TEN RISK MANAGEMENT LESSONS FROM PENSION LIABILITY ALLOCATION™

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Defined benefit plan sponsors have long accepted the risk / reward tradeoff in favor of expected higher returns of public equities relative to the lower volatility of fixed income securities. The majority of pension plan assets remain invested in equity and equity-like classes, as evidenced by the still ubiquitous "60/40" stock/bond strategic asset allocation. According to the 2006 Pension and Investments survey, the largest 200 defined pension plans allocate 62.6% of their assets on average to domestic and international equities (Pension & Investments, 2006). The average for the largest 1,000 plans is insignificantly lower at 62.1%.

The reward aspect of the tradeoff is relatively straightforward to quantify: the forward-looking "equity risk premium" is calculated as the excess of expected equity returns over that of fixed income. While considerable debate might arise regarding the magnitude of the equity premium, most plan sponsors believe that the equity risk premium is positive.

The risk aspect of the tradeoff is far more difficult to quantify. While most plan sponsors have the intuitive notion of greater risk due to higher volatility of portfolio returns, few have any quantified estimates of pension risk. The standard deviation of portfolio return continues to be a common risk measure, but remains detached from the ultimate concern, the pension liability.

Plan sponsors are very much aware that pension liabilities may be hedged over the short-term by appropriately selected fixed income investments. The allocation of assets to equities should be viewed as the plan sponsor's (hopefully) conscious decision to accept a level of asset / liability mismatch in exchange for the anticipated positive return premium. However, while the pension asset / liability mismatch risk from equities is widely comprehended, the understanding remains on an intuitive level, rather than a tangible, quantifiable measure.

This paper introduces the concept of *pension liability allocation*, and its potential use as a convenient, concise and effective measure of pension risk. Moreover, pension liability allocation can serve as a framework for reviewing current investment policy as well as investigating the impact of interest rate swaps, derivative overlays and other liability-driven offerings available in the market.

Pension liability allocation is fully discussed in two white papers available at pi2resource.com: "Pension Liability Allocation 1: Quantifying Asset / Liability Mismatch Risk" and "Pension Liability Allocation 2: Implementing Liability Driven Investing". This article summarizes the two papers in the form of pension risk management lessons from which plan sponsors can benefit.

1. Know your plan's Pension Liability Allocation

Pension liability allocation may be readily grasped by contrasting it with the widely understood asset allocation definition. It is well known that a "60 / 40" asset allocation means that the plan is invested such that 60% of its assets is in equity securities and the remaining 40% is in fixed income. When a pension plan is said to have a 60 / 40 liability allocation, the plan is invested such that 60% *of its liabilitie*s are matched by hedging assets, while the remaining 40% *of liabilities* are unmatched.

Thus, a pension plan's liability allocation takes into account its investment policy (including any interest rate swaps, derivatives and other investment overlays) as it relates to the extent assets match (or do not match) the plan's specific liabilities. The pension liability allocation is then the ratio of the plan's hedged liabilities to unhedged liabilities. A 100 / 0 pension liability allocation indicates that 100% of plan liabilities are hedged with matching fixed income securities such that there is zero risk.

A convenient feature of the liability allocation definition is that the sum of the hedged and unhedged factors sum up to the plan's funded ratio. While the prior example of liability allocation totaled to unity, it will be more common for the factors *not* to add up to one; the factors will sum up to one only when assets equal liabilities exactly. Thus, a 30 / 60 liability allocation denotes an investment policy resulting in 30% of the plan's liabilities being hedged, 60% unhedged and 10% unfunded.

2. Asset allocation isn't such a hot risk indicator.

Given only that two plans have the same 60 / 40 asset allocation, one cannot compare the level of pension risk faced by the two plan sponsors. From an asset perspective, there are an infinite number of ways to implement 60% in equities and 40% in fixed income. However, even if the two plans held the same exact securities, one cannot conclude that pension risk between the two plans are equal. This should be expected since asset allocation only deals with half of the pension equation and disregards differences in: (1) the starting pension surplus or deficit, and (2) the nature of the pension liability in terms of its sensitivity to interest rate changes.

On the other hand, pension liability allocation is not burdened by such shortcomings; the measure is able to effectively reflect risk arising from differences between plans' asset allocations, liability structures and starting funded positions.

3. Evaluate alternative investment policies and overlays using pension liability allocation.

Pension liability allocation provides a convenient, concise metric for evaluating changes to current investment policy. For example, an alternative investment policy calculated to have an 80 / 20 liability allocation will have half the surplus return volatility relative to the plan's current 60 / 40 liability allocation (i.e., 20% unhedged liability is half that of the current policy's 40%). By referring to the before and after pension liability allocation for any investment change, the plan sponsor can quickly gauge the consequent increase or decrease in pension risk relative to current policy.

4. Go long! Reduce pension risk from asset/liability duration mismatch from shorter-duration fixed income assets.

Pension liability allocation readily measures asset/liability mismatch risk caused by durational differences between assets and liabilities. Bond allocations have traditionally defaulted to a Lehman Brothers' Aggregate Index implementation, the duration of which has been consistently under five years over recent history. This is much shorter than the typical pension plan's liability duration (15.8 years for the plan in the case study below). Although strong arguments favoring longer duration bond exposures for pension plans' fixed income portfolios have become more common, there has been no effective means of quantifying the risk reduction benefits of doing so.

The case study in the first paper evaluated a sample frozen pension plan that was 80% funded; it considered several 100% bond portfolios to illustrate the full impact of the asset / liability duration mismatch. To the extent that actual allocations to fixed income are only around 40% in typical pension portfolios, the potential for risk reduction from the appropriate bond implementation is less, but still significant. The first portfolio considered in the case study was a typical US Core Fixed Income implementation using the Lehman Aggregate Index as a benchmark. As such, the calculated liability allocation was only 50 / 30 (i.e. only 50% out of a maximum 80% of liabilities were hedged). The second portfolio implements a longer bond portfolio using the Lehman Long Government Corporate Index as its benchmark with a duration of around 11 years, closer but still shorter than the liability duration. Shifting assets to the longer duration bond class extends hedged liabilities to nearly 60% with a 59 / 21 liability allocation.

5. Go longer … longest! With limited allocations to fixed income, invest beyond the liability duration.

The case study proceeded with three 100% customized bond portfolios involving the matching of varying 80% segments of pension liability cash flows (the plan was only 80% funded). The shortest cash-matched portfolio hedges the liability flows that come soonest, while the long cash-matched portfolio hedges flows that are farthest out. Finally, the equal percentage cash-matched portfolio hedges 80% of the liability cash flow in every year.

The use of customized bond portfolios permits higher levels of matched liabilities for a given level of assets. However with funds sufficient to hedge only a portion of total liabilities, there remains a question on which liabilities to match. Calculating the pension liability allocation of each implementation provides the answer. The long cash-matched portfolio with duration 18.9 years generates the least risky liability allocation of 80 / 0. The short cash-matched portfolio with duration 12.2 years only generates a liability allocation of 68 /12. Not surprisingly, the equal percentage cash-matched portfolio produced an intermediate 75 / 5 liability allocation.

6. Ouch!!! Equities mess up liability allocations big time!

A second case study using the same plan performed a similar analysis on quantifying asset / liability mismatch risk, this time focusing on the mismatch arising from using equity investments to defease pension obligations. The study looked at six portfolios. The first portfolio is 100% invested in a Long Government / Corporate bond benchmark mix and the subsequent portfolios have equity investments incrementing by 20% each step. The last portfolio is 100% equities.

Pension liability allocation calculations reveal the changes to the plan's surplus volatility as equities are introduced. As shown in Section 5 above, the hedged factor for the 100% Long Government / Corporate portfolio is nearly 60%. The analysis showed that each 20% equity increment increases the unhedged factor by 10 to 12 percentage points. Interestingly, the (excess) surplus volatility has doubled at 40% equity relative to that of the 100% long bond portfolio (i.e., unhedged factor of 42% in the 38 / 42 liability allocation of the 40% equity portfolio is twice that of the 59 / 21 liability allocation of the 100% long bond portfolio). The traditional 60 / 40 portfolio has two-and-a-half times the surplus volatility of the all-bond portfolio. At 80% equity, the volatility has tripled, with the unhedged factor at 66%.

7. Don't put the cart before the horse… validate / revise investment policy from a liability-perspective.

Traditional asset allocation approach involves the assignment of pension dollars to asset classes, both equities and fixed income. Candidate portfolios are constructed by varying percentages allocated to equities and fixed income, with allocations to a pre-selected subset of asset classes. After a reasonable number of alternative asset portfolios are selected for evaluation, various metrics are calculated for comparison and one portfolio is selected as the revised (or validated) investment policy. Clearly, considerations involving liabilities or liability-matching are considered only after the actual construction of the portfolios.

On the other hand, the liability allocation approach first assigns pension dollars to pension liabilities; consequently, asset securities are selected to hedge (or "unhedged") specific pension liabilities. For example, if a plan sponsor decides on a target 60 / 30 pension liability allocation, the policy requires asset instruments which result in 60% of its liabilities being hedged, 30% unhedged and the remaining 10% unfunded. Clearly, specific plan liabilities are immediately considered in creating this.

It is the new framework's conscious attention to plan liabilities in the target portfolio construction stage that distinguishes it from the current asset allocation process. The traditional process, in some respect, suffers from the proverbial adage of "putting the cart before the horse"'; liability concerns are only considered after the portfolios have been constructed and selected. The pension liability allocation framework, on the other hand, initiates target portfolio construction with liabilities front and center. While asset allocation varies equity / fixed income weights for target portfolios, liability allocation varies hedged / unhedged ratios.

8. Explore the full risk spectrum using the pension liability allocation efficient frontier when validating / revising current investment policy.

In validating or revising the current investment policy, the prudent plan sponsor should explore the entire spectrum of risk choices. Investigating alternative policies in the pension liability allocation efficient frontier from fully hedged (100 / 0 liability allocation) to fully unhedged (0 / 100 liability allocation) ensures that the plan sponsor is made aware of all available strategies. By including a range of hedging policies, the pension liability allocation efficient frontier is forced to include customized bond portfolios and interest-rate overlays as potential strategies to satisfy such high-hedged targets (and which otherwise would have been excluded under traditional asset efficient frontier approach).

The decision where to locate within this risk spectrum will ultimately depend on each plan sponsor's perception of the selected policy's cost relative to benefits. From a fiduciary perspective, the plan sponsor can be reassured that the full range of investment policy choices was at least considered and evaluated.

9. What liabilities? Ensure that the liabilities being hedged are the ones you care about.

Implicit in all the discussion here is the assumption of one well-defined pension liability that is "hedge-able". However, in practice, there is a multitude of liability definitions that vary both in assumptions used to generate cash flows as well as in the discounting algorithm. For the typical plan sponsor, critical liabilities generally involve funding and accounting concerns. Moreover, some liability definitions are difficult if not impossible to hedge due to discount rate smoothing.

Only one set of liabilities may be fully hedged given one set of assets. Ideally, the liability hedged by the assets would be the same exact definition applicable to the plan sponsor's funding and accounting policies. While accounting liabilities are market-based and permit hedging strategies, there is no guarantee that the calculated accounting liabilities would be equal to or greater than funding liabilities. A more conservative, higher quality yield curve choice for discounting may provide for a feasible liability that would suffice for both concerns; it would also provide a single "hedge-able" liability target for a comprehensive investment strategy encompassing both funding and accounting objectives.

10. Have your left hand talk to your right hand; have your investment manager(s) talk to your actuary.

In setting and implementing a liability-driven investment policy involving full or partial hedging of pension liabilities, it is critical that the assets intended for hedging be consistent with the liability valuation methodology. Fixed income securities valued off a yield curve different from the discount curve used by the actuary will likely result in asset / liability mismatches. Moreover, particular attention should be given to how cash flows beyond 30 years are discounted, recalling that the longest liabilities carry the largest interest rate risk; actuaries tend to use the 30-year rate to discount all later cash flows which may present hedging complexities. Clearly, closer interaction between investment managers and actuaries will be a prerequisite for any successful liability-driven investment implementation. Both parties will face a challenge to do so, given the current industry practice of minimal interaction between the actuary and the investment manager(s).

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About Pension, Investment and Insurance Resource, L.L.C.

Pension, Investment and Insurance Resource, L.L.C. (Pi2Resource) specializes in asset / liability management, risk budgeting and pension liability allocation. Pi2Resource provides risk/return modeling, benchmarking, investment policy setting and implementation services for pension funds, insurance pools, endowments / foundations and other investment funds.

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