Ronald Ryan, CEO, CFA

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How to De-Risk A Pension

Risk is best defined as the "uncertainty" of meeting the client objective. **The pension objective is to fund liabilities in a cost effective manner such that contribution costs remain low and stable.** Pension plans also want to de-risk their plans over time. The lowest risk assets for a pension are those that match the liability benefit payment schedule with *certainty*. By definition, Treasury zero-coupon bonds (STRIPS) and annuities would be the lowest risk assets for pension since they have a known future value… but they tend to come at a high cost since they are low yielding. Given that the pension objective is a cost objective, then solving for cost while matching the liability payment schedule would be the ideal way to de-risk a pension.

A pension liability benefit payment schedule is a term structure or yield curve often referred to as the ***liability cash flow***. In order to match or de-risk each pension liability payment requires a matching cash flow from assets. Basically, only bonds produce a certain cash flow (and perhaps, annuities). That is why bonds are used as the way to defease, immunize and de-risk a pension plan.

Problems with Hedges

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 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. Only A ***Custom Liability Index*** based on each pension's unique liability benefit payment schedule 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.

3. Generic Bond Indexes

A common proxy for the average duration of liabilities is to use a generic bond market index… usually the 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 16 years. 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 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 a single generic market index could represent the wide array of benefit payment schedules.

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. In 1991 Ron Ryan designed the first Custom Liability Index (CLI). Based on each client's unique projected liability benefit payment schedule, Ryan ALM produces *monthly* CLI reports on:

Structure (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)

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 less than 50 bps a year; such a duration mismatch could be very costly representing years of pension cost.

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 the 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 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 liability payment 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, 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.

Problems with Buyout Annuities

The buyout annuity is certainly the least risky approach to de-risking a pension but it comes at the highest cost. The current trend is to use a single discount rate of 3.00%. The plan sponsor would have to transfer assets and funds over to the insurance company such that the plan is fully funded at this discount rate. Using a sample benefit payment schedule totaling $1 billion with payments out thru 12/31/97 here is our calculation of the present value or cost of a buyout annuity versus using Treasury STRIPS to defease:

	6/30/15	Avg. Discount Rate
Buyout Annuity	**$594,993,913**	**3.00%**
Treasury STRIPS	**$592,514,819**	**3.03%**

Our calculation suggests that the buyout annuity may be even more costly than defeasing the plan with Treasury STRIPS which was always considered the high cost de-risking strategy. Defeasance may also allow an accounting removal of such debt. Since the primary pension objective is to fund liabilities at low and stable costs, the buyout annuity should be given a second thought before executing. In addition, if the insurance company goes bankrupt there may be a claw back of pension liabilities to the plan sponsor.

Solution: Cash Flow Matching

As stated in the beginning, **matching the liability benefit payment schedule (liability cash flow) at the lowest cost is the ideal way to de-risk a pension plan.** Ryan ALM spent the last two years building a liability cash flow matching product, named the **Liability Beta Portfolio™ (LBP)**, as a cost optimization model that matches the liability benefit payment schedule at the lowest cost given the investment policy restrictions of our

clients. Based on the same sample benefit payment schedule used above for the buyout annuity vs defeasance comparison, our LBP model shows a cost as follows:

	6/30/15	Avg. Discount Rate
LBP Model	**$435,287,164**	**5.157%**

The **LBP provides a 26.84% cost savings vs. the buyout annuity!** 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 plus the cost savings provides a large value added cushion.

The funded ratio should dictate the allocation to bonds. A surplus should have a high allocation to bonds matched to liabilities and vice versa for a deficit funded status. Unfortunately, asset allocation did not respond to the surplus status in the 1990s which led to the US pension crisis. With funded ratios at 120% to 150% then, why didn't pensions immunize and secure this victory? Because pensions are focused on achieving the ROA (return on asset assumption) instead of focusing on the funded ratio and status, they reduced their bond allocations when bond yields went below the ROA… around 1988. Amazingly, instead of increasing their bond allocation in response to a growing funded ratio they reduced it consistently to the lowest bond allocations in modern history by 1999.

Based on the allocation to bonds should determine how much of the liabilities we can cash flow match (i.e. 20% of total liabilities or perhaps, the next 7 years). Most current bond allocations are historically low. As a result, you cannot match and de-risk 100% of liabilities with a 25% bond allocation, especially if you have a funded status deficit. Such a 25% allocation could be used to match and de-risk either a % of total liabilities or liabilities ***chronologically*** which both methods will de-risk the plan gradually. There are advantages for each method.

Since liabilities are funded initially by contributions and then investment income, using the LBP model to cash flow match net liabilities *chronologically* may be able to fund more liabilities than you think. Assume that a 25% bond allocation could match the next seven years of net liability payments chronologically. Based on the Ryan ALM Liability Beta Portfolio™ (LBP) model we show a cost savings of about 4% on cash flow matching the first seven years of liabilities versus the ASC 715 discount rate (AA corporate zero-coupon

bonds). Note that Ryan ALM is one of few vendors who provide the ASC 715 discount rates since 2008. Our discount rates are consistently higher than the Citigroup rates providing a lower present value on liabilities and enhancing funded ratios and balance sheets.

Matching liabilities chronologically should also buy time for the non-bond assets (Alpha assets) to perform and outgrow liabilities. Given time (7-10 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 vs. liability growth over an extended time horizon especially at today's low yield on bonds (i.e. liabilities).

Since the pension objective is a cost focus, cash flow matching a % of total liabilities would produce the ***optimal*** cost savings since the longer the bond the less it costs given the same future value. Our LBP model is back tested since 2009 showing a cost savings of 8% to 12% on cash flow matching a % of total liabilities. For every $1 billion in bonds used in our LBP model could save about $100 million in cost savings vs. the ASC 715 present value of liabilities.

Asset Allocation (AA)

Pension consultants and plan sponsors should consider installing a LBP as the ***core portfolio*** in asset allocation. The best value in bonds is their cash flows. Bonds are usually not considered performance assets (Alpha assets) especially vs. pension liabilities which behave like bonds. As the Alpha assets (non-bonds) perform vs. liability growth, thereby enhancing the funded ratio, such excess returns should be transferred over to the Liability Beta Portfolio™ (LBP) to de-risk more and more liabilities… **Portable Alpha**. Had this *portable Alpha* discipline been in place during the decade of the 1990s when funded ratios grew to their highest historical levels with true economic surpluses… there would be no U.S. pension crisis today!

Nota Bene **(Note Well)**

Please note that the definition of risk used in this article is in sharp contrast to the traditional approach produced by the Nobel Prize winner Ph.D. William F. Sharpe back in 1966. Professor Sharpe proposed that risk is the volatility of total returns and that the three-month T-Bill was the default risk-free rate. He developed the Sharpe Ratio as a means of calculating the risk-adjusted return by subtracting the return of the three-month T-Bill from

the mean return of the asset(s) being analyzed and dividing the net return by the volatility of the return of the asset(s) in review. For many decades the Sharpe Ratio was the standard measurement of risk-adjusted returns. In 1994 Prof. Sharpe called me and invited me to Stanford to discuss our unique index data and index reports. I had the unique pleasure to meet and debate with one of the finest intellects I ever met.

I proposed that risk is not a *generic* measurement but based on each client's objective. I referenced pensions where every client's liabilities are different (like snowflakes). As proof, I asked him what is the risk-free asset for a 10-year liability payment? Prof. Sharpe answered… a 10-year Treasury zero-coupon bond. Prof. Sharpe identified that the three-month T-Bill would have 39 reinvestment moments of uncertainty, so there is no way the three-month T-Bill could match a 10-year liability future value with any certainty and would become a risky asset. Our discussion led to Prof. Sharpe re-inventing the Sharpe Ratio in 1994 to include the benchmark objective instead of the three-month T-Bill in the numerator and denominator such that the average return of the asset portfolio is reduced by the average return of the objective (numerator). This net average return is then divided by the standard deviation of the asset portfolio excess return vs. the objective return. This is commonly called today… the **Information Ratio**.