional climate policies are implemented and global average temperature rises by 4°C by 2100).

The rest of the paper focuses on considerations for various asset classes like fixed income, equity, real estate and infrastructure, derivatives and agricultural assets, green asset classes.

## **WE ALSO LOOK AT HOW COMPANIES MAY MEASURE CLIMATE-RELATED RISKS**

- Overall portfolio alignment: refers to the proportion of the portfolio committed to 'net zero by 2050'.
- Portfolio Emissions.
- Implied Temperature Rise: tries to estimate the global temperature rise, as if every company in the world operates on the same carbon intensity as this asset and experiences the same emissions pathway as this asset.
- Climate Value-at-Risk : quantifies the size of loss attributable to climate-related financial risks, by comparing the value of assets in a world with climate change relative to the same >

world without climate change. It is model- and data-intensive, so lacks transparency and comparability. The scenarios used could potentially be quite different by company, which would make it difficult for investors to understand what these figures represent.

Overall, these metrics are still evolving and we should be mindful of their limitations – in terms of data availability, comparability, transparency and intensity of computation.

***‘ If we are not also part of the solution...we are part of the problem.***



## **NEXT STEP**

The IAA is in the process of drafting a paper on adaptation based on the IPCC WGII report entitled ‘Climate Change 2022: Impacts, Adaptation and Vulnerability’.

One of its key messages is that adaptation plays a key role, along with mitigation, in addressing the risks of climate change. The report points out that we are already being affected by climate change and some of its adverse effects are already ‘baked in’ and must be addressed through adaptation.

Efforts to reduce carbon emissions through mitigation are of course key to slowing the rate of global warming but the report shines the spotlight on the vital role that adaptation efforts can play in reducing some of the adverse impacts of climate change.

Many natural systems are already being challenged by human development and climate change (ie loss of species, loss of habitat, loss of diversity etc). The report highlights that climate change affects our entire planet and that there are innumerable feedback loops, tipping points etc. that require all elements of our society to participate in solutions, even the actuarial profession.

If we are not also part of the solution.....we are part of the problem.

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**ANDRÉ CHOQUET, FCIA, FSA,  
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Institute of Actuaries

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# EVALUATION OF EUROPEAN DEPOSIT INSURANCE SCHEME FUNDING BASED ON RISK ANALYSIS

BY **RAFAEL MORENO RUIZ AND**  
AND **EDUARDO TRIGO MARTÍNEZ**

The proposal for a Banking Union (BU) emerged in 2012 as a solution to the banking and sovereign debt crisis experienced by some European Union (EU) countries, mainly caused by the links between banks and states. The objective of the BU is the creation of a single banking market based on three pillars, the Single Supervisory Mechanism (SSM), the Single Resolution Mechanism (SRM) and the European Deposit Insurance Scheme (EDIS). >



**RAFAEL MORENO RUIZ** is president of the Instituto de Actuarios Españoles.

The EDIS proposal is based on national guarantee schemes, which are regulated by the 2014 Directive. This directive introduces important changes in the financing of the Deposit Insurance Schemes (DIS), including the size of the target fund, for which a target equity of 0.8% of covered deposits is established, and the contribution regime of the member institutions, whose contributions are established according to the covered deposits and the risk profile of the institution within the scheme.

The European Commission (EC) proposal establishes an EDIS composed of national DISs and a European Deposit Fund (EDF), which would be implemented in three stages. At the first stage (reinsurance) the EDIS would provide liquidity assistance and

absorb a certain amount of loss when the resolution procedure exceeds the financial resources available to the national DIS. At the second stage (co-insurance) EDIS would progressively absorb an increasing share of the liquidity and loss needs regardless whether the resources of the national DIS were exhausted. At the third stage (mutualisation) EDIS would be the only DIS in the Eurozone, completely replacing the national DIS.

At the reinsurance stage, bank contributions would be calculated by reference to the level of risk in the national banking system, while at the co-insurance and mutualisation stages they would be calculated by reference to the risk in the Banking Union (BU).

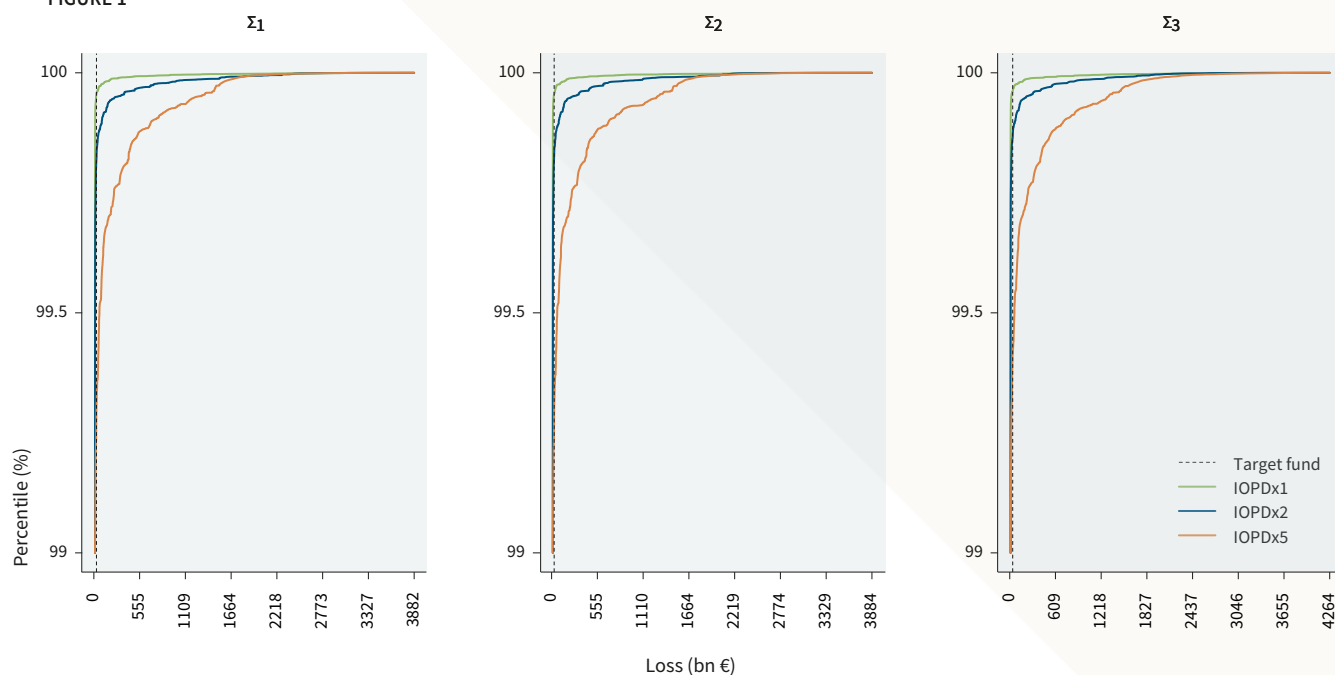
Negotiations on EDIS are a still ongoing process because there is

no consensus among EU countries. The main reasons for this lack of consensus are that some countries argue that its implementation would encourage cross-border subsidies between banking systems, could affect moral hazard by encouraging risk-taking behaviour by some banks, and could create disciplinary problems associated with deposit protection.

Additionally, the COVID-19 pandemic is expected to lead to an increase in bank risk because of declining asset quality and increased volatility in financial markets.

In our work we conducted a quantitative analysis of EDIS funding in the framework of risk management in order to assess the adequacy and potential impact of the proposed measures on EDIS equity and contribution regime. ➤

FIGURE 1





First, we estimate the EDIS loss distribution and analyse the impact on it of different sources of systemic risk. We model it by means of correlation matrices reflecting different degrees of interdependence between banks belonging to the same country and between banks belonging to other EU countries,  $\sum_i, i=1, 2, 3$ ; and different sources of bank risk, which are modelled by means of scenarios assuming different qualities of bank portfolios,  $IOPD_{xj}, j=1, 2, 5$ . Secondly, we analyse the EDIS contribution regime, determining the variation in the cost of insurance as a consequence of the risk profile of banks in relation to the BU, and the loss absorption capacity of the contribution made by countries by applying the methodologies proposed by the European Banking Authority (EBA).

We use the SYMBOL (Systemic Model of Bank Originated Losses) microsimulation model proposed by De Lisa *et al.* in 2011, which allows estimating the loss distribution of a banking system using the risk assessment framework established by the Basel Committee on Banking Supervision (BCBS), and which has been used by the EC on several occasions. The sample used consists of 806 Eurozone banks representing 81% of covered deposits in 2018.

Our results allow us to determine the fund needs according to the degree of risk aversion of the

regulator and to assess the level of protection offered by the target funds set in the EDIS considering the different risk factors that affect the losses which EDIS is exposed to. They also make it possible to determine the impact of the new contribution regime on moral hazard and the possibility of cross-border subsidies between BU countries.

The main conclusions are that interconnection between banks in different countries has an important influence on the tail of the EDIS loss distribution, that deterioration in the quality of bank portfolios leads to a significant reduction in the loss absorbing capacity of the target funds and that the new contribution regime proposed by the EC has a positive effect by reducing both moral hazard and the possibility of cross-border subsidies.

The paper shows that actuaries, and CERAs in particular, have a global background in risk management that can be applied to other areas than the insurance sector, such as the banking sector.

DISCLAIMER As the intent of this note is to provide a very high-level summary of our talk to be presented at the European Congress of Actuaries 2022 in Madrid, additional information can be found at the following link: [Evaluation of European Deposit Insurance Scheme funding based on risk analysis.](#) <



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**EDUARDO TRIGO MARTÍNEZ** is professor at Universidad de Málaga.

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# AAE NEWS

The Strategic Objective 3 of the Actuarial Association of Europe (AAE) is to promote a European community of actuaries; this has various purposes, including to encourage the exchange of information and ideas and to facilitate networking between actuaries. I would like to bring your attention to three events that support these objectives.

At the time of writing, the AAE is busy with preparations for ECA 2022. This event, the 4th European Congress of Actuaries, will take place in Madrid, Spain on June 2 and 3, 2022, hosted by the AAE and the Instituto de Actuarios Españoles. In total we expect more than 230 experts and executives from Europe and beyond to join this year's congress. The on-site event will feature a varied and inspiring program of excellent keynotes and lively parallel sessions discussing up-to-date topics such as current economic challenges, sustainability, IFRS 17 and much more, across the whole scope of actuarial fields. There will also be opportunities for networking after the scheduled congress hours. If you will not be able to join the congress in Spain, the presentations will be made available on [www.actuview.com](http://www.actuview.com) in July. Thanks to an AAE partnership with the actuarial CPD platform, actuaries belonging to AAE member associations can register to use actuview for free.

On June 30, 2022, AAE is hosting a webinar titled, 'Sustainability and the Role of the Actuary – a Professionalism Perspective'. This webinar is for actuaries who want to understand why and how sustainability impacts the actuarial world, as well as those who want to further develop their professional skills in relation to actuarial and sustainability matters. For more information and registration visit [AAE's webpage](#).

From September 19 to 23, 2022, the European Actuarial Academy (EAA) in conjunction with actuview will organize the 1<sup>st</sup> CONVENTION A – an online-only conference by the actuarial community for the actuarial community. The event program will not only offer five days of actuarial content but will also cover all time zones. This means that interested actuaries from all over the world can attend CONVENTION A at almost any time of day. AAE will

host two session blocks during CONVENTION A dealing with 'The Role of the Actuary', 'IFRS 17', plus the latest results from AAE committees. The sessions will take place on September 20, 9-13 CEST and September 22, 9-13 CEST. [More information](#).

For the latest news from AAE follow us on [LinkedIn](#) and [Twitter](#).

*Gunn Albertsen  
Member of AAE Board  
of Directors*



## COLOPHON

The European Actuary (TEA) is the quarterly magazine about international actuarial developments. TEA is written for European actuaries, financial specialists and board members. It will be released primarily as e-mail newsletter. The views and opinions expressed in TEA are those of the authors and do not necessarily reflect the official policy or position of the Editorial Board and/or the AAE.

The Editorial Board welcomes comments and reactions on this edition under [info@theeuropeanactuary.org](mailto:info@theeuropeanactuary.org).

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### NEXT ISSUE:

The next issue will appear 1 September 2022. Suggestions can be e-mailed to [info@theeuropeanactuary.org](mailto:info@theeuropeanactuary.org). The deadline is 1 August 2022.

### EUROPEAN AGENDA

Please check <http://actuary.eu/event-calendar/> for the most actual forthcoming events.

### ADVERTISING IN THE EUROPEAN ACTUARY

The European Actuary (TEA) is sent as an online magazine to 25,000 actuaries and financial professionals throughout Europe. An advertisement in TEA, size 210 x 145 mm (half A4 and seen as full-screen), costs 3,500 euros. Information on [info@theeuropeanactuary.org](mailto:info@theeuropeanactuary.org)