SOCIETY OF ACTUARIES

ALM Seminar
June 12-13, 2008

Portfolio Optimization

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ALM Seminar

Portfolio Optimization
An Overview of Approaches

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NEXUS RISK MANAGEMENT INC

Agenda

1) ALM Conceptual Framework
2) Portfolio Optimization – Asset Mix
3) Portfolio Optimization – Credit Spreads
4) Portfolio Optimization – Term Structure

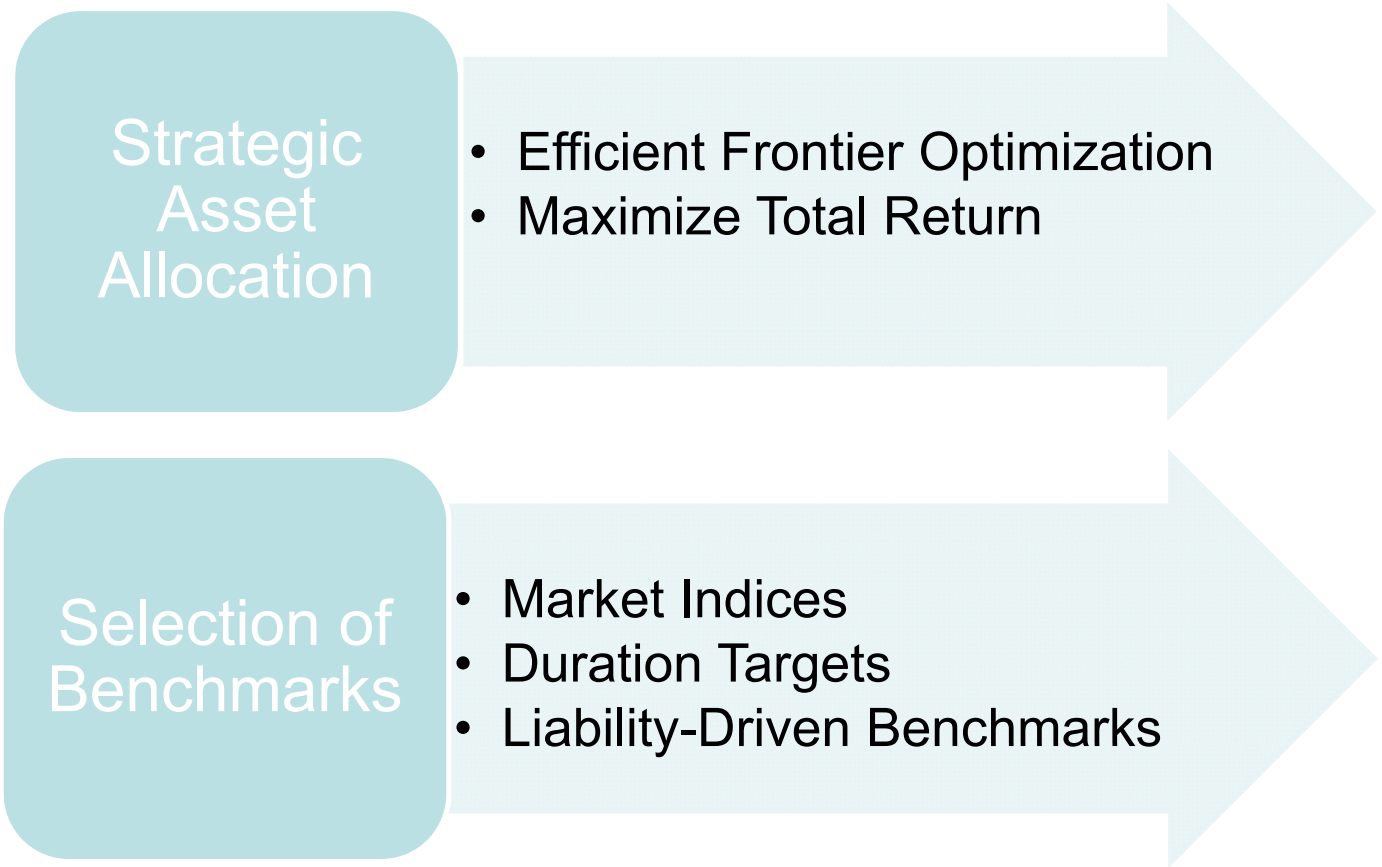
ALM Conceptual Framework

- Executing ALM at strategic level to run business
- Goal is not necessarily to eliminate or minimize risk
- Goal is to achieve overall financial objectives
  - investment objectives are ancillary
- Risk tolerances reflect risk appetite and specific considerations of company
  - determine specific risk limits
- Constraints include both internal and external sources
- Surplus management philosophy formalized
- ALM is executed as an optimization problem to max financial objective s.t. risk limits and constraints

Strategic Asset Allocation most important investment decision

- Defines the asset mix
- Reflects the investment objectives, risk tolerances and constraints of investor
- Usually determined based on expected returns, variance and correlation of asset classes
- Involves periodic rebalancing

SAA and selection of benchmarks are major sources of return/risk



Four main asset classes to consider

Equities	Bonds	Alternatives	Cash
• Large Cap • Small Cap • Foreign	• Long Term • Corporates • Callables	• Commodities • Derivatives • Hedge Funds / Strategies • Real Estate • Private Equity • Venture Capital	• Short Term Notes • Money Market

How much equities should back liabilities?

- Liability cash flows are uncertain – inflation, mortality
- Equities provide higher expected return, diversification benefit and hedge against inflation
- Insurance liabilities have substantial interest rate sensitivity
- Equities do not immunize against liability cash flows against changes in interest rates
- In fact, equities do not provide a good hedge against inflation
- Over the past 80 years correlation was 0.08
  - Canadian Institute of Actuaries Report on Canadian Economic Statistics 1924-2007
- When only assets are considered Equities provide highest expected return
- When both assets and liabilities are considered Equities expose the portfolio to the highest interest rate risk exposure; have the highest greatest potential loss
- Strongest argument against holding Equities in pension may be tax benefit

Information required to perform Mean-Variance analysis

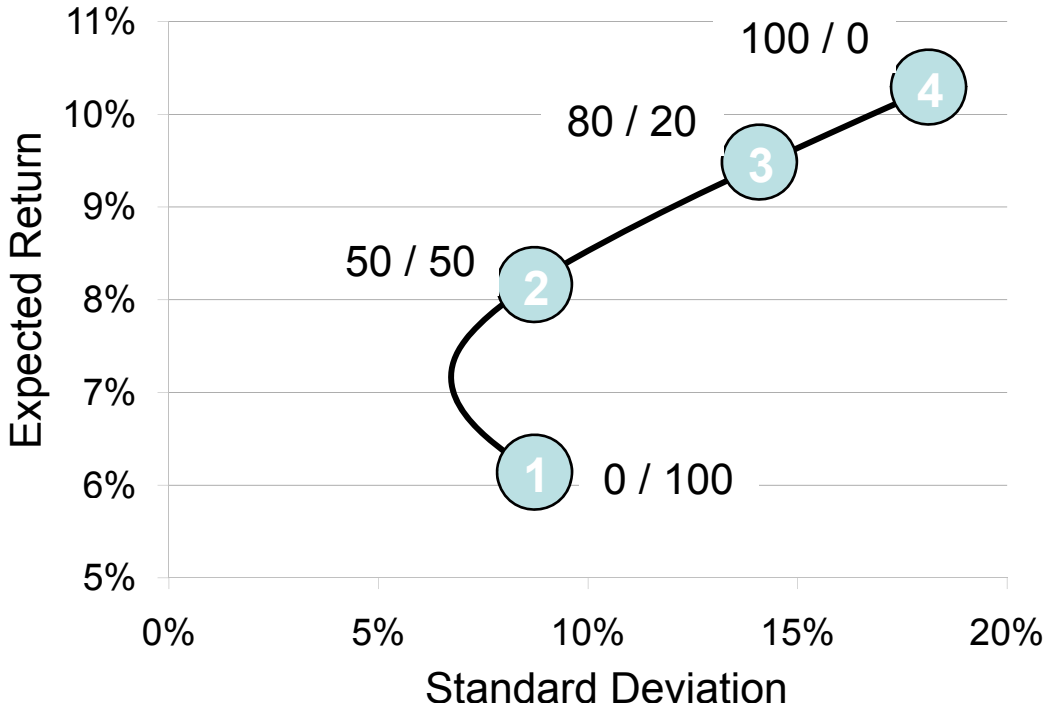
			Correlation Matrix		
	E[R]	σ	Equities	Bonds	Liabilities
Equities	10.3%	18.2%	1	0.31	0.31
Bonds	6.1%	8.8%		1	1
Liabilities	6.1%	8.8%			1

$$E[R_P] = \sum_{i}^{N} \alpha_i E[R_i]$$

$$\sigma_P = \sqrt{\alpha^2 \sigma_E^2 + (1-\alpha)^2 \sigma_E^2 + 2\alpha(1-\alpha)\rho_{E,B}\sigma_E\sigma_B}$$

SAA determined using efficient frontier analysis

Asset-Only Total Return

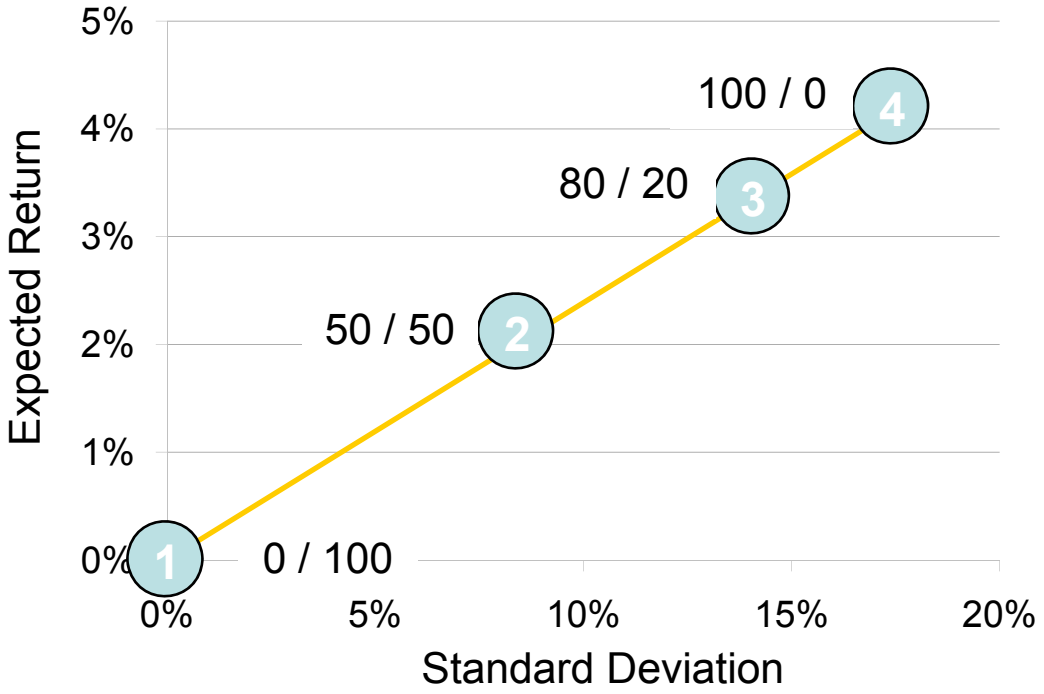


	E[R]	σ
1	6.1%	8.8%
2	8.2%	8.8%
3	9.5%	14.1%
4	10.3%	18.2%

Focus is on maximizing risk-adjusted total return of asset portfolio

Efficient frontier analysis can also incorporate liabilities

Asset Return – Change in Liability



	E[R]	σ
1	0.0%	0.0%
2	2.1%	8.8%
3	3.4%	14.1%
4	4.2%	17.6%

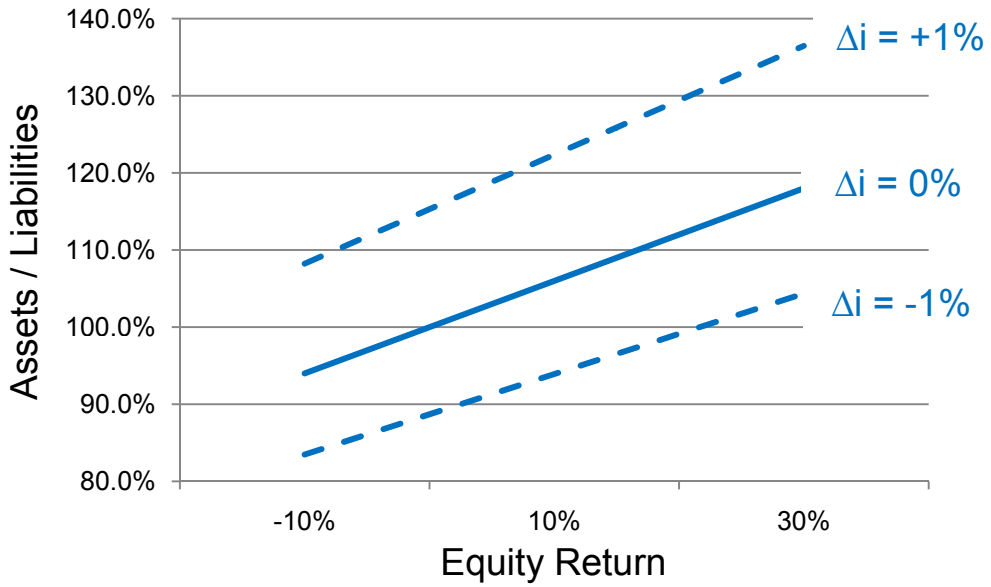
Impact of Interest Rates and Equity Returns on A / L Ratio

60/40 Asset Mix

Interest Rate Change

Equity Return	-1%	0	1%
-10%	83.5%	94.0%	108.2%
10%	93.9%	106.0%	122.4%
30%	104.3%	118.0%	136.5%

60 / 40 Asset Mix



Impact of Interest Rates and Equity Returns on A / L Ratio

100% Bonds

Interest Rate Change

Equity Return	-1%	0	1%
-10%	100.0%	100.0%	100.0%
10%	100.0%	100.0%	100.0%
30%	100.0%	100.0%	100.0%

100% Bonds


140.0%
130.0%
120.0%
110.0%
100.0%
90.0%
80.0%
Assets / Liabilities
-10%
10%
30%
Equity Return
Δi = -1%, 0%, +1%

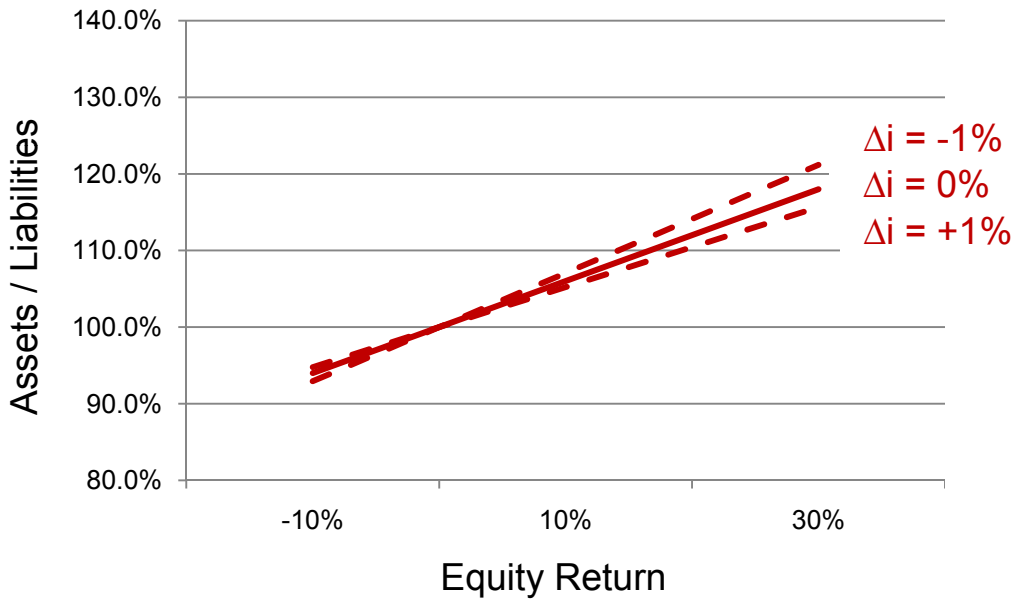
Impact of Interest Rates and Equity Returns on A / L Ratio

60 / 40 Asset Mix + Overlay

Interest Rate Change

Equity Return	-1%	0	1%
-10%	94.8%	94.0%	92.9%
10%	105.2%	106.0%	107.1%
30%	115.7%	118.0%	121.2%

60 / 40 Asset Mix + Overlay



Simulation used to analyze asset mix

- Stochastic modelling used to test asset mix
  - run thousands of economic scenarios for each asset mix
  - project economic surplus
- Illustrates trade-off between expected return / volatility
- Shows financial impact of SAA

Maximizing Portfolio Yield – Credit Spread Portfolio Optimization

- Goal is to maximize portfolio yield while without changing duration or average credit quality of the portfolio
- Asset universe includes all available or selected corporate bonds, current credit spreads and ratings
- Optimization consists of maximizing credit spread for average credit quality or for given rating category
- Oftentimes results in higher credit risk exposure

Exploiting the shape of the term structure

- Goal is to maximize portfolio yield on a default free basis
- Optimization is performed using risk-free government yield curve
- Simultaneously maximize yield and minimize interest rate risk exposure at all points across the yield curve
- Involves executing a partial duration immunization strategy with risk limits specified for all term to maturities
- Potential to add significant value