

AN IN-DEPTH ANALYSIS

Liability Driven Investing

Implementation



Northern Trust



FOREWORD

As pension plan sponsors embrace a Liability Driven Investing (LDI) strategy, they must familiarize themselves with the various approaches available to implement such a strategy. The key decisions plan sponsors must consider are how and when to implement an LDI strategy.

The “how to implement” issue considers broad applications ranging from physical securities and derivatives in a segregated solution, to options available when implementing with a pooled solution. The “when to implement” options range from averaging a hedge in over time, to implementation based on funded status levels. This paper will explore the approaches, vehicles and issues to consider when implementing an LDI strategy.

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LIABILITY DRIVEN INVESTING

Implementation

In recent years, due to changes in government and accounting regulations, Liability Driven Investing (LDI) has become an important topic for pension plans. As plans become more attuned to the need to manage their assets with a goal of paying future benefits, the focus of LDI is beginning to shift from *whether* to implement LDI to *how* to implement LDI.

Modifying asset-only investing behavior to take into consideration the plan liabilities and beginning to evaluate and allocate risk in a new way can be a monumental shift for an organization. For an organization considering what LDI means and educating its staff around the issues, this can take a significant amount of time, typically six months to one year. An organization not only has to work through an education phase, but also must communicate its decisions and rationale for these decisions to all stakeholders to ensure everyone understands its goals and objectives.

This paper will focus on what happens once the decision has been made to implement an LDI strategy. Although a considerable amount of research and education may have gone into arriving at this point, it is often at this stage that organizations tend to struggle with next steps. If consultants are leading the decision-making process, there is typically an emphasis on solutions that have been successfully installed for other clients. If an LDI solution is being led by the plan's actuaries, it is important that they not only understand the plan design, but also understand and incorporate the asset side of the plan in order to ensure a successful LDI solution. If the decision is being guided primarily by asset managers, the emphasis may be on making immediate transactions with proprietary products. During this process of meeting and talking with LDI providers, it should become clear to the plan which course of action would work best for its unique set of circumstances. Whichever LDI solution is ultimately selected, understanding the provider's philosophy and strategy around LDI – and how it is expected to direct plans to the end result of prudent plan management – is critical. One successful approach is to incorporate all of the parties mentioned above and utilize them within a process that helps determine the appropriate LDI solution. We believe that a five-step process, represented in the graphic below, provides the framework for a successful implementation strategy.

FIVE-STAGE LDI INVESTMENT PROCESS



Any LDI solution should be based upon sound risk management principals embedded in a philosophy that believes LDI is a framework for measuring, managing and monitoring the investment risk/return trade-offs of the portfolio in the context of the plan's liabilities. In other words, LDI should be a true holistic offering, bringing together asset management, liability management, ALM studies, reporting and analysis in one complete offering. While each of the components may be from different providers such as various asset managers, actuaries and custodians, they each have a critical role to play in developing a cohesive LDI solution. Much like individual players in a symphony, bringing together various professionals in an LDI solution and having them be well-orchestrated is key to a successful performance.

It is this philosophy of professional cohesiveness that drives the five-stage process for determining the best course of action for a plan considering the implementation of an LDI solution. After setting this course of action, effective implementation options can be discussed to optimize the risk/return tradeoffs of the pension plan relative to its liabilities.

DEVELOP OBJECTIVES

In the first stage, objectives must be developed that require plans to consider the short-term and long-term goals and objectives for the pension plan, i.e., what is the long-term viability of the plan, is the plan integral to employee retention, will there be any changes in plan design, etc. Other stakeholders to consider at this point are investors and participants as communication to them around any plan changes, including plan management, is important to ensure their understanding and acceptance of such changes.

CHARACTERIZE LIABILITIES

In our white paper entitled “How the Liability Benchmark is Developed and Used in Practice¹”, we explored the second phase of developing an LDI strategy, which is understanding the unique cash flows for any plan implementing an LDI solution. This step is important to help the plan understand where its risks are relative to liabilities across a yield curve and allows for the creation of a custom liability benchmark to track its liabilities.

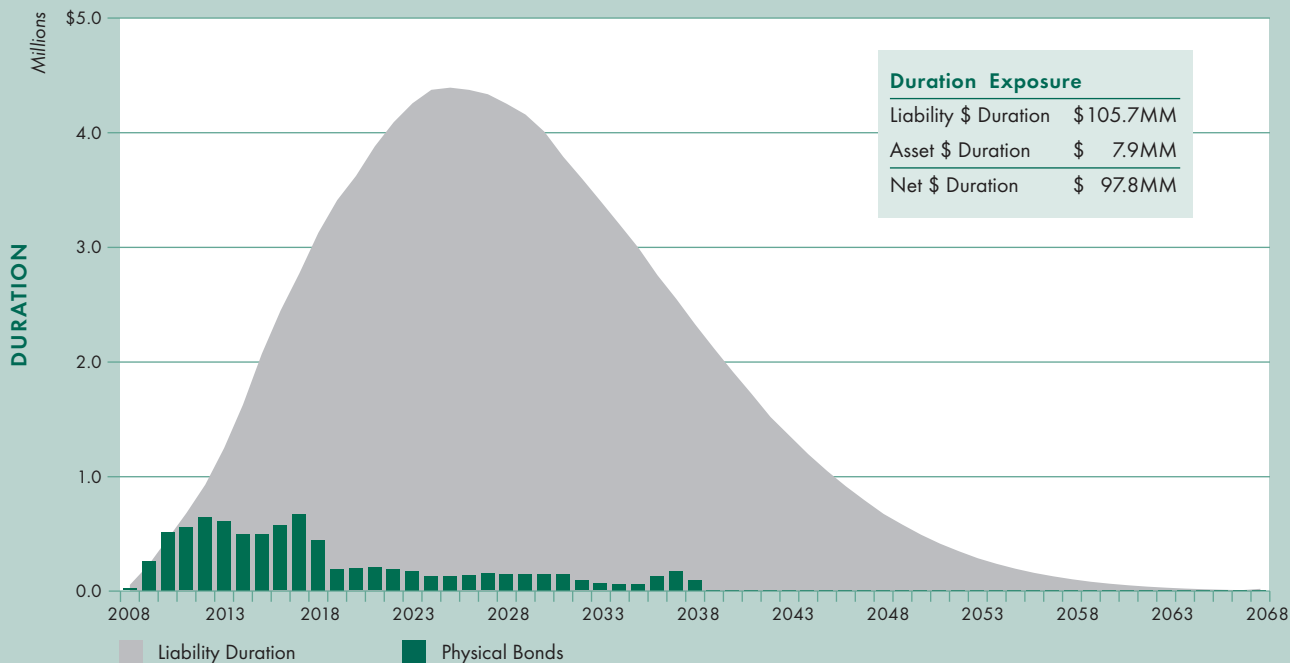
QUANTIFY RISKS

After the liabilities are analyzed and the risks measured, the next step is to compare the liability profile with the assets supporting them. In this step, quantifying the risk of the assets relative to the liabilities begins to shed light on the overall risk of the pension plan including the duration mismatch that exists between the two. In *Exhibit 1* (next page), the large “mountain” represents the dollar duration of a sample plan’s liabilities and the small bars represent the asset duration available to cover the liability duration. As can be quickly gleaned from the exhibit, there isn’t much duration provided by the assets, in terms of both volume and maturity, to appropriately cover the liability “mountain.”

It is in this stage that plan sponsors begin to understand and appreciate the magnitude with which the funded status of the plan can move given different interest rate scenarios.

Once it is understood where the risks are in the plan, consideration can be given for what solutions would optimally manage these risks. The phase that puts the strategy into action is the fourth: develop and implement solutions.

EXHIBIT 1: LIABILITY VS. ASSET DOLLAR DURATION



Source: Northern Trust
For Illustrative Purposes Only.

DEVELOP AND IMPLEMENT SOLUTION

When considering the fourth phase of the process, which is the implementation phase (and the focus of the remainder of this paper), there are many components that must be given consideration. One of the components involves what to hedge: interest rates, credit, inflation, equities or any combination thereof. Then, plans must determine when to hedge and with which instruments. Derivatives can play a big role in any implementation, but many plans are uncomfortable with them and prefer to transact only in the physical security space. A detailed review of the risks to hedge follows. This information also is summarized in the appendix on page 20 of this paper.

Hedging Interest Rate Risk

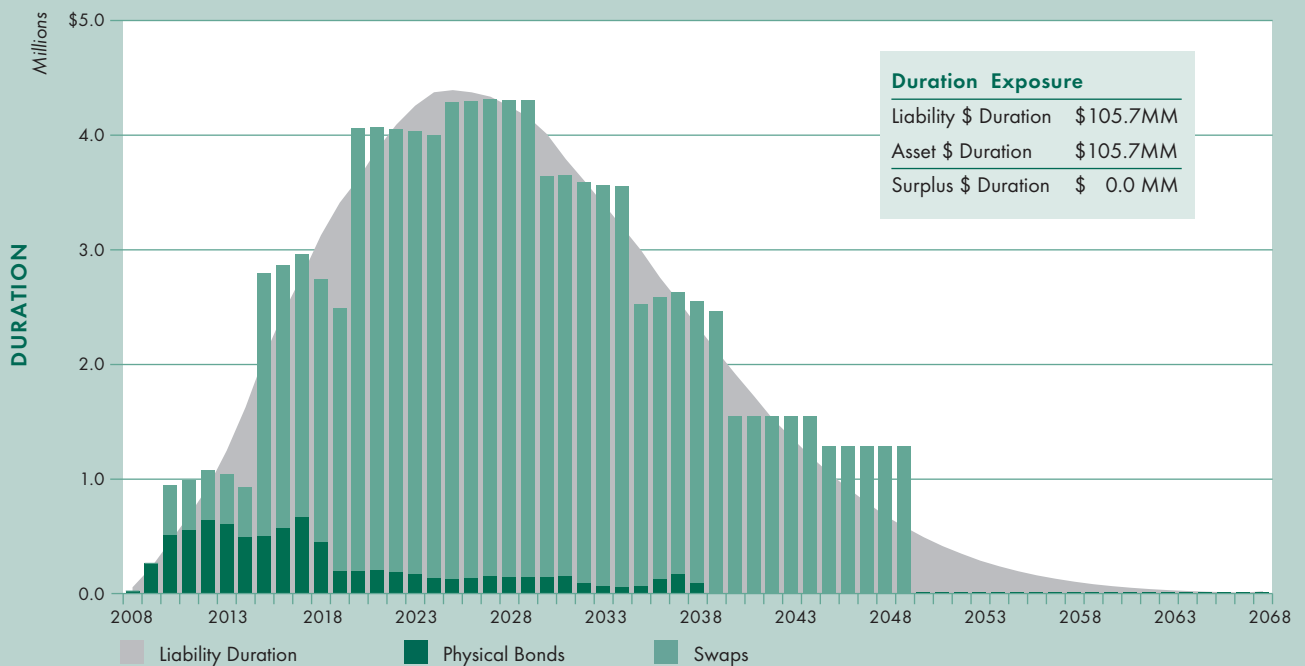
Interest rate risk is an uncompensated risk and changes in interest rates can have considerable impact on a plan’s future funded status. If the plan has no opinion on interest rates it should work toward hedging that risk as soon as possible. When faced with hedging interest rate risk, plans need to decide whether to hedge short-term cash flows (i.e., cash flows in the first 5 to 10 years), long-term cash flows or both. In addition, they need to consider cash flows with respect to pension retirees, terminated vested and actives.

Plan sponsors also need to decide the extent to which they wish to hedge cash flows. For example, some plans may decide to hedge the duration of the liabilities (the average time to payment) as a minimum. This should ensure that the plan funding level is hedged against any parallel shifts in yield curves (assuming liabilities are determined using a curve approach). This does not, however, protect against any changes in the shape of the yield curve. To protect fully against any curve changes, plans should theoretically invest in swaps (or bonds) that exactly match the cash flows of the plan.

We believe to effectively hedge liabilities, plans should hedge across the entire yield curve. This will ensure the plan liabilities are hedged against both parallel shifts and twists in yield curves. This can be achieved by purchasing swaps at various key tenors on the yield curve without necessarily purchasing swaps at every point on the yield curve. The hedging precision will depend greatly upon the unique requirements of plans and the practicalities and costs of using various fixed income assets at the time of implementation. For example, we have found that in the U.S., hedging cash flows over 40 years with a 40-year swap provides a high degree of accuracy without the need to purchase longer dated, less liquid swaps. A solution using swaps for the example plan shown previously is displayed in *Exhibit 2* below.

EXHIBIT 2: LIABILITY VS. ASSET DOLLAR DURATION

LDI Swap Solution



Source: Northern Trust
For Illustrative Purposes Only.

Some plans believe that equities have duration. Based on research we've conducted, we concluded that equities have little or no duration (interest rate sensitivity) so are an ineffective tool to hedge interest rate risk. *Exhibit 3* below shows that the correlation between the S&P 500 and long-duration U.S. Treasuries has been highly variable over the past 30 plus years, indicating a lack of consistent and significant duration from equities.

EXHIBIT 3: S&P 500 VERSUS LEHMAN LONG GOVERNMENT

36 Month Rolling Correlations



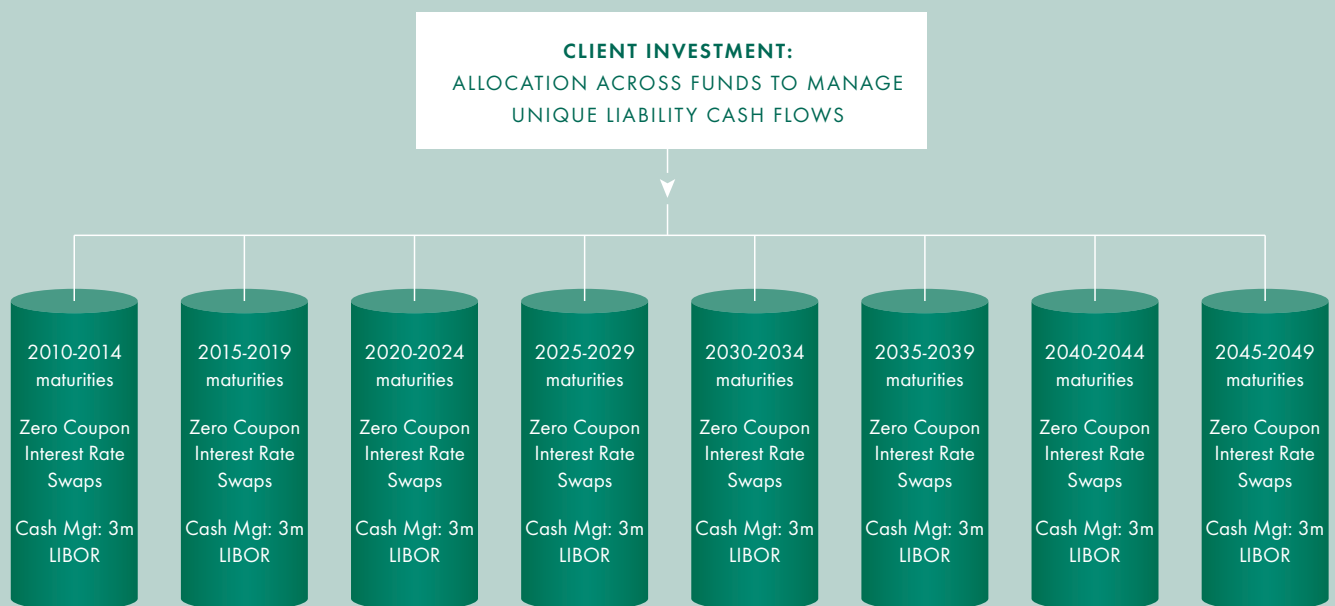
Source: Northern Trust and Lehman Brothers
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Plans may decide to hedge interest rate risk with fixed income assets such as bonds, futures and swaps, or a combination of all three. For example, a plan may choose to hedge cash flows in the early years with a combination of bonds and thereafter with swaps, whether they are zero coupon or plain vanilla (coupon-bearing) swaps. One advantage of zero coupon swaps over plain vanilla swaps is that they can be more easily tailored to match liability cash flows, which are similar in nature to a series of zero coupon swaps. A key determinant in this decision is the pricing and valuation of these assets at the time of implementation. A close partnership with the investment manager trading the swaps during this time is important.

There are various vehicles available to plans that allow them to hedge interest rate risk. Such vehicles fall into two main categories: segregated solutions or commingled funds, which have been referred to as “pooled solutions.” Either approach can use physical assets or swaps. The description below concentrates on the swap-based solution.

A pooled solution is typically a fund structure that incorporates both interest rate swap and cash management in order to effectively manage pension plan interest rate risk. Investment managers have been offering either pooled or segregated solutions or both. Within the pooled solution, fund managers could offer either levered or unlevered solutions. Such pools are prevalent in the U.K. and becoming more common in the U.S. An unlevered pool has the cash component of the fund approximately equal to the notional amount of the swaps. The levered pools have a larger notional amount of swaps than cash. One of the key advantages of the levered pools is that the plan can achieve its desired hedge with fewer assets, freeing the plan to invest the remainder of the assets in the search for higher returns. Pooled solutions are generally offered as a series of funds that provide interest rate risk hedging whereby each unique plan is custom fit across the funds. A typical fund structure is displayed in *Exhibit 4*.

EXHIBIT 4: POOLED STRUCTURE



Source: Northern Trust

For Illustrative Purposes Only – Not intended as investment advice or a recommendation to buy or sell a specific security or invest in a specific strategy.

Each type of solution will have advantages and disadvantages in how it deals with the practical issues of investing in swaps. Table 1 provides a comparison of the two approaches.

TABLE 1: COMPARISON OF POOLED SOLUTIONS AND SEGREGATED SOLUTIONS

ISSUE	POOLED SOLUTION	SEGREGATED SOLUTION
International Swaps and Derivatives Association (ISDA) Documentation	No individual negotiation of ISDA required. Avoiding legal and administrative costs and time to produce ISDA.	Need to produce an ISDA, although this can be a one-off exercise to cover all derivative instruments. In addition, use of an umbrella ISDA of an asset manager can reduce legal/administration costs and speed up completion time.
Collateral Flexibility	Required to invest funds in whichever vehicle is determined by the fund manager and at the level required by the fund structure.	Greater flexibility in collateral to be used as negotiated on an individual basis between the plan and the investment bank. There is also greater flexibility with rebalancing when plan liability changes.
Accuracy of Hedge	Pools can offer a cost-effective way of custom fitting a hedged solution.	More customized solution with flexibility around the nature and type of instrument used to hedge.
Usage	Can be used if direct investment in derivatives is not allowed.	Can't be used if investment in derivatives is not allowed.
Anonymity	Provides anonymity for plan when transacting.	No anonymity provided.
Ease of Understanding	Mechanics of pooled fund may be fairly technical.	Fairly straightforward in description.

Source: Northern Trust

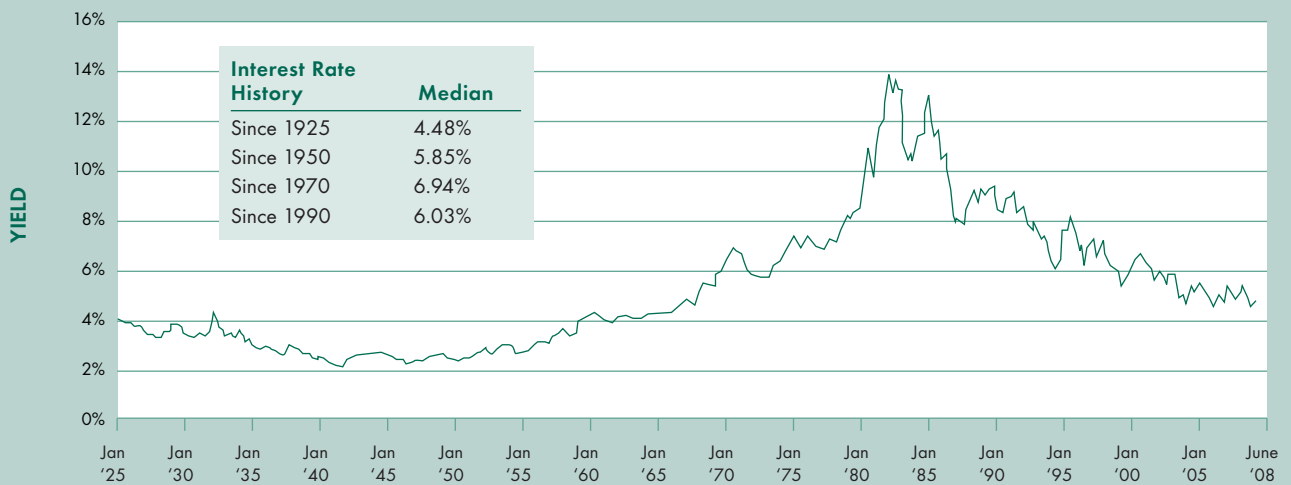
Once plans have decided how they are going to hedge interest rates, the hedge then needs to be implemented. If the plan does not have a strong opinion about the direction of interest rates, then the hedge should be achieved quickly. However, many plans pursue phased implementation strategies, which can take many forms and are commonly a function of time, interest rates and/or funded status.

Under a time-based approach, plans might slowly increase the amount of liability hedged every month or quarter. The hedge ratio, or the percentage hedged, might start at 10% to 25% and increase in 25% increments each quarter.

The second approach is to use interest rate triggers. When rates meet thresholds, the plan increases the amount of the hedge. This way, the interest rate hedge is layered into the portfolio as rates rise. A historical distribution of interest rates provides guidance on setting the thresholds. For example, in *Exhibit 5*, the history of long-term U.S. Government Bond yields since 1925 illustrates the various historical periods of interest rates. A “historical” view on interest rates depends on which history the plan selects.

EXHIBIT 5: HISTORY OF LONG-TERM GOVERNMENT BOND YIELDS

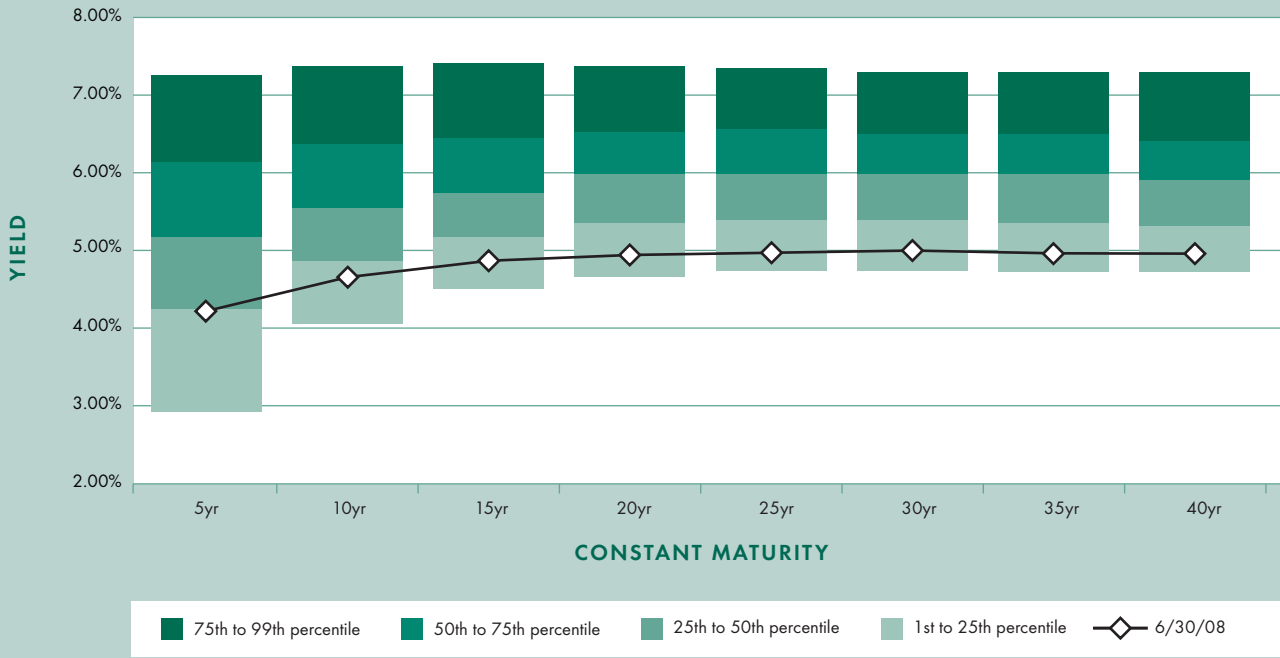
Average of Maturities Longer Than 10 Years (Average 20-Year Maturity)
History from January, 1925 through June, 2008



Source: Society of Actuaries, U.S. Department of Treasury
For Illustrative Purposes Only.

As derivatives are becoming a common approach to achieving a hedge position, swap rates are more relevant in determining interest rate triggers. *Exhibit 6* illustrates the distribution of yields on the swap curve over the period beginning in September 1995 through June 2008.

EXHIBIT 6: SWAP CURVE DISTRIBUTION, SEPTEMBER 1995 TO JUNE 2008

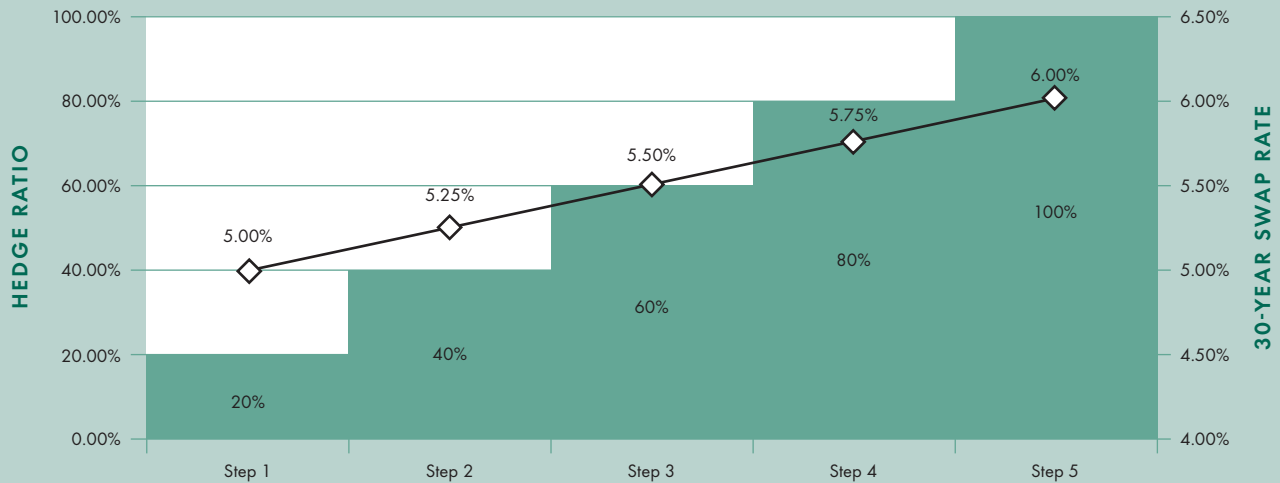


Source: Northern Trust
For Illustrative Purposes Only.

One of the challenges with using interest rate triggers is actually determining the interest rate triggers. *Exhibit 6* is an approximate framework that some plans have considered when establishing their hedge. At the median, swap rates have equal chances of increasing or decreasing. If hedging is the goal, then this median is the logical point to achieve the full hedge ratio. An interest-rate diversification approach to achieve the full hedge ratio requires a few steps from the current hedge ratio to the full hedge ratio. Using the swap rate history above, the schedule in *Exhibit 7* achieves a 100% hedge ratio in five steps.

EXHIBIT 7: IMPLEMENTING THE INTEREST RATE HEDGE

30-Year Swap Rate Based Implementation Schedule



Source: Northern Trust
For Illustrative Purposes Only.

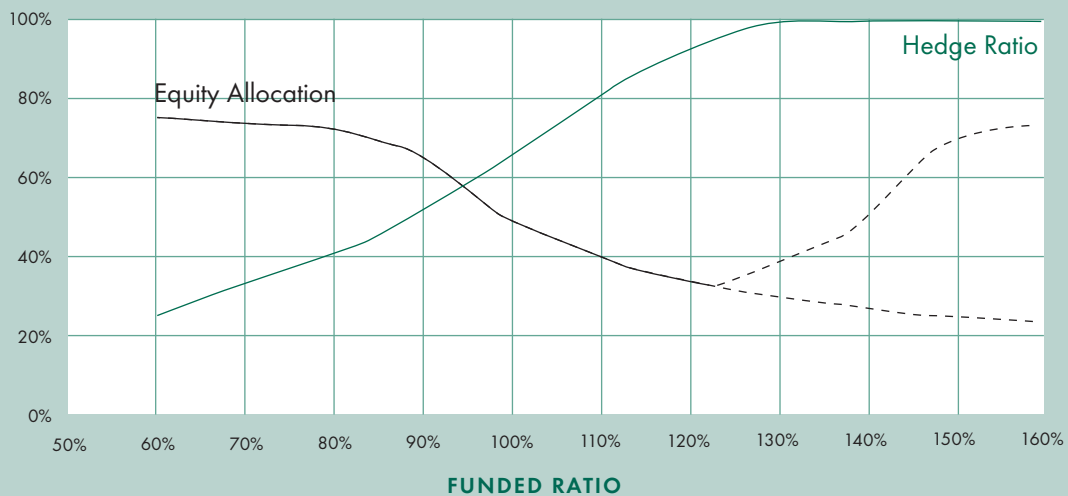
Even in a low interest rate climate, it makes sense to explore a phased-in approach. The goal with rate-averaging is to opportunistically build the hedge as rates rise without missing the markets, so plans can lock into higher rates.

If plans are concerned about the level of yields at which they wish to hedge, they could use swaptions. These derivatives are options on swaps and give plans the right but not obligation to enter a swap. Therefore, plans can potentially benefit when interest rates fall but not lose out if interest rates rise. However, there is a cost attached to this flexibility, namely the option premium. This premium could outweigh any benefit from going down this route. Swaptions have been used historically by Dutch pension schemes to meet regulatory requirements while keeping upside potential.

Pension plans at or near a fully funded status, or plans that are closed or frozen, might consider a third approach: a glidepath to reducing risk according to funding levels. As the funded status improves, plans gradually take risk off the table by adding to the interest rate hedge, reducing equities or both. These are independent decisions. By planning for what to do when fully funded, pension plans are more likely to stay fully funded. Once overfunded, some plans might want to use the surplus as a “risk buffer” to increase their equity allocations to seek additional returns. A typical solution using the glidepath approach is displayed in *Exhibit 8*.

EXHIBIT 8: GLIDEPATH APPROACH TO MANAGING RISKS

Sample Pension Risk Glidepath



Source: Northern Trust
For Illustrative Purposes Only.

A glidepath approach to LDI provides the potential for a plan to reduce risk as funded status improves by boosting the hedge ratio, reducing risky assets, or both.

Hedging Credit Risk

One key factor to consider is the actuarial basis used to determine the liabilities, in particular, the discount rate used. There are several different rates that could be used in discounting the liability cash flows such as government rates, AA corporate rates, swap rates, etc. In addition, an entire curve or single rate could be used. In some countries, these rates are defined by legislation or accounting requirements such as in The Netherlands. Further details are covered in our previous white paper on liability benchmarking entitled “How the Liability Benchmark Is Developed and Used in Practice”.

The precision and type of hedge employed in an LDI strategy will be impacted by whichever rate is used. For example, hedging a liability based on an AA corporate curve with interest rate swaps will introduce a basis risk between how corporate yields move and swap yields move. In this instance, plans may also decide to hedge the credit risk inherent in the discount rate used to value the liabilities. In addition, the amount of swap used will be

different than if hedging a liability discounted using a swap curve. For example, the dollar duration of a plan’s liabilities discounted using the U.S. swap curve might be \$250mm, but the dollar duration discounting using the PPA curve could be \$210mm, so the amount of swap notional to hedge dollar duration using the different curves would be different.

There are various ways of gaining credit exposure. The credit risk could, in part, be hedged by investing in corporate bonds, credit default swaps (CDS) and/or credit default indices. If using CDS (or, more typically, a basket of CDSs such as CDX), the pension plan would sell protection so that as yields fell and liabilities increased, the value of the CDS would increase, offsetting the impact of increasing liabilities on the plan’s funding level.

When determining an LDI strategy, plans will need to consider the advantages and disadvantages of using CDS/CDX over corporate bonds. For example, CDX allows synthetic exposure (like interest rate swaps) to credit risk

so fewer physical assets need to be allocated to credit risk than if purchasing corporate bonds. However, liquid CDX indices typically only extend to 10 years so they will not hedge the credit risk of long-dated cash flows as precisely compared to direct investment in corporate bonds.

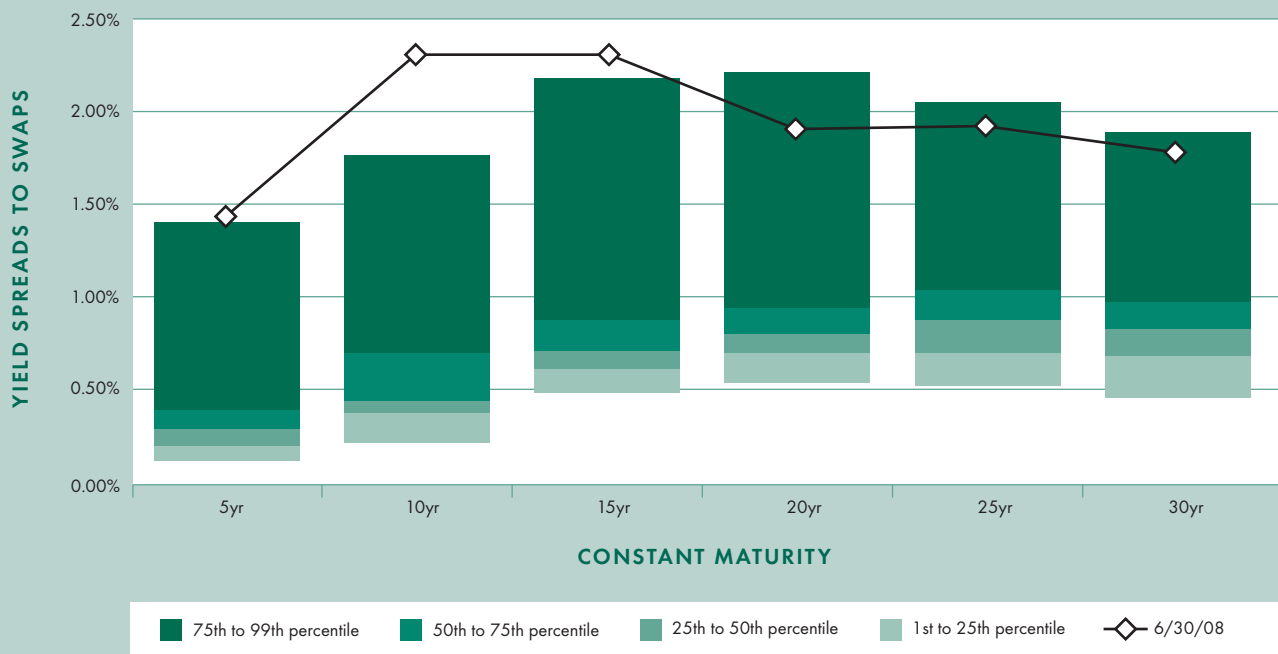
How Do Credit Default Swaps Work?

Credit default swaps (CDS) are essentially a form of insurance. There are two parties involved in the contract, a protection buyer and protection seller. The seller provides the buyer protection such that if a credit event occurs, such as a default, with respect to the underlying bond on which protection is sold, the seller makes a payment to the buyer to top up the value of the bond to its par value. In return for this protection, the protection buyer pays an “insurance” premium. If the premium increases, indicating a greater likelihood of default, the value of a CDS contract (to the buyer) increases, the converse is true if premiums fall.

Similar to hedging interest rate risk, the credit hedging strategy could be implemented as a one-off exercise or a phased approach. The phased approach again could be a function of time, funded status and in this case, credit spreads. A common curve used for U.S. pension accounting valuations is the Citigroup Pension Discount Curve (Citi curve), which is based on the yields of AA-rated U.S. corporate bonds. Credits spreads are the yields from the Citi curve in excess of the yields of the swap curve. *Exhibit 9* illustrates the historical distribution of credit spreads from the Citi curve.

EXHIBIT 9: CITIGROUP PENSION DISCOUNT CURVE

Spread to Swap Curve Distribution September 1995 to June 2008



Source: Northern Trust
For Illustrative Purposes Only.

In this case the plan would want to hedge when spreads are wide, as indicated in *Exhibit 9*. While interest rate hedging is generally maintained once achieved, credit hedging might be reduced when spreads are low.

Hedging Inflation Risk

Another risk identified in step 3 (identify asset vs. liability risk) of the process is inflation risk. The risk with inflation is that actual inflation is different from that expected. Hedging interest rate risk will mean that a plan is hedging expected inflation. This is because the yield on fixed income assets has inflation expectations as one of its components. However, *unexpected* inflation is not one of its components so will not be hedged. Inflation increases implicit in the cash flows could reflect salary increases or pension increases in deferment or payment. The

inflation element of cash flows is particularly important in the U.K., where a fair majority of pension benefits are linked to inflation. This isn't as relevant in the United States, although some plans may need to implement this type of hedge. In practice, this means that in countries where the only inflation risk in the plan is salary increases, plans will hedge this risk implicitly with assets such as equities. However, in countries such as the U.K. where there are other inflation increases such as pensions in payment, inflation can be hedged explicitly.

Inflation risk typically would be hedged using inflation swaps and/or inflation linked bonds. Such assets would be chosen so that they match the inflation sensitivity of the liabilities. These assets would hedge any unexpected changes in inflation.

The plan may decide to hedge inflation liabilities with real assets rather than swaps and/or bonds. Real assets would be asset classes such as property, commodities and even equities where the expectation is that these asset classes will increase in the long run at least in line with inflation.

Both pooled and segregated solutions are available, through fund managers, to hedge inflation risk, similar to interest rate risk. This is particularly true in the U.K. where fund managers may offer both interest rate and inflation pooled solutions or a solution that hedges both risks within one vehicle.

Similar to hedging interest risk, the hedging strategy could be implemented as a one-off exercise or a phased approach. The phased approach again could be a function of time, funded status or in this case, levels of future inflation expectations.

Hedging Equity Risk

A final key risk within the pension plan is equity risk. This is mostly an asset side risk (except for any correlation with the liabilities due to inflation). The decision about how much to invest in equities is part of setting the risk/reward framework detailed in the previous steps of the process.

There are various ways to reduce equity risk; one way is to sell equities, another way could be by diversifying across different overseas equity markets. Plans may not feel comfortable with reducing equity exposure. If this is the case, risk could be reduced by investing in equity derivatives such as options and futures. For example, the pension plan could buy puts on the relevant equity index. This would give it the right but not the obligation to sell equities at the strike price. Therefore, if equity prices fell the value of the option would increase to offset the fall in equity prices. Buying an option requires a premium to be paid, slightly reducing the return on the plan assets. There are other types of derivative strategies that could be employed to achieve any desired risk reward profile. For example, a plan could invest in a zero cost option collar. This is the purchase of a put and sale of a call where the premium to pay for the put is offset by the premium received from selling a call. This collar limits both upside and downside of investing in equities. Further details around the use of equities in LDI strategies is covered in the section entitled "Active and Passive Management" later in this paper.

The hedging strategy could be implemented as a one-off exercise or a phased approach. The phased approach could be a function of time, funded status and in this case, equity prices. For example, the exposure to equities could be gradually reduced over time as the funding level improves, essentially locking into equity gains. This could be achieved by using derivatives such as futures, which allow for portfolio changes to be made quickly and cheaply relative to transacting in the underlying equities.

Practicalities of Using Swaps: Market Liquidity and Capacity

A relevant consideration in implementing any swap-based LDI strategy is market liquidity and capacity. Both interest rate and inflation swaps tend to be liquid out to about 40 years. Beyond 40 years the liquidity very much depends on the currency of the swap. For example, in the U.K. there is reasonable liquidity up to 50 years whereas in the U.S. liquidity is reduced between 40 and 50 years. Liquidity beyond 50 years within all markets is very limited. Where liquidity is restricted, bid/offer spreads and transaction costs will be larger than normal.

The inflation swap market is much smaller than the interest rate market due to the lack of demand and supply. This is particularly true in non-Euro markets.

The CDS market is very liquid. In fact, CDS on single-name bonds can often be more liquid than the underlying bond. As mentioned previously, liquid CDS indices only extend to 10 years. This means that if plans wish to gain any exposure to credit spread changes at the 20-year point on the credit curve they may need to increase the amount of notional swap invested at the 10-year point to effectively “double up” their exposure.

In practice, the swap markets will be accessible to most, if not all, plans. Swap spreads may widen if plans attempt to carry out very large transactions particularly at long tenors. However, if such large transactions are split up into smaller transactions, then the spread-widening issue may be avoided.

Derivatives: Legal Documentation

There are other specific issues around the use of derivatives, and in particular swaps, that a pension plan will need to consider.

A swap is an over-the-counter legal contract between two counterparties, i.e., an investment bank and a pension plan. The swap is documented under industry standard legal documentation produced by ISDA (International Swaps and Derivatives Association) with supplementary documents. One key supplementary document detailing the collateral arrangements is called the Credit Support Annex (CSA). The ISDA documents are usually negotiated on an individual basis so they require legal input and can take time and be costly to complete. However, the use of pooled solutions, as mentioned previously, avoids the time and cost associated with negotiating ISDAs from scratch. The pooled solution, or funds, negotiate the ISDAs within their structure, eliminating the need for plans to negotiate the ISDAs themselves. Umbrella or agency ISDAs can also be used whereby the fund manager negotiates the ISDA terms for all its clients with investment banks on a generic basis. In effect, with an umbrella ISDA, the pension plan has delegated administrative responsibility to the fund manager but is still legally responsible for the economic exposures of the swap.

Collateral Management

Swaps are designed to remove or reduce interest rate risk, but they do introduce another risk, namely counterparty risk. Counterparty risk is the risk that the pension plan or investment bank does not fulfill its obligations under the swap agreement when the swap has positive value to the other party. In order to mitigate this risk, the counterparty that is out of the money (i.e., the party for whom the swap has negative present value) has to provide security in the form of collateral to the counterparty that is in the money. Therefore, if the counterparty that is out of the money does not fulfill its obligations under the swap agreement, the party that is in the money has access to funds to replace the lost positive net present value of the swap.

Collateral is normally in the form of cash or high-quality securities. Lower-quality securities can be used subject to appropriate haircuts, which means applying a discounted value to those securities that can be substantially less than their true market value.

The type and amount of collateral can have an impact on decisions around asset allocation. A certain amount of assets should be held as collateral-eligible assets to meet any collateral calls, typically cash-like instruments or high-quality bonds that are liquid in nature. The proportion will usually be determined using VAR (Value at Risk) analysis to ensure there are sufficient assets under different economic scenarios to meet collateral calls. In certain economic climates, banks may increase the level of haircuts or restrict the types of securities they will accept as collateral.

Any restrictions the collateral has on asset allocation decisions could be lessened by the use of derivatives. For example, plans may decide to sell their equity holdings to purchase bonds to be used as collateral but still maintain exposure to equities through the use of derivatives such as futures. The additional collateral could then be used to support both the swaps and the futures contracts.

Active and Passive Management

Many consider Liability Driven Investment strategies to be those that focus solely on investing in assets that match the liability profile of the pension plan, i.e., strategies that focus on hedging the risks described above. However, the LDI label could be extended to covering strategies that aim to outperform the liabilities, so long as that strategy takes account of the liabilities. The purpose of this outperformance could be used to help fill any funding gap or reduce pension contributions. As such, LDI portfolios could be defined as combination strategies, using physical assets and derivative exposures to long-term government and corporate bonds, fixed income derivatives, equities, alternatives and cash.

There are two sources of return: passive market exposure (beta) and active manager exposure (alpha). Bearing in mind that there will be higher transaction costs associated with alpha sources compared to beta sources, an LDI strategy may use these sources of return in different ways, as follow.

- Active management of the LDI hedge by making active decisions relative to the liability benchmark – for example, going long duration relative to the liabilities; or
- Passive management of the LDI hedge through the purchase of fixed income assets (including swaps) with the addition of alpha or beta separately. Beta could be achieved, for example, by investing in equity indices where it is expected that equities will outperform the fixed income assets. Alpha could be achieved through portable alpha strategies, which are often defined as achieving alpha for an asset class by investing in the asset class actively and shorting the asset passively through the use of an index derivative. This alpha can then be “ported” onto the LDI hedge. The use of portable alpha techniques in LDI strategies is covered in more detail in Northern Trust’s April 2007 Point of View article entitled: “Portable Alpha: A Risk-Efficient Approach to LDI.”² One advantage of using portable alpha with an LDI hedge is that the collateral for any swaps could also be used to support the derivatives within the portable alpha strategy. Another topical white paper dealing with risk budgeting and allocating alpha and beta is entitled “A Holistic Approach to Risk Budgeting.”³



**MONITOR
STRATEGY**

An important element of implementing an LDI strategy, and the fifth and final phase of the process, is monitoring and reporting on how the strategy is performing. The performance of the plan assets will be measured against the liability benchmark. This benchmark consists of several components, with time return and curve return being the two key components (details of which are given in our previous white paper on liability benchmarking). The benchmark can be used to compare plan results utilizing standard benchmark analysis. Key metrics to be used are standard deviation of benchmark, tracking error relative to plan assets and value at risk. Within an LDI framework, these measures should indicate how effectively the hedge is working in terms of the impact on the funding level of the plan.

Stress testing and scenario analysis can also provide additional risk information. Such testing and analysis is used within the Dutch market extensively because of legislative requirements.

Other characteristics that would be available to examine the liability benchmark and better understand its sensitivities would be effective duration, key rate duration, convexity and inflation sensitivity. Of particular interest to plans may be a reconciliation of the plan's funded status, which will detail changes with respect to key variables such as interest rates, contributions, benefit payments and investment gains and losses.

CONCLUSION

Prepare Today to Implement LDI Tomorrow

Considering the educational process needed to familiarize plans with LDI and the number of stakeholders who need to come to an agreement on an LDI strategy, early education and communication is key to getting everyone on board with decisions surrounding LDI. Even though plans may not implement their solutions immediately, getting things in order is the first step to defining the LDI solution. In other words, begin now to discuss the issues surrounding LDI and how they apply to each plan's unique situation. Plans should work towards developing their optimal solution and then they will be prepared to implement when the opportunity is right. It is only a matter of time before more plans adopt an LDI approach, and being prepared for that day is a critical step to ensure the right decisions are made and that all stakeholders are on board. Finally, whether or not plans adopt an LDI strategy by better aligning asset and liabilities, they will eventually be measured within that context, ready or not.

ENDNOTES

1. See <http://www.northerntrust.com/liabilitydriveninvestment>
2. See <http://www.northerntrust.com/liabilitydriveninvestment>
3. See <http://www.northerntrust.com/riskbudgeting>

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APPENDIX: LIABILITY DRIVEN INVESTMENTS – HEDGING RISKS

RISK TO HEDGE	WHAT TO HEDGE	HOW TO HEDGE	WHEN TO HEDGE	WHAT VEHICLES
Interest Rates	Short-Term Cash Flows Long-Term Cash Flows Hedge Liability Duration	Physical Instruments – Cash – Fixed Income Securities Derivatives – Zero Coupon Interest Rate Swaps – Swaptions	<ul style="list-style-type: none"> ▪ All at Once ▪ Phased Approach <ul style="list-style-type: none"> – Interest Rate Triggers – Time-Based Approach – Glidepath Approach 	Separate Accounts LDI Pooled Solutions
Credit	Credit Risk Inherent in Liability Discount Rate	Physical Instruments – Fixed Income Securities Derivatives – Credit Default Swaps (CDS) – CDX (Basket of CDS)	<ul style="list-style-type: none"> ▪ All at Once ▪ Phased Approach <ul style="list-style-type: none"> – Time-Based Approach – Glidepath Approach – Function of Credit Spreads 	Separate Accounts Bond Funds
Inflation	Inflation Element of Liability Cash Flows	Physical Instruments – Inflation-Linked Bonds Derivatives – Inflation Swaps	<ul style="list-style-type: none"> ▪ All at Once ▪ Phased Approach <ul style="list-style-type: none"> – Time-Based Approach – Glidepath Approach – Levels of Expected Future Inflation 	Separate Accounts LDI Pooled Solutions
Equity	Equity Risk in Risk/Reward Scenario	Physical Instruments – Stocks Derivatives – Options – Futures – Swaps	<ul style="list-style-type: none"> ▪ All at Once ▪ Phased Approach 	Separate Accounts Fund Structures

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