MILLIMAN REPORT

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

Paper 1 – Risk inventory and taxonomy and risk calibration

November 2023

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Introduction

The Space Age and Technological Revolution, the Industrial Revolution, the Renaissance—all are examples of eras that had a transformative impact on humanity. It feels as though we are at another such inflection point today, only with what seems like a lot less understanding and clarity around both what are drivers and what are outcomes. It may best be described as “The Age of Uncertainty.”

We only have to look back less than two years to consider that life insurers around the globe fretted, as they had done for many years previously, over the potential impact on their business of continuing ultra-low interest rates. Few at the time would have predicted such a rapid shift in sentiments from concern around low inflation and low interest rates to concern over high inflation and high interest rates, and what that has meant for how life insurers are managing their business.

We have witnessed tremendous speed of change and volatility in economic and market variables over the past couple of years. Market volatility has been at levels not seen since the global financial crisis of 2008, and we have seen both inflation and interest rates rise rapidly to levels not seen for over 30 years. Supply factors have been a substantial driver of this as well as an unusual pent-up demand following the COVID-19 pandemic. Central banks and financial regulators across the globe have taken drastic measures to help alleviate inflation and market turbulence—with some success—but the threat of recession and lower long-term growth remains. Underlying this, recent events have demonstrated how interconnected, and to some extent fragile, the global economy and markets have become to shocks, including the COVID-19 pandemic and geopolitical events.

Alongside this rethinking regarding economic risks, insurers continue to better identify and define other risk exposures, such as operational and strategic risks and the different exposures arising from holding alternative assets. This includes considering features such as business continuity risk, the impact of technological change, and of course how the increased uncertainty in the economic environment affects these other risk areas. Climate risk is a fast-developing area, with many regulators moving toward increased assessment and disclosure requirements.

Life insurers are going through genuine self-reflection regarding how their current risk management practices have responded to these evolving economic and other risks and how they will need to adapt in the future. How have we fared during the course of the past couple of years? Were there areas where we could have been better prepared? What things are we changing to be better prepared for what comes next during the next phase of this Age of Uncertainty?

In a series of two papers, we will examine how the industry is responding to the fast-evolving world based on conversations we have conducted with life insurers around the industry and we will draw out the implications for capital management, asset-liability management (ALM), and risk management practices more widely. The papers focus on these challenges in the context of the UK, European, U.S., and Bermudian markets specifically.

The papers are structured as follows:

Paper 1: Risk Inventory and Taxonomy, and Risk Calibration

Reflecting on the recent past, did insurers feel their risk inventories and taxonomies had satisfactorily captured the risks to which their business was exposed? Has there been a change in what risks have been viewed as more or less of a priority? Have the events of recent years caused companies to revisit how they identify risks? How do companies get comfortable that there isn’t something material that is being missed?

In Paper 1, we also consider how companies may have recalibrated their quantification of risk exposures in light of the recent past. Have previous assumptions and analyses borne up in this new world? How useful is history in gauging risk? What role does expert judgment play? What additional light can be shed using Stress and Scenario Testing (SST)?

Paper 2: Limitations of Risk Models and Monitoring, and Management Implications

In Paper 2, we will cover how insurers fared under the challenging recent economic conditions. Did models cope, or did they break down under extreme conditions? What were the difficulties faced?

Moreover, we will 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, governance or capital management, or liquidity strategies?

Risk inventory and taxonomy

RISK IDENTIFICATION AND CLASSIFICATION FRAMEWORK

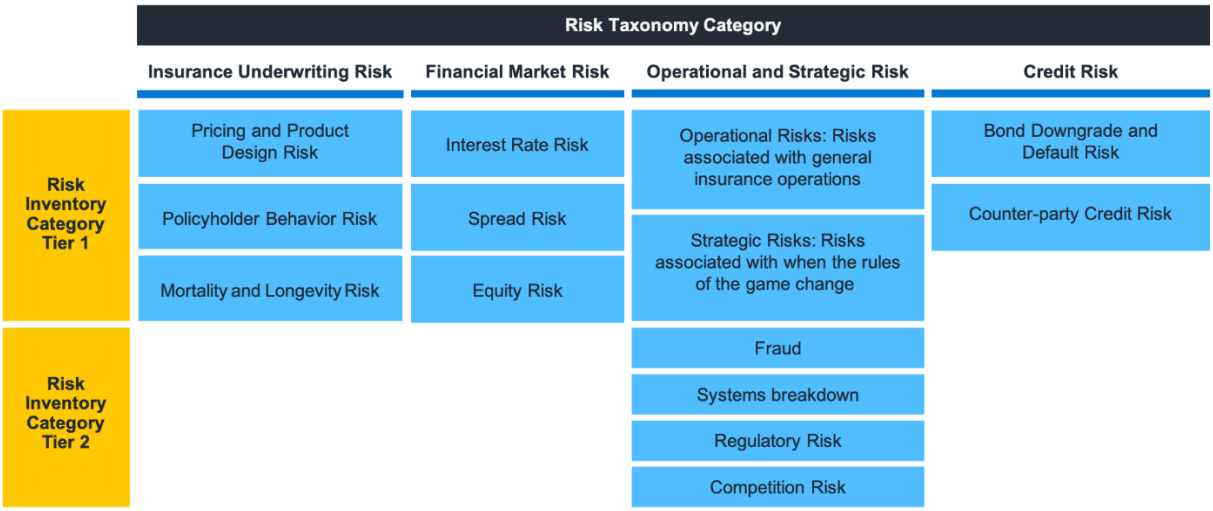
A robust risk management framework is a necessity for life insurers and should comprise well-defined processes for identifying, quantifying, and monitoring risks. Insurers are generally expected and often required to undertake regular Own Risk and Solvency Assessments (ORSAs) that detail how these processes are embedded into the business.

At the heart of risk identification and classification are the concepts of risk inventory and risk taxonomy. These terms are neatly defined by the Enterprise Risk Management (ERM) Committee of the American Academy of Actuaries' Actuarial Standards Board[1] as follows:

- **Risk inventory**: Identification of all the risks to which an organization is exposed. Also commonly referred to as "risk register," a risk inventory should be updated regularly to maintain an up-to-date profile of all risk exposures.
- **Risk taxonomy**: Risk classification, which may be tiered in a cascading structure with broad risk classifications at the top and more narrowly defined classifications further down. Risk inventories (or risk registers) typically use a taxonomy to index their entries.

An example of a possible non-exhaustive, cascading structure of a risk taxonomy is illustrated in Figure 1, with high-level categories at the top and funneling down one or more layers further before getting to the risk-by-risk articulation per the risk inventory.

FIGURE 1: SAMPLE RISK TAXONOMY AND RISK INVENTORY TIERED STRUCTURE (NON-EXHAUSTIVE LIST)



Methods for establishing a robust risk inventory and taxonomy

It is imperative that an insurer ensures its risk taxonomy encompasses all material risks to which it is or will be exposed, or at least minimizes the likelihood that something material is being missed. How can an insurer be comfortable that it is achieving this? Indeed, were companies successful in this regard over the past few years and, if not, what actions are being taken to remedy?

Some supervisory regimes provide a baseline set of risks for firms to consider. For example, the Standard Formula under Solvency II prescribes a set list of market risks (such as interest rate, equity, spread, and concentration risks) and credit risks, as well as noneconomic risks (such as mortality, longevity, lapse, and operational risks). However, under Solvency II an insurer is also expected to conduct a comprehensive review of its risk profile, including any risks specific to its business. Additional risks such as inflation, liquidity, strategic, group, and political risks are commonly documented in European companies' ORSAs.

[1] Actuarial Standards Board (March 2023). Exposure Draft of Proposed Actuarial Standard of Practice, Enterprise Risk Management.

In other parts of the world, we see varying degrees of prescription for what is expected in terms of risks to address, for example more being mandated in Bermuda, and less in the United States. But the theme is consistent across the industry globally. That is, substantial rigor is now being applied to the identification and classification of risks in all major insurance jurisdictions, with thorough detail on risk exposures being included in the ORSA reports.

Moreover, it is almost universal that insurers now employ the Three Lines of Defense model, which ensures that robust and consistent risk management practices are embedded in the organization. In practice, the whole business should play a role in identifying risks and should ensure that the relevant risk committees and governance functions are made aware of new, evolving, and emerging risks so that suitable action can be taken in a timely manner to manage and mitigate risk exposures.

Increasingly, companies are conducting regular management surveys to discuss what the executive team views as potentially problematic risk exposures. But even more insightful are management surveys that start at the grass roots and dig deep into understanding what processes are involved in the running of each line of business (LOB). In that way, a risk assessment can identify areas where there could be a breakage in the process, hence identifying areas where remedial action can be taken. Increasingly, building a causal or behavioral model of how the company works, based on information collected from management, is being viewed as yielding extremely valuable insights for risks where there is little or no historical data, and can help develop potential "worst case" and "plausible" scenarios to test for a given risk.

For some companies we have also seen, with excellent results, a hybrid approach to risk identification processes, with a top-down (or "risk-driven") perspective that starts with a preconceived view of the risk taxonomy and is supplemented by a bottom-up (or "process-driven") approach, which leverages internal functional-level expertise. This enables the corporation to identify the risks to which it is exposed with input from both the risk experts in the centralized enterprise risk management (ERM) unit, and the management team at the LOB level, which truly understands the workings of the area they are working in.

RISK IDENTIFICATION SPECIAL FOCUS AREA: OPERATIONAL AND STRATEGIC RISKS

Reflecting on recent experience, it is apparent that operational and strategic risks need to be treated on par with the "usual suspects" of insurance, market and credit risks, and insurers have greatly ramped up what they are doing in these areas. For example, the onset of the COVID-19 pandemic put front-and-center the question of business continuity, while the ongoing march of technological innovation has created many operational considerations, some good (such as improved speed and accuracy of transactions) and some threatening (for example, increased risks due to the threat of ransomware, or the threat of new market entrants using groundbreaking distribution approaches). Operational risks may lead to not only short-term financial losses, but can also have longer-term damaging effects on the business over and above the potential adverse impact of insurance and financial market risks, for which established mitigation strategies are often in place.

Moreover, unlike the more traditionally considered insurance and financial risks to which insurers are exposed, it is not always obvious (indeed, seldom is obvious) what the major operational risks exposures are. Notable strides in the level of sophistication in identifying and quantifying these risk exposures have been made in the industry over the past couple of years.

Risk-driven "top-down" approach to risk identification:

1. Identify initial risk inventory and risk taxonomy.
2. Review risk inventory and risk taxonomy against insurer's current risk profile.
3. Based on risks identified, map risks to different functions and business processes.

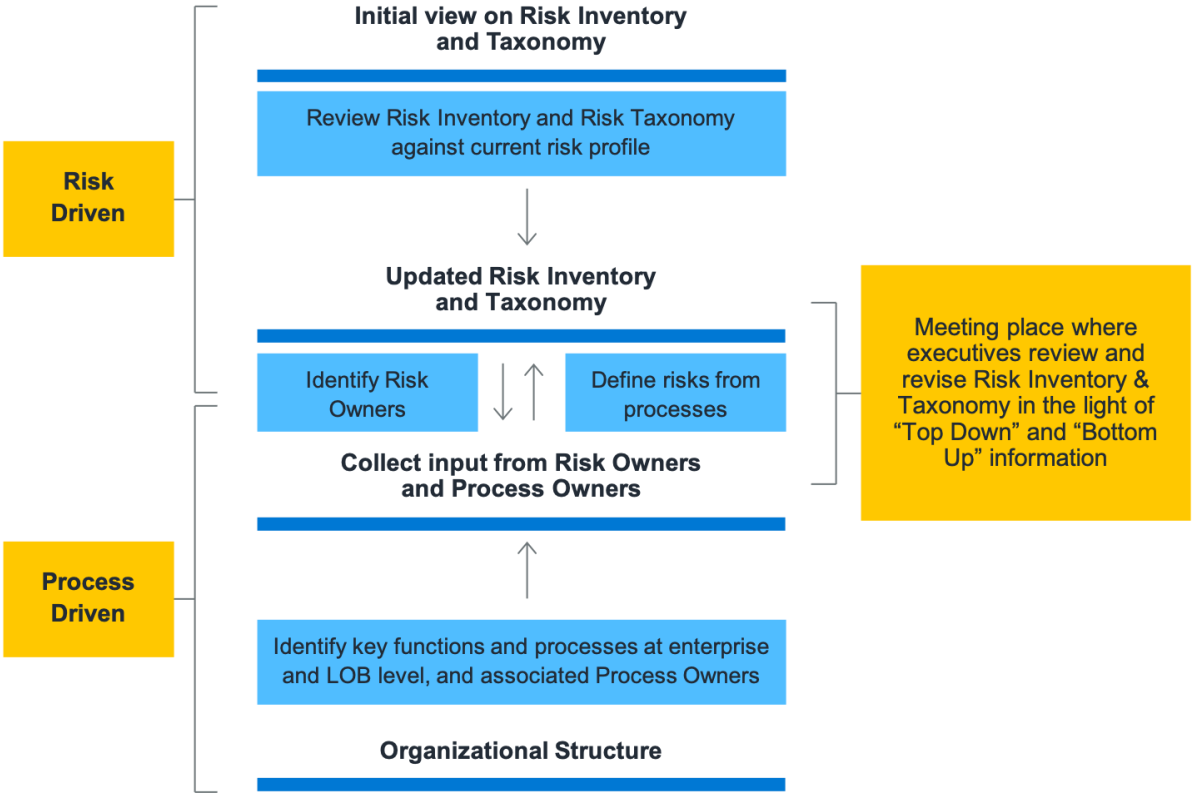
Function and process-driven “bottom-up” approach to risk identification:

1. Define entities and functional areas.
2. Work with each identified function area (e.g., LOBs, Investment, Finance, and Actuarial) to identify risks impacting processes at a granular level.
3. Develop the risk inventory and risk taxonomy from an understanding of the risks associated with the underlying business processes.

Under a hybrid approach, information from both a top-down and a bottom-up approach are brought together, and there will be a “meeting place” where senior management reviews and revises the risk inventory and taxonomy in light of this input. From our discussions around the market, a best practice appears to be emerging where this final decision group will be a formal management level risk committee that meets periodically—such as quarterly—and comprises the most senior members of the company’s executive management team, e.g., CEO, Chief Financial Officer (CFO), Chief Risk Officer (CRO), Chief Actuary, Chief Legal Counsel, Chief Technology Officer, and main LOB leaders. This clearly demonstrates the importance placed on the process of risk identification and helps embed a strong risk management culture at the most senior levels.

The hybrid approach is summarized in Figure 2.

FIGURE 2: RISK-DRIVEN/PROCESS-DRIVEN HYBRID APPROACH TO RISK IDENTIFICATION



Getting a dual perspective on risk exposures as a result of taking both a top-down and a bottom-up perspective should be viewed as a best practice in the Age of Uncertainty, and will help minimize the danger of “missing something” as a result of taking just one approach. As a very minimum, such an approach will act as a validation of one approach versus another. The framework is also fluid and adaptable—another advantage in times of a rapidly changing environment.

EVOLVING AND EMERGING RISKS

The recent changes in market conditions have led to an additional layer of unforeseen complexity for many of the "traditional" economic and financial market risks. The risks themselves are evolving, in terms of their drivers, magnitudes, and speed of change, for example the economic and geopolitical drivers that have led to much higher base levels and volatility in interest rates and inflation. In addition, the changes in these economic risks lead to implications for other risks, such as policyholder lapse behavior, which we explore below.

Another special consideration in the development of the risk inventory and risk taxonomy are emerging risks. In light of the experience of the past few years—a global pandemic, the war in Ukraine, the continued march of technology, the transition and physical risks associated with climate change—emerging risks are now top of mind at insurance company board meetings.

The industry has taken early steps to categorize emerging risks as its own bucket of risk and to identify and monitor them in their own right. Procedures for insurers to identify emerging risks are similar to what was outlined above for identifying risk exposures more generally: internal brainstorming sessions; maybe using a top 5/top 10 list to get board and senior management focus on the potentially most significant emerging risks; developing an "emerging issues log," with ongoing formal reporting for each issue on the log; and analyzing potential risks that could hit in the next 12 months.

In Europe, the CRO Forum is an initiative with the aim of promoting risk management practice among insurers. It periodically publishes a "risk radar," which both examines trends in evolving risks as well as scans the horizon for new emerging risks in the industry.

Over time, the emerging risks themselves will change and may manifest themselves with new features—the taxonomy of risks considered, and the materiality of these risks, can change over time. Cyber risk is an example of a risk that has been on insurers' risk inventory for many years but, because of its changing nature and the increasing threats that it exposes insurers to, it tends to be a permanent but changing fixture on the emerging risks roster.

Additionally, risks that may in isolation look to be relatively benign can have a more worrying impact when combined, and quickly become an emerging risk of major concern. For example, insurers may have viewed the impact of the COVID-19 pandemic and the war in Ukraine as manageable in isolation, but their combination and the knock-on effects on the downstream supply chain and cost inflation undoubtedly had serious consequences for insurers that needed to be very carefully managed.

From our discussions with the market, we are hearing that the following are currently evolving and emerging risk priorities across the life industry globally. Each one is discussed in detail in the subsections that follow, with a focus on how they are impacting insurers.

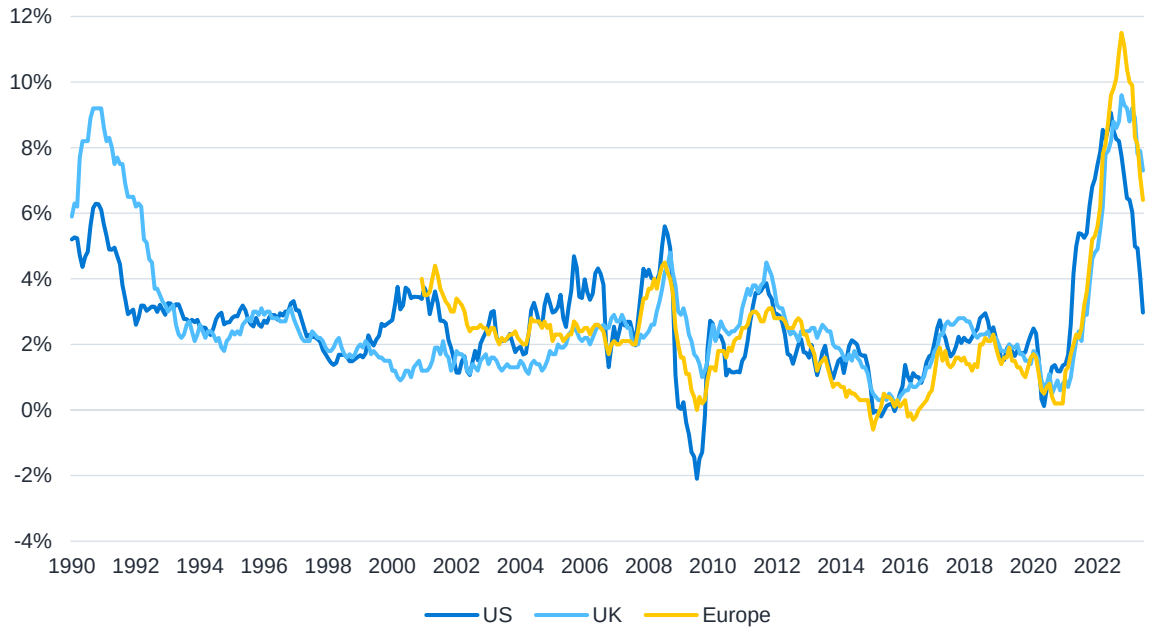
- Inflation
- Interest rates and liquidity risk
- Risks associated with alternative assets
- Market volatility
- Climate risk
- Model risk

Inflation

Inflation has emerged as a major economic challenge, driven by pent-up demand following COVID-19 and a range of supply-side factors, rising to the highest levels seen in decades. This leads to wide-ranging impacts across the businesses of insurers, whether directly (e.g., the escalation of index-linked policyholder benefits in the UK, or increases in the insurers' expense base) or indirectly (e.g., interest rates rising as central banks respond to manage inflation, which is a more established risk for all insurers).

Figure 3 shows the inflation rates for the United States, UK, and Europe, going back to 1990, indicating that recent rates have been among the highest in 30 years and developed over a very short period.

FIGURE 3: INFLATION IN THE UNITED STATES, UK, AND EUROPE - ANNUAL PERCENTAGE CHANGE IN CONSUMER PRICE INDEX



Source: Organisation for Economic Co-Operation and Development (OECD) database, September 2023. The European consumer price index (CPI) figures are based on the 27 member countries of the European Union effective from February 1, 2020, and are shown from 2000 onward.

Both the asset and liability sides of the balance sheet can be affected by inflation, particularly if they are coupled with consequential increases in nominal interest rates, depending on their nature. Fixed-interest assets, such as bonds, will reduce in value as a consequence of rising nominal interest rates, while index-linked or real assets, such as equities or certain illiquid assets (such as infrastructure), can offer more protection to portfolio values.

For liabilities, the policyholder will see the value of their fixed benefits erode while any index-linked or inflation-linked benefits (e.g., inflation-linked annuities from defined benefit pension plans) will hold more of their value in real terms. Under limited price indexation (LPI) business in the UK, policyholder benefits increase until a defined cap, but this can introduce complex dynamics in extreme scenarios where inflation exceeds these caps, potentially leading to asset-liability mismatches.

The consequences for the insurer therefore depend on its specific business mix and the knock-on impacts of inflation on consumer behavior—the level of full and partial surrenders, lapses, and option take-ups will change depending on how policyholders perceive the relative value of their policy. The European Insurance and Occupational Pensions Authority (EIOPA) has recently echoed this sentiment, warning insurers in Europe of an expected rise in lapse rates, and indeed recent data published by EIOPA has borne evidence to this.[2]

Additionally, as living costs increase, consumers may be less willing to buy insurance and so new business volumes could fall. Coupled with rising costs for expenses, staff, and reinsurance, pressure will be exerted on both profitability and solvency.

Interest rates and liquidity risk

Inflation also has consequences for interest rates as central banks seek to curtail it back to target levels. This has implications for new business volumes, solvency positions, asset performance, capital management, and mergers and acquisitions (M&A) activity. In the UK, the Bank of England has continuously raised interest rates over the last 21 months in response to levels of inflation that have continued to exceed expectations, with the uncertainty expected to continue in at least the short term. Interest rates have also been increased by the Federal Reserve in the United States and the European Central Bank in Europe. These moves aim to manage inflation and have been accompanied by commitments to continue increasing rates, marking the conclusion of a period of low-interest rates that began after the 2007-2008 global financial crisis.

[2] European Insurance and Occupational Pensions Authority (July 2023). Insurance Risk Dashboard.

As far as the United States is concerned, while most of the insurance products in the market are not directly linked to inflation, the resulting increases in interest rates have made general account annuity products that were issued during the low-rate period less appealing. As a result, surrender rates have been ticking up somewhat, and are higher than what most companies had assumed as an expected value, which in turn has raised the question of disintermediation[3] and associated concerns around liquidity to meet claim payments. We are not aware of any examples in the past couple of years in the United States where life insurers have experienced such a run-on-the-bank situation, but the general emerging experience of increased surrenders across the industry has certainly raised the question of how far this might go.

Elsewhere, the Italian insurer Eurovita experienced a surge of withdrawals in savings products as policyholders looked to benefit from more attractive rates. This, coupled with the sharp mark-to-market losses on its fixed income backing assets, led to the company entering administration in early 2023. This case provides a reminder of how dangerous rapid movements in interest rates can be in both directions, particularly when a company's lines of business are undiversified and exposed to mass lapse events. This experience has also resulted in a renewed interest in lapse reinsurance across Europe.

In addition to this policyholder behavior angle to mass lapse risk, the increased use of derivatives by life insurers for asset-liability management (ALM), particularly interest rate swaps and swaptions, but also equity derivatives, leads to increased liquidity risk. The derivative exposures can be large, which can result in substantial margin calls emerging very quickly in volatile economic conditions. Accurately assessing the exposures and being able to manage them in close to real time has become very important to insurers. Many UK insurers are carrying out more rigorous stress testing of their collateral exposure to rapid moves in rates and improving the data flows and controls between the Treasury teams and systems managing collateral and the liquidity monitoring.

A recent liquidity example was seen during the UK government bond ("gilt") crisis during September and October 2022, the result of a chain reaction of events following the unexpected announcement of the mini-budget economic policies by the UK chancellor. Markets were thrown into disarray, with the sharp rise in interest rates that ensued leading to dramatic falls in gilt prices. In particular, this led to a liquidity shock for many defined benefit pension plans, which were forced to sell assets (mainly inflation-linked or long-term conventional gilts[4]) to cover cash-settled margin calls on repo and swap positions. With pension schemes being such large gilt market participants in the UK, this further deflated gilt prices, causing a vicious cycle. The United States, on the other hand, may be less vulnerable to such an effect, given the larger dilution of investors in the U.S. Treasury securities market.

As a result, 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. With ever-increasing pressure to maximize returns, some insurers are assuming greater liquidity risks, by investing in illiquid alternative assets, and are less prepared to hold more cash than necessary. Solutions such as "dirty" credit support annexes (CSAs), whereby counterparties in a derivative transaction may post, for example, government or corporate bonds as collateral instead of cash, or moving toward high-quality overseas bonds coupled with foreign exchange (FX) hedges, help to ease illiquidity to a certain degree. With a decreasing supply of conventional publicly traded assets across all markets, and the liquidity of publicly traded assets also perceived to be declining, the presence of liquidity risk is set to continue within the industry for the foreseeable future.

Recent events in the banking sector, such as the failures of the Silicon Valley Bank, First Republic Bank, Signature Bank, and Silvergate Bank, as well as the takeover of Credit Suisse, highlight the perils of illiquidity even when in compliance with regulation. While these incidents do not appear to have had a significant impact on the liquidity of insurers, they have caused insurers to consider the potential contagion risk of further problems in the banking industry spreading to the insurance industry.

Finally, the picture is made even more complex by nonfinancial risks that contribute to liquidity risk—for example, the operational and reputational risks of events such as cyber breaches, which could lead to mass lapse events. Therefore, the problem of liquidity certainly involves, but is not limited to, interest rates and associated disintermediation.

[3] "Disintermediation" refers to the situation of policyholders cashing in their policies to get better returns elsewhere in the increasing rate environment, potentially forcing the insurer to sell assets to raise cash at a time when asset prices are relatively low.

[4] Bank of England (March 2023). An anatomy of the 2022 gilt market crisis. Retrieved November 1, 2023, from https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2023/an-anatomy-of-the-2022-gilt-market-crisis.pdf.

Liquidity risk is also a major consideration for policymakers. As an example, the Bermuda regulator—the Bermuda Monetary Authority (BMA)—has been one of the leaders in the thinking in this area. In its recent review of the local regulatory regime,[5] the BMA is proposing that all life insurers looking to use the scenario-based approach for its reserve calculations, and any insurer exposed to mass lapse risk, must implement a formal liquidity risk management program as part of its enterprise risk framework. The BMA articulates specific areas it expects to see addressed in a company's framework, with a focus on identifying and testing the business against potential liquidity stress scenarios. In many aspects, the BMA's emerging requirements can be viewed as a blueprint for what might be expected by regulators across the world with regard to best practice liquidity risk management.

Risks associated with alternative assets

The popularity of alternative assets[6] has grown in recent years, the reasons for which go further than simply the higher risk-adjusted returns they are perceived to offer. A recent Milliman survey confirmed that insurers across the United States, UK, Europe, and Asia have been increasing their exposures to alternative assets.[7]

In the United States, the increasing movement into alternative assets has been driven in large part by the entry of private equity firms into the life insurance industry. These firms often apply specialist expertise in high-yielding asset investment to benefit their business models, which in turn has motivated other life insurers to increase their exposure in this investment space to remain competitive.

But other global influences have also been a major factor, not least including the risks mentioned earlier. Some alternative assets can provide additional hedging against inflation, as they can potentially provide a suitable match for certain liabilities in nature and term. As always, a key consideration is whether the expected yield offers fair and adequate compensation for the reduced liquidity compared to a risk-free or conventionally liquid asset.

A notable example is the use of alternative assets in the UK to back bulk purchase annuities (BPAs), the outflows of which entail fixed or inflation-linked payments to policyholders over a long term. Some alternative assets have longer durations than are available on corporate debt and others may include long-term regular payments that are inflation-linked. These longer-duration alternative assets can therefore better match the liability cash flows than traditional fixed income securities.

In some instances, alternative assets have benefited from changing regulatory requirements. In some jurisdictions, the stipulated capital charges for such assets were very onerous, but these charges are being relaxed. For example, in Europe, even before the increased focus on alternative assets of the past few years, the Solvency II Standard Formula had started to lighten the capital charges of asset classes such as long-term equity. Future revisions to Solvency II also seem set to expand the range of assets permissible in the insurer's Matching Adjustment (MA) portfolio, and similar measures will apply to Solvency UK, the UK's own regime that is replacing Solvency II following its departure from the European Union. The reason for this shift in the regulatory position is both a general consensus that a more granular view is necessary to assign proportionate capital charges to different classes of alternative assets—insurers should not be penalized for holding alternative assets as long as the risks are well understood and managed—as well as a desire to "unlock" capital and divert investment to productive assets that can stimulate the economy, such as infrastructure.

This trend does not apply universally though, with the U.S. regulator seemingly increasing its scrutiny of alternative assets, e.g., the National Association of Insurance Commissioners (NAIC) has recently started to compel insurers to justify internal risk ratings of certain "bespoke securities" on a more thorough and ongoing basis. In the UK, the recent consultation paper (CP) from the Prudential Regulation Authority (PRA) on Matching Adjustment reform[8] also requires insurers to demonstrate how they assess alternative asset risks and internal credit ratings.

[5] Bermuda Monetary Authority (28 July 2023). Consultation Paper: Proposed Enhancements to the Regulatory Regime for Commercial Insurers.

[6] The expression "alternative assets" does not have a universally accepted definition and can be interpreted in various ways. For purposes of this paper, we use the definition used in the Milliman research report "Profiles of Alternative Assets in the Life Insurance Landscape" (available at https://www.milliman.com/en/insight/profile-alternative-assets-in-the-insurance-landscape), that is, assets which are not available to be traded on public markets.

[7] Bonnet, C., Darkiewicz-Moniuszko, G., Dobiac, J., & Ward, R. (December 2022). Alternative Assets for Life Insurers. Milliman Report. Retrieved November 1, 2023, from https://www.milliman.com/en/insight/alternative-assets-for-life-insurers.

[8] Prudential Regulation Authority (September 28, 2023). CP19/23 Review of Solvency II: Reform of the Matching Adjustment.

Another driver of the popularity of alternative assets is environmental, social, and corporate governance (ESG) initiatives. Alternative assets can offer insurers the opportunity to reinforce their commitments to green agendas by improving their environmental metrics and complying with ESG targets embedded in their investment mandates.

However, while many insurers are increasing their exposure to alternative assets, this needs to be balanced with the mixture of risks they introduce as well as their complexity. For example, in some parts of the world the current high volatility in the real estate market has forced insurers with property/infrastructure assets or equity-release mortgages to more closely examine their exposure.

For many insurers, the risks associated with alternative assets have therefore become a key talking point on the risk register. What is our risk appetite associated with these types of assets, do we have the right limits and monitoring systems in place, and how are we getting comfortable with the risks associated with the more esoteric and complex structures? These issues are complicated, and we expect to see many innovations and developments in risk management practices in this space in the years to come. A recent Milliman paper explores the wide diversity of alternative assets that we see life insurers holding and discusses both modeling and risk management issues around them.[9]

Market volatility

Furthermore, beyond just the economic and financial market risks discussed so far is their underlying volatility—the rate at which economic and market conditions are moving is an added concern for insurers.

Market volatility in itself can directly impact the cost of guarantees within liabilities, for example guaranteed rates of return or where policyholder benefits include other embedded options. As well as the best estimate liability cost of these guarantees, the impact of yet greater volatility under stress can be considered. In the UK, for example, many insurers aim to capture volatility risk within their capital models, most commonly in respect to interest rates, inflation, and equity values. However, this is by and large restricted to Internal Model (IM) firms, that is, firms that calculate their capital requirements using internally developed models as opposed to the prescribed Standard Formula approach under Solvency II. Of course, hedging the guarantees with appropriate options or swaptions (or other dynamic strategies) can mitigate these investment risks.

In addition to the direct impact on the cost of guarantees, the increased volatility means that insurers will want to assess their financial and operational resilience to potentially larger and faster-moving events.

Volatility in the markets also causes a number of issues for the asset-liability management of insurers. An example of this is the use of hedges, which are commonly calibrated on a regular basis to a predetermined metric (for example, in the UK, to safeguard certain Solvency II metrics against large market movements). There is invariably a lag in such processes due to the time it takes to refresh solvency positions, meaning that hedges may be purchased or sold based on slightly out-of-date information. Short-term volatility in the markets can heighten this basis risk, potentially leaving the insurer under-hedged or over-hedged, and even providing liquidity issues as mentioned previously.

Climate risk

Historically, life insurers have tended to view risks associated with climate to be more of a property and casualty (P&C) issue, and of less direct concern to the life market, i.e., the focus was on physical risk. However, with recent developments, not just with regard to the incidence of rapid climate change but also changing attitudes toward protecting the environment, this is a topic that is now very much top of mind for life insurers, particularly in relation to risks associated with the transition to a low-carbon economy.

Indeed, acknowledging that this has been a gap in the regime, regulators are now very active in promoting discussion around climate risks—recognizing this as an essential area to address for best risk assessment and management practice.

[9] Coyne, V.L., Shen, M., Ouyang, L. et al. (August 2023). Profiles of Alternative Assets in the Life Insurance Landscape. Milliman Paper. Retrieved November 1, 2023, from https://www.milliman.com/en/insight/profile-alternative-assets-in-the-insurance-landscape.

In the Solvency II jurisdiction, for example, for some years regulators have required considerable rigor around articulating stress tests to help quantify the impact of climate change. In the UK, the Financial Conduct Authority (FCA) has implemented reporting requirements for climate-related disclosures[10] that cover the pillars of governance, strategy, risk management, and targets, while the Bank of England has recently published a report setting out key focuses for ensuring the industry's resilience against climate change, such as SST.[11] The discussion is evolving and is also currently being extended to wider nature-related risks such as biodiversity loss. Requirements for nature-related disclosures following the same principles as climate-related disclosures could come into force soon.

Across Europe, insurers have been asked to carry out materiality assessments on their climate risk exposures and to model climate risk scenarios as part of the ORSA process, for material exposures. These requirements came into effect following the publication in April 2021 of the EIOPA's "Opinion on the supervision of the use of climate change risk scenarios in ORSA."

In Bermuda, the BMA has published a Guidance Note[12] requiring insurers to carry out an overarching climate risk status assessment regarding the implementation of an appropriate Climate Risk Management Framework, with that framework and its measures to be adopted on or before year-end 2025. The BMA Guidance Note is also very instructive in giving clarity around how risks associated with climate change can manifest themselves in the context of a life company, including potential impacts on mortality and morbidity, and of course the potential impact on the insurer's operations, such as due to building closure.

However, the area that seems to be getting the most attention from life insurers in the United States and Bermuda, so far as climate risk is concerned, is regarding the impact on assets. Could certain classes of investment become problematic for the insurer as climate change becomes more of an issue, e.g., oil stocks? What should be the company's position on ESG investments, and is the company doing the right thing by policyholders, shareholders, and other stakeholders? These are highly topical and difficult areas that are getting increased attention right up to the board level, in particular as many large insurers have publicly committed to net zero targets and have developed sustainability strategies to support these commitments. The asset considerations are also very important for European insurers also, of course, although that jurisdiction looks to be somewhat ahead of the United States and Bermuda in adopting a broader lens in assessing climate risks beyond the focus on investment management, with insurers developing more advanced methods of analyzing both the physical and transition risks of climate change across their balance sheets.

[10] Financial Conduct Authority (December 2021). PS20/21: Enhancing climate-related disclosures by asset managers, life insurers and FCA-regulated pension providers.

[11] Bank of England (March 13, 2023). Bank of England Report on Climate-Related Risks and the Regulatory Capital Frameworks. Retrieved November 1, 2023, from https://www.bankofengland.co.uk/prudential-regulation/publication/2023/report-on-climate-related-risks-and-the-regulatory-capital-frameworks.

[12] Bermuda Monetary Authority (March 2023). Guidance Note: Management of Climate Change Risks for Commercial Insurers.

Model risk

For many years, life companies have grappled with the issue of getting model risk management correct. Great strides have been made over the past two decades or so, in part driven by ramped-up regulation in the area (e.g., in the United States, VM-G in the regulators' Valuation Manual[13]). But issues remain, with material errors becoming apparent in models. Ongoing reliance on spreadsheets and manual intervention in some aspects of the modeling process remain persistent areas of challenge. Model risk management is also an area that the BMA is paying special attention to, as per its emerging expectations coming out of its recent review of the local regulatory regime.

Some notable best practices, however, have emerged, which are worth noting.

- Maintain a complete model inventory, preferably at the second line of defense but with the first line accountable for providing up-to-date information at all times.
- Have a clearly articulated model risk management policy that makes it clear who has responsibility for what.
- Have a clearly defined process for scoring models so that they can be prioritized, and thus models that could potentially have the most material impact on the business can be given special attention.
- Know what type of "independent challenge" is appropriate depending on the categorization of the model, e.g., a full independent model rebuild for a very high-priority model and ensure there is a rigorous process for making sure such challenge takes place periodically, such as every two years for high-priority models.
- For production models, a process map specifying how the various component parts of the end-to-end process are interlinked can help establish those areas where there could be a breakage and hence identify where controls need to be put in place.
- Have model risk management dashboards that report on metrics that genuinely help give the board and senior management comfort that the model risk management program is being implemented effectively.
- Implement policies that provide rigor around processes for model change and the testing of models, including processes around the analysis of change each quarter, etc.

[13] National Association of Insurers (January 1, 2023). Valuation Manual, Appendix G: Corporate Governance Guidance for Principle-Based Reserves (January 1, 2023, edition).

Risk calibration and dependencies

It is also instructive to consider how insurers may have revisited their risk projection assumptions—or recalibrated their models—in light of recent developments. We consider the risk calibration question, starting first with the challenge of gauging risk interdependence.

Risk dependencies

The current backdrop of economic conditions highlights the interconnectedness of the modern global economy. A chain reaction of world events such as the COVID-19 pandemic, the Ukraine war, global energy crises, Brexit, aging populations, and increasing labor costs have spurred large macroeconomic disturbances across the globe.

The result is that economic risks are increasingly harder to untangle and even have a compounding effect on each other, as shown by the example of interest rate rises in response to sustained inflationary pressure.

Various methods can be used to evaluate and model the interconnectedness of risks. The use of correlation matrices (which attribute correlation factors to each pair of risks directly) is a straightforward and commonly used approach but, while having the advantage of being simple to model and explain, they are limited in use especially in the context of capturing tail dependencies—i.e., how risks may interact differently in extreme scenarios from how they would under “normal” conditions. Copulas such as the Gaussian or Student (which aim to model tail risk dependencies more rigorously), or a combination thereof, can be more helpful at capturing the tail risk present in extreme economic stress environments. They have been used for some time across the life industry for tail-risk applications such as calculating both economic and regulatory capital.

However, approaches such as correlation matrices and copulas ideally require our having some prior knowledge of how risks interreact, based on historical observation. Yet much of what worries today’s Chief Risk Officer is around events we have seldom or never seen before, for which there is limited if any data. As mentioned earlier in this paper, in such situations, behavioral models—or causal models—can be extremely useful. Such models focus on underlying relationships of causal factors and seek to build a web of how these factors are related. For example, if we consider the risks associated with alternative assets, there may be a myriad of underlying behavioral causal factors at play, e.g., trader sentiment and investor perception of the private bond market, any of which could create a risk event. Understanding what these factors are and how they interplay can be much more insightful than what may otherwise amount to little more than rolling the dice to gauge risks associated with events we have not experienced before.

Notwithstanding the underlying the approach to assessing dependency, some insurers also develop adjustments to risk calibrations by allowing for nonlinearity of risks. The recent challenging economic conditions accentuated the need for such nonlinearity adjustments, with multiple insurers commenting that as a result they had more difficulty in producing accurate interpolated or extrapolated results for a range of stress environments.

A specific dependency of note is that between equities and bonds. While this has been considered a traditionally negative correlation in recent decades, evidence of a positive correlation has reemerged in recent years, with the underlying interest and inflation increases a major contributing factor. Whether this positive correlation continues, or a more neutral relationship between these two asset classes is restored, insurers may no longer be able to assume the same diversification benefit as before and may want to revisit their ALM strategies to account for higher volatility in portfolio values over the medium and long term.

A potential weakness of the Solvency II Standard Formula in dealing with the current economic turmoil is in respect of its risk aggregation methodology, which prescribes a correlation matrix with static correlation parameters between market risks. European insurers should reflect on whether these fixed assumptions go far enough in capturing the dependencies exhibited in recent market shocks.

Risk calibration

Fundamentally, the change in market conditions in recent years suggests a shift to a new economic paradigm, a sentiment shared among many insurers. Indeed, some of the changes in economics over the past 24 months have, for some economic indicators, exceeded what some insurers had assumed for the 1-in-200 confidence level. Priorities have shifted in a short space of time, and there are instances of what had seemed very significant previously being superseded by other risks becoming more of a concern. As already mentioned, an example of this is how insurers were only a few years ago dealing with the challenges that negative interest rates posed for their models—with government-issued negative yielding debt being apparent in a number of jurisdictions across the globe—but they are now seeing interest rates as high as they have been since the 2008 global financial crisis.

It remains to be seen what aspects of the current economy—be it high inflation, raised interest rates, or ongoing market volatility—will persist over the longer term, and whether this means insurers should be revising, or recalibrating, their assumptions regarding the risks to their business associated with such. The uncertainty associated with transition to a low-carbon economy could result in this economic volatility continuing for some time.

In our discussions with UK life insurers, many indicated they were revisiting the appropriateness of their inflation assumption for purposes of calculating reserves and capital requirements under Solvency II. For the time being, revisions to insurers' calibrations of inflation stresses are typically parameter changes to the overall shock applied, rather than any fundamental redesign of the model, such as adopting principal components analysis. Interest rate stresses have also been revisited, with many insurers specifically picking out the upward direction stress. For UK insurers, modeling inflation volatility is a difficult exercise, as there is no liquid market in inflation swaptions that can be observed. As a result, it was often modeled quite simply in the past. However, the steep rise in inflation levels and its volatility, along with increased exposure to inflation caps and floors from writing bulk purchase annuities, has led to rethinking inflation volatility modeling at some insurers. Some Solvency II IM firms indicated they had adjusted their calibrations of the inflation volatility assumption, though this was largely limited to those with exposure to LPI or otherwise inflation-linked liabilities.

A point worth noting is that the Solvency II Standard Formula does not explicitly mandate capital requirements in respect to volatility or inflation risks. Given the current economic uncertainty, it will therefore be interesting to see the extent to which Standard Formula firms will consider whether these or any other emerging economic risk should be assessed more, for example by capturing them under the Pillar II ORSA or potentially even developing a full or partial Internal Model to include under their Pillar I capital requirements.

However, while some insurers (both in the United States and the UK) have made some selective changes to their calibrations, overall a main theme that emerged from our discussions around the market was something of a "wait and see" attitude, especially in the context of lapse behavior in an era of increasing or at least higher interest rates. In other words, there is some reluctance to change best estimate assumptions and also risk distributions in response to trends and volatility that, while significant, have only emerged over the short term. Similar judgments apply to dependencies.

Regardless of the specific adjustments insurers have decided to make (or not make) in response to the recent economic uncertainty, the consensus is that it will be necessary going forward to be more agile in adapting calibrations in response to potential rapid changes in the market and risk environment.

One way this could be supported would be to incorporate older historical data into calibrations in order to represent a more diverse spectrum of economic regimes. However, as mentioned earlier in this paper, this may be of limited use as the world in which we live today, as well as the asset-liability profile of life insurers, is very different from what it was even just a decade or so ago. That said, insurers are leveraging expert judgment in combination with historical data in support of risk calibration and, again, this is an area in which behavioral approaches can be valuable. Utilizing expert judgment allows companies to guide assumption development in a rapidly changing environment where there is otherwise insufficient data for calibration.

Stress and Scenario Testing

In the absence of, or as an alternative to, significant changes to risk calibrations and dependencies in their capital models, insurers are more actively using Stress and Scenario Testing (SST) to address the greater uncertainty and interconnectivity of risks. Indeed, SST was a recurring talking point with the insurers in our discussions around the market. Insurers have typically made great strides in this area, building out expansive and considered suites of stress tests, and with continued improvements in technology and actuarial software they are producing results quicker and more flexibly. It may not be possible to predict with perfect accuracy the future direction of geopolitical relations or the frequency of pandemics and wars, but SST helps insurers come to grips with the range of end impacts they can expect these events would have on their business. We believe that insurers that are not doing this type of analysis, and perhaps using outdated and slow projection models, are going to find themselves at a competitive disadvantage and will fall behind as others in the market have access to better information on a more timely basis. The increased ability for SST in an effective and time-efficient manner is going to be more important in the Age of Uncertainty in terms of quick decision making, risk management, and driving strategy.

Interestingly, when we asked U.S. life insurers whether a few years ago they had anticipated the potential for a pandemic or a war, or a combination thereof, a number responded that their stress testing work had certainly picked up scenarios that captured the impact of these events on the company's risk exposures.

UK life insurers echoed this and some also commented that the regulator has seemed to shift relatively more of its attention toward robust scenario testing, to complement the Pillar I capital requirement calculations. This seems to be a sensible and pragmatic response to the wider economic and noneconomic uncertainty: as the risk landscape becomes more complicated, and risks become harder to untangle, time may be better spent ensuring that the business will withstand a diverse set of scenarios rather than further fine-tuning of model calibrations in only one central scenario. Typically, these scenarios will consider several plausible real-world events or shocks, such as an extreme recession, stagflation, disorderly transition, or specific geopolitical events, with the combination of stresses in each event being informed by a combination of expert judgment, causal modeling, and the base capital model.

This shift in thinking is also beneficial for the insurer internally, from both a financial and risk management perspective. For example, the results of a lapse stress in isolation may mean little to the board, whereas the impacts of a wide range of real-world scenarios can directly feed into business planning as well as highlighting where any preemptive mitigating actions or contingency plans would improve resilience. A good example of this is that, with the steep rise in inflation over the past two years, we found that many UK-based insurers now carry out SST on inflation specifically to assess the impact of a range of different inflationary scenarios, even if they decided not to revise their best estimate inflation assumptions and capital calibrations.

Another important application for SST is to better assess and manage liquidity risk. As discussed earlier in this paper, liquidity risk has gathered more attention and in particular life insurers have sought to understand the interplay with other risks. Assessing the impact on liquidity under composite SST over different time horizons, such as daily, weekly, and monthly shocks, has been key to getting a true picture of the liquidity constraints and vulnerabilities.

Better monitoring of liquidity among insurers, including SST, was something that the UK regulator paid particular attention to during the 2022 gilts crisis, given the rapid increases in interest rates. However, the major UK insurers seemed to be largely well-equipped to deal with this during this period, with timely provision of information, and were quick to react as needed to avoid potential liquidity strains. We will look more into this topic in our second paper.

UK insurers have continued to use SST to deepen their understanding of liquidity risk and have improved their internal monitoring and management information for liquidity risk, both in terms of quality and timeliness. They have more explicitly defined liquidity limits, often using for example red-amber-green tolerances. SST has also been used to highlight scenarios where things may fall out of tolerance—a liquidity "reverse stress test."

Similarly, in Bermuda, the BMA has also put in place regulatory enhancements to adapt to the evolving nature of liquidity risks in the market. This includes assessment of stress tests that capture the interaction of lapse and liquidity risks.

Therefore, while SST has already been a regulatory requirement or good practice for many years, it seems it will become even more relevant in the future and will surely play an important role in ensuring resilience in the new risk environment. If recent years are anything to go by, having a flexible and adaptable model, which can accurately capture intricate risk dependencies, will be key for insurers in managing uncertainty.

Conclusion and upcoming paper

In this paper we examined how life insurers have been revisiting their risk taxonomies and calibrations in light of recent events. As we continue to live in the Age of Uncertainty we can expect to see increasing attention paid to evolving and emerging risks and increasing investment made by insurers to identify these risks early and understand their potential impact. Our paper has also reviewed how companies have recalibrated their risk exposures and dependencies and use SST to better inform their risk management strategies.

Milliman continues to help clients navigate this market environment and this paper is the first in a two-part series providing insights into the impact of recent and emerging economic changes and their effects on life insurance risk management, capital management, and ALM. Our next paper, in which we will look at how insurers' models and monitoring have performed and the implications for future risk management, will be published in early 2024.

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