



2016 NCRS Asset Liability Study: Phase 2

April 19, 2016



North Carolina Department of State Treasurer
Investment Management

Learn. Invest. Grow. Prosper.

2016 NCRS Asset Liability Study: Phase 1

- Updated the baseline asset allocation assumptions
- Created three Scenario-Based Asset Allocation Model Portfolios
 - The purpose of these Model Portfolios is to facilitate analysis of how different asset allocation policies would perform on average and in specific economic/financial environments (i.e., Scenario Analysis)
 - Model Portfolios were developed with a blend of judgement and optimization
 - For purposes of evaluating possibilities, Model Portfolios were allowed to have flexibility in excess of current statutory limits—i.e., Model Portfolios may exceed asset class and other limits in current NC statutes
- Buck Consulting applied their asset liability modeling to TSERS to produce various cost and performance projections
 - The TSERS Employer Contribution Rate Stabilization Policy adopted earlier this year is incorporated into the modeling (Note for modeling purposes only, the Stabilization Policy does not sunset after 8 years)
 - Focus is on 10 year results, with extensive scenario analysis of different economic/financial environments
 - Selected 30 year results were presented



2016 Asset Liability Study: Phase 2 Topics

- Review LGERS modelling conclusions
- Review stagflation scenario-based asset allocation model portfolio
- Review Buck's results incorporating current statutory limits into model portfolios
 - “Blended Model Portfolio (50%, 25%, 25%)” presented in April, but subsequently adjusted to meet current statutory limits
 - New “Blended Model Portfolio” that assigns a 10% weight to Stagflation model portfolio
- Discuss possible next steps



LGERS Analysis

- LGERS and TSERS have historically had the same target asset allocation, but now have different Employer Contribution Rate Stabilization Policy (“ECRSP”) which were the basis for this year’s contribution rates
- Both TSERS and LGERS’ ECRSP are expected to cause contributions rates to rise 0.25% to 0.35% each year if investment returns meet or slightly underperform the 7.25% actuarial return assumption
- The ECRSP work very differently if investment returns significantly and persistently underperform the 7.25% actuarial return assumption
 - TSERS: Contribution rates are reset using the standard actuarial cost methods to reflect a growing unfunded liability
 - LGERS: Contribution rates rise by 0.75% if the required contribution rate calculated at the actuarial valuation is 50% greater than the target contribution rate



TSERS Employer Contribution Rate Stabilization Policy (ECRSP)

Under ECRSP the TSERS employer contribution rates are equal to the maximum of (1) and (2) but not greater than (3), as described below:

- (1) Current year's calculated Actuarially Determined Employer Contribution Rate
- (2) Prior year's appropriated contribution rate under the Policy increased by 35 basis points For FYE 2017, assumed to be the FYE 2016 appropriation of 9.15% plus 35 basis points
- (3) Contribution rate determined using a discount rate indexed by the 30-year Treasury Rate as of the actuarial valuation date. 30-year Treasury Rate is 2.75% as of December 31, 2014. Maximum contribution rate based on 30-year Treasury Rate is estimated to be 53.48% as of December 31, 2014



LGERS Employer Contribution Rate Stabilization Policy (ECRSP)

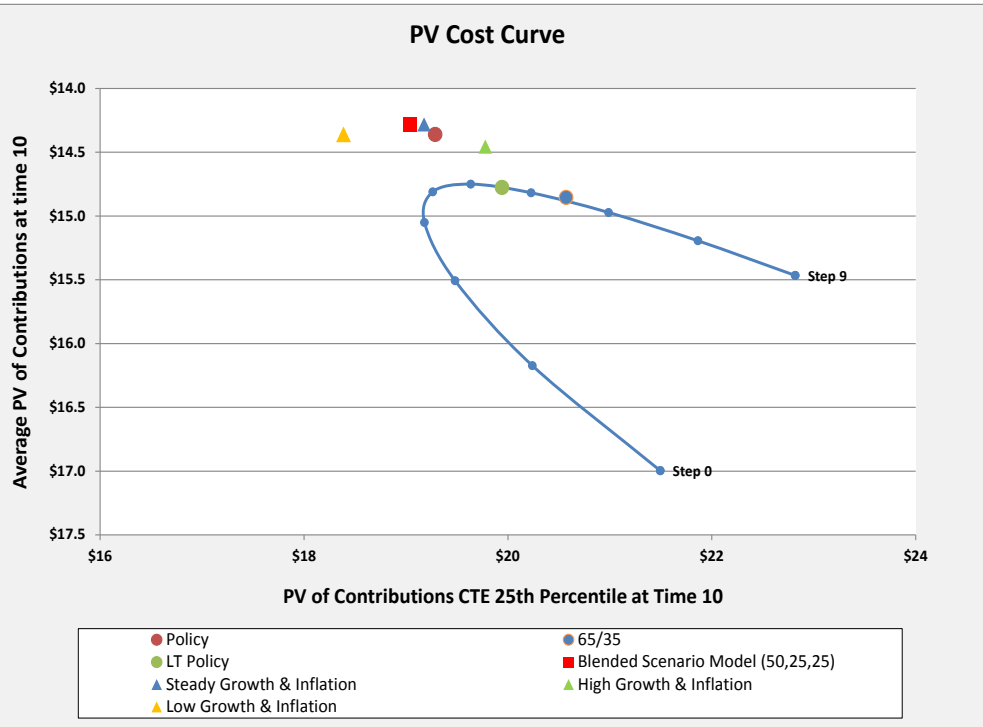
- The target general employee contribution rate is 7.25% at 7/1/2016 and will increase by 0.25% each year.
- The target general employee contribution rate in any given fiscal year will be increased an additional 0.50% if the required contribution rate calculated at the actuarial valuation is 50% greater than the target contribution rate.
- The target general employee contribution rate in any given fiscal year will be decreased by 0.50% if the required contribution rate calculated at the actuarial valuation is 50% less than the target contribution rate.
- The LEO contribution rate is always 0.75% greater than the general employee contribution rate.
- The cost of any allowable COLA granted by the Board under the authority allowed by statute will not impact the scheduled contribution rates.*

* If the legislature grants any additional COLA beyond the amount of COLA allowed and granted by the Board, or grants an increased multiplier for active employees, the schedule of contributions for the current and future fiscal years will be increased by the cost of the additional COLA or increased multiplier.

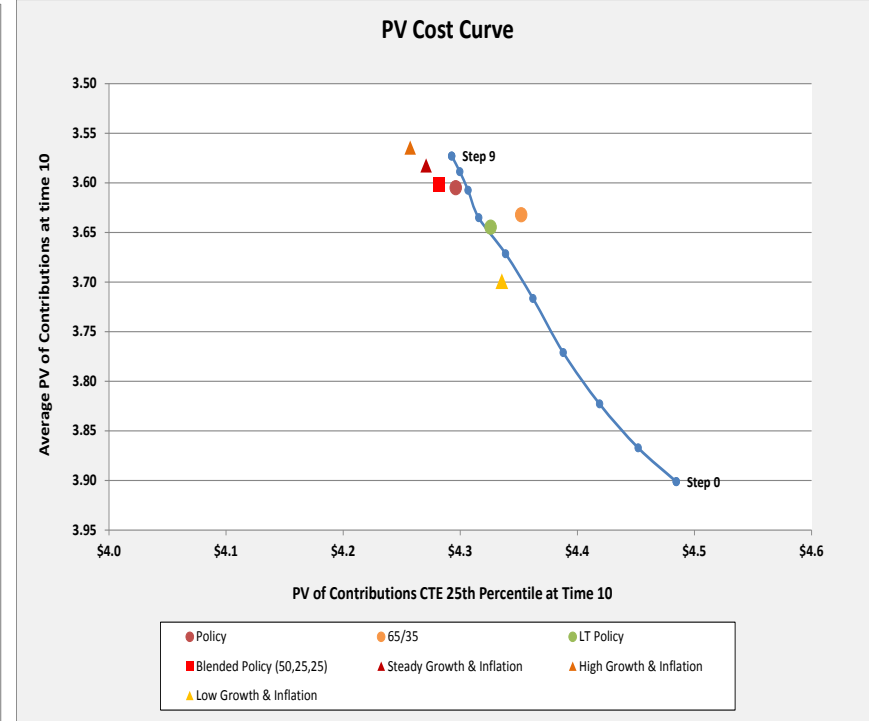


Cost Curves for 10 Year Horizon

TSERS Cost Curve



LGERS Cost Curve



- The cost curve for LGERS is very different than TSERS and distorts the analysis
- IMD believes the LGERS ECRSP would be revised with very poor investment performance
- IMD believes the investment policy should remain the same for TSERS and LGERS



Hypothetical Stagflation Modeling by UBS

- Reviewed historical global episodes (e.g., 1972-81) and did a 10 year projection starting with current conditions assuming:
 - 3 recessions with 0.8% average economic growth and inflation increases from 1% to 8%
 - T-bills rise to 8% and yield curve inverts
 - P/E for equity drops, equity earnings lag inflation, and US equity is hurt disproportionately
 - Credit spreads widen and high yield default rate increases to 5%
- Projected a hypothetical 10 year nominal NCRS total plan return of under 4% with a real NCRS total plan return of -2%
 - Weakest: IG fixed income, cash, public equity, private equity, infrastructure, and high yield
 - Strongest: Real estate, distressed, timber, private natural resources, commodities, and other real assets
- Projected no more than a 10% probability of stagflation over 10 years



IMD Asset Allocation Policy Model Portfolios

(Certain allocations are in excess of asset class limits under current law and are for discussion purposes only)

	Current Policy	Stagflation	Blended Policy (50,20,20,10)(Statute)
Long Only Public Equity	39.1%	29.0%	37.4%
Hedged Equity	2.9%	2.0%	2.5%
Private Equity	6.0%	4.0%	6.5%
Non-Core Real Estate	3.0%	5.0%	5.0%
Distressed	3.5%	5.0%	3.3%
High Yield	3.5%	2.5%	3.0%
Total Growth	58.0%	47.5%	57.7%
Government	7.6%	3.0%	7.3%
Corporate	8.8%	3.0%	8.4%
Mortgage	8.8%	3.0%	8.4%
Cash (includes Core Portfolio and Pension Cash)	3.8%	12.0%	4.7%
Total Rates & Liquidity	29.0%	21.0%	28.8%
TIPS	2.0%	5.0%	3.5%
Publicly Traded Natural Resources	1.0%	7.0%	1.0%
Private Natural Resources/Real Assets	3.0%	2.5%	2.5%
Private Equity Core Real Estate	4.0%	8.0%	3.5%
Public Equity Core Real Estate	1.0%	7.0%	1.0%
Total Inflation Sensitive	11.0%	29.5%	11.5%
Multi-Strategy	2.0%	2.0%	2.0%



Model Portfolios and Statutory Compliance

Statutory Category (Max/Min)	Current Policy	Stagflation	Blended Policy (50,20,20,10) (Statute)
Fixed Income (Min 20%)	29.00%	21.0%	28.8%
Public Equity (Max 65%)	42.00%	31.0%	39.9%
Aggregate Alternatives (Max 35%)	31.94%	50.0%	33.8%
Hedged Equity (Max 8.5%)	2.94%	2.0%	2.5%
Private Equity + MS (Max 8.75%)	8.00%	6.0%	8.5%
Real Estate (Max 10%)	8.00%	20.0%	9.5%
Other Fixed Income (Max 7.5%)	7.00%	7.5%	6.3%
Inflation Protection (Max 7.5%)	6.00%	14.5%	7.0%

Note: Certain allocations are in excess of asset class limits under current law and are for discussion purposes only. Allocation in excess of current statutes is designated in red bold text.



Blended Asset Allocation Policy Model Portfolios

	Current Policy	Blended Policy (50,25,25)(Statute)	Blended Policy (50,20,20,10)(Statute)
Long Only Public Equity	39.1%	35.8%	37.4%
Hedged Equity	2.9%	3.3%	2.5%
Private Equity	6.0%	6.0%	6.5%
Non-Core Real Estate	3.0%	7.0%	5.0%
Opportunistic Fixed Income	7.0%	6.5%	6.3%
Total Growth	58.0%	58.5%	57.7%
Government	7.6%	8.3%	7.3%
Corporate	8.8%	9.7%	8.4%
Mortgage	8.8%	9.7%	8.4%
Cash (includes Core Portfolio and Pension Cash)	3.8%	3.1%	3.7%
Total Rates & Liquidity	29.0%	31.8%	28.8%
TIPS	2.0%	3.0%	3.5%
Publicly Traded Natural Resources	1.0%	0.0%	1.0%
Private Natural Resources/Real Assets	3.0%	2.8%	2.5%
Private Equity Core Real Estate	4.0%	1.6%	3.5%
Public Equity Core Real Estate	1.0%	0.4%	1.0%
Total Inflation Sensitive	11.0%	7.8%	11.5%
Multi-Strategy	2.0%	2.0%	2.0%



Key Areas for IAC Input: Phase 2

- Is there a consensus on which updated “Blend” is more likely or preferable?
 - Blended Policy (50,25,25)(Statute)
 - Blended Policy (50,20,20,10)(Statute)
- Is there sufficient interest in one of the updated “Blends” to motivate a change in the target asset allocation?
- If there is not sufficient interest in one of the updated “Blends” to motivate a change in the target asset allocation, should we consider:
 - Shading our tactical over/underweights?
 - Monitoring markets for a dynamic shift in our tactical over/underweights?



Appendix: Additional Exhibits (on following pages)



Potential IMD Asset Allocation Shifts

	Current to Blended Policy (50,25,25)(Statute)		Current to Blended Policy (50,20,20,10)(Statute)	
Long Only Public Equity	-4.7%	\$(4,153)	-3.0%	\$(2,691)
Hedged Equity	0.3%	\$244	-0.5%	\$(421)
Private Equity	1.1%	\$937	1.6%	\$1,380
Non-Core Real Estate	2.6%	\$2,334	0.6%	\$561
Opportunistic Fixed Income	0.6%	\$569	0.4%	\$392
Total Growth	-0.2%	\$(69)	-1.0%	\$(778)
Government	0.9%	\$800	-0.1%	\$(119)
Corporate	0.9%	\$770	-0.4%	\$(346)
Mortgage	1.5%	\$1,301	0.2%	\$185
Cash (inc. Core Portfolio and Pension Cash)	-0.4%	\$(340)	0.2%	\$196
Total Rates & Liquidity	2.8%	\$2,518	-0.1%	\$(96)
TIPS	2.4%	\$2,151	2.9%	\$2,594
Publicly Traded Natural Resources	-1.0%	\$(886)	0.0%	\$0
Private Natural Resources/Real Assets	-1.5%	\$(1,350)	-1.8%	\$(1,572)
Private Equity Core Real Estate	-2.5%	\$(2,223)	-0.6%	\$(539)
Public Equity Core Real Estate	-0.3%	\$(306)	0.3%	\$226
Total Inflation Sensitive	-2.9%	\$(2,614)	0.8%	\$710
Multi-Strategy	0.2%	\$155	0.2%	\$155

Note: Current portfolio values are unaudited and as of 07/20/16. Dollar values are in millions.



Potential IMD Asset Allocation Shifts

	Policy to Blended Policy (50,25,25)(Statute)		Policy to Blended Policy (50,20,20,10)(Statute)	
Long Only Public Equity	-3.4%	\$(2,969)	-1.7%	\$(1,506)
Hedged Equity	0.4%	\$310	-0.4%	\$(354)
Private Equity	0.0%	\$0	0.5%	\$443
Non-Core Real Estate	4.0%	\$3,545	2.0%	\$1,772
Opportunistic Fixed Income	-0.5%	\$(442)	-0.7%	\$(619)
Total Growth	0.5%	\$444	-0.3%	\$(265)
Government	0.7%	\$623	-0.3%	\$(296)
Corporate	0.9%	\$785	-0.4%	\$(331)
Mortgage	0.9%	\$785	-0.4%	\$(331)
Cash (inc. Core Portfolio and Pension Cash)	0.3%	\$244	0.9%	\$780
Total Rates & Liquidity	2.8%	\$2,437	-0.2%	\$(177)
TIPS	1.0%	\$886	1.5%	\$1,329
Publicly Traded Natural Resources	-1.0%	\$(886)	0.0%	\$0
Private Natural Resources/Real Assets	-0.3%	\$(222)	-0.5%	\$(443)
Private Equity Core Real Estate	-2.4%	\$(2,127)	-0.5%	\$(443)
Public Equity Core Real Estate	-0.6%	\$(532)	0.0%	\$0
Total Inflation Sensitive	-3.3%	\$(2,880)	0.5%	\$443
Multi-Strategy	0.0%	\$0	0.0%	\$0

Note: Dollar values are in millions.



Phase 1: 2016 NCRS Scenario-Based Model Portfolios

- “Steady Growth & Inflation” Model Portfolio is designed to outperform the current Policy (with similar risk) under the baseline outlook
 - Initially very low interest rates moderately rising over intermediate term
 - Moderately rising inflation
 - Modest public equity market returns by long-term historical standards for intermediate term
- Two alternative scenarios:
 - “Low Growth & Inflation” Model Portfolio is designed to do better if U.S. economy has less momentum than expected; emerging market economic issues; delayed European normalization; systemic shocks
 - “High Growth & Inflation” Model Portfolio is designed to do better if inflation rises more than expected; global growth surprises on upside; supply shocks
- Blended Scenario Model weights 50% to Steady Growth & Inflation; 25% to Low Growth & Inflation; and 25% to High Growth & Inflation



Asset Allocation Policy Model Portfolios

(Certain allocations are in excess of asset class limits under current law and are for discussion purposes only)

	Current Policy	Steady Growth & Inflation	High Growth & Inflation	Low Growth & Inflation	Stagflation
Long Only Public Equity	39.1%	36.0%	42.0%	23.0%	29.0%
Hedged Equity	2.9%	3.0%	2.0%	2.0%	2.0%
Private Equity	6.0%	8.0%	10.0%	5.0%	4.0%
Non-Core Real Estate	3.0%	8.5%	10.0%	5.0%	5.0%
Distressed	3.5%	2.0%	1.0%	4.0%	5.0%
High Yield	3.5%	5.0%	1.0%	2.0%	2.5%
Total Growth	58.0%	62.5%	66.0%	41.0%	47.5%
Government	7.6%	6.5%	5.1%	13.5%	3.0%
Corporate	8.8%	7.6%	6.0%	15.8%	3.0%
Mortgage	8.8%	7.6%	6.0%	15.8%	3.0%
Cash (includes Core Portfolio and Pension Cash)	3.8%	3.4%	2.9%	6.0%	12.0%
Total Rates & Liquidity	29.0%	25.0%	20.0%	51.0%	21.0%
TIPS	2.0%	2.0%	4.0%	1.0%	5.0%
Publicly Traded Natural Resources	1.0%	0.0%	0.0%	0.0%	7.0%
Private Natural Resources/Real Assets	3.0%	2.5%	3.0%	1.0%	2.5%
Private Equity Core Real Estate	4.0%	3.2%	4.0%	3.2%	8.0%
Public Equity Core Real Estate	1.0%	0.8%	1.0%	0.8%	7.0%
Total Inflation Sensitive	11.0%	8.5%	12.0%	6.0%	29.5%
Multi-Strategy	2.0%	4.0%	2.0%	2.0%	2.0%



Equity Return and Implied Risk Premium Assumptions for 30-year Horizon

	2013-14 Study IMD Adjusted	Low Equity Risk Premium Scenario	2016 ALM Study IMD Adjusted
Equity Return (Arithmetic)	9.44%	8.29%	8.72%
Equity Volatility	17.00%	16.50%	16.63%
Cash Return	3.63%	3.35%	3.50%
Equity Risk Premium (Geometric)	4.37%	3.69%	4.00%
Equity Return (Geometric)	8.00%	7.04%	7.47%

Source: North Carolina Department of State Treasurer and Buck Consulting

* These figures reflect a recalibration of GEMS to implement IMD's provided current and forward yield curve data.



Description of Requested Assumption Adjustments

NCRS Asset Class	NCRS Sub Asset Class	Requested Adjustments to 30-Year Arithmetic GEMS Baseline	SAA Policy Weight
Public Equity	Long Only Public Equity	Reduce return assumption to equate the 30 year geometric equity risk premium to 400bps above cash	39.06%
	Hedged Equity	Return assumption modeled as $0.4 * \text{Public Equity} + 250$ basis points; risk adjusted similarly downward	2.94%
Private Equity	Private Equity	Return assumption equals US Small Cap + 300 bps	6.00%
Non-Core Real Estate	Non-Core Real Estate	Return assumption modeled as Core Real Estate + 200 basis points; risk approximates 20%	3.00%
Opportunistic Fixed Income	Distressed and Long-Short Credit	Use HFRI distressed hedge fund index to model returns and risk	3.50%
	High Yield	Return assumption should be modeled to 500 basis points over Intermediate Treasury Performance	3.50%
Investment Grade Fixed Income	Government Bonds	Use current yields and 3 year out forward curve combined with GEMS 5yr + Treasury to model returns	7.56%
	Corporate Bonds	Use current yields and 3 year out forward curve combined with GEMS 5yr + Corporate to model returns	8.82%
	Mortgage-Backed Securities	Use current yields and 3 year out forward curve combined with GEMS Agency MBS to model returns	8.82%



Description of Requested Assumption Adjustments

NCRS Asset Class	NCRS Sub Asset Class	Requested Adjustments to 30-Year Arithmetic GEMS Baseline	SAA Policy Weight
Cash	Cash	Use current yields and 3 year out forward curve combined with GEMS Cash adjusted to reflect a grade in of roughly 70bps of real yield over the horizon	3.80%
Inflation Sensitive	TIPS	Use current yields and 3 year out forward curve combined with GEMS short term TIPS (1yr-5yr) to model returns	1.98%
	Publicly Traded Natural Resources	Reduce return assumption so commodities return roughly 200 basis points over cash	1.02%
	Private Natural Resources/Real Assets	Model as infrastructure	3.00%
Core Real Estate	Private Equity Core Real Estate	Reduce return assumption so direct real estate return approximates 700 basis points; risk equaling 10%	4.00%
	Public Equity Core Real Estate	Use GEMS REIT assumptions	1.00%
Multi-Strategy	Multi-Strategy	Use GEMS diversified hedge fund assumptions	2.00%
Total			100.00%



Comparison of the Return Assumptions for the 2013 ALM Study, Lower Equity Risk Premium Scenario, and the 2016 ALM Study

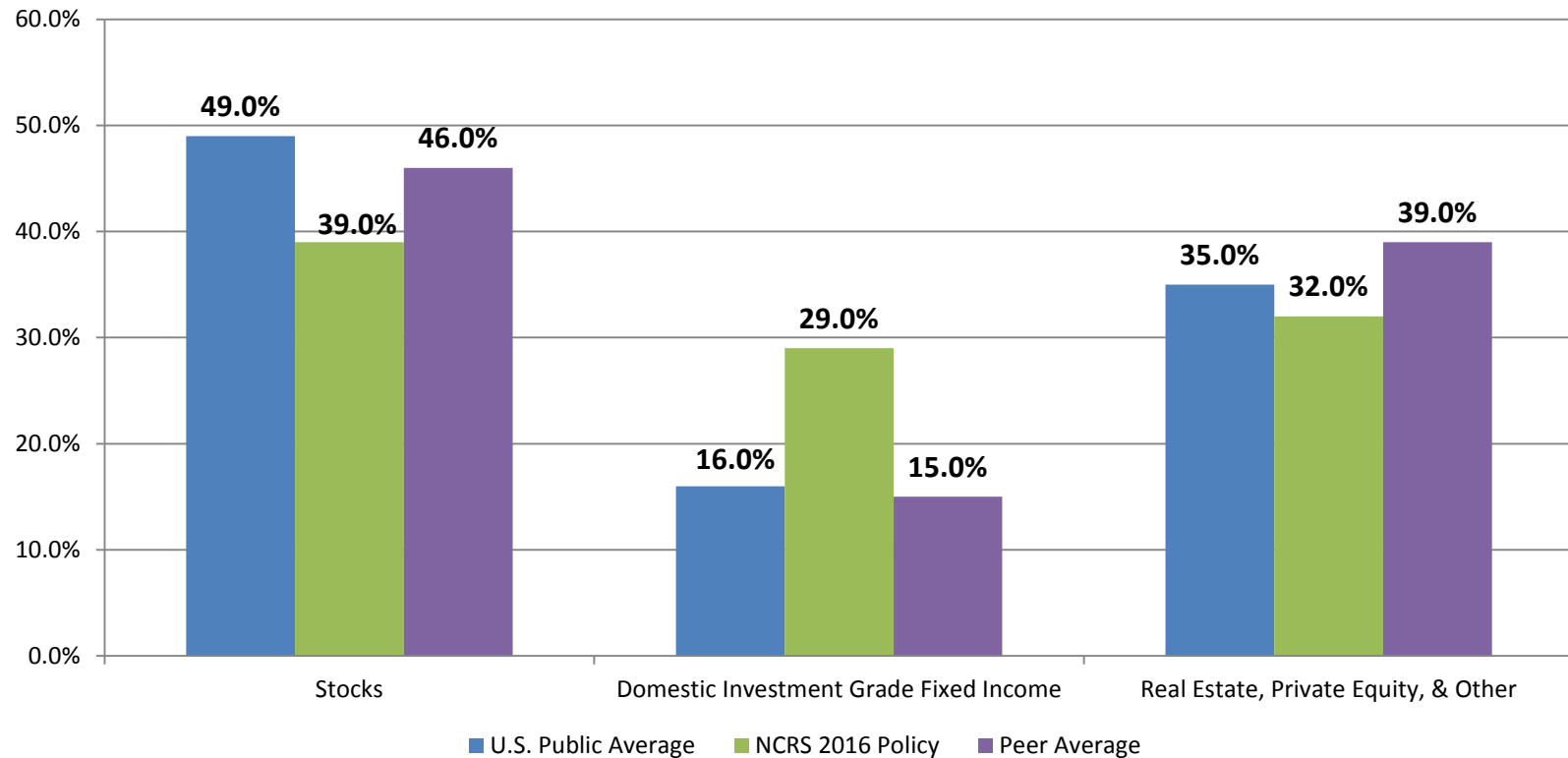
Capital Market Assumptions - Expected Returns (Arithmetic)

NCRS Asset Class	NCRS Sub Asset Class	10 Year			30 Year		
		2013 ALM	Low ERP	2016 ALM	2013 ALM	Low ERP	2016 ALM
Public Equity	Long Only Public Equity	8.40%	7.20%	7.96%	9.44%	8.29%	8.72%
	Hedged Equity	5.85%	5.38%	5.68%	6.28%	5.82%	5.99%
Private Equity	Private Equity	11.35%	11.39%	12.24%	14.58%	13.77%	14.15%
Non-Core Real Estate	Non-Core Real Estate	7.99%	6.91%	7.27%	10.00%	9.22%	8.70%
Opportunistic Fixed Income	Corporate - Non IG	6.56%	8.20%	7.99%	10.20%	9.41%	9.19%
Investment Grade Fixed Income	Government Bonds	3.19%	1.55%	1.88%	5.49%	3.81%	4.52%
	Corporate Bonds	4.09%	3.01%	2.99%	6.58%	5.09%	5.49%
	Mortgage-Backed Securities	2.82%	1.81%	1.73%	5.16%	4.00%	3.86%
Cash	Cash	1.97%	1.86%	2.12%	3.63%	3.35%	3.50%
Inflation Sensitive	TIPS	1.79%	5.22%	3.64%	3.65%	7.32%	5.17%
	Publicly Traded Natural Resources	4.44%	3.51%	2.67%	4.64%	5.69%	5.51%
	Private Natural Resources/Real Assets	9.28%	7.81%	7.69%	9.43%	9.28%	9.04%
Core Real Estate	Private Equity Core Real Estate	5.15%	6.05%	6.00%	7.76%	7.22%	6.70%
	Public Equity Core Real Estate	5.78%	5.73%	5.77%	7.53%	7.30%	7.08%
Multi-Strategy	Multi-Strategy	6.48%	6.45%	6.01%	9.65%	7.02%	6.48%



Public Pension Peer Policy Comparisons

Asset Allocation Policy Comparison (CEM: U.S. Public Funds) As of 12/31/2014



CEM Peer Group for NCRS:

- 15 U.S. public sponsors
- Fund sizes range from \$42 billion to \$158 billion
- Median size of \$74 billion



Large Public Pension Fund Actual Allocations

December 2015; Funds with Assets in excess of \$75 Billion

Percentage of Total Fund Value	Mean	10%	25%	Median	75%	90%
Commodities	0.5%	0%	0%	0.1%	0.5%	1.3%
Real Estate	8.9%	4.5%	6.3%	9.9%	11.1%	14.2%
Venture Capital	0.8%	0%	0%	0.9%	1.3%	1.7%
Private Equity/LBO	8.1%	3.4%	6.3%	8.1%	9.2%	11.8%
Total Fund Market Value (B)	\$105.3	\$60.3	\$79.2	\$85.9	\$142.0	\$179.3

Source: Department of State Treasurer

