

Liability Index Fund (the *Beta* Portfolio for LDI)

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Index Funds are quite popular in America but Liability Index Funds are not common. Given that the objective of most institutions and individuals is to fund some type of liability schedule, Liability Index Funds should be a *core* investment. A Liability Index Fund has all the benefits of an index fund plus valuable features no other index fund can have. An index fund or *Beta* Portfolio by definition is supposed to match or duplicate the risk/reward of an index objective at a low tracking error. Index funds became increasingly attractive due to several factors:

1. **Diversified portfolio** purchased as one transaction (i.e. ETF)
2. **Low to no tracking error** versus the target index benchmark.
3. **Lower cost** than most active management fees
4. Consistent **performance** vs. index objective

Since it is hard to consistently outperform indexes (especially after fees) index funds became an increasingly larger or core investment for many institutional and even retail investors in the last two decades. The largest mutual funds tend to be index funds (Vanguard). And in the last 20 years, ETFs (exchange traded funds) have grown significantly to over \$1 trillion in assets and over 1,000 index fund products, perhaps more so than any other financial product. Then we have the closet index funds that do not want the label of indexing (due to lower fees) but tend not to stray far away from the key characteristics and statistics comprising the index objective (i.e. weightings, sector stratification, yields, modified duration, ratings, etc.). **Indeed, it is an Index Investment World!**

Custom Liability Index (CLI)

The true objective of a pension is to fund the liability benefit payment schedule at a stable and low cost to the plan sponsor. In order for assets to function and be managed vs. this liability objective, liabilities need to be made transparent such that you can monitor the shape, size and growth rate of liabilities (in present value dollars) frequently. This requires **a Liability Index** customized to the unique benefit payment schedule of a plan sponsor to provide the data needed as the true benchmark objective for asset management. Just like snowflakes, no two pension plans are alike in their actuarial projected benefit schedule. Since each liability is weighted by its present value (market value) it is mathematical clear that a 10-year average liability duration

will behave much differently than a 20-year liability duration given the same interest rate change (i.e. 10% price difference for every 100 basis point change in yields). Since interest rates change every day, a *daily* Custom Liability Index would be the most accurate monitor of liability size, shape and risk/reward behavior (in present value dollars). There is no generic index that could accurately represent any liability behavior. A Custom Liability Index is always the best measurement and representation of any liability valuation and risk/reward behavior. The financial moral here is: **given the wrong index... you will get the wrong risk/reward!** This has been the consistent problem with pensions for decades... **they have the wrong index objective!** Until Custom Liability Indexes are placed as the true pension benchmark, pension assets will continue to demonstrate a risk/reward roller coaster behavior vs. liabilities wherein the Funded Ratio and Contribution rates remain quite volatile.

Beta Redefined

By definition, an index fund is the correct Beta portfolio that matches the index benchmark with such accuracy that the tracking error is nil with the Beta calculation at 1.00 and the correlation at or near 100.00. With a liability driven objective, only a *Liability Index Fund* could qualify as the Beta or matching portfolio. A Liability Index Fund, by definition, requires a *Custom Liability Index (CLI)* to create or model. Until you match each monthly liability payment (liability term structure) you cannot hedge the interest rate risk (systematic risk) that dominates the risk/reward behavior of liabilities. Unfortunately, the failure of many pension schemes from immunization to interest rate swaps have tried to only match the average duration of liabilities. This is incorrect math. You **must match the term structure** of liabilities (each and every monthly liability payment) to properly match liabilities. The stripping and reconstituting of the long Treasuries is a testimony to this mathematical disparity. Only through the CLI could you get the present value calculations necessary to understand how to match and monitor the ever changing shape and risk/reward behavior of liabilities.

The old Lehman Aggregate (now Barclay's), which I designed when I was Director of Research there, has been the standard index benchmark for most fixed income assets in pensions. Although this index is a good measurement of the bond market, it has little correlation to liabilities. Most pensions have long cash flow structures with volatile risk/reward behaviors much different than the Barclay's Aggregate. To illustrate the disparity between generic traditional bond indexes and liabilities, I compared the Barclay's Aggregate to the Ryan Liability Benchmark Index for the last 20 years (ending 12/31/09) in Table 1. The Ryan Liability Benchmark Index is the Treasury STRIPS yield curve (1-30 years) equally weighted with an average duration of around 15 years while the Barclay's Aggregate tends to be around a five-year duration:

Table 1
Risk/Reward Comparison
(12/31/89 – 12/31/09)

	<u>Barclay's Aggregate</u>	<u>Ryan Liability Benchmark</u>
Standard Deviation	3.86	12.52
Correlation	88.15	
Tracking Deviation	200	
Annual Total Return	7.01	8.72
Information Ratio	- 0.18	

Note: The Ryan Liability Benchmark Index is an equally weighted portfolio of the Ryan Treasury STRIPS Indexes from 1 to 30 years with an average duration @ 15 years. It is a proprietary index of Ronald J. Ryan, CFA and Ryan ALM, Inc. (patent pending).

This Table 1 comparison proves that the most popular generic bond index does not behave or correlate well to pension liabilities. With a correlation of 88.15 and an annual total return difference of -1.71%, the Lehman (Barclay's) Aggregate has proven to be a huge opportunity cost for the last 20 years. **No generic index should be used as a Beta portfolio for a liability driven objective.** Perhaps, the silliest notion of a Liability Beta Portfolio is the S&P 500 or any non-bond index. The S&P 500 as an index fund may be a *market* Beta portfolio but certainly does not correlate or behave like any liability term structure. **A Liability Beta Portfolio can only be a 100% bond portfolio matched to the liability cash flow schedule!** You have to create a *custom* Liability Index based on the client's actuarial projections of benefit payments to create a Beta portfolio that matches the liability objective of pensions (as measured by a CLI).

Alpha Redefined

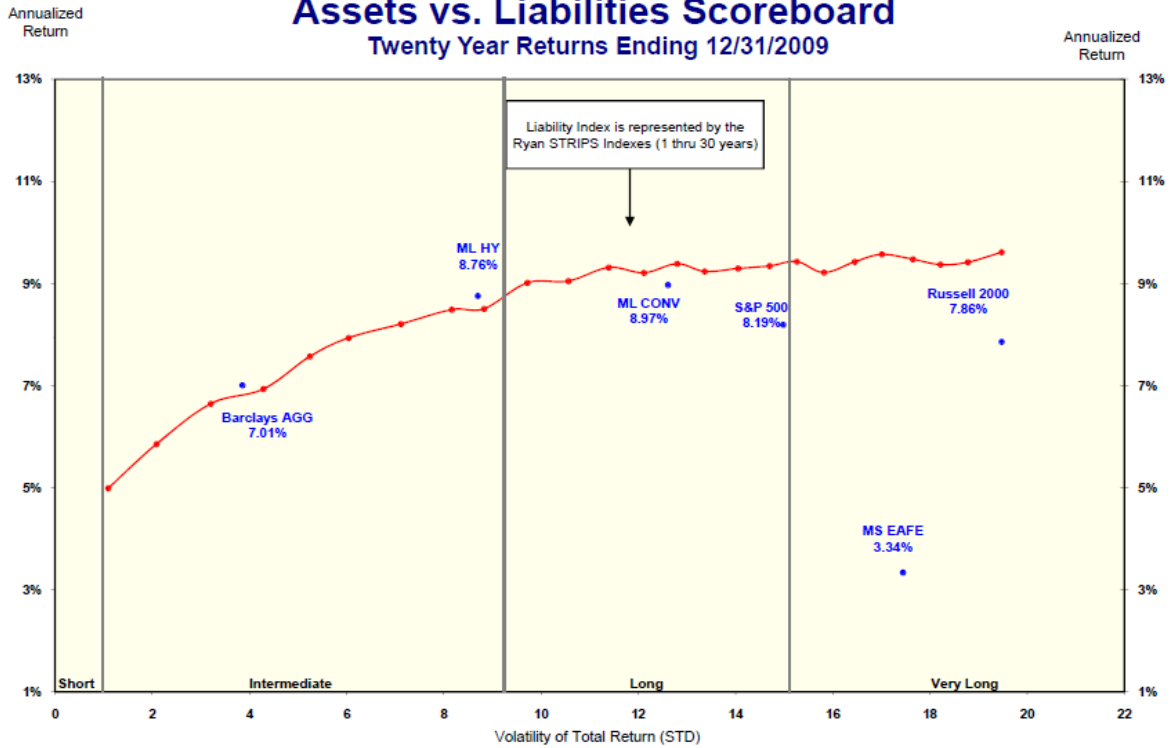
Alpha is defined as the excess return above the index objective's return. In liability driven objectives, **Alpha is correctly measured as the excess return above liability growth (as measured by the CLI).** Outperforming *generic* indexes is inappropriate performance measurement information vs. a liability objective. **If you outperform a generic market but lose to liability growth (CLI)... you lose!** The infamous correction years for the stock market (2000 thru 2002) certainly highlight this Alpha clarification. As hard as it is to believe, the S&P 500 underperformed a 15-year average duration Treasury STRIPS portfolio (Ryan Liability Benchmark Index) by **- 75.88%** over those three years:

	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>Cumulative</u>
S&P 500 Index	- 9.09	11.86	- 22.08	- 20.76%
Ryan Liability Benchmark	25.96	3.08	19.47	<u>55.12</u> - 75.88%

Assets vs. Liabilities

In the last 20 years ending 12/31/09, it is hard to find a single asset class away from bonds that outperforms liabilities as measured by the Ryan Liability Benchmark Index (1-30 year Ryan Treasury STRIPS yield curve indexes equally weighted). As the graph attached shows, I compared the popular generic market indexes vs. the 1-30 year Ryan Treasury STRIPS yield curve indexes with each red dot representing a 1-year incremental maturity (which equally weighted comprise the Ryan Liability Benchmark Index). As hard as it is to believe, all non-bond indexes underperformed the Treasury STRIPS Index that had a similar standard deviation (STD). Only the Lehman Aggregate and the ML high yield index outperformed the Treasury STRIPS Index with a similar STD although by very little. Noticeably, as you extend duration on the liability curve (Treasury STRIPS yield curve) liability returns increased in a rather linear fashion. This shows how interest rate risk dominates the risk/reward of Treasuries and liabilities (systematic risk). This is why it is so critical to match the interest rate risk of liabilities. Since most pensions have an average duration of 10 to 15 years, if you focus on the red dots on the Treasury STRIPS yield curve between 10 and 15 years (10th thru 15th dots), you will notice that no generic market index outperformed this area or average liabilities. Moreover, there are few generic market indexes that behave like 10 to 15 year Treasury STRIPS (ML Convertible Index only index observation that came close).

Ryan ALM, Inc. Assets vs. Liabilities Scoreboard Twenty Year Returns Ending 12/31/2009



Sources: Ryan ALM, Standard & Poor's, Barclays Capital Inc., Merrill Lynch, Morgan Stanley, Frank Russell, CSFB/Tremont, Dow Jones.
The information presented was compiled from sources believed to be reliable, and is furnished without responsibility for accuracy. Past performance does not guarantee future results.

Portable Alpha

Most Portable Alpha strategies today not only measure Alpha vs. a generic market index but also use the generic index as their Beta portfolio (generic index fund). This is incorrect thinking and inconsistent with any liability objective. The S&P 500 as an index fund could never represent the Liability Beta portfolio. That is also true for every asset class except zero-coupon bonds matched to liabilities. Using inappropriate asset classes and portable alpha strategies, a pension fund could lose at least three ways here:

- 1. Alpha portfolio loses to liabilities (CLI)**
- 2. Beta portfolio loses to liabilities (does not match liabilities)**
- 3. Performance fee paid on wrong Alpha measurement**

The asset side must be in sync with the liability objective if the asset side is to function properly. Without a CLI, how could Asset Allocation, Asset Management and Performance Measurement work properly? They all link to the liability objective as best measured by the Funded Ratio (assets/liabilities in market value dollars). Their needs to be coordination and orchestration of all asset functions in harmony with **the true objective... funding liabilities at low and stable cost with reduced risk to the plan sponsor.**

Index Funds as the Risk-Free Assets

I had the unique pleasure to brain storm with the Nobel Prize winner Bill Sharpe several years ago. He is certainly one of the outstanding intellects I have ever encountered. He was also a good listener. I explained to him how I thought that **the risk-free asset was always the asset that matched the objective with certainty** rather than the Sharpe Ratio approach using the lowest volatility asset (i.e. 3-month T-Bill) as the risk free asset. I gave Professor Sharpe two examples to prove my point:

1. Objective = S&P 500

The lowest risk asset here with this objective would be an S&P 500 index fund or ETF that matches the objective with certainty. The 3-month T-Bill would be very risky here as it could never match with any certainty the risk/reward behavior of the S&P 500. Professor Sharpe agreed.

2. Objective = Liabilities

Liabilities tend to be a schedule of monthly payments extending far out into the future so I asked Professor Sharpe what is the lowest risk asset I could buy to fund the 10-year liability. He said a 10-year Treasury zero-coupon bond that matches the liability payment with certainty. The 3-month T-Bill would again be very risky since it would have 39 reinvestment moments, 39 moments of uncertainty over a 10-year horizon.

I concluded with the obvious fact that **the objective decides what the risk-free asset is**. You cannot have a *generic* risk-free asset that applies to all objectives especially liability objectives since each liability is a unique set of cash flows (payment schedule). **Risk is best defined as the uncertainty of not meeting the client objective!** The greater the uncertainty... the greater the risk! Accordingly, if the liability objective is best measured as a custom liability index then a custom liability index fund is the risk free asset! Bill Sharpe agreed and proceeded to create a new Sharpe Ratio that focuses on the objective and not the 3-month T-Bill. The industry uses this concept as the Information Ratio.

PIPER Study

The PIPER is the oldest and most comprehensive performance study of asset management available today. In fixed income it consistently shows that there is little or no value added in *active* bond management. For almost any time horizon the PIPER study (see Table 2) shows that the median bond manager underperforms or barely outperforms the popular bond market benchmarks (i.e. Barclay's Aggregate). However, this study is *before fees*. After fees the median bond manager consistently underperforms the bond market.

Table 2

PIPER Study

(Domestic Fixed Income Managers for Investment Grade)

<u>Last 10 years ending:</u>	<u>12/31/08</u>	<u>12/31/09</u>
1st Quartile	5.75%	6.92%
Median	5.22%	6.46%
Barclay's Aggregate	5.63%	6.33%

The PIPER study is a product of Pensions & Investments magazine and is calculated by Morningstar.

If 50% of an asset class consistently underperforms its market benchmark... you index that asset class! As a result, bonds are best managed as index funds. The real question is what index to use? The answer is the index that best represents the client objective. If the objective is liability driven, only a Custom Liability Index could best represent the true client objective. As a result, bonds should be managed as Liability Index Funds (i.e. the Beta or core portfolio). The benefits of a Liability Index Fund (Beta Portfolio) are numerous:

1. Best matches and funds liability payment schedule
2. Reduces the volatility of the Funded Ratio
3. Reduces Contribution Costs
4. Eliminates Interest Rate Risk
5. Reduces asset management fees

Conclusion

Only a Custom Liability Index is the appropriate asset benchmark for liability driven objectives. With a Custom Liability Index, Beta and Alpha portfolios are redefined and can work in harmony with the true objective. Asset management can now understand the risk/reward behavior of the true economic objective especially the Liability Beta portfolio which should be installed as the *core portfolio*. Performance measurement can now properly assess the risk/reward behavior of assets vs. the liability objective to monitor that the assets are on track to fund a unique set of cash flows. Asset allocation can now understand and focus on the true economic Funded Ratio (market value of assets/liabilities). A large deficit should certainly have a different asset allocation than a surplus position. Without a Custom Liability Index all asset functions are in jeopardy of being managed vs. generic market indexes which will misinform and mislead the assets. With a CLI, all asset functions can now work in harmony with the true client objective (funding liabilities). The financial moral of our story is: **given the wrong index... you will get the wrong risk/reward!**