



OREGON PUBLIC EMPLOYEES RETIREMENT FUND

**ASSET/LIABILITY DISCUSSION:
PHASE THREE-ASSETS/LIABILITY ANALYSIS**

May 26, 2010

STRATEGIC INVESTMENT SOLUTIONS, INC.

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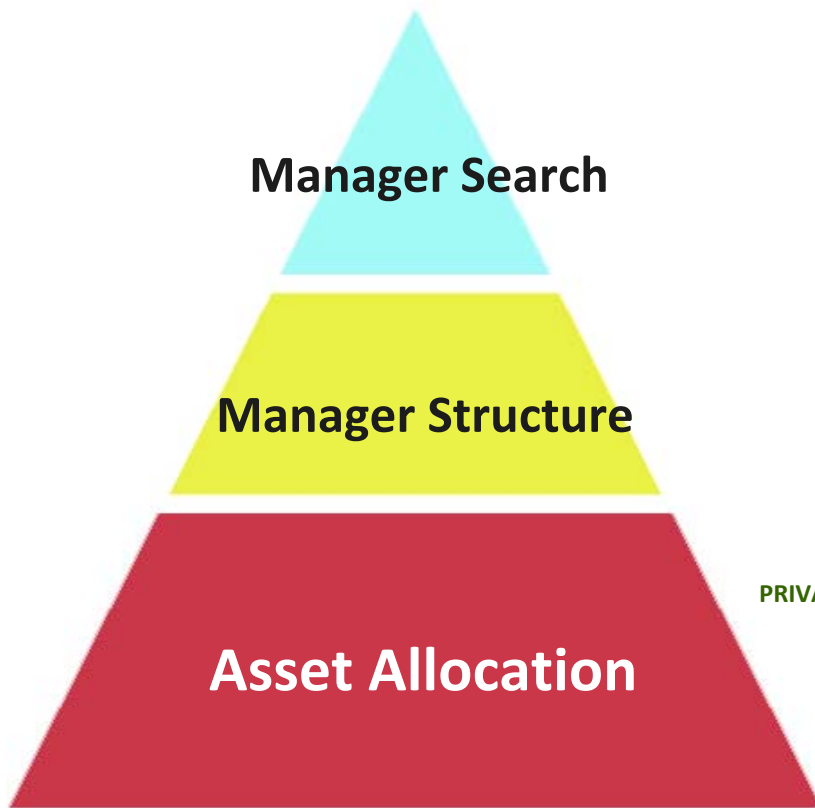
Michael R. Beasley
Managing Director

John P. Meier, CFA
Managing Director

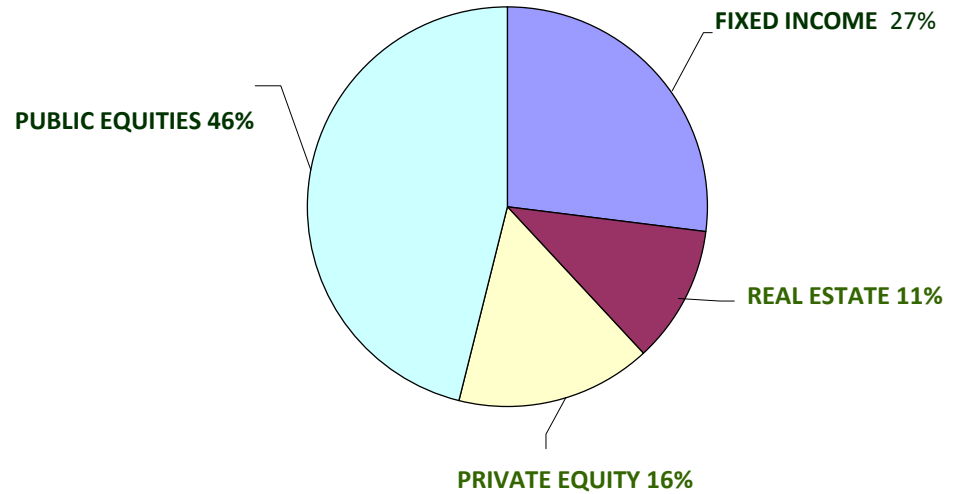
Road to Asset Allocation Policy

- Asset Liability Modeling Presentation Today
 - Stochastic Simulations for the next 5 – 7 years
 - Uses Representative Asset Mixes
 - Risk/Reward Analysis used to point toward an appropriate level of risk/return
 - Liquidity Analysis
 - Scenario Analyses
 - Inflation, Deflation, Recession and Low Return
- July Presentation
 - Refine ALM Analyses as necessary
 - Refine Potential Asset Allocation Policy
 - New Asset Classes or Implementation (Opportunity Portfolio, Alternatives Portfolio, TIPS, EMD, etc.)
 - Adopt New Asset Allocation Policy

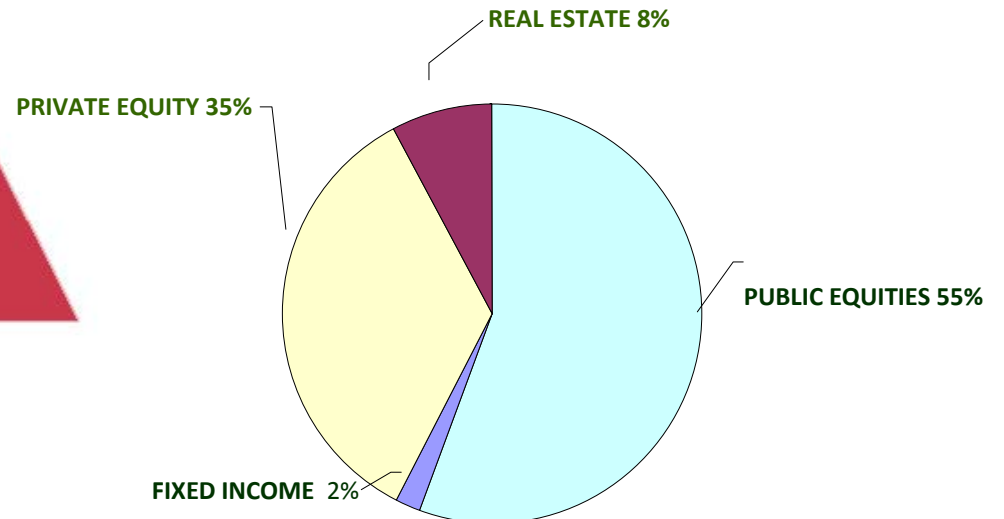
Asset Allocation



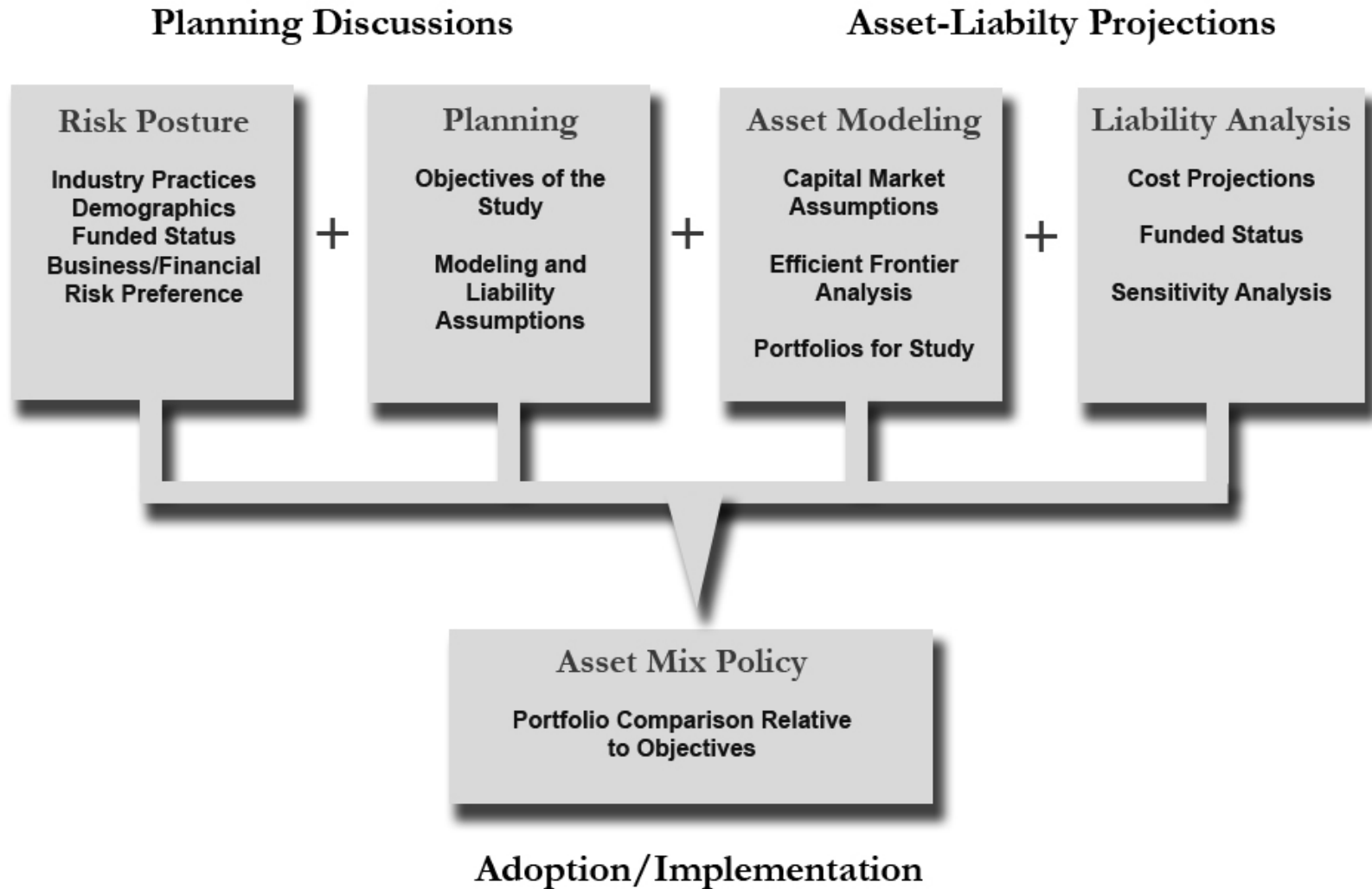
Plan's Strategic Policy



Portfolio Risk Allocation – Current Policy



Overview of the Asset-Liability Process



Current Asset Class “Implementation Assumptions”

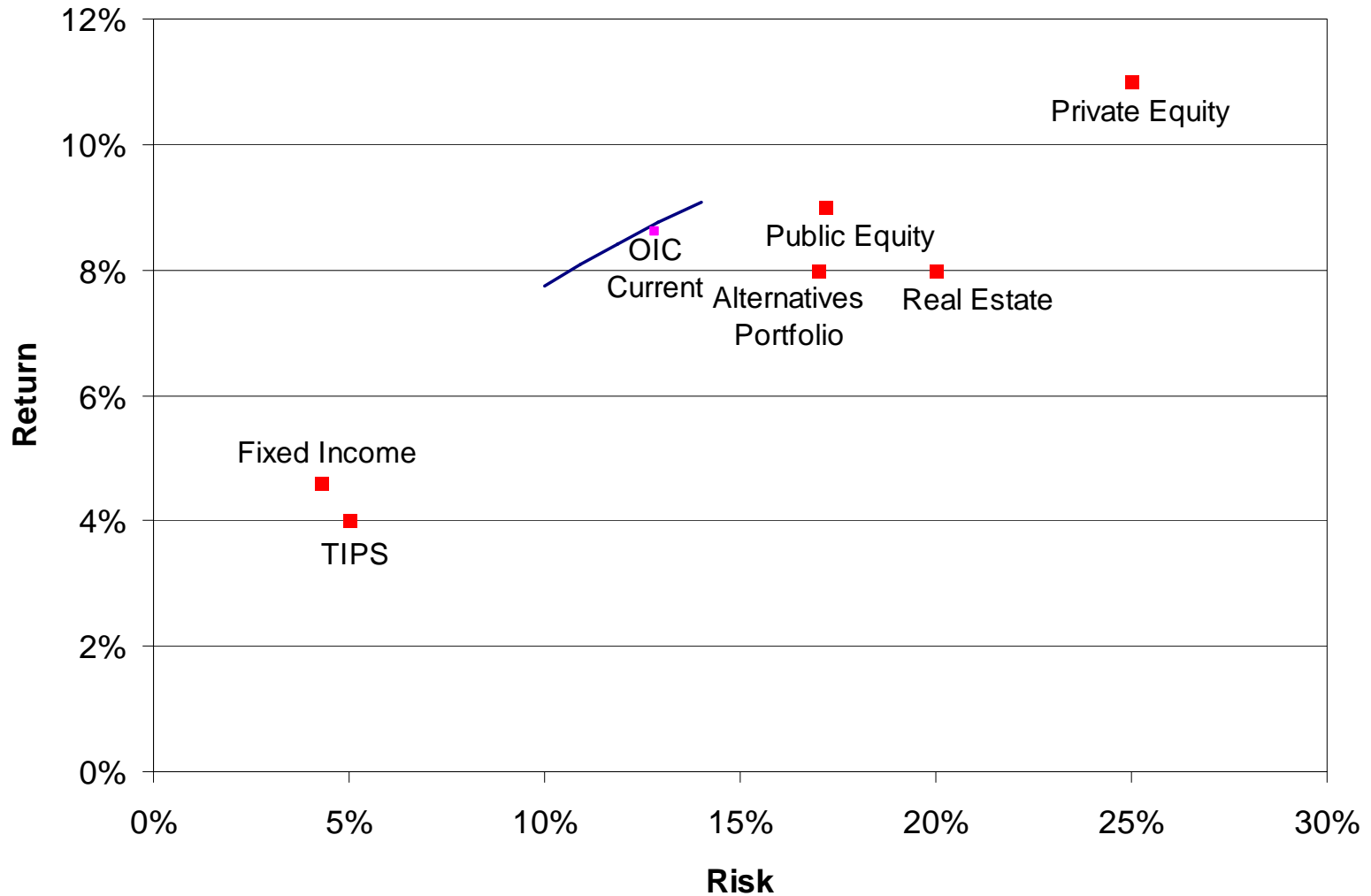
Asset Class	Expected Return	Expected Risk
Public Equity	9.0%	17.2%
Fixed Income	4.6%	4.3%
Private Equity	11.0%	25.0%
Real Estate	8.0%	20.0%
TIPS	4.0%	5.0%
Alternatives Portfolio	8.0%	17.0%

- Alternatives Portfolio – Permanent, Non Traditional, Real/Absolute Return Objective
 - Infrastructure, Absolute Return, Hard Assets/Commodities, etc.
- Lower Risk in PE than SIS Base Case to reflect OIC Capabilities and Experience
- Higher Return/Risk in RE than SIS Base Case to reflect OIC’s Risk Strategy and Experience

Alternatives Portfolio

- 33% Absolute Return
- 33% Infrastructure
- 34% Hard Assets
 - 11% Commodities
 - 11% Timber and Agriculture
 - 12% Industrial Commodity Producers

Expected Risk vs Return



Current Asset Class Implementation, Add TIPS and Alternatives Portfolio

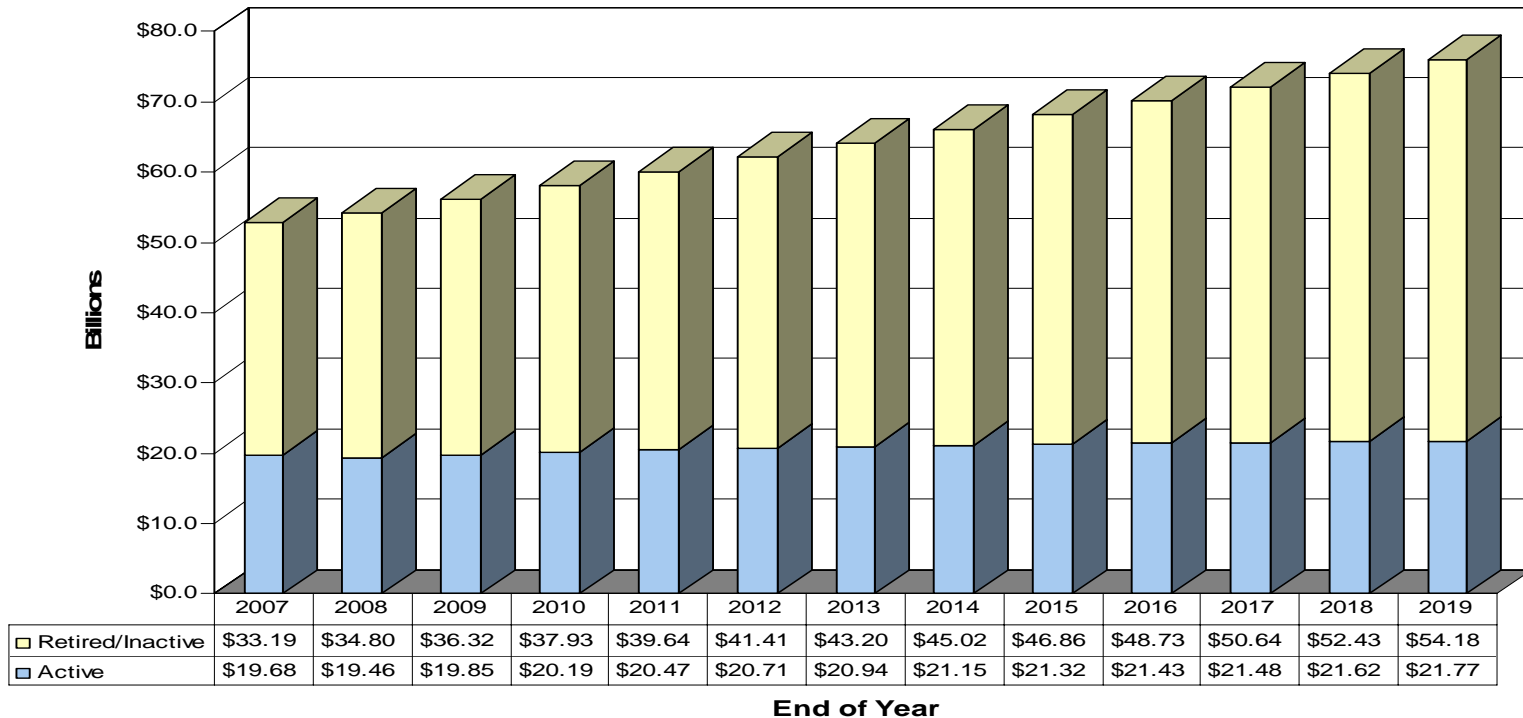
	Current Policy	Mix 4-1	Mix 4-2	Mix 4-3	Mix 4-4	Mix 4-5	Current Mix*
Public Equity	46.0%	19.8%	21.9%	24.2%	31.4%	39.2%	42.9%
Fixed Income	27.0%	36.9%	36.9%	31.5%	28.5%	20.7%	25.7%
Private Equity	16.0%	18.8%	20.7%	22.9%	24.0%	25.0%	19.8%
Real Estate	11.0%	8.2%	10.1%	12.1%	11.0%	10.0%	9.4%
TIPS	0.0%	11.4%	5.5%	4.3%	0.1%	0.1%	0.0%
Alts Port	0.0%	5.0%	4.8%	5.0%	5.0%	5.0%	2.2%
Equity	73.0%	51.7%	57.6%	64.2%	71.4%	79.2%	74.3%
Expected Return	8.61%	7.75%	8.08%	8.42%	8.76%	9.09%	8.61%
Std Deviation	12.8%	10.0%	10.9%	11.9%	12.9%	14.0%	12.8%
Sharpe Ratio	0.44	0.47	0.47	0.46	0.45	0.44	0.44

- TIPS are an important diversifier in lower risk mixes.
- Sharpe Ratio- Risk/Return Efficiency Higher for lower return mixes.
- Alternatives Portfolio at or near maximum for all mixes.
- All except the most conservative mix achieve the actuarial return without accounting for “alpha.”

*Actual mix as of 3/31/10

OPERF Actuarial Liability

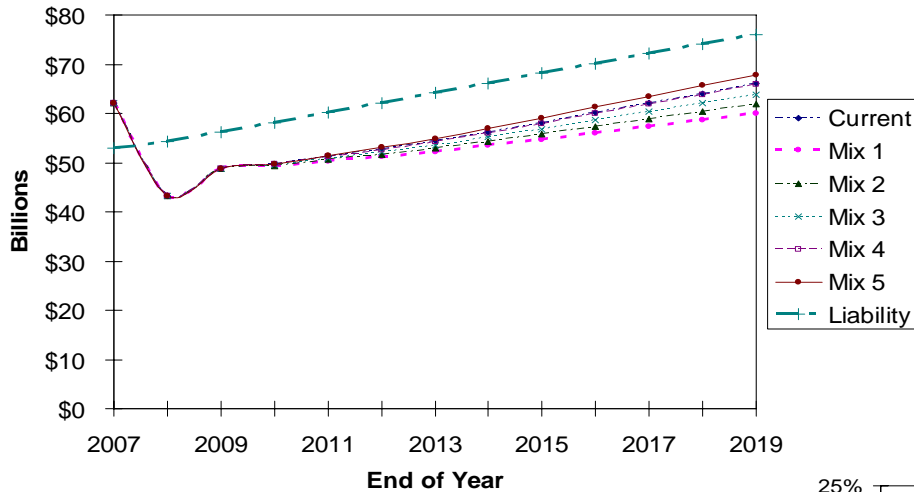
Projected Actuarial Accrued Liability



- Total Liability expected to grow by 3.1% over the next 10 years.
- Retired Liability grows from 65% to 71% of Total Liability

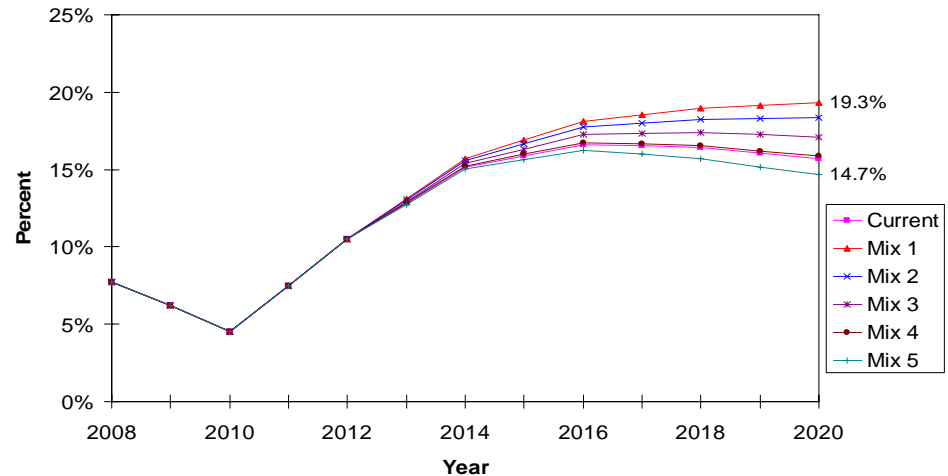
Simulation Results – “Expected” Values

Projected Values of Assets and Liabilities



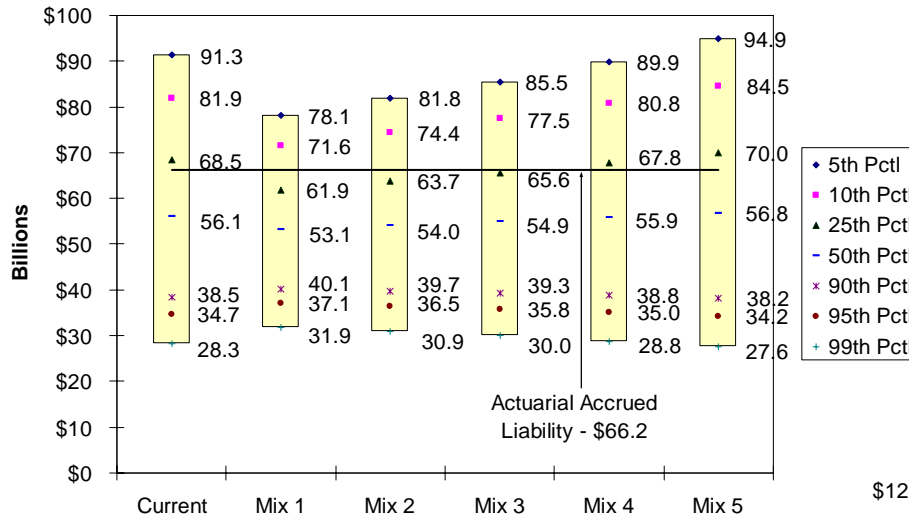
- Contribution Rates through Mid 2013 cannot be affected by asset mix.
- Expected Net (After Side Account Adjustments) Contribution rates stay in the upper teens for the next 10 years.

Projected Cash Contributions Made by Employer as Percentage of Pay (After Side Account Relief)



Distribution of Asset Values

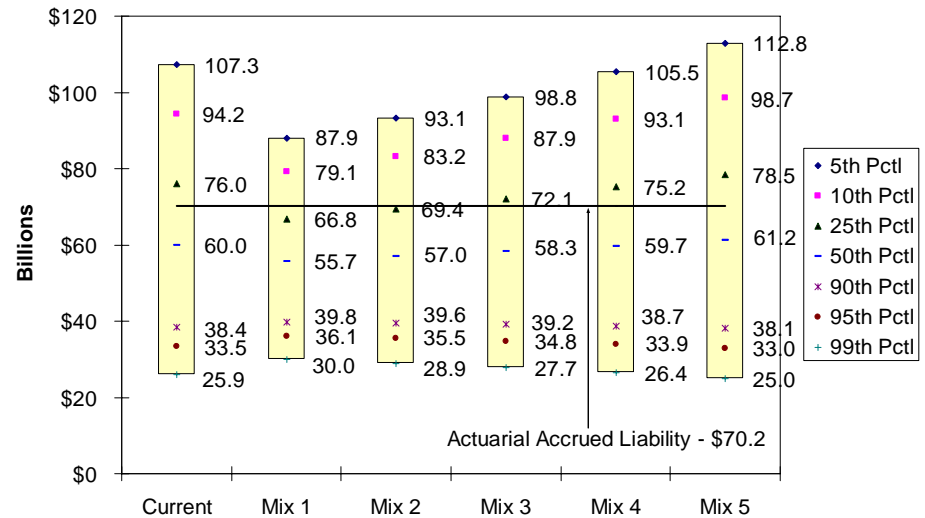
Range of Asset's Market Value
(Five Year Horizon - December 31, 2014)



- Examine 5 and 7 Year horizons
- 5% chance that the unfunded liability will be 29.1 to 32.0 billion in 5 years, 34.1 to 37.2 billion in 7 years.
- While \$3+ billion is significant, the loses are also significant with a “low risk” mix.

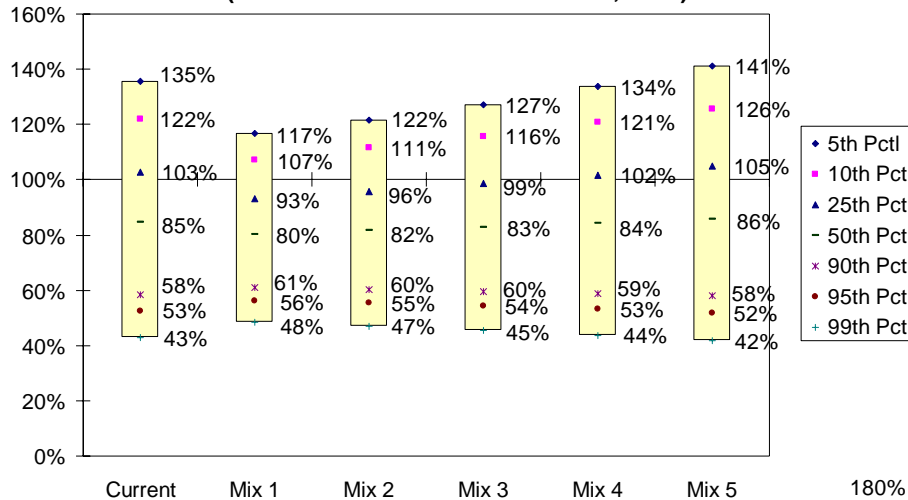
- The 5 years ending March 2008, were akin to a 90th percentile 5 year event.

Range of Assets' Market Value
(Seven Year Horizon - December 31, 2016)



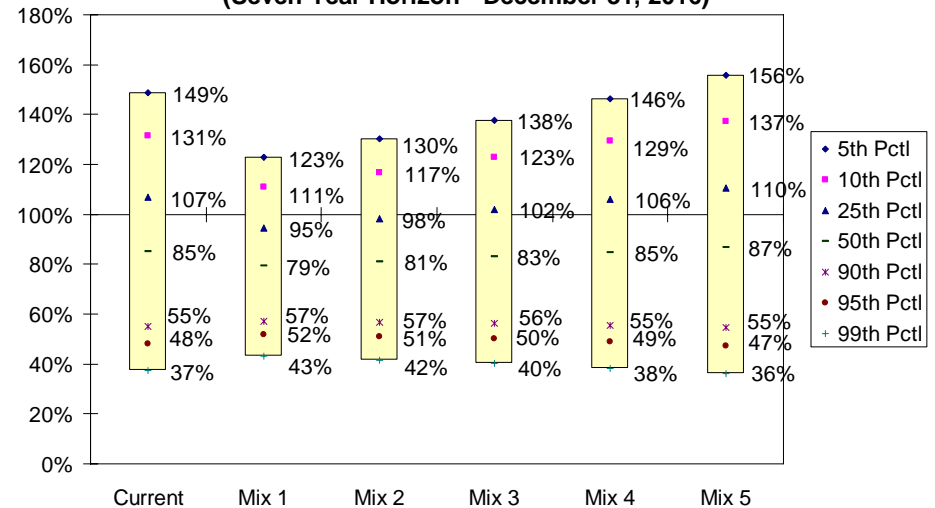
Distribution of Funded Status

**Projected Funded Status Using Market Value of Assets
Including Side Accounts
(Five Year Horizon - December 31, 2014)**



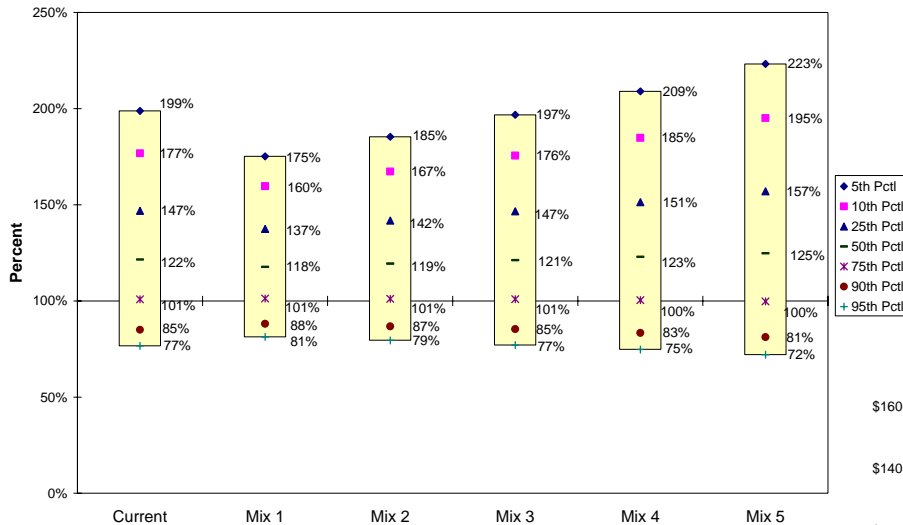
- Funded status expected to deteriorate for mixes 1 and 2 and improve or sustain for mixes 3 to 5.
- Roughly a 5% chance of that funded status could fall to less than 50% over the next 5 or 7 years.

**Projected Funded Status Using Market Value of Assets
Including Side Accounts
(Seven Year Horizon - December 31, 2016)**



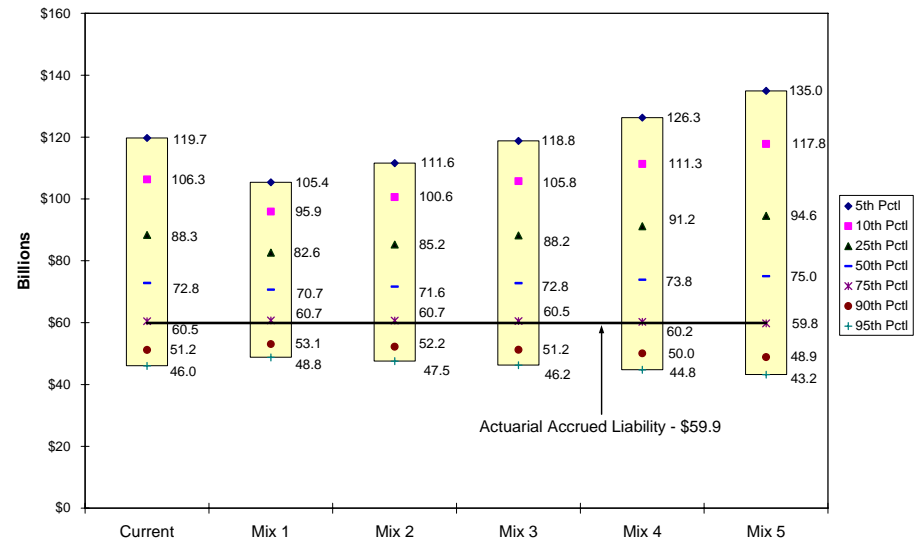
Comparable Charts from 2007 Study Presentation

**Projected Funded Status Using Market Value of Assets Including Side Accounts
(Five Year Horizon - December 31, 2011)**



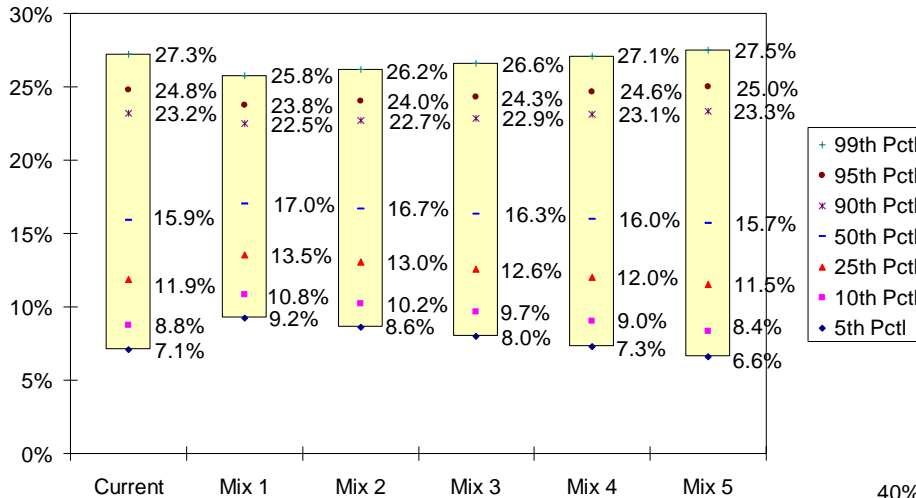
- 90 to 95th Percentile result similar to that which has been experienced since the study.

**Range of Asset's Market Value
(Five Year Horizon - December 31, 2011)**



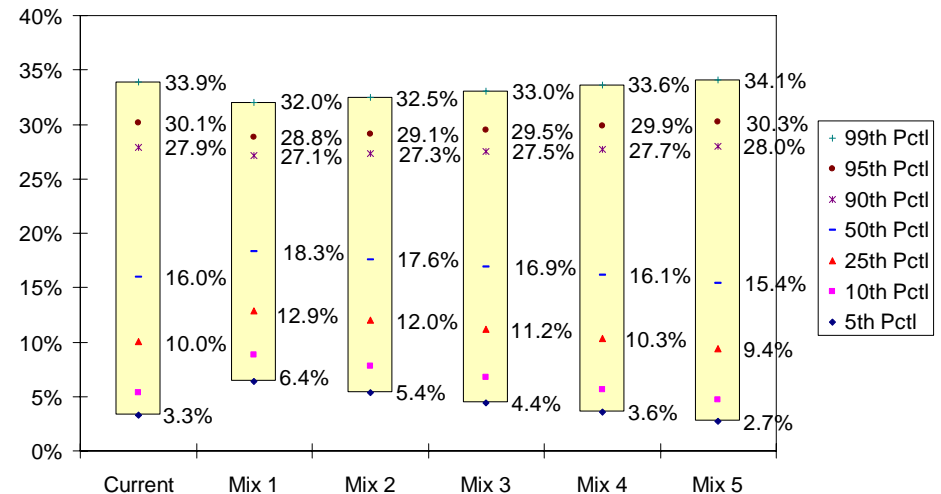
Distribution of Average OPERF Contribution (% of Pay)

**Projected Total Cash Contributions by Employer as a Percent of Pay After Side Account Relief
(Five Year Horizon - December 31, 2014)**

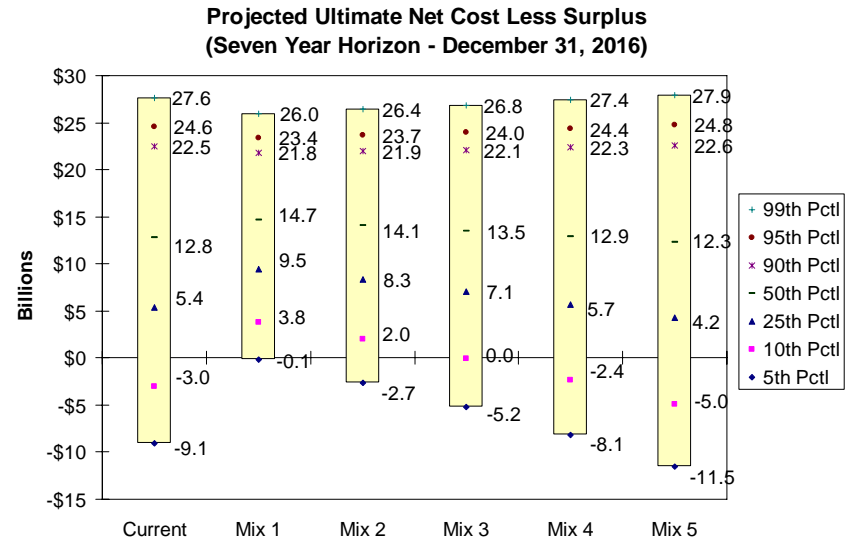
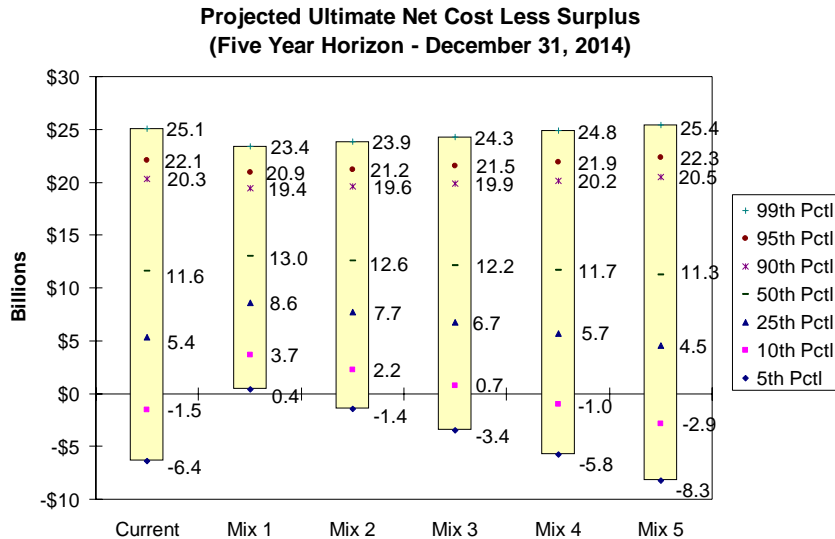


- In the event of a 95th Percentile event, taking less risk would limit contribution increases to 1.2% less at a five year horizon and 1.5% less at a seven year horizon.

**Projected Total Cash Contributions by Employer as a Percent of Pay After Side Account Relief
(Seven Year Horizon - December 31, 2016)**



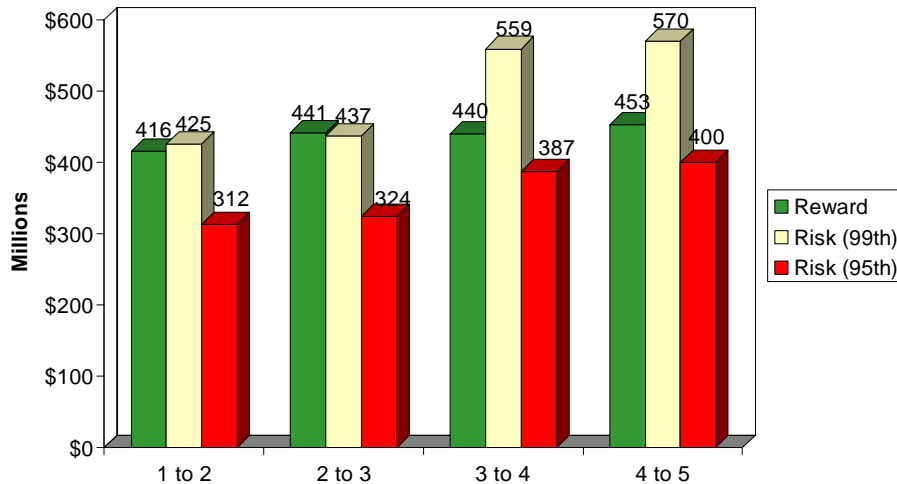
Distribution of Ultimate Net Cost



- Ultimate Net Cost Less Surplus** is the economic present value of the expected cost of the pension fund to the sponsor. All costs, whether or not they are actually funded during the projection time period are taken into consideration. The calculation of the Ultimate Net Cost is the present value of the plan's contributions over the projection time horizon plus the present value of the plan's unfunded liability (value of assets minus actuarial liability) at the end of the projection period. Ultimate Net Cost assumes that there is no economic benefit to any surplus that has built up. For our analysis, we include a credit to Ultimate Net Cost if at the end of the projection period a surplus has been accumulated. We determine the present value of the surplus and subtract it to obtain the variable we typically use in evaluating alternative asset allocations. This variable, Ultimate Net Cost Less Surplus, is the ideal variable for "fully funded" plans.

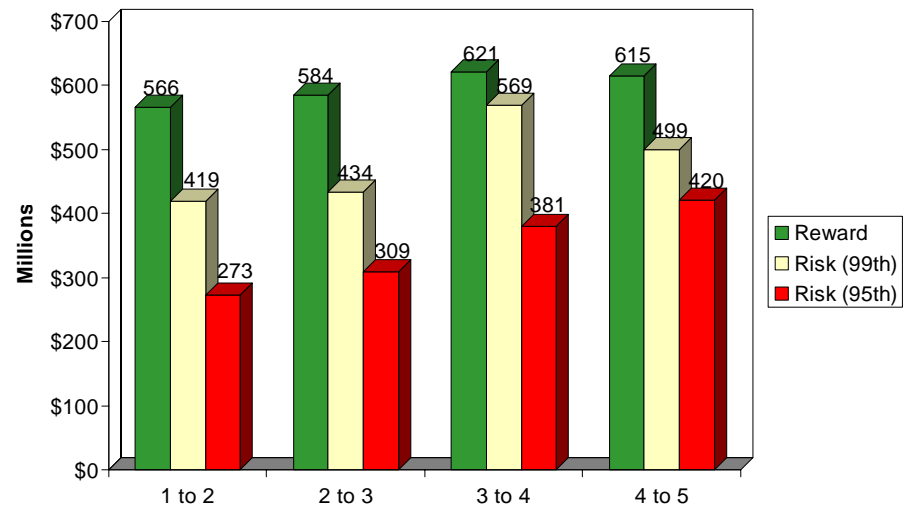
Risk/Reward Analysis

Ultimate Net Cost Less Surplus - Risk/Reward
(Five Year Horizon - December 31, 2014)



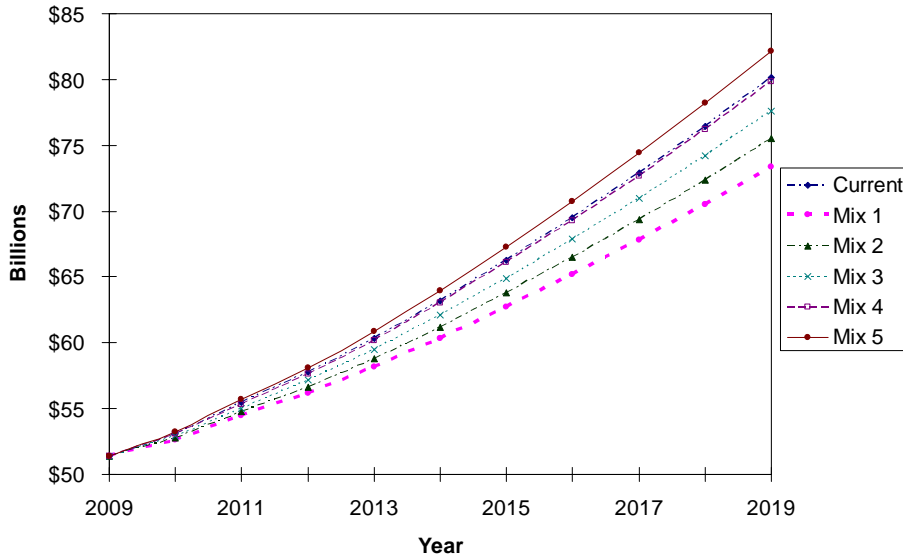
- 5 and 7 year horizon and a 95th Percentile level of risk suggest that most aggressive mix is appropriate.
- At a higher definition of risk, 99th, the most conservative mix is suggested as appropriate at a 5 year horizon.

Ultimate Net Cost Less Surplus - Risk/Reward
(Seven Year Horizon - December 31, 2016)



Liquidity Analysis – Potential Influence of the IAP

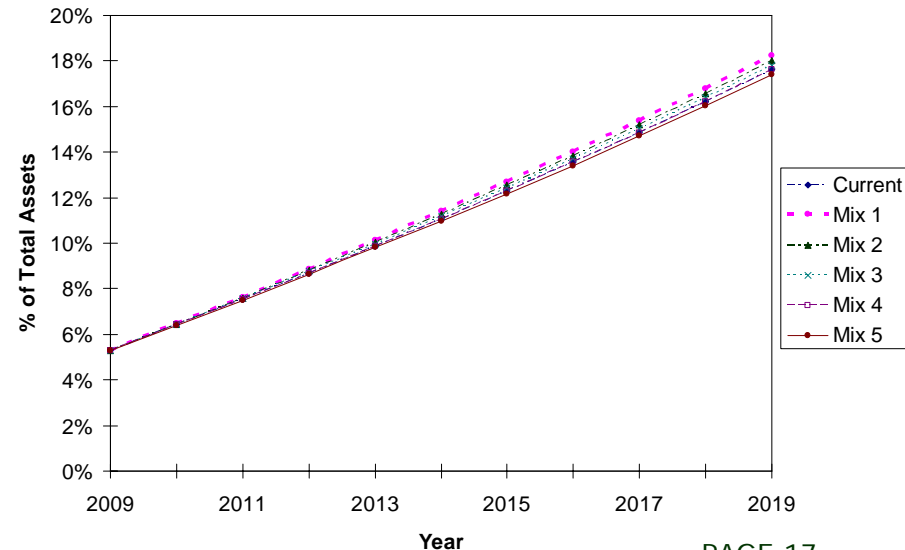
Expected Value of Total Trust Fund Assets



- IAP will be an increasing portion of the trust and influence on liquidity constraints on the trust.
- How will the IAP be managed as it becomes a larger portion of member retirement savings?
- For this analysis the IAP is assumed to be a significant positive cash flow contributor to the trust.

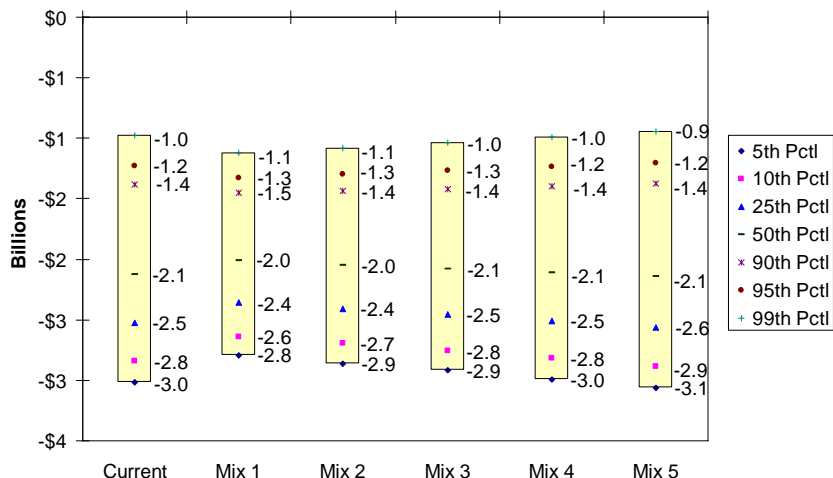
	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
2009	51.4	51.4	51.4	51.4	51.4	51.4
2010	53.1	52.7	52.8	52.9	53.1	53.2
2011	55.4	54.5	54.8	55.0	55.4	55.7
2012	57.8	56.2	56.7	57.1	57.6	58.1
2013	60.3	58.2	58.8	59.5	60.2	60.9
2014	63.2	60.3	61.2	62.1	63.0	64.0
2015	66.3	62.7	63.8	64.9	66.1	67.3
2016	69.5	65.2	66.5	67.9	69.3	70.8
2017	72.9	67.8	69.4	71.0	72.7	74.4
2018	76.5	70.5	72.4	74.2	76.2	78.2
2019	80.1	73.4	75.5	77.6	79.9	82.2

IAP as a Percentage of Trust Fund Assets

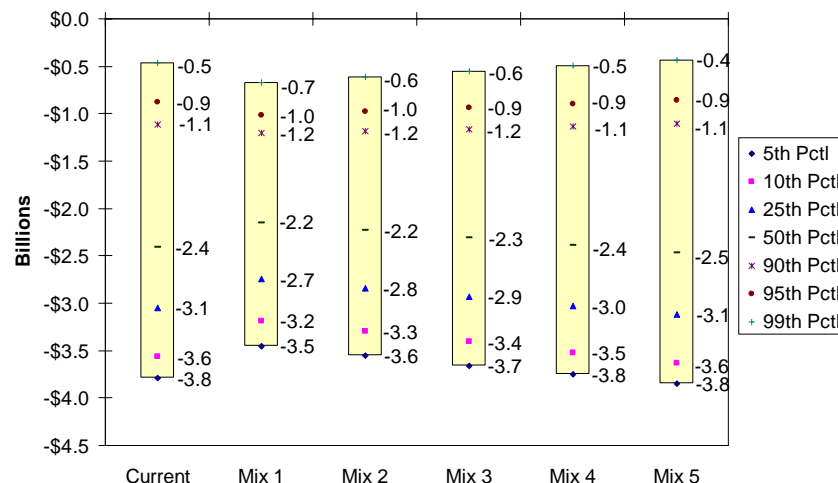


Liquidity Analysis – Trust Fund Net External Cash Flow

Range of Net External Cash Flow (OPERF + IAP)
(Five Year Horizon - December 31, 2014)



Range of Net External Cash Flow (OPERF + IAP)
(Seven Year Horizon - December 31, 2016)



Range of Net External Cash Flows (% of Assets OPERF + IAP)

	December 31, 2014					
	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
5th Pctl	-3.0%	-3.2%	-3.1%	-3.1%	-3.0%	-2.9%
10th Pctl	-3.1%	-3.3%	-3.2%	-3.2%	-3.1%	-3.1%
25th Pctl	-3.3%	-3.4%	-3.4%	-3.3%	-3.3%	-3.3%
50th Pctl	-3.4%	-3.4%	-3.4%	-3.4%	-3.4%	-3.4%
90th Pctl	-3.2%	-3.2%	-3.2%	-3.2%	-3.2%	-3.2%
95th Pctl	-3.1%	-3.1%	-3.1%	-3.1%	-3.1%	-3.1%
99th Pctl	-3.0%	-3.1%	-3.1%	-3.0%	-3.0%	-3.0%

Range of Net External Cash Flows (% of Assets OPERF + IAP)

	December 31, 2016					
	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
5th Pctl	-3.1%	-3.4%	-3.3%	-3.2%	-3.1%	-3.0%
10th Pctl	-3.3%	-3.5%	-3.4%	-3.4%	-3.3%	-3.2%
25th Pctl	-3.5%	-3.6%	-3.5%	-3.5%	-3.5%	-3.5%
50th Pctl	-3.5%	-3.3%	-3.4%	-3.4%	-3.5%	-3.5%
90th Pctl	-2.5%	-2.6%	-2.5%	-2.5%	-2.5%	-2.5%
95th Pctl	-2.2%	-2.4%	-2.3%	-2.3%	-2.2%	-2.2%
99th Pctl	-1.5%	-1.9%	-1.8%	-1.7%	-1.6%	-1.4%

- Net external cash flow is a manageable and stable portion of the trust.
- Under extremely poor events, net cash flow is actually a smaller portion of the trust.

Scenario Analysis Assumptions

- Inflation – Similar to late 1970's and early 1980's market returns
- Deflation- Hypothetical (no “extended” deflation experienced in the US recently)
- Low Return – Market conditions remain similar to now for extended period
- Recession – Similar to 1970's recession market returns

Current Asset Class Implementation-Scenario Analysis

	Current Policy	Mix 4-1	Mix 4-2	Mix 4-3	Mix 4-4	Mix 4-5	Current Mix*
Public Equity	46.0%	19.8%	21.9%	24.2%	31.4%	39.2%	42.9%
Fixed Income	27.0%	36.9%	36.9%	31.5%	28.5%	20.7%	25.7%
Private Equity	16.0%	18.8%	20.7%	22.9%	24.0%	25.0%	19.8%
Real Estate	11.0%	8.2%	10.1%	12.1%	11.0%	10.0%	9.4%
TIPS	0.0%	11.4%	5.5%	4.3%	0.1%	0.1%	0.0%
Alts Port	0.0%	5.0%	4.8%	5.0%	5.0%	5.0%	2.2%
Equity	73.0%	51.7%	57.6%	64.2%	71.4%	79.2%	74.3%
Scenario Return							
Inflation	9.11%	9.29%	9.27%	9.46%	9.33%	9.38%	9.13%
Deflation	5.20%	4.79%	4.99%	4.98%	5.13%	5.10%	5.19%
Low Return	6.36%	6.36%	6.59%	6.83%	7.09%	7.34%	7.14%
Recession	-1.15%	0.68%	0.35%	-0.11%	-0.95%	-1.92%	-1.49%

*Actual mix as of 3/31/10

Scenario Analysis Results

Inflation Scenario - December 31, 2014						
	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Actuarial Accrued Liability	69.4	69.4	69.4	69.4	69.4	69.4
MV Assets	59.1	59.5	59.3	59.6	59.3	59.6
Unfunded Liability	11.5	11.1	11.3	11.0	11.2	11.1
Funded Status	84%	84%	84%	84%	84%	84%
Ultimate Net Cost	12.1	11.9	12.0	11.8	12.0	11.9
Contrib % of Pay	14.2%	14.0%	14.1%	14.0%	14.1%	14.0%

Recession Scenario - December 31, 2014						
	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Actuarial Accrued Liability	66.1	66.1	66.1	66.1	66.1	66.1
MV Assets	32.3	36.6	35.7	34.6	33.1	31.5
Unfunded Liability	30.8	27.4	28.2	29.1	30.2	31.5
Funded Status	53%	58%	57%	56%	54%	52%
Ultimate Net Cost	23.4	21.3	21.7	22.3	23.0	23.8
Contrib % of Pay	23.6%	22.4%	22.6%	23.0%	23.4%	23.8%

Base Case Scenario - December 31, 2014						
	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Actuarial Accrued Liability	66.6	66.6	66.6	66.6	66.6	66.6
MV Assets	56.2	53.5	54.3	55.2	56.1	57.0
Unfunded Liability	11.3	13.6	12.9	12.2	11.4	10.7
Funded Status	83%	80%	81%	82%	83%	84%
Ultimate Net Cost	11.6	13.0	12.6	12.2	11.7	11.3
Contrib % of Pay	15.9%	16.9%	16.6%	16.3%	16.0%	15.7%

- Inflation Scenario results in an outcome that is slightly better than the Base Case.
- Under the Recession Scenario, the best outcome is with lowest risk mix but a poor outcome for all mixes.

Scenario Analysis Results

Deflation Scenario - December 31, 2014						
	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Actuarial Accrued Liability	66.2	66.2	66.2	66.2	66.2	66.2
MV Assets	46.9	46.0	46.5	46.5	46.9	46.8
Unfunded Liability	14.7	15.5	15.1	15.1	14.8	14.9
Funded Status	76%	75%	76%	76%	76%	76%
Ultimate Net Cost	15.9	16.4	16.2	16.1	16.0	16.0
Contrib % of Pay	19.1%	19.4%	19.2%	19.2%	19.1%	19.1%

Low Return Scenario - December 31, 2014						
	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Actuarial Accrued Liability	66.4	66.4	66.4	66.4	66.4	66.4
MV Assets	51.8	49.8	50.4	50.9	51.6	52.2
Unfunded Liability	15.0	16.6	16.1	15.6	15.1	14.6
Funded Status	77%	75%	76%	76%	77%	78%
Ultimate Net Cost	13.9	14.9	14.7	14.4	14.0	13.7
Contrib % of Pay	17.4%	18.1%	17.9%	17.7%	17.5%	17.3%

Base Case Scenario - December 31, 2014						
	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Actuarial Accrued Liability	66.6	66.6	66.6	66.6	66.6	66.6
MV Assets	56.2	53.5	54.3	55.2	56.1	57.0
Unfunded Liability	11.3	13.6	12.9	12.2	11.4	10.7
Funded Status	83%	80%	81%	82%	83%	84%
Ultimate Net Cost	11.6	13.0	12.6	12.2	11.7	11.3
Contrib % of Pay	15.9%	16.9%	16.6%	16.3%	16.0%	15.7%

- Riskiness of the mix does not materially change the outcome in the Deflation Scenario and all mixes are significantly worse than the Base Case.
- Under the Low Return Scenario, the best outcome emanates from the riskiest mix but as you would expect, costs are higher than the Base Case and the payoff for taking on risk is less.

Summary/Next Steps

- Ultimate Net Cost does not suggest taking less risk.
- Liquidity is not a problem.
 - IAP is the wild card.
- Refine ALM analyses as necessary.
- Refine asset mixes while reflecting OIC risk/return preferences.
- June/July – Share interim written correspondence, present final results on July 28, 2010.



APPENDIX

Professional Biographies

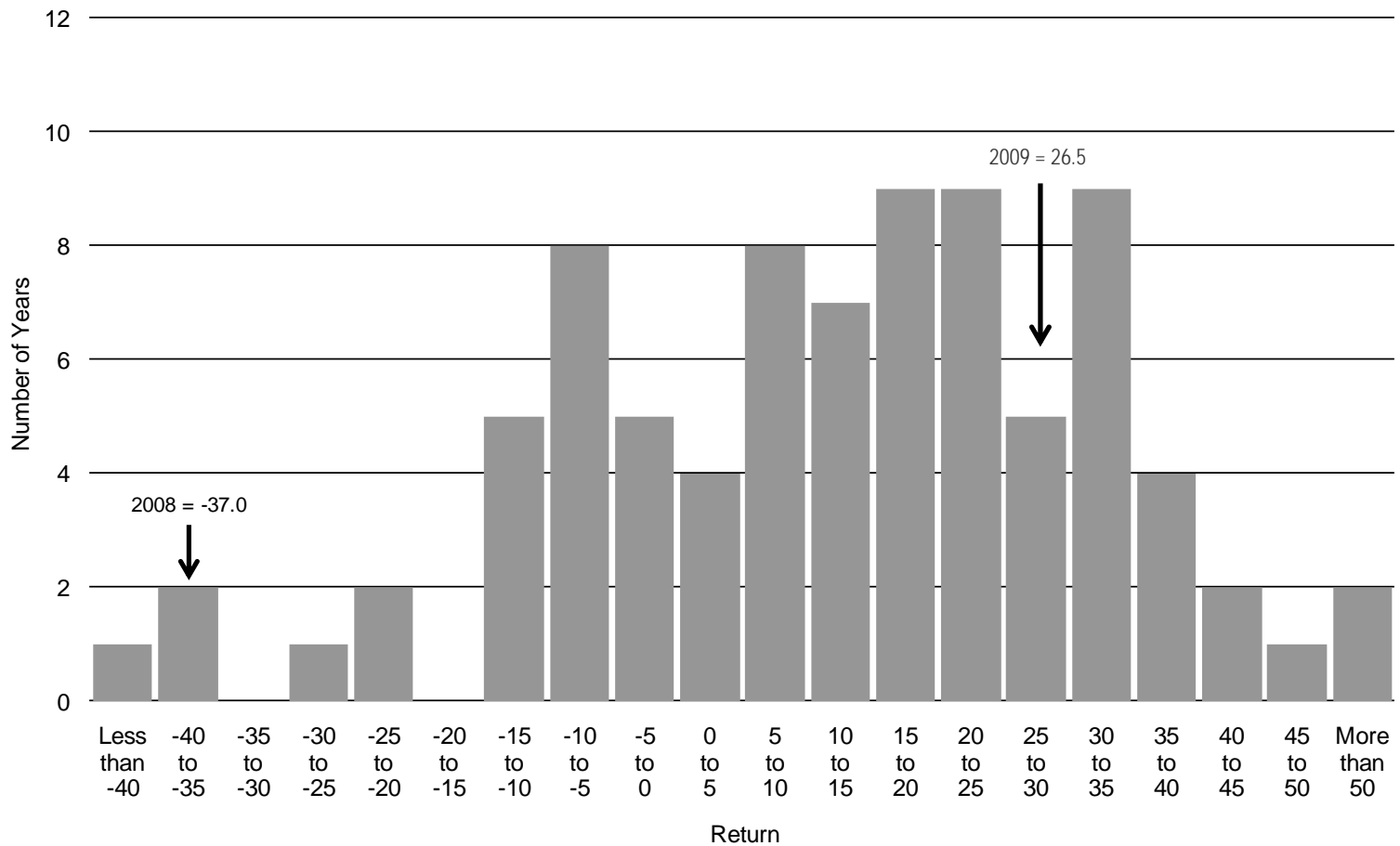
- **MICHAEL R. BEASLEY**. *Managing Director*. Co-founded Strategic Investment Solutions, Inc. (SIS) with Barry Dennis in 1994. Former EVP and Head of Consulting of Callan Associates, which he joined in 1986 and left in 1993. Founded Callan's Atlanta Office in 1986 and concurrently managed its New York Office in 1988. Served as Chairman of Callan's Manager Search Committee for two years. Brings 30 years of consulting and institutional investment experience to SIS. Prior experience includes 13 years with Merrill Lynch's Capital Markets Group in Jacksonville and Atlanta. Former Editorial Board member of the *Journal of Pension Plan Investing*. Frequent speaker on institutional investment issues. Graduate of the New Mexico Military Institute and an officer of the U.S. Army for five years that included a combat tour of duty in Vietnam.
- **JOHN P. MEIER, CFA**. *Managing Director and Head of Quantitative Services*. Highly experienced specialist in strategic planning, capital markets analysis, and quantitative investment strategies. A leading authority in the fields of performance benchmarking and portfolio performance attribution, whose ideas have been published in *Pensions and Investments*, *Futures*, *Risk* and *Quantitative International Investing*. Senior Product Manager at BARRA from 1988 to 1994, responsible for equity risk and valuation models and services. B.S. in Chem. Eng. From Michigan State, MBA in Finance from UC Berkeley.
- **MARC GESELL, CFA**. *Vice President*. Quantitative analysis, statistical research, and systems development specialist responsible for strategic planning. Seven years experience in software R&D, asset allocation modeling, and investment analysis. Most recently AVP and portfolio manager for First Interstate Bank (now Wells Fargo), responsible for managing \$200 million in private client portfolios. Helped establish clients' strategic plans, investment objectives, asset allocation mixes, and portfolio structure. B.S. in Computational Mathematics, Arizona State University, MBA in Finance, San Francisco State University, Chartered Financial Analyst. Former Officer, United State Army.
- **LOUIS KINGSLAND, JR.** *Adviser and Chair, Investment Policy Committee*. Developed first commercially available asset allocation and liability simulation model and asset mix optimizer, both still widely used today. Most recently EVP of Mellon Capital Management. Graduate, Air Force Academy. MA in Engineering, CalTech. Served as Deputy Mission Director of The Viking Space Project, and received a Distinguished Service Medal from NASA.

Defining Risk

- The basic definition of investment risk is variability of return. The alternative policies, or “asset mixes,” examined here are built to minimize this variability given an expected level of return over a long period of time. These mixes we call efficient. The method used to build them is an improved version of standard mean-variance optimization. The probabilities of continuously compounded returns to each asset class are assumed to approximate a bell shaped curve, or normal distribution. In other words, returns are random, and returns near the expected average are more likely than extreme returns. The likelihood of extreme returns is expressed as standard deviation. The probability of a particular asset-class return depends on the returns provided by every other asset class; this interdependence is expressed as correlation. Thus asset-class return expectations are commonly presented as three sets of numbers: mean returns, standard deviations, and correlations.

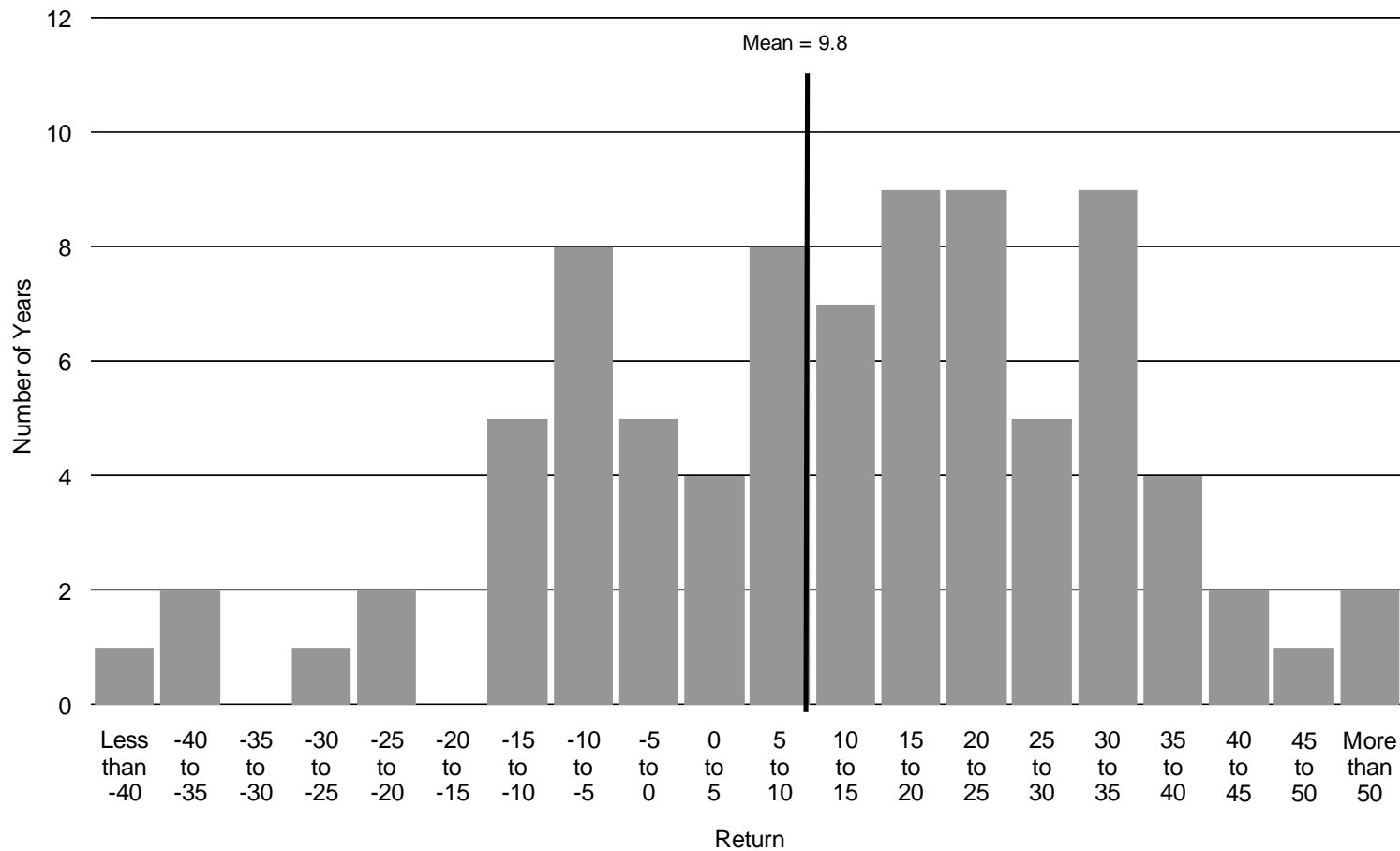
How Risky Are Investment Returns?

Distribution of S&P 500 Annual Returns 1926 - 2009



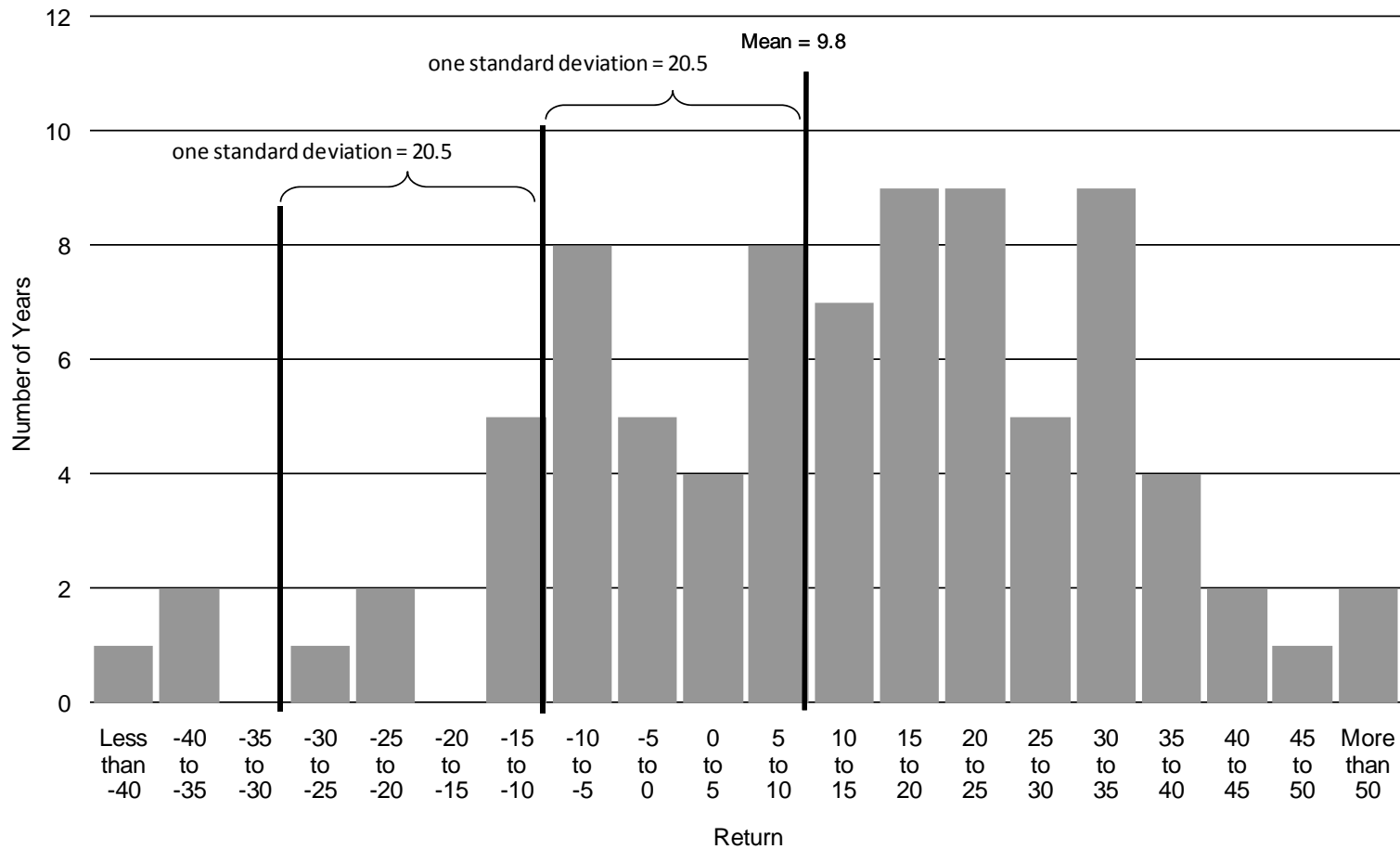
What Return Do We Plan On?

Distribution of S&P 500 Annual Returns 1926 - 2009



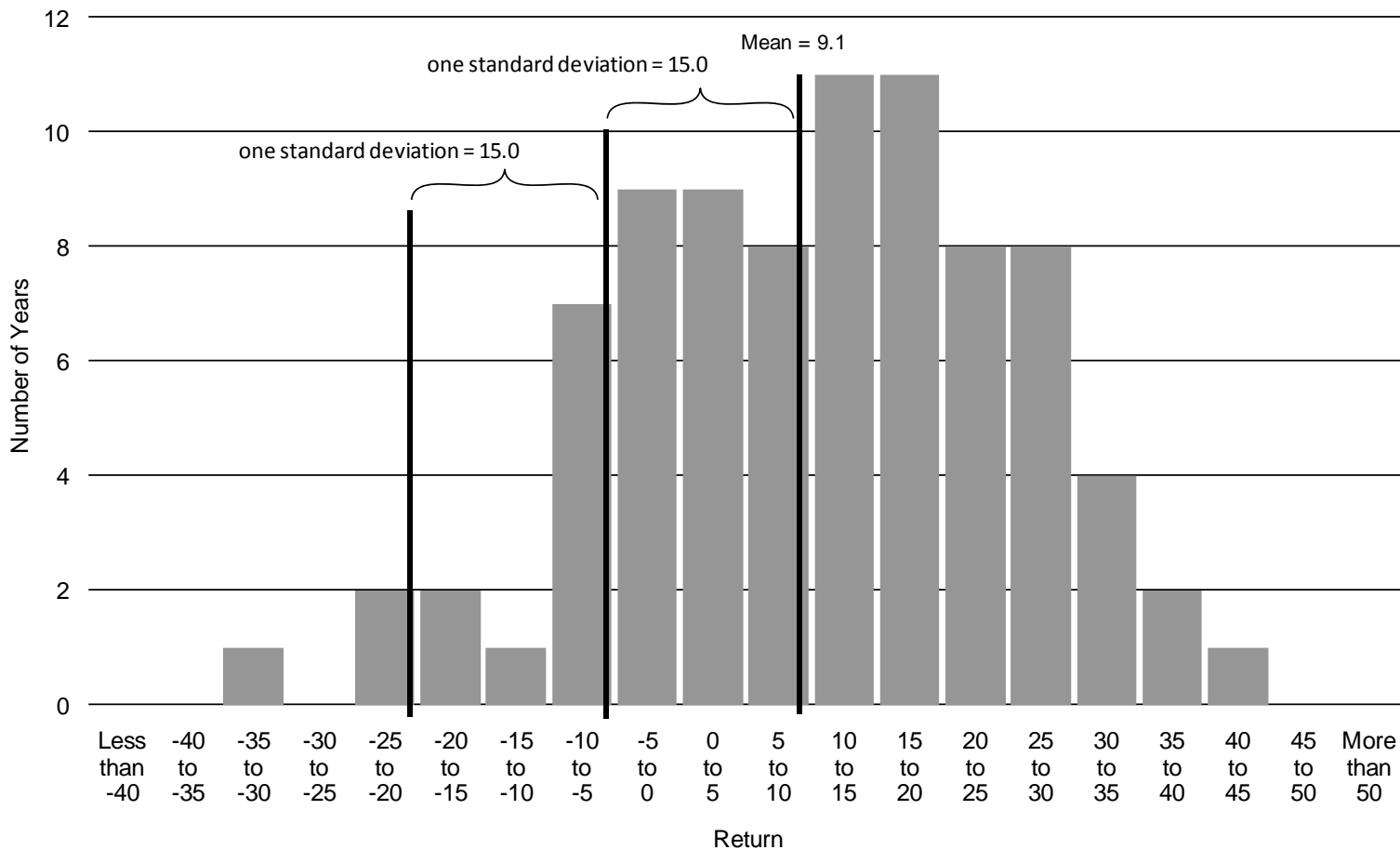
How Do We Measure Investment Risk?

Distribution of S&P 500 Annual Returns 1926 - 2009



Diversification Reduces Risk (at Some Cost)

Distribution of 70/30 Portfolio Annual Returns 1926 - 2009



Definitions

STRATEGIC ASSET ALLOCATION

The discipline used to determine which assets and what proportion among those assets meet an investor's cash flow requirements, planning horizon, and attitude toward risk.

EXPECTED RATE OF RETURN

The expected value or mean of a probability distribution of returns. In our case, the expected return is the compounded annual return which is the same as the geometric mean. After tax expected return nets out the expected income and capital gains taxes paid by the trust.

STANDARD DEVIATION

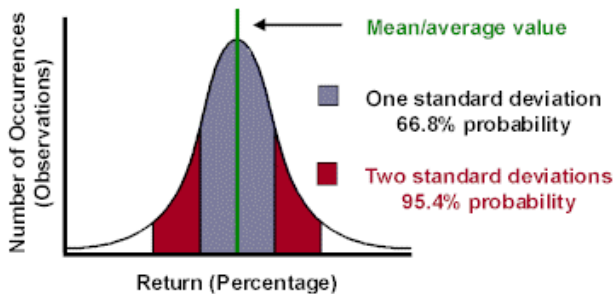
A statistical measure of the degree to which an individual value in a probability distribution tends to vary from the mean of the distribution. The square root of the **variance**. When returns are normally distributed, an individual return will fall within one standard deviation of the mean about two-thirds of the time. For example, if a portfolio had an expected return of 5% and an expected risk (standard deviation) of 13, then:

One Standard Deviation 68% of the time, returns can be expected to fall between -8.0% and +18%

Two Standard Deviations 95% of the time, returns can be expected to fall between -21% and +31%

Standard deviation is a useful historical measure of the variability of return earned by an investment portfolio. In performance measurement, it is generally assumed that a larger degree of dispersion implies that greater risk was taken to achieve the return.

Risk Measurement
Probability of Dispersion
Above or Below the Mean/Average



Definitions

CORRELATION COEFFICIENT

Correlation Coefficient
Shows Strength & Direction of Correlation



Correlation coefficient (r) is a measure of the degree of **correlation** between two quantities or variables, such as the rates of return on stocks and on bonds. A negative coefficient of correlation indicates an inverse or negative relationship, whereas a positive value indicates a direct or positive relationship. The range of values is from -1 to +1 inclusive. A zero (0) value indicates that no correlation exists. Correlation coefficients are useful in **asset class** identification and portfolio **diversification**.

Scenario Analysis Returns

ASSET	BASE	INFLATION	DEFLATION	LOW RETURN	RECESSION
US LRG CAP	8.5%	6.5%	4.5%	7.0%	-5.7%
US SML CAP	9.0%	6.5%	4.5%	7.5%	-5.7%
US FIXED	4.0%	5.3%	6.0%	4.0%	6.0%
INTL STOCK	8.5%	9.2%	4.5%	7.0%	-5.7%
EM STOCK	9.2%	9.2%	4.5%	7.5%	-5.7%
INTL FIXED	4.1%	8.0%	6.0%	4.0%	6.0%
REAL EST	8.0%	13.0%	2.0%	6.0%	5.0%
PRIV EQTY	11.0%	8.5%	4.5%	8.0%	-10.0%
HIGH YIELD	6.4%	5.9%	5.2%	5.5%	1.0%
EM DEBT	5.7%	8.0%	6.0%	5.0%	6.0%
TIPS	4.0%	11.0%	1.0%	3.5%	3.5%
BANK LOAN	5.0%	10.0%	2.5%	3.0%	3.0%
ALTERNATIVES PORT	8.0%	11.0%	2.0%	6.5%	-1.0%
CASH	3.0%	9.0%	0.5%	1.0%	1.0%
INFLATION	2.4%	9.0%	0.0%	2.4%	1.9%