

LIABILITY AWARE INVESTING FOR DEFINED BENEFIT PENSION FUNDS

There is an increasing prevalence of investment mandate offerings for pension funds that are “liability aware.” The popularity of these types of mandates is mainly due to the increasing attention to the economic risks of defined benefit pension plans. In this paper, we outline the benefits of liability aware investing while highlighting its limitations. We also provide a framework for plan sponsors to evaluate various approaches for implementing these types of mandates. While the latest trends in liability aware investing have been focused on addressing the sensitivity of the plan’s liability to interest rate changes, we favor an integrated approach that takes into account the impact of other risks in the pension plan. In particular, the benefits and risks from equity investments should be integral in the evaluation of liability aware investing mandates.

This research paper evaluates the strategies and implementation issues involved in liability aware investing (LAI) mandates. There is a wide range of approaches used by different LAI managers. However, the most common theme in all LAI mandates is the attempt to reduce a significant portion of the economic risks of a defined benefit plan. In particular, the risk of significant changes in interest rates used to discount pension liabilities is addressed by LAI mandates. It is important to recognize that reference to LAI does not mean a necessity to increase the bond allocation in order to reduce the interest rate risk for the pension plan liabilities. Our reference to LAI includes a better understanding of the implications of maintaining equity risk for the pension plan. In fact, we advocate an evaluation of the equity allocation target before considering implementation of a particular LAI mandate. The two major investment policy decisions for pension plans are: (1) How much is the appropriate allocation split between “risky” assets

(i.e., U.S. stocks, non-U.S. stocks, private equity, real estate) vs. “non-risky” assets (i.e., fixed income)?; and (2) What is the appropriate structure for the “risky” and “non-risky” assets? We elaborate later in this paper that the allocation to equity assets has a major impact on the structure of the fixed income portfolio, particularly in the target for hedging the interest rate risk.

The concept of “liability aware investing” is associated with “liability driven investing,” which has become a common catch-phrase to address plan sponsor’s concern in the risks from the plan’s liabilities. For the purposes of the discussion in this paper, we distinguish that LAI refers to a broader approach where the investment decisions are made, while being “aware” of the liabilities of the pension plan. Although LDI might be interpreted to have the same intention, we prefer to use LAI since LDI might have the connotation that the pension liability totally “drives” the investment decisions, which might force the policy to be solely invested in bonds in order to immunize interest rate risks.

The use of an LAI strategy pre-supposes that the focus is on the asset growth relative to liability growth, as opposed to the more traditional focus on absolute asset return. The ultimate goal is to have the assets grow at least as fast as the liabilities, with minimal volatility on the difference of asset and liability growth. The terminology “surplus return” captures this concept. Surplus return is defined as the excess return on assets over liability growth. The “liability growth or return” measure for this purpose does not include the natural increase in liabilities due to additional benefits being accrued each year. The “surplus risk” measure refers to the volatility (or standard deviation) of surplus return. The focus of an LAI

strategy is to minimize “surplus risk,” which can translate to a more stable funded status and contribution pattern for the pension plan.

It is worthwhile to clarify the definition of liability since it will affect the measures of surplus return and risk in the LAI framework. The major factor that drives the nature of the risk in liability growth or return is the interest rate used for discounting future benefit payments. If the liability is measured using expected or assumed return on assets for discounting future benefit payments, there is no inherent interest rate risk on the plan's liability. The liability would not change as a result of market fluctuations in yield rates (interest rates). For public funds, the convention is to report the plan's funded status using assumed return on assets as the discount rate. However, a public fund may still find an LAI mandate attractive if it is concerned with the “economic value” measure of the plan's liability. The “economic” valuation can be viewed as a way to focus on the fair value of the benefits promised to participants if all of the obligations have to be settled immediately.

Advantages/Merits of LAI approach

There are several merits for pursuing a liability aware investment mandate for a pension plan. The major advantages of LAI are:

Reduced interest rate risk. A pension plan's liability is calculated by discounting future expected benefit payments. The interest rate used for discounting is a key assumption that determines the value of a liability. If current bond yield rates (either government/treasury or high-quality corporate bonds) are used to discount future benefit payments, the liability calculated is more akin to an “economic value” or “market value” measure. In this case, any fluctuations on the bond yield rates can result in volatility of the liability value. The most common measure of interest rate risk is the “duration,” which is

basically the percentage change in liability value for every 100 basis point change in interest rates. An LAI mandate would typically reduce the interest rate risk by either completely or partially matching the liability duration.

Reduced volatility of funded status (on a market value basis). A reduction in volatility of a plan's funded status is a direct consequence from a reduction in interest rate risk.

Increased security of participant's benefits. An LAI mandate can be viewed as the most conservative investment approach for a pension plan because it attempts to be sensitive or aware of the timing of expected benefit payments for participants. Thus, an LAI approach can provide increased security of a plan's participant's benefits.

Disadvantages/Limitations of LAI

While there are clear advantages for pursuing LAI mandates, it is important to recognize the limitation of this approach. Recognition of these limitations can properly set more realistic expectations on the potential benefits of LAI mandates.

Interest rate hedging can not result in zero surplus risk. A zero surplus risk portfolio is impossible to achieve because there are other sources of “noise” that affect the liability changes. In particular, the projection of expected benefit payments is an estimate only. Every year, the actuarial valuation re-measures the best estimate for the benefit payments. Thus, even if an LAI portfolio is set-up to fully match the impact of interest rate changes on the liability, the surplus risk is not guaranteed to be zero because the demographic assumptions used to estimate the benefit payments would not be fully realized.

Implementation issues for LAI can be more complicated. A typical core bond portfolio is

usually easier to implement and understand for plan sponsors. An LAI approach can become more complicated to implement because the extension of duration might require the use of derivative products, such as futures or swaps. The available bonds with a longer duration are much more limited. These issues are further discussed in the implementation options for an LAI approach.

Peer comparison/Asset return comparison risks. Another major barrier for why pursuing an LAI mandate is not very attractive is because these types of portfolios usually imply that the asset return risk (i.e., standard deviation or volatility of asset return) would be higher in exchange for a lower surplus return risk. One way of viewing this is that the volatility of the liability return is high and the asset return is trying to match this higher volatility target in order to reduce the volatility of surplus return.

Most pension plans currently focus on asset return only performance. Thus, for pension plans

that usually compare their asset return performance to their peers, there is less incentive to go into an LAI approach. During periods of rising interest rates, an LAI approach will produce larger losses than a typical bond portfolio with a shorter duration. However, these larger losses from the LAI approach are accompanied by similar amounts of losses in the liabilities that the net result on the plan's funded status should be neutral.

The impact of increasing duration on the asset return risk for a typical pension plan is illustrated below. In particular, we are showing the impact of replacing a typical core bond portfolio (i.e., LB Aggregate Bond Index with 4.5 year duration) with a long bond mandate (i.e., LB Long Government/Credit Index with 11 year duration). The dots on the line represent different levels of equity versus bond allocations. The core bond portfolio is superior for optimizing asset returns but a long bond portfolio provides better optimization of surplus return.

Figure 1: Surplus Return Optimization

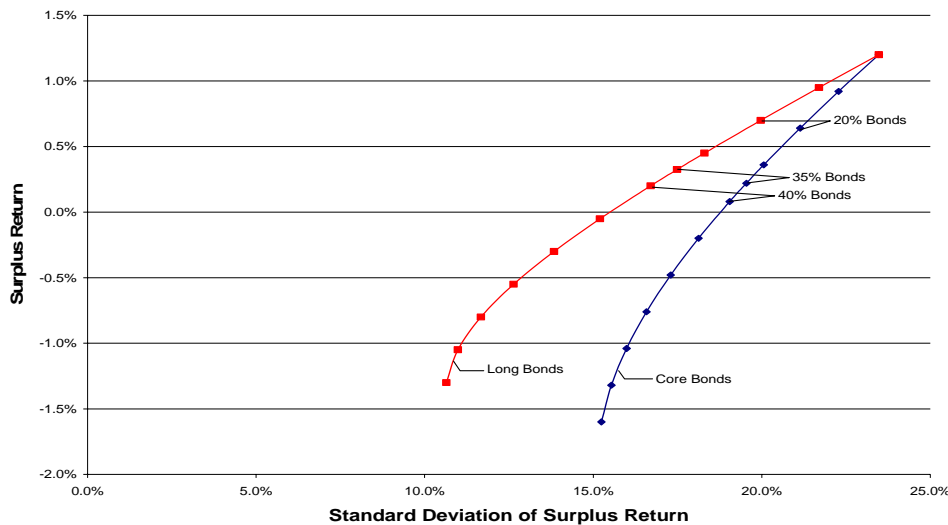
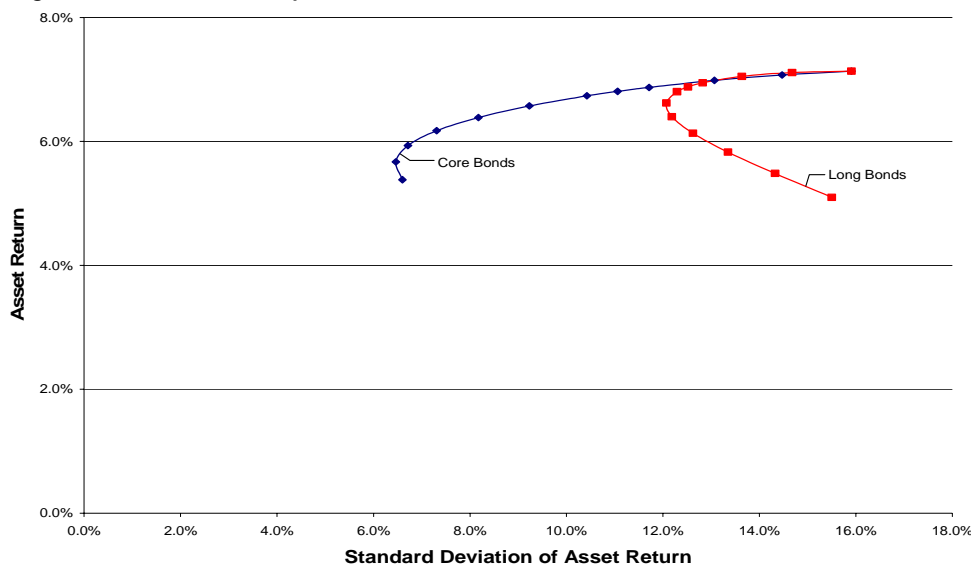


Figure 2: Asset Return Optimization



Factors to Consider When Investing in LAI (Long Bonds)

Given the benefits and limitations of LAI, the following discussion provides the factors to be considered when investing in liability-driven mandates.

Nature of pension plan’s liabilities. The characteristics of the pension plan’s liabilities should immediately be taken into account when considering LAI strategies. In this process, the role of the allocation to equities should be evaluated. In general, arguments that support maintaining an equity allocation for the pension plan might include:

1. An ongoing pension plan with new benefit accruals earned each year can benefit in the potential excess returns from equity over the long-term. The potential extra returns from equity can help reduce the cost of future benefit accruals.
2. Since a typical pension plan might be sensitive to inflation risk, equities can

provide real returns above inflation over the long-term.

3. If a pension plan has a deficit (i.e., liabilities exceed assets), the potential excess returns from equities can help reduce a funding gap.
4. If the pension plan has a long investment horizon, it may have the patience to withstand short-term volatility of equity returns in exchange for potentially long-term excess returns.

The reasonable level of equity allocation can vary depending on the following characteristics:

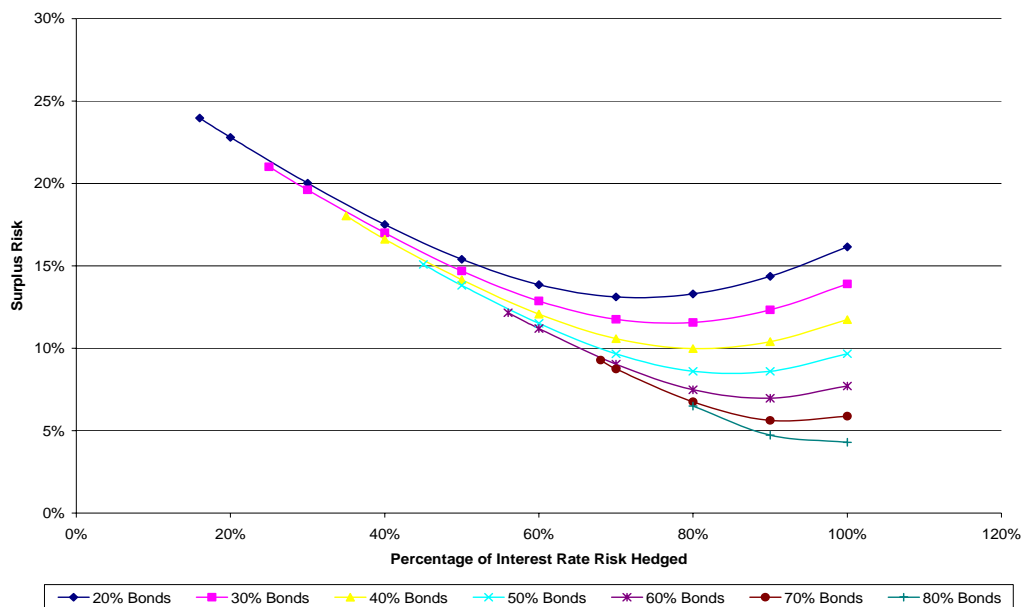
1. **Open vs. closed plans.** An open plan with new benefit accruals being earned would benefit more from an equity allocation compared to a closed plan without any new participants expected in the future. If a plan has frozen benefits, in addition to being closed to new participants, the potential benefits of excess returns from equity would be even less.

2. **Young vs. mature population.** A plan with younger participants might have a longer investment horizon.
3. **Contribution policy and funded status.** A plan that has a deficit or only contributes the required minimum may benefit more from potential excess returns from equity to help fund future obligations.
4. **Nature of benefits.** If the plan benefits are sensitive to inflation, the potential of equity to provide real returns over the long-term would be more beneficial.

After an appropriate equity allocation is determined for the pension plan, this equity allocation policy affects the level of what should be a reasonable target of interest rate risk to be hedged. For instance, if a significant equity allocation is acceptable (i.e., 80/20 percent equity/bond target), a significant portion of the surplus return risk is due to the equity return volatility. In this case, it is reasonable to hedge

only a small portion of the total interest rate risk of the liabilities. The graph below illustrates that at lower bond allocations, the improvement in surplus return volatility will not be significant even if the target for interest rate hedging is increased. In particular, it shows that at 20 percent bond allocation the surplus return volatility does not improve significantly, even if the target for interest rate hedging is increased beyond 60 percent. The surplus return volatility decreases from 15.4 to 13.9 percent if the interest rate hedging is increased from 50 to 60 percent. However, further increasing the interest rate hedging from 60 to 70 percent only lowers the surplus return volatility from 13.9 to 13.1 percent. The correlation of equity returns to bond returns is the main reason why the surplus volatility does not decrease significantly, even if the hedging target level is increased further. The assumed correlation between equity and bond returns is 0.2, based on historical data. The graph mainly provides a guideline for setting a maximum target level for interest rate hedging, given a particular bond allocation.

Figure 3: Volatility of Surplus Return (Surplus Risk) at Different Bond Allocations and Levels of Interest Rate Hedging



The table below summarizes the implied guidelines from the previous graph for setting a maximum target level for interest rate hedging, given a particular bond allocation. Limiting the

target level for interest rate hedging can also limit the use of derivative instruments (i.e., swaps or futures) to attain the desired duration exposure.

Table 1: Guideline for Setting a Maximum Target Level of Interest Rate Hedging

Allocation to Bonds	Maximum Target Level for Interest Rate Hedging
20%	60%
30%	70%
40%	70%
50%	80%
60%	80%
70%	90%
80%	100%

Rules governing contribution requirements and expense recognition. The increased interest in LAI type mandates for pension plans has partly been fueled by the changes in rules for corporate plan sponsors in the determination of minimum required contributions and recognition of pension liability in the balance sheet.

The *Pension Protection Act* of 2006 introduced significant changes in the regulations governing ERISA pension plans. In particular, the rules for calculating the minimum required cash contributions have changed. One of the main purposes for the change was to reduce the degree of smoothing for measuring assets and liabilities so that any adverse economic conditions resulting to a lower funded status would require the plan sponsor to make up those

shortfalls sooner rather than later. For instance, the smoothing of asset values are now limited to 2 years (instead of 5) and the smoothing of bond yields for discounting liabilities are now 2 years (instead of 4). The new rules no longer utilize the “ongoing” or actuarial liability concept, which uses asset return assumption for discounting benefit payments. Instead, the liability used for calculating contributions now solely relies on high quality corporate bond yields for the discount rate.

The recent FASB 158 statement changes the required financial disclosures by an employer to report the funded status of a defined benefit plan as an asset or liability in its statement of financial position. These changes in pension accounting rules represent Phase 1, which focuses on the

balance sheet impact of the pension plan. Phase 2 of the FASB project on pension reform will focus on the measurement of pension expense/income, which is reflected on an employer's income statement. The general expectation is that Phase 2 changes will be introduced within the next 2 to 3 years. These changes are expected to increase the transparency of the pension plan's financial status on the plan sponsor's accounting statements.

Implementation Considerations

While the concept of LAI is very appealing, there are several considerations for plan sponsors in the actual implementation of this strategy. Some plan sponsors might have a view that an increase in interest rates is more likely to occur. A counter argument for this concern is that even if interest rates increase, the loss in the bond portfolio should be matched by a decrease in the plan liability. However, this requires a change in the mindset of looking at the liability as the benchmark for evaluating performance instead of just the absolute asset return. This change in mindset can also address any concern that longer duration bonds will have a higher asset return volatility compared to a core bond portfolio.

The following specific factors should be considered in implementing an LAI strategy:

Ways of implementing LAI. The implementation of LAI can be broadly classified into three major categories:

1. **Full immunization or dedicated bond portfolio.** This approach is usually cost prohibitive since it implies that assets will be mostly (if not all) invested in long duration bonds whose payments match the expected benefit payments for the participants. For plans with completely frozen benefits, this

might be an acceptable approach since the benefit payments are less uncertain.

2. **Partially match duration by investing in bonds with long duration.** This is usually the most simple and straightforward approach of implementing LAI. For ongoing pension plans where a significant equity allocation is still warranted, this simple approach can be appropriate to at least reduce the interest rate risk. This implementation can be accomplished by adopting a fixed income benchmark that has a long duration. A common benchmark that is readily available is the LB Long Government/Credit index. This index has an 11-year duration, which is much higher than the 4.5-year duration of the more typical LB Aggregate Bond index.
3. **More precisely match duration and convexity by using overlay or derivative strategies.** A typical pension plan can have a duration that is usually in the 15 to 20-year range. The available bonds that have duration in this range are very limited. Thus, if a more precise matching of key rate durations along the yield curve is desired, use of overlay strategies such as futures and swaps would be required. This implies a more complicated approach of implementing an LAI strategy. For hybrid pension plans (i.e., cash balance plans), the liability duration can be much lower (i.e., it can be in the 3 to 7-year range) if the interest crediting rate for the cash balance account is directly related to the discount rate. Thus, an LAI mandate for hybrid plans should examine carefully the duration measurement for the liability that is relevant for the plan sponsor. In general, if the benefit payments are sensitive to interest rate changes, this additional source of interest rate risk should be examined carefully especially if a more

complicated and precise approach for LAI is desired.

Active vs. passive implementation. A passive strategy implies that the investment manager will match the performance of a pre-defined benchmark return. For an LAI mandate, the appropriate benchmark would be based on the specific liability of a pension plan. Theoretically, a passive mandate would result in a zero surplus return risk. However, there are other sources of “noise” that affect the liability changes. For instance, the demographic assumptions (i.e., mortality and retirement rates) used to estimate benefit payments may not be fully realized. Thus, an active approach would generally be more appropriate for LAI mandates because the “liability benchmark” has inherent risks that can not be fully immunized. A passive approach can be more reasonable for frozen and mature pension plans, where the other “noise” factors in the liability benchmark might be less significant compared to an ongoing plan.

If the reasonable equity allocation target for a pension plan is significant, this can increase the favor for an active approach since the major contributor for the surplus return risk would be the equity allocation. A counter argument for this reasoning is whether a pension plan should invest in a 100 percent passive mandate with a customized “liability benchmark” and use portable alpha strategies instead of equities in order to access potential excess returns. This model can be very appealing because portable

alpha strategies are meant to be uncorrelated with the “liability benchmark”. However, it is important to recognize that the portable alpha strategies have their inherent risks or uncertainty of ability to deliver excess returns.

In the table below, we illustrate the “liability benchmark risk” inherent from a 70/30 equity/bond mix. Liability benchmark risk refers to the volatility (as measured by standard deviation) of the difference between the asset return and the liability return (or growth in liability). In this example, the liability return is the pension liability benchmark published by Citigroup¹. Merrill Lynch has also introduced U.S. Pension Indices² to provide some generic samples of liability return benchmarks. Ideally, a customized liability benchmark that reflects a pension plan’s own cashflow projections can be used in this type of analysis. The equity is made up of both U.S. & non-U.S. stocks and the bond is the LB Long Government/Credit index. Note that the total active risk is 13.66 percent and the attribution shows that 94 percent of the total active risk can be attributed to the equity risk. A portable alpha strategy that has a risk of less than 13.66 percent can be considered superior to the 70/30 equity/bond mix below. Most portable alpha strategies would probably target a risk level that is lower than 13.66 percent. However, the difficulty in this comparison is whether or not the risk estimate for the portable alpha strategy is reliable and whether or not it is truly uncorrelated to the liability benchmark.

Table 2: Liability Benchmark Risk Attribution for a 70/30 Equity/Bond Allocation

Asset Class	Allocation Percentage	Annualized "Liability Benchmark" Risk	Contribution to "Liability Benchmark" Risk
U.S. Equity	50.0%	18.70%	67.4%
Non-U.S. Equity	20.0%	19.37%	26.7%
Long Duration Bonds	30.0%	4.72%	5.9%
Total Fund	100.0%	13.66%	100.0%

Another insight from the table above is that if the approach chosen to implement the LAI strategy is to simply use readily available bond indices (i.e., LB Long Government/Credit index) to increase the duration, this approach has an inherent benchmark risk relative to the pension liability. Thus, even if this strategy is implemented passively, the LB Long Government/Credit index has a 4.72 percent liability benchmark risk.

Summary

The theoretical arguments for long bonds in pension portfolios have been around for several decades already. The basic idea is that pension promises are very similar in nature as bond obligations; both are promises to make a specific payment in the future. Recent changes in regulations for pension plans have made the relevance of long bonds more evident.

We encourage our clients to take a comprehensive approach in evaluating the "liability-driven" or "liability-aware" mandates for their pension plans. This includes a thorough consideration of their plan's over-all characteristics by conducting an asset liability study to first address the appropriate exposure to equity or risky types of assets. The amount of

equity allocation should be considered when deciding the appropriate target level of interest rate hedging. A significant level of equity allocation will be the main source of volatility for the plans funded status regardless of the amount of interest rate hedging in place. A "liability aware investment" approach encourages plan sponsors to evaluate their pension plan's investment performance relative to the liability return benchmark, instead of focusing only on absolute asset returns.

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¹ Salomon Brothers, *The Citigroup Pension Liability Index (formerly Salomon Brothers Pension Liability Index)*, January 1995

² Merrill Lynch, *Introducing U.S. Pension Indices*, September 2007