Revisiting the Role of Insurance Company ALM within a Risk Management Framework

Executive Summary

As insurance sector fundamentals have improved over the past two years, we take a fresh look at the role of insurance company Asset Liability Management (ALM) and investment strategy. We look back at the impact of the financial crisis on US insurers, and how the industry responded. We observe signs of progress on financial statements that began to take hold starting in 2009, including improved capital adequacy, net income and lower realized losses as compared to 2008. However, when we look more closely at the post-crisis rebound, we note these improvements have largely been driven by regulatory changes, capital raising and reductions in dividends paid. In addition, the current prolonged low interest rate environment is expected to produce lower investment earnings potential, albeit partially offset by redeployment of elevated cash balances and improved performance on alternative investments. Now more than ever, we propose a revised ALM, risk management and investment strategy framework as a catalyst to improve the decision-making process and, ultimately, the operating performance of the insurance organization.

Within GSAM’s Insurance Strategy team, we are focused on advising insurers globally on the role of ALM, recognizing the need for this integrated ALM framework. In this white paper, we explore the complexities and stress within the US life insurance industry during the financial crisis and then present a case study applicable to all insurers to demonstrate “ALM at work.” We illustrate an overall ALM framework that is holistic, incorporates effective diversification of market risk and return sources, and focuses on capital preservation. We believe this framework can help insurers be more nimble and proactive in a variety of market environments. It is critical to build ALM and investment strategy processes that are linked together and part of an overall risk framework, with clearly defined risk budgets and risk reporting. This approach will empower an insurance company CEO to more efficiently manage through another volatile capital market environment.

This material is provided for educational purposes only and should not be construed as investment advice or an offer or solicitation to buy or sell securities.
Complex Landscape for Insurers

Insurers have a variety of key stakeholders focused on, in some cases, vastly different metrics. They must answer to policyholders, shareholders, rating agencies, regulators and tax agencies, to name a few. Each stakeholder within a life insurer’s universe serves a unique purpose, with its own objectives and constraints that sometimes complement and at other times conflict with each other.

In addition, an insurer with multiple legal entities and lines of business has to manage to its group’s overall balance sheet and regulatory framework but also may need to focus on managing and reporting financials and capital adequacy at the legal entity level. For insurers that are publicly traded, they also report financials based on the accounting requirements of their group’s domicile. And, each rating agency has a different set of criteria to evaluate the capital adequacy and financial strength of the insurer. Further complicating the job of risk management and ALM for life insurers, many of the stakeholders use different metrics to measure assets, liabilities and capital.

During the financial crisis, we believe the challenges for insurers were more complicated because of the multi-layered world in which they operate. In the table below, we illustrate some of the high level differences among these metrics and how they were impacted by the crisis.

### How US Insurers Evaluate Their Businesses

<table>
<thead>
<tr>
<th>Metric</th>
<th>Primary Objective</th>
<th>Key Characteristics</th>
<th>Crisis Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting (GAAP, IFRS)</td>
<td>Allocate income and expenses to the period earned; focus on shareholder</td>
<td>A mix of principles-based and economic valuation</td>
<td>Unrealized losses grew to an uncomfortable level that led to a focus on the economic framework</td>
</tr>
<tr>
<td>Economic (MCEV, Solvency II)</td>
<td>Intended to value assets, liabilities and capital with market-based valuations</td>
<td>Economic valuation</td>
<td>Served as an early warning to insurers, but was difficult to decide actions given significant illiquidity premiums</td>
</tr>
<tr>
<td>Rating Agencies</td>
<td>Assess the financial strength of insurers to determine a credit rating</td>
<td>Each agency has different evaluation criteria composed of rules-based, principles-based and economic valuations</td>
<td>Downgrades of insurers during the crisis reinforced the market’s view of distress in the sector</td>
</tr>
<tr>
<td>Regulatory (Statutory)</td>
<td>Maintain insurers’ solvency, focus on protecting policyholders</td>
<td>Prudent valuation of assets, liabilities, and capital is predominantly rules-based</td>
<td>As the unrealized losses continued to mount in GAAP AOCI, the main focus shifted to regulatory capital</td>
</tr>
</tbody>
</table>

Source: GSAM. For illustrative purposes only.

Certainly, insurers pay attention to all of the stakeholders and their metrics. But before the crisis, insurers focused more on accounting and rating agency measures that serve the interest of the investor community, including return on equity (ROE) and rating agency criteria. These are not necessarily mutually exclusive, but, as the crisis unfolded and the investor community began to recognize the potential need for US life insurers to raise capital, the attention quickly turned to the statutory balance sheet. There was a quick and sudden shift in focus to determine capital adequacy based on the statutory balance sheet and National Association of Insurance Commissioners (NAIC) risk-based capital.
History of the Financial Crisis from US Life Insurers’ Perspective

Stress in the insurance industry first began brewing in early 2008. The mortgage market was softening and the collapse of Bear Stearns increased the pressure. The situation intensified after the bankruptcy of Lehman Brothers and the bailout of AIG in September 2008 triggered a global financial meltdown. During this time frame, insurance companies faced several challenges, including significant realized losses, unrealized losses via Accumulated Other Comprehensive Income (AOCI), a severe drop in market capitalization versus the broader market and falling risk-based capital (RBC) ratios. Insurance companies responded by raising capital and increasing cash allocations.

Unrealized Losses via AOCI

Most publicly-traded life insurers classify the majority of their fixed income assets as available for sale under US Generally Accepted Accounting Principles (GAAP) or International Financial Reporting Standards (IFRS) accounting regimes. This means that fixed income assets are held on the balance sheet at their market value, but the difference between market value and amortized cost flows through equity on the balance sheet. This is referred to as AOCI. Each quarter, assets are evaluated for impairment, and the associated realized losses flow through the income statement. In addition, period-to-period gains and losses from other balance sheet assets such as private equity and hedge funds are realized directly through income each reporting period. Realized losses are due to defaults or a determination of an impairment of a security, as well as from mark-to-market changes from non-fixed income asset classes. It is important to understand these accounting differences to fully appreciate the figure below.

In Exhibit 1 we show the trend of steep realized and accumulated unrealized losses (AOCI) for 20 publicly-traded US domiciled life insurers. Accumulated unrealized losses (the difference between market value and amortized cost) grew to almost 60% of GAAP equity because of unprecedented spread levels and credit concerns. Investors were concerned that if a considerable amount of accumulated unrealized losses were forced to be realized, that these losses would have the ability to deteriorate GAAP equity, thus triggering a need to raise additional capital.

Life insurers had debated for some time whether market values were relevant to them given their long-term investment profile. In other words, life insurance is considered a long-term liability and the investment portfolio has a long-term horizon, so mark-to-market moves in the investment portfolio were not believed to be relevant. But the unrealized losses grew to such high levels that the market values became real to stakeholders and they started raising questions about capital adequacy.

Exhibit 1: Accumulated Unrealized and Realized Losses as a % of GAAP Equity

Source: SNL Financial and company financials, 12/31/09. The chart above shows unrealized and realized losses as a % of GAAP equity for 20 publicly-traded US domiciled life insurers.
Severe Drop in Market Capitalization

At the same time, the equity market began experiencing steep declines. But as bleak as the broader equity market appeared, insurers’ stocks were faring even worse, underperforming the S&P 500 significantly (Exhibit 2). This caused market capitalization of many large insurers to fall dramatically (Exhibit 3). Conditions were challenging in the equity market for insurers and it was clear that a capital raise, if necessary, could be expensive and dilutive.

Exhibit 2: Insurance Stocks Underperformed Relative to the Market

Source: Bloomberg and SNL Financial, 12/31/09. Chart at left shows the A.M. Best US Life Insurance Index (AMBUL) versus the S&P 500. Chart at right shows the total market capitalization of the AMBUL index.

Falling RBC Ratios

Concerns about capital adequacy continued to mount as yet another indicator suggested trouble. The RBC ratio, which compares available capital against levels of required capital, was expected to drop meaningfully in 2008. Regulatory required capital in the US is determined based on the statutory balance sheet and the application of a combination of principles-based and rules-based requirements as defined by the NAIC. Therefore, the focus shifted from GAAP to statutory financial statements and NAIC risk-based capital. Insurers’ RBC ratios were well in excess of what was required to remain a going concern from the regulators’ perspective. However, the expected decline from 2007 to 2008, along with the increased realized and accumulated unrealized losses on GAAP financial statements, signaled the need to raise fresh capital. Adding to the uncertainty, there was potential for ratings agency downgrades. Exhibit 4 shows the actual decline in RBC ratios, incorporating the additional capital raise prior to year-end 2008.

Exhibit 4: Average US Life Insurer RBC Ratio

Source: SNL Financial and company financials. 12/31/09. The chart above shows the end of year RBC ratios for 20 publicly-traded US domiciled life insurers.
Changing Portfolio Allocations

Insurance companies typically hold most of their general account assets in fixed income securities, and their overall fixed income allocations remained fairly constant between 2007 and 2009. However, insurers almost doubled their allocations to cash and short-term securities in order to meet potential liquidity needs (Exhibit 5). In addition, Exhibit 6 shows insurers during that time significantly reduced their exposure to securitized assets such as non-agency residential mortgage-backed securities (non-agency RMBS), with a decrease in their overall MBS allocation within fixed income to 16.1% from 20.9%. At the same time, their US government bond allocation rose to 9.0% from 5.2%, representing an overall flight to quality.

![Exhibit 5: Average Asset Allocation](image1)

![Exhibit 6: Average Fixed Income Allocation](image2)

Raising Capital

Against this backdrop, insurers were faced with the difficult task of raising capital when conditions were most difficult. Adding to the challenge, liquidity needs were increasing as product sales were falling and concerns were growing about the possibility of increased policy surrenders and withdrawals. Ultimately, the increased unexpected withdrawals never occurred, but 2009 saw a meaningful reduction in premiums across the US life insurance sector: a 20% reduction in life insurance premiums and 30% reduction in general account annuity premiums and deposits.¹

Variable annuity capital requirements and the significant downgrades in the non-agency RMBS portion of their portfolios, later partially mitigated by the NAIC’s RMBS risk-based capital changes, were also placing meaningful pressure on the RBC ratios.

What did companies do to manage through this? Many raised capital via common and preferred equity. In addition, there was significant issuance in senior unsecured debt, some surplus notes and subordinated debt. Many companies also diligently de-risked where possible, as evidenced by the 2009 asset allocation changes outlined above. However, many traditional capital raising options were no longer available without significant dilution. Some companies attempted to divest businesses, but there was a lack of buyers at attractive prices. Funding via securitization virtually disappeared.

As companies were looking to raise capital in the midst of the financial market volatility, boundaries that were in place clearly separating accounting and economics began to fade. There was heated debate around whether the increased unrealized losses (AOCI) were meaningful. In other words, did current economics matter to insurers that are providing for the long-term needs of policyholders? We would argue that the economics have always mattered, and our case study further illustrates this point. As we look forward, we are asking what we can do next time to be more prepared by improving the integration of risk management, investment strategy and ALM.

¹Source: SNL Financial.
Playing “Offense” and “Defense”

During stable economic periods, insurance company CEOs have historically focused on long-term strategy, growth, profit, disciplined capital allocation and the creation of shareholder value. At these times, when they are “playing offense,” they typically turn to share buy-backs, business efficiencies through synergies, economies of scale, improving the franchise, distribution growth and a focus on earnings.

But what happens when the tide turns quickly? They move from proactive to reactive, from offensive to defensive. With this comes a change in overall objectives: de-risking, improving liquidity, maintaining a sufficient capital level or sustaining the organization’s financial strength rating. The industry has recognized that capital concerns can change rapidly as evidenced during the financial crisis due to volatility of markets and relatively new capital requirements that are more dynamic, such as the C-3 capital charges for ALM risk. Note that the pending Solvency II capital requirements for European insurers will further exacerbate the need for capital contingency planning during volatile markets.

During the crisis, the industry turned to capital raises and most notably in the form of debt (surplus notes and senior unsecured notes) as well as equity/preferred/hybrids. In addition, companies turned to de-risking, which in some cases meant they sold out of equity and alternative asset classes after sharp drops in value, hedged when implied volatilities were at all-time highs and interest rates were low, and looked for reinsurance when capacity was scarce.

And when the dust settled, and the financial storm started to clear, insurance company CEOs circled back to offensive goals.

A Game-Changing Approach?

But is there a way to more nimbly shift between offense and defense? For one, the financial industry is looking at more effective forms of contingent capital. Flexibility in a customized structure would depend on the insurer’s objectives but would ultimately provide capital and liquidity when needed.

In addition, we propose that execution of improved risk management and ALM can also be at the heart of this game-changing approach. Risk management and ALM must be integrated with the offensive and defensive core objectives at all times. Strategy, growth, capital allocation and deployment and shareholder value are all firmly integrated with risk management and ALM at the core of the decision-making process.

Some of the current US capital requirements arguably worked. In some cases they helped minimize the blow for life insurers, as did the more stable liabilities such as whole life policies or immediate annuities. C-1 for market risk had insurers focused on de-risking as securities were facing potential downgrades. The introduction of the NAIC’s new capital requirements for RMBS, however, led to a material reduction in C-1 capital without further de-risking.

Pre-crisis, most insurance companies were on their way to establishing more effective, holistic risk management frameworks. The frameworks were initially oriented towards improving an organization’s risk governance, risk measurement and risk management processes. In addition, there was an increased focus on the risk management framework to facilitate improved strategic decision-making.
Post-crisis, we continue to see insurance companies resource their teams to improve their risk management frameworks. In the case study below, we show GSAM’s view of the relationship between risk management, ALM and investment strategy. In our integrated risk management framework, we focus on a number of key points:

- Clearly define a market risk budget on an economic basis as well as based on required capital constraints
- Evaluate economic objectives versus insurance constraints, where they differ
- Determine where and how the ALM process and constraints fit into the overall risk management framework

Within this overall risk management framework, the rest of this white paper will focus on ALM and Strategic Asset Allocation (SAA), a step-by-step illustrative process and case study.

Enterprise Risk Management

We believe an insurance company should evaluate the following six core processes together in order to create the most efficient approach to enterprise risk management.

- **Risk governance**: Formal and informal communication about day-to-day risk management and decision-making is critical.
- **Risk and capital measurement**: Each organization must define economic risk measures and overlay specific regulatory/rating agency capital constraints.
- **Risk budgeting**: Controlling the level of risk taken is a holistic, top-down process. This includes determining which risks will be actively or passively managed, as well as risks that will be managed through hedging or reinsurance. Allocation of risk and capital should be considered at both the aggregate and the legal entity or line of business level.
- **Liquidity risk management**: Liquidity needs should be defined both at the aggregate level as well as by each line of business, implicitly “charging” lines of business with higher liquidity needs.
- **ALM and SAA**: Defined risk and capital measures, allocated risk budgets and defined liquidity constraints are all inputs to determine ALM constraints and overall SAA.
- **Risk reporting**: Regular and routine monitoring of risks includes sensitivity, stress tests, multiple measures of risks and contingency planning. Risk reporting needs to be a living, nimble process that feeds back into the risk governance.
GSAM’s ALM and SAA Process

Our goal is to develop an ALM and SAA framework that optimizes client-specific business objectives, while satisfying investment constraints faced by insurers. For example, we focus on identifying various investment mixes that will maximize risk-adjusted return where risk is defined as minimizing surplus volatility. Surplus is the difference between assets and liabilities, and we use volatility as an economic risk measure.

ALM and SAA Process

Step 1: Investment Objectives and Constraints

This is the most important step of the process. Determining investment objectives and constraints is an iterative process. We often revisit this stage as we gain more insight and develop a greater understanding of a portfolio’s risk and return attributes under different scenarios. Importantly, we have the flexibility to analyze the trade-offs of various customized constraints. An example of initial investment objectives and constraints from this stage is shown in Exhibit 7.

Exhibit 7: Sample Investment Objectives and Constraints

<table>
<thead>
<tr>
<th>Objectives and Constraints</th>
<th>Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Yield 5.5%</td>
<td>Investment Grade Credit BBB 30%</td>
</tr>
<tr>
<td>Duration Mismatch Tolerance 0.2 yrs</td>
<td>High Yield Credit BB 5%</td>
</tr>
<tr>
<td></td>
<td>MBS/ABS/CMBS 25%</td>
</tr>
<tr>
<td></td>
<td>Equity/Alts/Real Estate 15%</td>
</tr>
</tbody>
</table>

For illustrative purposes only.

Step 2: Asset Universe and Assumptions

In this step, we establish the asset classes to be used in the strategic asset allocation. We believe it is preferable to employ a broad set of investable asset classes to take full advantage of the benefits of diversification and maximize portfolio efficiency. This is achieved through a combination of asset classes with superior risk-return characteristics and attractive correlation attributes.

In our view, correlations between asset classes and correlations of asset classes with the liability profile are key to constructing risk-optimal solutions. In instances where the liability cash flow profile extends beyond the duration of investable assets, we might also recommend including derivative instruments. This enables us to compare the risk-return characteristics with and without hedging long duration liability risk. Exhibit 8 shows a comparison of the long-term risk-return characteristics of a sample investable asset universe.

Exhibit 8: Sample Asset Universe Assumptions

Credit shown is intermediate duration.
Source: GSAM Insurance. For illustrative purposes only. Assumptions for expected return, volatilities and correlations are derived from our factor-based risk model and other analytics. Current yield assumptions based on Barclays Indices as of 02/26/2010. Volatility assumptions include two-year half-life decay based on factor exposures (interest rates and credit spreads). Fixed income correlation assumptions include five-year half-life decay based on factor exposures. Non fixed income assumptions are GSAM long-term strategic assumptions.
Step 3: Liability Cash Flow and Replicating Portfolio

Our investment approach explicitly incorporates liabilities as the investment portfolio is required to support liability cash flows as well as adequate surplus (Exhibit 9). We do this by:

- Understanding the liability profile—Using best estimate liability cash flows, we analyze the liability profile and capture features such as the maturity profile and minimum guarantees.

- Developing the duration profile—To capture the sensitivity of the liability value to movements and changes to the term structure of interest rates, we construct the overall duration as well as the key rate duration (KRD) profile of the liabilities.

- Designing a risk minimizing portfolio—Replicating portfolios using investable assets are then constructed to match key economic characteristics of the liabilities including KRD and guarantees.

Exhibit 9: Sample Liability Cash Flow and Duration Profile

For illustrative purposes only.

Step 4: Risk Measures

In assessing the effectiveness of different investment strategies, our main focus is understanding the trade-off between risk and return under the primary investment objective. For example, we seek to maximize return subject to surplus risk not exceeding a specified risk budget. However, viewing the solution under a single risk metric does not provide a complete picture and it is instructive to consider how the proposed strategy performs under a variety of risk measures. Examples of risk metrics that we commonly use to quantify the risk characteristics of the investment strategy include:

- Asset-only volatility
- Surplus volatility
- Economic or required capital, Value at Risk (VaR), Conditional Value at Risk (CVar)
- Surplus drawdown risk

In our view, understanding the impact of various risk measures is key to constructing an ALM and asset allocation solution that meets the objectives. In Exhibit 10 on the following page we illustrate how an efficient frontier can change under different risk metrics and hence an SAA that is optimal from one perspective may have less attractive characteristics under a different metric.
Step 5: Risk-Return Trade-Offs

Using our proprietary risk modeling systems, we apply optimization techniques to determine efficient portfolios that achieve incremental net excess yield and minimize risk, while meeting the various specific insurance constraints overlaid on the process. The specific risk measures identified at this point will be used to evaluate and compare various efficient frontiers.

During this stage, risk-return trade-offs can be evaluated with and without constraints—for example, duration mismatch tolerances, exposure limits, and so on—to better understand their impact and to explore how ALM and SAA can be more efficient.

As outlined in Exhibit 11, the output of this step is a range of efficient frontiers that we have identified as Approaches 1, 2 and 3, with varying constraints and risk measures.
Step 6: ALM and SAA

The overall SAA decision reflects an insurer’s risk and return objectives, ALM and other constraints. The SAA, once defined, is used to develop customized benchmarks.

In order to determine our recommendation for portfolio construction, we would also address:

- What is the appropriate benchmark(s) to be constructed in line with the SAA?
- What is the relevant tolerance for active management to achieve target alpha?
- How will current market views be incorporated into the portfolio?

Finally, we present our SAA recommendations to the client and work together to identify which approach will provide the best overall fit in terms of risk-adjusted return and the operating constraints of the company. In Exhibit 12 below we illustrate the output of an illustrative SAA and the optimal KRD gap between assets and liabilities.

Exhibit 12: Sample of SAA and ALM Analysis

For illustrative purposes only. SAA pie chart shows percentage allocation.

Case Study: Integrated Framework for ALM and SAA

Using our approach for ALM and SAA, we illustrate an example for a US life insurer. As discussed previously, insurers typically evaluate ALM solutions from a “bottom-up” perspective. They focus on assets backing reserves independent of surplus. For insurers writing many different liability product types, there is a separate investment portfolio backing the reserves for each major liability type. The reserve-backing portfolios have an objective of closely matching the cash flows or interest rate duration of the liabilities. The insurer’s surplus portfolio is managed consistently with the goal of capital preservation.

In contrast, holistic ALM and SAA consider the entire asset portfolio in aggregate to first optimize risk-adjusted returns within capital constraints and risk tolerance levels while simultaneously determining the most effective constraint for ALM.

For the purposes of this white paper, we are presenting a simplified example utilizing our ALM and SAA process. We compare three approaches with unique sets of constraints and risk metrics and then evaluate them in the context of maximizing net excess yield for a specified level of risk. We then look at how those methods fare under both economic and regulatory capital regimes.
Objective: For a given level of net excess yield, solve for the optimal asset allocation incorporating the specific risk definition and ALM constraint as outlined below.

**Approach 1**: Minimize asset-only risk while constraining the asset-liability duration gap.

**Approach 2**: Minimize economic surplus risk while constraining the asset-liability duration gap.

**Approach 3**: Minimize economic surplus risk while relaxing the duration constraint.

We also evaluate the economic and regulatory capital implications of the optimal asset allocations across the three approaches.

- **Economic capital measure**: Economic surplus market risk VaR (99.5% over a one-year horizon).
- **Regulatory capital measure**: NAIC US RBC impact for asset default (C-1) and ALM (C-3) risk.

**Case Study Liability Profile**

Typically, insurance liabilities are sensitive to many non-market risks such as mortality and catastrophe risk, and may have path-dependent market risk due to dynamic policyholder behavior, crediting rates, etc. In a real-life analysis we would consider a variety of these factors. In this case study, for simplicity and illustrative purposes, we assume one set of best estimate deterministic liability cash flows as previously outlined in Exhibit 9 on page 9. In our analysis, we assume an overall liability duration of eight years.

We also acknowledge the debate of liability discount rates and whether on an economic basis a liquidity premium or a firm’s own credit risk should be included as a spread. We assume the average discount rate is based on a AA credit curve as a proxy for the overall interest rate guarantee of the liabilities. We acknowledge that the ALM and SAA solution is dependent on this assumption.

**Questions to Explore**

In our case study, we aim to address a number of questions about risk measures, ALM constraints, risk-return trade-offs between asset classes and the impact of economic and regulatory capital requirements:

- Should a tight duration match be a constraint or should the level of duration (mis)match be a result of optimization?

- Does minimizing surplus risk versus minimizing asset-only risk lead to a more efficient asset allocation?

- Is there a benefit to allocating to a broad set of market risk sources, including: interest rate risk, credit spread risk and equity/real estate/alternatives risk?

- What are the capital implications of the efficient asset allocations and ALM constraints?
  - Assessing a surplus VaR (99.5%, one year) to approximate economic capital.
  - NAIC RBC C-1 and C-3 (Phase 1) used to determine credit and ALM capital.
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**Asset-Only Risk Framework (Portfolio Volatility)**

First, we consider the three approaches outlined on page 12 in an asset-only risk framework. We start by showing the results for minimizing portfolio volatility as defined in our three approaches for a given level of net excess yield. Net excess yield is defined as current asset yield less the average liability minimum interest rate guarantee. Each point on the efficient frontier moves an incremental 25 basis points in net excess yield and solves for the optimal portfolio under the given risk metric.

**Exhibit 13: Asset-Only Risk (Portfolio Volatility)**

For illustrative purposes only.

Note that Approach 1, where we are minimizing asset-only volatility for a given level of net excess yield, is the most efficient. Approach 1 is optimal since its efficient frontier was constructed to minimize portfolio volatility, while Approaches 2 and 3 minimize surplus volatility. But this is just the beginning of our findings.

**Asset and Liability Risk Framework (Surplus Volatility)**

We believe that because insurers need to manage both assets and liabilities, a more appropriate risk approach focuses on minimizing surplus volatility and therefore accounts for assets and liabilities. The first chart of Exhibit 14 illustrates how each of the three approaches compares when the risk measure is redefined as surplus volatility. The second chart shows the associated duration mismatch.

**Exhibit 14: Asset and Liability Risk (Surplus Volatility)**

For illustrative purposes only.
With surplus volatility as the risk measure, Approaches 2 and 3 outperform Approach 1. While both Approaches 2 and 3 seek to minimize surplus volatility, they impose different duration constraints. Approach 2 maintains a tight duration constraint, while Approach 3 allows for calculated duration mismatch. We determine that relaxing the duration constraint in the modeled economic environment actually improves the excess yield for a given level of surplus volatility. This may be a surprising result at first since life insurers have typically tightly matched the asset and liability interest rate risk; but there is a diversification benefit to introducing interest rate risk to offset credit and equity risk.

Exhibit 15 summarizes the results of the efficient frontiers and compares portfolio and surplus volatility risk measures.

**Exhibit 15: Three Approaches Side by Side within an Economic View**

For illustrative purposes only. Note, the X axes are different because surplus volatility is measured relative to liabilities.

In summary, what does each approach achieve? There are a number of parameters to assess including: the efficiency of the risk measure, economic capital requirement, and diversification of market risk sources. In Exhibit 16, we summarize each approach into its key components, demonstrating the trade-offs associated with each.

**Exhibit 16: Summary of Results**

<table>
<thead>
<tr>
<th>Approach</th>
<th>Allocation of Market Risk</th>
<th>Economic Capital Requirements</th>
<th>Diversification Across Market Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimize portfolio volatility with KRD constraints</td>
<td>☑️</td>
<td>☳</td>
<td>☰</td>
</tr>
<tr>
<td>Minimize surplus volatility with KRD constraints</td>
<td>☱️</td>
<td>☳</td>
<td>☳</td>
</tr>
<tr>
<td>Minimize surplus volatility relaxing KRD constraints</td>
<td>☳</td>
<td>☳️</td>
<td>☳️</td>
</tr>
</tbody>
</table>

For illustrative purposes only. Note: Market risks include rate, spread and equity risk.

Next we illustrate the efficient frontier asset allocations associated with our three approaches. As demonstrated in Exhibit 17 on the following page, Approach 1 utilizes lower credit quality fixed income assets to achieve the net excess yield objective while meeting the duration constraint. Approaches 2 and 3 include government bonds and higher quality fixed income as a ‘natural hedge’ against liabilities. Moreover, as we move across the efficient frontier to achieve higher net excess yields, we require higher allocations to:

- Lower fixed income credit quality
- Securitized assets (asset-backed securities, mortgage-backed securities and commercial mortgage-backed securities)
In addition, Approaches 1 and 2 include higher allocations to equities, real estate and alternatives than Approach 3. These asset classes achieve incremental yield and diversify with credit risk (rate risks are very constrained). Approach 3 achieves net excess yield with a more diversified allocation including rate risk, spread risk and some equity risk, and therefore requires lower allocations to equity risk.

**Exhibit 17: Portfolio Composition of the Three Approaches**

Thus far, the case study illustrates several important points:

- The overall asset allocation varies when the risk measure changes, as illustrated by the different asset allocation of Approach 1 versus Approaches 2 and 3.

- Because the insurer needs to evaluate asset allocation in the context of liabilities, we believe surplus volatility as a risk metric is most appropriate. Note how different the portfolio characteristics are when considering asset-only volatility.

- The introduction of rate risk is another source of market risk in Approach 3.

- Relaxing duration constraints in the current upward sloping yield curve environment is more efficient than constraining duration. This result needs to be evaluated under a variety of yield curve environments. In addition, while efficient from a strategic perspective, duration mismatch must be evaluated from a tactical perspective against the risks of rising and declining interest rates.

- As we move across the efficient frontier, more risk is taken in the portfolio. This risk needs to be aligned with the overall risk capacity of the organization.

**Implications of Economic and Regulatory Capital**

Let’s now evaluate the portfolios using an economic capital method. Here we have analyzed the three approaches using an economic capital measure to evaluate 99.5% surplus VaR for market risk (one-year time horizon) relative to net excess yield. Note the tail risk measure includes market risk only and incorporates skew (fat-tail distribution). As outlined in **Exhibit 18**, Approaches 2 and 3 clearly result in lower surplus VaR, with Approach 3 leading to the lowest surplus VaR at a similar net excess yield while utilizing a broader set of diversified risks. This is a conclusion consistent with the earlier net excess yield to surplus volatility measures.
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Exhibit 18: Economic Surplus VaR Using Approaches 1, 2 and 3

For illustrative purposes only.

Turning to regulatory capital, we will assess the market risk capital components (C-1 and C-3). C-1 charges for credit risk are rules-based. For fixed income assets, a prescribed factor is applied to the amortized cost of the bond depending on its credit quality. A lower credit quality requires a higher capital charge. Equities, real estate and other alternatives have higher capital charges. Exhibit 19 outlines the factors on a pre- and post-tax basis.

Exhibit 19: Risk-Based Capital Credit Risk Factors (C-1)

<table>
<thead>
<tr>
<th>Asset</th>
<th>Pre-Tax (%)</th>
<th>Post-Tax (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAIC 1 (AAA, AA, A)</td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>NAIC 2 (BBB)</td>
<td>1.3</td>
<td>1.0</td>
</tr>
<tr>
<td>NAIC 3 (BB)</td>
<td>4.6</td>
<td>3.4</td>
</tr>
<tr>
<td>NAIC 4 (B)</td>
<td>10.0</td>
<td>7.4</td>
</tr>
<tr>
<td>NAIC 5 (CCC)</td>
<td>23.0</td>
<td>17.0</td>
</tr>
<tr>
<td>NAIC 6 (CC and below)</td>
<td>30.0</td>
<td>19.5</td>
</tr>
<tr>
<td>Other*</td>
<td>30.0</td>
<td>19.5</td>
</tr>
</tbody>
</table>

*For simplicity includes common stock, alternatives, real estate.

Source: NAIC RBC Forecasting and Instructions

Goldman Sachs does not provide accounting, tax, or legal advice. Please see additional disclosures.

In addition, there is an ALM risk-based capital charge for certain types of annuity products. In this case study, we assume that our liability is an immediate annuity and therefore, we are required to compute C-3 capital. C-3 is required for deferred and immediate annuities. The C-3 factor is computed by projecting a company’s existing asset liability cash flows under a set of stochastic scenarios prescribed by the NAIC. Book value of surplus (book value of assets – book value of liabilities) and its present value are computed at each time step of the projection period. The greatest present values of future deficiencies (negative book surplus) are recorded for each of the stochastic scenarios. The scenario results are then weighted to arrive at the factor corresponding to the appropriate surplus tail value. The final capital charge is the greater of (i) a prescribed factor applied to the annuity reserves and (ii) the factor computed by running the cash flow models under the prescribed set of stochastic scenarios.
Comparing Approaches 2 and 3 Under a Regulatory Capital Framework

We start by picking two points on the efficient frontiers and evaluating the underlying portfolios from Approaches 2 and 3. Portfolios A and B were chosen such that they have a similar level of risk but a different net excess yield profile. The question becomes, does the excess yield come at the cost of additional regulatory capital? The answer is no. Recall that Portfolio A’s approach minimizes surplus volatility with tight duration constraints, while Portfolio B’s approach minimizes surplus volatility with relaxed duration constraints. In Exhibit 20, we compare portfolio compositions of the two selected portfolios.

Exhibit 20: A Closer Look at Two Portfolios

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Asset Allocation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Cash</td>
<td>2.5</td>
</tr>
<tr>
<td>Government</td>
<td>17.5</td>
</tr>
<tr>
<td>Corporate Bonds</td>
<td>43.6</td>
</tr>
<tr>
<td>Mortgages/Securitized</td>
<td>16.4</td>
</tr>
<tr>
<td>Real Estate</td>
<td>0.0</td>
</tr>
<tr>
<td>Equities</td>
<td>0.0</td>
</tr>
<tr>
<td>Other (Alternatives)</td>
<td>0.0</td>
</tr>
<tr>
<td>Total Reserve Assets</td>
<td>80.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Key Metrics</th>
<th>Port. A</th>
<th>Port. B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Excess Yield (%)</td>
<td>0.8</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Portfolio Duration</td>
<td>8.4</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>Liability Duration</td>
<td>8.2</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>Duration Mismatch</td>
<td>0.2</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>Surplus Volatility (%)</td>
<td>2.9</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>Required Capital (RBC) as % of Assets</td>
<td>2.2</td>
<td>1.3</td>
<td></td>
</tr>
</tbody>
</table>

For illustrative purposes only.

2The large duration mismatch is not a recommendation but rather to illustrate the level of mismatch with no C-3 capital implications.

3100% of company action level (CAL)
Portfolio A has a KRD profile that tightly matches the liabilities as seen below in Exhibit 21. Portfolio B has a significantly longer KRD profile than the liabilities.

Exhibit 21: KRD Profile (Liabilities versus Portfolios A and B)

For illustrative purposes only.

We evaluate the RBC implications of Portfolio A versus Portfolio B. Interestingly, Portfolio A requires more C-1 capital than Portfolio B due to the allocation of equity and alternatives to meet the return target, as outlined in Exhibit 22.

Exhibit 22: Portfolios A and B – Surplus Volatility and Regulatory Capital

For illustrative purposes only.

The statutory capital assessment concludes that the C-3 ALM risk charges are not constraining for this portfolio construction. Portfolio B is therefore more efficient from a statutory capital perspective because there is no additional C-3 capital charge associated with a duration mismatch. There is, however, a higher C-1 charge associated with equities and alternatives in Portfolio A. Neither Portfolio A nor Portfolio B generates a meaningful C-3 factor under the stochastic capital calculation prescribed by the NAIC because of the spread these portfolios are earning over the statutory discount rate. The 0.6% C-3 charge of the overall portfolio capital risk charge shown in the table above represents the minimum floor for immediate annuity products on the reserve portion of the overall portfolio.
Conclusion

Insurers came back from the brink following the financial crisis. In this white paper, we have highlighted the importance of ALM and SAA as companies continue to reposition in the aftermath. Insurers should take steps to periodically review and reset their ALM and SAA within the context of changing markets, business mixes and regulatory regimes. Along the way, insurers should stress-test their assumptions, and the sensitivities to assumptions should be clear.

Setting risk budgets at the aggregate level enables a holistic SAA to benefit from diversification of market risks. Diversification of additional non-financial and other market risks such as inflation should also be incorporated.

In addition, risk and capital budgets set at the enterprise level should be allocated to the legal entity or line of business level. This is a complex process requiring bottom-up considerations, such as varying regulatory capital requirements and fungibility of capital.

Certainly insurers post-crisis need to think creatively to improve their profitability. While ALM and SAA are not a cure-all for every challenge posed by volatile capital markets, they clearly can help improve the overall position of an insurance organization.

GSAM Insurance Asset Management

<table>
<thead>
<tr>
<th>AUTHORS</th>
<th>Ellen Cooper, CFA, FSA</th>
<th>Axel André, PhD</th>
<th>Serge Gabovich, FSA</th>
<th>Adina Pomerantz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Managing Director</td>
<td>Vice President</td>
<td>Vice President</td>
<td>Analyst</td>
</tr>
<tr>
<td></td>
<td>Head, GSAM Insurance</td>
<td>GSAM Insurance</td>
<td>GSAM Insurance</td>
<td>GSAM Insurance</td>
</tr>
<tr>
<td></td>
<td>Strategy</td>
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