



# Building a Better Pension Plan

Funding Crisis  
Calls for New  
Allocation  
Strategy

SUMMER 2009

*This paper discusses liability-driven investing, and is designed for plan sponsors, managers and consultants. The paper discusses a sophisticated allocation strategy combining long credit and minimum volatility equity that is designed specifically for institutional liability management. In addition, the paper relies on hypothetical and/or simulated performance results and does not represent returns that any investor actually attained. Accordingly, the paper is not designed for or suitable for retail investors and should be used only by knowledgeable institutional investors who understand the limitations and risks of the liability-driven investing framework and hypothetical and/or simulated performance results.*

**The perfect storm of 2008 exposed two significant pension plan allocation risks: extreme volatility in the capital markets and associated asset/liability mismatches.**

*For a detailed description of the asset allocation models and simulation methodology used in our research, as well as the underlying assumptions and limitations of those models, see Appendix B, page 10.*

*For a detailed description of the current funding crisis, see Appendix C, page 11.*

**Changes to pension regulations and the market upheaval** of 2008 have shifted the focus of many plan sponsors from returns-based investing to liability-driven investing (LDI). Liability-driven investing is a framework that reprioritizes pension management from absolute returns to the liabilities associated with future obligations. In this paper, Analytic Investors, LLC and Dwight Asset Management Company LLC explore the benefits of an innovative LDI approach that pairs a long credit fixed income portfolio with a minimum volatility equity strategy. This approach seeks to meet plan liabilities, minimize funded status volatility, and rebuild plan assets.

As has been widely reported, U.S. corporate pension plans are in a funding crisis. As of February 2009, the funded status of the largest corporate plans fell below 75%, down from almost 100% one year earlier.<sup>1</sup> Before 2006, a 75% funding level might not have raised the red flag it does today because corporations had greater flexibility to smooth extreme returns on their balance sheet.<sup>2</sup>

The Pension Protection Act of 2006 requires additional payments for underfunded plans (plans with a funded status below 94% in 2009 or below 96% in 2010) to close their funding deficit over a seven-year period. Pension consultant Milliman estimates that overall plan contributions must nearly double to resolve this funding shortfall. In this cash-strapped, recessionary economy, increased funding requirements could severely stress corporate budgets and earnings. Plans can no longer afford the asset/liability mismatches of the past.

## **Long Credit & Minimum Volatility Equity: Liability Matching with Equity Potential**

The perfect storm of 2008 exposed two significant pension plan allocation risks: extreme volatility in the capital markets and associated asset/liability mismatches. Recent market conditions have given plan sponsors powerful evidence that liability-driven investment solutions must directly address both risks.

**Investors considering an LDI strategy are typically looking for several benefits, including**

- **an increase in expected funded status (defined as a plan's ability to match assets with liabilities; a funded status of 100% is fully funded),**
- **a decrease in asset return volatility (the standard deviation of the expected return of the plan's portfolio)**
- **a decrease in funded status volatility (the standard deviation of the expected funded status), and**
- **a decrease in expected contributions (the funds a company would need to contribute over a two-year period to maintain compliance with federal funding requirements).**

Our research indicates that pairing a long credit fixed income strategy with a minimum volatility equity strategy could help investors meet these objectives. The long credit/minimum volatility LDI approach is designed to match a pension plan's future liabilities while harnessing the equity risk premium to rebuild plan assets and potentially reduce future funding shortfalls.

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**Step One: Improve asset/liability matching through the fixed income allocation**  
 The commonly used 70%/30% equity/core bond asset allocation ratio has historically been viewed as a successful long-term asset allocation strategy. However, it has rarely been a good match to pension plan liabilities. This fact was dramatically demonstrated last year, as falling interest rates drove plan liabilities higher while equities lost nearly 40% of their value. Similarly, utilizing a core bond strategy as the dominant fixed income strategy within a plan's allocation often compounds this mismatch between plan assets and liabilities.

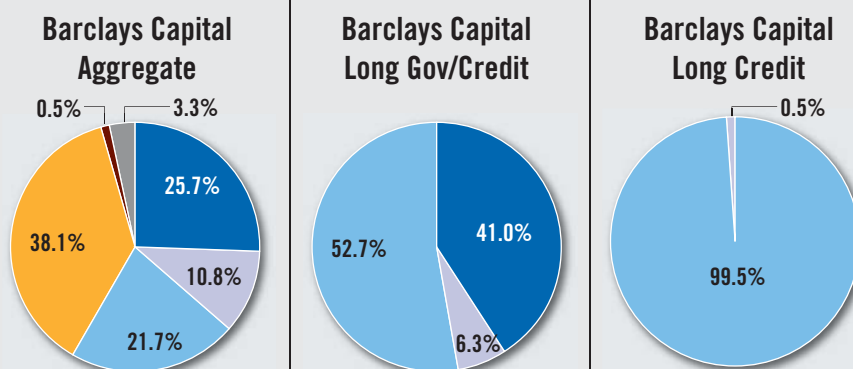
**Figure 1**

**LDI Benchmark Comparison**

as of 6/30/09

**Sector Diversification**

- U.S. Treasuries
- Agencies
- Corporates/Credit
- MBS Pass-Thru
- ABS
- CMBS



Effective Duration	4.3	11.6	11.4
Convexity	-0.30	2.03	2.07
Yield to Worst	4.12%	5.65%	6.83%
Number of Issues	8,866	1,112	980

SOURCE: Barclays Capital Live

The typical pension plan duration often averages between 10 and 15 years. Generally, the discount rate and present value of a plan's liabilities are determined by a yield curve composed of AA or AA-average quality corporate bonds. Since plan liabilities are being discounted in terms of corporate bond yields, an allocation to corporate bonds is a natural match to the liabilities. Potential corporate bond benchmarks for an LDI strategy include the Barclays Capital Aggregate Index, the Barclays Capital Long

Government/Credit Index, and the Barclays Capital Long Credit Index.

**We believe the Barclays Capital Long Credit Index is a particularly suitable benchmark for an LDI strategy.**

The Barclays Capital Aggregate Index typically exhibits a duration of four to five years and consists primarily of Treasury, corporate, and residential and commercial mortgage-backed securities. This difference in duration and reference bonds between pension liabilities and the Barclays Capital Aggregate Index means a portfolio benchmarked to the Barclays Capital Aggregate Index is unlikely to consistently respond to changes in a pension plan's liabilities.

In comparison, the Barclays Capital Long Government/Credit Index is a better proxy for plan liabilities given its longer duration range of 10 to 11 years and its higher allocation to corporate bonds. However, since approximately 50% of the index is allocated to government securities, the potential for a significant asset/liability mismatch remains.

The Barclays Capital Long Credit Index, which also exhibits a longer duration of 10 to 11 years, is a credit-only index. As a result, most of its constituents should behave similarly to the bonds used in determining the discount rate used to calculate plan liabilities. A fixed income allocation benchmarked to the Barclays Capital Long Credit Index should track a plan's liabilities more closely than other widely known cash bond proxies, all else being equal (see Figure 1).

**Table A**  
**Simulated Results of Switching from Core Bond to Long Credit<sup>3</sup>**

	34% Core Bond 56% Trad. Equity 10% Other	34% Long Credit 56% Trad. Equity 10% Other	Improvement Achieved by Switching to Long Credit (% change)
Expected Funded Status	89.6%	89.7%	No Change (0.0%)
Asset Return Volatility	13.6%	15.5%	2.0% More (+14.5%)
Funded Status Volatility	19.7%	18.4%	1.3% Less (-6.5%)
Expected Contribution* (\$Mil)	(198.0)	(189.0)	\$9 Million Less (-4.5%)

**Table B**  
**Simulated Results of Increasing Allocation to Long Credit<sup>3</sup>**

	34% Long Credit 56% Trad. Equity 10% Other	60% Long Credit 30% Trad. Equity 10% Other	Improvement Achieved by Increasing Allocation to Long Credit (% change)
Expected Funded Status	89.7%	92.1%	2.4% Greater (+2.7%)
Asset Return Volatility	15.5%	13.5%	-2.1% Less (-13.4%)
Funded Status Volatility	18.4%	13.9%	4.5% Less (-24.4%)
Expected Contribution* (\$Mil)	(189.0)	(144.0)	\$45 Million Less (-23.8%)

To illustrate the potential benefits of incorporating a long credit strategy, we utilized the monthly Citigroup Pension Liability Index to simulate the liabilities of a hypothetical \$1 billion corporate plan and replaced the commonly used core bond strategy with a long credit strategy. Using historical monthly data for the 10 years that ended in 2008, we calculated average two-year asset and liability returns to generate the results in [Table A](#) and [Table B](#).

[Table A](#) shows that replacing a core bond strategy (represented by the Barclays Capital Aggregate Index) with a long credit strategy (represented by the Barclays Capital Long Credit Index) reduced funded status volatility from 19.7% to 18.4%. Accompanying the decrease in funded status volatility was an increase in overall asset volatility due to the increase in bond portfolio duration. Based on our simulations, a hypothetical \$1 billion corporate plan would have been required to contribute nearly \$200 million to meet federal funding requirements over a two-year period. Switching to a long credit strategy reduced this expected funding shortfall to \$189 million, a savings of \$9 million.

[Table B](#) shows that larger allocations to long credit securities can help plans increase funded status and further reduce funded status volatility. By expanding the fixed income allocation from 34% to 60%, the

hypothetical plan's expected funded status increased by 2.7%, the volatility of that funded status fell by 24.4%, and asset volatility levels returned to those of a commonly used equity/core bond allocation. Significantly, the plan's expected contribution for the two-year period was reduced by \$45 million per the simulation.

### Step Two: Replace traditional equity with minimum volatility equity

History shows that increasing the fixed income allocation at the expense of the equity allocation will generally reduce long-term plan earnings. Under current pension regulations, that seems to be a necessary trade-off for reducing the mismatch between assets and liabilities. However, there are compelling reasons for plans to retain equity allocations.

- Equities may increase asset return above future liabilities, potentially reducing future contributions.
- Diversifying among asset categories generally offers risk reduction and return advantages.
- Retaining exposure to equities and other risk assets can help combat non-interest-rate related risks, providing some cushion against changes in actuarial assumptions and wage inflation, both of which could cause unanticipated increases in the actual liabilities.
- When a plan is underfunded, equities can provide the most attractive opportunity to rebuild plan assets.

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For a detailed description of the methodology used in our research, see [Appendix B, page 10](#).

A more detailed discussion of Dwight's LDI solutions can be found at [www.dwight.com](http://www.dwight.com).

A more detailed discussion of Analytic Investors, LLC's minimum volatility equity strategy can be found at [www.LowVol.com](http://www.LowVol.com).

**Table C**  
**Simulated Results of Switching from Traditional Equity to Minimum Volatility Equity<sup>4</sup>**

	60% Long Credit 30% Trad. Equity 10% Other	60% Long Credit 30% Min. Vol. 10% Other	Improvement Achieved by Switching to Minimum Volatility (% change)
Expected Funded Status	92.1%	92.9%	0.8% Greater (+0.9%)
Asset Return Volatility	13.5%	12.2%	-1.3% Less (-9.4%)
Funded Status Volatility	13.9%	13.0%	0.9% Less (-6.3%)
Expected Contribution* (\$Mil)	(144.0)	(134.0)	\$10 Million Less (-6.9%)

**Table D**  
**Simulated Results of the Long Credit/Minimum Volatility Equity Approach<sup>4</sup>**

	34% Core Bond 56% Trad. Equity 10% Other	60% Long Credit 30% Min. Vol. 10% Other	Improvement Achieved by Switching to Long Credit + Min. Vol. (% change)
Expected Funded Status	89.6%	92.9%	3.2% Greater (+3.6%)
Asset Return Volatility	13.6%	12.2%	-1.4% Less (-10.2%)
Funded Status Volatility	19.7%	13.0%	6.6% Less (-33.8%)
Expected Contribution* (\$Mil)	(198.0)	(134.0)	\$64 Million Less (-32.3%)

\* Expected contribution is the average funding required to bring a simulated \$1 billion plan back to 100% funded status following two-year trials in which funded status fell below 100%.

Underfunding is, of course, the prevailing concern in 2009, and we believe it will continue to be a dominant concern in the years to come. The need to “catch up” makes the equity risk premium an attractive option. However, downside equity risk suggests that a traditional equity approach may not be the best choice. Analytic’s research at [www.LowVol.com](http://www.LowVol.com) shows that a minimum volatility equity strategy has the potential to capture the higher historical long-term returns of stocks (equity risk premium) with less downside risk.

Table C builds on Table B and shows that replacing a traditional equity strategy with a minimum volatility equity strategy (represented by the MSCI Minimum Volatility Indices) further improved funded status, while also smoothing the variability of that status.

As depicted in Table D, which compares the hypothetical \$1 billion portfolio from Table A to a hypothetical long credit/minimum volatility equity LDI portfolio, the LDI portfolio improved the expected funded status by over 3%, reduced funded status volatility by nearly 34%, and reduced the expected plan contribution by \$64 million. Additionally, overall asset volatility is significantly reduced. The long credit/minimum volatility approach represents a significant enhancement over traditional LDI solutions because, per the simulation, it achieves better liability matching without significantly increasing the portfolio’s overall asset volatility.

## The Case for a Long Credit/Minimum Volatility Equity Approach

Long credit plus minimum volatility equity may deliver better short- and long-term liability matching, lower funded status volatility, and enhanced downside protection.

Simulations using historical index performance indicate that pairing a long credit fixed income strategy (represented by the Barclays Capital Long Credit Index) with a minimum volatility equity strategy (represented by the MSCI Minimum Volatility Index) would have delivered strong results for the period from January 1999 through December 2008.

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## Better Short-Term Liability Matching

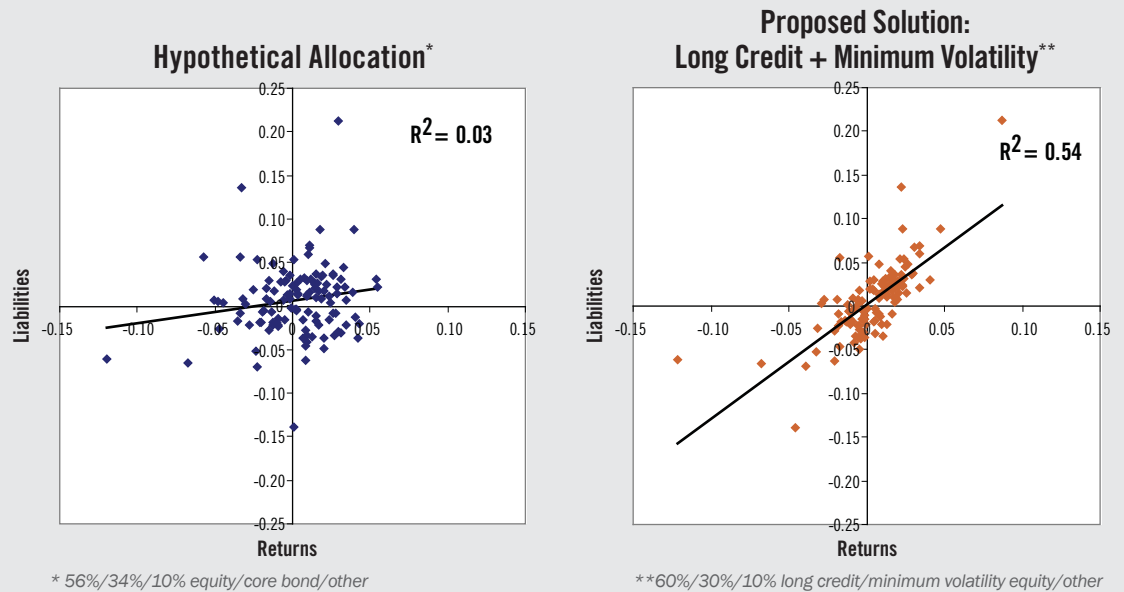
The long credit/minimum volatility equity pairing exhibited short-term returns that were better aligned with liabilities, a necessary objective in meeting the requirements of the Pension Protection Act of 2006 and FAS 158.

Figure 2 shows the monthly returns of a hypothetical allocation<sup>5</sup> and the monthly returns of the proposed long credit/minimum volatility equity approach, each compared to plan liabilities (represented by the Citigroup Pension Liability Index). As the data in Figure 2 indicates, monthly returns from the long credit/minimum volatility equity simulation better matched liabilities over the period. With the hypothetical equity/core bond allocation, monthly returns and monthly liabilities are statistically unrelated, as evidenced by an R-squared of 0.03. Combining long credit and minimum volatility equity raised the R-squared to 0.54 and, as shown in the chart, liabilities and returns tended to move together, increasing the likelihood that a plan would meet its liability target in any given month.

Figure 2

### Monthly Returns vs. Liabilities (Simulation)<sup>5</sup>

Jan. 1999 – Dec. 2008



## Lower Funded Status Volatility

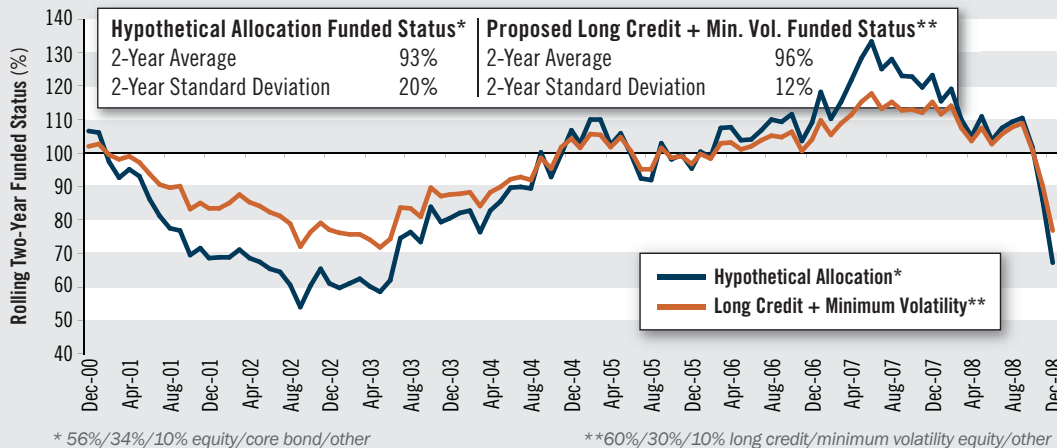
Focusing on the longer term, the rolling two-year funded status exhibited by the long credit/minimum volatility equity approach is 40% less volatile than that of the hypothetical equity-oriented pension allocation (Figure 3). This indicates that a long credit/minimum volatility portfolio should improve the ability of plan sponsors to meet their funding requirements with a lower cash outlay.

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Figure 3

### Lower Funded Status Volatility (Simulation)<sup>5</sup>

From 1999-2008, Long Credit/Minimum Volatility Equity Strategy Decreases Funded Status Volatility by 40%



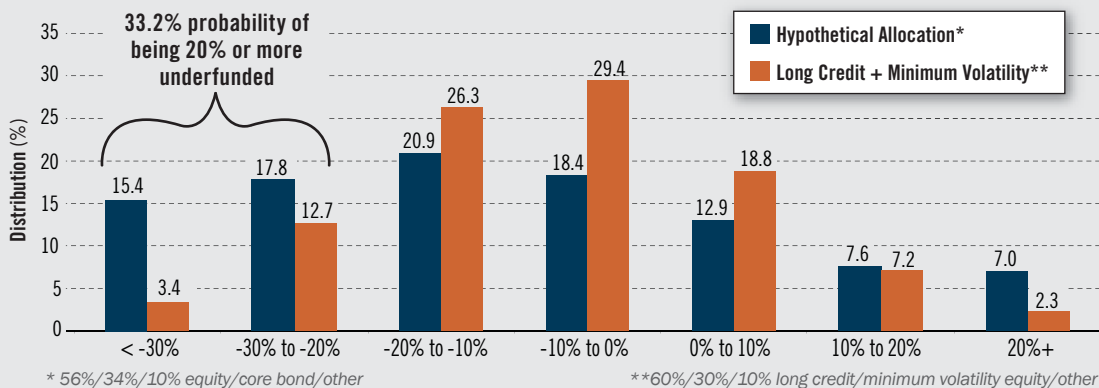
### Improved Downside Protection

Simulation analysis indicates that a plan using the hypothetical allocation has a 33% chance of being underfunded by 20% or more in any 24-month period. Increasing the allocation and duration of the bond portfolio and adding minimum volatility equity reduces this probability to about 16%, as shown in Figure 4.

Figure 4

### Distribution of the Two-Year Funded Status (Simulation)<sup>5</sup>

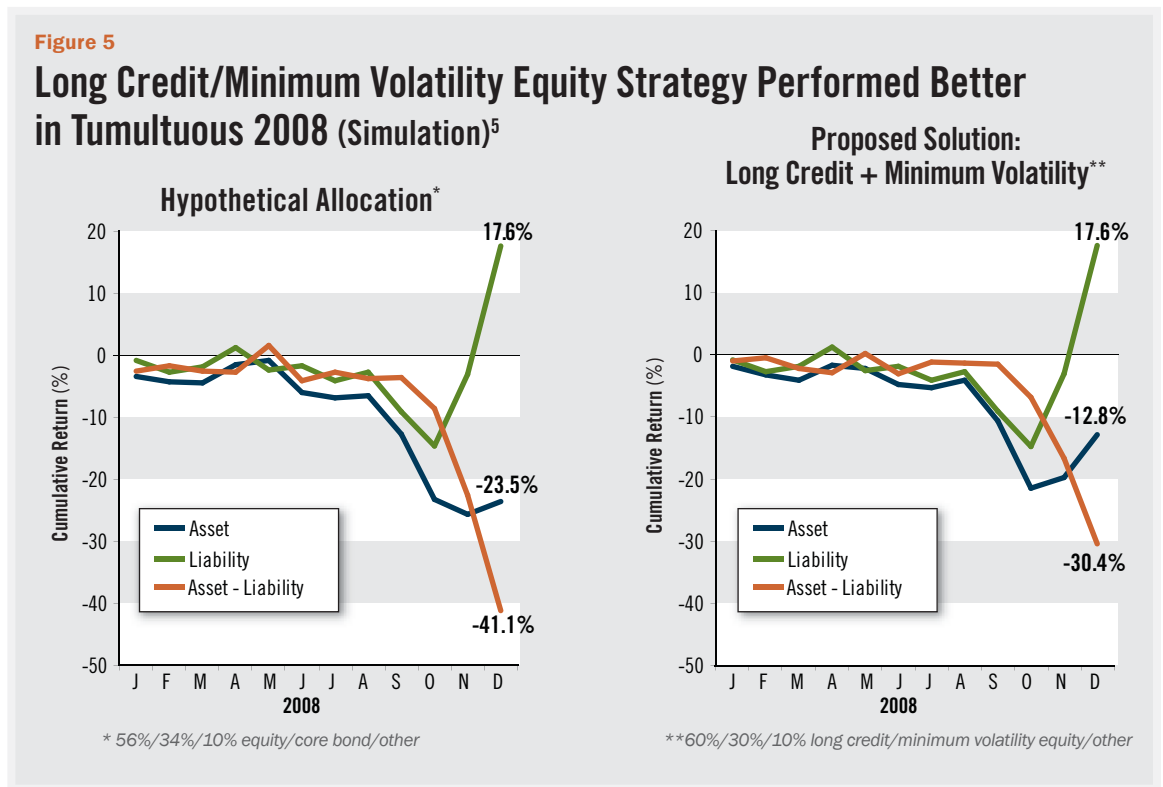
N=1,000,000



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### Testing in a Tough Market

With 2008's scars still fresh, it makes sense to view the effectiveness of this strategy by how it might have weathered last year's extreme market conditions. **Figure 5** shows that the proposed long credit/minimum volatility equity strategy would have improved both the return on plan assets and the funded status in 2008 relative to the hypothetical equity-oriented asset allocation. **Based on the simulation, compared to an equity-driven asset allocation, the hypothetical long credit/minimum volatility equity strategy would have reduced portfolio losses from -23.5% to -12.8%, and reduced underfunding from -41.1% to -30.4% for the year-ended 2008.**



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***In the aftermath of 2008, interest rates alone should no longer be the sole determinant for implementing an LDI strategy.***

*For more information regarding the proposed long credit/minimum volatility equity LDI approach, please contact Analytic Investors, LLC at [research@aninvestor.com](mailto:research@aninvestor.com) or Dwight Asset Management Company LLC at [info@dwright.com](mailto:info@dwright.com).*

## Implementing an LDI Strategy in Uncertain Times

A long credit/minimum volatility equity strategy offers potential benefits to plan sponsors seeking solutions to the current funding crisis because of its ability to better match asset returns to liabilities while retaining the potential to rebuild plan assets. Nevertheless, there are perceived risks of implementing an LDI strategy that should be addressed given the uncertainty in today's financial market environment.

**Fear of mistiming a shift into fixed income.** Perceived low interest rate levels and the anticipation that rates would go higher kept many plans from implementing an LDI approach earlier in this decade, despite pending changes in accounting standards. However, in the aftermath of 2008, interest rates alone should no longer be the sole determinant for implementing an LDI strategy.

- Gradual implementation of an LDI strategy through dollar cost averaging can help reduce the risk of ill-timed fixed income investments.
- Despite the recovery in spreads between corporate issues and Treasuries during the first half of 2009, corporate spreads remain relatively wide on a historical basis. This may help to mitigate concerns about current low interest rates for plan sponsors who select a long credit strategy.
- Long credit strategies supplemented by a variety of fixed income overlay strategies, such as Treasury strips, futures, and swaps, can further address the specific sensitivities of individual plan sponsors.
- Most plans, even with the implementation of a partial LDI strategy (which will exhibit shorter total asset duration relative to plan liabilities), should benefit from lower funded status volatility.

**Unwillingness to forego the equity market recovery.** Reducing the size and beta of a plan's equity allocation when stock prices are at low levels and plans have already taken the downside hit may seem ill-advised. However, our analysis shows that maintaining the commonly used equity-based allocation still exposes plans to the significant risks presented by mismatched liabilities.

- A minimum volatility equity strategy may capture the equity market's return potential with significantly decreased risk.
- Incorporating a minimum volatility equity strategy into an LDI approach retains exposure to the equity market's potential long-term rebound, while still improving the match between future returns and liabilities over short-term horizons.
- Because the strategy is designed to avoid asset/liability mismatches, it may lag in steeply rising equity markets.

## Conclusion

The combination of recent changes to pension regulations and the market upheaval of 2008 have redefined pension plan risk. The focus of many plans has shifted from asset risk to funding level risk as plans have found they can no longer afford the asset/liability mismatches of the past. Based on the data presented here, we believe this LDI approach offers a prudent opportunity for plan sponsors seeking to reduce funding level volatility while retaining the opportunity for asset growth.

## **Appendix A: Hypothetical Performance Disclosure**

Hypothetical performance results have many inherent limitations, some of which are described below. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. In fact, there are frequently sharp differences between hypothetical performance results and the actual performance results subsequently achieved by any particular trading program.

One of the limitations of hypothetical backtested performance results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. For example, the ability to withstand losses or to adhere to a particular trading program in spite of trading losses are material points that can also adversely affect actual trading results. There are numerous other factors related to the markets in general or to the implementation of any specific trading program that cannot be fully accounted for in the preparation of hypothetical performance results, all of which can adversely affect actual trading results.

Certain 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.

## Appendix B: Asset Allocation Models and Performance Simulations – Methodology and Assumptions

### Allocation Models – Methodology

**Exhibit 1** shows the indices and target asset allocation used to represent the hypothetical allocation referenced throughout this paper. The simulations assume monthly rebalancing back to the target asset allocations outlined in **Exhibit 1**. Examples within the paper may show various weightings of U.S. bonds and U.S./international stocks, with the combined allocation constant at 90%. The remaining 10% of the portfolio is allocated as listed in the last five rows of the table below.

**Exhibit 2** shows the indices and target allocations for the hypothetical long credit/minimum volatility equity portfolio. Examples within the paper show varying weightings of U.S. bonds and U.S./international stocks, with the combined allocation constant at 90%. The remaining 10% of the portfolio is allocated as listed in the last five rows of the table below.

**Exhibit 1**

### Hypothetical Allocation

Asset Class	Index	% Port
U.S. Stocks	S&P 500	40.0%
U.S. Bonds	Barclays Capital Aggregate	34.0%
Int'l Stocks	MSCI World Ex-U.S.	16.0%
Int'l Bonds	Citigroup World Gov't Bond (Hedged)	1.0%
Real Estate	Wilshire REIT	2.0%
Cash	3-Month T-Bill	2.0%
Hedge Fund	HFRI Fund of Funds Composite	2.5%
Private Equity	Cambridge Private Equity	2.5%
<b>Total/Avg.</b>		<b>100%</b>

**Exhibit 2**

### Proposed Allocation

Asset Class	Index	% Port
U.S. Stocks	MSCI U.S.A. Minimum Volatility	20.0%
U.S. Bonds	Barclays Capital Long Credit	60.0%
Int'l Stocks	MSCI World Minimum Volatility	10.0%
Int'l Bonds	Citigroup World Gov't Bond (Hedged)	1.0%
Real Estate	Wilshire REIT	2.0%
Cash	3-Month T-Bill	2.0%
Hedge Fund	HFRI Fund of Funds Composite	2.5%
Private Equity	Cambridge Private Equity	2.5%
<b>Total/Avg.</b>		<b>100%</b>

Pension plan liabilities were simulated using the monthly Citigroup Pension Liability Index.

### Methodology – Simulation

MSCI Minimum Volatility Indices were first available as of January 1999. Accordingly, we took 120 months (January 1999 through December 2008) of historical data and grouped it into 0.5% bins ranging from -10% to +10%. The average return for each bin was then calculated. Next, random draws were made across the bins to generate one million two-year return simulations for both assets and liabilities. This methodology preserves the kurtosis (fat tails) and skew (non-uniformity) of the underlying distribution in order to better model the probability of large portfolio losses (left tail).

## Appendix C: Asset Allocation and the Current Funding Crisis

In less than one year, pension plans plummeted from strong funding levels (approaching 100% in early 2008) to severely underfunded levels (below 75% in 2009). Understanding the causes of the funding reversal is essential to successful remediation.

For 30 years or more, pension plans had been moving toward higher equity allocations. By 2007, equity allocations of 60–70% were the norm, and these were typically combined with fixed income allocations that had declined from 40% to 20% or lower. Furthermore, many plans allocated approximately 10% of assets to alternatives such as real estate, hedge funds, private equity, international equities, and/or emerging market debt. The common belief was that large equity allocations would sustain funding levels, while alternative investments would provide increased alpha and diversification. Fixed income was relegated to a supporting role as a stabilizing component, with short-to-intermediate maturity securities dominating most fixed income portfolios.

### Perfect Storm Exposes Weakness in Plan Allocations

Plan assets invested according to a hypothetical asset allocation strategy<sup>5</sup> (as detailed in Appendix B) have never been well matched to future liabilities. In the past, strong equity results and companies' ability to cover funding shortfalls masked the mismatch. But 2008's perfect storm exposed structural weakness in the commonly used 70/30 allocation structure:

1. Equities plummeted, with the S&P 500 falling 37% for the year.
2. Core and core plus bond strategies that are typically benchmarked against indices such as the Barclays Capital Aggregate Index could not provide sufficient "cushioning." Though bond strategies were generally positive for the year (the Barclays Capital Aggregate Index was up 5.24% for 2008), a single-digit return from 30–40% of the portfolio (typical for many plans) did not begin to offset the nearly 40% losses in the remaining 60–70% of the portfolio. Meanwhile, the Citigroup Pension Liability Index, a commonly used liability benchmark, rose over 17% for the year.
3. Alternative investments that were thought to provide additional alpha and diversification became highly correlated with traditional equity strategies, were extremely volatile, and proved to be quite illiquid, putting more downward pressure on portfolio returns.
4. As the economy worsened, long rates plummeted, causing the present value of liabilities to surge upward just as the bear market devalued plan assets.
5. Corporate profit margins narrowed as the global economy weakened, reducing cash flow and straining companies' ability to meet higher funding requirements.

## Regulatory Actions Restrict Funding Flexibility

Recent regulatory changes exacerbated the unfavorable impact of last year's market. After falling interest rates and equity declines in 2000 and 2004 drove down funding levels, corrective actions were taken that resulted in the Pension Protection Act of 2006, as well as new pension accounting standards (FAS 158) issued by the Financial Accounting Standards Board. Together, these changes in regulatory and accounting standards reduced plan sponsors' ability to actuarially smooth over volatile investment returns and required that a plan's underfunding be shown directly on corporate balance sheets.

The new regulations and standards might have been a trigger point for action by corporate pension plans, but that was not the case. Why did many pension plans take no action despite new requirements?

- Funding shortfalls early in the decade were short-lived as equity markets recovered, reaffirming confidence in commonly used (i.e., heavily equity-weighted) asset allocation strategies.
- Risk analysis based on historical results underestimated the downside risk of the commonly used asset allocation scenario, feeding overconfidence. The probability of a portfolio falling 20% or more was widely considered to be minuscule.
- Interest rates were thought to be at historically low levels, ostensibly a poor time to shift toward the large fixed income allocations that characterize liability-driven investing.
- The common belief that equities could only go higher discouraged plan administrators from reducing equity allocations.
- Corporate profit margins were strong and executives fully expected to rectify any underfunding out of current revenues without substantially jeopardizing earnings.

**Consequently, despite the changes to the operating environment described above, there has been only a limited move toward liability-driven investing by plan sponsors, and the majority of U.S. pension plans had significant exposure to the devastating forces of 2008's market crisis. Plummeting asset values, soaring pension liabilities, and the inability to defer funding obligations have now forced plan sponsors to address the asset/liability mismatches in their defined benefit portfolios.**

## Appendix D: Projected Asset Returns

To understand and model the potential asset returns of the hypothetical asset allocation and the proposed long credit/minimum volatility equity strategy, we utilized expected returns forecasts from Callan Associates' 2009 Capital Market Expectations report for the asset classes below, with the exception of the long credit fixed income and minimum volatility equity asset classes depicted in the proposed allocation (please see notes below). The allocation percentages reflect the 56%/34%/10% equity/core bond/other hypothetical allocation and the 60%/30%/10% long credit/minimum volatility/other proposed allocation strategies discussed throughout this paper.

### Hypothetical Allocation

Asset Class	Index	% Port	Expected Return
U.S. Stocks	S&P 500	40.0%	9.20%
U.S. Bonds	Barclays Capital Aggregate Bond	34.0%	5.25%
Int'l Stocks	MSCI EAFE	16.0%	9.25%
Int'l Bonds	Citigroup Non-U.S. Gov't	1.0%	4.85%
Real Estate	Callan Real Estate	2.0%	7.60%
Cash	3-Month T-Bill	2.0%	3.00%
Hedge Fund	Callan Hedge Fund of Funds	2.5%	6.90%
Private Equity	VE Post Venture Cap	2.5%	12.00%
<b>Total/Avg.</b>		<b>100.0%</b>	<b>7.68%</b>

SOURCE: Callan Associates, 2009 Capital Market Projections, unless otherwise indicated.

### Proposed Allocation

Asset Class	Index	% Port	Expected Return
U.S. Minimum Volatility Equity*	S&P 500	20.0%	9.20%
U.S. Bonds	Barclays Capital Long Credit**	60.0%	6.83%
Global Minimum Volatility Equity*	MSCI EAFE	10.0%	9.25%
Int'l Bonds	Citigroup Non-U.S. Gov't	1.0%	4.85%
Real Estate	Callan Real Estate	2.0%	7.60%
Cash	3-Month T-Bill	2.0%	3.00%
Hedge Fund	Callan Hedge Fund of Funds	2.5%	6.90%
Private Equity	VE Post Venture Cap	2.5%	12.00%
<b>Total/Avg.</b>		<b>100.0%</b>	<b>7.60%</b>

SOURCE: Callan Associates, 2009 Capital Market Projections, unless otherwise indicated.

\* U.S. and global minimum volatility equity returns were based on the expected returns projected by Callan for large capitalization equity and international equity, respectively, as research has shown that minimum volatility portfolios may provide returns similar to equity market returns with 20% to 30% less volatility<sup>6</sup>.

\*\* The expected return for long credit was estimated by Dwight Asset Management Co. LLC. The estimate is a 10-year forward-looking return based on the Barclays Capital yield-to-worst estimate of 6.83% as of December 31, 2008. This estimate assumes that the interest rates and risk premiums of corporate bonds remain unchanged and that securities are not removed from the universe over the time period.

Expected returns are for illustrative purposes only and are not a guarantee of future results.

## Appendix E: Company Profiles

### Complementary Expertise Supports an Innovative Allocation Approach

Analytic Investors, LLC (“Analytic”) and Dwight Asset Management Company LLC (“Dwight”) are both independently operated, indirect subsidiaries of Old Mutual plc, a global financial services company with worldwide operations in asset management, banking, and insurance. As sister companies, Analytic and Dwight share a common goal in serving their clients’ investment needs. They also benefit from their parent company’s resources in the areas of product development, distribution, best-practice risk management, technology, and legal capabilities.

Working together, Analytic and Dwight applied their highly specialized capabilities to develop and test the long credit/minimum volatility equity strategy presented here. Analytic is well known for its quantitative equity and asset allocation strategies, while Dwight focuses exclusively on fixed income strategies for institutional investors, with expertise in liability-specific fixed income solutions. We believe that the combination of Analytic’s equity and asset allocation skills and Dwight’s in-depth fixed income and liability experience offers plan sponsors a broad and unique perspective on liability-driven investment strategies.

### About Analytic Investors, LLC

Analytic Investors, LLC specializes in state-of-the-art quantitative investment management techniques. The firm strives to fulfill clients’ objectives through rational, systematic identification of market opportunities while minimizing the impact of human emotions that often dominate investment decision making. Headquartered in Los Angeles with \$8.6 billion in assets under management as of year-end 2008, Analytic provides investment management services to corporations, public funds, foundations, and other institutional investors.

Considered a leader in the application of risk-managed investment strategies, Analytic applies its quantitative approach primarily to equity and asset allocation strategies. In every strategy, the firm practices an investment philosophy that seeks to bring together the best attributes of individual security selection and unbiased portfolio modeling for a management style that is both disciplined and responsive.

### About Dwight Asset Management Company LLC

Dwight Asset Management Company LLC focuses exclusively on fixed income investment management services for institutional clients including corporations, public funds, insurance companies, financial institutions, endowments, foundations, and Taft-Hartley plans. Dwight focuses primarily on five investment strategies: liability-driven investing, insurance asset management, stable value management, total return fixed income, and cash management. As of year-end 2008, Dwight had over \$76.3 billion in assets under management.

Headquartered in Burlington, Vermont, Dwight relies on independent thinking, a clear perspective, and a collaborative atmosphere to encourage innovation and creative solutions to complex investment challenges.

The information in this article, including statements concerning financial market trends, is based on current market conditions as of August 2009, which will fluctuate and may be superseded by subsequent market events or for other reasons. This information should not be considered a recommendation to make any particular investment.

<sup>1</sup> Funding for the Milliman 100 Pension Funding Index fell to 71.7%. Mercer reported that the S&P 1500 funding level was about 74% at the end of February 2009. "Corporate Pension Funding Slumps Below 72%," Fundfire, March 13, 2009.

<sup>2</sup> The Pension Protection Act (PPA) of 2006 shortened the smoothing period for assets and liabilities to two years; for more detail, see Appendix C. FAS 158 included the requirement to add the projected benefit obligation (PBO) to the corporate balance sheet as of 12/31/06.

<sup>3</sup> In Tables A and B, the core bond allocation is based on the Barclays Capital Aggregate Index, the long credit allocation is based on the Barclays Capital Long Credit Index, and traditional equity is based on the S&P 500 Index and the MSCI World ex-U.S. Index. The remaining 10% of each portfolio is allocated as follows: Citigroup World Government Bond (Hedged), 1%; Wilshire REIT, 2%; 3-Month Treasury Bills, 2%; HFRI Fund of Funds Composite, 2.5%; and Cambridge Private Equity, 2.5%. Simulations are based on 120 months of history (Jan. 1999 – Dec. 2008) grouped into 0.5% bins ranging from -10% to +10%. We calculated the average return for each bin and made random draws across bins to generate one million two-year asset and liability return simulations.

<sup>4</sup> In Tables C and D, the long credit allocation is based on the Barclays Capital Long Credit Index, traditional equity is based on the S&P 500 Index and the MSCI World ex-U.S. Index, and minimum volatility equity is based on the MSCI U.S.A. Minimum Volatility Index and the MSCI World Minimum Volatility Index. The remaining 10% of each portfolio is allocated as detailed in footnote 3.

<sup>5</sup> In Figures 2, 3, 4, and 5, the hypothetical equity/core bond strategy has 34% allocated to a core bond strategy (Barclays Capital Aggregate Index) and 56% allocated to capitalization-weighted equities (S&P 500 Index and MSCI World ex-U.S. Index). The long credit/minimum volatility equity strategy has 60% allocated to a long credit strategy (Barclays Capital Long Credit Index) and 30% allocated to a minimum volatility equity strategy (MSCI Minimum Volatility Indices). The remaining 10% of both strategies is allocated as detailed in footnote 3.

<sup>6</sup> Clarke, de Silva, Thorley. "Minimum-Variance Portfolios in the U.S. Equity Market." *The Journal of Portfolio Management*, Fall 2006. Co-authors Clarke and de Silva are Chairman and President of Analytic Investors, LLC, respectively.

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