Immunizing Pension Expense Volatility

Pension management is an Assets vs. Liabilities objective. Corporations tend to focus on pension expense since it is a direct hit to earnings and stockholder value. Corporations do not want volatility on earnings coming from pension expense. The major factors affecting pension expense are the dollar growth of assets minus the dollar growth in liabilities. This is in sharp contrast to a % growth difference (ROA of assets – discount rate of liabilities). **Pension expense is all about dollars not %**. There are two primary liability driven investment (LDI) bond strategies in use today: Duration Matching and Cash Flow Matching.

Duration Matching

The purpose of duration matching is for assets to match the interest rate sensitivity of liabilities (immunization). The objective is to have the market value change (% growth rate) in the immunization bond portfolio match the % growth rate (discount rate) in liabilities for a given change in interest rates. Many LDI fixed income managers attempt to match the average duration of their bond portfolio to the average duration of a bond market index with a similar duration to liabilities (i.e., Bloomberg Barclays long corporate index). They use the bond index as a proxy for liabilities. There are several problems and flaws with this strategy.

1) A *generic* bond index cannot replicate any clients' unique liabilities cash flows. Client's liabilities are like snowflakes: different labor force, salaries, mortality, etc..
2) *Average durations* give erroneous information because there are a numerous number of combinations of maturities for a bond portfolio that can all have the same average duration, but they will not have the same risk/reward profile or interest rate sensitivity.
3) Duration matching is only accurate for small *parallel shifts* in the yield curve. But the yield curve rarely moves an equal number of basis points at every point along the curve.
4) FASB requires a single discount rate for financial statements which does not calculate a proper target duration. You need to use the ASC 715 discount rate *yield curve*.

LDI bond management evolved to remedy these flaws by using Key Rate durations which attempt to match the duration of multiple points along the liability yield curve. Key Rate duration is an improvement over a single average duration, but still has several deficiencies:

1) Actuaries usually do not provide the average duration of liabilities and the projected benefits in their annual actuarial report… reason why generic bond indexes are used.
2) Matching key rate durations of a generic market index = wrong Key Rate durations.
3) Duration is a present value calculation requiring pricing each projected benefit with a different discount rate (i.e., ASC 715 discount rates yield curve). As a result, 30 annual benefit payments require 30 separate discount rates and 30 key rate durations.
4) Duration must be *modified* (duration/1+YTM) to use as a price return or interest rate sensitivity measurement.

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Solution: Dollar Duration Matching (DDM)

DDM matches the dollar value change per basis point change in yield for assets with the dollar value change per basis point change in yield for liabilities. When the dollar duration of assets is matched to the dollar duration of liabilities for **every year in the term structure of liabilities**, then DDM is in its most precise form. That would be the equivalent of 30 Key Rate durations… one at every point along the liabilities yield cure or benefit payment schedule (30 years = 30 key rate durations). Ryan ALM recommends DDM for ***Active Lives*** liabilities. The Ryan ALM DDM approach offers several value-added differences:

1. **Actuarial Projections** - We use the actuarial projected benefits of our clients and not a generic bond index benchmark.
2. **Modified durations** - to be an effective price sensitivity measurement, duration must be modified. Modified Duration measures the *percent change* in market value or present value for future value cash flows given a 100-basis point movement in yield.
3. **Dollar duration** - our objective here is to match the *dollar value change per basis point* in assets and liabilities in every annual liability maturity or duration.

The Ryan ALM DDM approach greatly improves the accuracy of Key Rate duration matching by matching the dollar value changes in liabilities with the dollar value changes in assets across the liabilities term structure. DDM is in harmony with the corporate objective of immunizing pension expense. The liabilities are measured and monitored by using a **Custom Liability Index (CLI)** to more precisely calculate the dollar value (PV) movement in assets versus liabilities given any movement in interest rates. The CLI is the most appropriate benchmark for any asset liability management (ALM) and should be the first step in any LDI strategy.

Ryan ALM uses an asset liability management *turnkey system* for defined benefit pensions:

1) **ASC 715 Discount Rates** – Ryan ALM is one of few vendors providing ASC 715 discount rates (AA corporate zero-coupon bonds as a yield curve). We will price each actuarial projected benefit payment on a monthly basis.
2) **Custom Liability Index (CLI)** - The CLI provides all of the calculations needed for either dollar duration matching or cash flow matching. The CLI will calculate YTM, modified duration, actual growth rate and interest rate sensitivity for each projected benefit as a term structure as well as total liabilities showing both the % and $ change in present values.
3) **Liability Beta Portfolio™ (LBP)** – our LBP will dollar duration match or cash flow match projected benefits ***chronologically*** using our proprietary LBP cost optimization model that will secure benefits, reduce funding costs significantly as well as immunize interest rate sensitivity.

Solution: Cash Flow Matching (CDI)

Ryan ALM believes that the true objective for a defined benefit pension is to ***fund and secure benefits*** when due in a cost-efficient manner. **The value in bonds is in the certainty of their known and scheduled cash flows** which is why cash flow matching has been used as a major strategy for hedging liabilities for many decades (i.e., dedication, defeasance). It is the matching and funding of benefits (future values) that is the primary focus of cash flow driven investments (CDI). As such, future values are **not** interest rate sensitive… a major benefit of cash flow matching. Cash flow driven investing (CDI) dominates the way European pensions are managed under IASB accounting standards. Key Rate duration and especially dollar duration matching (DDM) are good for matching present value movements between assets and liabilities but do not focus on funding liability payments (future values). Pensions require liquidity that is sufficient and timely to fund benefits + expenses (B+E). CDI will cash flow match both B+E based on the actuarial projections. **CDI is a best fit to fund Retired Lives** given their higher degree of certainty. Active Lives might be best served with dollar duration matching (DDM) given the actuarial noise and uncertainty of such actuarial projections.

Since the primary value in bonds is in the certainty of their cash flows, Ryan ALM will cash flow match projected benefit payments *chronologically.* This provides numerous benefits:

1) **Secures the benefits**
2) Significantly de-risks the plan
3) Reduces funding costs significantly
4) Higher yielding bond portfolio than CLI + DDM
5) Provide adequate and timely liquidity to fund B+E
6) Reduces volatility of funded ratio and contributions
7) Buys time for performance assets (Alpha) to grow unencumbered
8) No interest rate risk since LBP is funding future values (benefit payments)

A major benefit of the Ryan ALM cash flow matching model is the reduction in funding costs by usually 1% per year. If we cash flow match 1-30 years of benefits = 30% cost reduction between the cost of benefits (future value) and the cost to cash flow match (present value). The CDI is skewed to A/BBB+ bonds and longer maturities to reduce funding costs. This will cause the CDI to outyield liabilities by 50-100 bps and DDM. Moreover, the CDI provides adequate and timely liquidity to fund B+E. Many, if not most, pensions do a cash sweep of all asset classes to fund current benefits + expenses. CDI will fund B+E when due which will **buy time** for the performance assets (Alpha) to grow unencumbered. S&P data shows that dividends reinvested > 50% of the S&P 500 growth in the last 70 years. If interest rates rise, cash flow matching can reinvest any excess cash flows at the then higher yields which will lower funding costs while bonds managed with a purely total return focus would get hurt with lower price returns.

Solution: Duration Enhancing Overlay (DEO)

DDM and CDI cannot hedge 30+ year liabilities well due to the lack of bonds to buy. In a Duration Enhancing Overlay (DEO) strategy, derivatives are used to add duration. The assets in the DDM and CDI portfolios can be used as margin capital for targeted positions in interest rate swaps, swaptions or buy/sell Treasury Futures.

A Duration Enhanced Overlay (DEO) is a zero-investment strategy that can be constructed by taking long only derivatives positions like futures positions in long-dated Treasury bonds, or by taking positions in futures on long-dated treasury bonds while also taking the opposite positions in shorter term Treasury securities.

A DEO should be in addition to a CDI or DDM strategy not instead of. The issue becomes the size of the derivative contracts needed to close the duration gap. In the example below, it would take 2.2x to 3.5x the bond position to close the $ duration gap. Ryan ALM cautions against such a strategy as undue leverage but we admit the existence of a dollar duration gap.

Funded Ratio	85.00%	Total $	Mod Dur	Dollar Dur / 100 bps	Dur Gap $	Dur Gap %
	Assets	$850,000,000	5.50		-$106,625,000	-12.54
50.00%	Stocks	$425,000,000	0.00	$0		
50.00%	bonds	$425,000,000	5.50	$23,375,000		
	Liabilities	$1,000,000,000	13.00	$130,000,000		

	Need to Add	$106,625,000	Dollar Dur
X bond alloc	DEO Notional Amt	MDUR	DD / 100 bps
3.53	$1,500,000,000	7.11	$106,625,000
2.94	$1,250,000,000	8.53	$106,625,000
2.35	$1,000,000,000	10.66	$106,625,000