

# UNCONSTRAINED OPTIMIZATION VS 7.5% CaIPERS

November 2016



# Public Pension Plan Investment Return Assumptions

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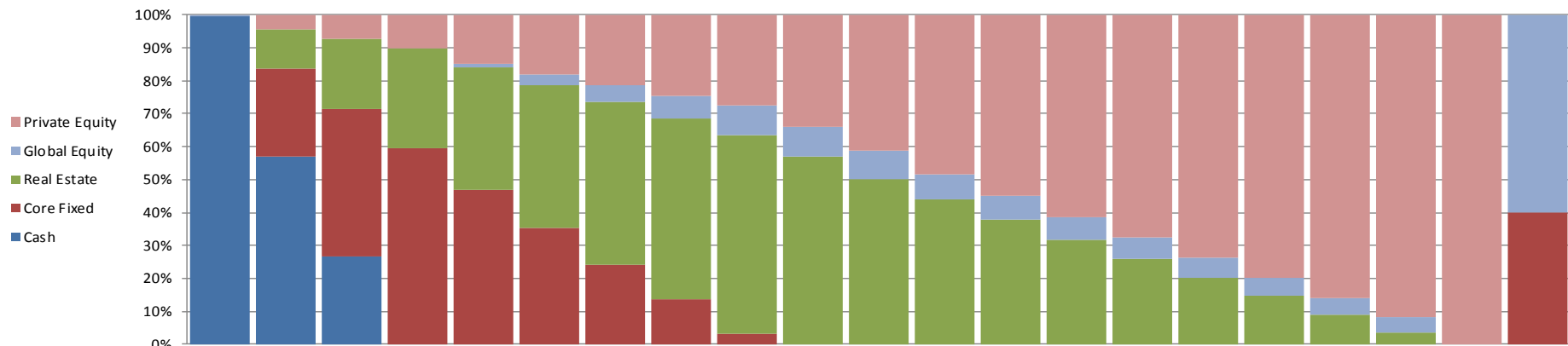
- At the November meeting the ability of the portfolio to generate a 7.5% compounded rate of return , in the current investment environment , was raised
- Using PCA's 2016 Capital Market Assumptions (attached) we "optimized" to determine which "unconstrained" asset allocation would generate that level of return
- To achieve 7.5% requires an allocation to real estate and private equity, that is not implementable.
- Portfolios with less private markets exposure have a lower probability of meeting 7.5%, as does the current portfolio

# Unconstrained Optimization

Allocation Constraints

	Min	Max
Cash	0%	100%
Core Fixed	0%	100%
Real Estate	0%	100%
Global Equity	0%	100%
Private Equity	0%	100%

Unconstrained Efficient Frontier Asset Allocations

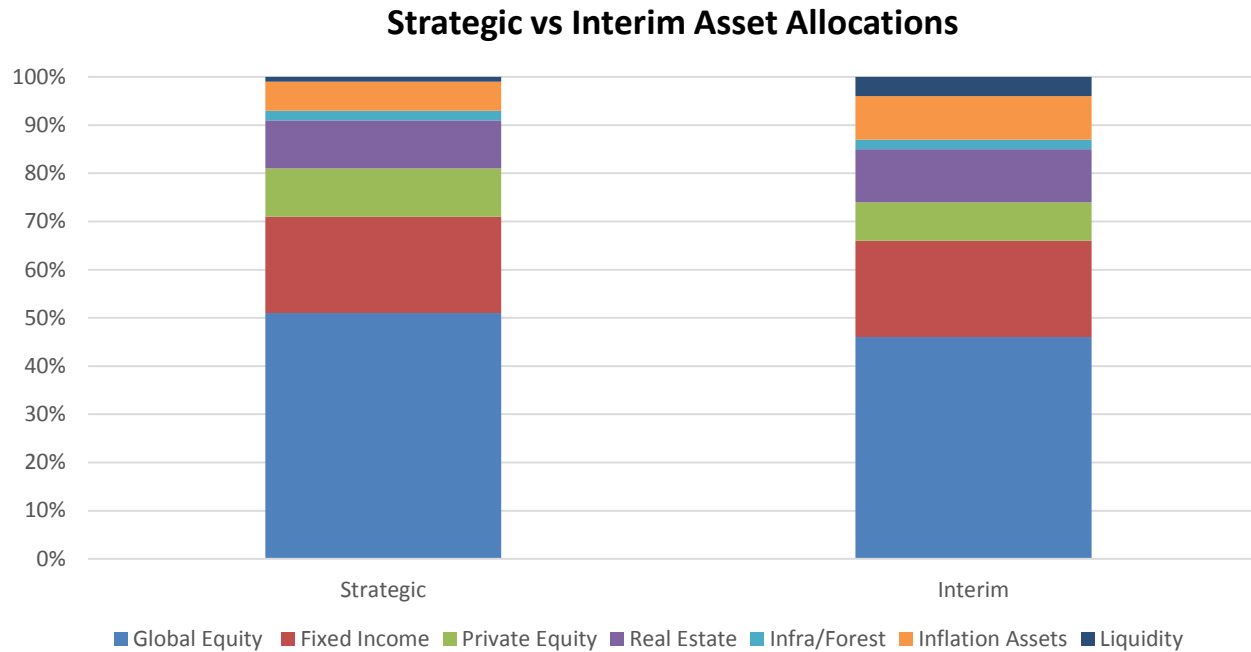


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	60/40
Cash	100%	57%	27%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Core Fixed	0%	27%	45%	60%	47%	35%	24%	14%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	40%
Real Estate	0%	12%	21%	30%	37%	44%	49%	55%	60%	57%	50%	44%	38%	32%	26%	20%	15%	9%	4%	0%	0%
Global Equity	0%	0%	0%	0%	1%	3%	5%	7%	9%	9%	8%	8%	7%	7%	6%	6%	6%	5%	5%	0%	60%
Private Equity	0%	5%	7%	10%	15%	18%	21%	25%	28%	34%	41%	48%	55%	61%	68%	74%	80%	86%	92%	100%	0%

Arithmetic Return	2.0%	3.1%	3.9%	4.7%	5.3%	5.9%	6.5%	7.0%	7.6%	8.1%	8.5%	9.0%	9.4%	9.8%	10.2%	10.6%	11.0%	11.4%	11.7%	12.1%	6.5%
Risk (StDev Rtn)	1.0%	2.3%	3.6%	5.0%	6.3%	7.6%	8.9%	10.2%	11.5%	12.8%	14.2%	15.5%	16.8%	18.1%	19.4%	20.7%	22.1%	23.4%	24.7%	26.0%	11.8%
Geometric Return	2.0%	3.1%	3.9%	4.6%	5.2%	5.7%	6.1%	6.5%	7.0%	7.3%	7.6%	7.9%	8.1%	8.3%	8.5%	8.7%	8.8%	9.0%	9.1%	9.2%	6.0%
Probability >7.5%	0.0%	0.0%	0.1%	3.1%	11.9%	22.1%	31.2%	38.3%	44.0%	48.1%	51.1%	53.2%	54.6%	55.8%	56.6%	57.2%	57.6%	57.9%	58.1%	58.2%	34.4%



# Strategic Asset Allocation vs Interim Asset Allocation



	Strategic AA	Interim AA
Arithmetic Return	7.4%	7.0%
Risk (StDev)	12.3%	11.7%
Geometric Return	6.8%	6.4%
Probability > 7.5%	43%	38%
Probability > 7.0%	48%	44%
Probability > 6.5%	53%	49%

- Probabilities are based on basic mean-variance calculations and assume normal distributions.
- Each probability assumes the respective allocation over a full 10-year period.

# PCA's 2016 10-year Capital Market Assumptions

	Expected Arithmetic Average Nominal Annual Return	Expected Geometric Compound Nominal Annual Return	Expected Risk of Nominal Returns (Ann. SD)	Cash	TIPS	TSY	CoreFxd	Credit	RealEst	USEq	IntlEq	GlblEq	HIntlEq	PrivEq
Cash	2.00	2.00	1.00											
TIPS	3.15	3.00	6.00	0.20										
US Treasuries Fixed Income	2.00	1.90	5.00	0.30	0.50									
US Core Fixed Income	3.00	2.90	4.00	0.25	0.60	0.30								
US Credit Fixed Income	4.00	3.85	6.00	0.00	0.65	0.00	0.75							
Core Real Estate	5.50	5.10	9.00	0.30	0.00	0.00	0.00	0.00						
Domestic Equity	8.50	6.90	18.50	0.00	0.00	-0.25	0.20	0.40	0.40					
International Equity	9.50	7.45	21.00	0.00	0.00	-0.35	0.10	0.20	0.30	0.80				
Global Equity	9.10	7.45	19.00	0.00	0.00	-0.30	0.15	0.30	0.35	0.90	0.90			
Hedged International Equity	9.40	7.65	19.50	0.00	0.00	-0.30	0.10	0.30	0.35	0.85	0.90	0.90		
Private Equity/Venture Capital	12.10	9.05	26.00	0.00	0.00	-0.30	0.00	0.30	0.30	0.85	0.80	0.80	0.80	
Inflation	2.25	2.25	1.00	0.50	0.45	-0.10	0.00	0.10	0.35	0.20	0.20	0.20	0.20	0.10

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