Customized Benchmarks for Insurance Portfolios

WESTERN ASSET

Executive Summary

Customized benchmarks are essential for insurance portfolio management.

- Customization captures a company's unique business profile, including:
  - The timing and variability of liability cash flows.
  - The firm's targeted risk profile and financial strength rating.
  - The baseline asset mix consistent with management objectives.
- Benchmark construction is influenced by a range of factors:
  - Liability profile. Insurance liability cash flows are a key factor in building portfolio benchmarks designed to optimize risk-adjusted ROE.
  - The firm's definition of risk (e.g. ROE volatility, ROE downside).
  - Other factors, including risk-based capital ratio, stress test limits and tax position.
- Benchmarks provide a reference point for risk management and performance evaluation:
  - What are appropriate ranges for exposures to non-diversifiable risk factors such as interest rates, liquidity spreads and stock prices?
  - What are appropriate limits for exposures to a single market sector or issuer?
  - How will the firm's investment results vary across economic and market scenarios?
  - How well has the asset management team performed?

Introduction

Insurance portfolio management is not simply a question of earning returns on assets. It is also a crucial part of an insurer's efforts to create value for stakeholders. Consequently, portfolio strategies must incorporate a firm's liability characteristics as well as regulatory, rating agency and other considerations. The process of building customized benchmarks helps establish a framework for portfolio management that is consistent with a company's overall business objectives.

This paper discusses the creation and use of customized benchmarks for insurance portfolios. Benchmark construction is illustrated with a mean/variance asset allocation model.

Market Indices versus Customized Benchmarks

Market-based fixed-income indices have specific, documented rules that identify a representative sample of securities in the market sector a particular index tracks. The resulting portfolio reflects the risk and return characteristics of that market sector. Investors often use market indices as a benchmark to measure the level and sources of value created by asset managers.

The usefulness of a benchmark is directly related to how well it reflects an investor's objectives and risk preferences. The primary objectives of an insurance portfolio are to meet policyholder guarantees and to provide a competitive, risk-adjusted return to shareholders. Because each insurance company has a unique product mix and liability cash flow profile, widely used market indices (e.g. Barclays Capital U.S. Aggregate Bond Index) generally are not consistent with these objectives. Customized benchmarks are required in order to reflect an insurance company's unique liability cash flows, risk/return targets and related investment restrictions imposed by management, regulators and rating agencies.

Barclays Capital, JPMorgan, Merrill Lynch and Citigroup maintain a wide range of indices and sub-indices. Benchmark customization varies the weights of index sub-components to meet an insurance company's objectives while preserving desirable benchmark characteristics such as transparency and investability.

A well-constructed benchmark reflects the passive portfolio that would best support an insurance company's business. Customized benchmarks explicitly communicate a company's investment objectives, establish a baseline for defining active management risks that may be taken in pursuit of excess return, and provide a relevant basis for portfolio performance evaluation, risk management and communication.

Customized Benchmark Construction

Benchmark construction is influenced by a range of factors. Perhaps the most critical are an insurance company's liability profile and risk/reward preferences. The following paragraphs discuss and illustrate customized benchmark construction.

Insurance Portfolios Revolve Around Policy Liabilities

Insurance companies are leveraged investors. They "borrow" policyholder premiums to purchase investment assets and service their "debt" by paying policyholder benefits. Shareholders' risk/reward profiles are, by definition, the level/risk of the difference between asset and liability returns. Therefore, investment strategy revolves around a company's liabilities. Shareholder return and volatility are not measured as absolutes based on assets alone; rather, they are measured based on assets

relative to liabilities. Liability-driven benchmarks should lead to less risk for policyholders and a more efficient risk/reward profile for shareholders.

Insurance companies often focus on maximizing the investment portfolio's book yield to achieve higher operating earnings. However, portfolio market value and the economic value of equity are important to a company's long-term balance sheet health and profitability. Most insurance companies therefore balance two objectives: high book yield/income, and maximizing the total return of assets versus liabilities. The latter objective is most relevant to this discussion because benchmark candidates are selected to maximize shareholder total return at various risk levels. In practice, the high book yield/income objective is addressed through a yield emphasis during portfolio construction.

Liability-Replication

Before a customized portfolio benchmark can be built, the creation of a market proxy for insurance liabilities is required. The market proxy is a set of traded instruments that replicates expected liability cash flows and risk exposures. As insurance liabilities are not traded in a liquid market, the market proxy provides an estimate of their market factor sensitivities and return performance. Asset portfolio benchmark construction then maximizes excess return over the liability proxy for specific levels of risk.

One approach to replicating insurance liability cash flows uses interest rate swap indices. The swap market is large, liquid, and includes a credit and liquidity spread commensurate with the borrowing costs of highly rated commercial banks. Although insurance company debt included in the Barclays Capital U.S. Aggregate Bond Index has an average rating of A2/A3 and trades at spreads significantly wider than swap spreads, policy liabilities are senior to debt. Insurance financial strength ratings, which measure an insurer's ability to pay policy claims, are approximately one full letter grade above senior secured debt. A company with an A2 senior secured debt rating often has a financial strength rating of AA2, comparable to the quality of the Barclays swap indices. Consequently, swaps may be a reasonable market proxy for valuing insurance policy cash flows.[1]

Liabilities can be replicated by weighting swap indices so their cash flows match projected insurance liability payouts. As a market-based proxy for the liabilities, liability-replicating swaps make the return calculation of liabilities more transparent. They also provide a starting point for constructing asset portfolio benchmarks designed to outperform liabilities and enhance shareholder returns.

As a simple illustration, assume that an insurance company's policy liabilities have a value equal to 90% of the market value of assets. The 10% difference between assets and liabilities is the value of balance sheet surplus.[2] Furthermore, assume that the liability cash flows are replicated by a mix of Barclays 1-, 3-, 5-, and 10-year swap indices with the following weights:

- *1-Year Swap = 20% of assets*
- *3-Year Swap = 20%*
- *5-Year Swap = 20%*
- *10-Year Swap = 30%*

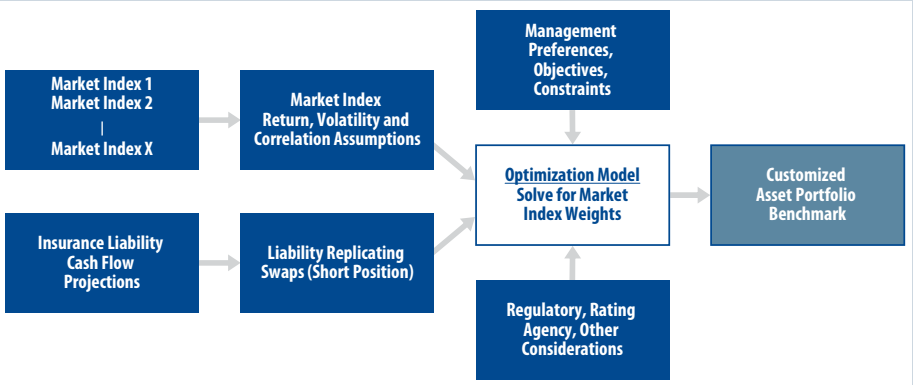
Total Liabilities = 90% of assets

Once the liability-replicating market proxy is defined, customized portfolio benchmarks can be created.

Investment Portfolio Benchmark Optimization

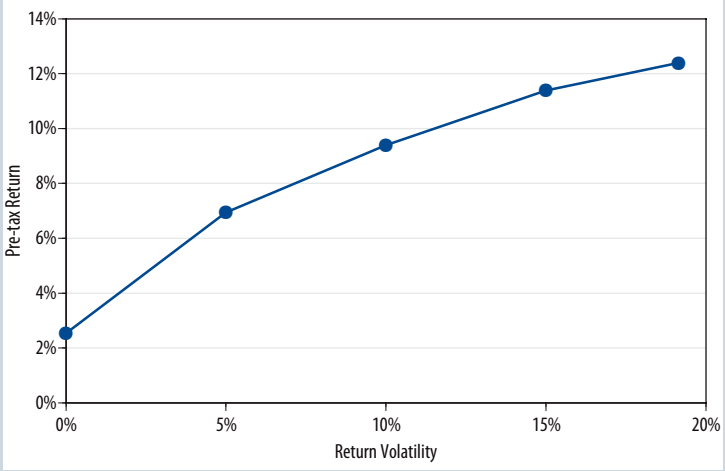
A mean/variance asset allocation model is used to illustrate the construction of efficient investment portfolio benchmarks. The model is long assets (100%) and short liabilities (90% of assets). Liability cash flows and characteristics are defined by the replicating swaps outlined in the

Exhibit 1
Customized Asset Portfolio Benchmark Contruction



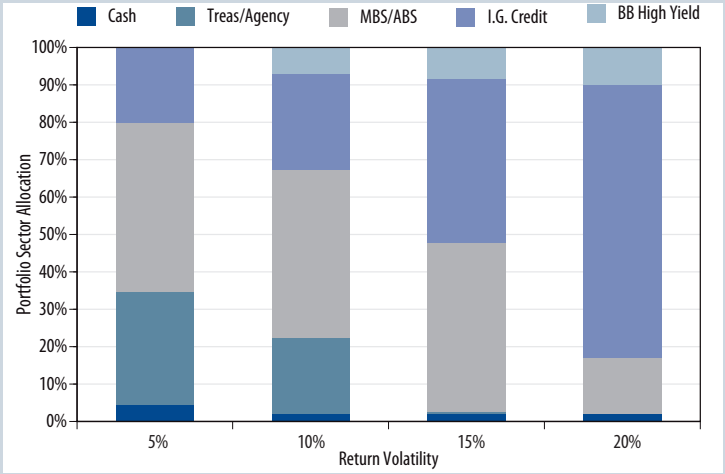
Source: Western Asset

Exhibit 2A
Return on Economic Surplus Frontier



Source: Barclays Capital, Western Asset

Exhibit 2B
Frontier Asset Mix



Source: Barclays Capital, Western Asset

previous section. The model's objective function selects asset index weights to maximize the total return on balance sheet surplus (i.e. the difference between asset and liability returns) for a range of risk levels, where risk is defined as the standard deviation of surplus returns. Exhibit 1 illustrates model inputs, which are shown in dark blue.

To create a customized portfolio benchmark, an extensive range of indices and sub-indices are available by sector, sub-sector, quality and duration. For this illustration, asset class choices are limited to the following Barclays fixed-income indices:[3]

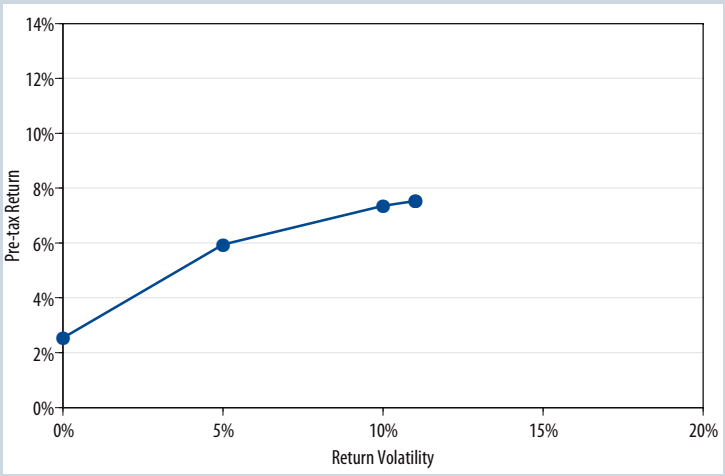
- *Cash: 3-month LIBOR Swap Index*
- *Treasuries/Agencies*
- *Mortgage-Backed (RMBS and CMBS) and Asset-Backed Securities*
- *Investment-Grade Credit*
- *BB Rated High-Yield*

The asset allocation model requires forward-looking return, volatility and correlation estimates.[4] For simplicity, this example bases its estimates on five years of historical data, from December 2001 to December 2006. In practice, judgment drives decisions about how historical relationships are combined with the current outlook to arrive at reasonable forward-looking assumptions.

Exhibits 2A and 2B display optimization model results. Exhibit 2A plots the risk/return trade-off for five targeted risk levels, ranging from 0-20% surplus return volatility (x-axis). The first point on the far left, with 0% excess return volatility, is the risk-free or hedge portfolio. It is 90% long liability-replicating swaps, exactly hedging liabilities to produce a zero net return contribution. The remaining 10% of assets, funded by surplus, is invested in cash.[5] Cash is shown to return 2.5%, the average rate earned over the 5-year period used in the analysis.

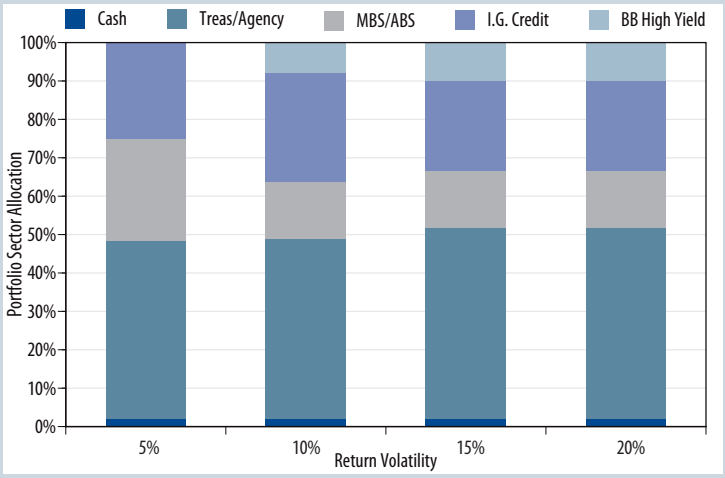
The hedge portfolio provides a low risk reference point. However, insurance companies will try to enhance surplus returns with more risky investment strategies designed to outperform liabilities. Exhibit 2A plots four alternative benchmark portfolios with surplus return volatility ranging from 5-20% and pre-tax returns from 7-12%. The asset index weights associated with these four alternative customized benchmarks are shown in Exhibit 2B. Ultimately, the benchmark choice is a management decision that is influenced by factors such as the company's target financial strength rating.

Exhibit 3A
Return on Economic Surplus Frontier (with downside risk constraint)



Source: Barclays Capital, Western Asset

Exhibit 3B
Frontier Asset Mix (with downside risk constraint)



Source: Barclays Capital, Western Asset

Downside Risk and Stress Testing

Mean/variance asset allocation models, like the one used in our illustration, are convenient and relatively simple to use. However, an underlying assumption is that fixed-income returns are normally distributed, which is not the case. Spread assets have asymmetric downside risk. Stress tests can supplement mean/variance models by showing how mean/variance optimized portfolios performed in stressful historical periods. This sheds light on the downside tail risk that is not evident with normal distributions.

The financial crisis that began in 2007 has been an extraordinary period of market stress. A severe stress test constraint uses the annualized benchmark returns from July 1, 2007 to October 31, 2008 for each asset class. The constraint limits the 1-year return on surplus to negative 50% during this period. All benchmark portfolios created in the earlier analysis, other than the liability replicating portfolio, fail to satisfy this constraint. The constraint moves the efficient frontier and associated asset class mixes to a significantly lower risk and return profile, as shown in Exhibits 3A and 3B.

Exhibit 3A shows that no portfolio with surplus return volatility greater than 11% will satisfy the negative 50% return constraint. Portfolios with 5% and 10% return volatility produce expected returns 1% and 2% lower than the unconstrained example. As illustrated in Exhibit 3B, the downside constraint is met only with a Treasury/agency weight of nearly 50%. The stress test results highlight the importance of evaluating the cost/benefit trade-offs of severe downside protection, including implications for insurance product pricing.

An alternative approach to incorporating downside risk changes the objective function's definition of risk from return volatility to a measure that focuses on downside return outcomes. Downside risk definitions include:

- *The probability that return falls below a specified minimum.*
- *The expected loss when return falls below a specified minimum.*

In a downside risk optimization, the model's objective function maximizes expected returns for various levels of downside risk.

Using Customized Benchmarks

A customized benchmark is an important reference point for investment guidelines, risk management and investment strategy communication.

Setting Active Risk Limits

Customized benchmarks are passive portfolios that fit a company's liabilities and management objectives. Once a benchmark is established, asset managers use it as a point of reference. In particular, when market conditions change, managers adjust portfolio risk exposures relative to the benchmark. Changes in relative values offered in the market typically translate into new

exposures to rates, sectors or issuers. The benchmark and risk budget drive the size of these exposures.

Investment guidelines should specify benchmark relative limits on exposure to non-diversifiable risk factors (e.g. interest rates) and to diversifiable risk factors (e.g. exposure to individual issuers). Limits should include measures of sensitivity to individual risk factors as well as overall portfolio risk. Examples of relevant risk measures include:

- *Duration*
- *Convexity*
- *Tracking error*
- *Sector exposure*
- *Issuer exposure*
- *Average quality*
- *Spread duration*
- *Value-at-risk*

Scenario analysis measures the implications of active risk limits using either historical or forward-looking assumptions.

Communication Benefits

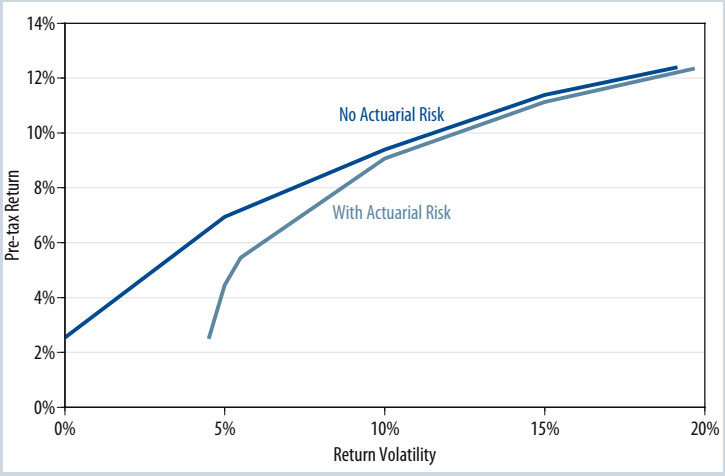
A well-constructed benchmark facilitates communication between insurance company management and the asset management team. Portfolio positioning relative to the benchmark reflects an asset manager's views about risk/reward opportunities in the market, and provides a starting point for more detailed discussion about portfolio strategy and risk factor exposures.

Portfolio performance is evaluated relative to the benchmark, and excess returns are attributed to active positions taken by the manager. Effective and proactive communication about the size and rationale for active risk exposures should lead to actual performance results that are well understood by both asset managers and insurance company management.

Other Issues and Considerations

Benchmark construction and portfolio management should consider a range of other important issues. The following paragraphs touch briefly on some of these.

Exhibit 4
Return on Economic Surplus Frontier



Source: Barclays Capital, Western Asset

Actuarial Risk

The benchmark analysis assumed that insurance liability cash flows were well defined. Clearly, many insurance products contain significant amounts of actuarial risk (i.e. variation in cash flows that is random and not related to events in the economy or markets). To the extent that this risk is uncorrelated with market factors and can not be hedged at a reasonable cost, the efficient frontier risk/reward menu may change significantly.

The efficient frontier from our original optimization, which included no actuarial risk, is shown in the dark blue line in Exhibit 4. The light blue line introduces 50 basis points (bps) of uncorrelated actuarial risk to insurance liability cash flows. The result is residual risk of 4.5% on surplus returns for the lowest risk portfolio. Uncorrelated actuarial risk limits how much risk can be hedged and introduces a steeper return/risk tradeoff, particularly at lower risk levels. Moving from the lowest risk portfolio's

4.5% return volatility to 5% produces an expected return pick-up of 2%. The information ratio for this move is four times; or, 200 bps of extra return for 50 bps of extra risk.

Some insurance products have payouts that are driven by events in the economy and markets. For example, a poor economy may reduce the amount of driving done by a property/casualty company's auto insurance customers, reducing claims and providing a benefit that offsets wider asset spreads. Long-term care policies offered by life insurance companies will often have payouts that vary with inflation. These relationships are important considerations for the benchmark and portfolio strategy.

Embedded Options

Certain insurance products (e.g. single premium deferred annuities) and investment asset classes (e.g. mortgage-backed securities) have significant embedded, path-dependent options. The benchmark analysis ignored these. Valuing these options and their factor exposures requires more sophisticated modeling techniques, but they are an important consideration.

Taxes

The benchmark analysis optimized pre-tax total return on surplus. Benchmark construction must also consider a company's ability to utilize tax-favored investments and the asymmetry in costs and benefits of erring on one side or the other of the optimal allocation to these instruments.

Risk-Based Capital

The benchmark analysis assumed that a company holds the same level of equity capital, regardless of portfolio composition. In a full analysis, companies will adjust the cost of equity to reflect differences in the firm's risk profile. They will also consider regulatory and rating agency perspectives and the need to increase capital for riskier portfolios to maintain risk-based capital ratios and financial strength ratings. Changing capital requirements are modeled as a variable that reflects changes in portfolio quality.

Benchmark Rebalancing

Benchmarks need to be rebalanced periodically for a number of reasons, including the following:

- *Changes in a company's business mix can change expected liability cash flows.*
- *Changes in the composition of market indices can occur as new securities are issued and other securities are removed.*
- *Changes in profitability may call for more or less tax-advantaged investments.*
- *Management's objectives may be modified as conditions change in markets for investments or insurance.*

Other Constraints

Management, rating agencies and regulators have concerns that may impose other constraints on the benchmark portfolio. Examples include liquid asset levels, average credit quality, yield objectives, asset allocation differences from peer group companies and accounting issues.

Summary

Well-constructed benchmarks are an essential part of the foundation for managing assets and creating value for insurance companies. They reflect a company's liability profile and risk preferences. Combined with active risk limits, these benchmarks are used to define the boundaries within which an asset manager can generate returns. As passive portfolios, they illustrate a manager's active risk exposures and identify the level and sources of excess return.

Benchmark construction is influenced by a wide range of factors. These include asset, liability, regulatory and tax considerations. The careful construction and use of a liability driven benchmark has several benefits. It facilitates substantive communication between a company's

management and their portfolio managers, and guides portfolio strategies to optimize shareholders' risk-adjusted return profile.

References

"*Quantitative Analysis of Fixed Income Portfolios Relative to Indices*," in **Handbook of Portfolio Management** (Frank Fabozzi), 1998.

Quantitative Management of Bond Portfolios, Lehman Brothers, 2001

Engineering LDI: Circumspect Pension Planning, Western Asset, 2008

Footnotes

1. It is assumed that the replicating portfolio has the same cash flows, market value and factor sensitivities as the liabilities. Other possible yield curves for constructing a replicating portfolio include a financial or insurance company sub-index with the company's credit rating, the company's outstanding debt and the yield curve implied by the company's currently offered insurance products.
2. The asset- to-surplus ratio is 10 in our example. As of December 31, 2007, the ratio of financial assets to surplus was equal to 18 for the life insurance industry (source: ACLI tabulations of NAIC data), and 2.6 for the property/casualty industry (source: Insurance Services Office Limited).
3. Asset classes are limited for simplicity. In practice, a wide range of fixed-income, equity and alternative asset class indices can be used.
4. The objective function optimizes excess return over matched-duration Treasuries. This isolates returns from spread duration, separating them from (Treasury) interest rate returns. The example constrains surplus duration to a maximum of 0.25 years, which ensures that the dollar duration of assets and liabilities are closely matched. However, term structure mismatches are possible.
5. It is assumed that cash is the "risk-free" asset for shareholder surplus. Return volatility is defined relative to the risk-free asset.