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So is there really a case for the in-house ESG model?

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Even the very largest corporations would not seriously consider building and maintaining all their software in house. So, why do some large insurance groups choose to take on the task of designing, building and maintaining Economic Scenario Generator (ESG) models in addition to the considerable challenges of actually using them?

In this note we will review the arguments in favour of the in-house build. Of course, as an ESG software provider, we do have a fairly strong interest in this debate. That is why we think it is worthwhile setting out the pros and cons as clearly as possible.

What is the scope of the task?

For simple problems and for simple views of the world, simple solutions do exist. And while it is possible to build a simple ESG in a few minutes, the problems faced by financial intermediaries are rarely simple and the behaviour of the capital markets turns out to be very complicated.

Insurance groups face a wide range of valuation, risk, capital management and communication challenges that require deep expertise and a set of analytical tools that are fit for a wide range of purposes. Developing a coherent, multi-asset stochastic model that can be regularly calibrated across a range of economies and building the robust, fast, auditable and fully documented technology to run it turns out to be a significant challenge. In practice, such a project may require different models and calibration choices for different purposes such as market-consistent valuation and real-world projections or analysis over different planning and valuation horizons.

Some of the tasks required fall unambiguously within the responsibility of the in-house model user, whereas others can be outsourced.

Let us look at the different tasks in more detail.

Software Design and Build

This is no small task and includes building all the procedures or tools required to initiate runs of the models, calibrations and validation and reporting analysis on the output. Firms must specify what functionality they need from their tools and be comfortable that they really will meet these requirements, but the remainder of the tasks – research and development of models and methods, specification, design, build, testing and documentation – are all capable of being outsourced.

In order to take on this burden in-house, firms must be confident that they can attract (and retain) the deep quantitative skills required to understand the modelling and calibration method challenges and the software engineering disciplines to ensure code is well-designed, controlled, built to required standards, is capable of extension and runs as efficiently as possible.

Constructing a House View

Projecting future 'real-world' possibilities requires a view of the future target distributions. Firms must identify the scope of coverage across territories, asset types, required update frequency and be able to demonstrate their understanding of the assumptions underlying the models and how these have changed. Generating real-world targets involves a number of tasks that are all capable of being outsourced, including, identifying market data sources and defining acceptance criteria and designing, building and executing data collection and target updating processes.

The assumptions underlying a model have a big impact on the results. We strongly believe that assumptions should be reviewed and updated regularly and documented in a way so that decisions makers can understand the impact of their choices. To do this requires economic expertise and an ability to analyse and understand information from market and other data sources.

Market Price Discovery

Market-Consistent valuation requires market data. Frequently markets for instruments relevant to valuation work are neither *deep* nor *liquid*. Some market prices may simply not exist at all. Methods are required in order to assess the available data, identify missing prices and fill any gaps. Other tasks include designing, building and executing these methods and the data collection process. Firms need to be comfortable with the methodology, but they do not necessarily need to create them or even run them. In fact, firms choosing to do this fundamentally important step in-house will need to convince themselves and auditors that any choices made are independent of the valuation process itself.

These methods should be clear, auditable and ultimately independent of the valuation process. It is not often clear how to best build these methods and, in our experience, this requires understanding of how the data is sourced together with quantitative, statistical and economic skills and a good measure of commonsense.

Calibration

Calibration involves setting up models to match selected targets or prices for specified purposes. This is not a one-off task, but something that needs to be done regularly – even as frequently as daily for some applications. Firms need to clearly identify the purpose and key performance criteria they will use to assess model performance. They also need to select the models and targets or prices relevant to the task in hand. While there is a need to show a clear understanding of the trade-offs, the data used and calibration decisions made, analysts do not always need to perform calibration calculations themselves.

The task of calibration can require judgment about the trade-offs being made to fit a model (i.e. the information that is included in the calibration exercise and how it is weighted). These processes and material decisions should be open with an appropriate level of governance and documentation. Given their recurring nature, firms will be required to apply significant skilled resources to these tasks. Further, given the demands of users of financial statements for objectivity, some firms believe that calibration should be performed independently and choose an outsourcing option.

Production and Operational

Once models are calibrated, producing scenarios requires the setting up and running of models, performing and documenting validations and delivering output to the end users. This all requires hardware – which for large problems can be a real constraint on the speed of the entire exercise. Firms do need a documented and auditable process, but could choose to outsource scenario production.

Models are only useful if the results and their sensitivity are well understood. Firms need to demonstrate that they have the ability to train and retain staff that can communicate these model risks and make informed choices. However, many of the other tasks described above involve hiring, motivating and retaining staff with deep technical skills and then managing the key-man dependence that arises.

Adding it all up

This list is not complete but it does give an idea of the full scope of an ESG model implementation. It is worth remembering that these tasks will be *in addition* to a parallel set of tasks required to implement a full internal model of liabilities, normally using other third-party actuarial modelling software. It is fair to say that the aggregate required resources, irrespective of how many of the tasks listed above are executed in-house, will be large, technical and expensive. These technically complex functions are notoriously difficult to manage. Further, any solution will be required to adapt as business needs and external demands on the risk management function evolve. In the current environment it is unlikely that firms can complete a simple one-off build. The complexity of market risks and the demands of management and regulators mean that model users are likely to face a sustained period of development and refinement of models, software, assumptions and related practices.

Most firms choose to outsource all or most of these tasks to firms like ours. Let's look at the main arguments in favour of and against the in-house ESG.

Some arguments in favour of the in-house ESG

1) <i>"Risk management is absolutely fundamental to the business. We'd be crazy to outsource it."</i>	<p>We agree that risk management is a core activity for large insurance groups who must hire in-house experts. It does not follow that <i>all</i> aspects of ESG development should be performed in-house. Firms need to think hard about which functions really do belong inside the organisation. Any decision to bring functions in-house should be tested against the cost and risk implications of using an external supplier.</p> <p>Our experience is that firms often have to learn this the hard way – i.e. by doing it and seeing the problems emerge. Typically, having tried the internal approach, firms realise it is harder than they expected, more expensive than they expected, and inevitably involves huge key-man risk and doesn't scale in the way a third-party service does.</p>
2) <i>"The regulator approves of in-house development and the level of expertise it demands of firms."</i>	<p>Regulators do expect firms to understand and document models and calibration choices. There is no question that firms that build ESGs themselves can gain from this expertise. But this is only an argument for doing <i>sufficient</i> hands-on building to understand an ESG. The vast majority of ESG users have been along this path. And the vast majority have figured out that many of these functions are best performed by people with sufficient scale, skill and focus. This is rarely achieved internally.</p>
3) <i>"External ESGs are expensive. We can do it cheaper in-house."</i>	<p>Any serious ESG project requires an ongoing commitment from software engineers, quantitative analysts, economists, actuaries and managers. Absolute baseline in-house solutions (which come with some significant operational risk) come at several hundreds of thousands of dollars per annum. Realistic solutions for a multi-national insurer will likely run well beyond the \$1M per annum mark. These costs are a multiple of the costs of external licences and calibration services.</p>
4) <i>"We've learnt by building ourselves."</i>	<p>Sure, we'd be the first to say that getting your hands dirty building models is a good thing, but don't confuse that with the permanent solution. You should also ask what happens when your in-house expert is hired by a hedge fund or falls off her snowboard – how well did she document the model? Does anyone else really understand it? Who else can make the required improvements or fix it when problems emerge?</p>

Some arguments against the in-house ESG

1) <i>Cost</i>	No one likes cost. The reality is that sharing research, development, maintenance and calibration costs across a large number of firms' results in lower costs than replication/duplication in-house.
2) <i>Quality and Knowledge</i>	We have a powerful commercial incentive for maintaining the quality of our products by hiring and retaining really knowledgeable people. Our success, and the fact that ESG modelling is our core activity, demonstrates that we have maintained high standards of quality.
3) <i>Operational risk</i>	Building, maintaining and running ESG software can expose the model user to operational risk primarily associated with loss of individual expert staff. This can be partially mitigated by building thorough documentation but mainly by ensuring you have more than one expert. These people are hard to find, expensive and easily bored so manage them carefully.
4) <i>Model risk</i>	<p>'Model risk' can be thought of as the risk of suffering a loss because a model or a calibration fails to match reality sufficiently well. Of course, every model is a cut-down, simplified version of reality (it's meant to be). Model risk can be managed by reviewing models and calibrations and documenting their weaknesses and sensitivities. Users should understand the range of applications for which a model is appropriate and the uses for which it is <i>not</i> suited.</p> <p>In practice this means maintaining a library of different models for different purposes and as a means of testing sensitivity. This requirement for multiple models is not discretionary.</p>
5) <i>The half-way house</i>	Using third-party ESG software should not mean you need to throw away your own favourite models. Modern ESG software allows the core model to incorporate external components so there is a 'half-way house' which lies between full internal development and full reliance on third-party model choices and implementations.

Summary

Building and operating ESG models requires the execution of a large number of complex tasks. In reality, some of these business-critical tasks must be retained in-house, not least because regulators and rating agencies now (quite rightly) insist that firms acquire and use expertise and document their compliance. However, there are a large number of tasks that can be outsourced. Access to a library of models, calibrations, validation tools, technical research and skilled advisers brings huge efficiency gains and mitigates the significant operational risk which arises when these skills and activities are concentrated in very small teams or inside the head of an individual.

Of course, the operational, modelling and calibration tasks required of ESG use still mean that any firm will require significant skilled internal resource. We want to help firms get the best out of this limited resource. As an ESG provider, we have a proven track record of working with in-house experts in both the multi-national and regional insurance groups. Our dedication to knowledge transfer empowers them to add real value, rather than committing time coding yet another mathematical model from scratch.

Appendix A - In-House ESG Task List

Here we provide a list of tasks firms need to consider when building an ESG, highlighting in bold those tasks that we believe a firm must do in-house.

Software Design and Build

1. **Specification of model functionality requirements**
2. Research and development of models
3. Preparation of technical specifications and test plans
4. Software design, build and testing
5. Managing software release cycles and version control
6. **User acceptance testing (e.g. Solvency II statistical quality, etc)**
7. Technical documentation of models and software
8. User documentation

Constructing a House View

1. **Identify scope of coverage across territories, asset types and required update frequency**
2. Identify market data sources, define acceptance criteria and tests
3. Design, build and execute market data collection process
4. Design, build and execute process for documenting and updating targets
5. Document processes and each pass through the process
6. **Understand all assumptions and how these have changed**

Market Price Discovery

1. Research and development of price discovery methods
2. **Understand these methods**
3. **Design auditable process showing independence of methods from valuation.**
4. Design, build and execute market data collection process
5. Design, build and execute methods

Calibration

1. **Identify model purpose and key performance criteria**
2. **Select models and calibration targets/prices**
3. Perform regular calibrations
4. **Understand calibration choices and acceptance of performance**
5. Document processes and each pass through the process

Production and Operational

1. Execute ESG runs, set up output formats, perform and document validations, deliver outputs
2. Design, configure and test hardware platform
3. **Document an auditable processes**
4. Design and build internal business processes across different teams
5. Hire, train and retain staff with deep technical skills, understand and manage key-man risks

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