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INVESTMENT
MANAGEMENT



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David Braun

Chief Risk Officer

Asset-Liability Management (ALM)

- A risk management technique designed to earn an adequate return while maintaining a comfortable surplus of assets beyond liabilities. Takes into consideration interest rates, earning power, and degree of willingness to take on debt.
- Also called surplus management.

Source: investorwords.com

Liability Driven Investing (LDI)

- See above definition of ALM.

Any parameter that impacts the value of a liability or an asset (and thus impacts surplus) should be measured/monitored in the ALM process.

Examples include:

- Interest rates
- Equity market performance
- Inflation rates
- Foreign exchange rates
- Liquidity issues
- Credit spreads/ratings
- Market implied volatility
- Liability “consumer” behavior
 - e.g., mortgage prepayment speeds, employee retirement date, mortality rates

Banks and Insurance companies pioneered improvements in ALM over past several decades. Today's marketplace is influenced by:

- Past mistakes
 - Interest rate volatility in the '80s and '90s, coupled with poor ALM, resulted in financial losses for several banks and insurers.
- Changing regulatory and accounting environments
 - Past: Financial reporting was book value accrual based. Drawback: Can disguise risk as it does not fully capture the true economic differential between assets and liabilities.
 - Present: Increasing movement towards fair value accounting. This will result in a more immediate recognition of performance differential of the assets vs. the liabilities.
- Growth in derivatives and securitization markets
 - Both are valuable ALM tools as they facilitate the redistribution of risks (and rewards)

Corporations and pension funds have begun to actively embrace advanced ALM techniques as well.

An insurance company sells a \$10 million 5 year Guaranteed Investment Contract (GIC, like a bank CD).

- ALM strategy: The insurer invests the deposit (the assets) in a way that mirrors the expected cash outflows of the GIC (the liability).

A power company signs a contract to deliver electricity to a customer at a fixed price for the next 2 years.

- ALM strategy: The power company utilizes derivatives (the assets) to offset the exposure embedded in the contract (the liability).

An employer provides OPEB and Pension benefits to employees.

- ALM strategy: Based on an analysis of the promised benefits (the liability), the employer develops a contribution plan and an investment strategy (the assets) that reduces the risk of surplus draw-down.

Why implement an ALM process for a Pension Plan?

Surplus Protection

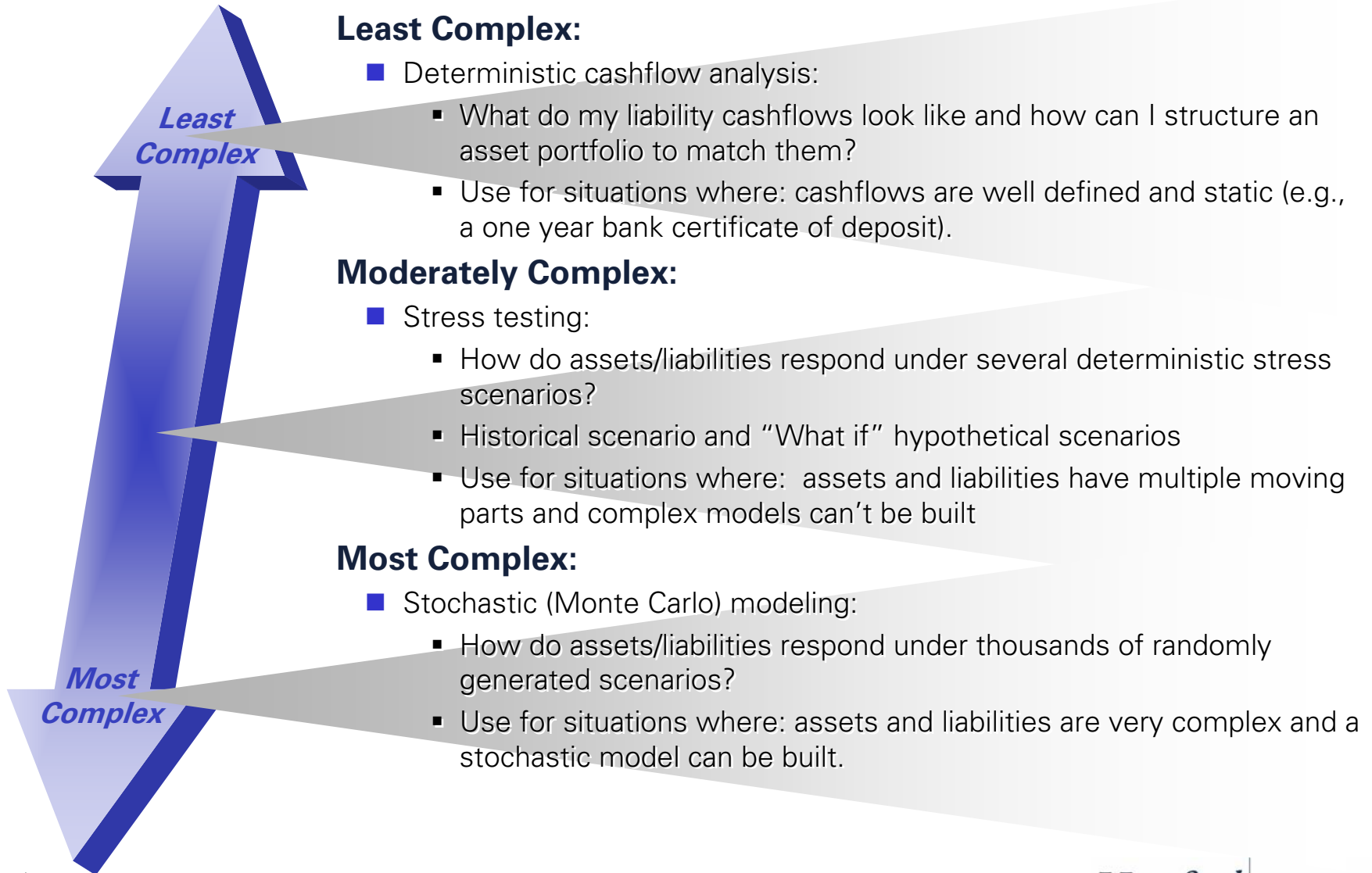
- Assets – Liabilities = Surplus
- Surplus may be adversely impacted if assets do not move in tandem with liabilities

Funding (Contribution) Stability

- As surplus position changes, required contributions are likely to change resulting in favorable or unfavorable budget deviations

Understanding Risk vs. Reward

- A robust ALM process sheds light on the risk/reward trade-off
- Risk should not be avoided at all cost, rather risk should be taken when ...
 - It can be measured and monitored
 - It is communicated clearly to and well understood by key stakeholders
 - Expected reward fairly compensates you for taking that risk



- Hypothetical Defined Benefit Pension plan
 - Liability = \$2.2 billion, Assets = \$2.0 billion
 - \$200 million deficit, ~ 91% funded
- Liability duration = 15 years
 - i.e., a 1% decrease in interest rates will increase the liability by 15%
 - e.g., if interest rates drop from 5% to 4%, the liability will go from \$2.20b to \$2.53b increasing by \$330 million
- Initial investment strategy is 65% equity, 35% bond
 - Bond duration = 15 yrs., Equity duration = 0 yrs.
 - Total Asset duration is 5.25 yrs. = $(35\% \times 15 + 65\% \times 0)$
- Duration mismatch of 9.75 yrs.
 - If rates drop 1%, the liability increases by \$330 million but the assets only increase by \$105 million ($5.25 \text{ duration} \times \$2.0 \text{ billion assets} / 100$)
 - **Would increase the deficit by another \$225 million to \$425 million!**

ALM goal: “maintaining a comfortable surplus of assets beyond liabilities”

ALM Case Study ... Continued

- Stochastic ALM model
 - Generate 1000 stochastic capital market scenarios
 - Each scenario represents a potential future path of interest rates and equity market returns
 - Run asset and liability flows through each of the 1000 scenarios
 - Capture asset, liability and surplus values for each
 - Analyze distribution of surplus results and other risk metrics

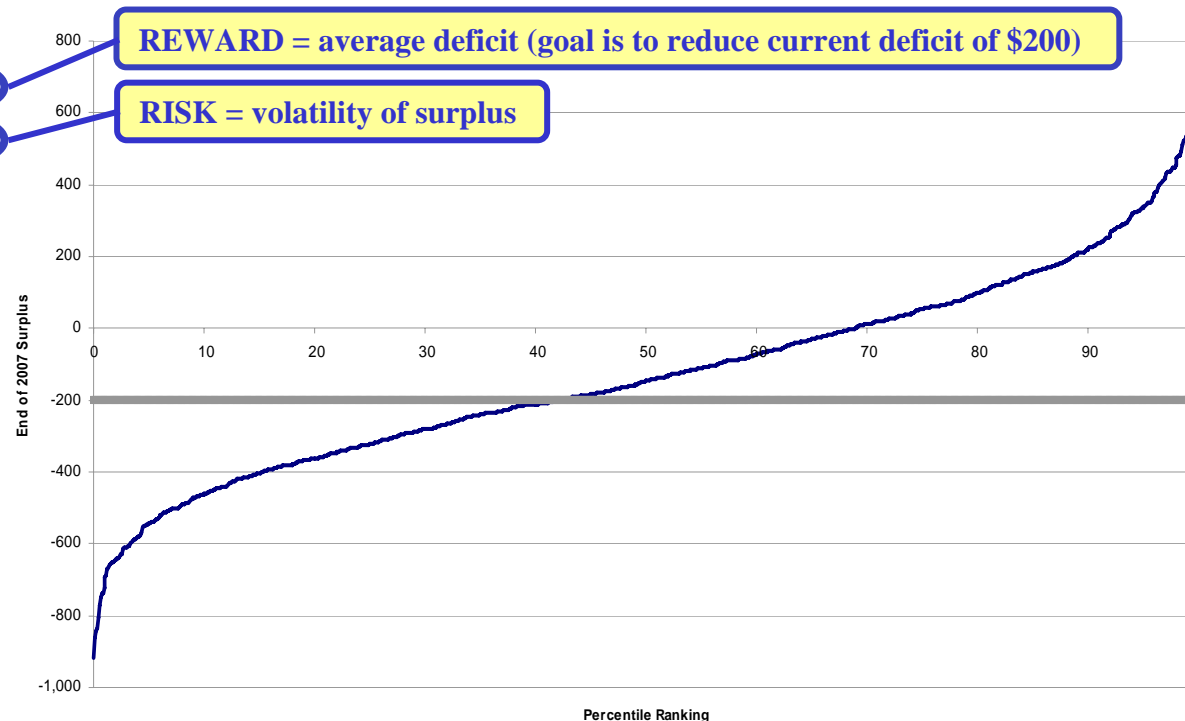
- Review Several Possible Scenarios Under Stochastic ALM Model
 1. Maintain current allocation 65%/35% equity/bond allocation
 2. 100% bond allocation with 15 year duration match
 3. Maintain current allocation and apply “swap overlay” to obtain 15 year duration match
 4. 60% bond, 20% equity, 20% alternative asset

- There will NOT be a correct answer

ALM Case Study: Current Allocation – 65%/35% Equity/Bond¹

End of 2007 Surplus

Average Surplus	-130
Volatility ²	271
Percentile	
1%	-721
5%	-543
10%	-462
25%	-322
50%	-147
75%	55
90%	220
95%	336
99%	540



Decomposition of Surplus Volatility

From Equities	226
From Interest Rates	149
Diversification Benefit	(104)
Total	271

- Volatility of surplus is large (\$271 million)
 - Duration mismatch causes interest rate driven volatility
 - However, equities are the largest driver of the volatility
- Average funding deficit is reduced from \$200 million to \$130 million due to positive expected equity returns³

All Surplus and Volatility numbers are in \$ millions

¹ Please see footnotes 1 and 2 on page A-1 for important disclosure regarding details shown above

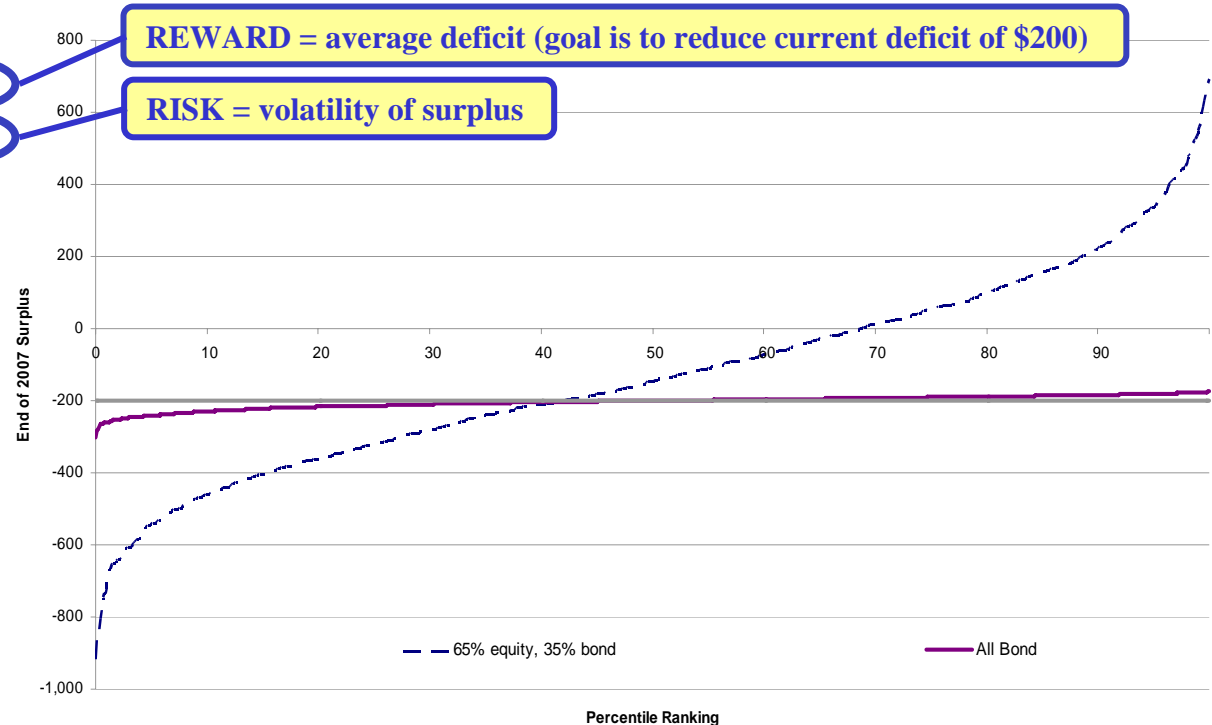
² Volatility = 1 standard deviation

³ Implicit in assumptions shown on page A-1

ALM Case Study: 100% Bonds - Fully Duration Matched¹

End of 2007 Surplus

Average Surplus	-204
Volatility ²	18
Percentile	
1%	-261
5%	-242
10%	-229
25%	-214
50%	-200
75%	-190
90%	-184
95%	-181
99%	-178



Decomposition of Surplus Volatility

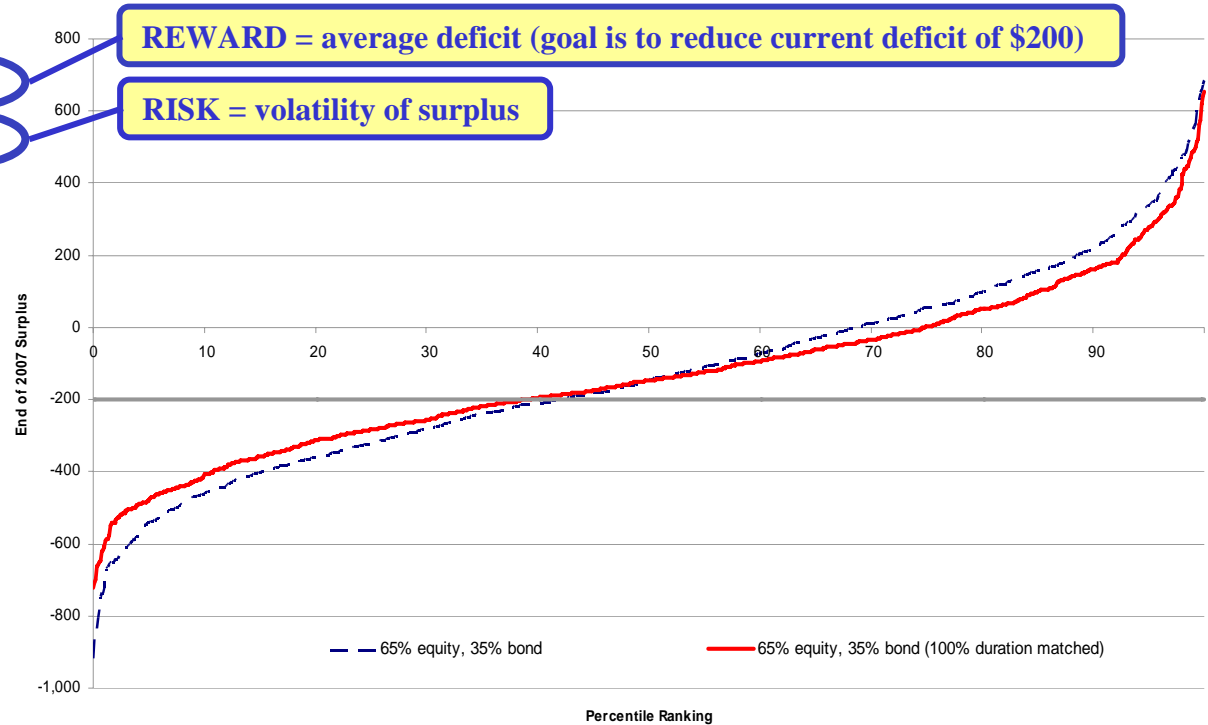
From Equities	0
From Interest Rates	18
Diversification Benefit	0
Total	18

- Low risk, low reward
 - Trade away potential reward from equity upside in order to reduce the volatility of surplus
 - Volatility is reduced to \$18 million
 - Essentially lock-in the under-funded amount of \$200 million
- This is an example of a Asset-Liability Matching strategy

ALM Case Study: 65%/35% Equity/Bond - Duration Overlay - Fully Duration Matched¹

End of 2007 Surplus

Average Surplus	-132
Volatility ²	226
Percentile	
1%	-610
5%	-482
10%	-412
25%	-284
50%	-148
75%	2
90%	160
95%	277
99%	488



Decomposition of Surplus Volatility

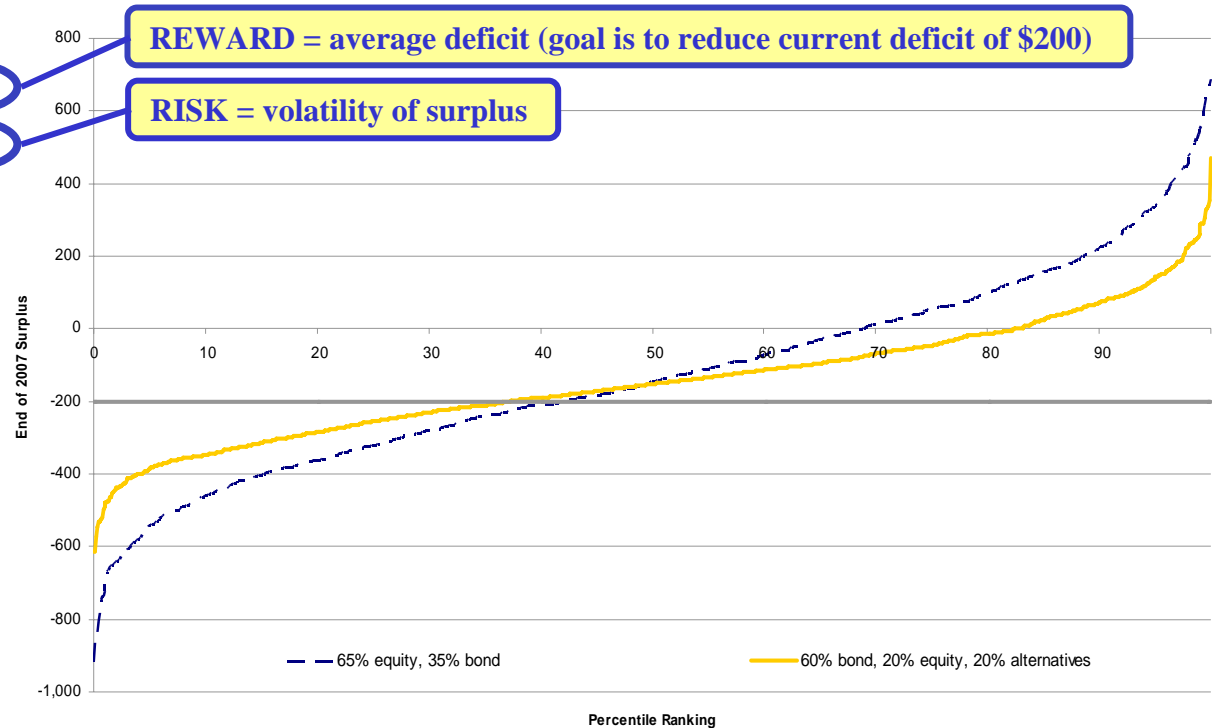
From Equities	224
From Interest Rates	29
Diversification Benefit	(27)
Total	226

- Volatility is reduced vs. current strategy
 - Significant reduction due to duration matching
 - Remaining volatility is nearly all from equities
- Keep upside equity return potential
 - Cutting average deficit to \$132 million

ALM Case Study: 60% bonds, 20% equities, 20% alternative assets¹

End of 2007 Surplus

Average Surplus	-145
Volatility ²	162
Percentile	
1%	-490
5%	-384
10%	-348
25%	-256
50%	-152
75%	-47
90%	71
95%	137
99%	260



Decomposition of Surplus Volatility

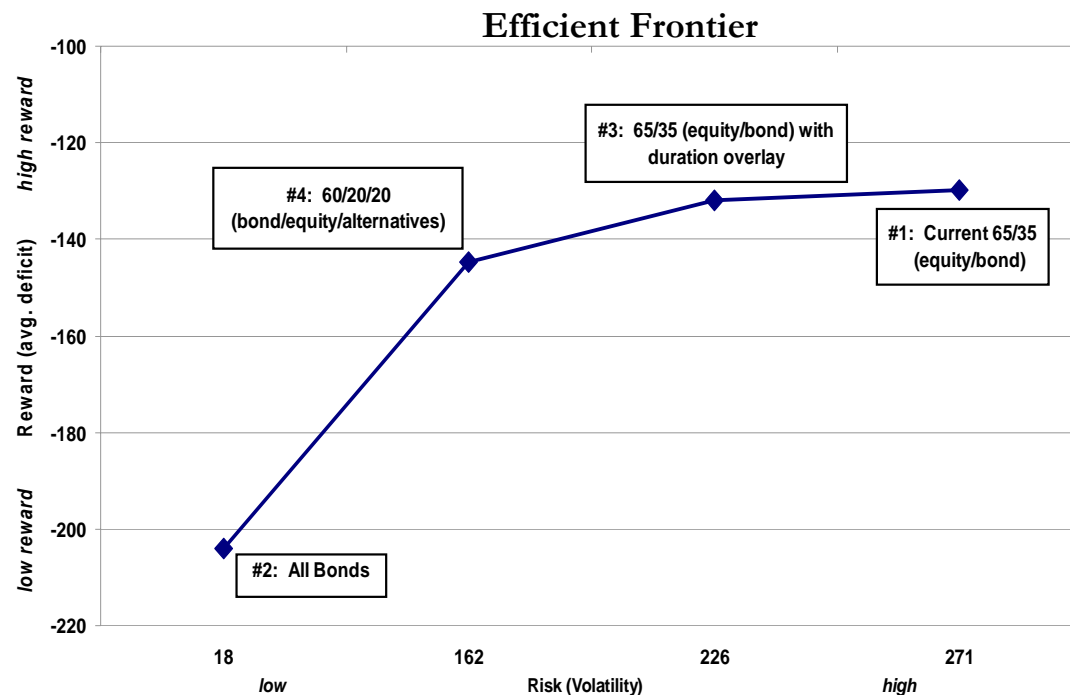
From Equities	129
From Interest Rates	95
Diversification Benefit	(62)
Total	162

- Invest 20% in alternative assets
 - Hedge funds and Private Equity
- More diversified investment strategy results in a dramatic reduction in volatility vs. current strategy (271 to 162)
- Potential reward is lower than current strategy, but not completely eliminated
 - Average deficit is cut to \$145 million, but is not as attractive as the current strategy (130)

ALM Case Study: Summary of Strategies 1 - 4¹

End of 2007 Surplus

	1	2	3	4
Average Surplus	-130	-204	-132	-145
Volatility ²	271	18	226	162
Percentile				
1%	-721	-261	-610	-490
5%	-543	-242	-482	-384
10%	-462	-229	-412	-348
25%	-322	-214	-284	-256
50%	-147	-200	-148	-152
75%	55	-190	2	-47
90%	220	-184	160	71
95%	336	-181	277	137
99%	540	-178	488	260



Decomposition of Surplus Volatility

	1	2	3	4
From Equities	226	0	224	129
From Interest Rates	149	18	29	95
Diversification Benefit	-104	0	-27	-62
Total	271	18	226	162

- Current: Highest risk, highest reward
- Strategy 2: Lowest risk, lowest reward
- Strategy 3: Lower risk, roughly equivalent reward vs. current
- Strategy 4: Lower risk, lower reward vs. current and # 3

How to Pick an ALM (Investment) Strategy?

Must consider:

- Risk appetite
 - How much risk are you willing to take?
- Risk/reward trade-off
 - How much extra reward do you need to justify the risk?
- Ability to implement and monitor
 - Some strategies may require significant repositioning of the portfolio¹
- Unique situations of plan sponsor
 - Financial flexibility (whole balance sheet, taxing power, etc.)
 - Funding pressure from various constituents
 - e.g., employees/unions, taxpayers/voters, rating agencies, investors, etc.
 - View of the future of the capital markets (impacts modeling assumptions which thus impacts model output)

¹ Model results are presented gross of fees and expenses and reflect hypothetical returns based on assumptions identified below. They do not represent actual management of any portfolio nor would they be the sole determinant in constructing an actual portfolio. Further, model results may not reflect the impact that material economic and market factors may have on portfolio investment management.

² Equity: Blend of U.S. and International equity with mean projected returns of 9.5%, standard deviation of 19.7%

Bond: U.S. Investment Grade Fixed Income with mean projected returns of 5.3%, standard deviation of 12.6%

Alternative Assets: Hedge Funds: mean projected returns of 7.1%, standard deviation 12%. Private Equity: mean projected returns of 14.0%, standard deviation 34%.

Interest Rates:

Average 10 Year Treasury Rate: projected returns of 4.6%, standard deviation of 0.8%

Average 30 Year Treasury Rate: project returns of 4.6%, standard deviation are 0.7%

Decomposition of Surplus Volatility:

Performed by running the stochastic model multiple times and capturing the impact on surplus volatility generated by each asset class based on their risk/return characteristics stated above. Diversification Benefit is the benefit achieved by simulating asset classes in tandem.

³ Although an investment using margin presents the opportunity for higher returns compared to an investment without the use of margin, the use of margin also increases exposure to loss and may increase volatility. Moreover, the use of margin may result in unrelated business taxable income to employee benefit plan investors and other tax-exempt organizations.

⁴100% Bonds refers to the lack of an equity component and reflects a purchase of \$2 billion in bonds as well as a derivative overlay to achieve the targeted duration.