

Minnesota State Board of Investment

Legislative Commission on Pensions and
Retirement

January 31, 2017

Mansco Perry | Executive Director and Chief Investment Officer

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State Board of Investment

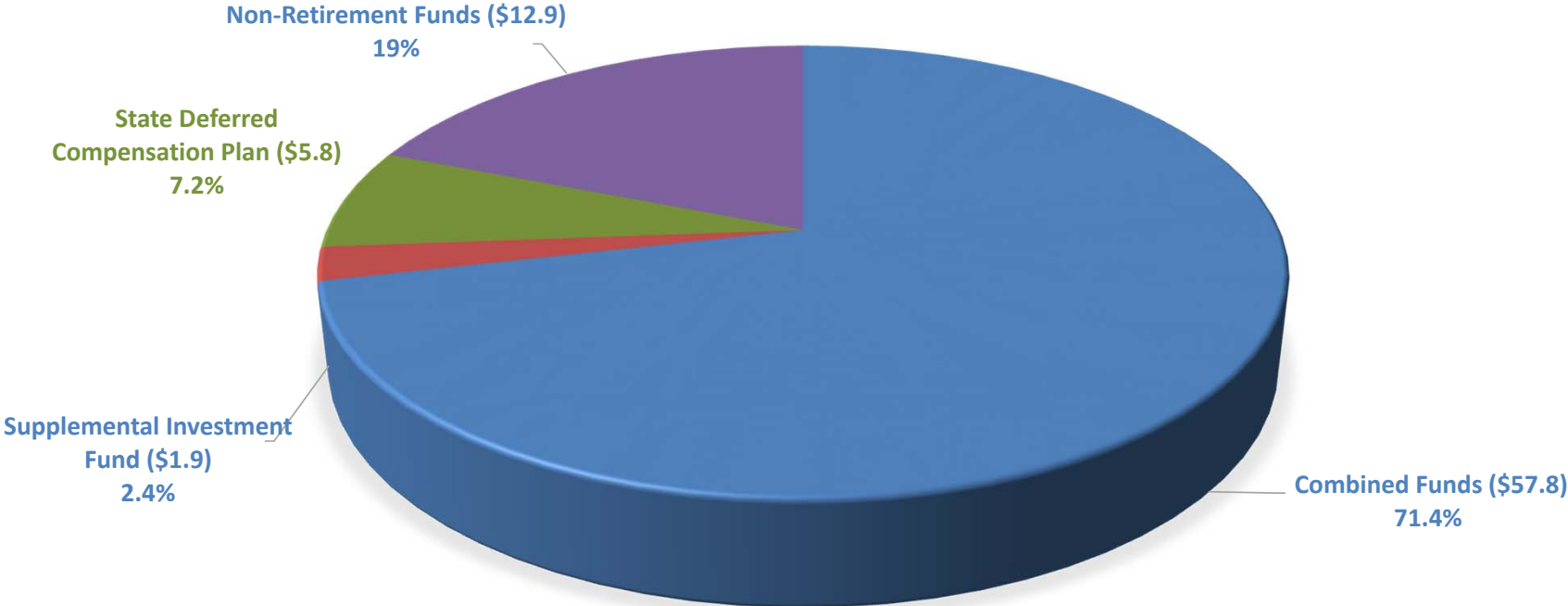
- Board is defined in Article XI of Minnesota Constitution

Constitutional Members of State Board	
Governor	Mark Dayton
State Auditor	Rebecca Otto
Secretary of State	Steve Simon
Attorney General	Lori Swanson

- Assisted by 17-member Investment Advisory Council (IAC)
 - 10 experienced investment professionals
 - Executive directors of statewide retirement plans
 - Commissioner of Minnesota Management & Budget
 - Two active members and one retired member appointed by the governor
- Managed by an internal staff of 26

Funds Under Management – Total Assets

As of June 30, 2016 (In \$ Billions)



What is the State Board of Investment (SBI)?

- Established in Article XI of the Minnesota Constitution for the purpose of managing and directing the investments of all state funds and pension funds.
- Not a pension plan or a sponsoring entity. By statute, the SBI has the investment authority and responsibility to manage assets. The SBI has limited capability and resources to administer accounts.
- All investments are codified in Minnesota Statutes Chapters 11A and 356A. The SBI owes a fiduciary duty to: the active, deferred, and retired members of the plan; the taxpayers of the state or political subdivision who help to finance the plan; and the state of Minnesota, which established the plan.

Investment Funds Managed by The SBI

Combined Funds	Represents the assets of the active and retired public employees who participate in ten defined benefit retirement plans administered by the three statewide retirement systems: Teachers Retirement Association (TRA), Public Employees Retirement Association (PERA), and Minnesota State Retirement System (MSRS). The assets are all invested with external institutional investment managers.
State Deferred Compensation Plan	Provides public employees with a tax-sheltered defined contribution retirement savings plan that is supplemental to their retirement plan. These assets are invested in mutual funds and commingled investment trusts and are directed by the participants.

Additional Funds listed on next page

Funds Managed by State Board of Investment

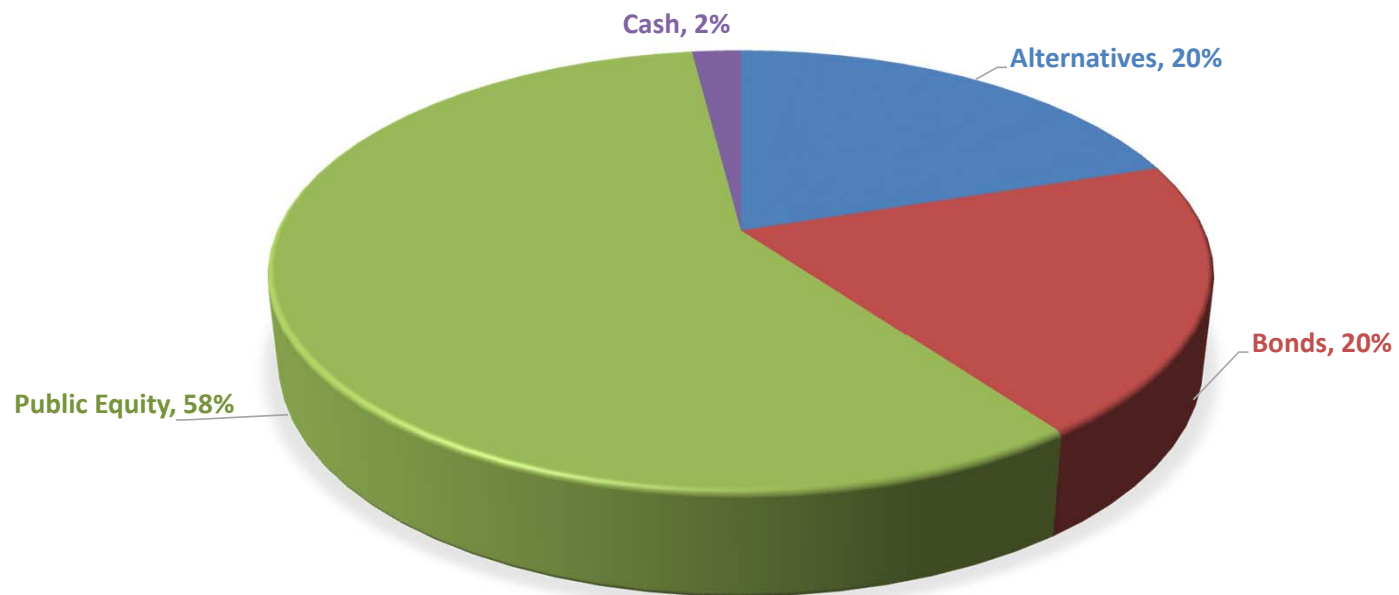
Investment Funds Managed by the SBI	
Supplemental Investment Fund (SIF)	SIF is a multi-purpose investment program that offers a range of externally and internally managed investment options to state and local public employees. Participating groups use the SIF for a variety of reasons. The assets of the Unclassified Plan, Health Care Savings Plan, PERA DC Plan, Hennepin County Supplemental Retirement Plan, Voluntary Statewide Volunteer Firefighter Plan, and some local police and firefighter retirement accounts are all invested through the SIF.
Assigned Risk Plan	The Assigned Risk Plan provides workers compensation coverage to Minnesota employers rejected by licensed insurance companies. These assets are invested externally with institutional investment managers.
Minnesota College Savings Plan	The Minnesota College Savings Plan is administered and invested with a third-party firm, TIAA-CREF. SBI and Office of Higher Education (OHE) contract jointly with TIAA-CREF to provide these services.
State Cash Accounts	State Cash Accounts represent over 400 separate accounts that flow through state treasury. These assets are invested internally by SBI staff.
Non-Retirement Funds	Non-Retirement Funds represents the assets of various state trust funds that include, among others, the Permanent School Fund, Environmental Trust Fund, and Closed Landfill; and Other Post Employment Benefit (OPEB) Accounts. All of these funds have three investment options that are managed by internal SBI staff: equity (S&P 500), fixed income (Bloomberg Barclays Aggregate), and cash.

Combined Funds - Summary

- The Combined Funds constitute the assets of Minnesota's three statewide pension plans—MSRS, PERA, and TRA—from which the plans draw funds to pay retirement benefits to public employees.
- The State Board of Investment serves the pension plans by investing plan assets through outside investment managers.
- The Board and staff provide on-going monitoring of investment managers

Combined Funds

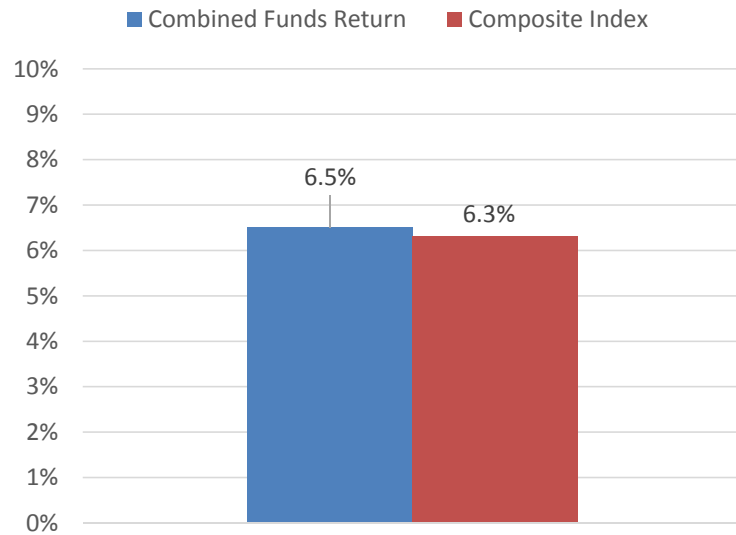
Strategic Asset Allocation



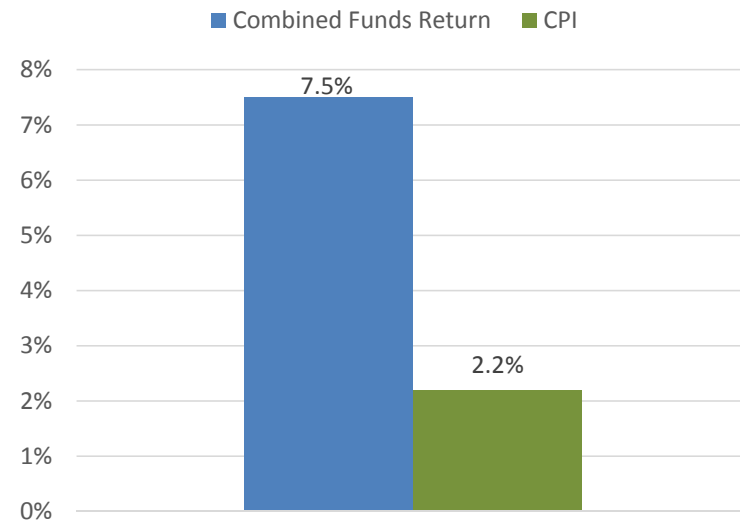
Combined Funds Long-Term Investment Objectives

Periods ending June 30, 2016

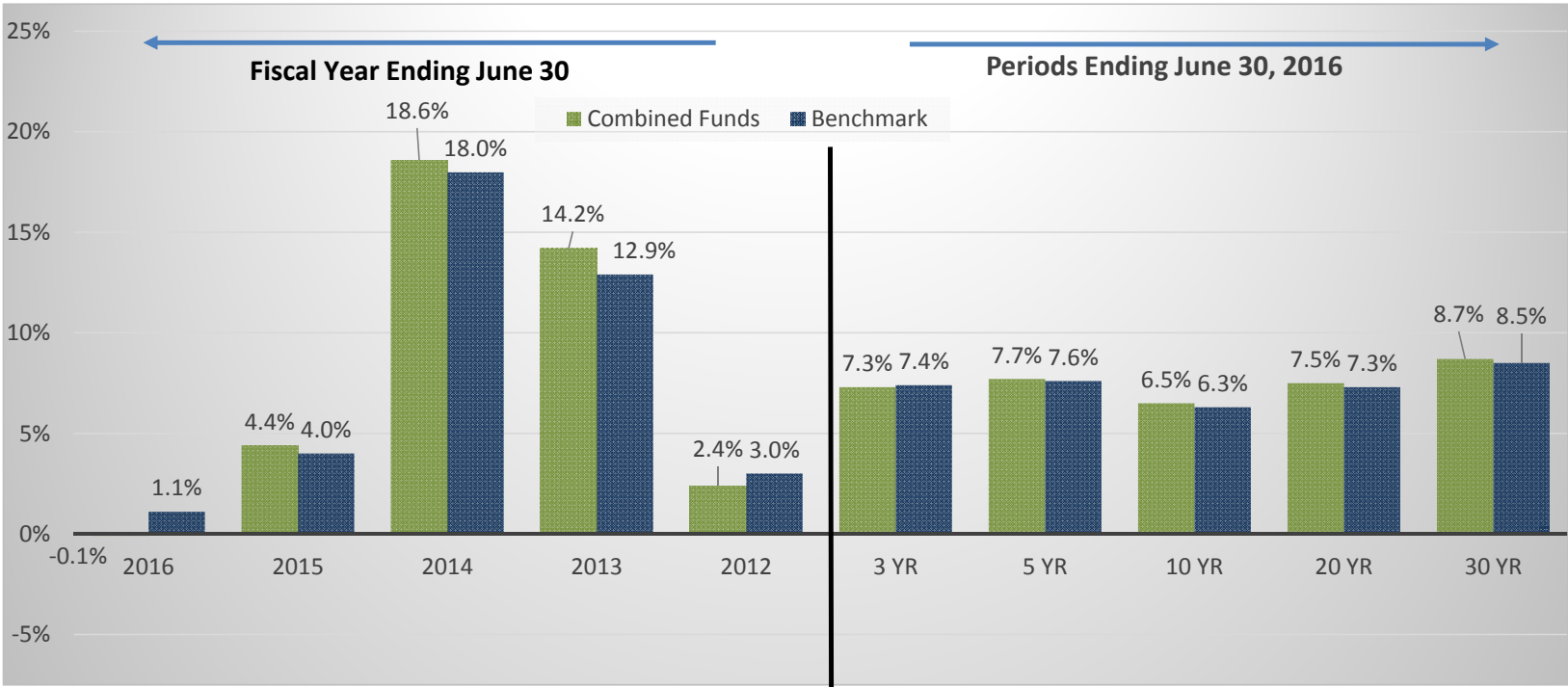
Match or Exceed Composite Index (10 Yr)



Provide Real Return (20 Yr) (Provide 3-5 percentage points over inflation)



Combined Pension Funds Investment Returns



Performance Compared to Other Pension Funds

For Time Periods Ending June 30, 2016

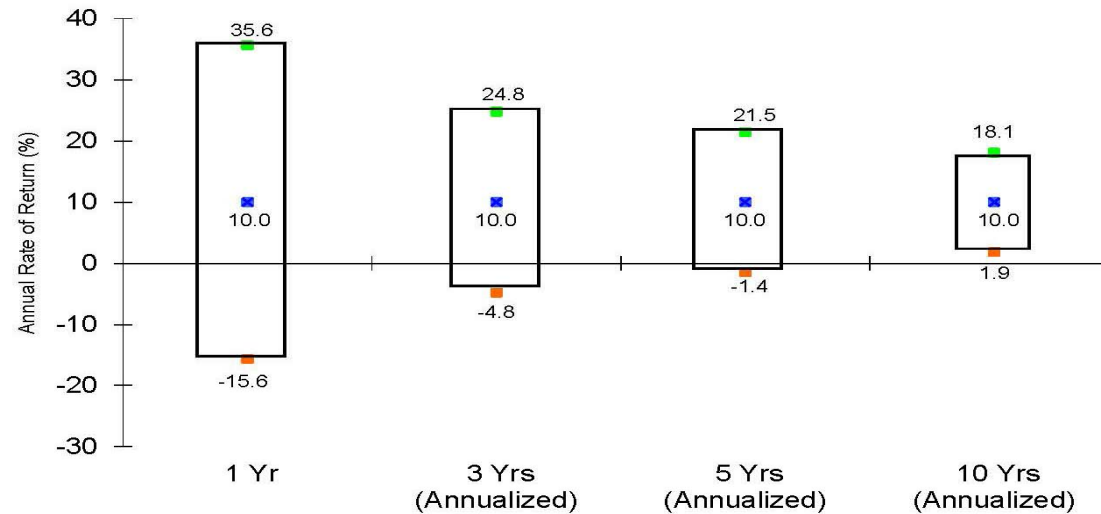
TUCS Universe Ranking ¹	1Yr	3Yrs	5yrs	10Yrs
Combined Funds Returns	-0.1%	7.3%	7.7%	6.5%
SBI Combined Funds Percentile Rank in TUCS ²	77 th	37 th	28 th	22 th

¹Source: Trust Universe Comparison Service (TUCS) includes the total returns of both public and private plans with assets over \$1 billion.

²Top performing plans will have low percentile rankings. For example, a plan that is ranked 24th would be a top quartile performing plan.

Market Risk Simulation: An Example

Capital Market Risk Asset Simulation: 75% Equity Allocation



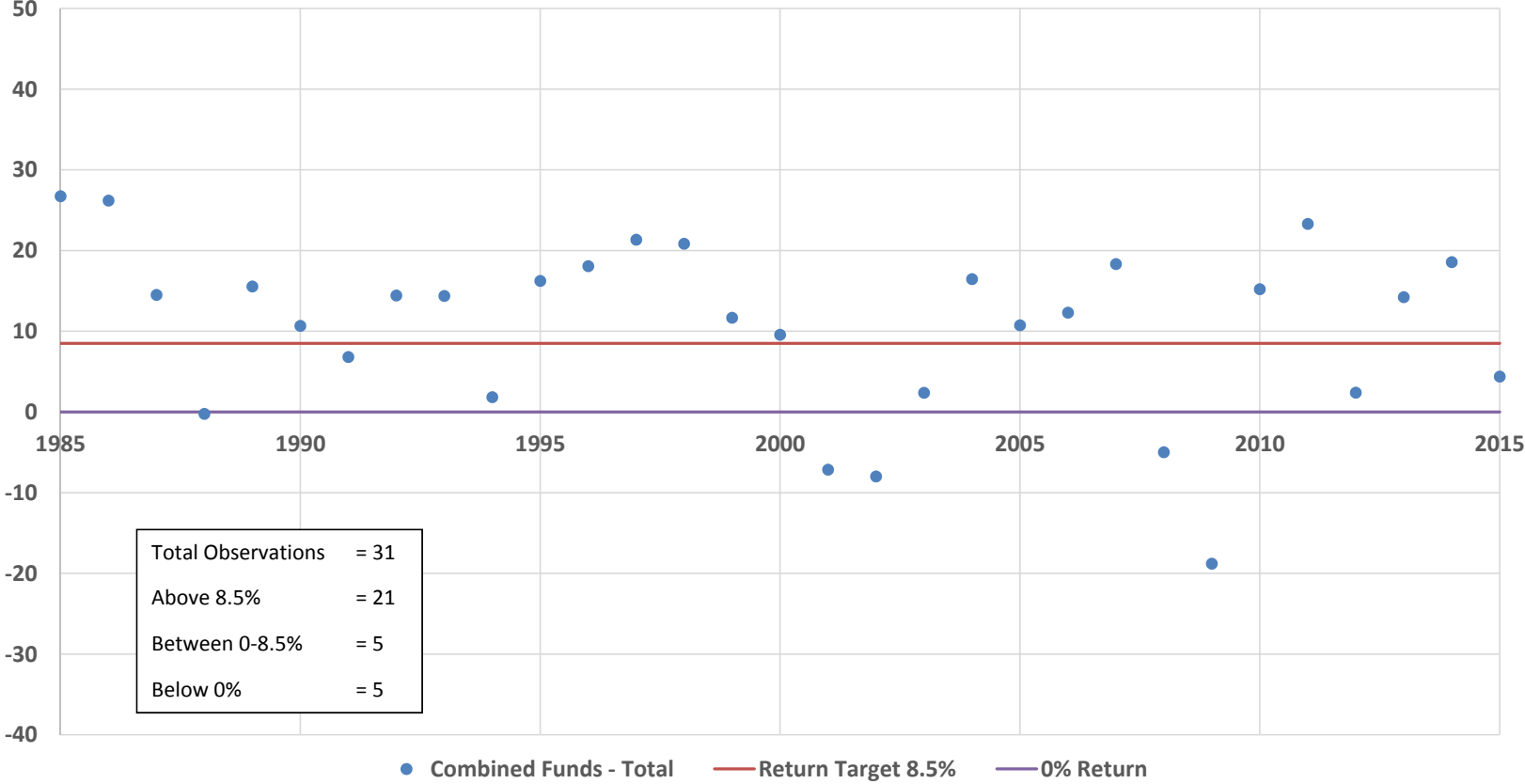
Assumptions: Annual Expectations

	Return	Std.Dev
Equity	11.2	20.0
Bonds	6.5	6.5

■ Expected
 ■ 95th
 ■ 5th

Combined Funds Returns

Fiscal Year 1985-2015



Phase 1: Methodology and Assumptions

Long-Term Capital Market Projections (2016 – 2025)

Asset Class	Index	PROJECTED RETURN			PROJECTED RISK		Projected Yield	2015 - 2024		Geometric* Delta
		1-Year Arithmetic	10-Year Geometric*	Real	Standard Deviation	Sharpe Ratio		10-Year Geometric*	Standard Deviation	
Equities										
Broad Domestic Equity	Russell 3000	8.85%	7.35%	5.10%	18.70%	0.353	2.40%	7.60%	19.00%	-0.25%
Large Cap	S&P 500	8.60%	7.25%	5.00%	17.95%	0.354	2.50%	7.50%	18.30%	-0.25%
Small/Mid Cap	Russell 2500	9.85%	7.55%	5.30%	22.75%	0.334	1.90%	7.85%	22.95%	-0.30%
Global ex-U.S. Equity	MSCI ACWI ex USA	9.55%	7.55%	5.30%	21.30%	0.343	2.70%	7.80%	21.45%	-0.25%
International Equity	MSCI World ex USA	9.00%	7.25%	5.00%	20.05%	0.337	3.00%	7.50%	20.20%	-0.25%
Emerging Markets Equity	MSCI Emerging Markets	11.15%	7.60%	5.35%	27.85%	0.320	1.70%	7.90%	27.95%	-0.30%
Fixed Income										
Short Duration	Barclays G/C 1-3	2.80%	2.60%	0.35%	2.25%	0.156	2.80%	2.40%	2.25%	0.20%
Domestic Fixed	Barclays Aggregate	3.05%	3.00%	0.75%	3.75%	0.213	4.60%	3.00%	3.75%	0.00%
Long Duration	Barclays Long G/C	4.30%	3.70%	1.65%	11.40%	0.197	5.30%	3.20%	11.40%	0.50%
TIPS	Barclays TIPS	3.10%	3.00%	0.75%	5.30%	0.160	4.20%	3.00%	5.30%	0.00%
High Yield	Barclays High Yield	5.40%	5.00%	2.75%	10.50%	0.300	8.00%	5.00%	11.10%	0.00%
Non-U.S. Fixed	Barclays Global Aggregate ex US	1.80%	1.40%	-0.85%	9.20%	-0.049	4.00%	2.30%	9.40%	-0.90%
Emerging Market Debt	EMBI Global Diversified	5.00%	4.80%	2.35%	9.90%	0.278	6.50%	4.70%	10.00%	-0.10%
Other										
Real Estate	Callan Real Estate	7.20%	6.00%	3.75%	16.45%	0.301	5.00%	6.15%	16.50%	-0.15%
Private Equity	TR Post Venture Cap	13.15%	8.15%	5.90%	32.80%	0.322	0.00%	8.50%	33.05%	-0.35%
Hedge Funds	Callan Hedge FOF Database	5.55%	5.25%	3.00%	9.30%	0.355	2.25%	5.25%	9.30%	0.00%
Commodities	Bloomberg Commodity	4.40%	2.75%	0.50%	18.50%	0.116	2.25%	2.75%	18.50%	0.00%
Cash Equivalents	90-Day T-Bill	2.25%	2.25%	0.00%	0.90%	0.000	2.25%	2.25%	0.80%	0.00%
Inflation	CPI-U		2.25%		1.50%			2.25%	1.50%	0.00%

* Geometric returns are derived from arithmetic returns and the associated risk (standard deviation).

Phase 1: Methodology and Assumptions

2016 Correlation Matrix

Broad US Equity	1.000																			
Large Cap	0.997	1.000																		
Small/Mid Cap	0.965	0.940	1.000																	
Global ex-US Equity	0.882	0.879	0.853	1.000																
Non-US Equity	0.852	0.850	0.820	0.986	1.000															
Em Mkts Equity	0.861	0.855	0.840	0.933	0.860	1.000														
Defensive	-0.240	-0.230	-0.260	-0.254	-0.230	-0.280	1.000													
US Fixed	-0.108	-0.100	-0.130	-0.123	-0.105	-0.150	0.870	1.000												
Long Duration	0.136	0.138	0.121	0.106	0.119	0.069	0.729	0.925	1.000											
TIPS	-0.050	-0.045	-0.065	-0.053	-0.045	-0.065	0.530	0.580	0.527	1.000										
High Yield	0.640	0.640	0.610	0.629	0.610	0.610	-0.170	0.020	0.220	0.060	1.000									
Non-US Fixed	0.014	0.050	-0.100	0.013	0.060	-0.090	0.480	0.510	0.542	0.340	0.120	1.000								
Em Mkt Debt	0.579	0.580	0.550	0.550	0.530	0.540	-0.120	0.030	0.159	0.150	0.600	0.010	1.000							
Real Estate	0.735	0.730	0.715	0.669	0.650	0.645	-0.140	-0.020	0.190	0.005	0.560	-0.050	0.450	1.000						
Private Equity	0.948	0.945	0.915	0.934	0.905	0.905	-0.240	-0.190	0.062	-0.100	0.640	-0.060	0.560	0.710	1.000					
Hedge Funds	0.797	0.795	0.765	0.760	0.735	0.740	-0.120	0.080	0.303	0.055	0.570	-0.080	0.540	0.600	0.770	1.000				
Commodities	0.167	0.165	0.165	0.177	0.170	0.175	-0.220	-0.120	-0.042	0.100	0.100	0.050	0.190	0.200	0.180	0.210	1.000			
Cash Equivalents	-0.043	-0.030	-0.080	-0.040	-0.010	-0.100	0.300	0.100	-0.049	0.070	-0.110	-0.090	-0.070	-0.060	0.000	-0.070	0.070	1.000		
Inflation	-0.011	-0.020	0.020	0.010	0.000	0.030	-0.200	-0.280	-0.284	0.180	0.070	-0.150	0.000	0.100	0.000	0.200	0.400	0.000	1.000	
	Broad US Eq	Large Cap	Sm/Mid Cap	Global ex-US	Non-US Equity	Em Mkt Eq	Defens	US Fixed	Long Duration	TIPS	High Yield	Non-US Fixed	Em Mkt Debt	Real Estate	Private Equity	Hedge Funds	Comm	Cash Equiv	Inflation	

- Relationships between asset classes is as important as standard deviation.
- To determine portfolio mixes, Callan employs mean-variance optimization.
- Return, standard deviation and correlation determine the composition of efficient asset mixes.

Source: Callan Associates

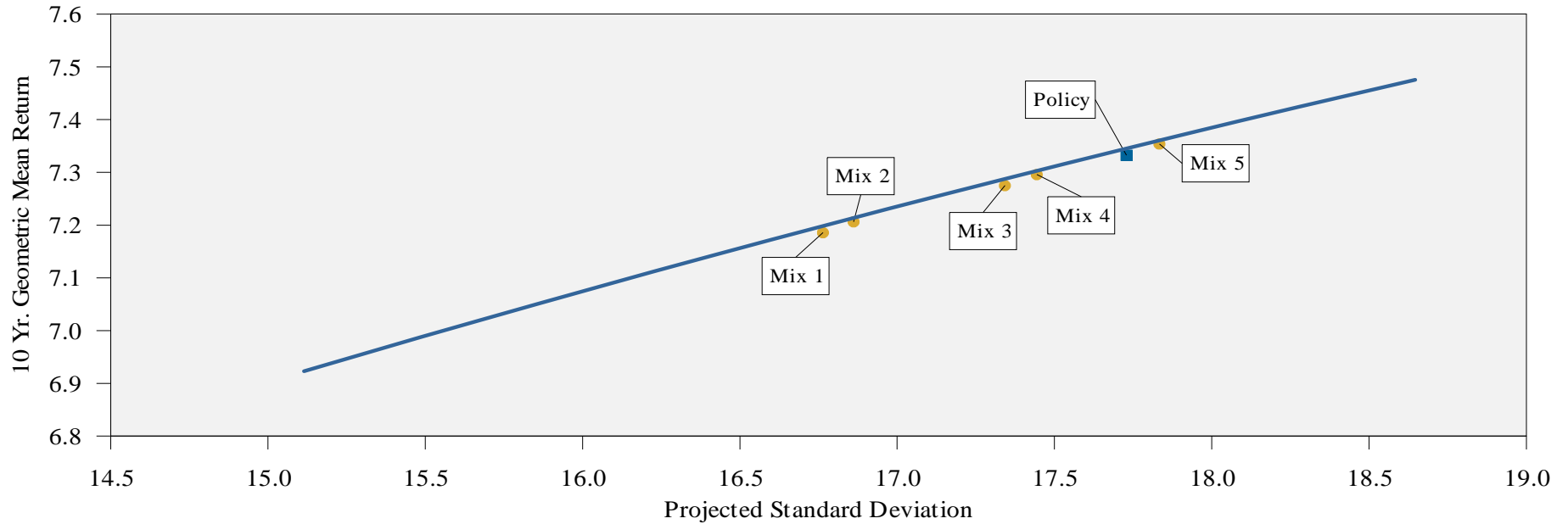
Phase II: Create Alternative Asset Mixes

Asset Classes	Policy	Constraints		Optimal Mixes				
		Min	Max	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
US Broad Equity	45	0	100	41	37	44	39	40
International Equity	15	0	100	14	18	15	19	20
Domestic Fixed	18	0	100	23	23	20	20	18
Private Equity	20	0	100	20	20	20	20	20
Cash Equivalents	2	2	100	2	2	2	2	2
Totals	100			100	100	100	100	100
Arithmetic Return	8.65			8.35	8.39	8.53	8.57	8.69
Compound Expected Return	7.34			7.19	7.21	7.27	7.30	7.35
Risk (Standard Deviation)	17.73			16.76	16.86	17.34	17.44	17.83
Public Equity	60.00			55.00	55.00	58.00	58.00	60.00
Public Fixed	20.00			25.00	25.00	22.00	22.00	20.00

- The alternative mixes were created by staff to compare allocations to fixed income and public equity US vs NonUS ratio
 - All mixes hold allocations to Private Equity constant at the current policy weight of 20%
 - Cash Equivalents are held constant at 2% to accommodate cash flows
- Mixes 1 and 2 have 23% in domestic fixed income
 - Mix 1 reflects current US vs NonUS ratio of 75/25
 - Mix 2 reflects US vs Non US ratio of 67/33
- Mixes 3 and 4 have 20% in domestic fixed income
 - Mix 3 reflects current US vs NonUS ratio (75/25)
 - Mix 4 reflects US vs NonUS ratio of 67/33
- Mix 5 has 18% in domestic fixed with US vs NonUS ratio of 67/33

Phase II: Create Alternative Asset Mixes

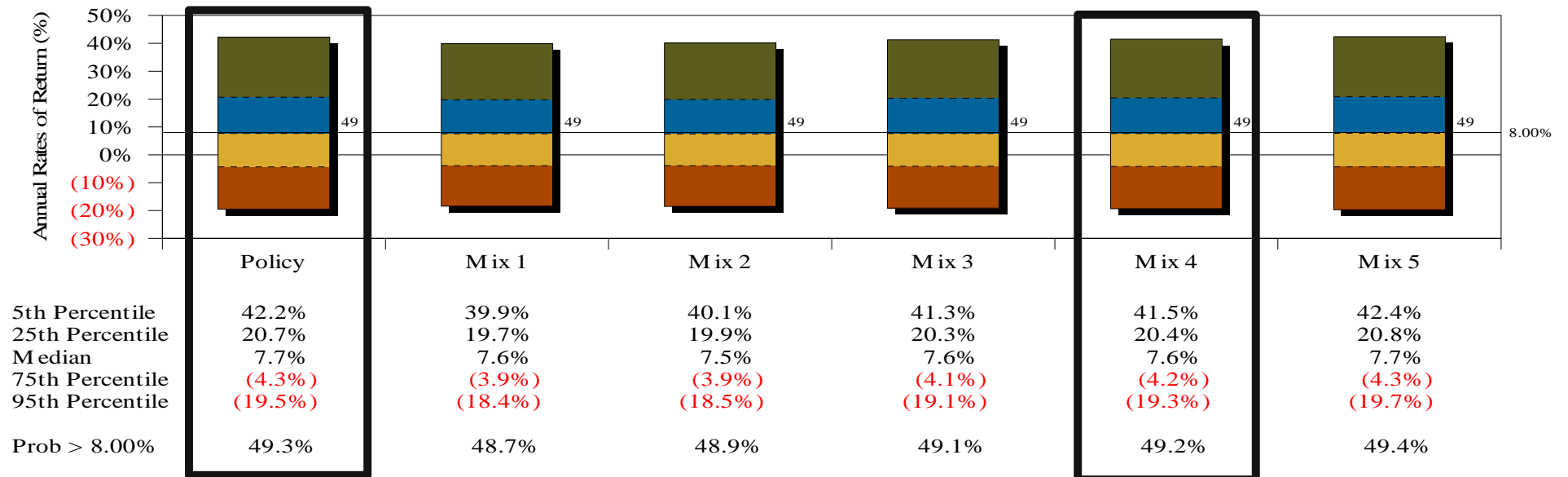
Efficient Frontier



- All of the asset mixes lie close to the efficient frontier
 - Mixes 1 and 3 lie slightly below the frontier
- When all mixes under consideration are essentially efficient, the mix with the maximum acceptable risk is often chosen

Phase II: Create Alternative Asset Mixes

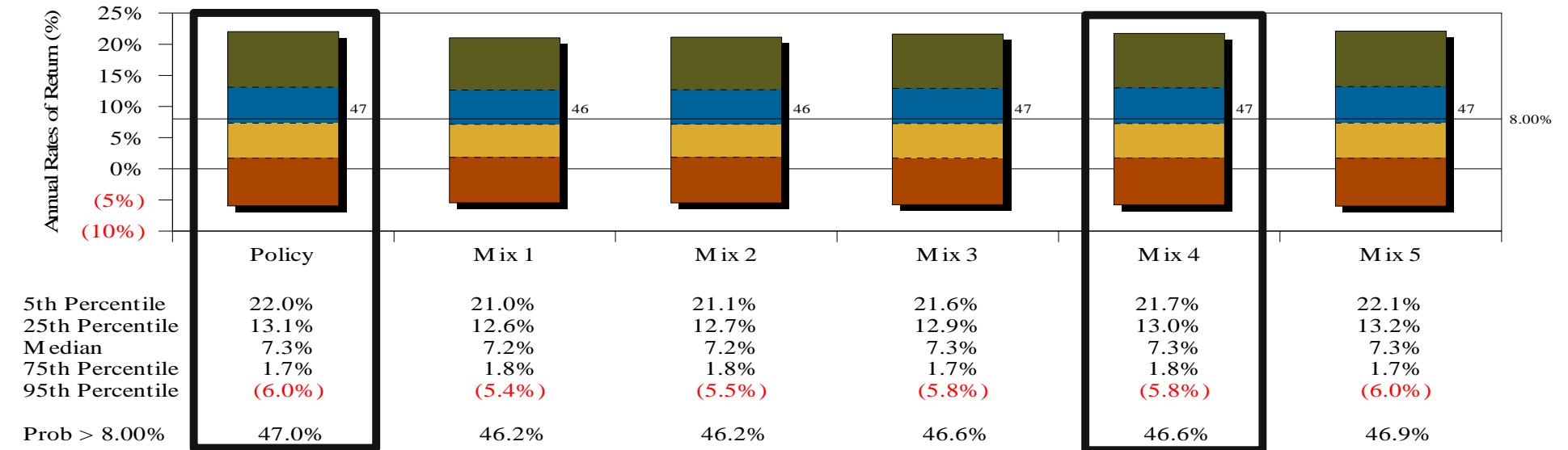
Range of Returns, 1 Year



- The graph above shows the performance of the asset mixes over any given year of the analysis
- All of the mixes have similar return and risk profiles
 - The asset mixes have very similar allocations
- In the absence of volatility drag most of the mixes come close to the 8% return hurdle

Phase II: Create Alternative Asset Mixes

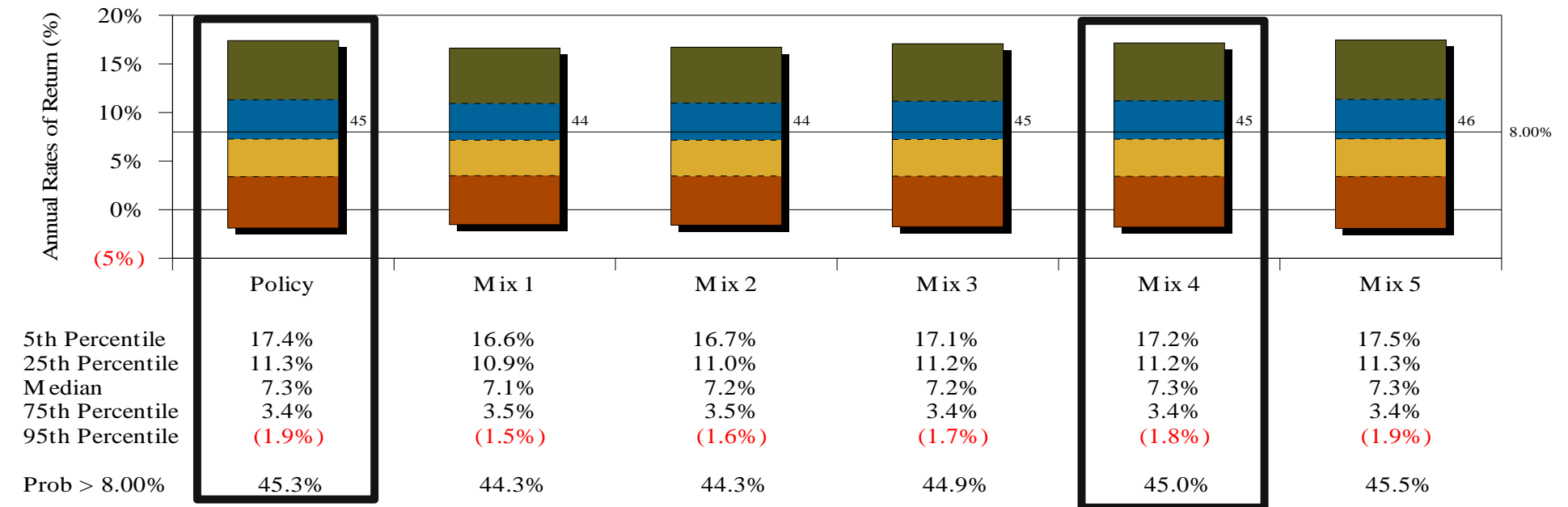
Range of Returns, 5 Years



- The five-year and one-year return distributions are measurably different
- Volatility drag reduces the median rates of return
 - Probabilities of realizing the target rate of return have fallen from near 50% to under 47%
 - A probability of 47% is still a high probability
- Return annualization (averaging) over longer time periods narrows the return distributions
 - Annualized returns are less extreme both above and below the median

Phase II: Create Alternative Asset Mixes

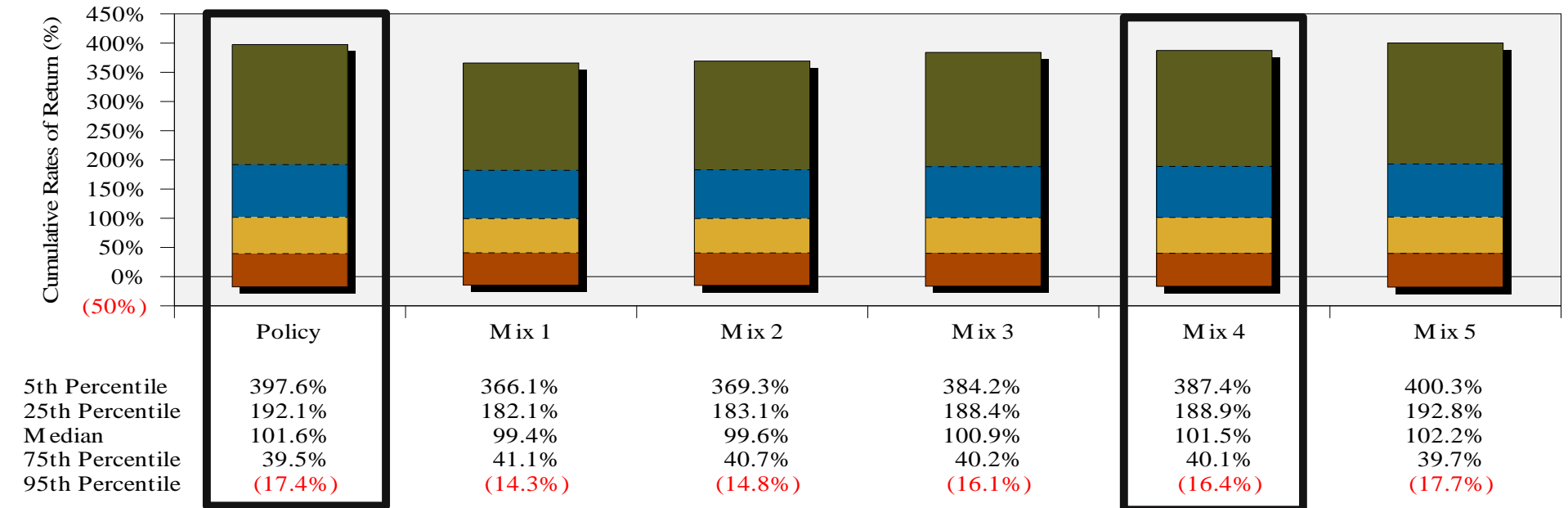
Range of Returns, 10 Years



- The ten-year distributions continue the trends shown in the five-year distributions
- Median returns fall further due to five additional years of volatility drag
- The probability of achieving 8% is now near 45%

Phase II: Create Alternative Asset Mixes

Range of Cumulative Returns, 10 Years



- The returns shown above are cumulative rather than annualized as shown in the prior 3 charts
- The lowest 5% of returns can be very negative
- The difference between the lowest 5% of returns and the median returns are large
 - This shows the potential for significantly underperforming expectations