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# The Case for LDI in Any Interest Rate Environment: Clarifying LDI Misconceptions

*By: Andrew Catalan, CFA,  
Managing Director, LDI Strategies*

***Liability Driven Investing Solutions:***  
*Drawing on over 75 years of fixed income experience, Standish is your choice for specialized fixed income and investment management.*

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## Executive Summary

While many investors accept the notion of managing their assets to their expected liabilities in theory, there continues to be a number of misconceptions about liability-driven investing (LDI) that prevent them from implementing such strategies in practice. The current market environment of low interest rates and heightened volatility has only added to investor uncertainty regarding LDI. The following discussion looks at the 10 most common questions we receive from clients, consultants and prospects about LDI. We seek to resolve some of the misunderstandings about what LDI is and is not, clarify how Standish approaches LDI solutions and argue the case for why investors should consider an LDI approach even in a low interest rate environment.

## Introduction

Standish manages over \$95 billion in assets, of which over \$12 billion are LDI strategies for more than 35 clients as of June 30, 2012. We define LDI investing as a process for allocating assets within a liability-conscious framework. Plan sponsors can use LDI to determine which investment strategy is likely to accomplish their liability-based objectives without violating their risk budget. These objectives can include funded status management, cash contribution requirements, reduced volatility of pension expense (as reflected on a company's income statement), or termination surplus/deficit status.

The appropriate asset allocation will depend on how much liability-based risk the sponsor is willing to assume. The benefits of an LDI strategy may include a higher expected portfolio return and lower funded status volatility, depending on the approach. Because the duration<sup>1</sup> of liabilities for most pension plans is long, sponsors who have adopted an LDI framework often extend the duration of their assets by purchasing long duration cash bonds or incorporating derivatives such as interest rate futures or swaps. We believe that establishing an analytical framework is the critical first step in considering any LDI approach. Once objectives and triggers for adjusting allocations have been identified, the plan can be executed based on an investor's risk and return guidelines.

Interest rate risk is one of the main variables investors seek to mitigate with LDI solutions. Given the current historically low interest rates, many investors wonder if they should wait for interest rates to rise (which would reduce the present value of their liabilities) rather than implementing an LDI solution now. Not surprisingly, this is the most frequent question we receive these days. Below, we discuss this and other common questions surrounding the implementation of an LDI strategy.

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“Standish believes that a pension fund's interest rate risk represents uncompensated risk.”

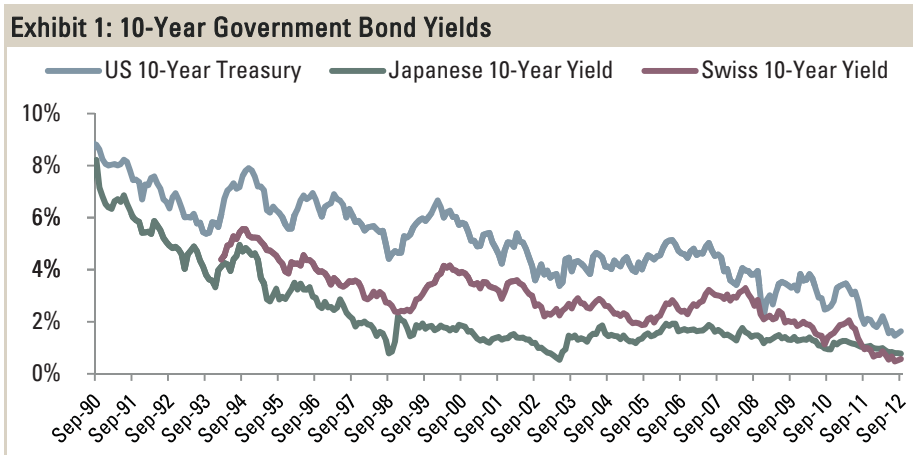
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<sup>1</sup> Duration is a measure of the sensitivity of values of assets and liabilities to changes in interest rates. The longer the duration, the more these change with rates.

## 1. Should we implement LDI in this low interest rate environment?

Standish believes that a pension fund’s interest rate risk represents uncompensated risk. If interest rate risk has not been eliminated for an underfunded pension plan, sponsors wonder if a loss should be locked in by increasing long duration assets while rates are low.

Our analysis shows that interest rates are currently below fair value based on fundamental factors. Yet, a return to a long-term equilibrium may still be some time off. Historical evidence indicates that interest rates tend to remain low for an extended period of time following financial crises. Exhibit 1 shows the yield of three sovereign 10-year bonds, the U.S., Japan, and Switzerland, over the past two decades. This chart raises the possibility that in the U.S., rates could go lower and remain low for an extended period.



Source: Bloomberg as of September 30, 2012

In the event of a major shock, such as the European debt crisis spiraling out of control, U.S. interest rates could go lower. Alternatively, the liquidity that has been pumped into the system by central banks could drive rates higher over the longer term if the expansion of the monetary base leads to faster inflation, which would likely cause central banks to tighten monetary policy.

Each basis point of interest rate lowering that takes us closer to 0% raises the question of when rates will reverse course. For a pension plan that is fully funded and has had most of its interest rate risk hedged for some time, the path is clear, since its funded status will remain intact if interest rates rise. For plans where a loss may be incurred on a new contribution or if assets are transitioned, committing new funds to long duration assets is a less clear-cut choice.

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However, predicting the direction of interest rates within any kind of precise time frame is one of the most elusive aspects of investing. We therefore argue that establishing goals against a pre-established risk budget, regardless of the current level of interest rates, should be the focus for plan sponsors.

We see four compelling reasons why investing in long corporate bonds as the foundation of a long duration LDI portfolio makes sense, even at current low rates. First, interest rates impact both assets and liabilities. Even after investing in long corporate bonds, if a plan's asset duration is less than its liability duration, an increase in rates will still improve the funded status. It is important to understand how both sides of the ledger will change when interest rates rise. Second, the yield curve is at historically steep levels. The Federal Reserve has anchored short-term rates near zero through two rounds of quantitative easing, and there is an opportunity cost holding shorter duration assets. Part of the principal loss from a gradual rise in rates is offset by the higher yield. Third, corporate bond spreads are at historically wide levels. The macroeconomic conditions that are likely to push rates higher will also tend to drive spreads tighter, muting the increase in the total yield. Finally, while rates are historically low now, sluggish growth generally justifies their current levels. From a tactical perspective, rates might be below an optimal level, but this new low level could persist for a prolonged period if current headwinds continue to weigh on growth.

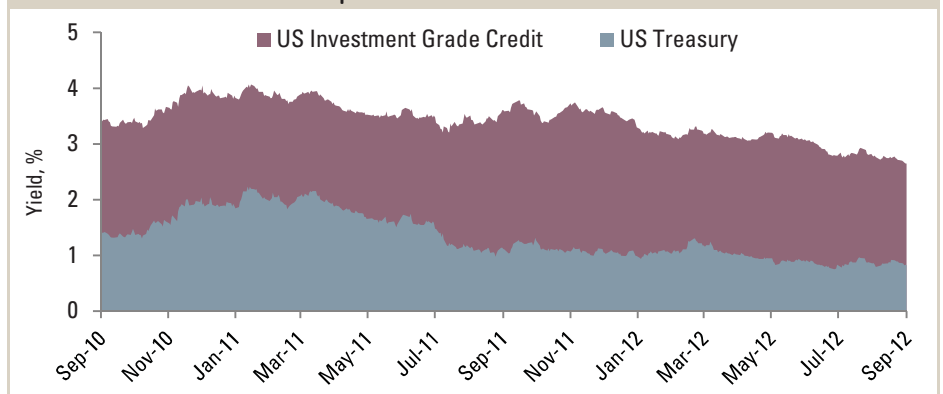
Exhibit 2 shows that currently, a large proportion of the overall yield in a long corporate strategy is derived from corporate spreads.

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“When a sponsor adopts an LDI framework, he typically establishes a balanced allocation of return-seeking assets and fixed-income hedging assets.”

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**Exhibit 2: Bond Index Yields & Spreads**



Source: Bloomberg as of September 30, 2012

We think there are sensible ways to incorporate this interest rate uncertainty into LDI approaches. One way toward increasing long duration assets in an LDI framework is to establish a glide path in which interest rate risk is diminished over time. This process can incorporate the sponsor's view on the direction of rates, and base triggers for adjusting allocations on time, the level of rates and/or funded status. This is the dollar cost averaging approach that is often used in building portfolios.

## 2. Does a plan that implements LDI have to invest 100% of assets in fixed income?

Plan assets can be categorized as either return-seeking or hedging. The return-seeking category includes more obvious candidates such as equities and alternatives. Corporate bond hedging strategies typically are anchored with long duration corporate and government bonds. Fixed income strategies such as emerging markets debt, high yield and opportunistic also fit into the return-seeking category, as they have higher expected returns but lower correlations with liabilities. When a sponsor adopts an LDI framework, he typically establishes a balanced allocation of return-seeking assets and fixed-income hedging assets. The amount allocated to fixed income will be based on plan status, plan type, funded status, interest rate outlook, liability duration, plan objectives and the sponsor's ability and willingness to take risk. Plan sponsors that adopt an LDI framework may consider a wide range allocation to fixed income assets. We provide two examples below.

Example 1: The sponsor of an ongoing pension plan might reduce their funded status volatility by redeploying their fixed income allocation from core bonds<sup>2</sup> to long duration bonds and hedge the remaining interest rate risk exposure with derivatives. In this example, the sponsor does not increase the fixed income allocation and typically increases the portfolio's expected return target.

Example 2: The sponsor of a fully-funded, frozen pension plan realizes there is little upside to maintaining an allocation to return-seeking assets such as equities and alternatives. Tax rules impose income and excise taxes on any reversion of plan assets back to the plan sponsor when the plan is terminated.<sup>3</sup> Given this asymmetric pay-off profile, the sponsor decides to immunize the plan's liability movements by moving to a 100% fixed income portfolio, thus preserving the plan's fully funded position.

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<sup>2</sup> Core bonds are intermediate duration bonds often benchmarked to the Barclays Aggregate Index.  
<sup>3</sup> Internal Revenue Code §4980.

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“In our view, active fundamental research is critical in assessing a long duration bond that could lose some of its value if downgraded below investment grade.”

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### 3. Why select active management for long duration bonds given the lower fees associated with an index fund?

We believe there are sufficient inefficiencies in the corporate bond market to warrant an active approach to selecting the appropriate long-duration exposure. Corporate bonds occupy a part of the market that is less liquid and efficient than other segments. There are no organized exchanges, so most transactions are negotiated between two parties, namely a dealer and the asset manager.

Indiscriminately buying securities in a bond index creates a risk of overpaying for smaller, infrequently traded issues. Exiting that same position could also be costly if an investor seeks to liquidate during a market downturn when buyers prepared to take the other side of the trade become scarce. Credit analysts evaluate these issues for active managers when they assess both the credit quality of the issuer and the relative spread for an issuer and the issue itself. We believe this continuous assessment builds the potential for adding risk-adjusted, net of fees, excess returns over the index return with active management.

We also believe that independent credit analysis is an important benefit that active managers can provide. Many investors are re-evaluating the reliability of the agencies' ratings following the poor performance during the financial crisis of securities rated highly by the agencies. To remain investment grade, securities need a median rating of BBB- or better from the three major credit agencies (Moody's, Standard & Poor's and Fitch). Credit analysis is particularly important for selecting BBB-rated credits, which can be heavily penalized if downgraded to high yield. Transition data from the rating agencies shows that over a long period, on average 5% of those securities rated BBB are downgraded below investment grade over the coming twelve months. In our view, active fundamental research is critical in assessing a long duration bond that could lose some of its value if downgraded below investment grade.

There is also the opportunity with active management to add value by selecting bonds that are not in the index, because they do not fit the criteria established by the index provider. Private placement securities issued by non-U.S. companies or private companies fit this description. These are included in the Bank of America Merrill Lynch indices but not the Barclays indices, and offer the potential to add incremental yield and total return. Finally, customizing a portfolio based on client guidelines or objectives can more easily be accommodated in an actively managed strategy.

The key objective of an LDI fixed income strategy is to increase the correlation between asset and liability returns to reduce funded status volatility. The major factors that accomplish this objective, in order of importance are: overall asset duration; credit quality; industry exposure; corporate bond spreads; and yield curve exposures. The active long duration strategy that Standish constructs to hedge liabilities starts by matching those major factors to the benchmark. Active risk is then used to purchase bonds that have been deemed to meet a particular credit quality, valuation metric and liquidity based on our proprietary analysis. The objective is to employ a modest amount of tracking error in achieving excess returns over a cycle while providing the liability hedge and protecting against downgrade risk. Ultimately a client's philosophy will dictate whether to implement an active or passive approach in LDI.

#### 4. What is an appropriate benchmark for a plan's fixed income allocation in an LDI strategy?

Pension liabilities are discounted using long-dated, high-quality corporate bonds; therefore, a good starting point in selecting an appropriate benchmark is to consider duration and sector composition. Most long duration benchmarks have durations greater than 12 years and will be suitable for increasing the plan's interest rate hedge. In Exhibit 3, we show the characteristics of the two commonly used benchmarks in LDI solutions and a custom benchmark often recommended by Standish to LDI clients.

<b>Exhibit 3: Barclays Benchmark Characteristics</b>			
	<b>Long Gov/Credit</b>	<b>Long Corporate</b>	<b>Custom Benchmark<sup>†</sup></b>
Duration	14.79 years	13.90 years	14.64 years
AAA %	42.9%	1.1%	30.6%
AA %	7.4%	7.0%	5.1%
A %	23.8%	46.1%	32.3%
BBB %	26.0%	45.8%	32.1%
Avg Quality	A+	BBB+	A+
Yield to Maturity	3.64%	4.44%	3.87%
Correlation to Liabilities*	0.93	0.91	0.95
Liability Tracking Error	4.63%	4.88%	4.10%

*\*Based on typical pension plan. <sup>†</sup> 70% Long Corporate / 30% Long Government  
Source: Barclays as of September 30, 2012. Liability correlation data as of December 31, 2011.*

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The benchmark needs to include an investment universe that satisfies three criteria: it needs to be an investible universe; diverse enough to mitigate downgrade/default risk; and it needs to closely match the liability returns. Each of the benchmarks in Exhibit 3 provide the building blocks to hedge interest rate risk as well as quality or spread risk. The optimal blend of interest rate and spread risks is dependent on how much of these the plan sponsor is currently hedging versus the ultimate objective. The 70% / 30% benchmark is designed to allow Standish to have more flexibility to alter the weights of each component depending on market conditions to take advantage of opportunities and reduce risk when appropriate.

Finally, for some investors it may be appropriate to construct a custom liability benchmark to best reduce tracking error relative to the liability. A method we use at Standish is to decompose the Barclays AA Corporate Index into five-year segments that are weighted to match the plan's liabilities. A portfolio is then constructed, combining corporate and government bonds along the curve. Key rate and overall durations are matched, as is the average credit quality of the portfolio relative to the custom benchmark. Our implementation strives to have less concentration of names in the portfolio relative to the AA benchmark, since we utilize the entire investment grade credit spectrum. We believe this is a more prudent approach.

### 5. Should I invest only in high-quality (A to AAA) bonds to best match the discount curves?

Standish recommends using the entire investment grade credit curve when selecting a long duration strategy. This is premised primarily on the practical aspects of implementing a solution that recognizes certain limitations in the market. The long corporate bond market as represented by the Barclays Long Corporate Index is less than \$1 trillion. Compare this to several trillion dollars in pension and insurance assets that present potential demand for these securities. Strip out the BBB component and the investible universe is reduced by an additional 45%.<sup>4</sup> In order to build a prudently diversified portfolio, we believe the investible universe on the asset side should be as broad and diverse as possible.



The discount rates used on the liability side are a theoretical construct that was not necessarily intended to be replicated on the investment side. The concentration of names, particularly in the accounting discount curve (as high as 20% per issuer<sup>5</sup>) would not present tolerable concentration risk in a bond portfolio. The implications of credit deterioration in a company represented in the discount curve and in the asset portfolio could present a double negative to the plan's funded status. Presuming the hypothetical deteriorating credit has a higher yield, it would fall out of the discount bond universe when downgraded, driving the discount rate down. If the same company is held in the asset portfolio, it would likely drop in value. Asset values would drop on one side and the value of the liability would rise on the other. We refer to this as the "double whammy".

Many stable credits are represented in the BBB space. Electric utilities, cable and railroad companies, for instance, have some of the most stable credit profiles and are typically rated BBB. Ironically but predictably, many of the credit issues over the past few years have centered on the higher-rated financial institutions. The higher yields offered by BBB's, if properly selected using active fundamental research, can provide some protection from a credit event. A high-quality corporate bond with a duration of 15 years and trading at a spread of 60 basis points (bps) over Treasuries, would lose its spread advantage for an entire year if it widens by only 4 bps. The announcement of an acquisition or a share repurchase might easily lead to 10 to 20 bps of widening. A BBB-rated credit with a duration of 15 years trading at Treasuries plus 200 bps can widen by 13 bps before it offsets a year of carry, thus providing a better cushion. Put another way, the asymmetric risk/return profile of corporate bonds worsens as investors move up the credit quality spectrum. An AAA-rated bond has only one direction to move.

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<sup>5</sup> Ibid.

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“Our Monte Carlo simulation model forecasts possible ranges of relevant pension measures such as funded status, cash contribution requirements, pension expense, and termination surplus/deficit.”

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## 6. How does Standish analyze a plan’s liabilities?

Standish begins by requesting a plan’s current strategic asset allocation, benchmarks for each asset class, the most recent month-end portfolio value, the most recent Projected Benefit Obligation (PBO) cash-flow stream and the most recent pension accounting disclosures. This information allows us to calculate the funded status standard deviation (a liability-based risk measure) and determine how each asset class contributes to this volatility. We also calculate the levels of interest rate risk, spread risk, and curve risk that are being hedged. Our Monte Carlo simulation model forecasts possible ranges of relevant pension measures such as funded status, cash contribution requirements, pension expense, and termination surplus/deficit. Finally, we determine the correlation and tracking error of various LDI strategies using a plan’s liability return. We use these to assess the pros and cons of various strategies to determine an appropriate LDI strategy for a pension plan.

## 7. What is a glide path? How is it structured?

A glide path is an asset allocation model used to gradually de-risk a pension plan over time. Glide paths typically incorporate “triggers” such as funded status, time intervals, and interest rates, or a combination of these factors. The first phase of the glide path is usually the existing asset allocation, while the final phase (or endgame) will be based on plan status, plan type, long-term return target, plan objectives, and the sponsor’s ability and willingness to take risk.

For example, a frozen plan sponsor may have an endgame of 100% fixed income, while an ongoing plan with an 8% expected return and hedging 100% of the sponsor’s interest rate risk may have an endgame with only a moderate allocation to fixed income.

Glide paths are often agreed upon by a plan’s investment committee and board members in advance. By securing agreement from key parties in advance, plan sponsors can move quickly when glide path trigger points are reached. We believe an attractive feature of glide path structures is that they diversify the timing risk of LDI implementation.

## 8. How does Standish evaluate the level of interest rates and forecast their future direction?

Standish evaluates interest rates each month through econometric models and in-depth qualitative assessment of economic conditions. We use a short-term model that serves two functions. First, the model estimates the current fair value across the yield curve to assess whether rates are currently too high or too low. Second, after a discussion of the model's signals and current macroeconomic conditions, we use the model to establish several scenarios on a probabilistic basis, including values for each macroeconomic factor under such a scenario, which in turn generates a forecast six months into the future.

We also evaluate future rates over a five-year horizon using our long-term model. The primary difference between the two models is the influence of the U.S. government's fiscal position. In the short term, bond investors will often give a government that has been fiscally responsible in the past the benefit of the doubt that it will restore fiscal balance at some point in the future. Consequently, a government can temporarily run large budget deficits without experiencing a material increase in its borrowing costs for periods of three to five years. However, over longer periods, governments that run persistent or structural budget deficits are forced to pay a premium to borrow due to a perceived elevated risk of default. Our independent analysis suggests that the premium investors demand ranges between 20 and 30 bps for each percentage point increase in the structural budget deficit. Today, the U.S. structural budget deficit may be as much as three to four percentage points higher than it was before the financial crisis. That would imply 10-year Treasury yields that are 60-120 bps higher in long-term equilibrium than would otherwise be the case.

These econometric models provide a valuable framework for assessing at what level interest rates should be relative to where they actually are, based on fundamental factors. There are many macro events that drive rates and these technical factors can cause rates to be less predictable and to deviate from fundamental valuation. For example, we believe the current flight to quality resulting from the European debt crisis is the largest driver of the current deviation from fair value for interest rates, explaining as much as 100 bps of the richness in Treasuries.

## 9. Are derivatives appropriate to use in an LDI Strategy?

Derivatives can play an important role in the management of an LDI strategy from both a strategic and tactical perspective. Derivatives used in LDI strategies include futures, swaps and options or swaptions. Of these, futures are the most commonly used. We use these instruments in an LDI framework to synthetically adjust duration on an explicit basis (futures and swaps) or a contingent basis (swaptions and options). At a strategic level, a plan sponsor can use derivatives to extend duration without committing as much capital as needed with cash bonds. This allows the plan to maintain an allocation to risk-seeking assets while hedging part or all of the interest rate mismatch between assets and liabilities. On a tactical level, a portfolio manager can adjust duration efficiently in a portfolio using derivatives.

Futures provide a practical vehicle to alter duration. As exchange-traded securities, they do not involve counterparty risk (other than that of the exchange). Contracts are limited to 2, 5, 10 and 30 years as well as an ultra-long contract. The introduction of the ultra-long contract by the CME in January 2010 was welcomed by LDI investors since they provide a longer duration of nearly 20 years. Ironically, at current yield levels the 30 year futures contract has a duration of only 11 years as these futures represent a basket of eligible treasury securities including some with short durations.

Swaps are over-the-counter instruments that introduce counterparty risk with a dealer but offer two attractive characteristics. First, swaps are highly customizable. Second, swaps can accommodate durations longer than that offered by futures. Long-dated swaps are currently less attractive than futures because they are relatively more expensive.

Swaptions can be used to alter the duration profile of the assets on an asymmetric basis; that is, more duration impact in a rising interest rate environment, or vice versa. Since swaptions provide insurance against interest rate fluctuations, the premium can be expensive and if the swaptions expire out of the money, that premium is lost. Accordingly, swaption strategies can be structured as costless packages by both buying and selling options in order to mitigate out-of-pocket costs. A swaption strategy can also be tied to a plan sponsor's glide path. For example, by selling a payer swaption at a strike price above the current forward rate, a plan sponsor can collect a premium if rates remain below the strike, but also add duration at higher rates. This effectively increases the plan's interest rate hedge as rates rise in line with the pre-established glide path.

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“Swaption strategies can also be tied to a plan sponsor's glide path.”

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Collateral requirements are an important consideration in establishing derivative positions. Implementing an overlay requires initial margin requirements as well as maintenance margins. Capital used as collateral must be maintained in highly liquid securities with the overlay manager. In a rising rate environment, a derivatives position will lose money and require replenishing the collateral capital. We believe plan sponsors need to carefully consider the availability of liquid collateral when using derivatives. In particular, while funded status may remain hedged in a rising rate environment, liability decreases do not create liquid assets to meet margin collateral calls on the derivatives.

## 10. What is a minimum level of tracking error that can be achieved in an LDI strategy?

There are several sources of tracking error in an LDI framework. Even if a fully funded plan were to fully immunize its liabilities with a 100% allocation to fixed income, the minimum possible tracking error would still likely be approximately 4% annually.<sup>6</sup> Consider what happens if Company X were to be downgraded from AA to BBB. The bonds were likely already trading at wide levels relative to other credits on the discount curve. If downgraded, removal from the bond universe would cause the discount rate to fall, increasing the present value of the liabilities. If the same position was held in the portfolio, the downgrade might result in a decline in price, thus reducing asset values. This double whammy described earlier results in some measure of tracking error. Other methodologies for discounting liabilities also contribute to tracking error levels.

Another source of tracking error is introduced by an active strategy relative to a manager's benchmark. This tracking error is expected to contribute to excess returns over time. Standish's philosophy is to take modest levels of active risk but maintain portfolio characteristics that are consistent with hedging the liabilities. As plan sponsors implement LDI strategies and progress along their glide path, we believe reducing, rather than eliminating tracking error is a realistic goal.

The volatility of returns in an LDI framework should shift depending on the goals of the fixed income portion of the portfolio. Similar to the glide path framework, the range of tracking error for the portfolio should decline as the plan gets closer to fully funded status. Plans that want to generate alpha within the fixed income portion tend to be moving towards a larger or longer fixed income allocation, but with a funded status well below 100%. As plan funded status moves closer to 100%, or closer to the longer term goals of their fixed income portion, the range of tracking error relative to the benchmark should come down.

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“Even if a fully funded plan were to fully immunize its liabilities with a 100% allocation to fixed income, the minimum possible tracking error would still likely be approximately 4% annually.”

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<sup>6</sup> Standish analysis. Please see important disclosures at the end of the document.

## Summary

While these are the most common questions we hear from our target audience, we know this is not an exhaustive list. As liability-aware pension investing gathers momentum, we believe it is important for investors to understand the multi-dimensional risk and return issues involved and to clarify the misconceptions that continue to cloud what we regard as clear benefits to a liability-driven approach to investing.

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Hypothetical performance reflects performance an investor would have obtained had it invested in the manner shown and does not represent returns that any investor actually attained. The information presented is based upon the described hypothetical assumptions. Certain of the assumptions have been made for modeling purposes and are unlikely to be realized. No representation or warranty is made as to the reasonableness of the assumptions made or that all assumptions used in achieving the returns have been stated or fully considered. Changes in the assumptions may have a material impact on the hypothetical returns presented.

Standish uses the various models presented as tools in implementing the LDI framework, but the management of a particular plan may be different than the models used to present the hypothetical backtested performance. These differences include the current status of the plan with respect to assets and liabilities, the particular plan structure, and other factors. Standish cannot assure that the hypothetical backtested performance results would be similar to what Standish's experience would have been had it actually been managing accounts in this manner for the period presented. Standish believes that the backtested performance shown is reasonably representative of its implementation of the LDI framework and is sufficiently relevant for consideration by potential Fund investors.

Hypothetical backtested returns have many inherent limitations. Unlike actual performance, it does not represent actual trading. Since trades have not actually been executed, results may have under- or over-compensated for the impact, if any, of certain market factors, such as lack of liquidity, and may not reflect the impact that certain economic or market factors may have had on the decision-making process. Hypothetical backtested performance also is developed with the benefit of hindsight. Other periods selected may have different results, including losses. There can be no assurance that the Adviser will achieve profits or avoid incurring substantial losses.

Similarly, projected and forecast returns and data are hypothetical in nature and are shown for illustrative, informational purposes only. This data is not intended to forecast or predict future events, but rather to demonstrate Standish's investment process.

The BNY Mellon Pension Liability Indexes are calculated using the present values of hypothetical Retired, Mature, Typical, and Young benefit liability cash flow schedules, as calculated by BNY Mellon research. These cash flows are discounted according to a proprietary term structure model applied to every forward payment date. Pricing for the term structure model is developed from BNY Mellon internal research. Returns for each of the BNY Mellon Pension Liability Indexes are calculated from monthly changes in the present values of each index.

Index valuations and return calculations are performed using two sets of data. The Reporting Basis discounting uses high-grade corporate bond yields to fit a proprietary BNY Mellon term structure model. This method is intended to provide a reasonable approximation of the methodologies generally used for accounting and funding purposes. The Market Value Basis discounting uses US Treasury bond yields to fit a proprietary BNY Mellon term structure model. This method is intended to provide a reasonable approximation of the cost to purchase annuities for the liabilities.

Returns for each of the hypothetical portfolios described in the text are calculated as the unmanaged weighted average of the applicable indexes, with monthly reset to the target asset mix.

Barclays US Long Corporate Index, which is a subset of the broader Barclays US Long Credit Index, is representative of publicly issued, investment-grade, fixed rate, dollar-denominated, non-convertible, US corporate debt securities that have at least \$250 million par amount outstanding and an average maturity greater than 10 years. To qualify, bonds must be registered with the U.S. Securities and Exchange Commission (SEC).

The Barclays US Corporate AA Index, which is a subset of the broader Barclays US Corporate Index, is representative of publicly issued, AA rated by two of the three agencies (Moody's: Aa3/Aa2/Aa1, S&P/Fitch: AA-/AA/AA+), fixed rate, dollar-denominated, non-convertible, US corporate debt securities that have at least \$250 million par amount outstanding and have at least one year to final maturity. To qualify, bonds must be registered with the U.S. Securities and Exchange Commission (SEC).

The Barclays Long Government/Credit Index is comprised of dollar denominated, investment grade rated corporate and government bonds with at least \$250 million par amount outstanding, a maturity of ten years or more and at least one year to final maturity.

Fitch is an international credit rating agency based out of New York City and London. The company's ratings are used as a guide to investors as to which investments are most likely going to yield a return. It is based on factors such as how small an economic shift would be necessary to affect the standing of the bond, and how much, and what kind of debt is held by the company.

Moody's is an independent, unaffiliated research company that rates fixed income securities. Moody's assigns ratings on the basis of risk and the borrower's ability to make interest payments. Moody's backs its ratings with exhaustive financial research and unbiased commentary and analysis.

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The strategy may use alternative investment techniques (such as derivatives) which carry additional risks. The low initial margin deposits normally required to establish a position in such instruments may permit a high degree of leverage. As a result, a relatively small movement in the price of a contract may result in a profit or loss that is high in proportion to the amount of funds actually placed as initial margin and may result in a disproportionate loss exceeding any margin deposited. Transactions in over-the-counter derivatives may involve additional risk as there is no exchange on which to close out a position, only the original counterparty. Such transactions may therefore be difficult to liquidate, to value, or to assess the exposure. The strategy may at times use certain types of investment derivatives, such as options, futures, forwards and swaps. These instruments involve risks different from, and in certain cases, greater than, the risks presented by more traditional investments.



BNY Mellon Center • 201 Washington Street • Boston, Massachusetts  
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