



Insights on...

## HOW THE LIABILITY BENCHMARK IS DEVELOPED AND USED IN PRACTICE

*In the wake of pension legislation passed in the United States and throughout the United Kingdom and Europe, pension plan stakeholders are looking at their plans in a new light. In a paradigm shift away from measuring plan assets versus a policy benchmark, plan sponsors are focusing on the liability side of the equation like never before by measuring asset performance relative to movements in liabilities. In order to appropriately examine the risks involved with a pension plan relative to its liabilities, it is important to understand how the liabilities — as defined by benefit cash flows — can be modeled to create a measurable index.*

### WHAT IS THE LIABILITY BENCHMARK?

Quite simply, the liability benchmark represents the fair market value of a pension plan's obligations. In this context, it is similar to a standard market index that represents a collection of securities that can be used to analyze performance.

In a Liability Driven Investing (LDI) framework, the liability benchmark will serve as the new scorecard for plan sponsors to measure plan performance. In the past, the asset only benchmark for a plan was a blend of market indices, typically a policy benchmark. This policy benchmark could be comprised of, for example, 50% domestic equity, 20% international equity and 30% domestic fixed income. Historically, the benchmark was intended to mirror the asset allocation established by the plan sponsor or plan trustee in order to compare asset only results with the blended index performance. If the plan assets outperformed the policy benchmark, then all was well, even if the funded status of the plan deteriorated because of adverse movements in plan liabilities. In an LDI framework, where the liabilities are the focus, the appropriate benchmark is the plan liabilities.

At the end of the day, a pension plan exists for the purpose of providing benefits to pension plan participants. If this is the case, shouldn't the benchmark that measures the performance of plan assets in fact be their liabilities? Aligning the plan assets to make certain of these payments requires measuring their performance relative to the liabilities they are expected to support. There are many stakeholders who are concerned with the health of plan assets relative to liabilities, from plan sponsors and plan trustees to plan participants, actuaries, accountants and certainly, governments. Providing these stakeholders with an accurate measure of the pension plan's status is critical to align interests and ensure its survival. Thus, using the plan liabilities as the benchmark is the key to measuring its ongoing viability.

### UNIQUE BENCHMARK FOR EACH PLAN

When creating and analyzing a liability benchmark, it is important to know that each plan is unique in its characteristics. Plan demographics, plan type, participant age, number of participants and many other factors all come together to create a distinct liability cash flow profile. Certain providers in the marketplace offer liability indices that serve to benchmark the average pension plan liability. While these indices may give plan sponsors a sense of how the average pension plan is performing, there is no substitute for using the plan's own unique liability structure to understand the inherent risk plan sponsors face in their own plan.



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## CHARACTERISTICS OF A BENCHMARK

In creating a liability benchmark, it is useful to examine the development of existing market-based portfolio benchmarks and make comparisons to how those indices are established relative to the formulation of a liability benchmark. In this way, there is consistency in methodology, which translates into better understanding of the components and the calculation of the liability benchmark.

According to a study by Bailey, Richards and Tierney<sup>1</sup>, a typical portfolio benchmark should exhibit certain characteristics. Those characteristics, as well as how liability benchmarks share those characteristics, are presented in Table 1.

With the analysis in Table 1 creating the link between establishing a market index and a liability index, the construction and calculation of the liability benchmark can be examined.

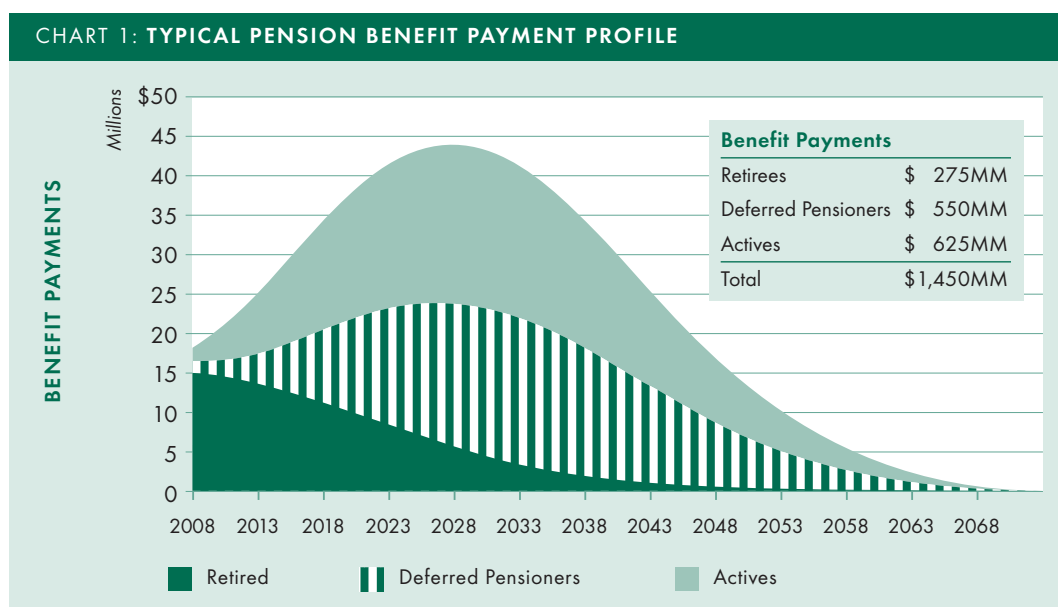
TABLE 1: SIX CHARACTERISTICS THAT DEFINE MARKET INDEXES AND HOW LIABILITY BENCHMARKS MEET THOSE CRITERIA

Characteristic	Definition	Liability Benchmarking: Meeting the Definition	Meets Benchmark Characteristic Definition
<b>Unambiguous</b>	The names and weights of securities comprising the benchmark are clearly delineated.	Liability cash flows contain a great deal of information on plan participants including their expected retirement dates, service costs, vested percentages, etc. These components represent the building blocks to create the cash flow profile of the liability stream, which can be replicated using swaps. Swaps can then be valued periodically like any other benchmark.	✓
<b>Investable</b>	The option is available to forgo active management and simply hold the benchmark.	Pension plans are essentially "investing" in this benchmark today as it represents future pension obligations. The streams of cash flows expected from specific plan obligations can be replicated using physical securities and/or interest rate and inflation swaps, making this liability benchmark investable.	✓
<b>Measurable</b>	It is possible to calculate the return on the benchmark on a reasonably frequent basis.	Cash flows, calculated by the plan's actuary, are discounted to their present value. After they are discounted, they can be measured on a monthly or even a daily basis to provide information on how the plan is performing relative to its liabilities.	✓
<b>Appropriate</b>	The benchmark is consistent with the manager's investment style biases.	There is no more appropriate benchmark for plan assets than its liability cash flows. The plan assets exist to pay pension obligations, thus, it is less meaningful to measure the risk/return profile of the plan assets against any benchmark other than the plan liabilities.	✓
<b>Reflective of current investment options</b>	The manager has current investment knowledge of the securities that make up the benchmark.	Since the liability cash flows are projected and discounted by the plan actuaries based on a variety of plan and actuarial information, the LDI portfolio manager has access to detailed information with regards to its components.	✓
<b>Specified in advance</b>	The benchmark is constructed prior to the start of an evaluation period.	Plan actuaries analyze and estimate the plan cash flows each year and thereby establish the basis for benchmark construction.	✓

Source: *Investment Analysis & Portfolio Management, 7th edition, Reilly & Brown, pp. 1140 and Northern Trust.*

## CREATING A LIABILITY BENCHMARK

There are a number of steps in creating the liability benchmark, the first of which is obtaining the projected benefit cash flows from the plan trustees or plan actuary. By receiving the cash flows directly from these providers, all pertinent information is captured, such as service costs, projected salaries, etc. At this stage, the plan sponsor or trustee, working with their advisors, determines the appropriate benefit payment profile to use in calculating the liability benchmark. In the U.S., this might be the ABO (accumulated benefit obligation) or PBO (projected benefit obligation), while in the U.K. it is typically the DBO (defined benefit obligation) that is modeled. Chart 1 below represents a typical benefit payment profile.

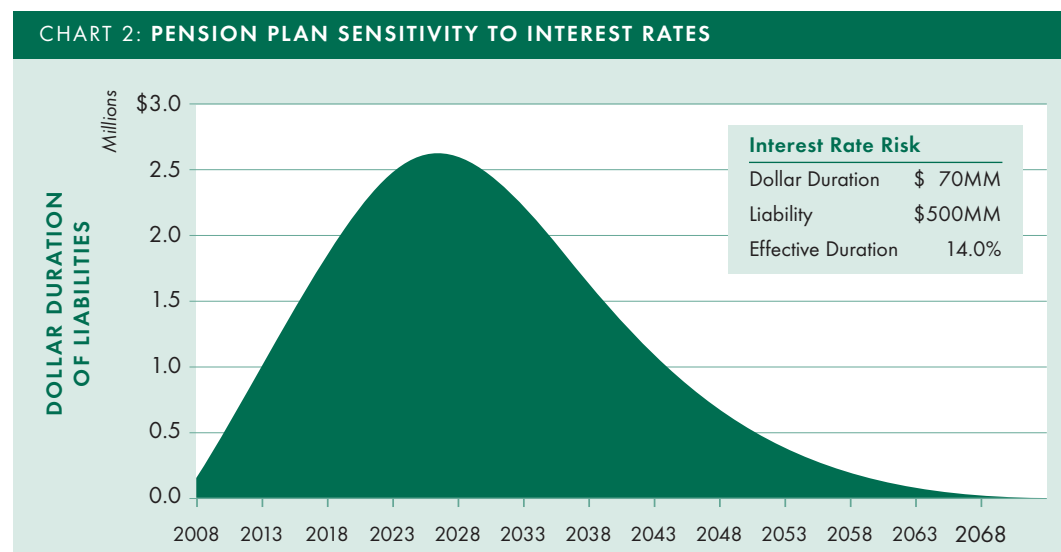


Source: Northern Trust.

It is important to note that no two plans are alike and economic and demographic assumptions made for various plans by different actuaries will vary. In addition, plan design will influence the liability benchmark result as the calculation takes into consideration cash balance plans, average pay plans, etc. Also, since different countries have created distinct accounting rules and regulations that apply to their own market environment, the application of those rules and regulations will affect the calculation of benefit cash flows in various ways.

Once all of these factors are taken into consideration, the cash flows need to be discounted to calculate their present value in order to understand their value in today's currency. In the past, the discount rates used typically were not market-based and allowed for asset outperformance; for example, by using a higher discount rate with an allowance for an equity risk premium. Stable and aggressive discount rates were used, resulting in stable and low plan liabilities. This led to plans reporting healthy funded statuses. If these same plans used a more "conservative" discount estimate (i.e., lower rates), then liability values would be much higher and plan funded status would be lower and more conservatively estimated.

In the new global pension regulatory environment, plans are being forced to reconsider the discount rates that they use to value plan liabilities. There is a shift away from using non-market based rates. The environment is pushing plan stakeholders towards measuring liabilities using a full yield curve approach based on either corporate or government yield curves. Chart 2 indicates the interest rate sensitivity of a hypothetical plan's benefit payments when examined across a full yield curve. The dollar duration of \$70 million (represented by the shaded area of the chart) indicates the interest rate exposure that exists within this plan if rates move by 100 basis points. In this case, if interest rates rise 100 basis points, the liability value will decrease by \$70 million. Conversely, if interest rates fall 100 basis points, the liability value will increase by \$70 million. In this simplified example, the effects of convexity have been ignored. The dollar duration is calculated by multiplying the liability value of \$500 million by its effective duration of 14%. In addition, the shape of the graph below indicates where the duration sensitivity is relative to each time period.



Source: Northern Trust.

In using the full yield curve approach, each cash flow relative to its point on the yield curve (i.e., key rate duration) is discounted back to the present. This allows for the better measurement of each cash flow and its contribution to the overall return (and volatility) of the cash flows, i.e., benchmark. In addition, this key rate duration approach is a better method for managing the assets that are required to service the plan liabilities, as those fixed income portfolios are certainly managed to full yield curves and not flat rates. For overlay portfolios, swaps also take into account the full yield curve. Plan stakeholders may want to use a number of different curves to discount their liabilities and create multiple liability benchmarks in order to better understand the sensitivities embedded under different scenarios.

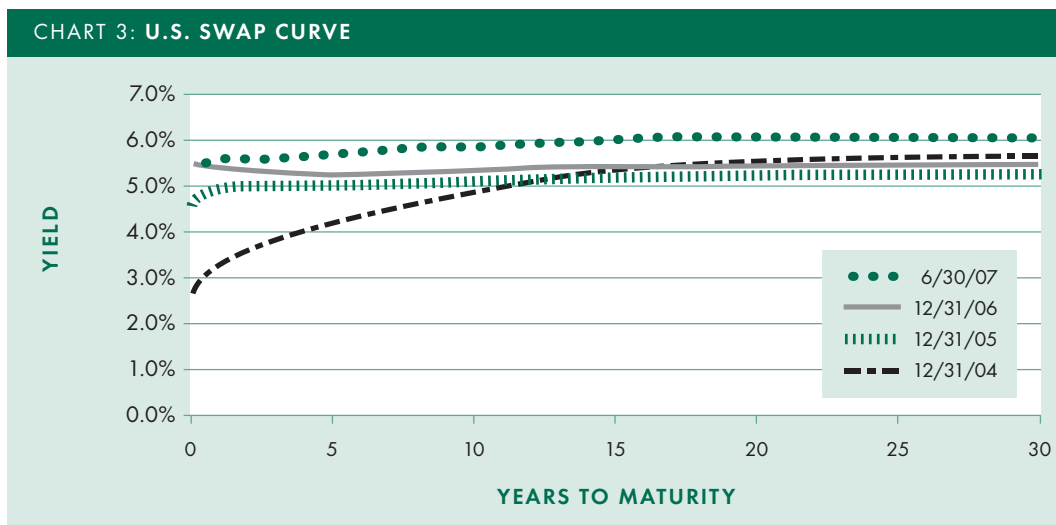
## MEASURING PERFORMANCE

Building on the previous example, assume for simplicity that the plan is ongoing and benefits continue to accrue. Now that the discount method is suggested (i.e., key rate duration approach using a selected yield curve) and the plan benefit cash flows have been obtained from the actuary, the liability benchmark can be created and measured on a monthly basis (or daily, if more timeliness is desired). The liability benchmark consists of several components, with time return and curve return being two key components. The product of these two components will then equal the total return of the liabilities.

The time return component of the benchmark calculation accounts for the monthly differences in the present value of the liability stream holding the yield curve constant between the start and end of each month; it essentially involves rolling down the yield curve. This component typically resembles the return of a short-term bond and exhibits less volatility of returns.

The curve return component of the benchmark calculation accounts for the monthly differences in the present value of the liability stream, taking shifts in the yield curve into consideration. This component tends to exhibit more return volatility as it accounts for changes in the yield curve, taking into consideration all points across the curve.

Chart 3 shows the actual U.S. Swap Curve at year end 2004 through year end 2006, and at June 2007. The shifts in the curves over the time periods presented indicate the volatility that may occur when utilizing a full yield curve approach to value the plan's liabilities.



Source: Northern Trust.

Once the time return and curve return components are calculated, the product of the two results produces the total return figure. The calculation is performed by adding 1 to each component before multiplying them together, then subtracting 1 from the result. The component and total return results utilizing the U.S. Swap Curve for the calculation are shown in Table 2. The process can be repeated each month to generate the liability benchmark over time.

TABLE 2: LIABILITY BENCHMARK PERFORMANCE			
Period	Time Return	Curve Return	Total Return
2005	3.10%	5.71%	8.99%
2006	4.84%	-3.53%	1.14%
First Half 2007	2.65%	-8.07%	-5.64%
<b>Total</b>	10.96%	-6.26%	4.01%
<b>Total Annualized</b>	4.25%	-2.55%	1.59%

Source: Northern Trust.

Going forward, this benchmark can then be used to compare plan results utilizing standard benchmark analysis. This analysis includes calculating standard deviation of the benchmark, tracking error relative to plan assets (i.e., measurement of funded status volatility), periodic rates of return and more. Tracking error is arguably the most important measure because it indicates how closely the returns of the plan assets are tracking the liability returns. This is the goal of LDI, to minimize tracking error by reducing unrewarded risks in the portfolio — namely interest rate and inflation risks. This frees up the risk budget for return-enhancing investment strategies. Working with this framework ensures that plans focus on the risk inherent in the liabilities while growing assets to close any funding gaps.

Table 3 below indicates those characteristics that would be available to examine the liability benchmark and better understand its sensitivities.

<b>TABLE 3: LIABILITY BENCHMARK CHARACTERISTICS</b>	
<b>Projected Benefit Payments</b>	\$ 1,450,000,000
<b>Liability</b>	\$ 500,000,000
<b>Equivalent Level Discount Rate</b>	6.0%
<b>Weighted average maturity (years)</b>	22.4
<b>Interest Rate Risk</b>	
Effective Duration	14.0%*
Effective Dollar Duration	\$ 70,000,000
<b>Key Rate Duration</b>	
Key Rate Duration 1–10 Years	1.8%
Key Rate Duration 11–20 Years	4.7%
Key Rate Duration 21–30 Years	4.5%
Key Rate Duration 30+ Years	3.0%
<b>Yield Curve Risk (short-end decreases 1.0%)</b>	
Sensitivity	4.8%
Dollar Sensitivity	\$ 24,000,000
<b>Inflation Risk</b>	
Inflation Sensitivity	4.2%
Inflation Dollar Sensitivity	\$ 21,000,000
<b>CURRENCY</b>	100% U.S. Dollar

\*Subject to convexity 1.5%

Another way to replicate the liability benchmark is to create a liability index using index provider swap securities. The industry offers many swap securities as stand alone indices that can be combined across the curve to replicate a scenario similar to the cash flow profile of a pension plan. Since the liability benchmark is simply the liability cash flows discounted at a specific curve, the securities that comprise that curve can be used to replicate the benchmark. In this way, all of the typical index characteristics of the benchmark can be generated, which will provide more insight into the liability cash flows. When examining the actual liability cash flows, characteristics such as duration, convexity, maturity, key rate durations, etc., are available for analysis. In addition, automated, daily values would also be available from these providers as well as daily and monthly performance information.

Whichever way a plan chooses to create, maintain and analyze the liability benchmark, the benefits of doing this are certain. By creating the liability benchmark and consistently using it to measure a plan's asset performance relative to liabilities, the plan can be managed in a much more efficient manner that is appealing to all stakeholders. This in turn will allow a pension plan to maintain its health and be well positioned to be able to pay benefits to beneficiaries for years to come.

Footnote:

1. Investment Analysis & Portfolio Management, 7th edition, Reilly & Brown, pp. 1140

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