Stochastic modelling and AI – what are the new developments?

Hens Steehouwer, Chief Innovation Officer, and Hamish Bailey, Head of Insurance and Investment, from Ortec Finance, discuss the latest innovations in stochastic modelling and Artificial Intelligence.

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(L-R) Hamish Bailey and Hens Steehouwer from Ortec Finance.

Andrew Putwain: Can you tell us about stochastic scenario approaches in the wider context of Artificial Intelligence (AI) and the new technologies that Ortec Finance is working on?

Hens Steehouwer: We have two AI streams that we're working on. The first, like for many other companies, is to improve our own internal efficiency, and the second is to see how AI can improve the solutions that we provide to our investor clients.

This second stream links to our existing scenario approach because the most interesting and most promising application of AI on the solution side is in improving scenario analysis techniques.

The stochastic scenario approach is the workhorse to support strategic investment decision-making as well as the subsequent risk management of strategic decisions over time. The aim is to support effective portfolio decisions and then to monitor whether strategies are still the right ones in changing circumstances.

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It's been that workhorse for decades in the pension industry and has been growing in the private wealth space as well.

What we have been observing in the last couple of years is that the stochastic scenario approach is increasingly also being adopted by insurers and their asset managers. Our thoughts on this uptake in the industry of insurance relate to the underlying trends that we have been seeing for some time.

Firstly, the industry is consolidating; fewer, larger organisations are emerging, there is increasing transparency, and more pressure on product margins. Furthermore, we've also had more than a decade of low rates that are still in the portfolios, and all of this is putting pressure on returns that have to be found. As a result of all of that, we have been observing an increase in the "asset awareness" of the insurance industry and an emphasis on "putting the asset side of the balance sheet to work".

This increasing importance of the insurer asset portfolios and investment strategies – as an instrument to provide value to the stakeholders of an insurer – is very prevalent. This means the most promising and important application of AI for us, in terms of solutions, is addressing the challenges in creating strategic asset allocations for insurers in the face of a range of, often competing, constraints. That's where the core of our activities are focused on at the moment.

Hamish Bailey: From an asset management perspective, the market dynamic that we observe is a continued move towards outsourcing of mandates by insurers, even by the largest players.

We're also seeing more asset managers pivot towards managing insurance assets as the pensions industry assets start to dwindle or are transferred to insurance companies and insurance structures as the market changes.

As a result of this, we're seeing a lot more competition between asset managers - to prove their added value to clients and to differentiate themselves from their competitors. There's a lot of pressure on their requirements as well.

Adding to the complexity, asset managers have many different clients to manage. The challenge lies in supporting their clients efficiently whilst maintaining personalised touch points and delivering added value. This balance has been a major focus of our work recently.

It's an area where we see the biggest application for AI technologies coming into play.

Andrew: What do these products offer to the market? Especially around forward-looking investment strategies – what are the practical applications?

Hens: The primary application of the stochastic scenario approach is strategic asset allocation and portfolio construction: how to invest the assets in the portfolio in the best possible way to achieve the risk/return objectives of the insurer shareholders or policyholders?

The other investment application naturally emerges as the financial position of an insurer changes continuously as the market evolves, new products are launched, and new regulation is introduced. Therefore, it's important to check in regularly, often quarterly, and ask, “Is my strategy still appropriate given the current circumstances?”.

This is what we call the risk monitoring of a strategy over time, which should be distinguished from the traditional day-to-day risk management exercise.

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Now, what’s the appeal of the stochastic scenario for these investment applications? One key reason is that it's flexible - especially to incorporate all the complexities that drive an insurer's balance sheet through both the asset as well as the liability side into the analysis. On top of this, there's solvency regulation that every insurer must comply with, which responds to asset and liability dynamics and market movements in nontrivial ways.

The strong point of a scenario approach is that it offers flexibility to include all these complexities accurately and realistically into the investment analysis. This has been the case since the early days of asset liability management and still holds today as complexity and uncertainty only increase.

But there are also challenges: the stochastic scenario approach is sophisticated, but in the end is a person-driven search for optimal portfolios and strategies on complex risk/return objectives.

For example, there's an analyst behind the computer who wants to try a strategy, and he or she simulates that strategy and then evaluates it. How does it perform in terms of the risk/return objectives that the insurer stakeholders find important? Then the analyst assesses that and tries another strategy, to see if it can improve the risk/return trade-off.

This approach will produce accurate evaluations of candidate strategies, but it’s not an efficient way of finding the best strategies. And, at least as important, there's no guarantee that the most optimal strategies will always be identified using this approach! These challenges are not new, they have been known for decades, and it’s exactly these challenges that we can now aim to solve with the help of AI.

Andrew: Building on this, can you tell us about the use of optimisation algorithms in these products and how the use of AI can add value?

Hens: Next to the stochastic scenario approach, there are other investment decision support methods such as analytical optimisation algorithms. A well-known example is mean variance optimisation dating back to the famous work by Harry Markowitz. This starts from certain assumptions, and results in a formula that essentially says, “under these assumptions, this is the optimal portfolio”. Contrary to the stochastic scenario approach, such analytical optimisation algorithms tend to be efficient and automated.

However, on the negative side of this approach, it only works for specific risk/return objectives that an investor might have. In most cases, this is too restrictive and simplistic for the risk/return objectives of real-world insurers, which are more complex than these analytical optimisation algorithms can handle.

Furthermore, unlike the stochastic scenario approach, analytical optimisation algorithms are also not a generic approach. Every algorithm is developed to optimise on specific risk/return objectives, which already requires significant effort. If an insurer then wants to optimise on a different set of risk/return objectives, a new algorithm needs to be developed, if the problem can be solved analytically at all.

Analytical optimisation algorithms are valuable in their own right. In our solutions, they're used in combination with the stochastic scenarios, to create a tandem of two approaches, working together, interactively with the analyst, in the search for more optimal portfolios.

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Now wouldn’t it be powerful if we could combine the strong points of both approaches into one new one? Is it possible to maintain the flexibility and accuracy of the scenario approach and have the efficiency of an automatic optimisation algorithm added to that?

This is where AI has come to the rescue. We think, based on our research, that we have finally solved this long-lasting challenge of portfolio optimisation for investors with the help of AI.

Now, let’s explain this. Firstly, AI is an umbrella term. There are different types of approaches that we have developed that can together best be described as Scenario-Based Machine Learning (SBML). We start from the stochastic scenario data that we already have from our balance sheet modelling and combine this with carefully designed and calibrated Machine Learning techniques to provide us with what turns out to be a powerful combination.

This allows us to combine the accuracy and the flexibility of the scenario approach on the one hand with the efficiency of an automated optimisation algorithm on the other hand. As an example, think of an “AI investor” that is trained on many thousands of simulated stochastic scenarios. That AI investor learns about the dynamics of an insurance balance sheet and how different portfolios, or different investment strategies, perform in terms of the risk/return objectives that the insurer might have.

One example that we have been working on with our clients is what is an optimisation in the Present Value of Distributable Earnings (PVDE) risk/return space. This is a highly complex risk/return space that insurers care about. The present value of money that can be paid out to the stakeholders is a return measure, which is driven by asset liability dynamics, solvency ratios, and the dynamic rules of dividend payments. There's also a risk measure, which can mean more solvency-oriented actions are required, like for example capital injections in situations where solvency ratios are low.

This complex risk/return space does not fit into an analytical optimisation algorithm. But - it does fit in the stochastic scenario approach. But then how do we optimise it? Well, with the SBML approach, we can do just that: to optimise portfolios in a PVDE risk/return space for actual insurer cases with all the real-world complexities included.

Andrew: Can you tell us more about the opportunities and challenges of training an AI agent in this context?

Hens: The biggest opportunity is that SBML is a generic approach that can be used to optimise portfolios on any set of risk/return objectives that has already been captured in the stochastic scenario approach.

This means that it can optimise, in a generic way, on multiple objectives and multiple constraints, such as the downside solvency risk, volatility of solvency ratios, duration gaps between asset liabilities, turnover constraints, and ESG scores of the portfolio.

But it can also optimise on a broader set of decision or strategy variables. So far, we've been talking about one "simple" decision rule, which is the portfolio composition. However, one can also think about the duration profile of certain portfolios, the rating profile of the portfolio, currency and interest rate overlays and how to steer those, or even move into dynamic investment strategies.

All those complexities of real-world investment decision problems, both in terms of the risk/return objectives and the investment strategy variables, can be handled by the SBML approach.

I've been in this field for my entire working life, I've known this puzzle for a long time, and I'm excited that we finally have solved it. It's stimulating to see that AI technology has provided us the tools to do so.

Hamish: My experience talking to existing clients is that they've been engaging with AI experts to apply these technologies in-house, but they haven't found it easy. In many cases, there has been a disconnect between the AI technology experts on the one hand and the investment professionals on the other, and they've struggled to bring these things together.

That's going to be the biggest advantage in this area. Because we're coming at it with an understanding of both AI and the investment process we have the ability to enhance our existing tools and deliver a coherent solution that can be easily applied by insurers and asset managers alike.

Andrew: The latest AI regulation in the EU says that human interference/explainability is a must-have – how will this help insurers and what does it mean for the technology?

Hens: It's a logical question in the context of AI and we agree that human-AI interaction is key.

In general, when working with models and technology, we don't think that algorithms should produce automatic portfolio strategy recommendations without the human intervention of an analyst.

Essentially, AI algorithms including our SBML approach, are based on models. As humans, we build models and technology to support our decision-making in complex and uncertain environments. But no matter how refined these models become, they will always remain models and never fully represent reality.

> *"It's important to remember that it is never the "machine" making the decisions."*

That's why we will always need human interventions – in this case, the analyst interacting with the AI technology in a way to get the best results. The analyst can evaluate what are the suggestions that come out of the algorithms. He or she can add more qualitative arguments that the algorithm cannot see or know. Also, the analysts can work on the communication of the strategy to decision makers.

Hamish: It's important to remember that it is never the "machine" making the decisions; what we're trying to do is help our clients identify better alternative strategies in a more efficient way. Some potential strategies aren't being identified at the moment given the limitations of current technology. The SMBL methodology will change this and put true optimisation in reach.

Andrew: Can you discuss what's coming down the pipeline for Ortec Finance, and how will future tech help investment teams?

Hens: We started our AI R&D programme about four years ago and have recently conducted 'proof of concept' projects with some of our insurance clients to further test and refine our SBML methodology.

The projects were successful, and our clients were enthusiastic. Motivated by these positive findings, we are now preparing the first version of this technology to be released for our clients in the first half of 2025.

While doing so, we are collaborating with clients to conduct pilot programs that further test the practical application of the tool we developed. Several clients are already lined up to participate in these pilots before year-end.

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It will start with portfolio optimisation in the PVDE risk/return space that we spoke about because that's where we have immediate demands from our clients. But because SBML is a generic approach, it will be extended to other applications – like other types of risk/return objectives, and it will, in my opinion, quickly move beyond the insurance industry.

The stochastic scenario approach is already used extensively in the pension industry, and increasingly in the private wealth industry. The context is different – but in these industries optimising portfolios and investment strategies on investor-specific risk/return objectives is of essential importance.

Scenario-Based Machine Learning [AP1] can provide efficient and effective support to do so.