

# Liability-Driven Pension Investing Introduction and Primer

For Traditional-Formula Pension Plans

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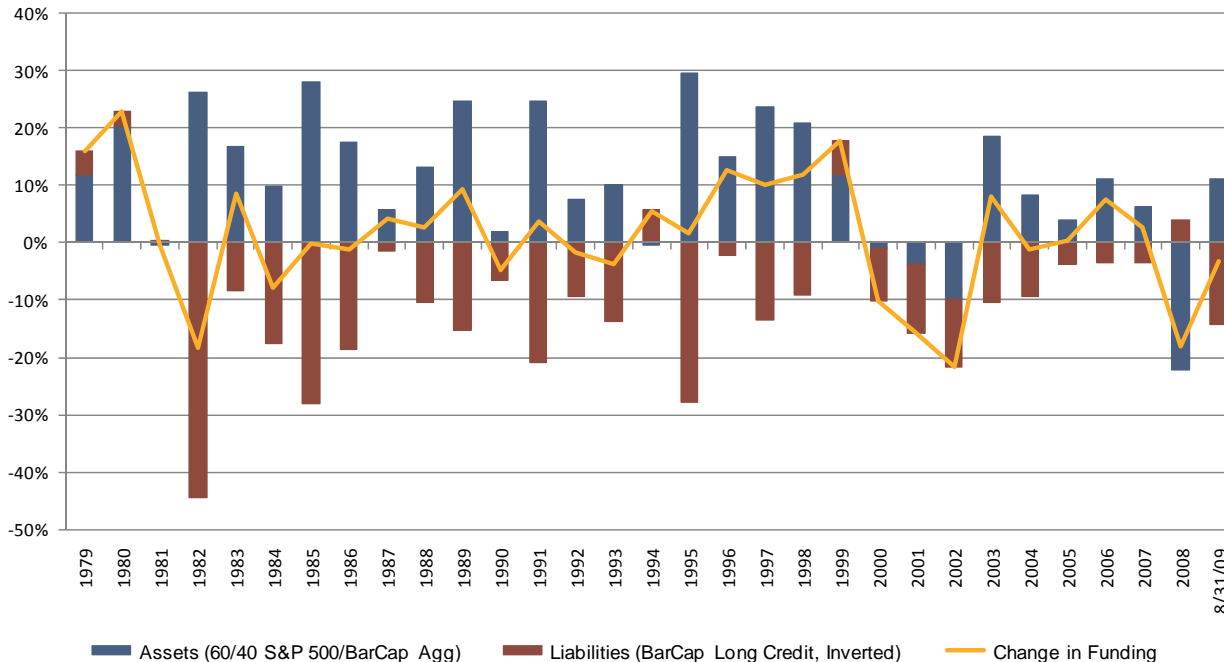
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# What Happened?

- Pension Crisis of 2000-2002 – The Financial Story
  - Plan assets fell sharply as the stock market collapsed
  - Plan liabilities rose sharply because interest rates declined
  - Funding for many plans collapsed, requiring plan sponsors to book losses and increase cash contributions
  - Notion of “liability performance” caught many plan sponsors and fiduciaries by surprise





# Pension Liabilities

- A Pension Liability is the *present value of future benefits* owed to employees
  - Promising a pension benefit is financially equivalent to issuing a bond to your employees as part of their pay package
  - Since the liability is a type of bond, it is valued the same way bonds are valued – by discounting future cash flows using a certain interest rate
  - Terminology and accounting treatments can alter the perception or recognition timing of pension obligations, but they cannot alter the economics

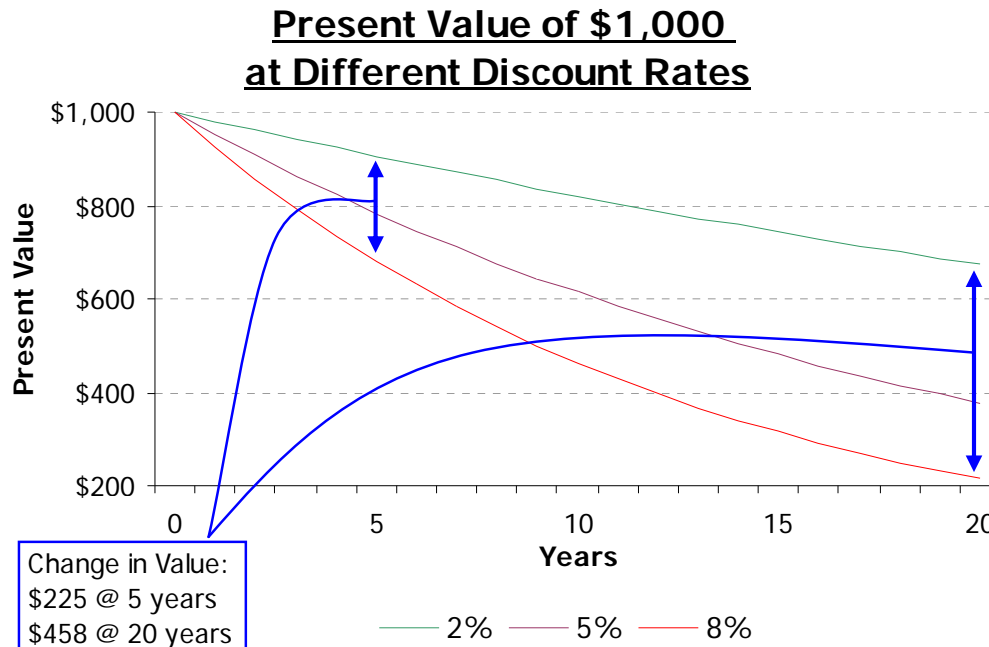
## Parallel Concepts, Different Names

<u>Pension Plan</u>	<u>Bond</u>
Plan Sponsor	Issuer
Employee	Bondholder
Service Cost	More Bonds
Interest Cost	Amortization
Plan Assets	Sinking Fund
Benefit Payment	Redemption
Lump Sum Payment	Put
Service Life	Duration/Maturity
Funded Ratio	Credit Risk
Discount Rate	Market Interest Rate
ERISA	Covenants
Plan Termination	Call
PBGC	Credit Enhancement



# Discount Rate and Effect of Duration

- The return of a bond asset (or liability) has two components:
  - Interest return (e.g., coupon interest) that marks the passage of time
  - Capital gains or losses resulting from changes in market interest rates
- *Duration* measures the sensitivity of a bond's value to changes in discount rates
- The longer the duration of an asset or liability, the greater its value will rise (or fall) when interest rates fall (or rise).





# Interest Rate Exposure

- Duration of a typical liability is approximately 12 to 15 years
  - A 1% decrease in interest rates results in a 12% to 15% increase in the liability
- Duration of the typical Plan's bond assets is much shorter – a little over 4 years
  - The same 1% decrease in rates results in a 4.3% increase in bond assets
- The hedge ratio provides a measure of how exposed plan funding is to interest rates
  - Because of underfunding, a low allocation to bond assets, and short duration, the hedge ratio is often very low
  - A typical plan hedges away less than 10% of its interest rate exposure
- Of course the reverse is true – Plans are positively exposed to rising rates

<b>Typical Policy Allocation:</b>			
<u>Risk Assets</u>			
US Equity	40%		100.0
Int'l Equity	15%		37.5
Other Risk Assets	5%		12.5
	60%		150.0
<u>Rate Hedging Assets</u>			
Cash	2%		3.3
IG Intermediate	30%		43.4
High Yield	8%		29.5
Long Bonds	0%		-
	40%		76.2
<b>Plan Assets:</b>	100%	\$	250.0
<b>Plan Liability:</b>		\$	300.0

<b>Interest Rate Hedge Ratio</b>					
	<u>Base</u>	<u>Duration</u>	<u>Duration Dollars</u>		
<b>Assets:</b>	76.2	X 4.27	=	325.1	= 9%
<b>Liabilities:</b>	300.0	X 12.0	=	3,600.0	



# Periodic Changes in Assets and Liabilities

- Service Cost
  - Cost of new benefits earned
  - HR's number – the true cost of providing a pension benefit
- Interest Costs
  - Cost of financing benefits that have already been earned
  - Finance's numbers – the "time value" of money
- Other Factors
  - Mortality experience not under your control
  - Accounting factors alter the timing of cost recognition, but have no effect on total cost or other economic factors
- Cost Management
  - It is tempting to lump costs together – but that's a mistake
  - Financing costs can be incurred inside or outside of the Plan; you cannot "finance away" service costs
  - Asset strategies should be focused on financing costs, while service cost problems should be addressed via plan design

## Beginning of Period Liability

+	Service Cost
+	Interest Cost
+/-	Change in Rates X Duration
+/-	Change in Mortality Assumptions
+/-	Accounting Factors
-	Benefit Payments
=	<b>End of Period Liability</b>

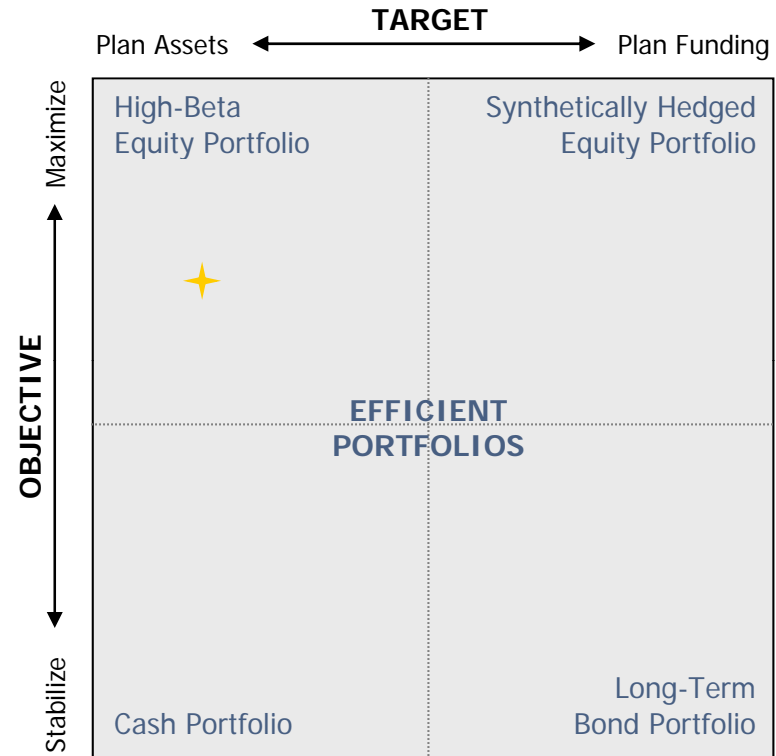
## Beginning of Period Assets

+	Contributions
+	Investment Income
+/-	Capital Gains
-	Operational Expenses
+/-	Accounting Factors
-	Benefit Payments
=	<b>End of Period Assets</b>



# Strategies for Managing a Pension Plan

- Asset allocation is the primary determinant of financial outcomes for a pension plan
- Plan fiduciaries have differing views on the “right way” to allocate pension plan assets
  - Focusing on assets versus funding yields a very different set of efficient portfolios
  - Unfortunately, there is no optimal strategy that drives both plan assets and plan funding; fiduciaries must make a choice
- The choice of strategic target (assets versus funding) drives the definition of risk; we can then:
  - Identify “efficient” portfolios
  - Project levels and volatility of future asset and funding levels



★ Typical U.S. Pension Plan



## Capital Markets Assumptions

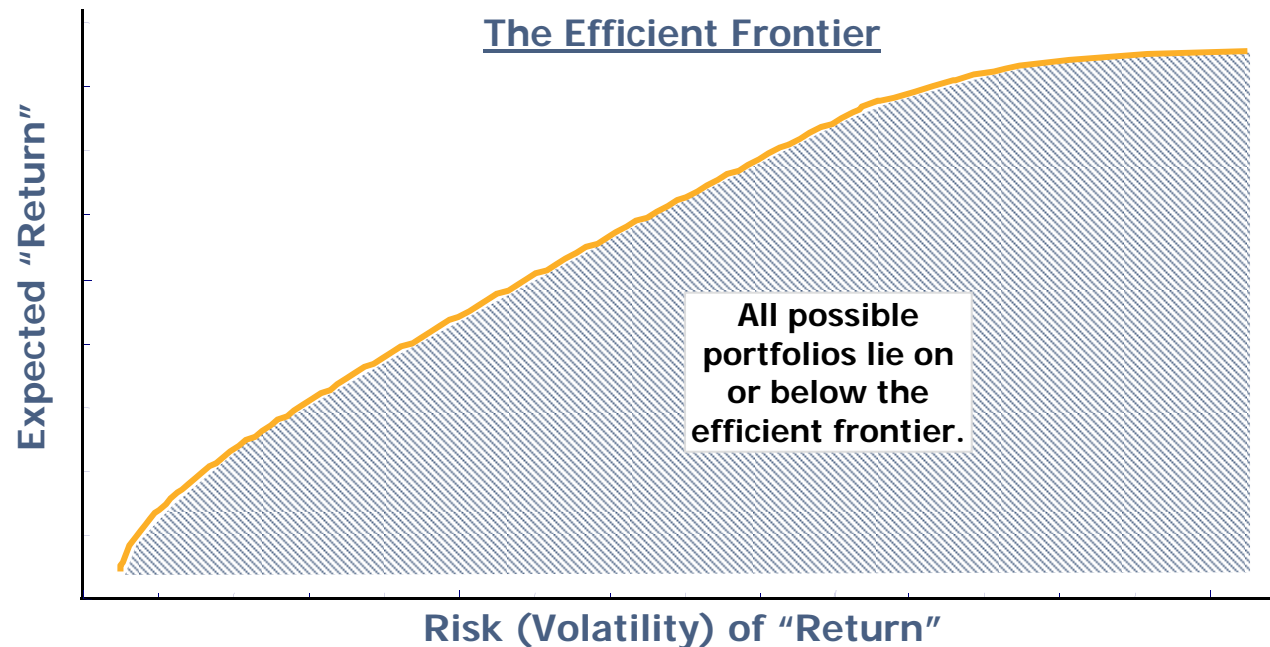
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- Investment policy requires parameters for each asset class:
  - Expected return and volatility of return
  - Expected correlation to every other class
  - Policy constraints, imposed by the Plan or the Committee
- Liabilities too can be characterized this way
  - Expected (negative) return and volatility driven by interest cost, service cost, duration
  - Correlation to asset classes arises from exposure to common interest rates and inflation
  - Policy “constraint” arises from the benefit formulae in the Plan
- Once you have established a set of assumptions, you can compute the expected return and risk of any portfolio (any combination of assets consistent with the constraints)
- A computer model called an “optimizer” can compute and plot the return and risk of all possible portfolios



# Portfolio Optimization and Efficiency

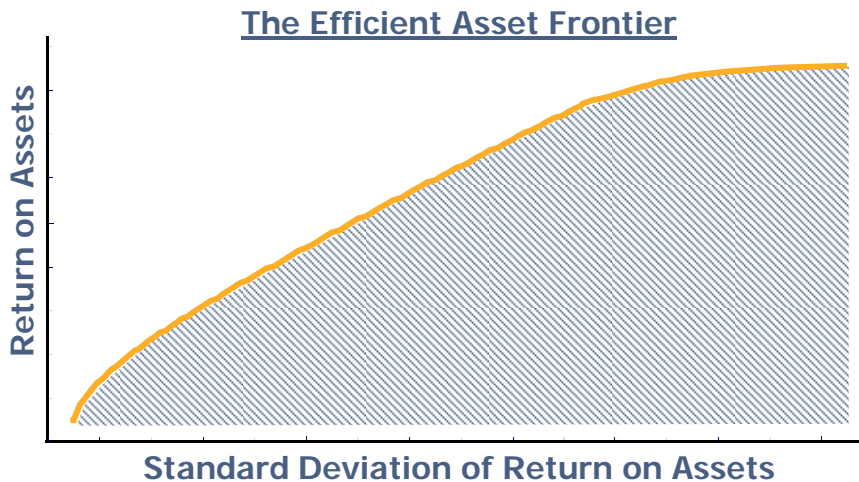
- Every possible portfolio can be plotted in terms of expected return and risk
- Efficient portfolios are those portfolios that yield the highest return for a given level of risk (or lowest risk for a given level of expected return)
  - A prudent investor would never deliberately invest in an “inefficient” portfolio
  - However, there are no “right” or “wrong” portfolios on the efficient frontier; only “more risky” and “less risky” portfolios
- Results change if you:
  - Add or remove a class of assets or liabilities
  - Change a capital market assumption
  - Change your definition or “return” or “risk”





# The Asset-Only Framework

- Asset-Only Framework



- Return and risk are measured in asset terms only ... liabilities are not factored in

- Increasing concentrations in equities driven by:

- Unusually long bull market
- Tendency to project trends based on past performance
- Heavy marketing from Wall Street – the “Cult of Equities”
- Herd mindset
- FAS-87 accounting
- Perceived complexity of plan liabilities



## Setting Investment Policy

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- “Every employee benefit plan shall provide a procedure for establishing and carrying out a funding policy and method **consistent with the objectives of the plan** and requirements of this title” ERISA §402(b)(1)
- The objective of every pension plan is to pay the benefits promised when they become due!
- Therefore – Every pension investment policy should revolve around management of the **funded ratio**.

$$\text{Funded Ratio} = \frac{\text{Plan Assets}}{\text{Plan Liabilities}}$$



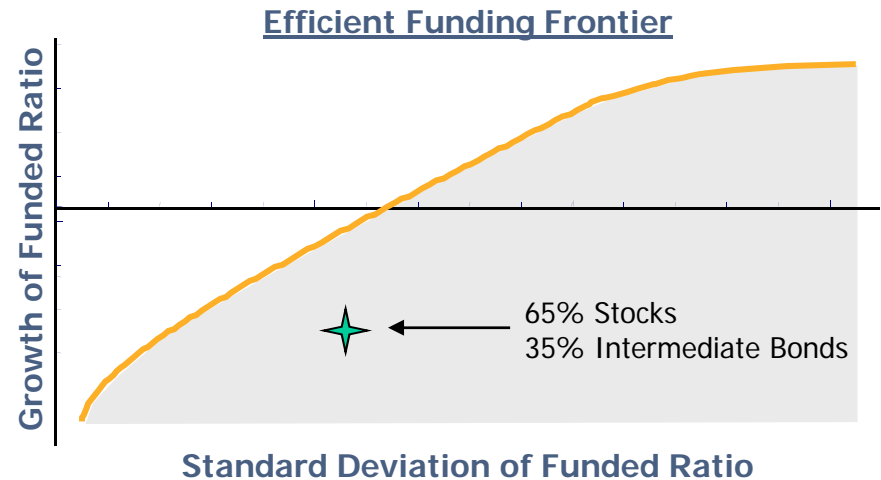
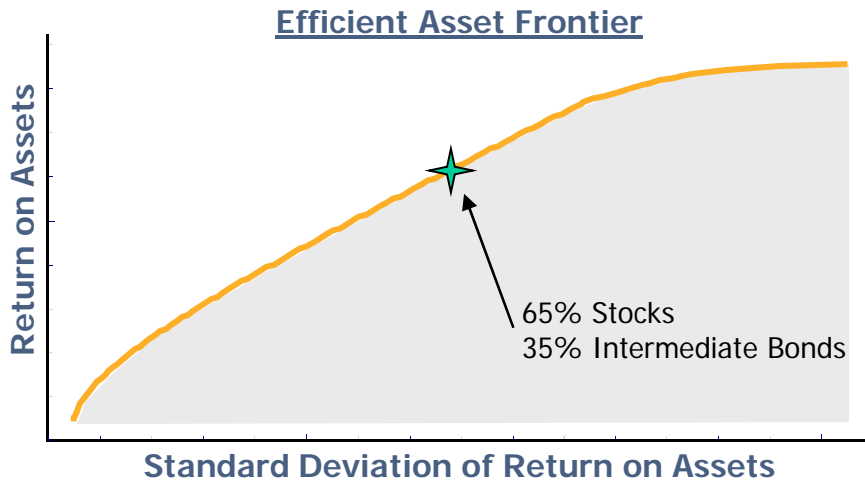
$$\text{Funded Ratio} = \frac{\text{Plan Assets}}{\text{Plan Liabilities}}$$

- Plan Liabilities = Present Value of Promised Benefits
  - Present value of future cash flows are determined by “discounting”
  - The discount rate based on long-term bond yields
  - As rates decline, the present value of future payments increase
- Liability changes can affect plan funding, expense, and contributions, just as asset returns do
- Asset and liability returns may be correlated – or may not be
- Typical pension liability duration: 12 – 18 years



# Effect of Incorporating Liabilities Into the Analysis

- An *Asset-Liability Study* focuses on the expected growth (or degradation) of the funded ratio without contributions
- General observations:
  - Only risky strategies produce positive expected funding growth without contributions – pension plans are not naturally self-funding!
  - A portfolio which is efficient in an asset-only analysis is probably not efficient in an asset-liability analysis, and vice-versa





# "Liability Driven Investing" Myths and Realities

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- Myth – LDI:

- means putting everything into bonds
- means putting everything into hedge funds
- increases pension costs and contributions
- is itself a financial product

- Reality – LDI strategies:

- involve making risk and return tradeoffs
- provide the lowest level of pension cost and contributions for a given level of risk
- often result in portfolios which include equities (although the "equity premium" is lower)
- result in longer bond portfolio duration, to the extent bonds are used at all
- may benefit from derivatives and other synthetic strategies for more efficient implementation



# Matching and the “No Surprise” Strategy

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- Asset-Liability analysis yields some counter-intuitive results about risk
  - The “risk-free” asset is the asset with identical expected performance as the liabilities
  - Since liability duration is relatively long, the natural matching asset for a traditional pension plan is a long-term bond
  - Cash is a (very) risky asset in a pension plan if you’re worried about funding!
- A bond portfolio that precisely matches the liability is said to “defease” the liability, or form an “immunized” portfolio
  - Bond interest = liability interest cost
  - Bond duration = liability duration (so mark-to-market changes offset)
- This strategy yields stability, with annual pension expense and contributions equal to service cost plus operating cost (adjusted for occasional changes in mortality assumptions)
- The “matched portfolio” strategy can never be perfectly implemented
  - Different liability measurements have different credit risks and duration
  - Changing yield curve shape can distort the results
  - Accounting effects such as smoothing actually get in the way!

# Liability-Driven Investing

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- The “matched portfolio” is the baseline for evaluating any investment strategy
- Riskier portfolios are evaluated in terms of funding impact, not asset returns
- It can be argued that both the Plan and Plan Sponsor benefit
  - The Plan is more secure, since the funded ratio (not asset returns) measures the security of the benefit promise
  - The Plan Sponsor is able to budget risk more effectively, inside and outside of the plan trust
- It requires a change in mindset for fiduciaries accustomed to an asset-driven approach



## Riskier Efficient Strategies and the Effect of Constraints

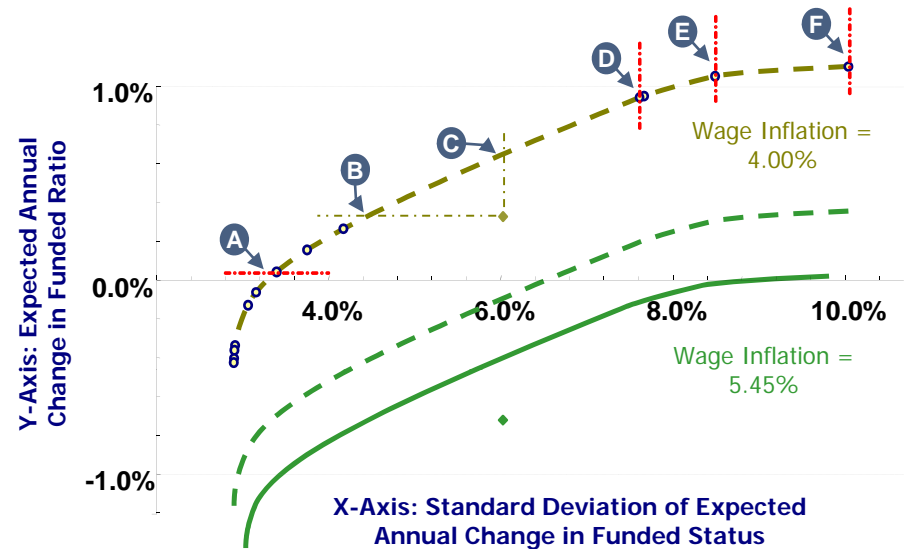
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- The challenge with riskier strategies is maintaining as much rate-hedging as possible while creating capacity for equity investments
- Constraints on the analysis should be evaluated carefully, since they remove portfolios from consideration that would otherwise be efficient
  - Relaxing the “long only” fixed income constraint:  
Allowing portfolios that short cash to purchase asset duration allows you to use swaps for rate hedging – while freeing up the maximum amount of assets for risk investing
  - Relaxing the duration constraint:  
Investing in “extended duration” fixed income (asset duration >> liability) allows you to increase the portfolio’s dollar duration while using less capital in fixed income strategies
  - Relaxing the alternatives constraint:  
Investing in strategies that credibly reduce beta can make the overall level of risk in the portfolio more palatable.
- Regardless of the strategy selected, you should make sure your information systems and governance processes are robust enough to manage the risk



# Asset-Liability Project – 10-Step Process Illustration

- 1) Assess the current funding situation.
- 2) Develop capital markets assumptions.
- 3) Analyze the Plan's liabilities, based on actuarial valuation and benefit formulae.
- 4) Project the duration, optionality, and inflation sensitivity of the liabilities and model as an inflation-sensitive bond.
- 5) Utilize a mean-variance optimizer to construct an efficient frontier of asset-liability portfolios.
- 6) Identify a portfolio with expected 0% funding growth and minimal volatility; this "matched portfolio" serves as a baseline.
- 7) Select additional portfolios that provide for greater funding growth. Project results of all portfolios to determine expected funding.
- 8) Construct confidence intervals around each portfolio to determine maximum probable funding losses at various levels of certainty.
- 9) Discuss the tactical environment and identify any constraints the Committee may wish to apply.
- 10) Repeat analysis to incorporate Client input and prepare final policy weights.



**Long-Term Annualized Funding Expectations (US\$,000)**

<b>Funding</b>	<b>Current</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
Expectation	(39,206)	(67,729)	(39,059)	(7,627)	21,017
84% Confidence	(628,055)	(397,781)	(474,113)	(596,448)	(723,065)
98% Confidence	(1,216,903)	(517,833)	(809,167)	(1,185,270)	(1,667,148)
<b>Portfolios</b>					
US Largecap	42%	14%	26%	37%	48%
US Mid/Smallcap	14%	4%	7%	9%	14%
International Stock	14%	9%	17%	24%	32%
Real Estate	0%	1%	2%	4%	4%
High Yield	5%	0%	0%	0%	0%
Long Bonds	0%	70%	46%	24%	0%
Intermediate Bond	23%	0%	0%	0%	0%
Cash	<u>2%</u>	<u>2%</u>	<u>2%</u>	<u>2%</u>	<u>2%</u>
	100%	100%	100%	100%	100%



### **Keith A. Hocter, CFA** **Investment Consultant**

Keith is a co-founder of Bellwether Consulting, where he is directly responsible for advising retirement plan sponsors and other institutional investors. A fiduciary to client accounts with over \$35 billion under advisement, his practice scope includes investment policy, asset-liability analysis, performance review, manager/fund searches, fee analysis, and general governance.

Published in 2001, Keith's book Setting the Table addresses the investment decision-making process for sponsors of employee-directed retirement plans. He regularly writes and speaks on topics including the economy, market trends, and implications of public policy for plan sponsors and participants. In addition, he is responsible for design and maintenance of the Firm's asset-liability analysis model, and maintaining the Firm's database of key economic variables.

He received a B.S. in Computer Science from The Ohio State University, an M.B.A. from Rensselaer Polytechnic Institute, and holds the Chartered Financial Analyst (CFA) designation. An active member of the New York Society of Security Analysts, he serves on the Institutional Investment Management Committee. Keith and his wife, Paula, reside in Cedar Grove, New Jersey.



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