

MILLIMAN REPORT

Life insurance risk, capital, and asset-liability management in the age of uncertainty

Paper 2 – Risk models and monitoring, and management implications

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Introduction

The world has entered “The Age of Uncertainty”—a period of exceptional fragility and volatility in the global economy. Indeed, as the world has faced pandemics, geopolitical conflict, energy crises and rising social issues in the past few years, economic conditions have mirrored this uncertainty: inflation and interest rates have risen rapidly to levels not seen for over 30 years and question marks persist over future volatility and economic growth. Life insurers have therefore been presented with a fresh set of challenges in dealing with these emerging and evolving risks.

We have carried out a piece of research on the challenges this poses for life insurers, based on our market experience and conversations we have conducted with life insurers, with a focus on the UK, other European, United States, and Bermudian markets specifically.

In the first of the two papers in this series,¹ we examined what this meant for risk management practices and whether insurers had expanded their risk inventories or taxonomies. We also investigated how insurers had modified their model calibrations as a result. Some of the key themes covered in that first paper included the following:

- Insurers were diligent in following their usual risk management processes during the recent economic volatility and in particular their risk identification processes to scan the horizon for new and emerging risks.
- Overall, there was a larger focus on evolving risks rather than emerging risks. Well-established risks, especially those financial in nature, such as inflation, interest rates and liquidity, were manifesting in different ways and required more attention than before.
- Insurers did not necessarily re-design their model calibrations from the ground up. Overall, insurers were content in applying more moderate adjustments, such as new parameterizations, to calibrations and stresses.
- Notably, though, there has been a shift towards more extensive stress and scenario testing (SST). Insurers gained insight from testing, for example, a range of inflationary scenarios, or mass lapse events following interest rate stresses. As a result, insurers have better understood their most significant individual risks or combinations thereof, with a particular emphasis on better understanding the risks to the business in tail event scenarios.

In this second paper, we turn our attention to how insurers’ models performed under the recent challenging economic conditions, considering capital, asset-liability management (ALM) and liquidity models and monitoring during the events of 2022-23. Based on our conversations with insurers, how well have models and processes coped with the market movements and did they struggle given the speed and size of change? What were the difficulties faced and what are the lessons for future improvements?

Moreover, we will also explore the management implications for businesses looking forward. What are the takeaways from this period? Have there been any changes to the risk management framework and governance for capital, ALM or liquidity? What are the implications for the broader business strategies?

As with the first paper in the series, our research has looked at perspectives from each of the UK, Solvency II jurisdiction, United States and Bermuda markets.

¹ Dardis, A., Ford, M., Kirk, A. et al. (November 2023). Life Insurance Risk, Capital, and Asset-Liability Management in the Age of Uncertainty, Paper 1 – Risk inventory and taxonomy and risk calibration. Milliman Report. Retrieved 18 June 2024 from <https://www.milliman.com/en/insight/life-insurance-risk-capital-asset-liability-risk-inventory-taxonomy-calibration>.

Capital models, monitoring and performance

Understanding the business risk profile and holding capital commensurate with its aggregate risk exposure is a fundamental part of every insurer's business model. Capital models therefore stand at the core of an insurer's duty to safeguard against future unforeseen events, protecting the interests of policyholders, investors, regulators and other stakeholders. Additionally, capital models can often be leveraged for many other functions across the business, including in developing profitability metrics as well as stress and scenario testing.

In this section, we provide a brief overview of regulatory capital regimes in the different regions, including the risk aggregation approach. We then summarize how, based on our conversations, insurers' capital models have fared under the recent economic conditions and the lessons they have learned for the future.

OVERVIEW OF REGULATORY CAPITAL REGIMES

Regulatory capital is the principal measurement used by regulators and investors in examining an insurer's solvency and assessing its balance sheet health. Globally, capital models have been undergoing a shift from a traditional, but somewhat inflexible, factor-based approach to a principle-based framework. This transition has enabled insurers to incorporate company-specific business risks into their risk measurement process and therefore to derive more tailored capital requirements.

United States

In the US, the minimum statutory capital for insurers is determined by a risk-based capital (RBC) framework. RBC, historically a factor-based model, classifies risks stemming from assets, insurance, market and business operations. The capital requirement within each category is determined by applying prescribed factors to the corresponding risk exposure amount. The aggregation to the final capital requirement is based on a sum-of-squares formula, allowing for a certain level of covariance benefit.

The development of principle-based reserving (PBR) over the past two decades in the US has led to the use of stochastic testing on market risk (C-3) to capture the complex interaction between product risks and market risks in a more precise manner. For example, the C-3 Phase II calculation, implemented for variable annuities since 2009, requires insurers to conduct model projections over a set of stochastic market scenarios for its specific asset and liability profile. The minimum capital requirement is then set based on the Conditional Tail Expectation (CTE) at the 98th percentile of scenario-based accumulated deficiencies.

UK and Europe

In the UK and Europe, the principle underpinning the capital requirements under the Solvency II regime stipulates that insurers should hold a Solvency Capital Requirement (SCR) sufficient to ensure that the firm can withstand a 1-in-200-year adverse event, or, in other words, the 99.5th percentile of risk. Insurers therefore will translate their 1-in-200-year stresses in respect of each risk on their risk taxonomy to an aggregate SCR that allows for the diversification benefit of different risks as well as other adjustments such as the loss-absorbing capacity of deferred tax (LACDT).

Interestingly, for many insurers, the severity of the recent shifts in economic conditions did in fact exceed the 1-in-200-year calibration of their models for certain risks, and in particular for interest rates and inflation.

Bermuda

Similarly in Bermuda, the Bermuda Solvency Capital Requirement (BSCR) that regulates solvency capital of Bermudian insurers is also in the process of undergoing changes that are introducing principle-based elements in a mostly factor-based regime. The prescribed capital charges are calibrated to 1-in-200-year events, encompassing risk categories including market, credit, insurance and operations. Additionally, a set of covariance factors is also prescribed to incorporate the diversification benefit arising from the blend of diversified business and risk. In recent years, there has been growing emphasis amongst insurers in this jurisdiction to better understand and manage liquidity and ALM and therefore a shock-based approach has been introduced (e.g., on interest rates and lapse rates) in order to quantify risks from ALM mismatches, liquidity and lapsation.

Global

In addition to more local reporting capital regimes, it is also worth commenting on global requirements that are expected to come into force in the coming years. Although currently under a monitoring period following an initial implementation, the Insurance Capital Standard (ICS) will apply to Internationally Active Insurance Groups (IAIGs) as a group-level standard in earnest from 2025 onwards. IAIGs are insurance conglomerates or groups operating in three or more countries with assets under management or gross written premiums over specified thresholds. There are currently over 50 IAIGs that have been identified, with roughly 30 of them based in the UK and Europe.

In many ways, the ICS has proven comparable to Solvency II,² aligning in a number of principles including the use of market value for assets, a market-consistent best-estimate valuation of liabilities and a margin over best-estimate liabilities to allow for non-financial risks, known as the Margin over Current Estimate (MOCE). Moreover, the approach to calculating capital requirements, known as the “Standard Model” under ICS, is similar to the Solvency II Standard Formula, whereby 1-in-200-year stresses are applied to a defined risk taxonomy, which is then aggregated using a correlation matrix. However, there are differences in the two regimes, including the calibrations of certain risks, illiquidity premia in discounting and an overall lower level of the MOCE compared to the analogous Solvency II Risk Margin.

Despite the general international movement towards a more principles-based approach, regulatory capital models still often lack the flexibility to consider company-specific risk profiles, risk appetites and risk management programs. For example, some regimes may give credit to an insurer with a robust operational risk management program, such as Bermuda, others less so (if at all), such as the United States. Furthermore, prescribed models often exhibit a delay in response to the continuously evolving risk taxonomy and correlations. Recognizing these limitations, many insurers have formulated their own capital models for internal usage. These internal capital models provide insurers the flexibility to calibrate risk charges based on management’s more tailored assessment on risk frequency and severity, as well as to promptly incorporate new risk categories as new risks emerge. Another benefit is the improved feedback loop, as this more accurate view enhances the monitoring of risk exposures, therefore enhancing risk mitigation strategies and the overall effectiveness of the risk management program.

RISK AGGREGATION APPROACH AND USE OF PROXY MODELS

Most regulatory capital regimes are based on the impact of tail event stresses to individual risks, with an allowance for dependencies between these risks (such as correlations or copulas). However, the way that the capital requirement is aggregated together has a major impact on the underlying calculations and complexity of the capital model needed. There are essentially two aggregation approaches in use:

- Calculation of capital requirements using loss amounts for each stressed risk and aggregation of the individual loss amounts. Often these loss amounts are aggregated using a correlation matrix, in which case the calculation is a straightforward matrix multiplication. This aggregation may also be done in multiple stages. For example, under the Solvency II Standard Formula approach, a correlation matrix may be applied to more granular market risks (such as equity, interest rate and spread) to aggregate to an overall market risk component. Similarly, granular life underwriting risks may be aggregated to an overall life risk component. These risk groups are then aggregated again (along with default, health and non-life risks) using another correlation matrix to form the Basic SCR under Solvency II.
- Calculation of capital requirements using an aggregated loss amount at an “all-risks” level. Under this approach, dependencies are applied between the risks themselves, rather than to the loss amounts. The capital requirement is then based on the loss for an extreme scenario—for example, the scenario with the 99.5th percentile loss under the Solvency II regime. In practice, this entails creating a very large number of all-risk scenarios (such as hundreds of thousands) for each of which the loss amount is calculated. These loss amounts can then be ranked and the appropriate extreme scenario can then be determined. The all-risks approach is quite commonly used for Solvency II Internal Models, giving a more bespoke aggregation better reflecting the insurer’s specific business.

² Christy, N., Huffer, J., Osman, R., Simpson, P. & Ward, R. (February 2021). The Insurance Capital Standard (ICS): Not Just a Sideshow. Milliman Report. Retrieved 19 June 2024 from <https://www.milliman.com/en/insight/the-insurance-capital-standard-ics-not-just-a-sideshow>.

Each of these risk aggregation approaches presents its own pros and cons.

The first approach is a relatively simple calculation, requiring only that loss amounts are calculated for each individual stressed risk, with the aggregation itself a straightforward matrix multiplication.

Although the second all-risks approach gives a more realistic view of the risk exposures in the capital requirement, particularly where other dynamics are at play (such as hedging strategies), it does lead to considerable complexity and other issues in solvency modelling and monitoring. In particular, carrying out an all-risks aggregation requires loss amounts to be calculated (or at least ranked) for hundreds of thousands of combined risk stresses, which is often not computationally practical.

UK and Europe

In the UK and Europe, many insurers overcome the practical challenges of the second all-risks approach described above by building and calibrating proxy models that approximate the losses across the whole risk space. These proxy models take the form of polynomial functions fitted to the losses, with each variable being an individual risk (alternatively, the polynomial may be fitted to each of the asset and liability values individually rather than the overall loss). Once the proxy model is fitted it can then be used to quickly derive the capital requirement in base conditions and under stresses to base conditions, as well as for ongoing solvency monitoring.

There are still drawbacks to the use of proxy models:

- The fitting and validation of these proxy models can still prove intensive in terms of both elapsed time and computational resources, though mathematical techniques such as the Least Squares Monte Carlo approach can help mitigate this. As a result, few insurers carry out the proxy model fitting in-cycle after each period end. Instead, a typical cycle is to produce this quarterly in advance of period end. This leads to real additional limitations for this approach. In particular, the underlying cash flow data being used may then be three months out of date when the model starts to be used, increasing to nearly six months for the period when it is in use. Hence the impact of new business or run-off is exacerbated.
- The use of polynomials can restrict the fitting range for each risk (or combination of risks) within which the results will be reliable. If the risk values (for individual risk and very importantly also for cross-terms) fall outside of this range, then the model will lose accuracy: the model is being extrapolated outside of the range for which it was built.

United States

In the United States, insurers often use “model efficiency” techniques to address the computational burden of the risk aggregation approach used, which may entail efficient well-written code, creative application of mathematical and actuarial techniques or state-of-the-art technology. An article published by Anthony Dardis in the Society of Actuaries’ “The Modeling Platform” a few years ago gives an overview of the primary model efficiency techniques in use across the industry, including scenario reduction, proxy modeling, cluster modeling and replicating portfolio.³

Due to the real-world focus of statutory capital calculations in the United States, such as C3 Phase II variable annuity capital, there has been less attention paid to proxy modeling other than for companies that are using a market-consistent approach similar to Solvency II for their internal capital assessments. However, companies with large block of complex business often deploy techniques such as scenario reduction and cluster modeling approaches to reduce model runtime and improve reporting frequency.

Cluster modeling involves sampling the representative individual data points or scenarios, and mapping similar data points/scenarios into the selected representative data points. The representative data points are selected through the clustering process based on the key risks and cash flow characteristic each product represents. Its application does not just cover capital calculations but can be used to help manage the calculations associated with any complex metric. For an excellent introduction to the topic, a 2008 Milliman report by Avi Freedman and Craig Reynolds, “Cluster Analysis: A Spatial Approach to Actuarial Modeling”⁴, is well worth reading.

3 Dardis, A. (April 2016). Model Efficiency in the U.S. Life Insurance Industry. The Modeling Platform, published by the Society of Actuaries. Retrieved 19 June 2024 from <https://www.soa.org/globalassets/assets/Library/Newsletters/The-Modeling-Platform/2016/april/mp-2016-iss3-dardis.pdf>.

4 Freedman, A. & Reynolds, C. (August 2008). Cluster Analysis: A Spatial Approach to Actuarial Modeling. Milliman Research Report. Retrieved 19 June 2024 from <https://www.milliman.com/en/insight/cluster-analysis-a-spatial-approach-to-actuarial-modeling>.

Cluster modeling continues to hold much promise for the industry, as senior management at life insurance companies continue to demand deeper, more timely and more frequent analytics. For products with significant market risks, such as variable annuities with guaranteed minimum benefits of different types (GMxB), stress analysis under different market shocks is an essential part of an insurance company's hedging and risk management process. Moreover, to the extent runtime issues will still exist around proxy modeling in having to calculate "actual" values for fitting and validation purposes, cluster modeling can be a very useful supplement to proxy modeling. Indeed, we are aware of some practitioners in the industry applying the techniques in tandem—a kind of "hybrid" approach to model efficiency.

CAPITAL MODEL AND MONITORING PERFORMANCE

Notwithstanding the extremity of recent events, and in particular those surpassing the 1-in-200-year probability underlying the Solvency II regime in Europe, insurers commented to us that they remained broadly happy with the overall quality of their capital modeling and monitoring, and overall the industry globally continued to be well-capitalized. Insurers were able to monitor solvency in a timely manner, both for internal purposes and to meet any additional queries from regulators. The results are sufficiently accurate for their purpose; whilst some insurers find reasonably sizable "true-up" adjustments at each period end between their solvency monitoring models and the actual period-end valuation results, they are generally within manageable values.

There are common themes for the areas that caused particular challenges for capital monitoring, which included the following:

- The size of the market moves, especially for interest rates and inflation. Where intra-period solvency monitoring was carried out using matrices or similar approaches, the size of the market moves, both for individual risks and from the combination of risks, would cause these calculations to become inaccurate. For example, the large changes in interest rates caused non-linear effects on long-duration cash flows, e.g., for lifetime annuity products (the "cross-term" impact).
- Allowance for changes in underlying business. Solvency monitoring models are typically rolled forward from the previous valuation date. Whilst they can include adjustments for predicted new business and in-force run-off, these volumes and/or the capital impacts may not always be accurate. While models can generally cope well with predictable organic business sales and business run-off, large block transactions such as a pension risk transfer (PRT) can lead to large and sporadic increases in new business premiums; the new business strain can also be quite varied depending on the size of the scheme, market conditions at the time of the transaction and any reinsurance placed. Tracking and modeling all of this in volatile economic conditions proved challenging for several insurers.
- Modeling discontinuities in the capital regime. Whether it entails a fundamental transformation of the capital regime or the smaller continuous reforms that usually follow, changes in regulatory capital regime can mean a discontinuity in how it operates and it can be hard to predict when and how this bites.
 - As an example, under Solvency II, insurers may make use of a transitional measure on their technical provisions (TMTP), which allows the increase in technical provisions (TPs) as a result of the switch from the previous Solvency I regime to be gradually phased in over a number of years, but subject to a financial resources requirement (FRR) test that ensures the resulting TPs are not lower than they would have been under Solvency I. This has surfaced as an issue for some insurers in the UK where the FRR test has recently been on the cusp of biting, given recent market conditions. However, the test is now being rapidly phased out during 2024 by the Prudential Regulation Authority (PRA), which is a helpful simplification.
 - In both the United States and Bermuda, while regulatory capital changes have focused primarily on updating risk charges, insurers find themselves compelled to reconsider their strategic asset allocation (SAA) and target business mix to optimize their capital efficiency in response to regulatory shifts.
- A further challenge encountered, especially for insurers with large books of complex business, relates to out-of-model (or "manual") adjustments within their calculations. These adjustments, for example, may include tax calculations as an overlay to the valuation or business that is not explicitly modelled within the main valuation systems (due to its recent acquisition, lower materiality or because it is non-insurance business such as a staff pension scheme). Often the capital modeling of these manual items is more limited than for the main model, and/or the aggregation of it into the overall results is approximate. Under the severity and volatility of recent economic conditions, these limitations have been exacerbated and the potential misstatement has become more material.

- A related point to the manual adjustments is the overall solvency modeling and monitoring processes. Those insurers that had slick and controlled processes, such as efficient and well-defined workflow tools, performed best in terms of producing timely forecasts, and were able to spend more time understanding and explaining the results and underlying exposures. A benefit of this is a quicker feedback loop on the outputs of models, ultimately leading to more accurate results within fixed deadlines.
- The quality of end-of-period analysis of change (AOC) or surplus attribution. Often this analysis is based on approximate techniques or data – whilst this may lead to a reasonable AOC in more benign conditions, the limitations can have more impact when experience has been more varied, leading to large unexplained items in the AOC or potentially even some level of misattribution across the factors considered. The impact of cross-terms between risks, new business or asset trading or hedge rebalancing were examples of the causes of this.

STRESS AND SCENARIO TESTING

A recurring theme in our discussion with insurers, as discussed in the previous paper, was the increased attention towards SST, which allowed insurers to understand their exposure to individual risks or combinations of risks and to test their resilience across a range of different scenarios.

Insurers that had thoroughly carried out this investigative SST work in advance of the recent events had been able to use the insight gained to improve their capital monitoring, for example by introducing or enhancing specific cross-terms where they knew they had greater sensitivity, and it also helped them to better explain and understand the results. Other insurers are now following suit here, being more questioning and proactive in their use of SST.

This seems to be a tool set to be used consistently across the industry in the future, building on the significant progress made in recent years to enhance SST capabilities.

LESSONS LEARNED AND FUTURE IMPROVEMENTS

In some ways, the improvements insurers are looking to make to their capital models simply follow on from activity started before the recent period of market shocks—the continuous refinement of the accuracy of models and their operation, albeit with perhaps a little more urgency now.

Analysis of change

An accurate and granular AOC is a very important control tool for capital monitoring. The most material elements within the unexplained highlight the limitations that have the most impact on the model accuracy, and hence represent the areas to prioritize to improve. Insurers have carried out work on their AOC processes, data and methodology to improve the timeliness and understanding from this control. Of course, improved AOC is also a good starting point for understanding items such as hedge effectiveness for ALM.

We have commented above on the additional use of SST to gain insight into the risk exposures and the increased use of this by insurers. SSTs can also be used to better understand and complement the AOC.

To help bring the concepts to life, an example of a capital management dashboard, showing details of the components of required capital and including an AOC showing how each underlying risk has contributed to the movement in capital between periods, is shown in Figure 1. It was previously published in a Milliman paper outlining Bermuda enterprise risk management (ERM) best practices,⁵ but is applicable more broadly as an indication of the type of “at-a-glance” picture that can be provided to senior management to help their understanding of what is driving their company’s capital movements.

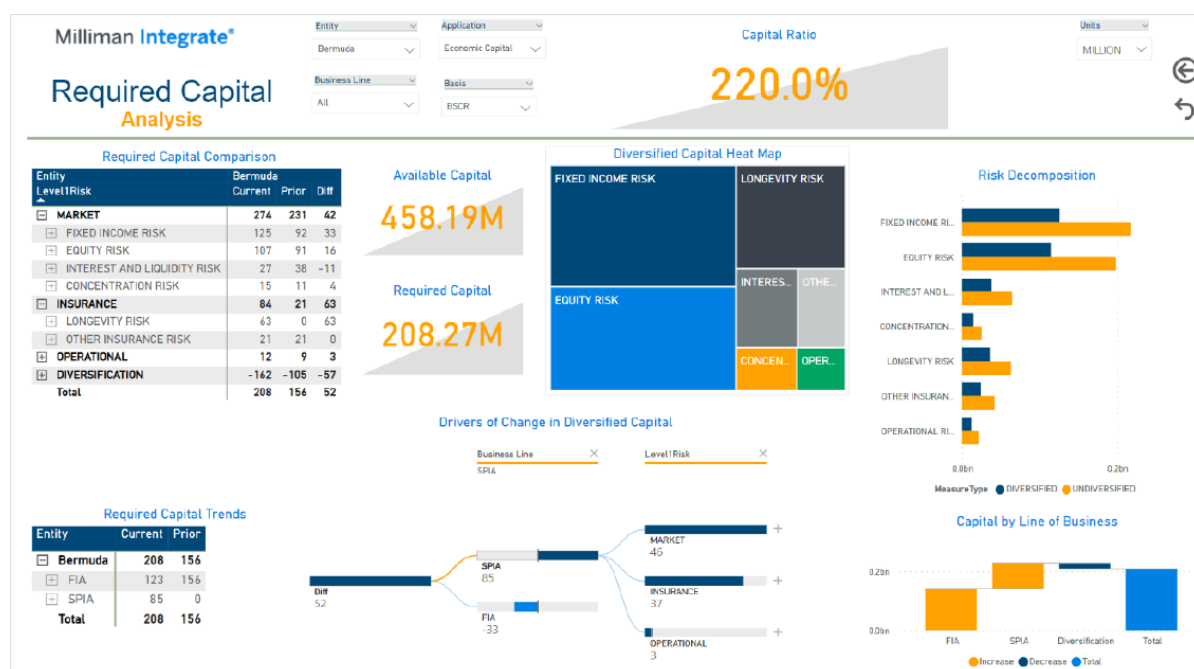
At the top of the dashboard, management has the option to slide the data in a variety of ways, including looking at capital from a regulatory or internal capital perspective and by line of business. The dashboard then presents, in an easily digestible format, the following (moving clockwise from top left-hand corner):

- Analysis of current versus prior period required capital, split by risk category and individual risks under each category, including an AOC.
- Amount of available to required capital is highlighted. The important capital ratio metric is also shown at the top of the dashboard.

⁵ Dardis, A., Hines, W. & Lee, S.M. (October 2022). Best Practices in Risk and Capital Management for Bermudian Life Companies. Milliman White Paper. Retrieved 19 June 2024 from <https://www.milliman.com/en/insight/best-practices-risk-capital-management-bermuda-life>.

- Heat map of the target capital contribution of each risk after allocation of the diversification benefit.
- A risk decomposition analysis, showing the contribution of each risk on a pre- and post-diversification basis.
- Capital allocation analysis by line of business.
- Analysis showing the drivers of change in diversified capital from prior period to today, split by line of business and risk category.
- Summary of change in current versus prior period required capital by line of business.

FIGURE 1: SAMPLE REQUIRED CAPITAL MANAGEMENT DASHBOARD



Use of internal capital models

Regarding the usefulness of internal capital models, there looks to be mixed views. While in theory there are benefits to a company having its own view of the risks to which it is exposed and the funds needed to cover long-tail exposures, it can be an expensive number to calculate, and there can be issues with the timeliness of producing these numbers. There is an important difference between practice in the United States compared to the UK and Europe. In the United States, the company will have to hold capital requirement based on the standard requirement anyway, with any internal capital model only being used for internal management and decision making. In the UK and Europe, insurers can apply to the local regulator for their internal model to be approved. Although this is a costly and time-intensive exercise, once approved the model is used for regulatory capital, rather than the Solvency II Standard Formula approach. Whether an internal capital model or the Solvency II Standard Formula apply, however, the firm will still have to perform the Own Risk and Solvency Assessment (ORSA) to form its own view of its solvency and capital requirements, from which insurers will help determine the capital buffer the insurer feels is appropriate above that amount which is strictly required from the regulator.

Among the companies that do have an internal capital model, getting widespread usage across the company appears to be an issue. Again in the United States, as a general point, while we don't see differences in the attitude towards internal capital by size or business complexity, and whether publicly listed or mutual, we do see less emphasis placed on the metric and its usefulness by companies with ownership in an investment management or private equity (PE) firm, where there are other financial metrics and lenses that are viewed as more relevant to running the business. In that regard, the cost associated with calculating an internal capital number isn't just one of staffing and computing resources to produce the numbers, but also an opportunity cost in potentially crowding out senior management's focus on other metrics that are more important.

Other operational improvements

Insurers are also searching for operational improvements that can be made to their end-to-end processes where possible, such as automation or better organization of data streams. As always, the extent to which these processes can be made quicker, more efficient or with fewer limitations allows the insurer to be more responsive and accurate to rapidly changing economic conditions. Of course, quicker capital model refreshes can provide quicker and more up-to-date “hand-ins” to the teams managing ALM or liquidity, which we shall look at in the next sections.

Some insurers using proxy models—popular in Europe but less so in the United States and Bermuda—have been relooking at the model fit and its applicable range to see if they can be improved, though this can be challenging as mentioned above.

ALM models, monitoring and performance

In many ways the recent market volatility has been a very genuine test of insurers’ ALM capabilities, and this has certainly been a testing and busy period for ALM teams. Moreover, with the increased movement into alternative assets across the industry, this has created considerable need for more sophistication on the asset modeling side as well as new types of ALM analytics to assess the appropriateness of more esoteric and potentially more complex structures. There are also regulatory challenges, e.g., increased scrutiny in the United States by the National Association of Insurance Commissioners (NAIC) and other regulatory bodies on alternative assets, which adds additional uncertainty to the future appeal of some asset types, and further adds to the complexity of ALM in “The Age of Uncertainty.”

As well as differences in models and processes, the underlying ALM and hedge strategies and frameworks themselves have had a large impact on how well insurers have met their objectives.

In this section, we will briefly examine current ALM practices before visiting how the challenges of recent years will lead to improvement in the future. Throughout this section, when we refer to ALM, this will include any hedging carried out as part of the management of the portfolio.

CURRENT ALM PRACTICES

Traditionally, ALM across the life insurance industry primarily has been focused on interest rate risk management. That generally means aligning the sensitivity of assets and liabilities to interest rates, i.e., aligning asset and liability duration, and if there is optionality in the assets and liabilities also looking at the sensitivity of duration to changes in interest rates, i.e., aligning asset and liability convexity. It’s also important to look at sensitivity to parallel shifts in the yield curve, while “Key Rate Durations” (which look at shifts at specific points in the yield curve) are also valuable in helping to assess sensitivity to non-parallel shifts.

Metrics to support hedging take these concepts further to consider a wider range of sensitivities, namely the so-called “Greeks”: delta (sensitivity of an option’s price to changes in the price of the underlying asset); gamma (sensitivity of an option’s delta to changes in the price of the underlying asset); theta (rate of change in an option’s price over time); vega (sensitivity of an option’s price to changes in the volatility of the underlying asset); and rho (sensitivity of an option’s price to changes in the risk-free interest rate).

For certain product lines we have seen interest rate risk management go beyond just duration/convexity matching and extend to cash flow matching, e.g., a “dedicated portfolio” approach is sometimes seen to cover annuities in payment. We have also seen cash flow matching used where local regulations have a requirement for such, e.g., for Matching Adjustment portfolios in the UK, or from the Bermudian regulator’s recent overhaul of its regulatory framework and requirement that the Best Estimate Liability (BEL) assumes a cash-flow-matched portfolio.

Hence, the responsibilities of the modern ALM unit can now go well beyond just managing interest rate risk.

- Responsibility for interest rate risk management, with duration/convexity calculations, remains a core function of any ALM unit. This may also include the responsibility for setting limits or at least guidance on duration targets.
- Some ALM units may also be responsible for managing liquidity and currency risk. However, this does not extend to credit risk—this is generally managed within the investment department.

- If the company practices asset segmentation, the ALM unit's mandate may also include responsibility for aspects related to that.
- The ALM team may also support aspects of SAA, e.g., setting limits on the mix of assets considering risk and return and regulatory and capital constraints. This is especially relevant when more complex risk-return metrics involving liabilities as well as assets are brought into the SAA decision, such as the present value of distributable earnings (PVDE).
- We are also undergoing a noticeable shift towards environmental, social and corporate governance (ESG) considerations being integrated into investment frameworks, adding another dimension.
- Some units also take responsibility for cash flow projections and sensitivity testing exercises, such as Asset Adequacy Testing (AAT) in the US, plus ALM stress testing to help support the Own Risk and Solvency Assessment (ORSA), e.g., impact of a higher for longer interest rate environment.

A simple and typical ALM process can be considered as follows.

- Set the ALM objectives or strategy. This will of course depend on the business objectives, constraints and risk appetite, but a simple example might be "to protect the position of excess assets over technical provisions, with respect to equity, currency and interest rate risks" (within a specified tolerance). In some jurisdictions such as Bermuda, companies will also have to consider a number of regulatory thresholds including liquidity ratios in their ALM strategy.
- Determine the "liability" benchmark for this strategy. Typically, this can be determined as the liability sensitivities to market movements (duration, convexity and the Greeks, as discussed earlier); another approach (particularly if the liabilities include options or guarantees) would be to calculate a replicating portfolio, which responds in a similar manner to the liabilities.
- Determine, hold and maintain the matching assets—that is, the asset portfolio that will match the liability sensitivities. This will of course allow for all assets held, those being used to back liabilities, excess assets and any specific additional matching or hedging assets.
- The ALM implementation will typically be either "static," where the liability benchmark and asset rebalancing is carried out relatively infrequently (for example at the end of each quarterly reporting period), or "dynamic," where the liability benchmark is updated very frequently (either through a direct calculation or through the change in the liability replicating portfolio Greeks) and the assets rebalanced correspondingly.

ALM MODELLING AND MONITORING PERFORMANCE

Whilst some ALM modelling and monitoring performed well, there was a more mixed performance across different insurers than was experienced for capital modeling.

In the United States, companies often use the same models as used for AAT as a starting point for ALM, to the extent those models involve full projections of asset and liability cash flows. In the spirit of "one source of the truth," in an ideal world there would just be one model handling all of reserves, capital, AAT, ALM and liquidity risk management, but in practice there are many reasons why this may not be the case. Most notably, the models for AAT would only consider assets backing the best estimate reserves, so any ALM involving target capital over and above that, and ALM involving the surplus account over and above target capital, will require additional modeling. Moreover, it will also likely require more sophistication in asset modeling because more illiquid and complex investments will likely be found backing the funds in excess of best estimate reserves.

With that in mind, we often see ALM models based on a combination of the main reserves/capital or AAT models, supplemented with other models for the cash flows on specific assets, liabilities or hedges. One advantage of having these supplementary, more focused cash flow models is that they can be more transparent and intuitive than a full capital model, which may have a lot of underlying complexity and interaction, becoming a so-called "black box." However, the two types of models do need to complement each other and work consistently together. Supplementary models that look at one component of an ALM program for example, may miss the impact of offsets or additions from other business areas.

The underlying ALM strategy or objective has proved to be a key factor in how successful insurers were in achieving their ALM over the past few years. For example, in the UK it is common for insurers' ALM strategy to be one of the following:

- To protect the excess of assets over technical provisions (for the UK this is the “Own Funds” position), or something fairly equivalent to this (such as the Own Funds position with moderate adjustments, or the International Financial Reporting Standard [IFRS] 4 position). The key prerequisite here is that that liability benchmark being matched will typically be quite well-behaved, for example reasonably linear (or close to some fairly vanilla options) and also independent of the ALM or hedging strategy.
- To protect the excess over capital requirements (for the UK, this is the SCR) position, such as the excess surplus over capital requirement, or even excess surplus over capital requirement plus solvency risk appetite buffer. The difficulty around this is that the liability benchmark has to include the capital requirement, which typically behaves in a far less straightforward manner than technical provisions. Additionally, the capital requirement will itself change as the matching or hedging asset position changes, which introduces circularity into the ALM calculations and processes.

There has been a wide range of areas that caused challenges to ALM modeling, monitoring and performance.

- As mentioned above, the increased movement into alternative assets across the industry has created considerable need for more sophistication on the asset modeling side. This has certainly proved to be challenging, given that these new asset types require specialist skill sets, which are more typically housed in the investment team than the actuarial modeling side. Moreover, we can only expect the sophistication required on the asset modeling side to increase. Certainly, the demand for alternative assets had been, in part, driven by the pursuit of yield in a low interest rate environment, and there may be less pressure to invest in alternative assets in the current rate environment. However, another driver of activity has been the competitive pressure that has come about because of the increased presence of PE firms in the life insurance space and their ability to generate additional returns in specialist investment areas, and that will not go away in a higher interest rate environment. Coupled with shifting regulatory treatment on alternative assets, the requirement for advanced asset modeling can be expected to continue.
- Managing the excess surplus over capital requirements position is considerably more complex than one based on excess over technical provisions. The capital requirements are often sensitive to market conditions in quite complex ways, for example they often have greater convexity, there are interactions with other risks and there may also be circularity with any hedging strategy. Modelling the liability benchmark (including the capital requirement) is more complex than it is when modelling technical provisions in isolation, and this becomes increasingly less accurate in volatile market conditions. From our discussions, insurers trying to manage excess over technical provisions were able to do this more successfully than those matching excess over capital requirements.
- Over the recent period, markets witnessed dramatic and rapid changes in both the level and shape of interest rate curves. Interest sensitivities typically exhibit a fair level of convexity, so the ability to frequently update the PV01 (the impact on the assets/liabilities of a change in interest rates of 1 basis point) or to build the non-linearity into benchmarks was important, given the large size of the changes. Further, the changes in curve shape highlighted the importance of matching PV01 for different duration periods, rather than just to parallel shifts in the curve.
- Changes in inflation rates were also extreme. Similar factors applied as for interest rate matching, albeit that inflation matching is often less material than interest rate matching. Exceptions to this apply when the policyholder liabilities have inflation linkages, or even inflation caps and floors, as is found on some PRT business, such as Limited Priced Indexation (LPI) business in the UK.
- Hedging, and the rebalancing of hedges, is a difficult operational process for insurers. Often, this can be due to the fact that ALM teams are “end customers” of other business as usual (BAU) processes—meaning that, for example, they may require the results of the on-cycle capital and liquidity models to finish to calibrate their hedging strategies. This can push the hedging exercise to late on in the cycle and the time lag that results can cause risk to the insurer that its hedging benchmark is out of date. This risk is heightened through periods of market volatility. There is a wide range of approaches to determining the liability benchmark and hedge rebalancing—for example, some insurers rebalance assets on a very frequent dynamic basis, whereas some perform this on a fixed regular basis such as monthly or quarterly.

- Hedge effectiveness monitoring—which analyzes the change in balance sheet to economic conditions between (i) the impacts from the liability benchmark, and (ii) how closely the assets perform to the liability benchmark—is a critical control to understanding and improving hedge performance. Often, the key input for this is the AOC from capital models, or similar information, which, as we have noted earlier, was an exercise that some insurers found difficult to perform with the accuracy they desired.

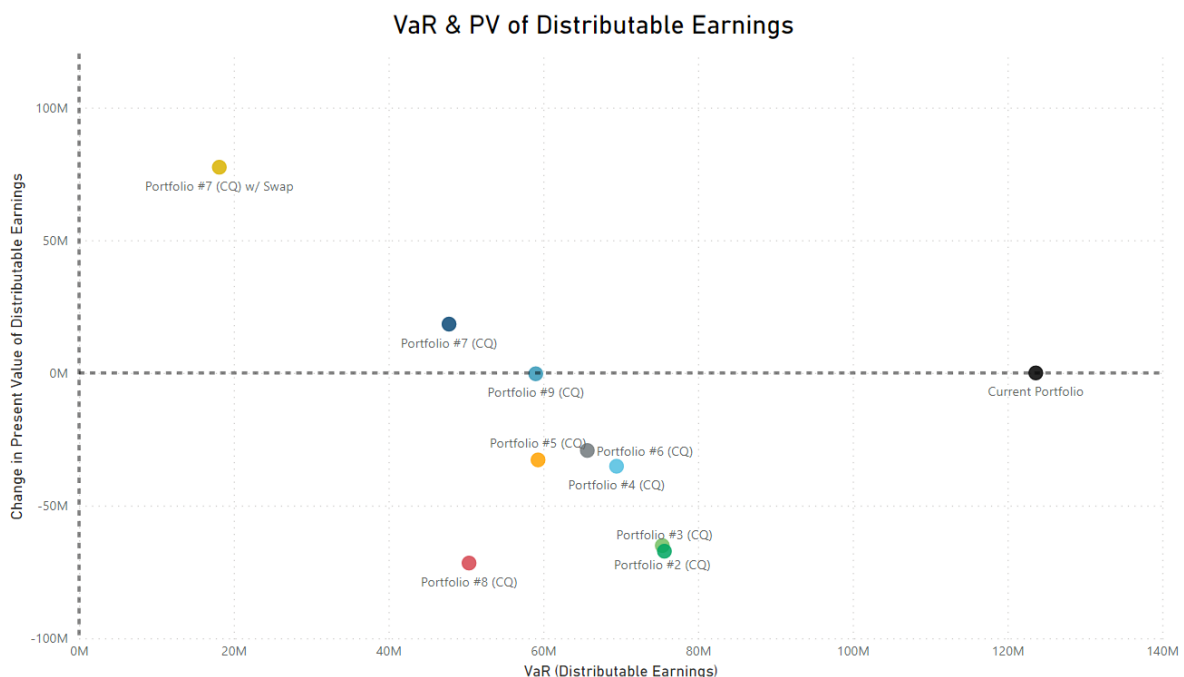
WHAT MIGHT ALM LOOK LIKE IN THE FUTURE?

Recent developments regarding ALM and SAA becoming more intertwined have been particularly interesting in the United States. Increasingly, we are seeing life insurers bring more complex measures into their asset allocation process, and looking at risk-return metrics that capture liability aspects as much as asset aspects. In a recent Milliman survey of SAA practices in the US and Bermuda, out of 29 participating companies, as many as six reported they were using PVDE as a return metric and four reported they were using internal or economic capital as a risk metric to create an efficient frontier showing optimal asset profiles for given levels of risk appetite for the company. The relatively high number of companies referencing their use of metrics such as PVDE and economic capital to support asset allocation is quite remarkable given these are highly complex calculations. It is reflective of how far along technology has come in recent years in making such practices computationally possible. Moreover, some are starting to look at risk measures such as the volatility of PVDE (Value at Risk, or VaR) and downside risk to capital (Capital at Risk) in supporting SAA. An example of a complex (albeit hypothetical) efficient frontier using PVDE as the central risk-return financial lens is shown in Figure 2. This hints at what the next generation of ALM will look like.

Some background notes:

- All alternative portfolios to the current portfolio shown are asset-liability cashflow-matched portfolios—and, because they are all to left of the current portfolio, they reflect a reduction in VaR from all cashflow-matched portfolios.
- The “(CQ)” label indicates credit quality matches with the existing portfolio.
- The example is Bermuda-oriented, which credits insurers for cash flow matching. In this example, when cash flow timing is optimized, each of the Bermuda Solvency Capital Ratio (BSCR), interest rate risk charge, BEL and VaR factors is reduced.
- In our example, a swap overlay provides an additional cash flow hedge.

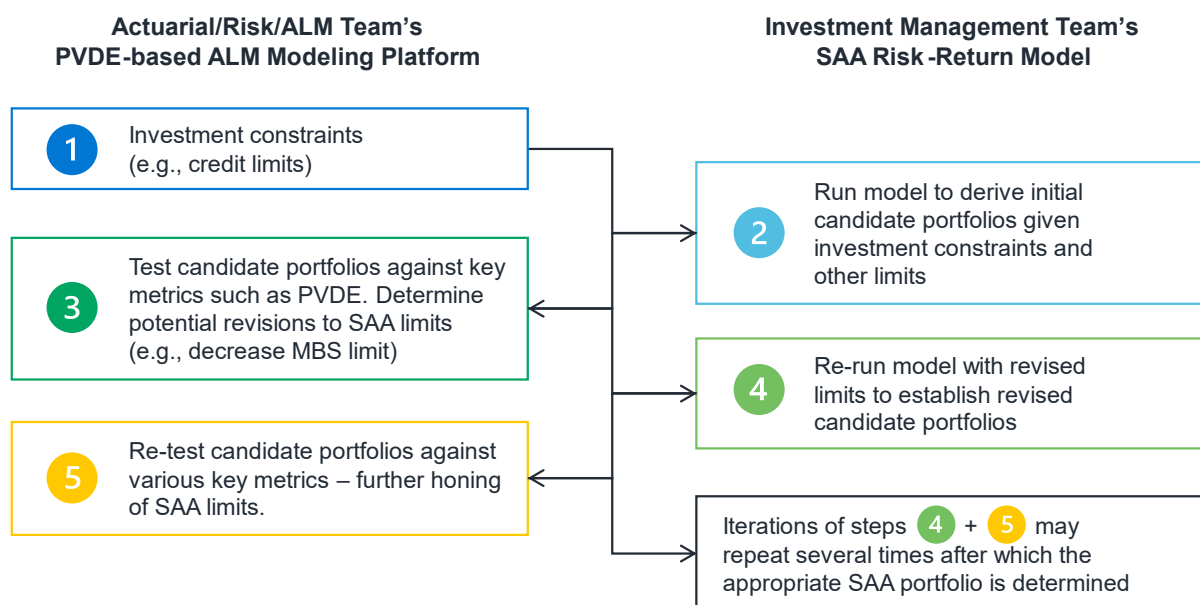
FIGURE 2: THE NEXT GENERATION OF ALM – EFFICIENT FRONTIER DEVELOPMENT USING COMPLEX ASSET-LIABILITY RISK-RETURN METRICS



While certainly not replacing the more traditional models used by investment departments to make asset allocation decisions, models on the ALM side are being used more frequently to help supplement the investment team's models, ensuring that better informed decisions are being made. This leads to a fascinating new dynamic: in "The Age of Uncertainty," investment, ALM, risk, and actuarial teams are necessarily being brought closer together to optimize strategic decisions.

Specific to the question of how complex risk-return metrics are being brought more into the SAA decision, Figure 3 shows how, in a best practice state, the decision on optimal asset mix reflects iteration between ALM (and/or risk and/or actuarial) and investments.

FIGURE 3: SAA AS AN ITERATIVE PROCESS BETWEEN THE INVESTMENT AND THE ALM, RISK AND ACTUARIAL TEAMS



The result of this iterative process is more open dialogue, and ultimately investment decisions that are truly optimal in balancing all the critical financial lenses through which the company wishes to manage itself.

LESSONS LEARNED AND FUTURE IMPROVEMENTS

When reflecting on their performance over the past couple of years, insurers will consider a number of key ALM areas to improve for the future.

Insurers will certainly be keen to further improve the data streams providing asset and liability data as well as the hand-ins from other teams. Indeed, this was often commented upon in our conversations. The more granular and accurate data that can be provided, the better the ALM performance. In addition, the quicker the ALM team receives this information, the lower the exposure to adverse market movements over the period. Automation of the more routine steps of the end-to-end processes can help in this regard.

The recent economic conditions also underline the importance of regular monitoring, including assessment of hedge effectiveness. Again, insurers seem keen to further refine such exercises as part of their control cycle to better attribute the performance to drivers as part of the AOC and reduce any unexplained movements.

Finally, and perhaps most importantly, some insurers are reassessing their overall ALM objectives or strategy. With the rises in interest rates, many insurers that were matching the excess over technical provisions have made large surplus profits, giving them more capacity perhaps to take on risk. In contrast, many insurers that were matching excess over capital requirements will have reduced their Own Funds position or IFRS earnings and are now considering whether a more nuanced hedging strategy would be more appropriate. IFRS earnings are also important to some insurers and the introduction of IFRS 17, which behaves very differently from IFRS 4, is another driver causing insurers to consider their ALM objectives.

Liquidity models, monitoring and performance

More so than had been anticipated, insurers faced real challenges in managing and monitoring their liquidity over the recent period, and in numerous cases liquidity has become a truly biting constraint. The underlying reasons were explored in more detail in the first paper, but there are three aspects in particular to highlight.

- While liquidity has been viewed as a key risk for life insurers for many years, the current rate environment has brought that risk front and center for many firms in the context of potential policyholder lapsation.
- With ever-increasing pressure to maximize returns, insurers are assuming greater liquidity risks, by investing into illiquid alternative assets, and are less prepared to hold more cash than necessary. This in turn has brought liquidity risk management into focus as a crucial component of an overarching ALM program.
- A material factor in recent years has been the requirement to post margins or collateral on derivative positions, in particular for interest rate or currency positions. The exposures on these positions can be very sizable, geared and hence very sensitive to conditions and requiring real-time postings.

In addition, in some jurisdictions, the local regulator is placing considerable emphasis on liquidity risk management, putting pressure on insurers to ramp up their programs to clearly articulate how they are measuring, monitoring and managing this risk. The Bermuda Monetary Authority (BMA), in particular in its recent review of the local regulatory regime,⁶ places great emphasis on this risk, and on aspects of a company's programs they expect to see in place. In the UK, the PRA is expecting to introduce standardized liquidity reporting for insurers, although it is also notable that the Bank of England is planning to set up a liquidity backstop for non-banks during market stress, targeting the UK gilt market, insurers and pension funds. This initiative reflects the need for such solutions, given the recent crises in markets, including the gilts crisis in the UK over September and October 2022, which was commented upon in more detail in Paper 1.

Liquidity models used by insurers are usually a combination of top-down (e.g., based on capital models) and bottom-up (e.g., based on collateral cash flows). They assess liquidity over a number of different time horizons, such as 1-day, 1-week and 1-, 3-, 6- and 12-month periods. Different derivative arrangements can require different collateral asset types—they can be cash, or for “dirty” non-cash credit support annexes (CSAs) government or corporate bonds, which can have a very material impact on liquidity management.

LIQUIDITY MONITORING AND MODEL PERFORMANCE

Insurers had mixed results in dealing with their liquidity over the period. We can pinpoint two general processes that determined insurers' performances.

- The day-to-day management of liquidity positions, particularly with respect to managing margins and collateral.
- Using liquidity models to understand the overall level of liquidity, the risk exposures and how to manage them.

The factors affecting each of these processes were as follows.

- Day-to-day liquidity management is very much a “real-time” issue, requiring daily monitoring and posting, often on highly geared liquidity positions. A key foundation for robust and proactive liquidity management is accurate and up-to-date data. Armed with that, insurers then needed fast and well-controlled processes to manage the positions. In practice, there was a wide range of outcomes for different insurers here.
- Derivative strategies may have built up over a long time and comprise a very large number of different positions. Where this is the case, the day-to-day posting becomes more complex.
- Day-to-day management frequently involves several teams, for example the ALM team, Treasury team and an investment operations and/or investment management team, which may also involve a third party. Responsibilities and hand offs may not always have been transparent—indeed, the different teams may have acted in silos, leading to poor communication and other inefficiencies.

⁶ BMA (28 July 2023). Consultation Paper: Proposed Enhancements to the Regulatory Regime for Commercial Insurers. Retrieved 20 June 2024 from <https://www.bma.bm/viewPDF/documents/2023-07-28-16-11-59-Consultation-Paper---Proposed-Enhancements-to-the-Regulatory-Regime-and-Fees-for-Commercial-Insurers.pdf>.

- Selecting the most efficient asset to post is important—for example, always posting corporate bonds to a dirty CSA whenever this is possible, rather than cash or a government bond. Due to the speed that postings were made, this was not always achieved in practice.
- Understanding the overall liquidity position, particular intra-period between valuation dates, is of course also important. Success here typically depends on an accurate underlying valuation position, such as from the capital model, but will also require up-to-date information on the holdings of different asset types.
- Each of these factors leads to uncertainty in the overall liquidity position or in how to operate it efficiently. These shortcomings have led insurers to hold additional liquidity buffers.

LESSONS LEARNED AND FUTURE IMPROVEMENTS

The consequences of poor liquidity management can be very real, and we are aware of insurers holding substantial buffers on their required liquidity to compensate for the limitations or inaccuracies involved. The size of collateral postings required means also that short-term liquidity has often become a biting constraint, which it may not have been in the past. Certainly, where these two factors combine, and perhaps more generally, liquidity data flows, models and operational processes are being reviewed and upgraded at many insurers to make them more efficient and robust. Although improving them was always an objective for insurers, they are being given more priority now. Understanding and managing liquidity is being given more focus by regulators as well in their interaction with insurers.

Insurers are starting to do better in joining up the teams involved in liquidity management, ensuring that responsibilities are clarified and processes clear, particularly, for example, what to do and how to communicate when issues arise. Some insurers have moved their ALM and Treasury teams under the same reporting line to reinforce this.

Relating back to the theme of SST, again those firms with well-developed SST were the best equipped to cope with market movements that had the potential to squeeze liquidity. Testing a range of different scenarios, especially those that tested combinations of risks, shone a light on the key constraints and sensitivities of their portfolios, and therefore guided insurers where remedial action was required. We expect SST to be adopted even more widely as a key tool in liquidity management in the future.

Some insurers mentioned they are reconsidering their liquidity framework or will do so in the near future. A common change is to expand the time horizons over which liquidity is assessed, but other factors being considered are the appropriate level of risk appetite and how this interacts with buffers, for example.

Insurers have also explored how to reduce their collateral strain and have made use of solutions such as the use of dirty CSAs to achieve this where possible. Some have also simplified their hedging arrangements, that is, consolidating a large number of positions with different managers into a smaller number and thereby reducing the operational complexity of collateral posting and monitoring.

Management implications

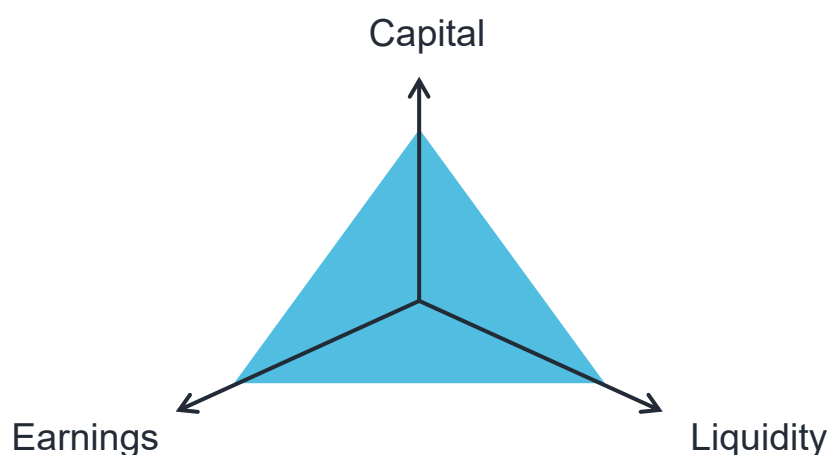
Ultimately, every insurer had its own experience over the recent economic conditions, reflecting pre-existing risk profiles and risk management processes. In turn, this has translated to management implications that are unique to each firm, ranging from the short to the long term. That being said, there are common themes in some of the priorities that have emerged across the industry.

MANAGING IN THREE DIMENSIONS AND BUSINESS STRATEGY

All life insurers have to manage through multiple financial lenses, but ultimately it comes down to managing their financial and economic positions across three dimensions; maintaining an appropriate level of capital (statutory, rating agency or internal/economic), of earnings (which may be on a similar basis to the capital measure or a different one, such as IFRS or US GAAP) and of liquidity. Each dimension has its own targets, constraints and sensitivities.

We can think of this as moving around a three-dimensional space, as depicted in Figure 4. For any insurer action, external impact or event, the insurer will move to a different point in that three-dimensional space. Prior to the recent volatility, given the long period of relative stability, insurers will have developed a good understanding of and perhaps even a fairly robust equilibrium point within the three-dimensional space, along with a fairly predictable business model. For example, a company may have found that one of the constraints could be easily met and did not really impact its strategy, or that it had a good understanding of how the sensitivities interacted. Its investment strategy and new business profile may have been reasonably static for a number of years.

FIGURE 4: LIFE INSURERS MANAGING THE THREE-DIMENSIONAL FINANCIAL SPACE OF CAPITAL, EARNINGS AND LIQUIDITY



However, in the new economic conditions, insurers are now in a different position in the three-dimensional space, and different sensitivities apply. Constraints that may have had little practical impact in the past now need to be carefully managed and the interplay between risks and sensitivities understood. Previous sensitivities or “rules of thumb” that applied within this space may now behave very differently.

This is not just a matter for Risk, Finance or Actuarial teams to model and manage, but is of fundamental strategic consequence for insurers. A number are carefully considering the strategic impact of the changes and how best to deploy capital and liquidity across different business lines or how to adapt their investment, ALM or hedging position to the new environment.

Other related points to the business strategy include the following:

- Overall, any changes to the operation of the business should be considered in tandem with the wider business planning strategy. Most, if not all, life insurers carry out an annual planning exercise, which typically projects out a three-year or five-year plan and business strategy. This will provide an additional lens for the changes insurers are making—for example, is it beneficial to perform SST over a three-year or five-year time period, and are liquidity projections also needed for the three-year or five-year time horizon?
- Furthermore, for companies outside of the United States, has the recent adoption of IFRS 17 led to changes in business strategies and/or risk management processes? For example, could the IFRS 17 process and model development benefit also be leveraged elsewhere in the business? Going forward, to what extent will IFRS 17 metrics, such as new business contractual service margin (CSM), be weighted over other metrics (such as value of new business) and what impact will that have on the business strategy?
- We expect risk identification processes to feed into the wider business strategy setting more closely in the future, especially given the rate at which the risk landscape is evolving. This is exemplified by climate risk: as insurers have integrated it into their risk management processes, they have also considered how to reduce the environmental impact of their operations throughout their supply chain.

OTHER IMPROVEMENTS AND DEVELOPMENTS

We have mentioned in several places the increased importance of and benefits to be gained from SST. It is a key tool to gain a better understanding of the insurer's critical risk exposures and its dependencies. In the past, SST was often focused on sensitivity to individual risk factors, plus a combined stress at the risk appetite level (for example at a 1-in-10-year level) derived from the capital model and a reverse stress test. Insurers are broadening this now, to look at a range of plausible economic event scenarios, such as a deflation scenario, or market liquidity event, and getting input from in-house or external economists to design responses to them. This gives a more practical insight into the exposures and can also help test how effective management action plans would be in more realistic events. We are also seeing boards look more at the earnings impact under SST as well as for capital and liquidity.

This increased depth for SST seems a very beneficial development. Whilst capital standards and models are very useful, they can be very theoretical in their approaches and designs and may not necessarily protect the insurer against the combined risk events or shocks that are most likely to happen in practice. Testing the insurer against plausible real-world events is an excellent and practical way of complementing this, improving insurer resilience and action plans.

Regulators are also placing more emphasis on SST, to understand both the risks to individual insurers and more systemic financial system risks. In the UK, the Bank of England is requiring over 50 major banks, insurers and other financial services providers to carry out the system-wide exploratory scenario (SWES)⁷ stress test during 2024, which models a severe but plausible market-wide liquidity shock that emerges over a period of 10 days. The Bank of England will use the responses to assess whether and how the firms' actions and their interactions might collectively amplify the shock.⁸ In Bermuda, the BMA has made stress testing a requirement for insurers to demonstrate their ALM program effectiveness. This includes having companies perform asset downgrade stresses and liquidity shock stresses in assessing the Scenario Based Approach reserves, as well as a more comprehensive list of stresses across various risks to ensure companies can maintain solvency. In Europe, the European Insurance and Occupational Pensions Authority (EIOPA) is also carrying out a 2024 stress test exercise, focusing on the economic consequences of a re-intensification or prolongation of geopolitical tensions and the impact on insurers' capital and liquidity positions.⁹

We have commented that some insurers are improving the level of communication and data flows within their organization or making changes to their Target Operating Model (TOM). Particularly with respect to liquidity, some insurers are bringing their Treasury and ALM teams closer together with a single reporting line. We have also noted the closer interaction between investment teams and ALM or Actuarial and Risk teams regarding SAA and ALM. This seems to be a learning point from the changes in the risk landscape—with the increased interconnectivity of risks, the identification, management and monitoring of these risks needs input from across the whole organization.

ALM teams have had a busy period in dealing with the market conditions, with the need for better and faster liquidity management becoming ever more relevant. Hedging strategies are being reconsidered and, even where there are quick wins (e.g., consolidating derivatives), there is a clear need for longer-term objectives such as revisions to the metrics being targeted, or the introduction of automation to reduce the time lag between the timing of derivatives being bought/sold and the date upon which the economic data is based. In addition, insurers that have previously not actively hedged against inflation have considered the need to now develop a more fully fledged inflation hedge strategy.

7 Bank of England (10 November 2023). Launch of the scenario phase of the system-wide exploratory scenario. Retrieved 20 June 2024 from <https://www.bankofengland.co.uk/financial-stability/boe-system-wide-exploratory-scenario-exercise/launch-of-the-scenario-phase-of-swes>.

8 Bank of England (10 November 2023). The Bank of England's system-wide exploratory scenario exercise. Retrieved 20 June 2024 from <https://www.bankofengland.co.uk/financial-stability/boe-system-wide-exploratory-scenario-exercise/boe-swes>.

9 EIOPA. Insurance stress test 2024. Retrieved 20 June 2024 from https://www.eiopa.europa.eu/insurance-stress-test-2024_en.

Another takeaway for insurers has been the importance of their management action plans under stress—sometimes being a question of documentation, to provide more comfort and visibility to the board. In the UK, there has been synergy with this and efforts in recent years in defining Recovery and Resolution Plans following requirements set out from the PRA, along with a recent consultation paper on solvent exit planning,¹⁰ and in Europe the development of the EU Insurance Recovery and Resolution Directive.¹¹

Overall, pricing methodology has changed more modestly as a result of the new environment, though of course the parameters being used have changed. Pricing methodology has very typically allowed for a locked-in cost of capital (or required a hurdle return on capital) but for products with significant liquidity strains and where liquidity is a biting constraint or has the real potential for it, we are aware of insurers considering a locked-in liquidity cost. Other areas that insurers are considering in more depth are the pricing of inflation-linked benefits and options (such as the LPI-linked annuities on PRT in the UK), ensuring that hedging costs (or mismatch exposures) are fully priced in. For lapse assumptions, past practice was typically just to assume that historical experienced rates would continue into the future, whereas now insurers are starting to consider more dynamic customer behavior.

Conclusion

In our two papers, we have examined how the life insurance industry is navigating the new era that is “The Age of Uncertainty.”

In Paper 1, we examined how life insurers have been revisiting their risk taxonomies and calibrations in light of recent events.

In this Paper 2, we have discussed the performance of insurers’ models and management in the recent challenges, and the implications for the future, which we can summarize very briefly as follows:

- Capital models and monitoring performed reasonably well, though there was a wider range of performance for ALM and wider still for liquidity. With the increased use of derivatives and large changes in interest and currency rates, short-term liquidity management was particularly complex and often became a much more relevant constraint.
- Insurers are making improvements across these processes and models, with liquidity monitoring getting particular focus. Improved AOC or hedge effectiveness monitoring are an important control cycle improvement here.
- Exciting developments in the space of ALM and SAA are bringing the historically siloed areas of Investments, Risk, ALM and Actuarial closer together. Those companies that can exploit these opportunities to greatest effect will ensure strategic decisions are made consistently across their organizations and will be well-positioned to gain a competitive advantage.
- The increased use of SST by insurers and also regulators, both to better understand the risk exposures and to test out management actions in plausible shock events.
- “The Age of Uncertainty” has seen a breakdown in the previous status quo within the three-dimensional space of managing life companies across capital, earnings and liquidity. Those companies that are successful in the continuing era of uncertainty that lies ahead will be those that fully understand how the three dimensions interact in the new environment and the implications for their business strategy.

We hope that the papers have been of interest and given you some food for thought as you move forward into the uncertain regime. Should you wish to discuss any of the points raised in greater depth please reach out to any of the authors listed below or your usual Milliman contact.

10 Bank of England (23 January 2024). CP 2/24 – Solvent exit planning for insurers. Retrieved 20 June 2024 from <https://www.bankofengland.co.uk/prudential-regulation/publication/2024/january/solvent-exit-planning-for-insurers-consultation-paper>.

11 Insurance Europe (September 2023). Insurance Recovery and Resolution Directive (IRR) key messages ahead of trilogues. Retrieved 20 June 2024 from <https://www.insuranceeurope.eu/publications/2963/insurance-recovery-resolution-directive-irr-key-messages-ahead-of-trilogues>.



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