

TEACHERS' RETIREMENT BOARD

INVESTMENT COMMITTEE

SUBJECT: 2012-13 Asset Liability Study – Framework: Risk Framework ITEM NUMBER: 6
Discussion

CONSENT: _____

ATTACHMENTS: 2

ACTION: _____

DATE OF MEETING: January 9, 2013 / 90 mins.

INFORMATION: X

PRESENTERS: Neil Rue, PCA

POLICY

This item is covered by the Teachers' Retirement Board Policy Manual, Section 1000, Page A-1: [Investment Policy & Management Plan](#), (IPMP).

HISTORY OF THE ITEM

CalSTRS reviews our asset allocation targets once every three years through a full asset / liability (A/L) study. The 2012 study will transpire over several Investment Committee meetings and since it is now spreading into the new year, it will be known as the 2012-13 Study.

Tentative Agenda Plan for 2012-13 Asset-Liability Project

September	Investment Return Objectives, Investment Objectives and Philosophy
November	Introduction of risk allocation across asset types
December	Continued discussion of risk class allocation across asset types
January 2013	Risk Class Framework discussion continued
February	Discuss and approve capital market assumptions, and asset class constraints
April	Approve Asset / Risk classes and review objectives - decision factors
June	Presentation of CalSTRS A/L Model Interactive sensitivity analysis of objective / decision factors
July	Approve factor weightings, select policy portfolio and set allowable ranges, adopt the strategic asset class targets into the Investment Policy & Management Plan

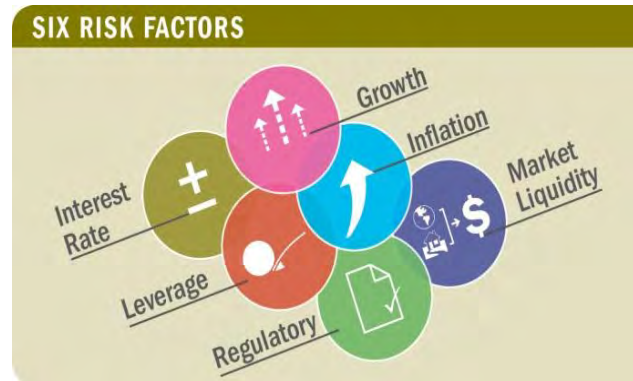
PURPOSE OF THIS AGENDA ITEM

The purpose of this step is to continue the second half of the risk framework discussion from the December Committee meeting as presented by Neil Rue of Pension Consulting Alliance ([PCA](#)).

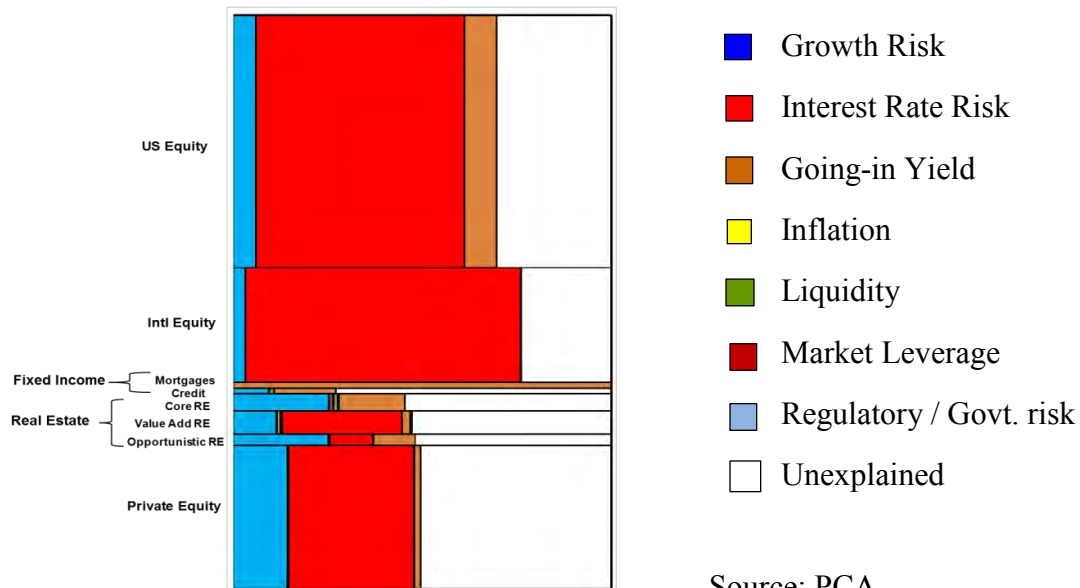
BACKGROUND

As discussed at the December Investment Committee meeting, PCA has presented a new Risk Class framework to view and model the CalSTRS Investment Portfolio. At this meeting, PCA will present comparisons of optimized portfolios using both risk class and asset class frameworks. The risk class framework is still in the concept phase and, at this point, this analysis is more for illustration purposes than suggesting immediate implementation. Readers are cautioned not to forecast ahead.

These risk classes closely focus on three of the six CalSTRS risk factors (Growth, Interest Rate, and Inflation). They are not designed explicitly to mirror our other three risks (Market Liquidity, Regulation, and Market Leverage) due to the transient nature of these risks. While these risks are inherent in the global capital markets, they are difficult to hedge or mitigate directly. PCA believes that their risk classes pick up the vast majority of the investments risk within the total portfolio.



At the September and November meetings, PCA used the following chart to demonstrate how the CalSTRS Investment portfolio had a preponderance of risk exposure to Global Growth Risk in multiple asset classes. Modeled here in red:



Source: PCA

PCA proposed CalSTRS use a risk class framework comprised of six classes (see box):

- | | |
|--------------------------------------|-------------------------|
| • Strong economic growth environment | • Volatile risk |
| • Poor equity market | • Rising interest rates |
| • Volatile interest rates | • Inflation |

These classes attempt to address the bulk of the risks CalSTRS seeks to manage across the global capital markets. As Neil Rue explained, there are numerous risk variables that can be measured

and analyzed, but the above framework of risk classes seek to address the management of the core risks impacting investments typically utilized by CalSTRS and other institutional investors. While the large exposure to growth risk enabled CalSTRS to earn an investment return of 7.5 percent over the past 20 years, it also exposed the Fund to the enormous losses during the financial meltdowns in 2002 and 2008.

DISCUSSION

In the Pension Consulting Alliance risk model, CalSTRS' major asset classes are broken down into individual sub-classes. These sub-classes are then analyzed to determine how and which of the six CalSTRS risks factors has been most influential in explaining their performance over the past decade. As a result, it is important to recognize that a sub-sector's characteristics could change over time as a result of the dynamic behavior of the six CalSTRS risk factors. Inevitably, significant changes are infrequent but can occur. For example, U.S. Government Bonds had a negative correlation to the U.S. equity market, (a negative correlation) during the 1970 to 1980s, but in the 1990s and 2000s they began to move in parallel (a positive correlation). Therefore, U.S. bonds went from a risk diversifier to a risk amplifier for U.S. equities. As a result, the model needs to be dynamic and the classifications will be revisited annually.

CalSTRS currently utilizes traditional asset classes and the sub-sectors based on the major market indices categories. The weighting of the various sub-sectors is developed from the market weighting or CalSTRS Policy guidelines and risk limits. For example the Investment Committee has set the U.S. versus non-U.S. equity weighting at $\frac{2}{3}$ to $\frac{1}{3}$, compared to the market weighting of 50/50. This is compared to the Fixed Income subcategory weightings which are largely driven by the market / index weighting in each category. The only "functional" asset class as described by Neil Rue is one combining various investments in the newest class, Inflation Sensitive. The color categories are used to assist in a comparison of the various frameworks.

CalSTRS "traditional" ASSET CLASS FRAMEWORK:

		ASSET CLASSES				
Sub Asset classes / Investments	GLOBAL EQUITY	FIXED INCOME	PRIVATE EQUITY	REAL ESTATE	INFLATION SENSATIVE	
	U.S. Equity	Core plus	Buyouts	Core RE	TIPS / Linkers	
	Non-U.S. Equity	Governments	Venture Capital	Value Added RE	Infrastructure	
	Emerging Markets	MBS - Asset Backed	Growth Equity	Opportunistic RE	Innovation	
	Activist-C.G. managers	Credit	Distressed Debt	Public RE	FX - Currency	
		High Yield	Co-Investment		Member Home Loan	
		Bank Loans				
		Liquidity				

This structure is contrasted with the Risk Class structure where the investments or sub-sectors are allocated based on their risk factor characteristics as reflected in PCA's research. One attractive feature of this framework is that the generalized nature of the strategic risk classes can utilize additional sub-sectors that may not be included under the current structure. In addition, many of the considered sub-sectors are approved investments and already exist within the overall CalSTRS portfolio, but current investment is at such low levels that they do not warrant strategic consideration. There are also a few additional investment strategies that are under research within the Innovation and Risk unit and only have a very small amount of assets committed at this time. The newer sub-sectors and Innovation tested sub-sectors are noted in italics.

RISK CLASS FRAMEWORK:

PCA RISK CLASSES							
Sub Asset classes / Investments	GROWTH RISK	PRIVATE GROWTH	ABSOLUE RETURN	GROWTH DIVERSIFY	INFLATION RISK	INTEREST RATES	INTEREST RATE UNCERTAINTY
	U.S. Equity	Buyouts	Interest Rates	TIPS / Linkers	Bank Loans	<i>Convertibles</i>	Core RE
	Non-U.S. Equity	Venture Capital	MBS	Liquidity	TIPS / Linkers	<i>Commodities</i>	Infrastructure
	Emerging Markets	Growth Equity	<i>Oil & Gas</i>	<i>Commodities</i>		<i>Oil & Gas</i>	<i>Commodities</i>
	Activist-C.G. managers	Distressed Debt	<i>Agriculture</i>	<i>Long Treasuries</i>		<i>Hedge Funds</i>	
	Credit	Co-Investment	<i>Hedge Funds</i>				
	High Yield	Value Added RE	<i>Long Treasuries</i>				
	Public RE	Opportunistic RE					

Using the same color codes from the Asset Class framework provides a picture that reinforces the prior comments that the vast majority of CalSTRS assets tilt to the left side of the chart in growth risk investments. The graph also shows by the white investment areas to the right, that CalSTRS has very little exposure to these other risk factors. If this framework is adopted and if assets were allocated to those areas additional policies, guidelines and internal controls would need to be developed.

The second half of the PCA presentation provides an initial analysis of preliminary optimal portfolios formulated under both the asset class and risk class frameworks. At this point of the study, the optimizations do not explicitly account for CalSTRS' liabilities. They do, however, provide an initial indication of the merits and efficacy of the Risk Class framework. Optimizations are examined under two versions of risk: (i) the traditional standard deviation (total volatility) measure and (ii) a downside risk measure. Under the assumption of normal (i.e.,

symmetric) distributions, both measures would produce the same optimal portfolios, but the world is far from normal. In fact, over the course of this asset-liability study, PCA has not relied on the normal distribution assumption. Instead, PCA's assumptions reflect the *actual behavior* of each investment class (asset-based or risk-based) overlaid with forward-looking long-term views about the expected return-and-risk tradeoffs of each class. PCA then applies simulation procedures to project expected class and portfolio behavior as well as determine optimal portfolios given certain return/risk criteria. For this specific presentation, PCA determines optimal portfolios using the return-and-risk characteristics of CalSTRS' current policy portfolio as the baseline reference point.

From this analysis, there is evidence that utilizing a risk class-based framework for structuring portfolios may yield better risk-adjusted portfolios than the traditional asset class-based framework. These initial findings are in addition to the more qualitative benefits of having a portfolio strategy that provides more direct visibility into specific macroeconomic risks borne by the portfolio.

It is always important to acknowledge and note, while these simulations are developed based on market activity over a prolonged period of 1970 through 2011, some of the sub-sector investment areas do not have return data for the entire period. To complete the data, the returns for the following investment areas were developed using the available history and then modeling procedures were utilized to back-fill the remaining period: Inflation Linkers (TIPS); Convertible Bonds; Bank Loans; Infrastructure; Emerging Market Debt; Agriculture; Hedge Funds and High Yield Bonds.

SUMMARY

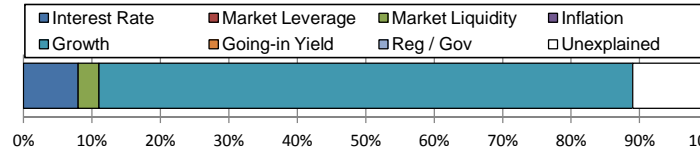
The Risk Class framework and the traditional Asset Class framework are not mutually exclusive, but they are not interchangeable, each examines risk through different prisms. At this stage of the 2012-13 Study, staff proposes the Committee continue to pursue both frameworks to provide a more comprehensive view of the portfolio. To accomplish a comparison, the Asset Class framework will also utilize the more granular sub-sector investment areas. However, if the Committee desires one framework over the other, PCA and staff can deftly make the switch.

No matter which framework is used, ultimately, at the April or June meetings, the Investment Committee will need to determine the approximately level of risk for the portfolio. At that point, the CalSTRS liabilities will be taken into consideration and the Committee's risk level will be expressed in terms of lowering the year to year volatility of the funded status versus the desire to be properly funded at some point in the future. This intersects perfectly with the Retirement Board's funding strategy objectives. Just as the assets need to link to the liabilities, the investment objectives need to be linked to the contribution levels.

CalSTRS Preliminary Custom Risk Classes - Constrained Optimization

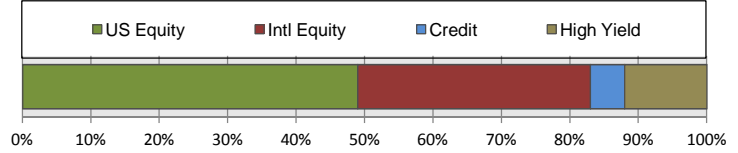
Attachment 1
Investment Committee - Item 6
January 9, 2013

Allocation by Risks



Class Modeled Exp: Geo. Ret: 8.7% Vol (SD): 15.7% Best Yr: 1985 34.5% Worst Yr: 2008 -36.3%

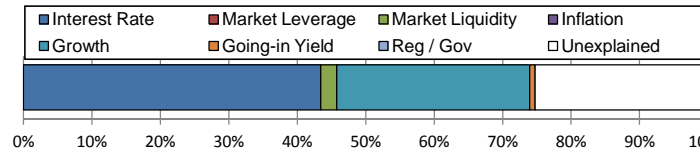
Allocation by Assets



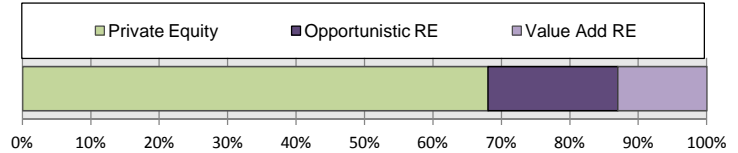
Risk Class Growth Risk Oriented
Optimization Risk Factors
Constraints Credit: 5% min
Assets Included US Eq, Intl Eq, Credit, High Yield

Class heavily dependent on economic growth prospects.

Risk Class Private Growth Risk Oriented
Optimization Risk Factors
Constraints Current portfolio weights
Assets Included PE, Opp RE, Value Add RE

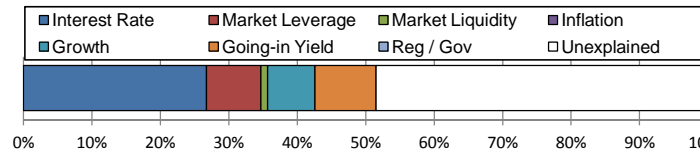


Class Modeled Exp: Geo. Ret: 9.9% Vol (SD): 20.3% Best Yr: 1980 58.8% Worst Yr: 2008 -41.2%

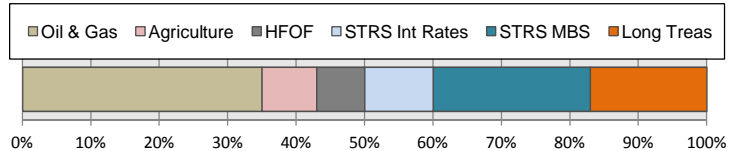


Class heavily dependent on economic growth prospects through the utilization of private assets.

Risk Class Absolute Return Oriented
Optimization Risk Factors
Constraints HFOF: 5% min, Liquid: 50% min
Assets Included Timber, Oil & Gas, Agr, HFOF Interest Rates, MBS, Long Treas

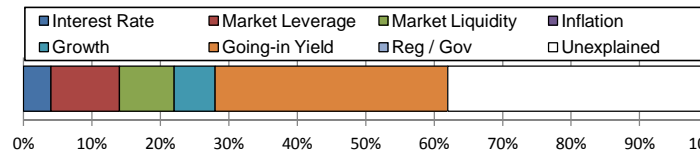


Class Modeled Exp: Geo. Ret: 4.1% Vol (SD): 4.6% Best Yr: 2005 12.5% Worst Yr: 2008 -7.8%

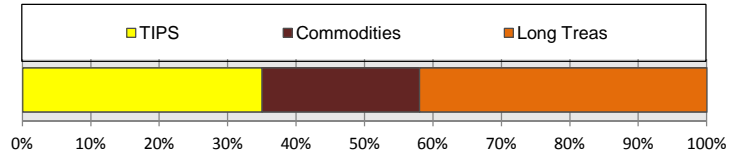


Designed to produce positive returns regardless of risk environment.

Risk Class Equity Risk Diversifying
Optimization Risk Factors
Constraints None
Assets Included 13 sub-classes (excluding Growth and Private Growth sub-classes)



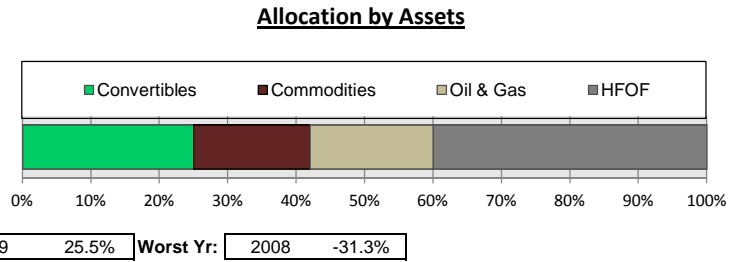
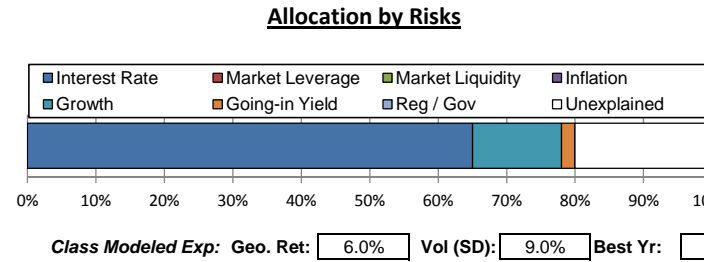
Class Modeled Exp: Geo. Ret: 5.2% Vol (SD): 9.5% Best Yr: 2009 24.7% Worst Yr: 2008 -28.3%



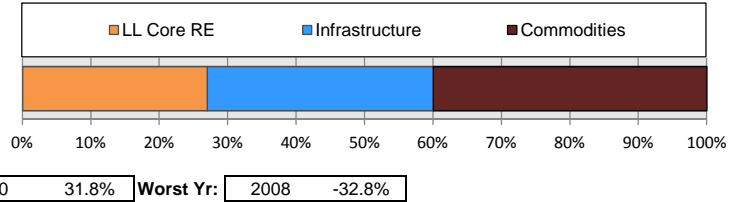
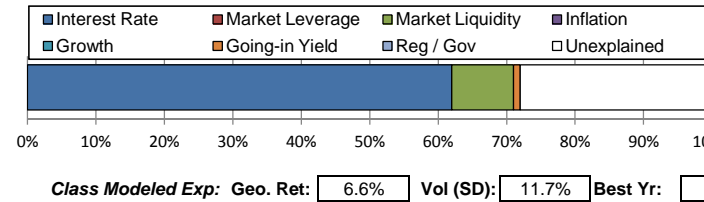
Designed to produce positive returns when equities are performing poorly.

CalSTRS Preliminary Custom Risk Classes - Constrained Optimization

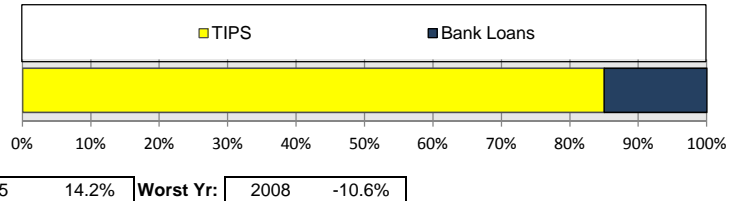
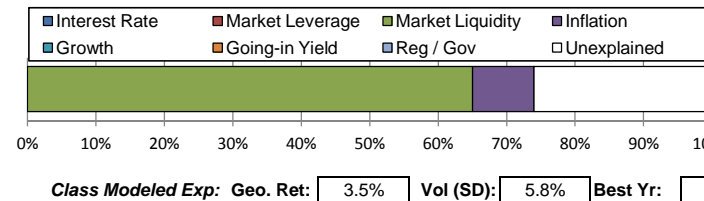
Risk Class Interest Rate Participation
Optimization Risk Factors
Constraints Converts: 25% max, HFOF: 40% max
Assets Included 13 sub-classes (excluding Growth and Private Growth sub-classes)
 Designed to produce positive returns when interest rates are rising.



Risk Class Interest Rate Risk Participation
Optimization Risk Factors
Constraints Commodities: 40% max
Assets Included 13 sub-classes (excluding Growth and Private Growth sub-classes)
 Designed to produce positive returns when the interest rates environment is volatile.



Risk Class Inflation Risk
Optimization Risk Factors
Constraints TIPS: 90% max, BL: 5% min
Assets Included TIPS, BL, LL Core RE, Timber Commod, O&G, Agr, HFOF
 Designed to produce positive returns when inflation uncertainty is high.





CALSTRS

2012-2013 Asset-Liability-Session III

Policy Portfolio Options Under Asset- and Risk-Based Frameworks

Continuation from December 2012



Agenda

Background

The Impact of Macro Risk Factors

Rationale for Asset Class Framework

Rationale for Risk Class Framework

Analysis of Policy Portfolio Options Under Both Frameworks

Conclusions



Background

Several presentations on diversification by macroeconomic risk

Analyzed the STRS portfolio across risk types instead of asset types

Key finding: a bias toward economic growth risk

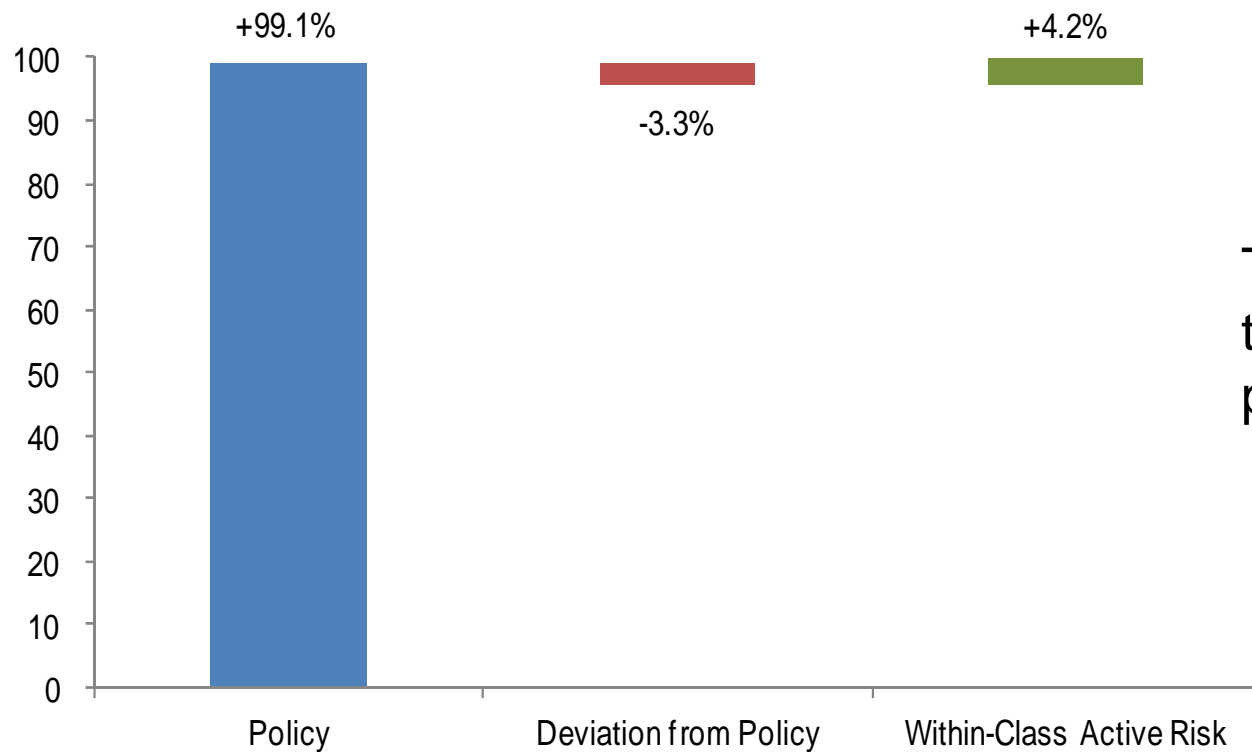
Key policy issue: management of macro economic risk biases/exposures

Discuss an alternative framework for establishing a policy portfolio mix

Consider mixing by risks instead of assets

The Impact of Macro Risk Factors

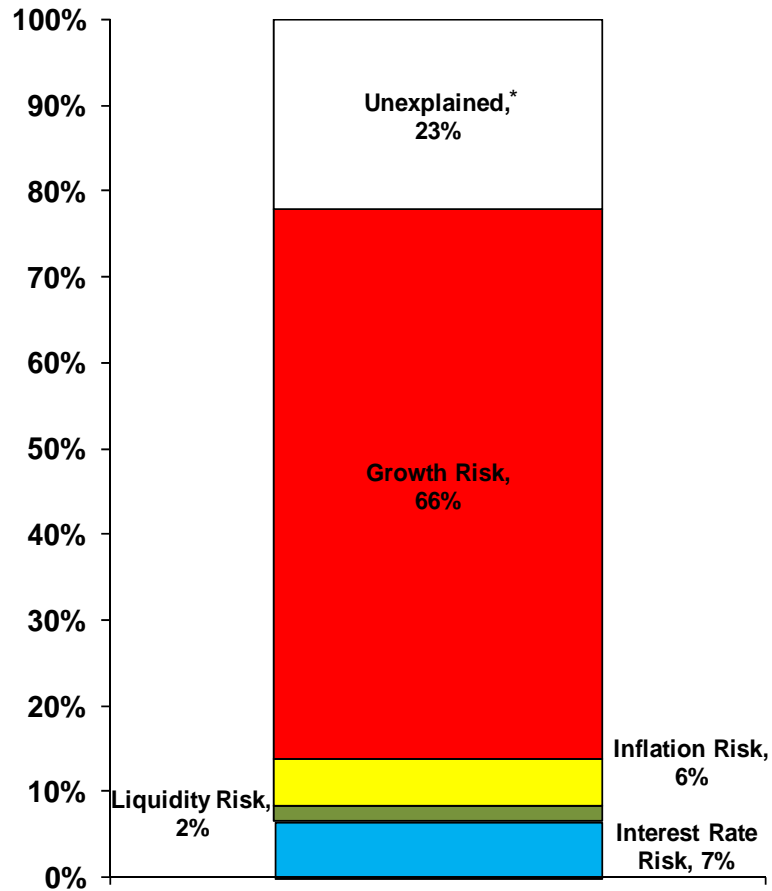
Relative influence of key decisions upon investment risk



The policy mix has had the largest impact on portfolio volatility

Source: 9/30/2012 PCA-STRS Risk Dashboard

The Impact of Macro Risk Factors



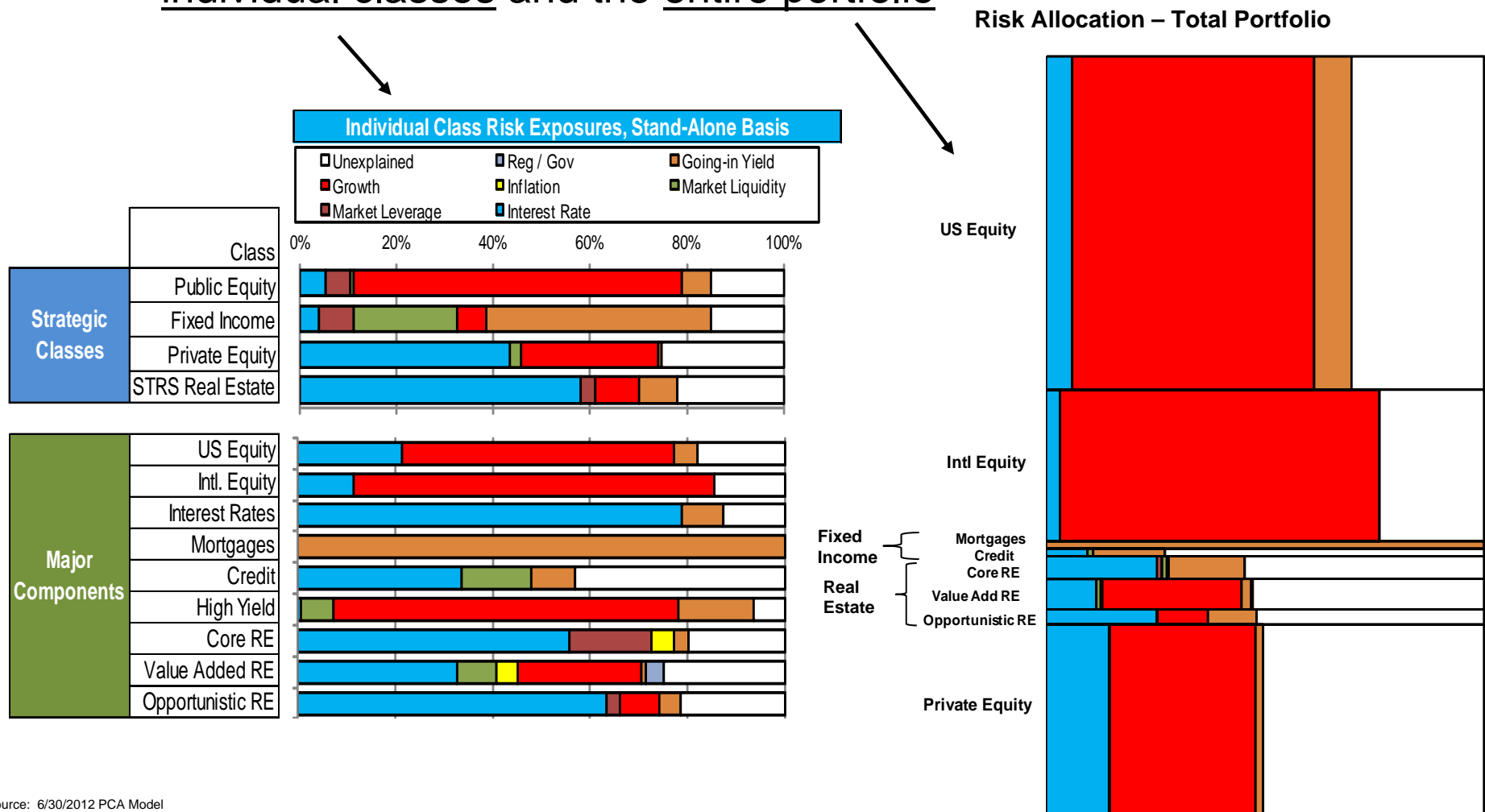
...and, in turn, the policy portfolio is dominated by one single risk factor...

economic growth risk accounts for 75% of explainable risk

*It is rare that a statistical model can explain 100% of a portfolio's behavior. Subject to a variety of assumptions, if a model can explain 50% or more of a portfolio's behavior, the model may be deemed as helpful/useful to decision makers. The "unexplained" portion highlights that amount of portfolio behavior that the model cannot account for.

The Impact of Macro Risk Factors

...and these risk factors are pervasive across individual classes and the entire portfolio



Source: 6/30/2012 PCA Model



The Impact of Macro Risk Factors

It is widely understood that a limited number of macroeconomic risk factors can have significant influence upon investment returns

Investors are beginning to take these risks into account when making long-term strategic allocation decisions

Risk factor allocation has its foundation in Arbitrage Pricing Theory (APT) which is an expansion of MPT that took place 25 years ago

The asset-based and risk-based frameworks may yield different allocation results



Rationale for Asset Class Framework

All the extra effort to examine various risks may lead to a solution equivalent to one found under the traditional asset class framework

The basic exercise is allocating between higher-risk assets (equity-like) and low-risk assets (bond-like)

The key risk to be managed is return variability, regardless of the framework used



Rationale for Risk Class Framework

Assets are poor proxies for the risks actually borne by the portfolio

Risk factors provide better visibility into actual risks inherent in the policy mix

Risk is not symmetrical, nor is it static; analyzing risk extends beyond focus only on total volatility

Risk impacts are dynamic, managing their exposures is critical to avoiding the next major drawdown



Analysis of Policy Options

We will develop solution options under each framework

Preliminary policy mix solutions will relate to specific objectives/concerns

We will analyze the linkage to liabilities once a policy mix framework is determined

Quantitative modeling approaches rely heavily on numerous assumptions; qualitative judgment by decision makers is also crucial



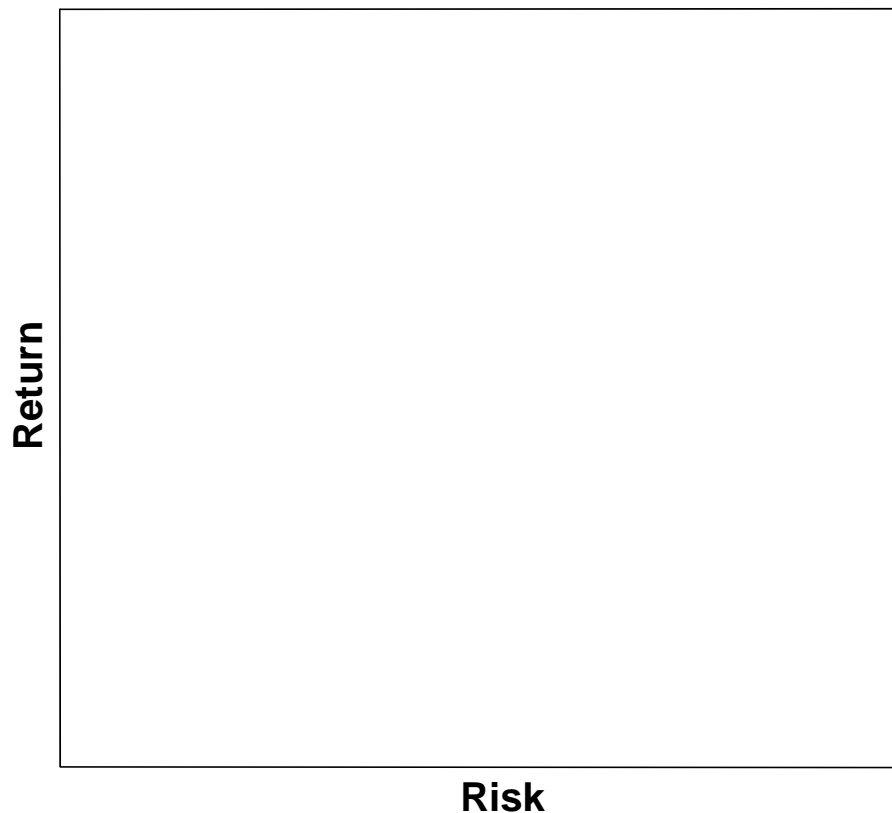
Analysis of Policy Options

Determine the “best” (or “optimal”) portfolios exploring the following potential objectives:

- Highest expected return with similar risk as current policy
 - Equivalent total risk
 - Equivalent drawdown/downside loss
- Minimize risk while maintaining long-term return objective
 - Lowest feasible total risk
 - Lowest feasible downside/drawdown loss
- Minimize total volatility
- Risk management orientation: equal-weight asset classes versus balanced across risk exposures

Analysis of Policy Options

Optimization “basics”



Two dimensions:

Risk

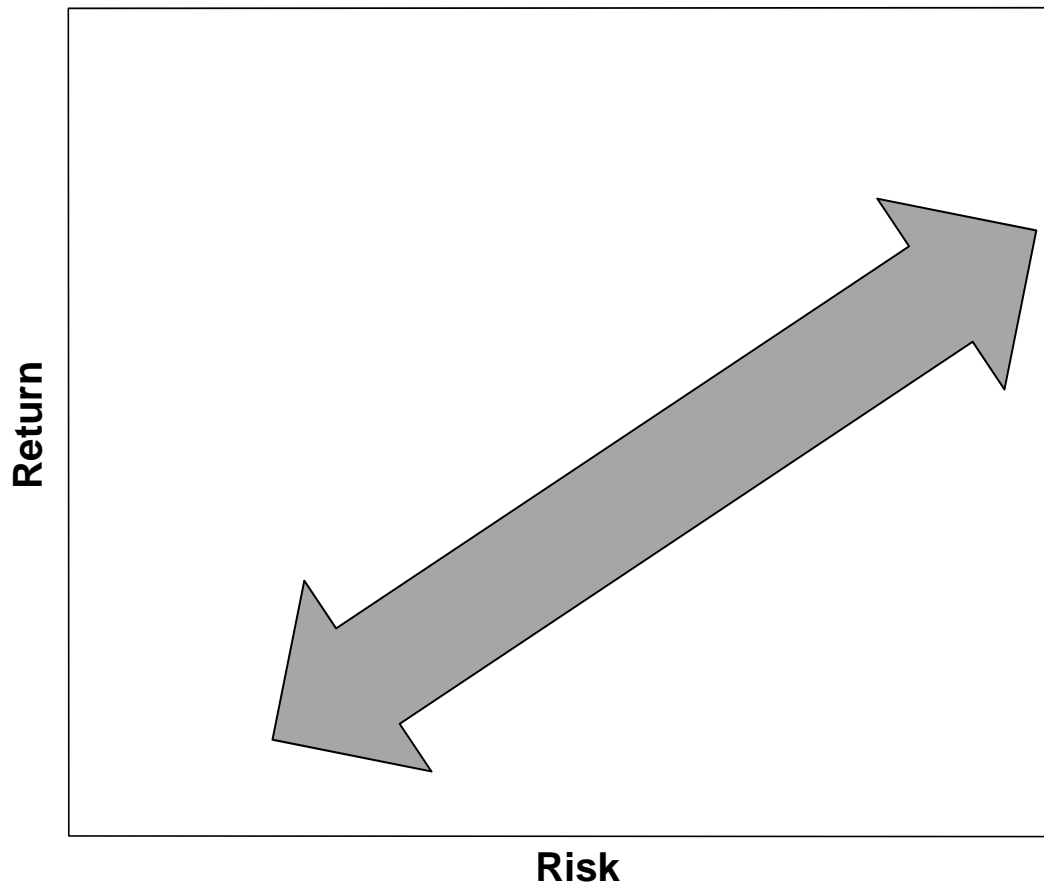
Return

...risk “drives” return

many definitions of
risk

Analysis of Policy Options

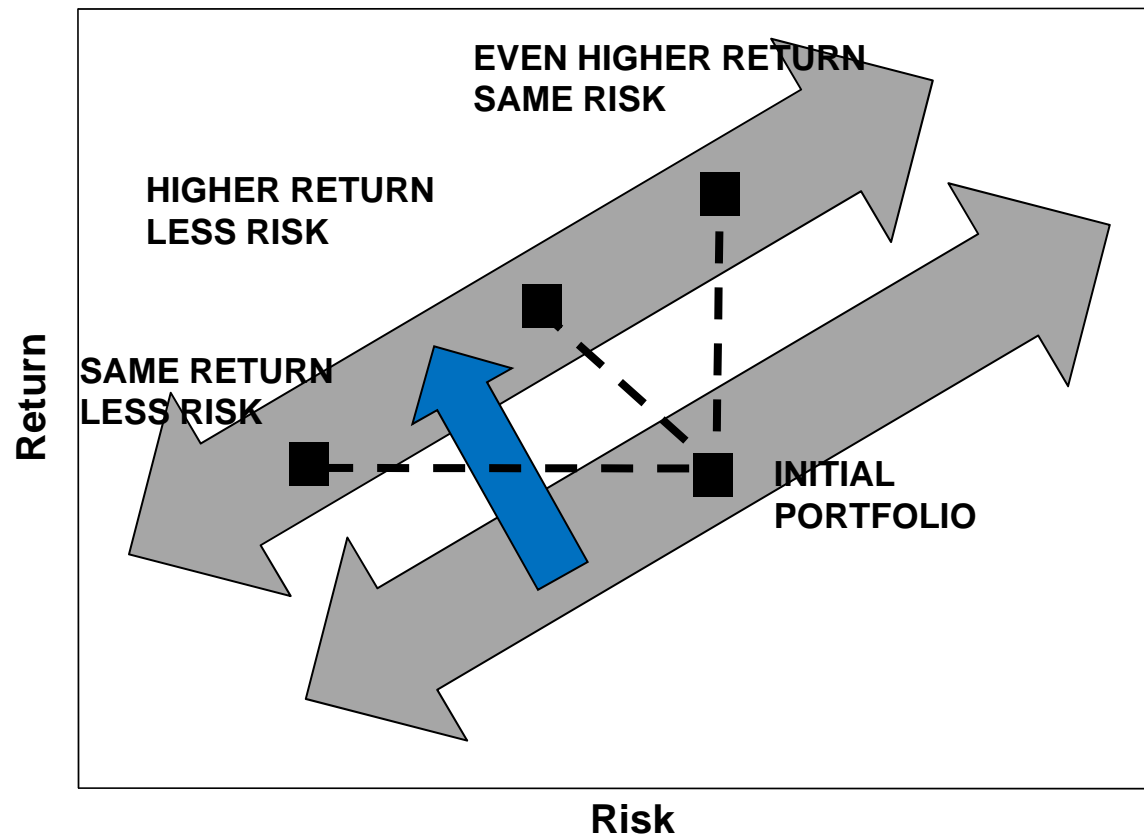
Optimization “basics”



Basic premise: you have to incur more risk to increase return and if you seek lower risk you'll need to accept lower return

Analysis of Policy Options

Optimization “basics”



...but, we are always looking to improve the tradeoff function...



Analysis of Policy Options – Considered Classes and Components

- Asset Class Framework (ACF or Traditional):
 - Five Strategic classes
 - 13 sub-classes
- Risk Class-based Framework (RCF):
 - Seven Strategic classes
 - 19 sub-classes
- Modeling allows for numerous combinations of classes and sub-classes

Analysis of Policy Options – Considered Classes and Components

Current CalSTRS Policy

US Equity	
Intl Equity	
Fixed Income	
Real Estate	
Private Equity	
Inflation-Linked	

Asset Class	Weight
US Equity	38%
Intl. Equity	15%
Fixed Income	21%
Real Estate	12%
Private Equity	12%
Inflation Linked	2%

...policy determined under traditional framework...

Analysis of Policy Options – Considered Classes and Components

Traditional Framework – STRS asset classes and their sub-classes

Asset Class	Sub-Classes												
Private Equity	Priv Eq												
Real Estate		Core RE	ValAdd RE	Opp RE									
Fixed Income					Int Rates	MBS	Credit	High Yld	Core Plus				
Public Equity										US Eq	NonUS Eq		
Inflation Sensitive												TIPS	Infrastrctr

Legend

Core RE	Core Real Estate
Core Plus	Core Plus Fixed Income
Credit	Credit Fixed Income
High Yld	High Yield Fixed Income
Infrastrctr	Infrastructure
Int Rates	Interest Rates Fixed Income (US Treasuries)
MBS	Mortgage Backed Securities Fixed Income
NonUS Eq	Non U.S. Equities
Opp RE	Opportunistic Real Estate
Priv Eq	Private Equity
TIPS	Treasury Inflation Protection Securities
US Eq	U.S. Equities
ValAdd RE	Value Added Real Estate

Analysis of Policy Options – Considered Classes and Components

Risk-based Framework – Preliminary risk classes and their sub-classes

Risk Class	Sub-Classes																	
Growth Risk							Credit	High Yld	US Eq	NonUS Eq								
Private Growth	Priv Eq		ValAdd RE	Opp RE														
Absolute Return					Int Rates	MBS									Oil&Gas	Agricultr	HFOF	L Treas
Eq Risk Diversifying											TIPS			Commods				L Treas
Interest Rates												Converts	Commods	Oil&Gas			HFOF	
Interest Rate Risk		UnL/LL Core RE										Infrastrctr		Commods				
Inflation											TIPS							Bk Lns

- Risk classes likely contain complex structures: 2 to 9 sub-classes
- Risk classes are customizable

Legend

Agricultr	Agriculture/Farmland
Bk Lns	Bank Loans (floating-rate fixed income)
Commods	Commodities
Converts	Convertible Bonds/Fixed Income
Credit	Credit Fixed Income
HFOF	Hedge Funds/Funds of Funds/Other long-short
High Yld	High Yield Fixed Income
Infrastrctr	Infrastructure
Int Rates	Interest Rates Fixed Income (US Treasuries)
L Treas	Long-maturity U.S. Treasuries (10+ years)
MBS	Mortgage Backed Securities Fixed Income
NonUS Eq	Non U.S. Equities
Oil&Gas	Oil & Gas projects
Opp RE	Opportunistic Real Estate
Priv Eq	Private Equity
TIPS	Treasury Inflation Protection Securities
US Eq	U.S. Equities
UnL/LL Core RE	Unlevered/Low-levered Core RE
ValAdd RE	Value Added Real Estate

Analysis of Policy Options – Considered Classes and Components

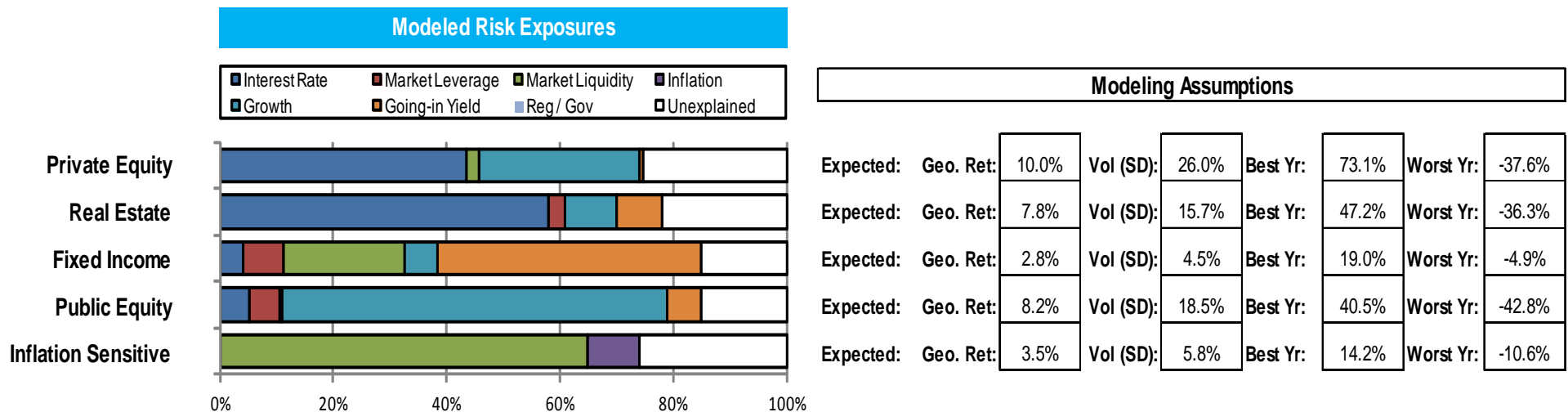
Risk-based Framework

Risk Class	Description
Growth Risk	Heavily dependent on economic growth prospects.
Private Growth	Privately-held investments excluding Core real estate.
Absolute Return	Designed to produce positive returns regardless of risk environment.
Eq Risk Diversifying	Designed to produce positive returns when equities are performing poorly.
Interest Rates	Designed to produce positive returns when interest rates are rising.
Interest Rate Risk	Designed to produce positive returns when the interest rates environment is volatile.
Inflation	Designed to produce positive returns when inflation is rising.

- Within each risk class, components are optimized to best reflect specific exposures to the six STRS risk factors

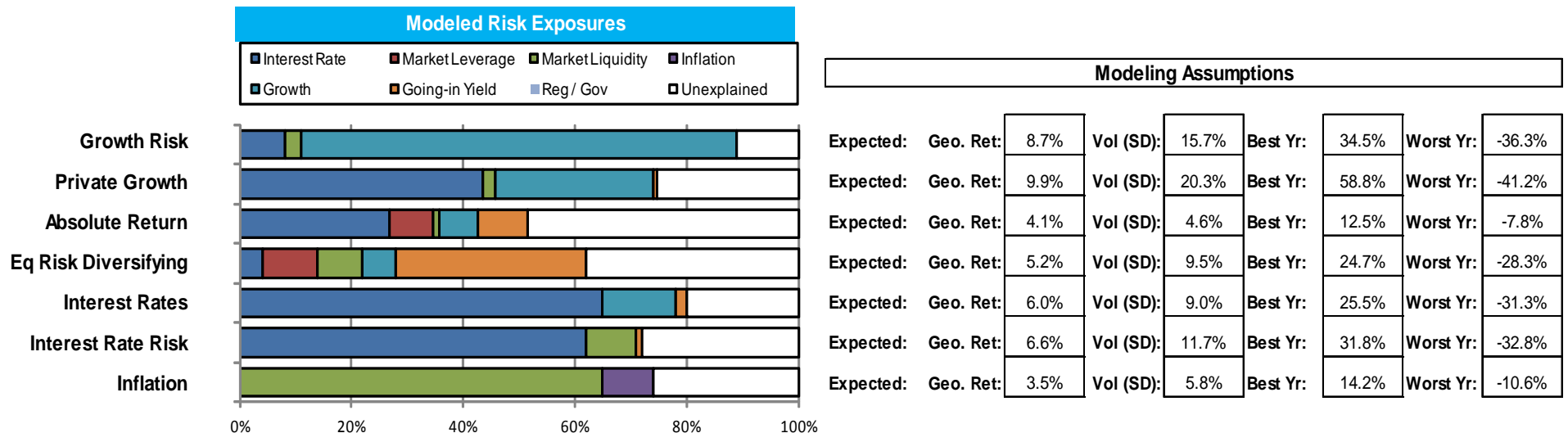
Analysis of Policy Options – Considered Classes and Components

Risk-exposures and assumptions: Traditional Classes



Analysis of Policy Options – Considered Classes and Components

Risk-exposures and assumptions: Risk Classes



- Risk classes generally have “purer” allocations to specific risks than asset classes



Analysis of Policy Options – Finding Optimal Portfolios

Three basic issues:

- Outperform policy portfolio (either higher return, lower risk, or both)
- Apply different definitions of risk (total volatility, shorter-term downside/drawdown risk)
- Allocation to macro risk factors

Analysis of Policy Options – Sample Summary (Current Policy Mix)

Asset Class Framework (ACF)	Curr. Policy
US Equities	35%
Intl Equities	18%
Fixed Income	21%
Real Estate	12%
Private Eq	12%
Inflation Sensitive	2%
Total	100%
<i>Simulation Results (1,000 Scenarios)</i>	
Median 10-Yr Geo. Avg. Ret.	7.9%
Median Annualized SD	12.0%
2-Yr. Drawdown at 10% Prob. (in \$B)	(28.3)
Max 2-Yr. Drawdown (in \$B)	(62.7)
Risk Factor Exposures	
Interest Rate Risk	6%
Leverage Risk	0%
Market Liquidity Risk	0%
Inflation Risk	0%
Growth Risk	55%
Constant	9%
Reg / Gov Risk	0%
Unexplained	30%
Total	100%

Traditional Framework

Analysis of Policy Options – Sample Summary (Current Policy Mix)

Asset Class Framework (ACF)	Curr. Policy
US Equities	35%
Intl Equities	18%
Fixed Income	21%
Real Estate	12%
Private Eq	12%
Inflation Sensitive	2%
Total	100%
<u>Simulation Results (1,000 Scenarios)</u>	
Median 10-Yr Geo. Avg. Ret.	7.9%
Median Annualized SD	12.0%
2-Yr. Drawdown at 10% Prob. (in \$B)	(28.3)
Max 2-Yr. Drawdown (in \$B)	(62.7)

Allocation %'s to strategic classes
Either "asset classes" or "risk classes"
Shown at left is STRS' current policy allocation

Risk Factor Exposures	
Interest Rate Risk	6%
Leverage Risk	0%
Market Liquidity Risk	0%
Inflation Risk	0%
Growth Risk	55%
Constant	9%
Reg / Gov Risk	0%
Unexplained	30%
Total	100%

Traditional Framework

Analysis of Policy Options – Sample Summary (Current Policy Mix)

Asset Class Framework (ACF)	Curr. Policy
US Equities	35%
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Total	100%
<i>Simulation Results (1,000 Scenarios)</i>	
Median 10-Yr Geo. Avg. Ret.	7.9%
Median Annualized SD	12.0%
2-Yr. Drawdown at 10% Prob. (in \$B)	(28.3)
Max 2-Yr. Drawdown (in \$B)	(62.7)
Risk Factor Exposures	
Interest Rate Risk	6%
Leverage Risk	0%
Market Liquidity Risk	0%
Inflation Risk	0%
Growth Risk	55%
Constant	9%
Reg / Gov Risk	0%
Unexplained	30%
Total	100%

Optimized results from simulations of 1,000 scenarios

Median 10-Yr Geo. Avg. Ret. – the median geometric average (compound) return of the optimized portfolio over 10 years

Median Annualized SD – the median annualized Standard Deviation (total volatility) of the optimized portfolio over 10 years

2-Yr Drawdown at 10% Prob. – Average two-year \$ loss incurred by the optimized portfolio during the worst 10% of all scenarios

Max 2-Yr Drawdown – the worst 2-yr \$ loss incurred by the optimized portfolio

Traditional Framework

Analysis of Policy Options – Sample Summary (Current Policy Mix)

Asset Class Framework (ACF)	Curr. Policy
US Equities	35%
Intl Equities	18%
Fixed Income	21%
Real Estate	12%
Private Eq	12%
Inflation Sensitive	2%
Total	100%

Simulation Results (1,000 Scenarios)

Median 10-Yr Geo. Avg. Ret.	7.9%
Median Annualized SD	12.0%
2-Yr. Drawdown at 10% Prob. (in \$B)	(28.3)
Max 2-Yr. Drawdown (in \$B)	(62.7)

Risk Factor Exposures

Interest Rate Risk	6%
Leverage Risk	0%
Market Liquidity Risk	0%
Inflation Risk	0%
Growth Risk	55%
Constant	9%
Reg / Gov Risk	0%
Unexplained	30%
Total	100%

Exposures to CalSTRS' six risk factors

%s indicate how much of the volatility in the optimized portfolio's returns over the recent investment cycle are explained by a specific factor. For example, at left, Growth Risk has explained 55% of the policy portfolio's total return volatility

Traditional Framework

Analysis of Policy Options – Current Policy Mix

Asset Class Framework (ACF)

Curr. Policy

US Equities	35%
Intl Equities	18%
Fixed Income	21%
Real Estate	12%
Private Eq	12%
Inflation Sensitive	2%
Total	100%

Simulation Results (1,000 Scenarios)

Median 10-Yr Geo. Avg. Ret.	7.9%	➡	Expected return exceeds assumed rate of return
Median Annualized SD	12.0%	➡	Expect a return lower than -4% about 1-in-6 years
2-Yr. Drawdown at 10% Prob. (in \$B)	(28.3)	➡	10% chance of losing approximately \$28B over a 2-year period (based on \$142B)
Max 2-Yr. Drawdown (in \$B)	(62.7)	➡	Expected maximum potential loss over 2-year period (1 in 600)

Risk Factor Exposures

Interest Rate Risk	6%
Leverage Risk	0%
Market Liquidity Risk	0%
Inflation Risk	0%
Growth Risk	55%
Constant	9%
Reg / Gov Risk	0%
Unexplained	30%
Total	100%

Significant bias toward growth risk: ≈80% of explainable risk is growth risk

Traditional Framework

Analysis of Policy Options – Match Policy Risk, Maximize Return

Portfolios optimized using two versions of risk

Standard Deviation (traditional) – total volatility range (upside & downside)

Downside Deviation – severe downside outcomes, more relevant when expected distribution is not necessarily symmetric

Same Risk/Max the Return						
		Mins	Maxs	StdDev	DownDev	
				Constrained	Constrained	Curr. Policy
Asset Class Framework (ACF)						
US Equities	20%	45%	23%	32%	35%	Lower Fixed Income allocations
Intl Equities	12%	45%	25%	18%	18%	
Fixed Income	15%	50%	15%	15%	21%	
Real Estate	9%	15%	15%	15%	12%	
Private Eq	9%	15%	15%	15%	12%	
Inflation Sensitive	0%	25%	7%	5%	2%	
Total			100%	100%	100%	
Simulation Results (1,000 Scenarios)						
Median 10-Yr Geo. Avg. Ret.			8.2%	8.2%	7.9%	Expected returns improve
Median Annualized SD			12.0%	12.2%	12.0%	
2-Yr. Drawdown at 10% Prob. (in \$B)			(26.9)	(28.3)	(28.3)	
Max 2-Yr. Drawdown (in \$B)			(62.7)	(64.2)	(62.7)	
Risk Factor Exposures						
Interest Rate Risk			8%	9%	6%	Even higher biases toward growth
Leverage Risk			5%	0%	0%	
Market Liquidity Risk			0%	6%	0%	
Inflation Risk			5%	0%	0%	
Growth Risk			66%	69%	55%	
Going-in Yield			3%	0%	9%	
Reg / Gov Risk			0%	0%	0%	
Unexplained			13%	16%	30%	
Total			100%	100%	100%	
Traditional Framework						

Lower Fixed Income allocations

Expected returns improve

Even higher biases toward growth

Traditional Framework

Analysis of Policy Options – Match Policy Return, Minimize Risk

		Same Return/Min the Risk				
			StdDev	DownDev		
	Mins	Maxs	Constrained	Constrained	Curr. Policy	
Asset Class Framework (ACF)						
US Equities	20%	45%	26%	26%	35%	Lower Fixed Income allocations, significant allocation to Inflation Sensitive,
Intl Equities	12%	45%	18%	18%	18%	
Fixed Income	15%	50%	15%	15%	21%	
Real Estate	9%	15%	15%	15%	12%	
Private Eq	9%	15%	15%	15%	12%	
Inflation Sensitive	0%	25%	11%	11%	2%	Regardless of risk measure, same portfolio
Total			100%	100%	100%	
Simulation Results (1,000 Scenarios)						
Median 10-Yr Geo. Avg. Ret.			7.9%	7.9%	7.9%	Expected risks decline
Median Annualized SD			11.1%	11.1%	12.0%	
2-Yr. Drawdown at 10% Prob. (in \$B)			(25.4)	(25.4)	(28.3)	
Max 2-Yr. Drawdown (in \$B)			(59.7)	(59.7)	(62.7)	
Risk Factor Exposures						
Interest Rate Risk			8%	8%	6%	Higher biases toward growth
Leverage Risk			6%	6%	0%	
Market Liquidity Risk			0%	0%	0%	
Inflation Risk			4%	4%	0%	
Growth Risk			66%	66%	55%	
Going-in Yield			3%	3%	9%	
Reg / Gov Risk			0%	0%	0%	
Unexplained			13%	13%	30%	
Total			100%	100%	100%	
						Traditional Framework

Analysis of Policy Options – Match Policy Risk, Maximize Return

				Same Risk/Max the Return					
		Mins	Maxs	StdDev	DownDev				
				Constrained	Constrained	Curr. Policy			
Risk Class Framework (RCF)									
Growth Risk		25%	70%	34%	45%	}	Lower amounts of public equity-oriented classes		
Private Investments		18%	30%	30%	30%		}	Again, max out private classes, but Core RE not included	
Absolute Return		0%	25%	0%	0%			}	25%-35% in completely new classes
Growth Risk Diversifying		0%	25%	0%	0%				
Interest Rates		10%	25%	10%	10%				
Interest Rate Uncertainty		5%	25%	16%	5%				
Inflation		10%	25%	10%	10%				
Total				100%	100%				
<u>Simulation Results (1,000 Scenarios)</u>									
Median 10-Yr Geo. Avg. Ret.				8.3%	8.3%	7.9%	}	Higher return/lower risk solutions versus traditional framework	
Median Annualized SD				10.8%	12.1%	12.0%		}	10% potential loss amount under SD option \$3B lower than traditional framework
2-Yr. Drawdown at 10% Prob. (in \$B)				(23.9)	(28.3)	(28.3)			
Max 2-Yr. Drawdown (in \$B)				(61.2)	(65.6)	(62.7)			
Risk Factor Exposures									
Interest Rate Risk				10%	12%	6%	}	Growth bias still evident, but equivalent or lower than traditional framework	
Leverage Risk				0%	0%	0%			
Market Liquidity Risk				0%	0%	0%			
Inflation Risk				3%	0%	0%			
Growth Risk				57%	69%	55%			
Going-in Yield				6%	0%	9%			
Reg / Gov Risk				0%	0%	0%			
Unexplained				24%	19%	30%			
Total				100%	100%	100%			

Risk Class Framework

Analysis of Policy Options – Match Policy Return, Minimize Risk

		Same Return/Min the Risk		Curr. Policy	
		StdDev	DownDev		
		Constrained	Constrained		
Risk Class Framework (RCF)		Mins	Maxs		
Growth Risk	25%	70%	29%	28%	Lower amounts of public equity-oriented classes
Private Investments	18%	30%	29%	30%	
Absolute Return	0%	25%	1%	2%	
Growth Risk Diversifying	0%	25%	0%	1%	Again, max out private classes, but Core RE not included
Interest Rates	10%	25%	11%	12%	
Interest Rate Uncertainty	5%	25%	11%	10%	
Inflation	10%	25%	19%	17%	39%-41% in completely new classes
Total			100%	100%	
<u>Simulation Results (1,000 Scenarios)</u>					
Median 10-Yr Geo. Avg. Ret.		7.9%	7.9%	7.9%	Significant drop in expected volatility
Median Annualized SD		9.9%	10.0%	12.0%	
2-Yr. Drawdown at 10% Prob. (in \$B)		(22.4)	(22.4)	(28.3)	10% potential loss amount under both options \$3B lower than traditional framework
Max 2-Yr. Drawdown (in \$B)		(56.7)	(65.6)	(62.7)	
Risk Factor Exposures					
Interest Rate Risk		9%	9%	6%	Growth bias still evident, but equivalent or lower than traditional framework
Leverage Risk		0%	0%	0%	
Market Liquidity Risk		0%	0%	0%	
Inflation Risk		6%	6%	0%	
Growth Risk		55%	54%	55%	In both cases, growth as % of explainable risk is lower
Going-in Yield		7%	7%	9%	
Reg / Gov Risk		0%	0%	0%	
Unexplained		23%	24%	30%	
Total		100%	100%	100%	


Risk Class Framework

Analysis of Policy Options – Lowest Volatility: ACF vs. RCF

					Lowest Volatility			
					StdDev		DownDev	
					Constrained		Constrained	
					Mins	Maxs	Mins	Maxs
Asset Class Framework (ACF)								
US Equities					20%	45%	20%	20%
Intl Equities					12%	45%	12%	12%
Fixed Income					15%	50%	25%	37%
Real Estate					9%	15%	9%	10%
Private Eq					9%	15%	9%	9%
Inflation Sensitive					0%	25%	25%	12%
Total							100%	100%
Simulation Results (1,000 Scenarios)								
Median 10-Yr Geo. Avg. Ret.							6.6%	6.5%
Median Annualized SD							7.9%	8.1%
Drawdown at 10% Prob. (in \$B)							(16.4)	(16.4)
Max 2-Yr. Drawdown (in \$B)							(43.3)	(43.3)
Risk Factor Exposures								
Interest Rate Risk							10%	10%
Leverage Risk							6%	7%
Market Liquidity Risk							1%	1%
Inflation Risk							0%	0%
Growth Risk							65%	65%
Going-in Yield							6%	5%
Reg / Gov Risk							0%	0%
Unexplained							12%	12%
Total							100%	100%
					Lowest Volatility			
					StdDev		DownDev	
					Constrained		Constrained	
					Mins	Maxs	Mins	Maxs
Risk Class Framework (RCF)								
Growth Risk					25%	70%	25%	25%
Private Investments					18%	30%	18%	18%
Absolute Return					0%	25%	11%	16%
Growth Risk Diversifying					0%	25%	1%	0%
Interest Rates					10%	25%	10%	10%
Interest Rate Uncertainty					5%	25%	10%	6%
Inflation					10%	25%	25%	25%
Total							100%	100%
Simulation Results (1,000 Scenarios)								
Median 10-Yr Geo. Avg. Ret.							7.0%	6.8%
Median Annualized SD							7.6%	7.7%
Drawdown at 10% Prob. (in \$B)							(16.4)	(16.4)
Max 2-Yr. Drawdown (in \$B)							(46.3)	(46.3)
Risk Factor Exposures								
Interest Rate Risk							8%	12%
Leverage Risk							4%	0%
Market Liquidity Risk							1%	7%
Inflation Risk							5%	0%
Growth Risk							56%	60%
Going-in Yield							6%	0%
Reg / Gov Risk							0%	0%
Unexplained							20%	21%
Total							100%	100%

Risk-based has higher expected returns and lower expected total volatilities

Risk-based has lower growth bias but higher unexplained



Analysis of Policy Options – Risk Management Considerations

Consider that each macro risk has an equivalent likelihood of occurrence

If that is the case, weight different risks equivalently

Using the ACF, either (i) equal-weight the assets or (ii) weight the assets so that each asset contributes the same amount of risk to the total portfolio

Using the RCF, balance macro risk exposures to equivalent or near-equivalent proportions

Analysis of Policy Options – ACF Approaches: Weighting the Assets

Asset Class Framework (ACF)		Eq. Wgtd.*
US Equities		17%
Intl Equities		17%
Fixed Income		17%
Real Estate		17%
Private Eq		17%
Inflation Sensitive		17%
Total		100%

Simulation Results (1,000 Scenarios)

Median 10-Yr Geo. Avg. Ret.	7.6%
Median Annualized SD	10.0%
Drawdown at 10% Prob. (in \$B)	(22.4)
Max 2-Yr. Drawdown (in \$B)	(53.7)

Risk Factor Exposures

Interest Rate Risk	13%
Leverage Risk	0%
Market Liquidity Risk	6%
Inflation Risk	0%
Growth Risk	65%
Going-in Yield	0%
Reg / Gov Risk	0%
Unexplained	16%
Total	100%

Equal-weight by assets (left table); equal-weight by risk contribution (right table) - since equity assets have more risk to begin with, they get assigned less weight

Asset Class Framework (ACF)		Eq. Asset Risk Wgt.**
US Equities		7%
Intl Equities		6%
Fixed Income		38%
Real Estate		11%
Private Eq		5%
Inflation Sensitive		33%
Total		100%

Simulation Results (1,000 Scenarios)

Median 10-Yr Geo. Avg. Ret.	5.2%
Median Annualized SD	5.0%
Drawdown at 10% Prob. (in \$B)	(7.5)
Max 2-Yr. Drawdown (in \$B)	(28.3)

Risk Factor Exposures

Interest Rate Risk	2%
Leverage Risk	7%
Market Liquidity Risk	56%
Inflation Risk	0%
Growth Risk	12%
Going-in Yield	16%
Reg / Gov Risk	0%
Unexplained	7%
Total	100%

*Weighted by capital invested in each class

**Weighted so that each asset contributes the same proportion to total portfolio volatility

Analysis of Policy Options – ACF Approaches: Weighting the Assets

Asset Class Framework (ACF)		Eq. Wgtd.*
US Equities	17%	
Intl Equities	17%	
Fixed Income	17%	
Real Estate	17%	
Private Eq	17%	
Inflation Sensitive	17%	
Total	100%	

<u>Simulation Results (1,000 Scenarios)</u>		
Median 10-Yr Geo. Avg. Ret.	7.6%	
Median Annualized SD	10.0%	
Drawdown at 10% Prob. (in \$B)	(22.4)	
Max 2-Yr. Drawdown (in \$B)	(53.7)	

Risk Factor Exposures		
Interest Rate Risk	13%	
Leverage Risk	0%	
Market Liquidity Risk	6%	
Inflation Risk	0%	
Growth Risk	65%	
Going-in Yield	0%	
Reg / Gov Risk	0%	
Unexplained	16%	
Total	100%	

Equal-weight by assets (left table); equal-weight by risk contribution (right table) - since equity assets have more risk to begin with, they get assigned less weight

Equal-weighting by asset has higher expected return (close to long-term assumption); equal weighting by risk causes return to be much lower due to large fixed income weights, but risk levels much lower

Asset Class Framework (ACF)		Eq. Asset Risk Wgt.**
US Equities	7%	
Intl Equities	6%	
Fixed Income	38%	
Real Estate	11%	
Private Eq	5%	
Inflation Sensitive	33%	
Total	100%	

<u>Simulation Results (1,000 Scenarios)</u>		
Median 10-Yr Geo. Avg. Ret.	5.2%	
Median Annualized SD	5.0%	
Drawdown at 10% Prob. (in \$B)	(7.5)	
Max 2-Yr. Drawdown (in \$B)	(28.3)	

Risk Factor Exposures		
Interest Rate Risk	2%	
Leverage Risk	7%	
Market Liquidity Risk	56%	
Inflation Risk	0%	
Growth Risk	12%	
Going-in Yield	16%	
Reg / Gov Risk	0%	
Unexplained	7%	
Total	100%	

*Weighted by capital invested in each class

**Weighted so that each asset contributes the same proportion to total portfolio volatility

Analysis of Policy Options – ACF Approaches: Weighting the Assets

Asset Class Framework (ACF)		Eq. Wgtd.*		Asset Class Framework (ACF)		Eq. Asset Risk Wgt.**
US Equities	17%	Equal-weight by assets (left table); equal-weight by risk contribution (right table) - since equity assets have more risk to begin with, they get assigned less weight		US Equities	7%	
Intl Equities	17%			Intl Equities	6%	
Fixed Income	17%			Fixed Income	38%	
Real Estate	17%			Real Estate	11%	
Private Eq	17%			Private Eq	5%	
Inflation Sensitive	17%			Inflation Sensitive	33%	
Total	100%			Total	100%	
<u>Simulation Results (1,000 Scenarios)</u>		Equal-weighting by asset has higher expected return (close to long-term assumption); equal weighting by risk causes return to be much lower due to large fixed income weights, but risk levels much lower		<u>Simulation Results (1,000 Scenarios)</u>		
Median 10-Yr Geo. Avg. Ret.	7.6%			Median 10-Yr Geo. Avg. Ret.	5.2%	
Median Annualized SD	10.0%			Median Annualized SD	5.0%	
Drawdown at 10% Prob. (in \$B)	(22.4)			Drawdown at 10% Prob. (in \$B)	(7.5)	
Max 2-Yr. Drawdown (in \$B)	(53.7)			Max 2-Yr. Drawdown (in \$B)	(28.3)	
Risk Factor Exposures		Regardless of asset-weighting approach, macro risk exposures still remain biased; biases are in contrasting factors due to asset weighting schemes		Risk Factor Exposures		
Interest Rate Risk	13%			Interest Rate Risk	2%	
Leverage Risk	0%			Leverage Risk	7%	
Market Liquidity Risk	6%			Market Liquidity Risk	56%	
Inflation Risk	0%			Inflation Risk	0%	
Growth Risk	65%			Growth Risk	12%	
Going-in Yield	0%			Going-in Yield	16%	
Reg / Gov Risk	0%			Reg / Gov Risk	0%	
Unexplained	16%			Unexplained	7%	
Total	100%			Total	100%	

*Weighted by capital invested in each class

**Weighted so that each asset contributes the same proportion to total portfolio volatility

Analysis of Policy Options – Balancing the Risk Exposures

Risk Balanced

Risk Balanced Framework (ACF+RCF)

US Equities	13%
Intl Equities	7%
Private Growth	10%
Absolute Return	60%
Interest Rate Uncertainty	10%
Total	100%

Simulation Results (1,000 Scenarios)

Median 10-Yr Geo. Avg. Ret.	6.3%
Median Annualized SD	7.2%
2-Yr. Drawdown at 10% Prob. (in \$B)	(14.9)
Max 2-Yr. Drawdown (in \$B)	(41.8)

Risk Factor Exposures

Interest Rate Risk	13%
Leverage Risk	12%
Market Liquidity Risk	14%
Inflation Risk	0%
Growth Risk	15%
Going-in Yield	17%
Reg / Gov Risk	0%
Unexplained	29%
Total	100%

Instead of merely balancing by asset class volatilities, balance by the type of macro risk; in this case portfolio is balanced across 4 of the 6 macro risk factors, no significant tilt to a specific risk

Analysis of Policy Options – Balancing the Risk Exposures

Risk Balanced

Risk Balanced Framework (ACF+RCF)

US Equities	13%
Intl Equities	7%
Private Growth	10%
Absolute Return	60%
Interest Rate Uncertainty	10%
Total	100%

Simulation Results (1,000 Scenarios)

Median 10-Yr Geo. Avg. Ret.	6.3%
Median Annualized SD	7.2%
2-Yr. Drawdown at 10% Prob. (in \$B)	(14.9)
Max 2-Yr. Drawdown (in \$B)	(41.8)

Result falls between traditional equal-weighting options (see prior)

Risk Factor Exposures

Interest Rate Risk	13%
Leverage Risk	12%
Market Liquidity Risk	14%
Inflation Risk	0%
Growth Risk	15%
Going-in Yield	17%
Reg / Gov Risk	0%
Unexplained	29%
Total	100%

Instead of merely balancing by asset class volatilities, balance by the type of macro risk; in this case portfolio is balanced across 4 of the 6 macro risk factors, no significant tilt to a specific risk

Analysis of Policy Options – Balancing the Risk Exposures

Risk Balanced

Risk Balanced Framework (ACF+RCF)

US Equities	13%
Intl Equities	7%
Private Growth	10%
Absolute Return	60%
Interest Rate Uncertainty	10%
Total	100%

A mixture of asset classes and risk classes utilized to obtain the best macro risk diversification solution; very different than traditional growth-biased portfolio

Simulation Results (1,000 Scenarios)


Median 10-Yr Geo. Avg. Ret.	6.3%
Median Annualized SD	7.2%
2-Yr. Drawdown at 10% Prob. (in \$B)	(14.9)
Max 2-Yr. Drawdown (in \$B)	(41.8)

Result falls between traditional equal-weighting options (see prior)

Risk Factor Exposures

Interest Rate Risk	13%
Leverage Risk	12%
Market Liquidity Risk	14%
Inflation Risk	0%
Growth Risk	15%
Going-in Yield	17%
Reg / Gov Risk	0%
Unexplained	29%
Total	100%

Instead of merely balancing by asset class volatilities, balance by the type of macro risk; in this case portfolio is balanced across 4 of the 6 macro risk factors, no significant tilt to a specific risk



Analysis of Policy Options – Balanced Risk Exposures Comments

Balanced Risk Exposures (BRE) findings consistent with other practitioner findings*

BRE portfolio's expected return falls below STRS' objectives

However, the BRE portfolio exhibits a solid return-risk tradeoff and very little risk bias

“Risk Parity” advocates typically apply leverage to a BRE portfolio to meet return objective

Advocates utilize a broad spectrum of investment vehicles to capture risk exposures

Investor choice: growth risk factor bias or much less bias, but leverage or lower returns

*See, for example, “The 5-Percent Solution,” Asness, Clifford, Ilmanen, Anti, Institutional Investor, May, 15,2012;
“Diversification–still the only free lunch?,” Yazann, Rohami, Santiago, Katherin, JP Morgan, October 2012.



Presentation Summary

- PCA analyzed two allocation frameworks: Asset Class (ACF) and Risk Class (RCF)
- Quantitative analysis indicates the RCF provides favorable return-risk tradeoffs
- PCA recommends STRS take further steps to implement a RCF
- Under a RCF, strategic classes would be reorganized along risk management considerations
- From a qualitative and organizational standpoint, implementing a RCF could present certain challenges



Appendix

Unconstrained Optimizations

	Mins	Maxs	Same Risk/Max the Return		Same Return/Min the Risk		Lowest Volatility		
			Std Dev	DownDev	Std Dev	DownDev	Std Dev	DownDev	
			Unconstrained	Unconstrained	Unconstrained	Unconstrained	Unconstrained	Unconstrained	
Asset Class Framework (ACF)									
US Equities	20%	45%	28%	15%	15%	0%	0%	0%	
Intl Equities	12%	45%	8%	7%	13%	1%	0%	0%	
Fixed Income	15%	50%	0%	0%	0%	0%	71%	72%	
Real Estate	9%	15%	49%	44%	39%	41%	7%	4%	
Private Eq	9%	15%	11%	30%	10%	27%	3%	4%	
Inflation Sensitive	0%	25%	4%	4%	23%	31%	19%	20%	
Total			100%	100%	100%	100%	100%	100%	
Simulation Results (1,000 Scenarios)									
Median 10-Yr Geo. Avg. Ret.			8.9%	9.3%	7.9%	7.9%	3.7%	3.6%	
Median Annualized SD			12.0%	13.5%	9.5%	10.2%	3.9%	3.9%	
2-Yr. Drawdown at 10% Prob. (in \$B)			(26.9)	(28.3)	(20.9)	(16.4)	(3.0)	(3.0)	
Max 2-Yr. Drawdown (in \$B)			(67.1)	(67.1)	(55.2)	(47.7)	(16.4)	(14.9)	
Risk Class Framework (RCF)									
Growth Risk	25%	70%	50%	43%	1%	0%	0%	0%	
Private Investments	18%	30%	26%	32%	37%	39%	0%	0%	
Absolute Return	0%	25%	0%	0%	6%	7%	65%	70%	
Growth Risk Diversifying	0%	25%	0%	0%	5%	6%	0%	0%	
Interest Rates	10%	25%	0%	0%	1%	0%	0%	0%	
Interest Rate Uncertainty	5%	25%	24%	25%	35%	35%	0%	0%	
Inflation	10%	25%	0%	0%	15%	13%	35%	30%	
Total			100%	100%	100%	100%	100%	100%	
Simulation Results (1,000 Scenarios)									
Median 10-Yr Geo. Avg. Ret.			8.8%	8.9%	7.9%	7.9%	4.0%	4.1%	
Median Annualized SD			12.0%	12.2%	9.2%	9.3%	3.8%	3.8%	
2-Yr. Drawdown at 10% Prob. (in \$B)			(22.4)	(28.3)	(17.9)	(17.9)	(3.0)	(3.0)	
Max 2-Yr. Drawdown (in \$B)			(53.7)	(68.6)	(49.2)	(49.2)	(17.9)	(17.9)	
Differences (RCF - ACF)									
Median 10-Yr Geo. Avg. Ret.			-0.1%	-0.4%	0.0%	0.0%	0.3%	0.5%	
Median Annualized SD			0.1%	-1.3%	-0.3%	-0.9%	-0.1%	-0.1%	
2-Yr. Drawdown at 10% Prob. (in \$B)			4.5	-	3.0	(1.5)	-	-	
Max 2-Yr. Drawdown (in \$B)			13.4	(1.5)	6.0	(1.5)	(1.5)	(3.0)	

