

The Asset Return - Funding Cost Paradox

The Case for Liability Driven Investment

Or

The Next Crisis is Already Here: Defined Benefit Pension Plans

My message is simple: Almost every corporate pension fund should be entirely in fixed dollar investments.

Fischer Black, Financial Analysts Journal 1980

Overview

- Why Do I like Defined Benefit (DB) Pension Plans?
- An Introduction to Liability Driven Investing (LDI)
- The Current State of DB Pension Plans
- LDI Performance & The Equity Risk Premium

- The Asset Return – Funding Cost Paradox
 - Proof of its Existence: A Simple Example
 - Why can the Asset Return – Funding Cost Paradox arise?
 - The Step from Possibility to Reality – Why is it likely to arise?
 - Can we Quantify the Effects?

Why Do I Like Defined Benefit Pension Plans?

Cost efficient way to manage longevity risk

- Unlike an individual with a 401(k) plan, DB pension plans can use the average life expectancy of plan participants
- When switched from DB to defined contribution (DC) plans, individuals should increase their savings rate
 - either inefficient oversaving in the economy
 - or less than adequate retirement assets

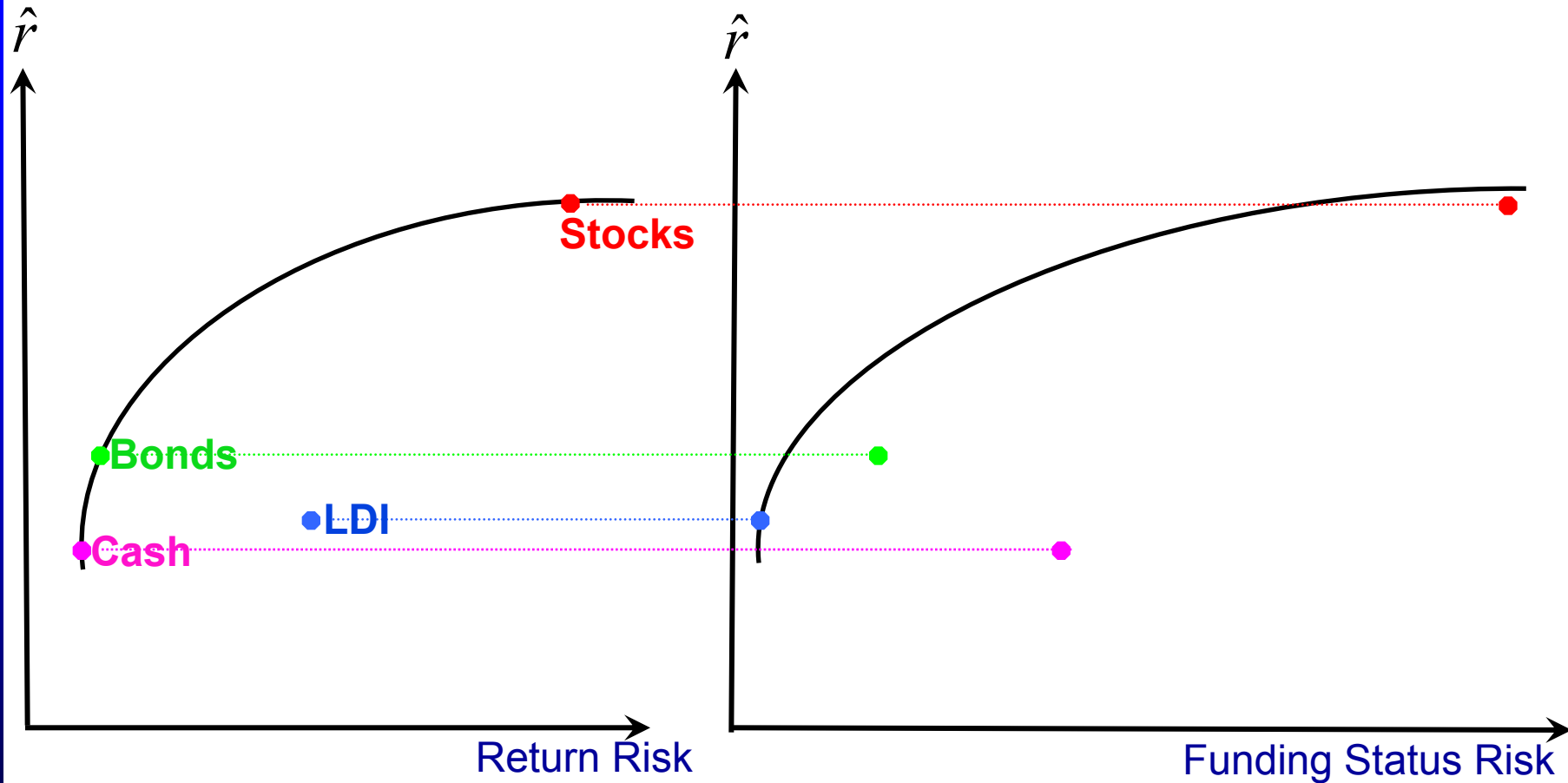
Liability Driven Investing (LDI) 101

- To fund future liabilities, e.g.,
 - Defined Benefit (DB) Pension Plans
 - Life insurance claims
 - Retiree health benefits
 - Social Security
- Matching of assets and liabilities through the use of correlated assets
 - Falling (rising) interest rates → PV(Liabilities) ↑ (↓)
 - Falling (rising) interest rates → bond prices ↑ (↓)
- Liability benchmarks instead of asset benchmarks
- Focus on funding status volatility rather than asset volatility

Two Views of the Efficient Frontier

In the CAPM-Framework

In an LDI-Framework



The Current State of Our DB Pension Plans

(also known as “A Pension Deficit Disorder”)

- Lowest-ever funding levels of U.S. corporate pension plans (Watson Wyatt February 2009 study)
 - An asset plunge of \$445 billion in 2008 for the 450 DB plans of the Fortune 1000 companies
 - A \$78 billion aggregate surplus turned into a \$366 billion deficit
 - For 2008, about 61% of pension plans will have funding levels between 50% and 70% (only 5% of plans were in that range a year earlier)
- Similar, if not worse, for public pension plans
- Underfunded Pension Benefit Guarantee Corporation
 - Underfunded by \$11.2 billion (fiscal year 2008, ended in Sep '08)
 - Moves from LDI to equities
- Social Security (???)

Why Not more LDI? The Volatility-Return Trade-Off

■ Pros: LDI strategies

- ❑ avoid large funding shortfalls,
- ❑ reduce funding status volatility, and hence
- ❑ balance sheet volatility (FAS 158),
- ❑ and contribution volatility.

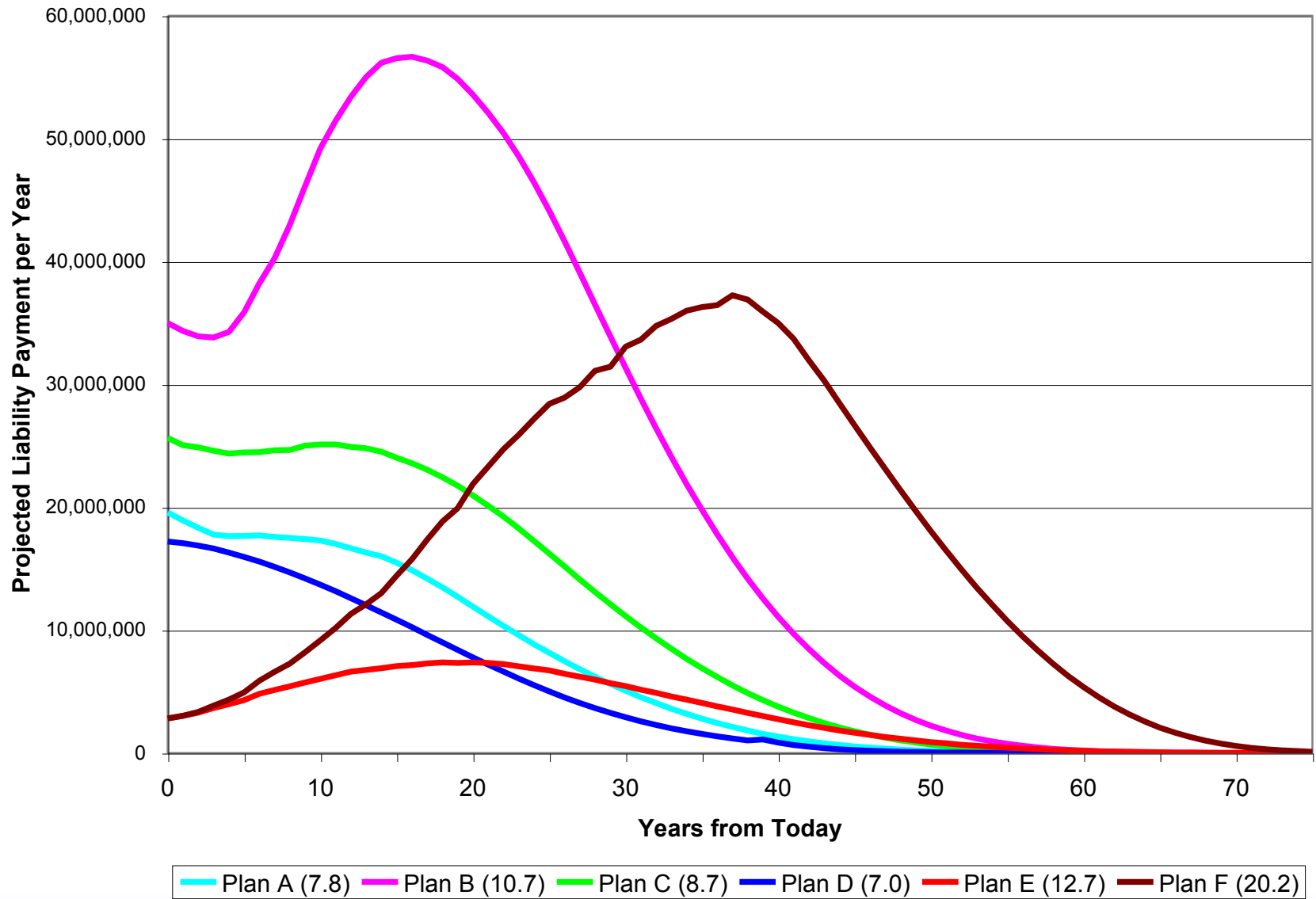
■ Cons:

- ❑ Supposed to lock-in an eventual funding deficit
- ❑ Interest rates are at historic lows
- ❑ Pure LDI solutions are fixed income based and thus have lower expected returns than equity
- ❑ **Lower expected returns are supposed to lead to higher funding costs**

“Heard on the Street” – Opinions from Plan Sponsors, Investment Managers, and Analysts

- ❑ “Not sure plans will be able to stomach performance of LDI in a rising rate environment.”
- ❑ “Why would a plan adopt an LDI strategy when equities are expected to outperform over long periods of time. It's a strategy that's "too safe" for most plans.”
- ❑ “The best hedge against future liabilities is a strong record of portfolio total return.”
- ❑ “... politicians will care much more about maximizing return and minimizing contribution rates than short term swings in funding status.”
- ❑ “LDI raises the cost of the DB plan in the low rate environment we are in.”
- ❑ “We are in for the long term.”
- ❑ “A 3% difference in expected return would increase the cost of a defined benefit plan to employers by 30% over ten years.”

Liability Profiles of Six DB Pension Plans



Historical LDI Performance

“LDI strategies outperformed funds with traditional asset allocation in 2008 by a significant margin.” (Watson Wyatt, February 2009)

Plan	Duration	Annualized Rate of Return (Gross of Fees) [*]		
		1 year (2008)	5 years (Jan '04 – Dec '08)	10 years (Jan '99 – Dec '08)
D	7.3	4.48%	4.93%	6.01%
A	8.1	5.22%	5.29%	6.27%
C	9.1	6.34%	5.65%	6.53%
B	10.4	7.16%	6.10%	6.75%
F	11.7	6.60%	6.32%	6.76%
E	18.7	18.13%	10.54%	8.62%

*** : Obtained through Back Testing of the RiverSource Strategic LDI Solution, unlevered**

And By the Way: What Equity Risk Premium?

Asset Benchmark	Annualized Total Rate of Return				
	1 year 2008	5 years 2004 – 2008	10 years 1999 – 2008	15 years (1994 – 2008)	20 years (1989 – 2008)
Lehman Aggregate (Barclays Agg.)	5.24%	4.65%	5.63%	6.18%	7.43%
S&P 500 TRI	-37.00%	-2.19%	-1.38%	6.46%	8.43%
60% S&P500 40% Lehman Agg.	-22.06%	0.71%	1.69%	6.65%	8.30%
70% S&P500 30% Lehman Agg.	-26.03%	0.01%	0.95%	6.64%	8.37%

* : Data from Lehman Live and Bloomberg

And What if it is a Risk Premium?

- The theoretical debate about its source is far from settled.
- Is the risk really lowered (for DB pension plans) if only a long enough time horizon is considered?
- Can a risk premium be picked up for free if one has a long enough time horizon?
- If it is a risk premium, then pension managers take on substantially higher risk levels to get higher returns.
- In that case, the high equity allocation is not justified.

The Asset Return – Funding Cost Paradox

Higher average asset returns do not automatically translate into lower average funding costs for DB pension plans.

It is possible for a lower yielding bond portfolio to require lower average contribution payments than a higher returning equity portfolio.

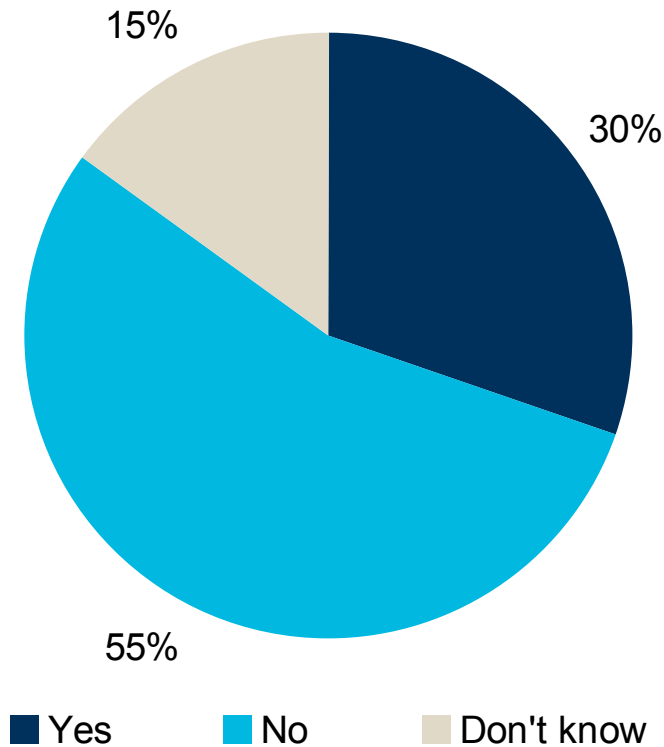
The requirements to convert an eventual equity risk premium into lower funding costs are regularly violated in practice.

Do You Think that Higher Returns in a Given Period Automatically Translate into Lower Funding Costs?

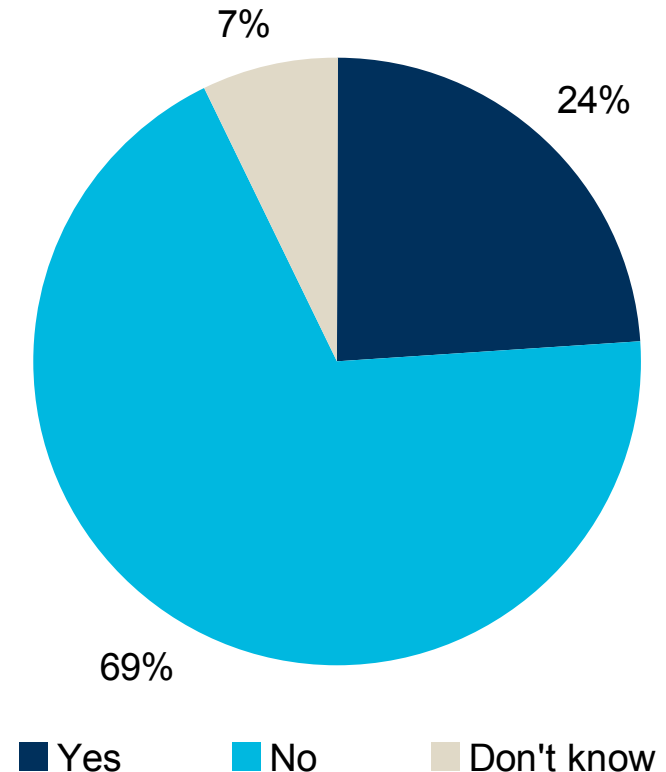
PLANSPONSOR / RiverSource Investments study (August 2008)

(21 questions to 4,090 DB plan sponsors, responses from 98 corporate plans and 52 non-corporate plans)

Corporate Defined Benefit Plans



Non-Corporate Defined Benefit Plans

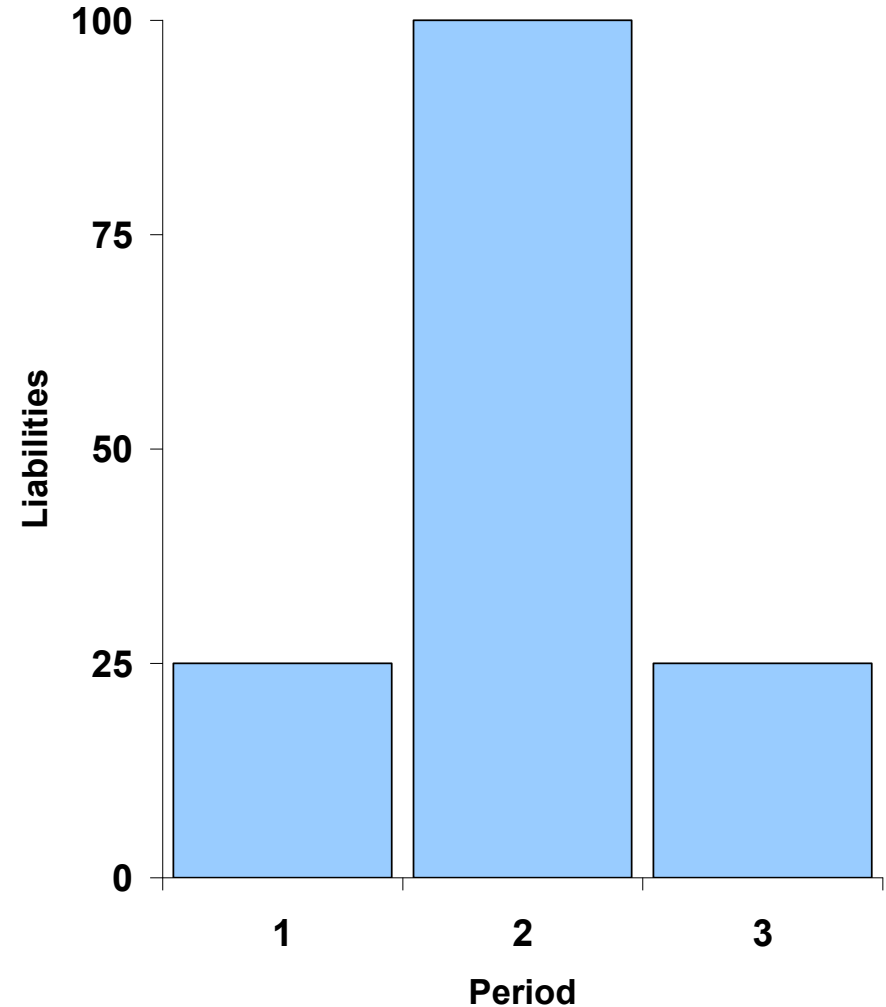


Funding Cost Scenarios for a Simple DB Pension Plan

The “Traditional” View

Year	Return	Liability payment	End of year asset value	End of year funding status
Bonds: 6% annualized rate of return				
Scenario 1: Return sequence 6%, 6%, and 6%				
0			133.58	100.0 %
1	6 %	25.00	116.59	100.0 %
2	6 %	100.00	23.58	100.0 %
3	6 %	25.00	0.00	N/A
Stocks: 8% annualized rate of return				
Scenario 2: Return sequence 8%, 8%, and 8%				
0			128.73	100.0 %
1	8 %	25.00	114.03	100.0 %
2	8 %	100.00	23.15	100.0 %
3	8 %	25.00	0.00	N/A

Liabilities of a Simple DB Pension Plan



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3	8 %	25.00	0.00	N/A

What Else Could Happen?

Year	Return	Liability payment	End of year asset value	End of year funding status
Stocks: 8% annualized rates of return				
Scenario 3: Return sequence of 10%, 10%, and 4%				
0			128.73	100.0 %
1	10 %	25.00	116.60	102.3 %
2	10 %	100.00	28.26	122.1 %
3	10 %	25.00	+4.39	N/A

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2	10 %	100.00	28.26	122.1 %
3	10 %	25.00	+4.39	N/A
Scenario 4a: Return sequence of 4%, 4%, and 16%				
0			128.73	100.0 %
1	4 %	25.00	108.88	95.5 %
2	4 %	100.00	13.23	57.2 %
3	16 %	25.00	-9.59	N/A

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The “Traditional” View

Year	Return	Liability payment	End of year asset value	End of year funding status
Bonds: 6% annualized rate of return				
Scenario 1: Return sequence 6%, 6%, and 6%				
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1	6 %	25.00	116.59	100.0 %
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0			128.73	100.0 %
1	8 %	25.00	114.03	100.0 %
2	8 %	100.00	23.15	100.0 %
3	8 %	25.00	0.00	N/A

What Else Could Happen?

Year	Return	Liability payment	End of year asset value	End of year funding status
Stocks: 8% annualized rates of return				
Scenario 3: Return sequence of 10%, 10%, and 4%				
0			128.73	100.0 %
1	10 %	25.00	116.60	102.3 %
2	10 %	100.00	28.26	122.1 %
3	10 %	25.00	+4.39	N/A
Scenario 4a: Return sequence of 4%, 4%, and 16%				
0			128.73	100.0 %
1	4 %	25.00	108.88	95.5 %
2	4 %	100.00	13.23	57.2 %
3	16 %	25.00	-9.59	N/A
Scenario 4b: Return sequence of 4%, 4%, and 16%				
0			133.58	103.8 %
1	4 %	25.00	113.92	99.9 %
2	4 %	100.00	18.47	79.8 %
3	16 %	25.00	-3.57	N/A

Intermediate Results

- ❑ The Asset Return – Funding Cost Paradox arises because of **volatile asset returns** and **current benefit payments**.
- ❑ The long term funding costs for DB pension plans are **path dependent** on the sequence of asset returns.
- ❑ Current benefit payouts break the link between average returns and average funding costs (**reverse dollar cost averaging**)
- ❑ When under funded, current benefit payments still need to be paid in full by selling assets at depressed prices
- ❑ When severely under funded, the required asset returns to maintain or improve funding status may reach unreasonable levels.

To convert an eventual equity risk premium into lower funding cost, DB pensions plans need to be, on average, fully funded.

Required Asset Returns to Maintain Funding Status

Pension Fund's Asset Value = Present Value of Liabilities x Funding Status

$$AV_t = PV(\text{Liab}_t) FS_t \quad AV_{t+1} = PV(\text{Liab}_{t+1}) FS_{t+1}$$

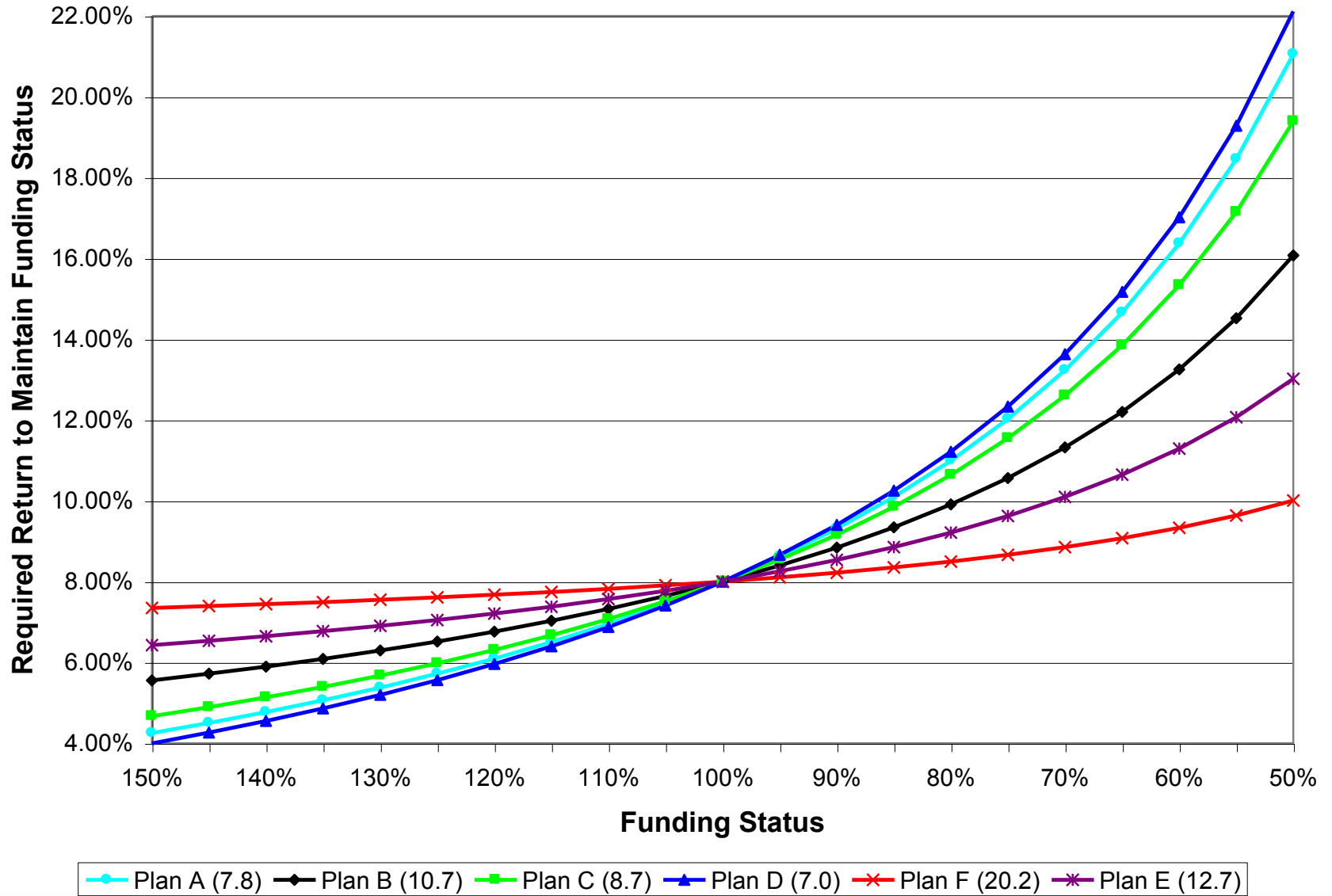
Case 1: Benefit Payments at the End of the Period

$$AV_{t+1} = AV_t(1+i) - BP_t$$
$$i = \frac{PV(\text{Liab}_{t+1}) FS + BP_t}{PV(\text{Liab}_t) FS} - 1$$

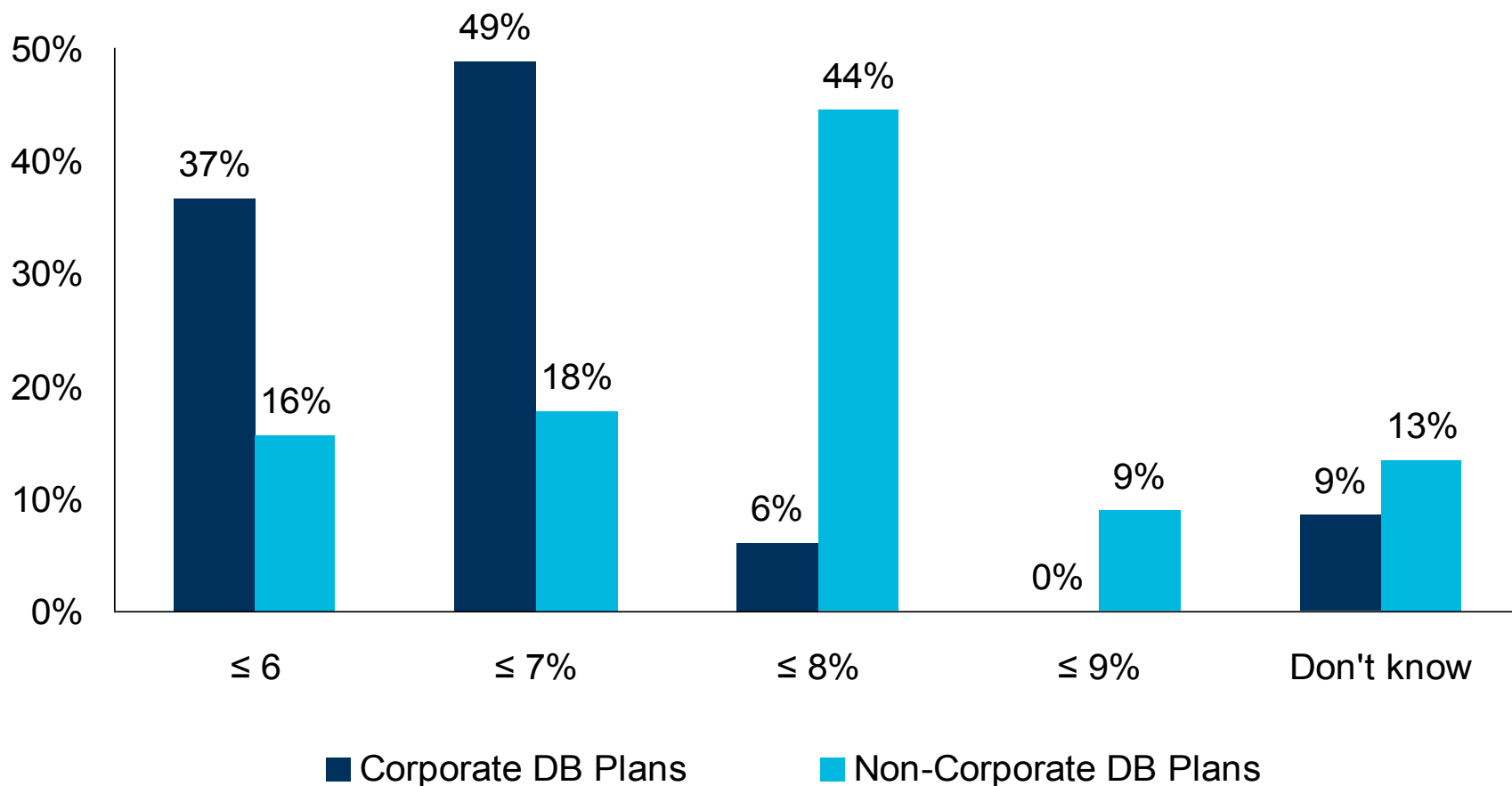
Case 2: Benefit Payments at the Beginning of the Period

$$AV_{t+1} = (AV_t - BP_t)(1+i)$$
$$i = \frac{PV(\text{Liab}_{t+1}) FS}{PV(\text{Liab}_t) FS - BP_t} - 1$$

Required Asset Returns to Maintain Funding Status



What is Your Current Discount Rate Assumption for Determining the Present Value and Duration of Your Liabilities?



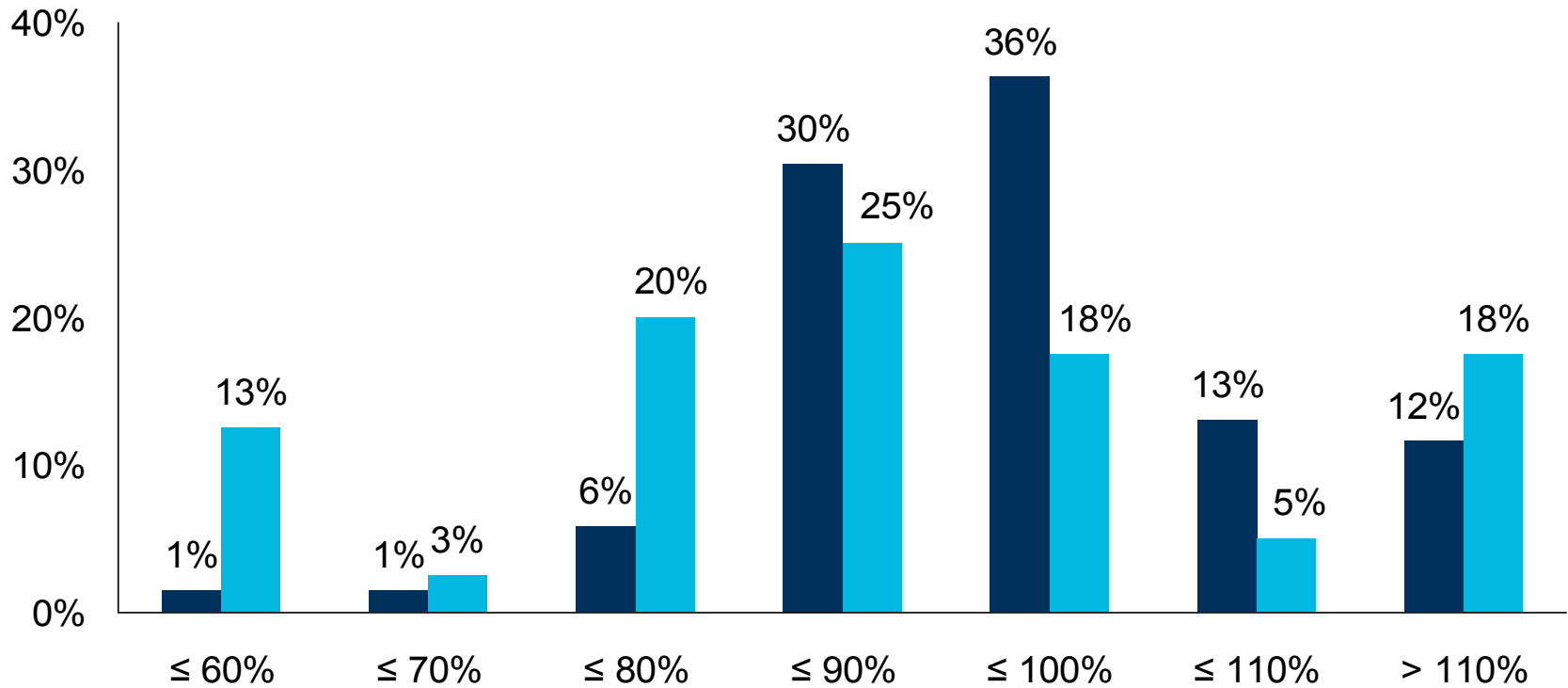
The Asset Return – Funding Cost Paradox: How Likely is it?

- So far, we have only shown the possibility of the Asset Return – Funding Cost Paradox
- Isn't it equally likely that pension plans with equity portfolios end up with a funding surplus or deficit depending on the realized return sequence?

In reality, DB pension plans tend to be, on average, underfunded. Therefore, they are not in a position to profit from an eventual equity risk premium.

Why?

What Has Your Average Funding Level Been Over the Last 10 Years?



■ Average funding levels over last 10 years (Corporate)
■ Average funding levels over last 10 years (Non-Corporate)

Reasons for Persistent Underfunding

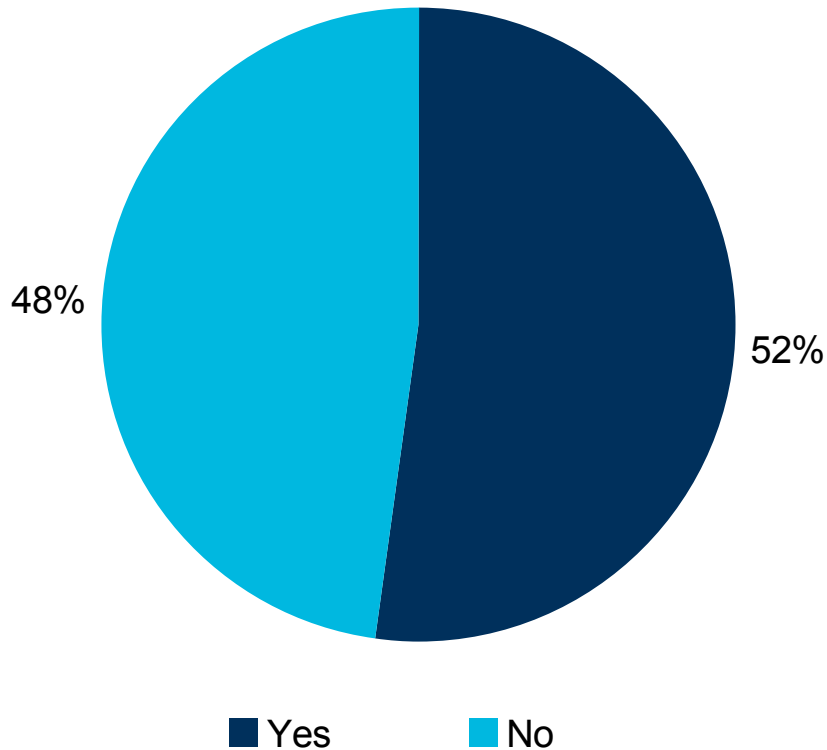
- Inability to close arising funding gaps (Pension Funding Relief Bill 2008)
 - Funding gaps for equity portfolios are potentially very large and usually arise in adverse business conditions.
 - Funding gaps for LDI solutions are usually small and not systematically correlated with business cycles
- Minimum funding policies (Mercer Sep. 2008)
- Substantial funding cushions to weather unfavorable market conditions are unlikely to be acquired because of
 - contribution holidays,
 - benefit bargaining, and
 - tax treatment.
- Asset and Liability Smoothing

A Note on Asset and Liability Smoothing

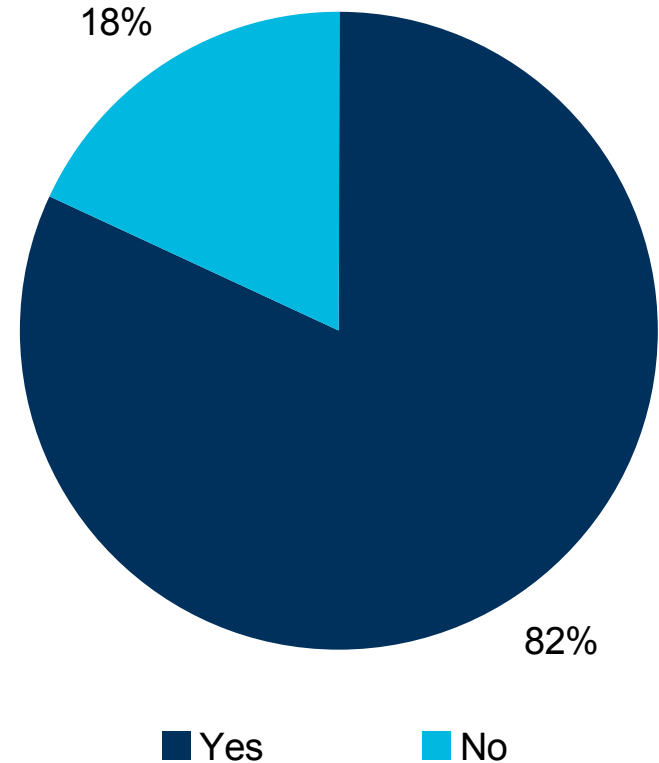
- mask the true economic funding status of a pension plan.
- needed to **minimize balance sheet & contribution volatility** for non-LDI strategies (i.e., to defer necessary contributions)
- Introduce a wedge between “accounting” and “economic” funding levels
- Huge differences between reported funding levels and funding levels on a termination basis
 - Bethlehem Steel 2002: 84% vs. 45%
 - US Airways 2003: 94% vs. 35%
 - Currently: Concerns about the “Big Three” pension plans

Have You Smoothed Asset and Liability Values?

Corporate Defined Benefit Plans



Non-Corporate Defined Benefit Plans



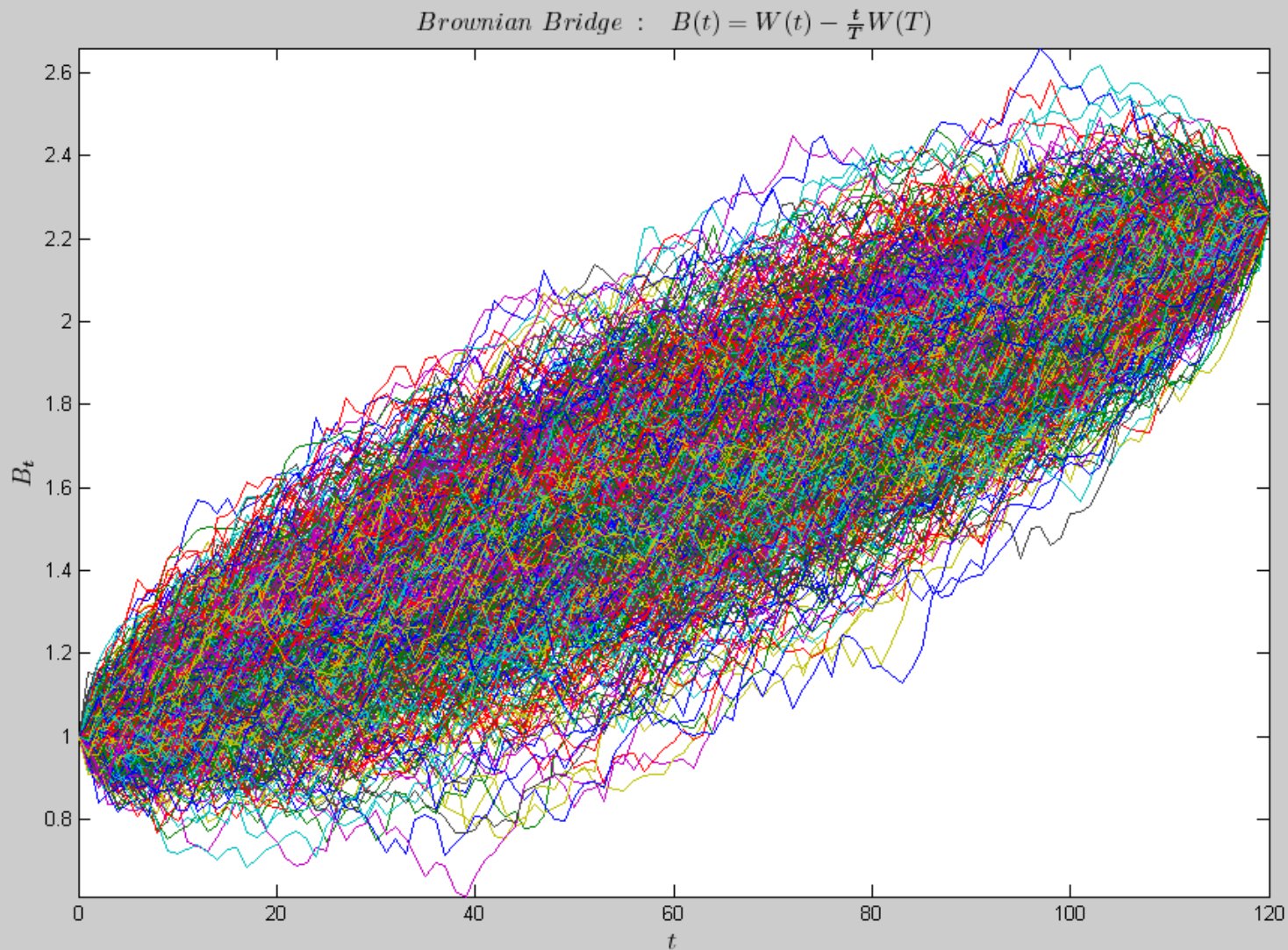
What do Volatile Asset Returns Really Mean?

- How to quantify the effects of underfunding and volatile asset returns?
- Retroactively is possible, but I can't get any data

Monte Carlo Simulation

- Our six DB pension plans (A to F), hard frozen, no contributions
- Generate 1,000 monthly return paths with an annualized rate of return of 8%

Generate 1,000 Asset Price Paths with $r=8\%$



What do Volatile Asset Returns Really Mean?

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Monte Carlo Simulation

- Our six DB pension plans (A to F), hard frozen, no contributions
- Generate 1,000 monthly return paths with an annualized rate of return of 8%

- **Simulation structure:**

For all plans and all return paths

Initialize plan with xx% of the PV(Liabilities)

For i = 1 to 120 months

Earn return

Pay out benefit

Next i

Analyze terminal funding levels

Monte Carlo Simulation Front-End / Results

Monte Carlo Simulation for Determining the Path Dependency of Final Funding Status

Asset-Parameters

realized total return (ann.)= **8.50%**
 sigma= **0.4**
 use 3-tier corporate discount rate= **No**
 discount rate = **6.50%**
 initial funding status= **80.0%**

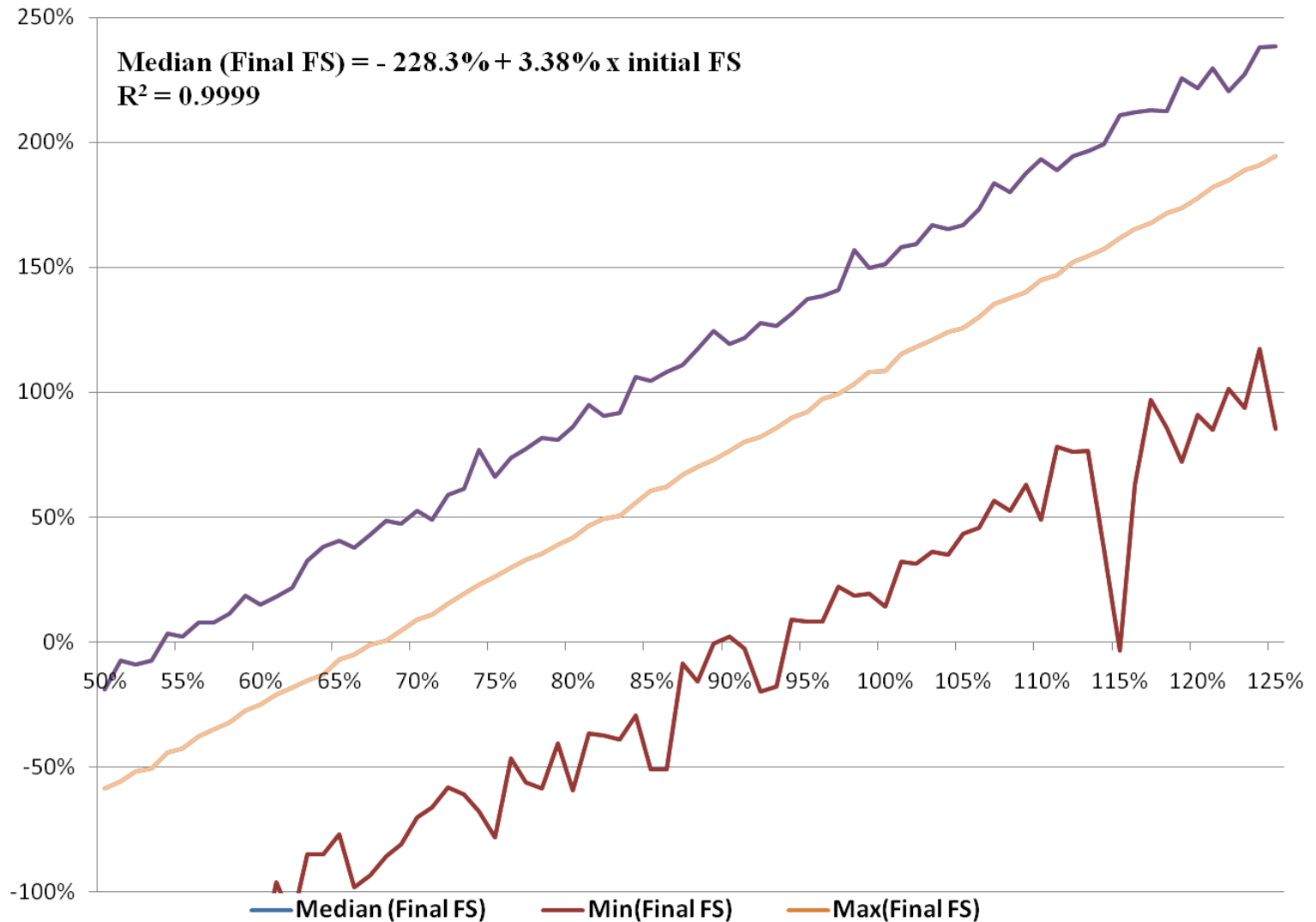
Simulation-Parameters

of simulations= **1,000**
 # of periods= **120**
 show asset prices= **Yes**

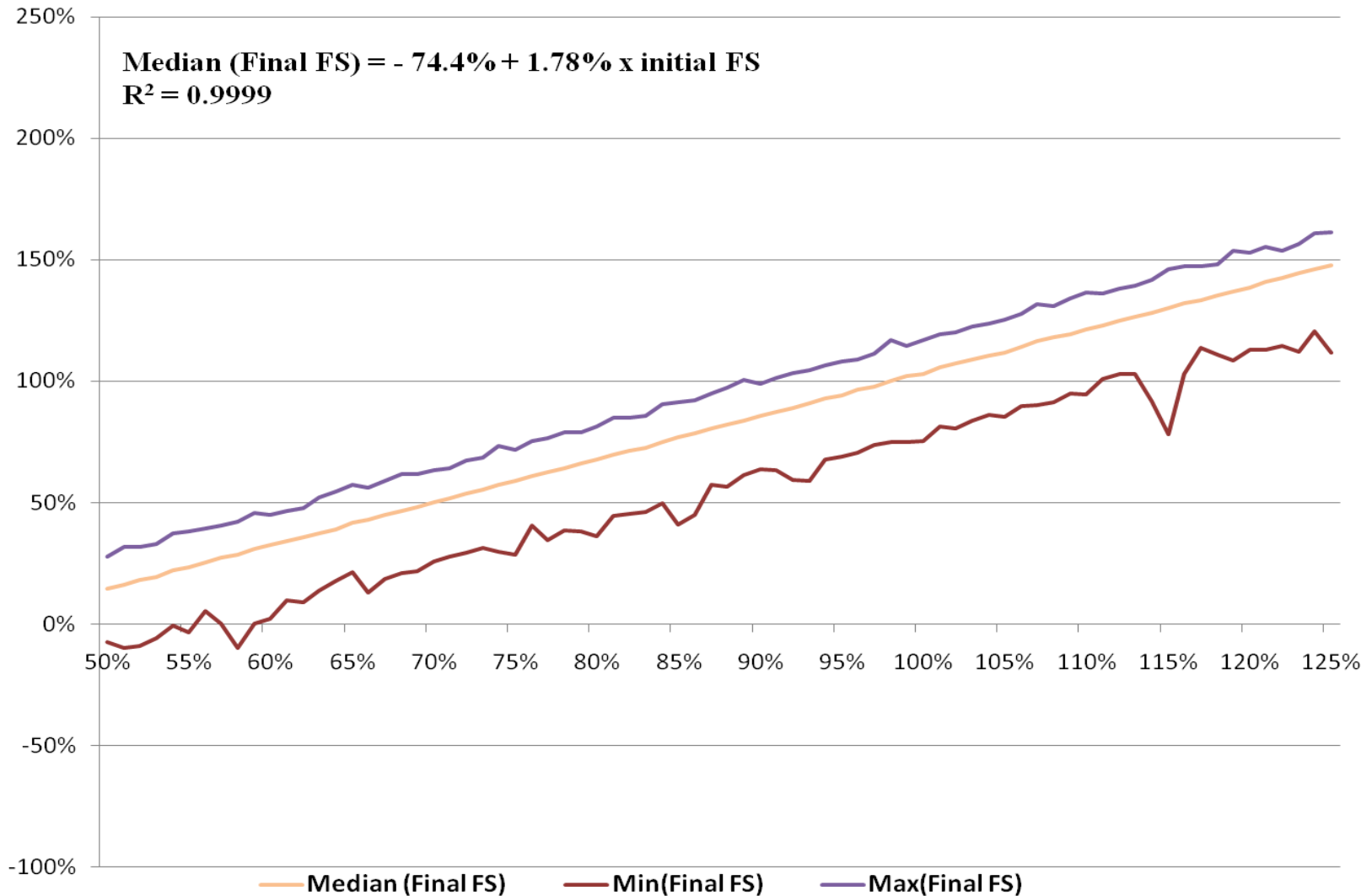
Monte Carlo Results

	Plan						Mean
	D	A	C	B	F	E	
average discount rate	8.50%	8.50%	8.50%	8.50%	8.50%	8.50%	
average plan duration	7.34	8.11	9.06	10.44	11.68	18.69	
Mean(Final Funding Status)	75.2%	79.9%	83.1%	88.6%	90.9%	95.0%	85.4%
Median(Final FS)	76.8%	81.1%	84.1%	89.2%	91.4%	95.1%	86.3%
Std.-Dev.(Final FS)	17.2%	13.3%	10.9%	6.5%	5.1%	1.6%	9.1%
Min(Final FS)	-8.2%	15.7%	30.1%	56.5%	64.8%	86.8%	40.9%
Max(Final FS)	117.8%	113.0%	110.4%	105.2%	104.2%	99.2%	108.3%

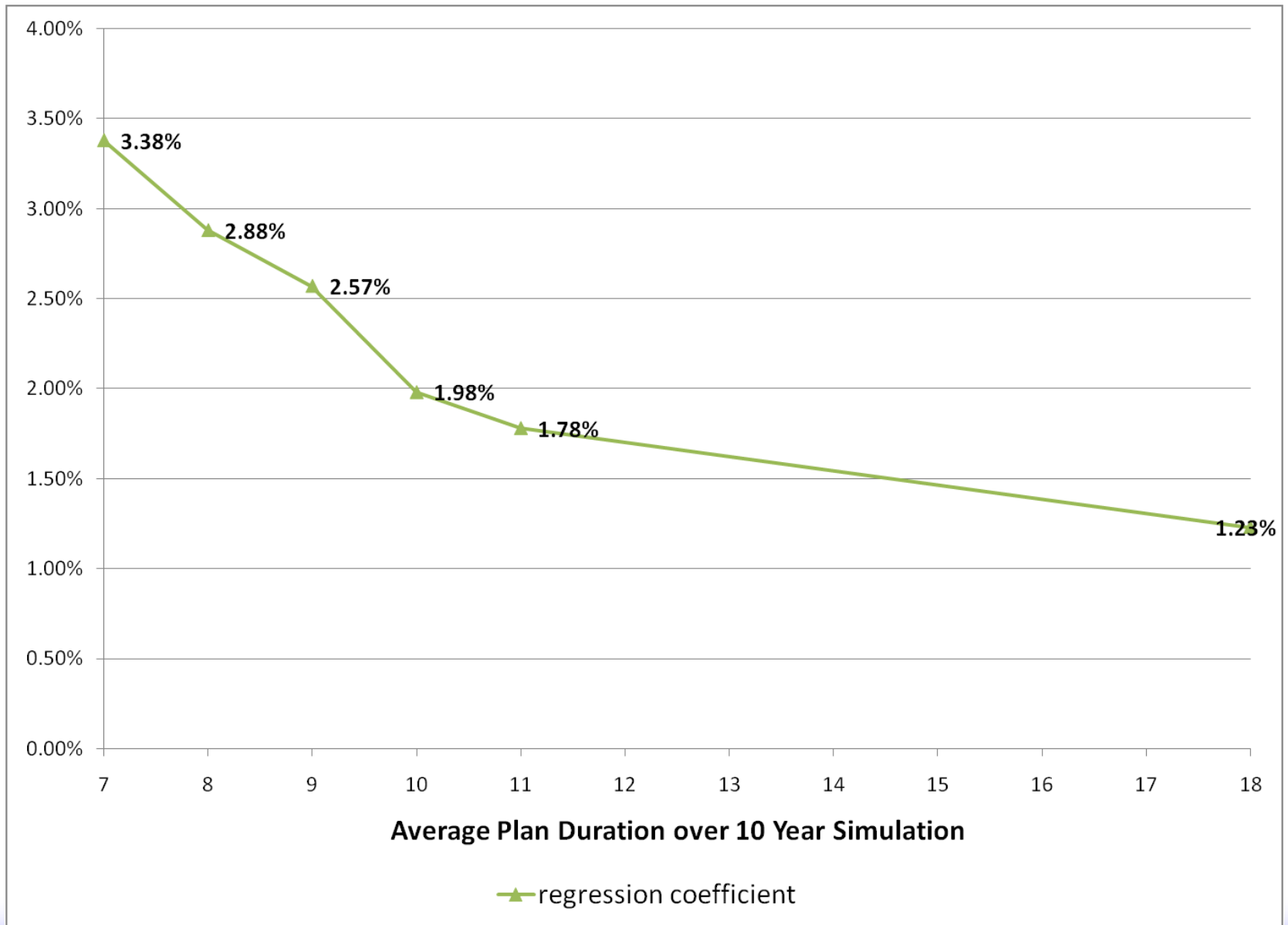
Final Funding Levels after 10 Years as a Function of Initial Funding Status (Plan D, Duration 7.3)



Final Funding Levels after 10 Years as a Function of Initial Funding Status (Plan F, Duration 11.7)



Average Change in Final Funding Status after 10 Years for a 1% Change in Initial Funding Status as a Function of Plan Duration



Conclusions

- The Asset Return – Funding Cost Paradox is real. Low duration plans are more likely to experience it.
- LDI strategies minimize the risk of creating large funding deficits from which it is hard to recover.
- Funding costs are a function of asset returns and funding levels.
- By continuing to use unmatched equity strategies, underfunded plans have a slight chance of improving their funding status, yet run the risk of failing even earlier (Russian roulette).
- There is little hope for severely underfunded pension plans to earn their way out of their funding deficit.
- Even if average return expectations materialize, non-LDI plans have a positive risk of failing if no further contributions are made.
- In my opinion, plans have no viable alternative to LDI in terms of risk managements **and** funding costs.

Questions, Comments, Refutations (?)

- Let me know what you think, especially if you disagree.
- Contact me at Norman.Ehrentreich@yahoo.com
or at info@thepensioncrisis.us