



Ronald Ryan, CEO, CFA

# Pension LDI: Cash Flow Matching vs. Duration Matching

The primary pension objective is to *secure* promised benefits (Retired Lives) in a cost-effective manner (stable to lower contribution costs) with prudent risk. The secondary objective is to enhance the benefits of Active Lives. They are both liability objectives with assets intended to be managed vs. liabilities. Benefits are future value numbers. As a result, in order to manage assets vs. benefits would require knowing the future value of assets. Assets are best managed versus Retired Lives which are the most certain and imminent liabilities. Active Lives tend to be the most uncertain (actuarial noise). There are basically only two ways to manage assets vs. future value benefits and to secure these benefits:

1. **Insurance Buyout Annuities (IBA)**
2. **Defeasement (through *cash flow matching*)**

## **Insurance Buyout Annuities (IBA)**

Insurance buyout annuities (IBA) guarantee future benefit payments of Retired Lives and remove this liability off balance sheets (risk transfer) but are extremely expensive. Corporations are purchasing IBAs to get rid of the high and rising PBGC premiums caused by the MAP 21 (Moving Ahead for Progress in the 21<sup>st</sup> century) legislation of July 6, 2012. Since public pensions do not have the PBGC and multiemployer plans have very limited PBGC benefits, the IBA is certainly not appropriate and/or affordable for these pension plan sponsors. However, Corporations would be wise to do a cost analysis of the IBA versus a cash flow match defeasement. The typical IBA prices Retired Lives (liabilities) at a discount rate of Treasury STRIPS plus a 4% premium. According to our calculations, a **defeasance strategy (cash flow matching) using investment grade corporates would provide a cost**

*William F. Sharpe*  
Lifetime Achievement Award

*Money Management Letter*  
Lifetime Achievement Award

*Capital Link*  
Most Innovative ETF Award

*IMN*  
ETF of the Year Award

*Bernstein Fabozzi/Jacobs Levy*  
Research Paper of the Year Award



**savings of about 25% versus IBA**, which is a very significant present value cost savings and should be reviewed.

### **Cash Flow Matching**

A lower cost and low risk way to secure benefits is to *cash flow match* these future value benefit payments (Retired Lives). In the 1960s thru the early 1980s dedication strategies (cash flow matching) with corporate bonds was common and in vogue for pensions. This strategy became less common as pension consultants and accounting rules focused on present values (Funded Ratio and Funded Status) not future values. This led to great confusion as to how to calculate the present value of liabilities (discount rates)... and even assets (i.e. smoothing). In truth, ***cash flow matching the liability benefit payment schedule (liability cash flow) at low cost is the ideal way to de-risk a pension plan.*** Ryan ALM spent two years building a liability cash flow matching product, we named and trademarked as the **Liability Beta Portfolio™ (LBP)**. Our LBP is a *cost optimization model* that matches the liability benefit payment schedule at the lowest cost given the investment policy restrictions of our clients. Bond math suggests that the longer the maturity and the higher the yield... the lower the cost. Our LBP runs several iterations to achieve low cost by skewing the weights to longer maturities and higher yielding bonds within the liability benefit payment schedule we are funding (i.e. 1-10 years Retired Lives).

The **Liability Beta Portfolio (LBP) provides funding cost savings of 10% to 15% vs. Retired Lives projected cash flows, @20% vs. Treasury STRIPS and @ 25% vs. IBA!** This is a serious cost reduction and should be a major consideration of any de-risking strategy. Yes, the LBP model has some credit risk but very small since we are using investment grade bonds with credit filters (i.e. no bonds on negative watch lists and several solvency tests) plus the cost savings provides a large value-added cushion.

The funded ratio should dictate the allocation to bonds. Based on the allocation to bonds should determine how much of the liabilities we can cash flow match (i.e. 15% bond allocation might fund the next seven to 10-years of Net Retired Lives). ***We recommend funding at least the next 10 years of Retired Lives on a net liability basis*** (after contributions). Indeed, contributions are the first source to fund liabilities such that current assets fund the net liabilities not the gross liabilities. Our LBP model will calculate with precision the cost to fund liabilities (gross or net) in a cost-effective manner ***chronologically.***

Since liabilities are funded initially by contributions, using the LBP model to cash flow match net liabilities *chronologically* may be able to fund more liabilities than you think. Assume that a 15% bond allocation could match the next 10 years of net Retired Lives benefit payments chronologically. Based on the Ryan ALM Liability Beta Portfolio™ (LBP) model we show a cost savings of about @10% on cash flow matching the first 10 years of net liabilities versus the projected net Retired Lives benefit payment schedule – projected contributions.

Matching liabilities chronologically should also buy time for the non-bond assets (Alpha assets) to perform and outgrow Active Lives liabilities. Given time (10 years) most non-bond asset classes tend to outperform bonds. Since liabilities behave like bonds there is a high probability that non-bond asset classes could outperform liability growth over an extended time horizon especially at today's low yield on bonds and liabilities. This would enhance the funded status allowing for reduced contribution costs or increased Active Lives benefits or both. Our LBP has numerous benefits that best achieve the true pension objective:

#### **Secures Benefits**

Cash flow matches + funds monthly Retired Lives benefits chronologically

#### **Enhances Funded Ratio /Status**

LBP outyields Liability discount rate (ASC 715) @ 50 - 100 bps... creates Alpha

#### **Reduces Costs**

LBP reduces Contribution, Funding and Asset Management Costs

##### **Contribution Costs:**

LBP outyields liabilities thereby creating Alpha, which enhances Funded Ratio

##### **Funding Costs:**

**Funding Cost Savings = 10% to 15% vs. projected benefit payments  
20% vs. Treasury STRIPS  
25% vs. IBA**

##### **Asset Management Costs:**

**LBP Fee = 15 bps** (25% to 50% less than most active bond managers)

#### **Reduces Volatility**

Liability *Beta* Portfolio matches and funds liability benefit payments

Reduces *Volatility* of Funded Ratio/Funded Status

Reduces *Volatility* of Contribution Costs

#### **Reduces Risk**

Risk = Uncertainty of Funding Benefit Payments (LBP funds benefits with certainty)

Projected Benefit Payments are Future Values (FV have No Interest Rate Sensitive)

#### **Enhances ROA**

LBP composition is: Investment Grade corporates (skewed to longer A/BBB bonds)

LBP should *outyield* most active management bond portfolios

#### **Benefit: Buys Time**

Liability *Beta* Portfolio Matches & Funds Liabilities *Chronologically*

Moves deficit out longer extending the investment horizon

Buys Time for Non-bond Assets (Alpha assets) to outgrow Liabilities

Non-bond Assets Outperform Bonds (Liabilities) over Long Horizons

## **Duration Matching (DM)**

Duration-matching strategies (Immunization), Interest Rate Swaps, futures, derivatives, risk overlays, etc. are all hedging tools to help assets match the liability growth rate. **They are NOT de-risking strategies since they do not match or fund the liability cash flows.**

Duration matching has several difficult, if not erroneous, data gathering choices it uses:

### **1. Average duration of liabilities**

Where do you get the average duration of liabilities? Most, if not all, actuarial reports do not provide this calculation. Moreover, they do not provide the projected liability benefit payment schedule which you would need to calculate duration. In addition, actuarial reports are annual reports usually three to six months delinquent so there would be serious delayed information. The duration calculation is at a precise moment in time... like a balance sheet. As time and interest rates change... so will duration.

Importantly, assets are funding net liabilities after contributions which is not calculated by the actuary. Only a *Custom Liability Index (CLI)* based on each pension's unique projected Retired Lives benefit payment schedule and projected contributions could provide an accurate and monthly duration profile.

### **2. Discount Rates**

Since the duration of liabilities changes with interest rates (discount rates) this calculation needs to be refreshed and updated on a frequent and accurate basis. According to pension accounting rules (FAS 158, GASB 67) and federal funding standards (PPA – MAP 21 and spot rates) there is an assortment of discount rates required to price liabilities. **There is no bond index that uses any of the required pension accounting discount rates... they use market rates!** The yield difference could be serious. Any difference in yield creates a difference in the calculation of duration and liability growth rates. Only a Custom Liability Index using the appropriate discount rates could provide an accurate duration and liability growth rate calculation.

### **3. Generic Bond Indexes**

A common proxy for the average duration of liabilities is to use a generic bond market index... usually the Bloomberg Barclay's long corporate index. Such a proxy creates

several erroneous data issues. This index has no bonds shorter than 10 years and no durations longer than 17 years although heavily skewed to long coupon bonds. This certainly does not represent any pension liability schedule even if the average durations were similar. Accounting standards and actuarial practices price liabilities as a portfolio of zero-coupon bonds with a single average discount rate based on the present value of this zero-coupon liability portfolio. **There are no generic bond indexes that use zero-coupon bonds as their portfolio. There are no generic bond indexes that use pension discount rates in accordance with FASB, GASB and PPA guidelines.** Every pension plan's liabilities are different and unique to that plan due to different labor force, salaries, mortality and plan amendments. There is no way any generic bond market index could represent any pension plan liability term structure. Only a **Custom Liability Index** could properly represent and measure any pension plan's liabilities providing all of the critical data calculations needed to de-risk the plan.

#### **4. Interest Rate Sensitivity**

For every-one year of duration difference between the liability proxy and the actual duration of each plan's benefit payment schedule would represent a 1% mismatch in liability growth for every 100 bps of discount rate change. In truth, the duration mismatch is more likely to be three to five years rather than one year. Given that pension cost for the actuary, administration, asset managers and consultant are usually way less than 1% a year; such a duration mismatch could be very costly representing years of pension cost. Moreover, most duration matching strategies are heavily skewed to maturities longer than 10-years. This makes the DM strategy extremely interest rate sensitive. Given today's historic low yields, there is a high probability of higher rates and negative growth on DM strategies over time.

#### **5. Funding Liabilities**

Imagine a 12-year average duration liability benefit payment schedule. It could have many different term structure shapes to come up with an average 12-year average duration. Imagine 100% of the assets in a 12-year duration bond portfolio. If interest rates rose 50 basis points in a year, total assets and liabilities supposedly would both

have a -6% price return (interest rate movement x duration (as a negative number)) . If they had the same income return = 4% they would match again (note that assets usually don't match the income or yield of liabilities). However, if the duration matching assets are used to *fund* liabilities then a -2% loss (-6% + 4% = -2%) on assets could be funding a one-year liability which will have a small positive growth rate. So the assets could be taking a loss each year to fund the next year's liability benefit payments if interest rates continue to rise. This could get to be a serious costly mismatch if interest rates began a secular trend to higher rates for the next five years. But the point is...there is no cash flow match here, only a duration match so there is both a funding and interest rate risk!

Interest rate swaps and futures are contracts not assets. There is no cash flow or funds available to make the liability cash flow payments. They are certainly NOT de-risking strategies but hedges vs. the liability growth rate. In fact, these strategies introduce more risk: counter party risk, interest rate risk, non-matching risk of assets purchased (usually equities) vs. liabilities and leverage. In addition, interest rate swaps and futures have all of the problems associated with a liability proxy data gathering... as listed with duration matching.

- Issues:**
1. Duration matching does NOT fund and does NOT secure benefits
  2. Duration is a PV calculation so it is very interest rate sensitive
  3. Duration changes every day requiring frequent rebalances
  4. Generic bond indexes typically used as proxy for liabilities
  5. No generic bond index can match client's unique liability cash flow
  6. Forced into buying costly Treasury STRIPS after 16 years
  7. Duration is NOT calculated by the actuary

## **Solution: Custom Liability Index**

Only a **Custom Liability Index (CLI)** could properly represent and measure any pension plan's liabilities providing all of the critical data calculations needed to manage assets vs liabilities and de-risk the plan. Pension liabilities are like snowflakes... there are no two plans alike due to the different labor force, salaries, mortality and plan amendments. Given the extreme amount of work and calculations performed by the actuary, their report to the pension is usually received annually several months delinquent. This is understandable, but inappropriate for the asset side to function efficiently. Imagine if an important index benchmark (S&P 500) came out annually, months delinquent, could you manage assets

effectively vs. this index? In 1991 Ron Ryan and his team designed the first Custom Liability Index (CLI) as a solution to this problem. Based on each client's unique projected liability benefit payment schedule, Ryan ALM produces *monthly* or *quarterly* CLI reports on:

**Structure**-(the Present Value, Average Duration, YTM, Price, etc.)

**Growth Rate** (Liability growth for month, year and since inception)

**Interest Rate Sensitivity** (PV change in % and \$ given rate changes)

## Future Value vs. Present Value

Actuarial practices use present values (PV) to calculate the funded ratio and funded status. But benefit payments are future values (FV). This suggests that the future value of assets vs. the future value of liabilities is the most critical evaluation. But most asset classes are difficult to ascertain their future value. This is why the PV is used. Only bonds (and insurance annuities) have a known future value and have historically been used to cash flow match liabilities (i.e. defeasance, dedication). To prove my point as to the potential misinformation with using a PV calculation, let's use a simple example below. Two pensions both at \$1.0 billion market value would have the same funded ratio in PV\$. But pension B is 100% invested in A and BBB corporate bonds that outyield pension A (100% invested in Treasuries) by 100 bps per year. Certainly, plan B has a much greater future value (@ 20% higher) and funded status if we used future values. This suggests that the funded ratio and funded status are not that accurate or even good indicators of the true economic solvency:

<b>Pension</b>	<b>Composition</b>	<b>YTM</b>	<b>PV</b>	<b>FV</b>
<b>A</b>	<b>100% Treasuries</b>	<b>2.00%</b>	<b>\$1.0 billion</b>	<b>\$1.5 billion</b>
<b>B</b>	<b>100% Corporates</b>	<b>3.00%</b>	<b>\$1.0 billion</b>	<b>\$1.8 billion</b>

The point of all this is... that we need to focus more on the FV of assets vs. liabilities. If we value liabilities at market rates, they would have discount rates of AA corporates (FASB method) or even better U.S. Treasury STRIPS (defeasance method). A corporate bond portfolio matched to liabilities that outyields liabilities would enhance the funded ratio on a future value basis thereby reducing funding costs (i.e. contribution costs). This is why “**cash flow matching**” of liability future values is the most prudent risk and lowest cost methodology to de-risking a pension through asset liability management (ALM).