Perspective: Global Assets in a Liability-Driven Investing Platform

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Editor's note: This is the second of three companion articles describing how institutional investors are moving beyond traditional equity and fixed income by implementing marketable real asset strategies into a liability-driven investing program.

Traditional Asset Management before Liability-Driven Investing

Traditional approaches to investment performance emphasize diversification and risk-return tradeoffs. Nobel Memorial Prize winners Harry Markowitz and William Sharpe provided much of the theoretical work behind modern portfolio theory. Markowitz (1959) demonstrated the logic of diversification by combining individual securities into a portfolio. The risk of the portfolio is less than the weighted average of the risks of individual securities as long as securities are not perfectly positively correlated. The Markowitz efficient portfolio algorithm allows practitioners to construct the lowest-risk portfolio for a given level of return. The Markowitz algorithm works because risk cancellation occurs when the interactions of all individual securities are taken into account. Performance benchmarks based on the difference between actual returns and expected returns (alpha), sensitivity of assets to equity market movements (beta), and returns relative to portfolio volatility (Sharpe ratio) emerged as common metrics for measuring both manager and overall plan performance (Sharpe 1964, 1966).

"The Markowitz algorithm works because risk cancellation occurs when the interactions of all individual securities are taken into account."

Using the traditional approach, pension plan sponsors tended to focus on asset performance in search of returns to fund pension liabilities. Managers were evaluated in terms of their alphas and betas to calibrate performance, often without considering interactions of manager holdings in the plan. Over the past decade the traditional approach hit a wall with respect to pension fund management. Actuarial target returns to fund plan liabilities exceeded what the markets provided from investments in stocks and bonds. At the same time lower interest rates (discount rates) made the present value of fund liabilities higher. Two themes developed in plan management. First, plan sponsors began to look more carefully at the role liabilities play in the overall management of the plan. Second, a wider array of securities beyond stocks and bonds was considered. Alternative assets in combination with traditional investments gained more attention as a vehicle for plan management.

Emergence of Liability-Driven Investing Platforms for Pension Plans

Current practices in pension fund management recognize the many different moving parts at work in a pension plan. The funding status of a plan is sensitive to movement of assets, movement of liabilities, and the interaction of assets and liabilities. A range of risk drivers, often called factors, is responsible for the movements of individual securities, asset classes, and ultimately the final portfolio. A given factor affects more than one asset class at a time. For example, changes in risk tolerance affect equity and bond pricing with higher or lower impacts on different individual securities. The important risk is the "surplus volatility" measured from the interaction of all assets *and* liabilities in the fund.

A liability-driven investing (LDI) approach focuses on managing plan assets in a way that best meets the present and future values of liabilities. From a portfolio perspective, we can think of the plan's funding status, which is a residual of all asset and liability interactions, as the relevant "portfolio" to be managed. The funding status may be defined as follows:

Market Value of Plan Assets – Present Value of Plan Liabilities = Funding Status

The goal is to improve the funding status by managing the risk and return of the net asset and liability portfolio. The LDI approach identifies the common risk factors that drive the surplus volatility of the plan and works toward reducing this total risk while gaining returns. For example, risk factors for a given portfolio might include equity risk, interest-rate risk, credit-risk spread, inflation risk,

yield curve slope risk, and a range of factors affecting security performance. Stephen Ross's (1976) arbitrage pricing theory (APT) provides the theoretical background on risk factors. Risk factors can first be viewed in terms of asset classes, but asset groupings are not very useful in an LDI framework. Asset classes are too broad and risk factors cut across asset classes. Furthermore, many risk factors affecting assets also affect liabilities, making it important to evaluate the surplus volatility from all net interactions.

To illustrate the basic mechanics of an LDI plan we offer a simple example. The data come from a set of securities held by actual managers for a given market period. We use algorithms from our LDI program to generate the results. To simplify and focus on key issues we make the following assumptions:

- The equity market volatility is 15 percent
- Asset mix: 67 percent equities; 33 percent fixed income
- Funding ratio = 54 percent
- Market value of assets = $540 million
- Present value of liabilities = $1 billion
- Credit spreads have a 35 percent correlation with equities; all other covariances are zero
- Duration of liabilities = 11.4 years = 11.4 percent (increase) decrease in liabilities per 1 percent (decrease) increase in interest rates
- No consideration of actuarial risk

Before the results of the LDI example are presented, it is worth noting a few points about the LDI relationships. Without specific attention to the interest-rate exposure mismatch in assets and liabilities, the plan will lose ground in a falling interest-rate environment. Even if the interest sensitivity of all assets is matched to the interest sensitivity of the liabilities, declining interest rates would make the funding ratio lower because the plan is underfunded, everything else equal. To make matters worse, the duration of the liabilities (percentage change in the value of the liabilities given a 1-percent change in market interest rates) is normally much longer than the duration of a typical plan's interest-sensitive assets. This common situation places increased pressure on the performance of other types of investments in the plan.

The first portfolio (circle) on the left in figure 1 represents the basic asset allocation of $540 million. Within the asset classes are holdings of specific securities. When we break down the risk factors driving the assets of the plan we find that 98.5 percent of the volatility in the asset portfolio is due to equity market risk (beta) even though equities are only 67 percent of assets. This outcome occurs because equities are much more volatile than fixed income, resulting in a higher contribution to asset volatility. This outcome also could occur when fixed-income securities are correlated with the equity risk factor. When we look at the asset portfolio as a whole (second portfolio down on the left) we find total volatility of 10.25 percent.

The first portfolio on the right side in figure 1 represents the liability structure of the plan. The projected cash payouts of the plan are discounted back to present value to find the $1-billion liability. The duration is 11.4 years, which is not unusual for a plan. The two dominant risk factors driving the present value of the liabilities are interest-rate risk and credit-risk spread. Lower interest rates make the present value of liabilities higher, because the discount rate is an important factor in the present value of outflows calculation. A credit-risk spread also plays a role because the credit quality of the discount rate is not risk free. In the second portfolio on the right in figure 1 the risk factors of the liabilities are presented. The credit-risk spread factor becomes a bigger component when credit spreads are wide and general interest rates are low. Therefore it is also necessary to track the volatility of overall interest rates relative to credit spreads to help structure a hedge. In our simple example, the volatility of liabilities is 10.83 percent.

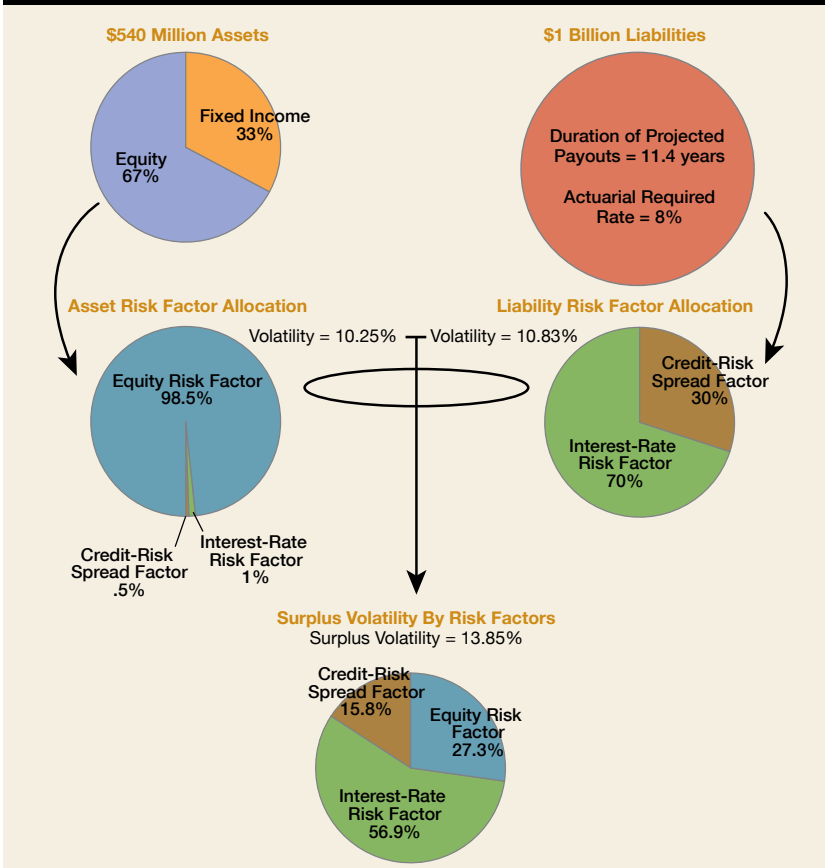
Surplus risk is not just the simple netting of the volatilities of assets and liabilities. Just like traditional Markowitz portfolio theory, the portfolio of assets and liabilities involves interactions of risk factors but there is little risk cancellation in this case. The funding ratio is also important because the risks in the liabilities play a larger role in an unfunded status. In our example, interest-rate risk is the dominant risk and the plan is underfunded, a common situation. This combination of underfunding and investments in securities that fall in value when interest rates fall make the plan performance riskier. In our example, the surplus volatility is 13.85 percent, which is higher than either the asset volatility or liability volatility.

The example suggests that low surplus volatility and an increase in the funding ratio are two important indicators of how well a plan is managed. The process is best implemented with an iterative process where changes in assets, managers, and manager weights are reviewed to find the best asset portfolio for a given liability structure. In many cases, the dominance of interest-rate exposure, especially in underfunded plans, must be managed.

A number of general insights can be gained from figure 1. Many of these insights open the door to more-aggressive use of alternative assets. Even without more detail in the example of the LDI format we can conclude:

- The emphasis is on total returns. The goal is to achieve a better funding ratio while managing surplus volatility. Alphas and surplus volatility are relevant but beta risk is not a relevant, consideration in this context.
- The emphasis should be on consistent returns with low surplus volatility. Long-run returns with high short-term volatility result in short-run contributions to the plan that are not recoverable later when the return performance recovers. The implication is that short-term shifts in volatility must be managed.

FIGURE 1: LIABILITY-DRIVEN INVESTMENT PLATFORM SCHEMATIC



- Plan assets must include a wider array of securities to offset the recent (and expected) modest performance of stocks and bonds. Plan returns and volatility from stock and bond contributions are not sufficient to improve funding ratios.
- Underfunded plans are not able to simply match interest-rate exposure of liabilities to interest-rate exposure of assets.
- Flexibility is required to adjust to short-term movements in security returns and changes in short-term correlations between securities.
- The gap in interest-rate risk between assets and liabilities is often difficult to address within the investment structure of the LDI. An overlay of interest-sensitive derivatives (for example, interest-rate swaps) may be needed for underfunded plans to balance the return objective with risk mitigation.

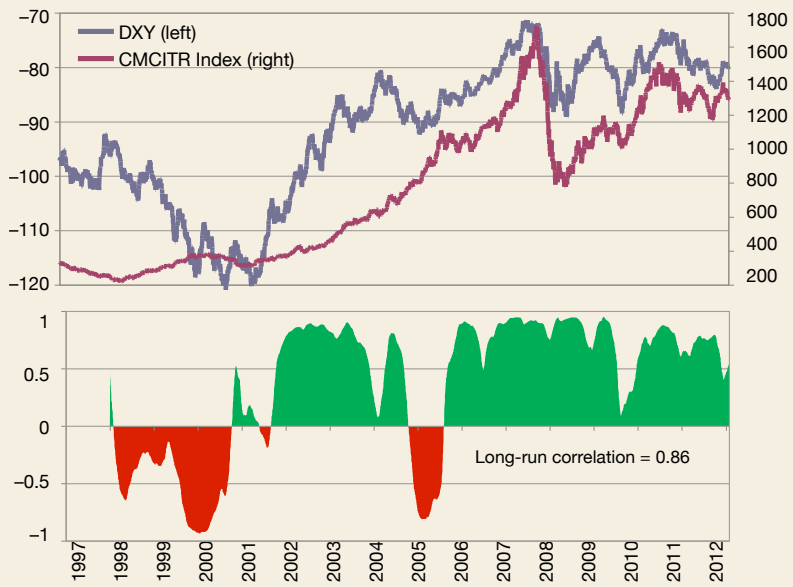
Global Real Assets in the LDI Platform

The tangible properties of a real asset allow its price to fluctuate with overall market prices of physical assets. Real assets tend to be sensitive to inflation because of their tangible nature. Examples of real assets include direct investment in real estate, commodities, precious metals, timber, energy, farmland, commodity-linked stocks, and commodity-linked hedge funds. Most investors are more familiar with investments in financial assets, which are contractual claims that generally do not have physical worth. In an LDI platform, real assets provide potential reductions in surplus volatility to the extent that real asset movements are not highly correlated to movements of financial assets. Inflation plays a role because real assets generally appreciate with inflation while inflation directly drives interest rates higher and financial assets lower. Returns from real assets also may boost returns, because real assets may not be as efficiently priced as the more competitively priced stocks and bonds. The return potential for real assets has become especially attractive in recent years since stocks and bonds have not performed well.

From a risk-management perspective, a key benefit from expanding asset classes to include real assets rests on correlations. A group of assets that have high correlations with each other but have low correlations with other groups of assets represent an asset class. There tends to be much less diversification potential from combining assets within an asset class than from combining assets from different asset classes. Real assets represent such a broad asset class that a wide range of correlations exists both within the asset class and with assets from other asset classes, allowing for attractive diversification.

We find that the best long-run performance comes from avoiding the large losses that markets often impose on passive investment portfolios. This tends to be especially important for real assets. As a first step we look behind the market consensus and identify where herding and overreaction phenomena may be at work. These phenomena occur both within and across asset classes. We perform extensive modeling with sensitivity analysis to find our best risk-management strategy for the LDI structure, which often leads to an analysis of derivative applications. From there we model our best set of active asset managers within an asset class and simulate the surplus volatility and return. This is not just simple quantitative analysis because we also must build in forward-looking scenario planning. We track actual LDI performance against expected LDI performance. This type of tracking is revealing in that we

FIGURE 2: GLOBAL COMMODITIES VS. INVERSE PURCHASING POWER OF A DOLLAR



Source: 2012 Bloomberg Financial L.P.

can review what we were expecting when the allocations were set and identify where things developed differently. This type of learning over many years of experience is very helpful in building a dynamic LDI program.

As opposed to a passive LDI program in which a static allocation to bonds or interest-rate derivatives is maintained to achieve a target hedge percentage, a dynamic approach varies the size and composition of hedge assets in response to economic and market factors in an effort to improve outcomes. For example, with respect to the composition of assets, when credit spreads are wide and the contribution to volatility from credit factors is high, more credit-sensitive assets may be warranted. Conversely, when credit spreads are tight, better and more-efficient outcomes may be achieved by decreasing the allocation to credit-sensitive assets. Since credit sensitivity can be modulated through a variety of potential assets, including risk assets such as equities, the dynamic approach to managing liability risk should be incorporated into the plan's asset allocation framework.

Flexibility and dynamic asset allocation are important features of our LDI models, especially with respect to the use of real assets. More passive allocation strategies and infrequent attention to plan performance tend to rest on long-run correlations. But, correlations are not stable in the short run and surplus volatility must be actively managed with prompt and pre-planned responses. For example, in figure 2 we plot a global commodities index (maroon line) against the inverse purchasing value of the dollar (blue line index falls when the dollar rises). The relationship illustrates how a real asset (commodities) tends to be correlated with inflation (inverse of the value of a dollar). The correlation is 0.86 in the long run, suggesting some diversification potential from using real assets to reduce inflation factor risk. The bottom frame of figure 2 demonstrates the instability in the correlation with significant short-run periods where the correlation is positive (green shaded area) and some periods where the correlation is negative (red shaded area). The point is that flexibility and dynamic hedging is required to keep surplus volatility in check, because short-run correlations between assets deviate significantly from long-run movements. We address this issue with forward-looking scenarios linked to simulations. Added flexibility with shorter response time is allowed in our firm's "manager of managers" structure.

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