



C A M B R I D G E   A S S O C I A T E S   L L C

# U.S. PENSION PLANS: INVESTMENT CONSIDERATIONS FOR ENDOWMENT PROFESSIONALS

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Although there are many forms of pension plans offered by public and private sector institutions, including various defined contribution plans such as money purchase plans and thrift/savings plans, this paper focuses on the issues related to nonpublic defined benefit plans.

Pension plan sponsors face a variety of issues in setting asset allocation policy, largely related to the ability of a plan's assets to cover its liabilities. This paper provides a framework for assessing pension plan asset allocation by examining the key drivers of pension liabilities and their impact on asset allocation in contrast to endowment asset allocation considerations.

By law, the plan sponsor's primary goal is to meet its fiduciary duty to present and future participants by assuring that funds are available to meet benefit payments when needed. Secondary goals include minimizing the present value of future required contributions,<sup>1</sup> reducing the volatility of periodic contributions and pension expenses, and maintaining the plan's fully funded status.

## **Liabilities**

Similar to many endowments and foundations, the liability of a pension fund involves current and future payouts, causing plan sponsors to balance the risks of today (potentially higher volatility of contributions and expenses) with the risks of tomorrow (possibility that growing contributions will put increasing financial stress on the sponsor). However, the pension liability is distinct in that the "spending" is a legal, contractual obligation that if not met will eventually result in the bankruptcy of the sponsor. In other words, pensions cannot adapt their current payouts to changing market conditions since benefit payments are contractually inflexible. In addition, when pension benefits cannot be met through pension assets without violating the legally required asset/liability relationship, the sponsor must make cash contributions. Therefore, plan sponsors often consider the tradeoff between minimizing the volatility of "plan funded status" and maximizing long-term asset returns that could reduce the present value of future contributions.

The liability is a stream of payments to present and future plan beneficiaries, which consists of both inactive and active participants. Inactive participants ("inactives") are retirees and their families who are currently receiving benefit payments. Active participants ("actives") are those who are not yet receiving benefits, primarily the current and future workforce.<sup>2</sup>

A pension's short- to intermediate-term obligations are principally made up of benefit payments to inactives. The amount of the payments to this group are relatively certain, assuming no cost of living adjustments (COLA), since the amount of the benefit has already been defined. The primary source of uncertainty is the time horizon, which is determined by the death of the participant and/or other beneficiaries (e.g., spouse).

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<sup>1</sup> Required contributions are defined by law and triggered when plan assets are insufficient according to regulatory requirements.

<sup>2</sup> Others might include those who are retired and eligible to receive benefits but who have elected to defer or those who have left the organization but who are eligible for benefits in the future.

Longer-term pension liabilities are future obligations to active employees. Similar to near-term obligations, the ultimate time horizon is uncertain. However, unlike the near-term obligations, there are several other significant sources of uncertainty, which may include:

- onset of the payments (generally retirement);
- size of the benefit stream at retirement, which is formulaic, typically including years of service and/or future compensation; and
- number of employees who terminate before attaining retirement and before vesting.

Measuring the solvency of the plan requires a calculation of the total present value of these future obligations. This present value is compared with the market value of assets to determine the funded status of the plan (Exhibit 1). The funded status of the plan provides some insight into its strength, as it measures its ability to meet future obligations from plan assets. Various regulatory bodies set guidelines that help sponsors determine the appropriate discount rates to use in present value calculations (Exhibit 2).

Accumulated benefit obligation (ABO) is one measure of the present value of the liability. ABO accounts for benefits that have been accumulated to date, ignoring any growth in benefits owed to current employees resulting from future increases in compensation levels or additional years of service that may be accumulated prior to retirement. An alternative measure of the liability incorporates expected compensation growth into estimates of the future stream of cash outflows. The present value of these payments is referred to as the projected benefit obligation (PBO). Because it incorporates estimated wage growth, which is likely to occur, PBO is more reflective of economic reality. Actuarial accrued liability (AAL) is similar to ABO except that AAL is defined by the Employee Retirement Income Security Act (ERISA) as opposed to FAS. ABO and PBO are accounting measurements, while AAL is used to determine the funded status on which minimum required contributions are based.

### **Some Characteristics of Pension Liabilities and Why They Matter**

Fundamental characteristics of a pension's liabilities include the average age of plan participants, the percentage of participants that are inactive (receiving benefits), male/female mix, distribution of years of service, distribution of population age, presence of a COLA feature, availability of lump sum distributions at the termination of employment, as well as the formula<sup>3</sup> used to determine benefit payments. Plan structure, as well as actuarial and accounting assumptions, affect the character of the liabilities. Although accountants and actuaries are responsible for providing appropriate advice on these issues, other parties involved in the investment process should have a solid understanding of how they affect the liability structure and thus future changes in liability value. Variations in the underlying assumptions and plan characteristics will affect plan liquidity requirements, the time horizon of the asset pool, constraints on the amount of illiquid assets that can be held in the portfolio, and the structure of the fixed income portfolio (duration, size, etc.).

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<sup>3</sup> Terms of the benefit formula include eligible retirement age, years of service, and calculation of salary.

## Importance of the Discount Rate Applied to the Liabilities

The current financial health of the pension plan (funded status) is dependent on the value of assets, estimated future benefit payments, and the discount rate applied to those payments. Over short periods, estimates relating to future payments are relatively stable, whereas the discount rate applied to the liabilities can change materially. Therefore the funded status from one year to the next is primarily affected by volatility in asset returns and changes in the discount rate.

The value of a pension's liability will react similarly to changes in interest rates, as would a bond of similar duration and credit quality due to the nature of the discount rates. This concept is intuitive when one considers that a pension plan is an obligation to make a future stream of payments, hence the sponsor has in essence issued an instrument similar to a bond. The connection between bonds and pension liabilities is apparent because the value of a bond portfolio and the present value of the liability generally move in the same direction in response to changes in interest rates (Exhibit 3).

The degree to which portfolio returns keep pace with changes in the value of the liability caused by shifts in the discount rate is a principal consideration when evaluating asset allocations. Therefore plan sponsors are likely to be more concerned with the volatility of assets relative to liabilities (i.e., tracking error) than with the absolute volatility of asset returns.

## Risks

### Risks to Consider during the Asset Allocation Process

**Long-Term Funding Shortfall.** The risk that asset growth does not keep pace with liability growth, thereby requiring substantial contributions. This can result from some combination of large errors in the actuarial estimate of the liability and/or disappointing asset returns. It should be noted that in some cases this is a function of non-investment-related factors (rapidly growing organization).

**Volatility in Funding Status.** Volatility in funding status has the particularly undesirable consequence of uncertain and sometimes large required contributions. The significance of this risk depends on a variety of factors including, but not limited to the following: the importance of smooth and predictable earnings and cash flows, the size of the pension liability relative to other aspects of the organization, the availability of cash, and the sponsor's access to the capital markets. If this risk is significant it can result in a lower credit rating and a higher cost of debt and equity capital.

**Volatility of Periodic Expenses and Contributions.** Volatility of expenses and contributions is related to volatility in plan funding status. Higher volatility of contributions and expenses increases cash flow and earnings uncertainty, which can impact a firm's credit rating, cost of debt and equity capital, and corporate planning.

**Maverick Risk.** Based on the wording of ERISA and subsequent interpretations regarding the concept of “prudent expert,” a plan sponsor is likely to avoid allegations of imprudence if they invest in a manner similar to their peers. Although utilizing an investment approach different from one’s peers does not imply imprudence (it could very well be the only prudent course of action), many sponsors take the stance that they are acting prudently if the majority of their peers have taken similar action.

### **Factors Affecting the Ability of a Plan to Take Risks**

**Current Funded Status.** A plan’s funded status is a principal measure of a plan’s financial health. A fully funded plan *could* choose not to take investment risk so as not to jeopardize the funded status. On the other hand, an underfunded plan *must* determine what combination of investment risk and cash contributions will close the funding gap.

**Characteristics of the Liability.** The characteristics of the liability relate to the demographics of the pension’s participants and certain provisions of the plan. From the actuarial report one can obtain the average age of the participants and the percentage of the participants that are retired. The demographics of the plan affect the time horizon and liquidity required of plan assets. A younger workforce and higher percentage of active participants lengthens the time horizon of the plan and increases the plan’s ability to accept greater risks. In contrast, if a plan provides for lump sum distributions, which are difficult to forecast, this acts as a liquidity constraint. Additionally, if a COLA is provided, this further increases the uncertainty of future cash outflows, which may also affect the ability and/or willingness to accept higher near-term volatility of asset returns.

**Preferences of the Pension Board.** These are no different than the typical biases and preferences of other committees. The pension board normally includes the CFO and possibly the CEO of the organization. Their personal goals will likely be to avoid problems with the plan that distract them from managing their business and to minimize future contributions and pension expense.

**Financial Health of the Sponsor.** How healthy is the sponsor’s balance sheet? Are there any short-term capital constraints? If cash contributions are required and the sponsor’s operating cash flows are insufficient, would the sponsor be able to access the capital markets to obtain the required funding? Might higher short-term contributions affect the sponsor’s credit rating? A sponsor with greater financial strength has the ability to undertake risk. In contrast, while a sponsor in a weaker financial position may wish to undertake more risk in an effort to increase return, possibly lowering future contributions, a weak position may be an impediment to the assumption of additional risk.

**Relationship between Asset Returns and the Cash Flows of the Sponsoring Organization.** This can be an important consideration when examining alternative asset allocations. The stronger the tie between the sponsor’s cash flows and asset returns, the more likely the sponsor will be required to make contributions at an inopportune time, when operating cash flows are depressed. If the sponsor is flush with cash or can easily and reasonably access the capital markets, this is less of a concern.

## **Asset Allocation**

Plan sponsors must consider the nature of their liabilities, liquidity constraints, and financial flexibility when determining their asset allocation. For example, a plan with few retired participants and a lower average participant age will have fewer liquidity requirements, and will have a relatively high percentage of its liabilities attributable to the long-term effects of wage inflation. The plan sponsor will have the ability to invest a larger portion of its assets in longer duration investments, such as equities, venture capital, private equity, and direct real estate.

In addition, the manner in which the benefit is calculated at retirement, including whether the benefit contains a COLA feature, will likely affect the amount of inflation protection that is desired. For instance, if the benefit is based on an average of the final three years' salary rather than a career average, or if the benefit provides a COLA, the plan will be more sensitive to inflation. These factors will have to be considered when determining the appropriate asset allocation.

The sponsor may think of the plan as consisting of different subpools of assets blended together. For example, the sponsor may think of the liabilities in terms of maturity, with different asset allocations for short-, medium-, and long-term expected payments. Or the sponsor may think of the liabilities in terms of groups of beneficiaries, with different allocations for inactive beneficiaries, active beneficiaries' accrued benefits, active beneficiaries' future benefits, and future beneficiaries. The asset allocations for these subpools, when blended together, determine the asset allocation for the entire pool of assets.

## **Immunization**

Generally immunization refers to a strategy that inoculates a portfolio against some specific risk(s), (e.g., interest rate risk). In the case of pension investing, immunization is an asset allocation strategy that seeks to coordinate the movement of plan assets and liabilities. Immunization strategies seek to remove volatility in the funded status of the plan, required contributions, and pension expense.

There are two general approaches to immunization: cash flow matching and duration matching. Cash flow matching is an attempt to dedicate cash flows generated from assets (including income and return of principal) to cover projected benefit payments. In theory, the sponsor removes all uncertainty regarding the source of "known" future cash flows. Duration matching involves creating a portfolio of assets whose change in value will mirror the change in the value of a liability when interest rates change.

Immunization is not necessarily more appropriate for any specific pension profile. A sponsor with an overfunded plan may desire immunization with the goal of eliminating funding risk, essentially taking bets off the table. Alternatively, while growth would be ideal for an underfunded plan, the sponsor may be averse to volatility in required contributions, effectively preferring a stable, though undesirable, contribution rate.

## **Costs, Benefits, and Practical Limitations of Immunizing the Liability**

While immunization works well in theory, practical limitations, such as opportunity and implementation costs, can be significant. If a sponsor's sole goal is to eliminate volatility in contributions and minimize future uncertainty relating to cash outflows, then cash flow matching could be desirable. Cost considerations aside, cash flow matching requires precise estimates of future benefit payments and constant adjustment of the immunized portfolio as estimates of cash outflows change over time. In most cases, near-term payments are reasonably known while longer-term payments are less certain.

Immunization via duration matching is less of an undertaking than cash flow matching in that the process focuses on the aggregate liability rather than individual cash flows. The goal is to set the asset allocation such that the portfolio duration is identical to that of the liability. Duration matching does not eliminate the future risk of cash flow mismatches, but strives to minimize tracking error between changes in assets and liabilities. It is difficult to eliminate tracking error because of a variety of factors, such as nonparallel yield curve shifts, differences in credit quality, basis risk, and other factor mismatches.

Duration matching entails investing in a portfolio of high-quality, noncallable, non-mortgage-backed securities fixed income instruments with an aggregate duration approximately equal to that of the liabilities. The liability structure will change from year to year, so the asset and liability characteristics should be re-examined annually and adjustments implemented to assure that the desired duration match is maintained. The attractiveness of immunization is unique to each institution, based on the characteristics of their liability,<sup>4</sup> their risk preferences, profitability, and financial position.

While the reduction in the volatility of plan funded status, contributions, and pension expense reduces risk, it also bears an opportunity cost in that it does not allow for a reduction in contributions and expenses that could be achieved by higher investment returns. Plan sponsors should consider whether it is better to be assured of less volatile contributions and expenses, even if they are higher than what a prudently diversified portfolio containing a higher equity allocation might require.

### **Partial Immunization as an Alternative**

While complete immunization can be costly and impractical, the motive is reasonable. It is desirable to prevent a scenario where the value of the liability increases substantially due to a decrease in interest rates while the value of the asset pool falls or fails to keep pace. Market environments in which this is likely to occur are periods when interest rates decline substantially due to deflationary pressures and economic contraction while other asset classes perform poorly, such as the United States in the 1930s, Japan in the 1990s, and the United States in 2000-02 (Exhibit 4). In addition to the divergence in asset and liability values, sponsors' profits generally decreased in these periods, resulting in broader financial stress.

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<sup>4</sup> If a plan has an unusually young workforce and a plan duration exceeding 30 years it would be essentially impossible to immunize the liabilities with a fixed income portfolio.



Partial immunization, via duration matching, should be viewed as a tool for reducing volatility in funded status (i.e., tracking error of asset returns versus liability growth). It can be an effective way of implementing a pension plan's fixed income portfolio. The plan's liability structure and the relevant discount rate provide a benchmark by which the fixed income pool could be managed. Additionally, an immunized fixed income portfolio provides a source of cash for near-term beneficiary payments so that depressed equity assets need not be sold at inopportune times, thereby protecting the institution's ability to meet its future obligations to beneficiaries (Exhibit 5).

### **How Asset Classes are Viewed Differently by Pension Funds and Endowments**

In analyzing the attractiveness of asset classes in pension plan asset allocations, the risk-minimizing asset class would be highly correlated to changes in the value of the liability that occur when interest rates decrease and negatively correlated to changes in the liability value caused by increases in interest rates. Of course this asset does not exist. Nevertheless the lesson holds; plan sponsors are often more concerned with the volatility of asset returns relative to the liability than with the absolute volatility of returns (Exhibit 6). Pension liquidity requirements may also differ from an endowment, affecting the required allocation to liquid short-term investments and possibly limiting holdings in illiquid assets.

When non-pension investors think about a risk-free asset they often think of T-bills, where the principal is stable. Since plan sponsors are concerned with the relationship between the value of plan assets and the value of plan liabilities, the risk-free asset for a pension plan is often considered to be a portfolio of bonds that mirrors the characteristics of the liability. The bonds would then have a similar sensitivity to changes in yields.

**Fixed Income.** As examined in the discussion on immunization, the fixed income portfolio of a pension plan has a similar objective as that of an endowment—to provide a hedge in the case of an economic contraction. An important difference is that the duration of the liability should be considered when designing the fixed income portfolio. Additionally, the fixed income portfolio should be concentrated in domestic securities. Global fixed income securities provide a poor match to the liability since the discount rates defined by regulatory bodies are generally based on domestic benchmarks.

With endowments and foundations, fixed income provides a source of cash for near-term spending so that depressed equity assets need not be sold at inopportune times, thereby protecting future spending as well. Fixed income plays a similar deflation-hedging role for pension plans. However, for pension funds, fixed income also protects the relative value of the portfolio when rates are high but falling (e.g., fall from 10% to 8%), which would not be as big a concern for endowments and foundations.

While the required fixed income allocation, and its characteristics, is less defined with endowments and foundations due to the uncertain profile of an economic contraction, plan sponsors can use their liability as a benchmark for their fixed income portfolio, as they attempt to minimize their asset-liability mismatch. Furthermore, higher fixed income allocations may be more attractive to the pension plan sponsor because of the strong relationship of this asset class to the liability.

**Equities (Marketable and Non-Marketable).** Equities are generally considered long-duration<sup>5</sup> assets that potentially provide real growth to cover future obligations. There is a risk of significant tracking error relative to the liability at the worst times (deflationary periods). However, equities are also desirable because they have historically provided protection against wage inflation.<sup>6</sup>

**Real Assets.** Although real assets are attractive for the protection they provide against inflation and their diversification characteristics, they are also likely to perform very poorly in deflationary times, which is precisely the time when liability values are likely to increase as interest rates drop. However, hard asset investments should be considered as they relate to sponsors' wage inflation and any benefit payment COLAs.

### **The Precision of Asset/Liability Modeling**

The complex and formulaic nature of pension liabilities implies that quantitative modeling should play a critical role in asset allocation decisions. When something is as complex as a pension liability, it is natural to defer to a model that presumably incorporates every detail. Unfortunately, with this complexity comes many estimates. When uncertainty is layered on top of uncertainty, any apparent precision in the results is just as likely to be illusory as real. The point of these caveats is not that these assumptions should not be made, rather when interpreting analysis that is dependent on so many unknowns, we must take extra care not to overestimate the precision of the output. It should not be assumed that quantitative analysis precisely replicates reality, but it can help investors understand some of the tradeoffs they face.

Some of the issues and estimates that are firmly in the province of actuaries and pension benefits consultants include benefit formulation, future wage growth, future employee base, liability decrements (termination, mortality, etc.), and accounting or regulatory smoothing and amortization. Note that these estimates will be revised many times over the life of a plan, some every year.

It should be noted that a sponsor or its actuary are required to be detailed in their estimates because of the many accounting standards and other regulatory obligations. However, this amount of detail is not required for the evaluation of asset allocation.

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<sup>5</sup> Equities are generally considered long-duration assets due to their long-term and open-ended characteristics. Unlike bonds, cash flows from equities (dividend payments) are variable and there is no established maturity date or price, making the calculation of duration problematic. In addition, the impact of interest rate changes on equity prices is indirect and less definable than for fixed income assets.

<sup>6</sup> Plan sponsors are concerned with wage inflation since it affects the actuarial valuation of the liability.

## **EXHIBITS**

Exhibit 1

COMPARING ASSETS TO LIABILITIES

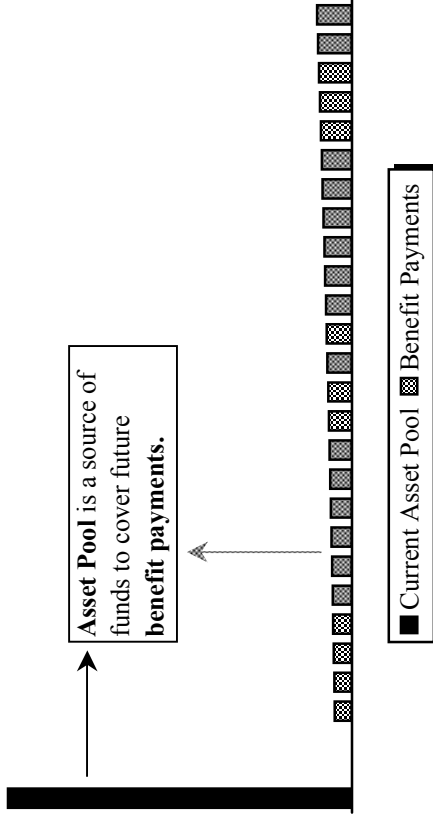
Pension assets exist to cover future benefit payments to beneficiaries. The graph to the right shows the asset pool (in black) and 25 years of these benefit payments (in gray).

The sufficiency of the pool is dependent on the return on assets and the size and timing of the benefit payments. It is convention to aggregate the future benefit payments in today's dollars for comparison with the market value of the asset pool.

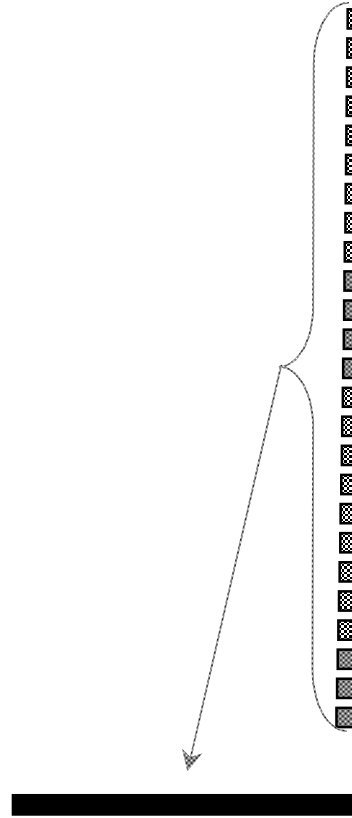
The chart below shows the future benefits in today's dollars based on an assumed discount rate. Note that while the benefits to the right are increasing, the present value as shown below decreases because the discount rate is larger than the growth in benefit payments. The solid black bar is the sum total of the present value of the individual payments.

The chart in the bottom right compares the present value of the aggregate liability from the chart below to the total assets from the chart to the right. In this sample there is a surplus, so the pension is said to be "overfunded."

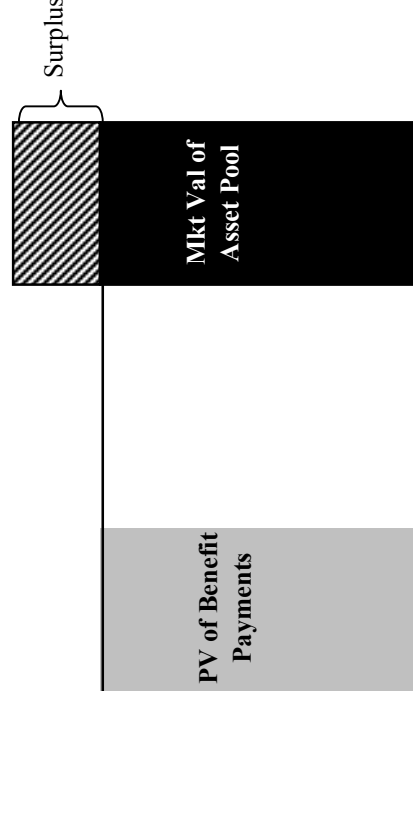
Asset Pool & Benefit Payments



Present Value of Benefit Payments



Assets Sufficient?



## Exhibit 2

### DISCOUNT RATE OVERVIEW

Pension liability valuation is dependent on discount rates, which enable a plan sponsor to value their liabilities in current dollars for comparison with an asset base. Allowable discount rates for pensions are governed by Employee Retirement & Income Security Act of 1973 (ERISA) and the Federal Accounting Standards Board (FASB), which determine what securities (e.g., x-year, AA-rated corp) may be used in determining market rates. A brief description of the requirements follows:

**ERISA** – Prior to 2004 (under temporary legislation) the allowable discount rate was 90% to 120% of the weighted-average yield of the 30-year Treasury bond. Currently, under legislation that will expire after 2005, the discount rate is calculated by taking a “weighted average” of interest rates on long-term investment-grade corporate bonds. This discount rate is used to determine the funded status of the plan and the required level of sponsor contributions.

**FASB** – The only requirement in the sponsor’s determination of the appropriate discount rate is that it is reasonable. Moody’s Aa-rated corporate bond yields are often used. This discount rate is used in the plan-funding calculation for financial statements that are provided to investors and the SEC.

**Exhibit 3**

**DISCOUNT RATES AND THE PRESENT VALUE OF LIABILITIES**

The chart to the left shows a hypothetical string of benefit payments. While unrealistic, as most plan sponsors would be facing more than ten years of payments, this example illustrates the significance of changes in the discount rate.

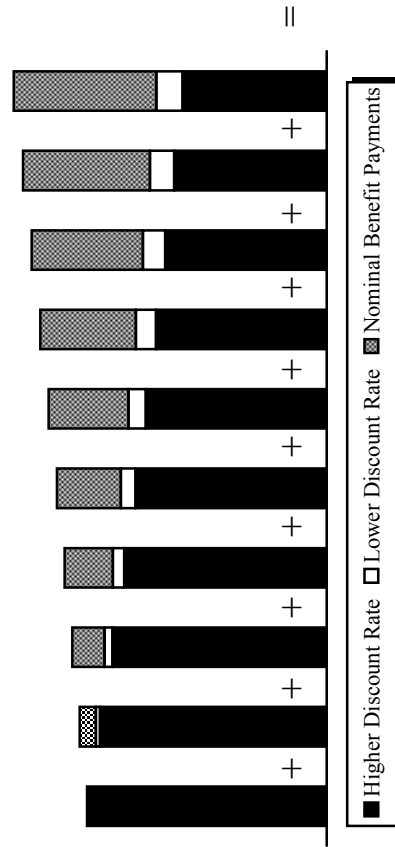
**Future Benefit Payments**



The chart on the bottom left introduces discount rates to determine the present value of each future payment. Note that the further out the benefit payment, the bigger the difference in present value caused by the rate differential. This increased sensitivity to rate changes is analogous to bond behavior. The present values at the higher discount rate are shown by the black bars. The present values at the lower discount rate are shown as the white bars.

The chart below shows how the total present value of identical benefit payment streams changes with different rates.

**Future Benefits Discounted at Different Rates**



**Present Value of Future Benefits**

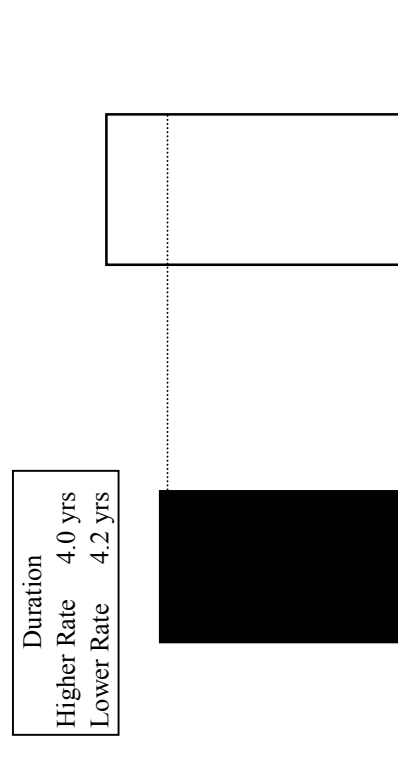


Exhibit 4

PERIODS OF STRESS FOR PENSION FUNDS

Historical Economic Contractions (Three-Year Periods)

|  | Cumulative Return (%) |       | Cash Yield |      | Annual Inflation |        |        | Cumulative Return of Various Allocations (Equities/Bonds)* |       |       |       |
|--|-----------------------|-------|------------|------|------------------|--------|--------|--|-------|-------|-------|
|  | Equities              | Bonds | Start      | End  | Year 1           | Year 2 | Year 3 | 50/50  | 60/40 | 70/30 | 80/20 |
| <b>U.S. Depression</b><br><i>(Jul 1929 - Jun 1932)</i>       | -81                   | 7     | 6.2%       | 0.2% | -1.8%            | -10.1% | -9.9%  | -37  | -46   | -54   | -63   |
| <b>Japan (first 3 years)</b><br><i>(Jan 1990 - Dec 1992)</i> | -53                   | 28    | 6.8%       | 3.8% | 3.8%             | 2.6%   | 1.1%   | -12  | -20   | -29   | -37   |

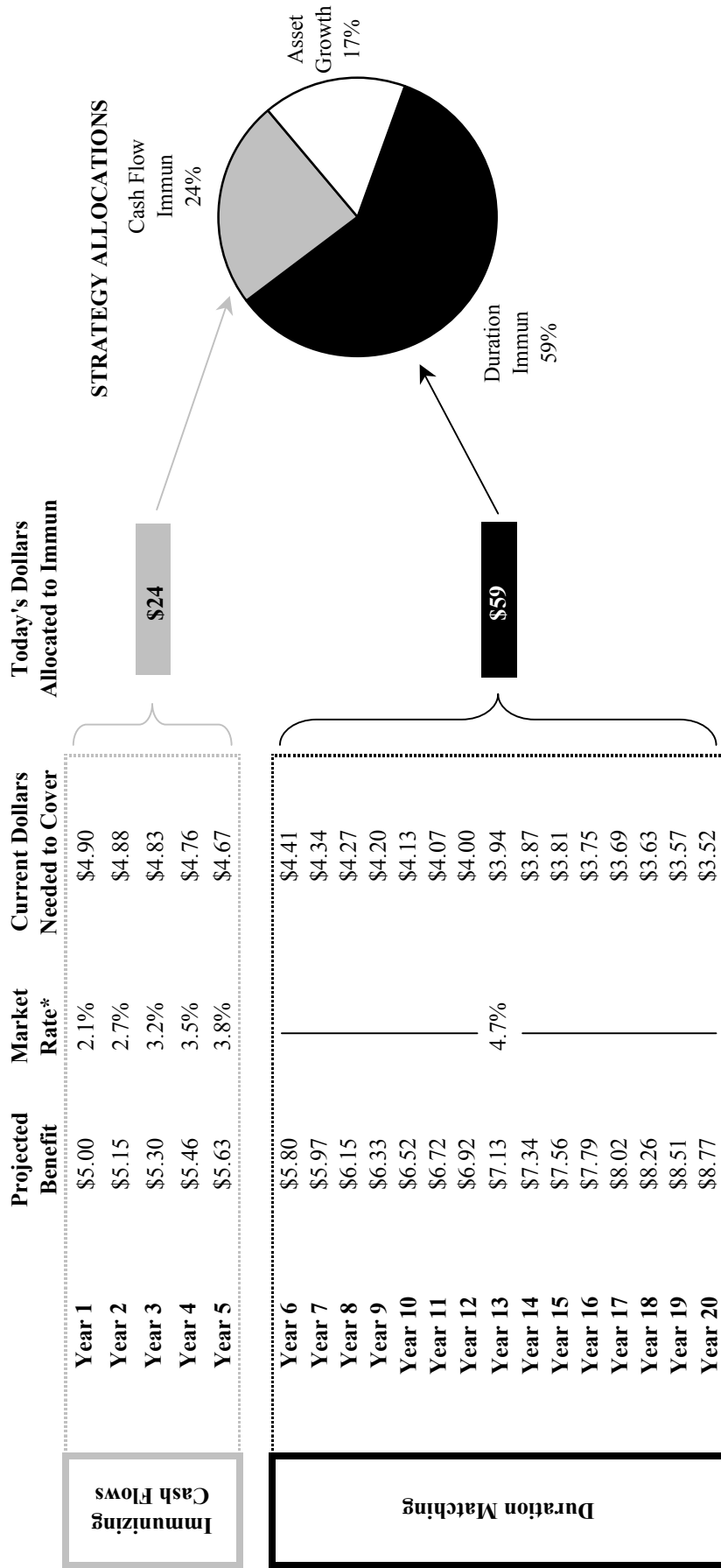
Other Periods of Stress

|  | Cumulative Return (%) |       | Cash Yield |      | Annual Inflation |        |        | Cumulative Return of Various Allocations (Equities/Bonds)* |       |       |       |
|--|-----------------------|-------|------------|------|------------------|--------|--------|--|-------|-------|-------|
|  | Equities              | Bonds | Start      | End  | Year 1           | Year 2 | Year 3 | 50/50  | 60/40 | 70/30 | 80/20 |
| <b>Oil Crisis (U.S.)</b><br><i>(Jan 1972 - Dec 1974)</i>         | -25                   | 5     | 3.7%       | 7.2% | 3.4%             | 8.7%   | 12.3%  | -10  | -13   | -16   | -19   |
| <b>U.S. Bull Market Collapse</b><br><i>(Apr 2000 - Mar 2003)</i> | -41                   | 45    | 5.9%       | 1.1% | 2.9%             | 1.5%   | 3.0%   | 2  | -7    | -15   | -24   |

\*Allocations assume no rebalancing during period.

**Exhibit 5**

**PARTIAL IMMUNIZATION SAMPLE**



**Duration approx 13 years**

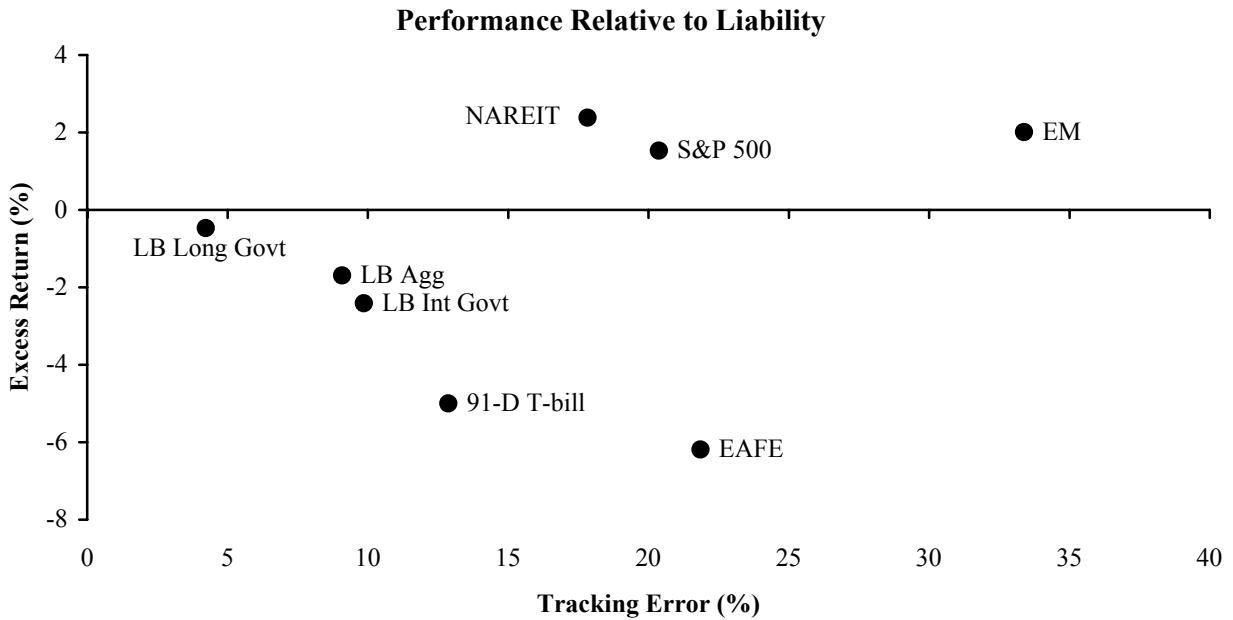
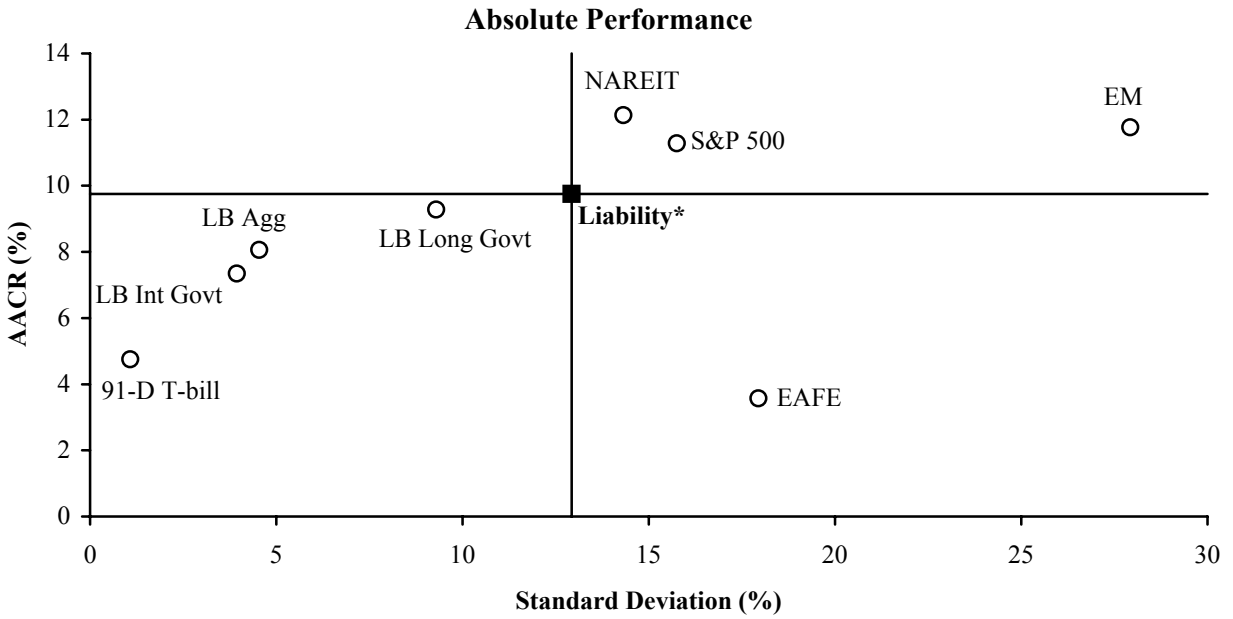
\*Market rate refers to bond yields of different maturities. The rates in this sample have no specific meaning and are used only for illustrative purposes.



**Exhibit 6**

**HOW DO PENSION PLAN SPONSORS MEASURE PERFORMANCE?  
ABSOLUTE VERSUS RELATIVE**

**January 1989 - June 2004**



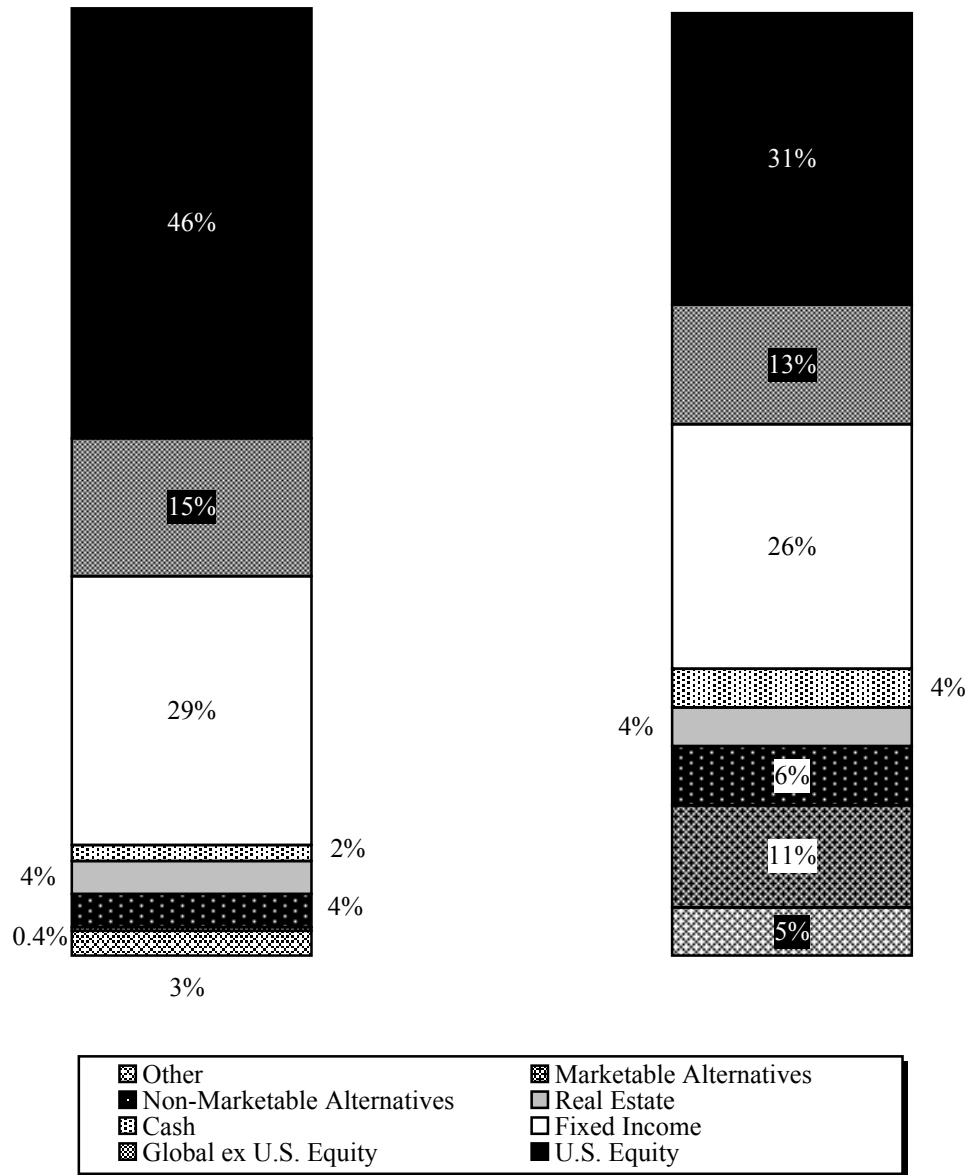
\*Liability represented by the Ryan Labs Liability Index.

Exhibit 7

COMPARATIVE ASSET ALLOCATION: PENSIONS VERSUS ENDOWMENT

Top 1,000 Defined Benefit Plans<sup>1</sup>

CA All Endowment Mean<sup>2</sup>



<sup>1</sup> Pensions & Investments, 2004 Top 1,000 Pension/Employee Benefit Funds.

<sup>2</sup> CA All Endowment Mean as of June 30, 2004.

**Exhibit 8**

**THE MATH OF LIABILITY DURATION**

**Assumptions:**

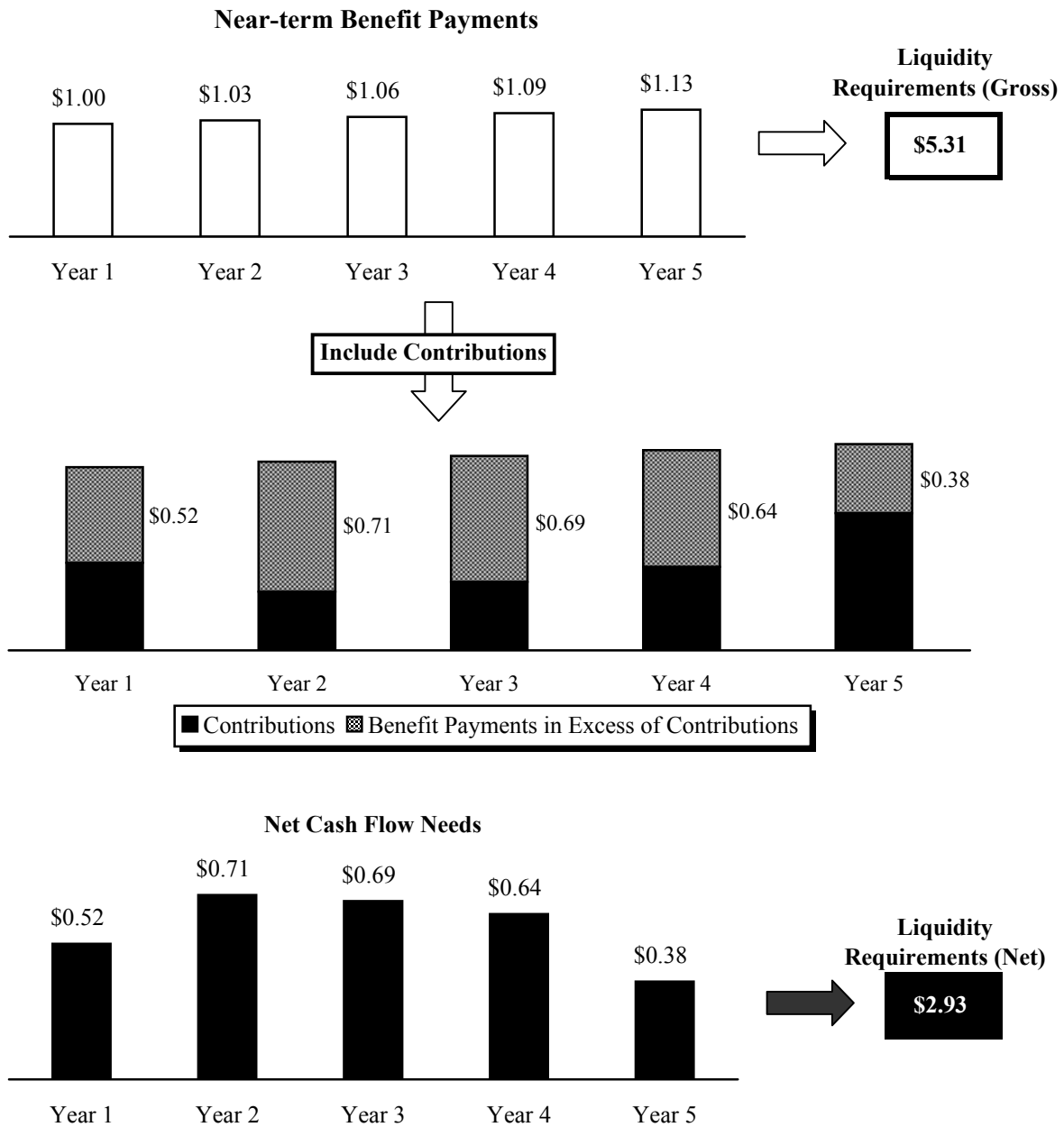
- 20 years of benefit payments start at \$1.00.
- Payments increase (i) at 3.0% each year.
- Discount rate (r) = 6.0%.

| Year<br>(A)     | Benefit Payment<br>(B)        | Discount Factor<br>(C) | PV of Benefits<br>(D) | Fraction of Total PV<br>(E) |
|-----------------|-------------------------------|------------------------|-----------------------|-----------------------------|
| <i>Formula:</i> |                               |                        |                       |                             |
|                 | $\$1.00 \times (1+i)^{(A-1)}$ | $(1+r)^{-A}$           | $(B) / (C)$           | $(D) / \text{SUM}(D)$       |
| 1               | \$1.00                        | 1.06                   | \$0.94                | 6.5%                        |
| 2               | \$1.03                        | 1.12                   | \$0.92                | 6.3%                        |
| 3               | \$1.06                        | 1.19                   | \$0.89                | 6.1%                        |
| 4               | \$1.09                        | 1.26                   | \$0.87                | 5.9%                        |
| 5               | \$1.13                        | 1.34                   | \$0.84                | 5.8%                        |
| 6               | \$1.16                        | 1.42                   | \$0.82                | 5.6%                        |
| 7               | \$1.19                        | 1.50                   | \$0.79                | 5.5%                        |
| 8               | \$1.23                        | 1.59                   | \$0.77                | 5.3%                        |
| 9               | \$1.27                        | 1.69                   | \$0.75                | 5.1%                        |
| 10              | \$1.30                        | 1.79                   | \$0.73                | 5.0%                        |
| 11              | \$1.34                        | 1.90                   | \$0.71                | 4.9%                        |
| 12              | \$1.38                        | 2.01                   | \$0.69                | 4.7%                        |
| 13              | \$1.43                        | 2.13                   | \$0.67                | 4.6%                        |
| 14              | \$1.47                        | 2.26                   | \$0.65                | 4.5%                        |
| 15              | \$1.51                        | 2.40                   | \$0.63                | 4.3%                        |
| 16              | \$1.56                        | 2.54                   | \$0.61                | 4.2%                        |
| 17              | \$1.60                        | 2.69                   | \$0.60                | 4.1%                        |
| 18              | \$1.65                        | 2.85                   | \$0.58                | 4.0%                        |
| 19              | \$1.70                        | 3.03                   | \$0.56                | 3.9%                        |
| 20              | \$1.75                        | 3.21                   | \$0.55                | 3.8%                        |
|                 |                               |                        | <b>Total PV</b>       | <b>\$14.56</b>              |
|                 |                               |                        |                       | <i>SUM(D)</i>               |
| <b>Duration</b> |                               | <b>9.6 years</b>       |                       |                             |
|                 |                               | <i>SUM of (A x E)</i>  |                       |                             |

**Exhibit 9**

**LIQUIDITY CONSTRAINTS**

Pension funds have very real liquidity constraints. Near-term benefit payments are relatively certain and therefore the liquidity needs are relatively well-known. While estimated benefit payments are the primary driver of the need for liquidity, plan sponsors may also want to consider the cash flow needs net of expected contributions. For example, if benefit payments are expected to be \$5 but the sponsor is required to contribute \$2, then the asset pool need only reflect the \$3 in the asset allocation process.



## **APPENDIX**

## GLOSSARY OF COMMON PENSION TERMINOLOGY

**Accumulated Benefit Obligation (ABO)** – The pension benefits that have accrued to current and former employees based on current and past compensation levels and discounted at current interest rates. This present value of accrued liabilities makes no assumptions about future compensation levels.

**Cost-of-Living Adjustment (COLA)** – A small incremental increase in retirement benefits, granted to retirees by a plan in an attempt to keep such benefits in line with inflation.

**Defined Benefit Plan** – A pension plan in which the amount of benefits received by an employee is defined by a formula, which usually considers years of service and salary.

**Defined Contribution Plan** – A pension plan in which the amount of benefits payable to an employee is determined by the amount contributed to the employee's account and any growth on such contributions.

**Discount Rate** – The interest rate used to discount the amount of future benefit payments in determining its present value (FAS and ERISA).

**Employee Retirement Income Security Act (ERISA)** – The federal law that establishes the basic requirements for employee benefit plans. The authority for administering and enforcing ERISA is divided among three federal agencies: The Internal Revenue Service, the Department of Labor, and the Pension Benefit Guaranty Corporation.

**Financial Accounting Standards Board Statement 87 (FASB 87)** – Issued in 1985, it established new standards for employers' accounting for pensions and focused on the surplus—the difference between the assets and liabilities.

**Fiduciary** – A person or organization with control over the plan or its assets.

**Fully Funded Plan** – A pension plan with sufficient assets to cover benefit payments.

**Funding Ratio** – Plan assets are often expressed as a percentage of the PBO. A funding ratio of 100% indicates plan assets are equal to liabilities. A funding ratio of less than 100% indicates that the plan has unfunded liabilities.

**Minimum Required Contributions** – Amount of contributions required to cover net pension cost and make necessary payments to cover the unfunded PBO.

**Multi-Employer Plan** – A pension plan set up by collectively bargained agreements involving more than one unrelated employer, generally in one common industry.

**Net Pension Cost** – Accounting measure—including several components—of the cost to a company of providing pension benefits.

**Noncontributory Plan** – A benefit plan that is funded completely by contributions from the employer.

**Omnibus Budget Reconciliation Act of 1987 (OBRA)** – Mandates pension contribution rates and PBGC insurance premiums that are sensitive to the pension-funding ratio.

**Participant** – A person who is or may become eligible to receive a benefit from a pension plan.

**Pension Benefit Guaranty Corporation (PBGC)** – A government agency that was established by ERISA to protect or guarantee a certain portion of a plan participant’s benefits in case of voluntary or involuntary plan termination.

**Projected Benefit Obligation (PBO)** – Restates the ABO based on projected future benefits that incorporate assumptions about future salary growth.

**Pension Surplus** – The amount by which a plan’s assets exceed the PBO.

**Required Contributions** – The necessary level of contributions, in the case of an underfunded plan, as determined by an actuary to improve the funded status of the plan.

**Single-Employer Plan** – A pension plan sponsored by a single employer or a group of companies under common control. (Also, a pension plan sponsored by unrelated companies that is not collectively bargained.)

**Trustee** – A person or organization with a duty to receive, manage, and disburse the assets of a plan.

**Underfunded Plan** – A pension plan without enough assets to pay or cover the present value of benefit payments.

**Unfunded Benefit Liabilities** – The amount of promised pension benefits that exceeds a plan’s assets.

**Valuation Date** – The date dictating the interest rate to be used in determining present value, thereby establishing value as of such date.

**Wage Growth (inflation and merit)** – Estimate with respect to the future compensation of current and future workers, can vary by industry (e.g., wage inflation in the medical/hospital industry is higher than that in the mining industry).