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SCERS
SACRAMENTO COUNTY
EMPLOYEES' RETIREMENT SYSTEM

For Agenda of:
September 21, 2016

September 16, 2016

TO: President and Members
                  Board of Retirement

FROM: Steve Davis
                  Deputy Chief Investment Officer

SUBJECT: Education on Approaches to Asset Class Development

INTRODUCTION:

Over the past few months, SCERS has initiated an asset liability modeling ('ALM') study. As you will recall, at the May Board meeting Verus provided an initial introduction to the ALM process, and the approach that Verus takes to conducting an ALM study. The process includes: (1) The identification of the objectives of an ALM study; (2) An Enterprise Risk Tolerance analysis and discussion with the Board, which helps to identify and prioritize investment-related objectives, principles and risks; (3) The development of a liability model; (4) The modeling of asset allocation portfolios; and (5) The review of the ALM study results that will lead to a recommended and approved asset allocation.

At the July Board meeting, Verus and Staff led a discussion with your Board around the topic of Enterprise Risk Tolerance ('ERT'). To assist in the ERT analysis and discussion, Staff and Verus developed a survey which your Board completed, the results of which will play a part in designing and recommending SCERS' strategic asset allocation.

Verus is currently conducting and developing the liability model, which is anticipated to be presented at the October Board meeting. While this is being completed, Staff and Verus wanted to provide continuing education at the September Board meeting, specifically related to risk based approaches to asset allocation that have been communicated previously, as these are concepts which will most likely be incorporated into the modeling of assets and liabilities, and the presentation of asset mixes that will be chosen as part of the ALM study.

RECAP ON APPROACHES TO ALM:

As you will recall, the approach that Verus takes to conducting an ALM study is different than previous approaches used for SCERS' ALM studies. Verus approaches ALM by looking at the exercise through multiple lenses, which include: (1) Risk factor exposures; (2) Economic factor exposures (how is a portfolio exposed to different economic environments); (3) Stochastic projections (using Monte Carlo models to develop capital market assumptions); (4) Deterministic projections (using actuarial assumptions to determine funded status outcomes); and (5) Stress tests.

As mentioned previously, SCERS last conducted an ALM study in 2011 with SIS. SIS and Staff used mean variance optimization ('MVO') as the backbone for the study, but at that time also believed that sole reliance on the MVO approach would not necessarily produce a portfolio that was truly diversified. Therefore, Staff and SIS incorporated alternative risk-based approaches, specifically an economic regime approach ('ER') and a risk factor approach ('RF'). In addition, Staff and SIS explored relabeling and redefining asset class groupings that were better aligned to the various risk lenses. The objective was to create a portfolio that was not only efficient according to the MVO approach, but one that better achieved true diversification.

As background, mean variance optimization ('MVO') is a universally applied, and the most common historical approach to designing strategic asset allocations. MVO takes the expected returns and historical standard deviations (volatility), along with correlations of defined assets classes, and forms capital market expectations. These expectations are run through an optimizer to arrive at optimal mixes of asset classes along the efficient frontier (a graph that plots optimal portfolios that have the highest expected return for a given level of risk).
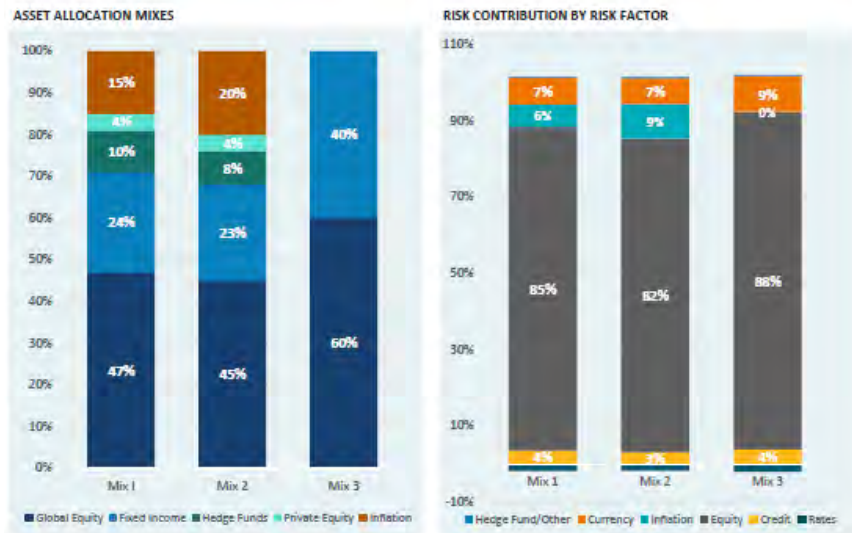
MVO is effective at diversifying across asset classes and geographies, but the MVO approach has several shortcomings, including: (1) Utilizing standard deviation as the sole measure of risk; (2) Utilizing capital market projections based off of historical data, to forecast the future, which can prove challenging; and (3) Using normal return distribution assumptions, which underestimates the frequency and severity of 'left tail' events (negative skew and excess kurtosis). MVO can mask certain risks that are inherent within asset classes, which can result in over diversification within some asset classes and under diversification within others. For example, fixed income serves two roles – anchor to safety/diversifier and return generator. Both roles are leveraged to different risk factors. By mixing all fixed income investments under the umbrella of a fixed income asset class, the portfolio can be over or under diversified relative to the role that the asset class is expected to play, and the outcome it is expected to produce. MVO also typically groups investments into asset classes defined by traditional and well known labels. Examples of these include: public equities (both domestic and international); fixed income; hedge funds; private equity and real estate.

Standard deviation is the primary measure of risk in the context of traditional ALM studies such as MVO. It measures how far from an average (or mean) return an event is likely to range in any given period. The higher the standard deviation measured, the more accurate the measurement, as a higher standard deviation will cover a wider range of outcomes. For example 67% of outcomes will fall within one standard deviation, and 95% of outcomes will fall within two standard deviations. Equity-like investments will tend to have the highest standard deviation measures within a portfolio. A shortcoming of standard deviation is that it assumes a normal return distribution, and underestimates risk at the left tail of a distribution such as when market dislocation events occur.

SCERS' recently conducted ERT survey identified that capital at risk is an important risk for SCERS' portfolio, ranking higher than standard deviation. The aftermath of the Global Financial Crisis ('GFC') introduced alternative approaches and perspectives to measuring risk and to designing and constructing asset allocations that more effectively protect against capital at risk. A key objective of these other approaches and perspectives are to do a better job of uncovering hidden risks within traditional asset classes, and to view asset allocation through different risk lenses than the traditional asset class labels, in order to better diversify a portfolio. Two approaches are the aforementioned risk factor approach ('RF') and economic regime approach ('ER'). An investment portfolio is an amalgamation of risk factors and exposure to economic environments.
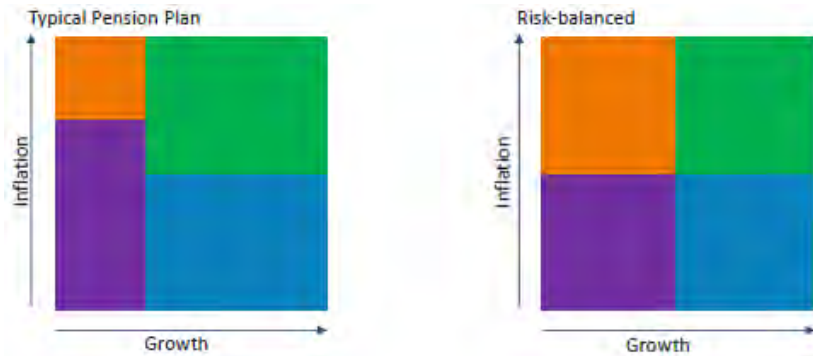
The RF approach views assets based on the systematic risks that a portfolio is exposed to. Examples of risk factors include the equity risk premium, interest rates, credit, inflation, currency and hedge funds (often defined as their own risk factor due to their ability to maintain long and short market exposures). The RF approach helps to decompose volatility into fundamental sources that a portfolio is exposed to. The more volatile risk factors, such as equity, will tend to contribute a greater
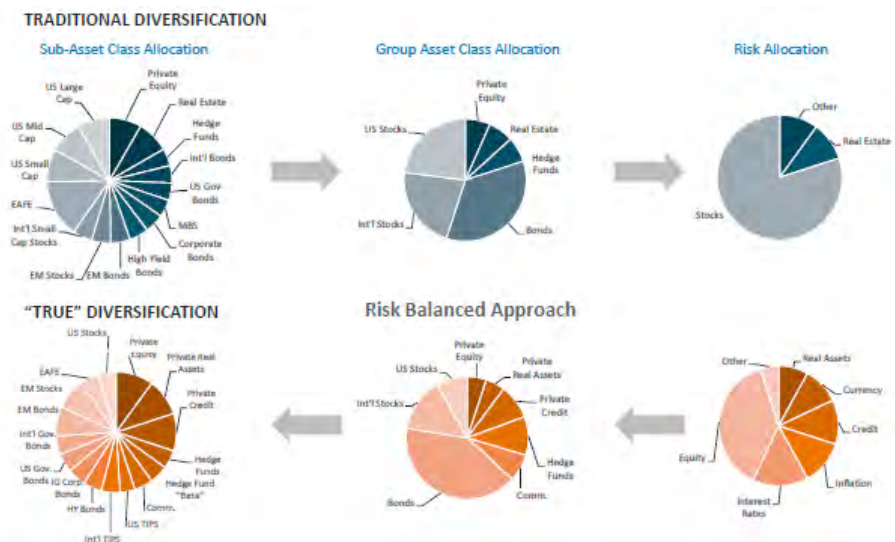

percentage of portfolio risk, as measured by volatility, than other less volatile risk factors, and at a higher level than their actual capital allocation. Accordingly, through a RF approach, diversification can be interpreted as a portfolio that better balances and allocates risk across these factors.

The ER approach views asset classes based on economic environments (or regimes) and balances investments in the portfolio among these environments. Examples of economic environments include high GDP growth, GDP contraction (recession), high unexpected inflation, low inflation and deflation. The ER approach assumes that economic environments will largely determine the return of an asset class. Accordingly, risk is defined and driven by the volatility of performance in different economic environments, and diversification can be interpreted as a portfolio that better balances and allocates risk across economic environments.

Most institutional portfolios, SCERS included, are more heavily weighted toward performing well in a growth environment with low to moderate inflation, and the equity risk premium risk factor, due to the fairly robust actuarial return assumptions that underlie most plans. This typically translates to higher allocations to growth oriented segments, including equity and equity-like investments, which makes a portfolio more susceptible during dislocated market environments. To construct a portfolio that is truly diversified would require a risk balanced approach that more heavily weights bond-like assets, and relies less on growth like assets. The consequence of this would be a much lower expected return for this type of portfolio. Utilizing ER and RF approaches can help to find a balance by better insuring against unknowingly positioning a portfolio in one market environment over another, or one risk factor over another, and to identify asset allocation mixes that can help a portfolio perform better across a variety of economic environments and risk factors, even if there is a bias toward more growth oriented assets.

SCERS' ASSET CLASS ASSESSMENT:

In order to better understand the concepts of different approaches to identifying risk, we have taken SCERS' current asset allocation and regrouped and reclassified segments of

the portfolio. This allows one to better identify the risk factors that these particular segments are exposed to, and the roles that these segments play in the portfolio, including the expected outcomes that they would be expected to experience in different economic and market environments.

Current Asset Allocation:

SCERS' current asset allocation is mostly broken out by traditional asset class labels, including Domestic Equity, International Equity, Fixed Income, Absolute Return (commonly referred to as Hedge Funds) and Private Equity.

SCERS' Real Assets asset class is a segment that is defined less by a traditional label, and more by objectives and functionality. Real Assets, which was formed as a result of SCERS' 2011 ALM study, combines the former standalone Real Estate asset class, along with other segments, including private real assets, commodities and Treasury Inflation Protected Securities (TIPS). The Real Assets asset class performs the following roles and objectives within SCERS' overall portfolio: (1) Inflation hedge; (2) Moderate generator of cash flows; and (3) Diversifier to other segments of SCERS' portfolio.

The current asset allocation, while somewhat diversified, does not fully group segments of the portfolio by risk factors and by functionality. This is particularly evident in the Fixed Income

	Policy
Domestic Equity	
US Large	18.2%
US Small Cap	3.2%
US REITs	1.1%
	22.5%
International Equity	
International Developed	16.0%
EM Equity	5.4%
International REITs	1.1%
	22.5%
Fixed Income	
Core Fixed Income	5.0%
Core Plus Fixed Income	10.0%
High Yield Credit/Bank Loan	2.0%
Global Fixed Income	3.0%
	20.0%
Absolute Return	
	10.0%
Private Equity	
	10.0%
Real Assets	
Real Estate	7.0%
Commodities	2.0%
TIPS	0.0%
Private Real Assets	6.0%
	15.0%
Opportunistic	
	0.0%
Total	100.0%

and Absolute Return asset classes. Both of these asset classes are exposed to multiple risk factors, and different segments of each will tend to perform differently in various economic environments, and therefore serve different functions within SCERS' overall portfolio. The expected outcomes of each will tend to differ depending on the economic and market environment that is being experienced. There are several asset classes within SCERS' portfolio that are dominated by one risk factor and which serve a similar function within SCERS' portfolio. These include Domestic Equity, International Equity and Private Equity. The equity risk factor is the dominant risk factor for each of these asset classes, and each tends to perform better in a high GDP growth type of economic environment, combined with low to moderate inflation. Credit related fixed income investments also tend to perform well in a more growth oriented economic environment.

Asset Allocation Regrouping #1:

By grouping segments of SCERS' portfolio at the sub-asset class level by their primary risk factors and by which economic environments they tend to perform well in, we can simplify the current asset allocation. Relabeling asset classes and regrouping investments can make it easier to understand a portfolio's actual diversification and account for the risk factors that a portfolio is exposed to. This example introduces the blending of traditional and alternative asset classes, an example of which is grouping SCERS' multiple equity exposures into one Global Equity asset class, by aggregating Domestic Equity, International Equity and Private Equity. While public equities are generally considered traditional assets and private equity are alternative (illiquid) assets, each of these segments are exposed to the equity risk factor and tend to perform best in a high growth and low/moderate inflationary environment. In contrast, they tend to perform poorly during recessionary periods, when GDP growth is contracting, or during certain periods when unexpected inflation arises. So, grouping them together gives a better measure of where common risk exposures lie within the portfolio.

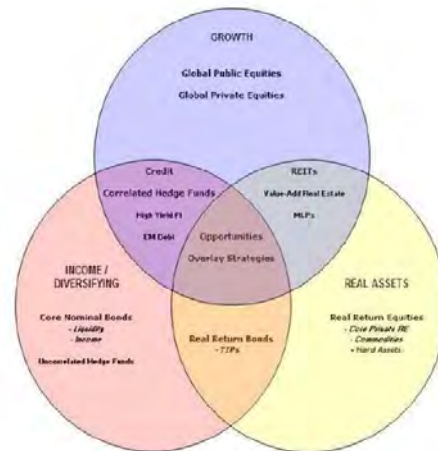|	Policy
Global Equity	
Domestic Equity	
US Large	18.2%
US Small Cap	3.2%
US REITs	1.1%
International Equity	
International Developed	16.0%
EM Equity	5.4%
International REITs	1.1%
Private Equity	10.0%
	55.0%
Global Fixed Income	
Return Generating Fixed Income	
High Yield Credit/Bank Loan	2.0%
Diversifying Fixed Income	
US Treasury	0.0%
Core Fixed Income	5.0%
Core Plus Fixed Income	10.0%
Global Fixed Income	3.0%
	20.0%
Absolute Return	
Growth Oriented Absolute Return	6.5%
Diversifying Absolute Return	3.5%
	10.0%
Real Assets	
Real Estate	7.0%
Commodities	2.0%
TIPS	0.0%
Private Real Assets	6.0%
	15.0%
Opportunities	
	0.0%
Total	**100.0%**

This example also relabels and regroups segments of the Fixed Income asset class according to the primary roles that they play in the portfolio. For instance, fixed income plays two key roles in a portfolio. One is an anchor to safety/diversifier, and the most prevalent risk factor in this role is interest rate risk, as well as some exposure to higher quality credit risk. Another role is return generator, especially in the credit oriented segments of the asset class, in which lower quality credit risk is the most prevalent risk factor. In this latter role, return generating fixed income investments such as high yield credit and private credit will typically perform well in a higher growth environment, whereas the anchor to safety/diversifying segment will generally perform best in a contracting period of economic growth.

Another asset class that was regrouped in this example was Absolute Return. Like Fixed Income, Absolute Return plays multiple roles within a portfolio. The simplest distinction is to separate those strategies that typically do well during a more favorable economic environment, and have higher correlations and betas to equity markets, from those strategies that have low to negative correlation to equity markets and serve as a diversifier to the more growth orients segments of a portfolio. Examples of the more growth oriented and correlated absolute return strategies include equity long/short; long/short fixed income;

event driven; and activist. Examples of diversifying and uncorrelated absolute return strategies include global macro systematic; global macro discretionary; market neutral; relative value; and multi-strategy. While Absolute Return as an asset class has been designated a segment whose objective is to generate equity-like returns with approximately half the volatility, individual absolute returns strategies have different risk/return profiles, serve different roles and are expected to have varying outcomes within a portfolio.

Asset Allocation Regrouping #2:

A broadened asset allocation regrouping further blends traditional and alternative asset classes, and relabels SCERS' exposures at the asset class level, by linking asset classes that are exposed to similar economic environments and risk factors, and which would be expected to have similar roles and outcomes in a portfolio. This functional regrouping takes a simplified approach at the asset class level, by breaking a portfolio into three segments, with greater complexity reserved at the sub-asset class level. The simplified asset classes include: (1) Growth; (2) Diversifying; and (3) Real Returns. This Venn diagram (similar to ones that have been used by Staff and Verus at previous meetings, and during the last ALM study), demonstrates this approach.

Looking specifically at SCERS' current target asset allocation in this context, we see the following portfolio composition. A Growth segment inlcudes public equities and private equity for similar reasons as described previously. It also includes the growth oriented absolute return strategies that have a higher correlation and beta to equity markets (though still lower than most long-only equity strategies). These absolute return stragies, which currently comprise the majority of SCERS' Absolute Retrurn portfolio, generarlly perform better in a growth oriented market. They will generally keep up with equities during up markets, and should lose less than equities in down markets, but would still be expected to generate negative returns during the latter.

		Policy
Growth		
Domestic Equity		
	US Large	18.2%
	US Small Cap	3.2%
	US REITs	1.1%
International Equity		
	International Developed	16.0%
	EM Equity	5.4%
	International REITs	1.1%
Growth Oriented Absolute Return		6.5%
Private Equity		10.0%
Return Generating Fixed Income		
	High Yield/Bank Loan	2.0%
	Private Credit	0.0%
		63.5%
Diversifying		
Diversifying Fixed Income		
	US Treasury	0.0%
	Core Fixed Income	5.0%
	Core Plus Fixed Income	10.0%
	Global Fixed Income	3.0%
Diversifying Absolute Return		3.5%
		21.5%
Real Return		
Core Real Estate		7.0%
Commodities		2.0%
TIPS		0.0%
Private Real Assets		6.0%
		15.0%
Total		**100.0%**

The Growth segment also includes the return oriented segments of fixed income. For SCERS, this includes the dedicated opportunistic credit mandate, which is comprised mostly of high yield and bank loans. While SCERS doesn't currently have a dedicated private credit portfolio, a segment such as this would fit within a Growth segment also. SCERS' current private credit exposure is aggregated within SCERS' Private Equity and Real Assets allocations, however, a separate and dedicated allocation could be considered within the ALM study, as it has a different risk and return profile than the segments where it is currently housed. While the credit related segments have a meaninful yield component, the risk profile of these strategies tend to increase during a stressed economic and market environment, as default rates will tend to increase and issues get marked down, especially within the liquid credit markets.

The Diversifying segment includes those segments of the portfolio which are expected to protect capital during dislocated market environments. Strategies within this segment are expected to generally perform better than the growth segments of SCERS' portfolio, such as public equities, when broad financial markets experience distress. This could include having a positive profile when growth markets are negative, or at a minimum, experiencing significantly less muted downside returns. Diversifying assets can still experience periods of negative returns, however, they are expected to have a positive return profile over longer periods of time.

Within SCERS' Absolute Return portfolio, diversifying strategies are those that tend to have low or negative correlations to the equity markets, and tend to have positively skewed distribution return profiles (lower probability of large negative outcomes), and a smaller degree of kurtosis (smaller/narrower left tails).

The Diversifying segment also includes the diversifying fixed income strategies, which inlcudes SCERS' core and core plus fixed income strategies, as well as the diversified global fixed income strategy. These strategies generally have meaningful exposure to government securities, including U.S. Treasuries and government agency bonds, and exposure to high quality corporate credits, as well as some currency exposure. Exposure to higher yielding/lower quality credits can comprise a smaller portion of some of these strategies, but in the context of a diversifying segment of SCERS' portfolio, these would need to be re-evaluated. Several risk factors make up this fixed income segment, including interest rates, credit and currencies.

A Real Return segment (labeled Real Assets within SCERS' current asset allocation), as described previously, provides a combination of objectives for SCERS' overall portfolio, including: (1) Inflation hedge; (2) Moderate generator of cash flows; and (3) Diversifier to other segments of SCERS' portfolio. The segment includes a combination of real estate exposure, private real assets exposure (energy; infrastructure; natural resources), and commodities.

As referenced previously, SCERS' portfolio, similar to most public pension plans, is weighted toward performing well in a growth oriented environment, and equity risk is the primary risk factor with equity-like assets dominating the portfolio. Breaking the portfolio

up between functional asset classes helps to demonstrate this point, and to identify those portions of the portfolio that provide diversification across risk factors and economic environments. An objective of the ALM study is to formulate an asset allocation that helps to achieve the outcomes and objectives identified in the recent ERT survey. This includes a proper level of diversification, and constructing a portfolio that is able to achieve SCERS' actuarial return assumption, but which also has enough diversifying assets that can to some level, protect capital during down market environments.

CONCLUSION:

As mentioned previously, Verus is in the process of performing modeling of the liability and asset components of SCERS' plan. The modeling will be presented at upcoming Board meetings, starting in October. As part of this, multiple asset allocation mixes will be presented to your Board, and it is expected that the mixes will be presented in a more functional and outcome based asset class format versus traditional asset classes, in order to better identify portfolio risk and the true level of diversification within the various asset mixes.

At the conclusion of the ALM study, your Board will be encouraged to decide on the ultimate asset allocation mix for SCERS' portfolio. The final asset allocation selection should not necessarily be made solely to achieve a desired return assumption, but rather should be made within a holistic framework, based on the outcomes that SCERS wants to achieve. Meeting these outcomes could entail adjusting SCERS' assumed rate of return to a prudent lower level, especially in a potentially lower investment return environment.

However, it should be understood that regardless of where SCERS' assumed rate of return is set, it will still be necessary to continue to have a portfolio more heavily weighted toward assets that tend to do well in a growth oriented environment. This doesn't mean that SCERS should construct a portfolio with an unsustainable level of risk just to meet a return assumption, but rather to identify the proper blend of asset mixes that will provide a certain level of diversification that will best allow SCERS to achieve its desired outcomes.

We would be happy to address any questions.

Respectfully submitted,   Concur:

Steve Davis   Richard Stensrud
Deputy Chief Investment Officer   Chief Executive Officer

Attachment

![Verus]

PERSPECTIVES
THAT DRIVE
ENTERPRISE
SUCCESS

Sacramento County Employees' Retirement Association

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Introduction

— Building long-term portfolios requires multiple approaches to ensure robust analysis

— Asset classes are the typical underlying building blocks of portfolios
  - Long-term return drivers influence the behavior of each asset class
  - Our Capital Market Assumptions and Scenario Analysis tool use the same drivers
  - The relationships between asset classes must be considered

— Embedded in asset classes are factor risk structures
  - We provide this information for each asset class
  - Investors can gain factor as well as asset class diversification

— Current State Assessment of SCERS Portfolio

Building Portfolios

Building portfolios

Traditional Approach – Mean Variance Optimization ('MVO')

Combines expected returns, historical standard deviations (risk) and correlations among asset classes

— Determine portfolio with highest expected return for a given level of risk

Shortcomings:

— Utilizes standard deviation as the sole measure of risk;

— Utilizes capital market projections based off of historical data, to forecast the future, which can prove challenging;

— Using normal return distribution assumptions, which underestimates the frequency and severity of 'left tail' events

Building portfolios

Measuring investment risk

Standard deviation measures how far from the average (or mean) return one event is likely to fall in any given time period

— A normal distribution will contain 2/3rds of events within 1 standard deviation of the mean; 95% of all events will fall within 2 standard deviations

Building portfolios

Stocks vs. Bonds

Historical stock and bond returns indicate stocks have a higher return, on average

Historical volatility is also higher for stocks than it is for bonds

Std. Dev. = 7.8%

Mean = 5.8%

Std. Dev. = 15.2%

Mean = 10.4%

# of Observations

-30.0   -20.0   -10.0   0.0   10.0   20.0   30.0   40.0   50.0   60.0

Return %

Verus

Building portfolios

Correlations

Choosing asset classes with different return profiles reduces the volatility, or risk, of a portfolio while maintaining its long-term average return

Average Return = 8.0%

— Asset Class A   — Asset Class B   — 50/50 Mix

Verus

Correlations – 10 years

	Cash	US Large	US Small	Developed Large	Developed Small	EM	Global Equity	PE	TIPS	US Treasury	Global Sovereign	US Core	US Core Plus	Short-Term Gov't/Credit	Short-Term Credit	Long-Term Credit	HY	Bank Loans	Global Credit	EMD USD	EMD Local	Commodities	Hedge Funds	Core Real Estate	REITs	Risk Parity	Inflation
Cash	1																										
US Large	-0.1	1																									
US Small	-0.1	0.9	1																								
Developed Large	0.0	0.9	0.8	1																							
Developed Small	-0.1	0.8	0.8	1.0	1																						
EM	0.0	0.8	0.7	0.9	0.9	1																					
Global Equity	-0.1	0.9	0.8	0.9	0.9	0.9	1																				
PE	-0.2	0.7	0.7	0.8	0.8	0.7	0.8	1																			
TIPS	0.0	0.2	0.1	0.2	0.3	0.3	0.2	0.1	1																		
US Treasury	0.1	-0.3	-0.3	-0.2	-0.2	-0.2	-0.3	-0.2	0.6	1																	
Global Sovereign	0.1	0.2	0.2	0.4	0.4	0.4	0.3	0.1	0.6	0.5	1																
US Core	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.0	0.8	0.9	0.6	1															
US Core Plus	-0.2	0.3	0.3	0.5	0.5	0.4	0.4	0.5	0.6	0.4	0.4	0.7	1														
Short-Term Gov't/Credit	0.4	-0.1	-0.1	0.1	0.1	0.1	0.0	-0.1	0.6	0.6	0.6	0.7	0.4	1													
Short-Term Credit	0.1	0.3	0.2	0.3	0.4	0.3	0.3	-0.1	0.5	0.2	0.5	0.6	0.4	0.7	1												
Long-Term Credit	-0.1	0.3	0.2	0.4	0.4	0.4	0.3	0.1	0.6	0.5	0.5	0.8	0.8	0.5	0.6	1											
HY	-0.2	0.7	0.7	0.8	0.8	0.7	0.7	0.6	0.4	-0.2	0.3	0.2	0.6	0.1	0.5	0.5	1										
Bank Loans	-0.1	0.6	0.5	0.5	0.6	0.5	0.5	0.2	0.2	-0.4	0.0	0.1	0.2	0.0	0.5	0.3	0.8	1									
Global Credit	-0.1	0.6	0.5	0.8	0.8	0.7	0.7	0.5	0.6	0.2	0.8	0.6	0.8	0.5	0.6	0.7	0.7	0.5	1								
EMD USD	-0.1	0.6	0.5	0.7	0.7	0.7	0.7	0.6	0.7	0.2	0.5	0.6	0.8	0.3	0.5	0.7	0.8	0.5	0.8	1							
EMD Local	0.1	0.7	0.6	0.8	0.8	0.8	0.8	0.6	0.5	0.1	0.6	0.4	0.5	0.3	0.4	0.5	0.7	0.4	0.8	0.8	1						
Commodities	0.1	0.5	0.4	0.6	0.6	0.6	0.6	0.2	0.3	-0.1	0.4	0.1	0.2	0.2	0.4	0.2	0.5	0.4	0.6	0.4	0.6	1					
Hedge Funds	0.0	0.7	0.6	0.8	0.8	0.8	0.8	0.7	0.2	-0.4	0.1	-0.1	0.4	-0.1	0.3	0.2	0.6	0.6	0.5	0.5	0.5	0.6	1				
Core Real Estate	-0.1	0.3	0.3	0.3	0.3	0.3	0.6	0.3	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.1	0.2	0.0	0.2	0.2	0.2	0.0	0.3	1			
REITs	-0.1	0.8	0.8	0.7	0.6	0.6	0.7	0.6	0.2	-0.1	0.3	0.2	0.4	0.0	0.2	0.4	0.7	0.5	0.6	0.6	0.6	0.3	0.4	0.4	1		
Risk Parity	0.0	0.5	0.4	0.6	0.6	0.6	0.6	0.5	0.7	0.3	0.6	0.5	0.7	0.4	0.3	0.5	0.5	0.2	0.7	0.7	0.6	0.6	0.5	0.3	0.4	1	
Inflation	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-0.3	-0.1	-0.3	-0.1	-0.3	-0.2	-0.3	0.2	0.2	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	1

Note: Correlation assumptions are based on the last ten years. Private Equity and Real Estate correlations are especially difficult to model – we have therefore used BarraOne correlation data to strengthen these correlation estimates.

Building portfolios

Evolved approaches

Portfolio risk lens:

—Standard deviation is a traditional method of measuring portfolio risk

—ERT survey identified that capital at risk is an important risk for SCERS' portfolio

—Aftermath of global financial crisis has introduced other ways of measuring risk, with an objective of understanding areas where a portfolio is vulnerable to capital at risk

- Risk factor

- Economic environment impact

—An investment portfolio is an amalgamation of risk factors and exposure to economic environments

—We want to think about asset allocation more in the context of risk factors and exposure to economic regimes; less so by traditional asset class labels
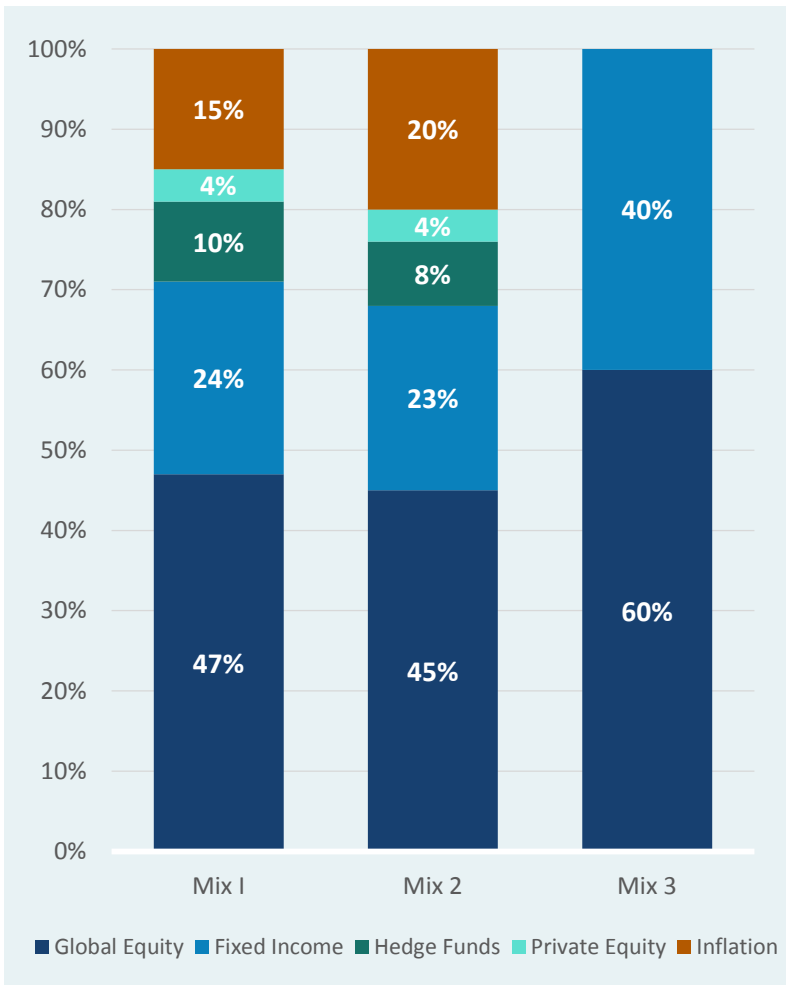
Risk Factor Lens

Risk factors

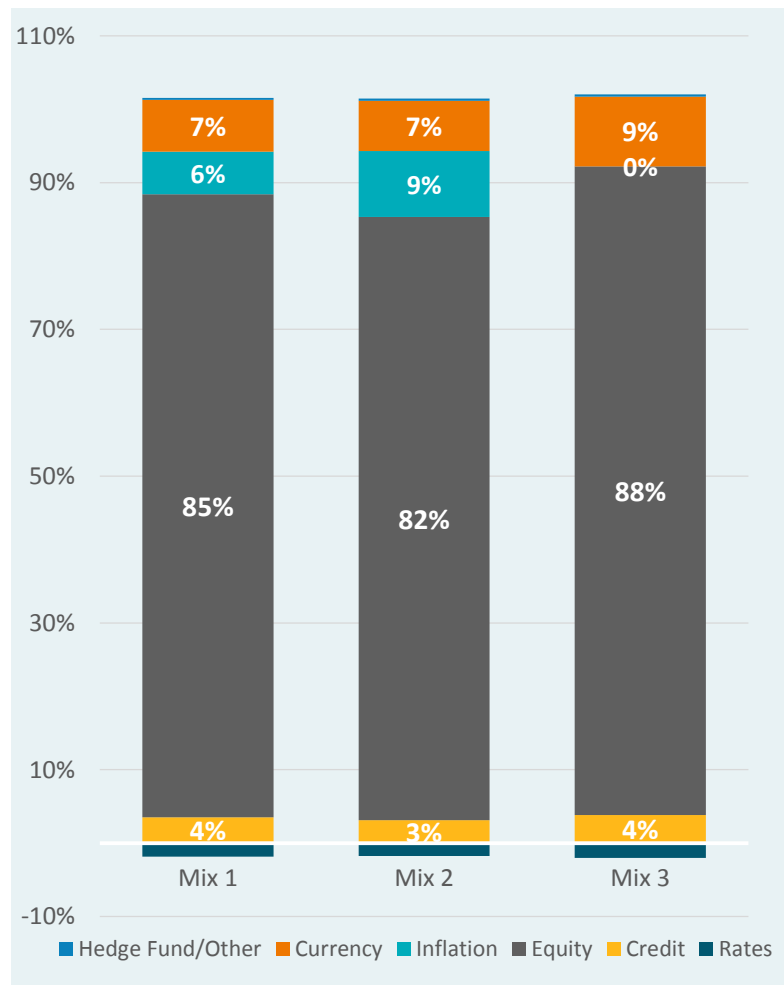## Risk premia encompasses primary, secondary, and tertiary building blocks

Rates	Credit	Equity	Inflation	Currency	Hedge Fund Premia
Domestic	Investment Grade	Domestic	TIPS	Developed	Event driven
International	High Yield	International	Commodities	Emerging Market	Convertible arbitrage
	Emerging Markets	Emerging Markets			
Curve			Country	Value	Fixed income relative value
Duration	Curve	Country	Curve	Momentum	Dedicated shorts
Liquidity	Duration	Sector	Duration	Carry	Equity market neutral
Country	Liquidity	Value	Liquidity	Country	Emerging markets
Sector	Quality	Momentum			Global macro
	Country	Quality			Equity long/short
	Sector	Size			Managed futures

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Asset allocation ≠ risk allocation

ASSET ALLOCATION MIXES
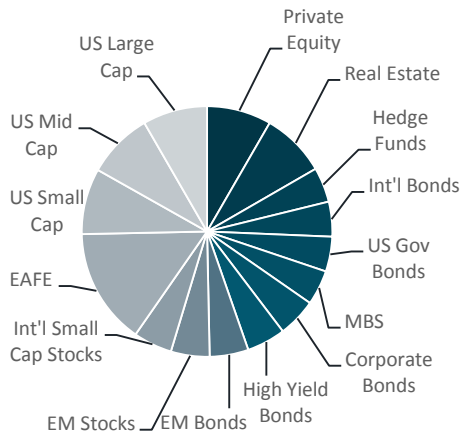

RISK CONTRIBUTION BY RISK FACTOR

Traditional asset allocation methodologies do not take into account that different asset classes contain the same risk factors
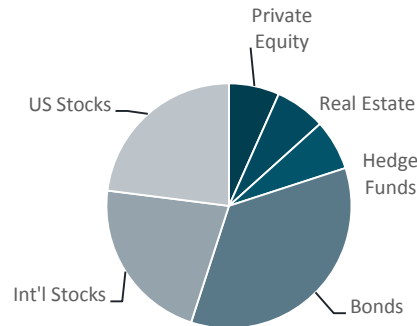
"True" diversification
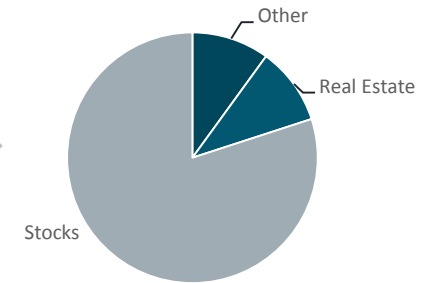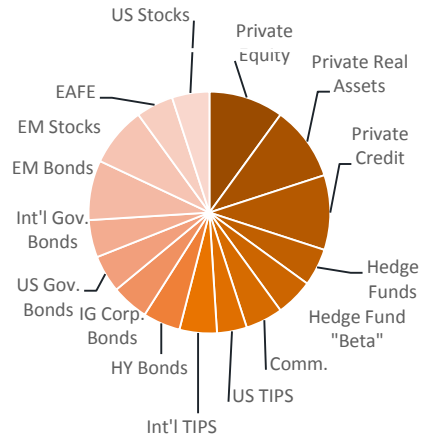
TRADITIONAL DIVERSIFICATION

Sub-Asset Class Allocation   Group Asset Class Allocation   Risk Allocation
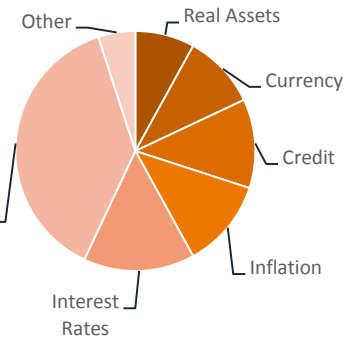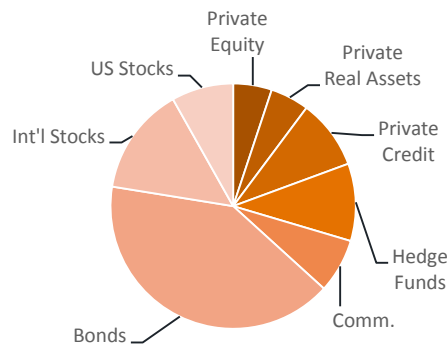

"TRUE" DIVERSIFICATION   **Risk Balanced Approach**

— **"True" Diversification creates a more balanced risk portfolio but at the cost of lower expected returns**

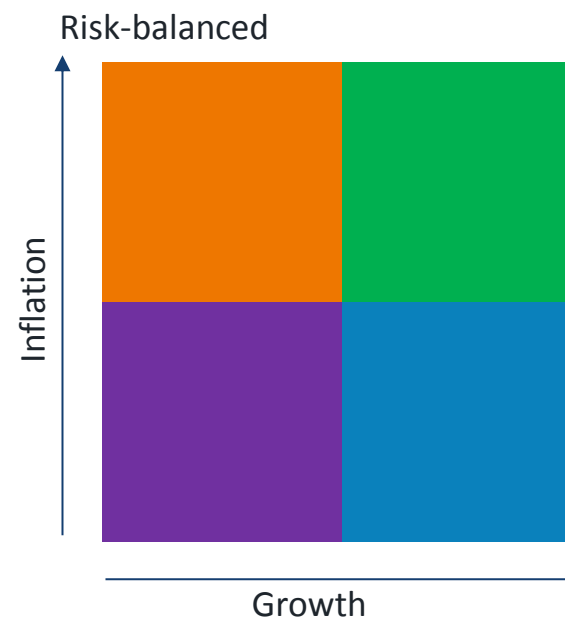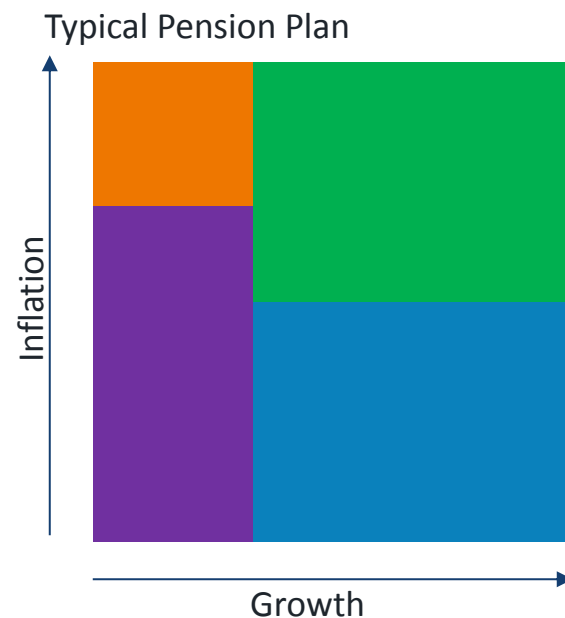# Economic Diversification

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Economic sensitivity

GROWTH

The future is uncertain.

When constructing a portfolio, it is important to not heavily rely on a single economic scenario.

Rising growth
Falling inflation

Equities, corporate bonds, emerging market debt, infrastructure, mortgages, government bonds, real estate,

Equity Risk

Credit Risk

Commodities, infrastructure, real estate, equities, corporate bonds, emerging market debt

Inflation Risk
Equity Risk

Rising growth
Rising inflation

INFLATION

Falling growth
Falling inflation

Government bonds, corporate bonds, emerging market debt, inflation linked bonds

Rate Risk

Inflation linked bonds, commodities, infrastructure, real estate

Inflation Risk

Falling growth
Rising inflation

Market environments

Economic diversification profiles

Investment pools can be designed to various economic regimes

— Economic regimes largely determine the returns of an investment portfolio

— Typical pension plans are designed for higher growth/low to moderate inflation environments

Typical Pension Plan

Risk-balanced

The role of asset classes

— Why do we invest in various asset classes?

— What is it we practically expect them to contribute to the portfolio over time?

— What will determine whether or not they serve the desired role?

Current State Assessment

SCERS asset allocation analysis – current labels

	Policy
Domestic Equity	
US Large	18.2%
US Small Cap	3.2%
US REITs	1.1%
	22.5%
International Equity	
International Developed	16.0%
EM Equity	5.4%
International REITs	1.1%
	22.5%
Fixed Income	
Core Fixed Income	5.0%
Core Plus Fixed Income	10.0%
High Yield Credit/Bank Loan	2.0%
Global Fixed Income	3.0%
	20.0%
Absolute Return	
	10.0%
Private Equity	
	10.0%
Real Assets	
Real Estate	7.0%
Commodities	2.0%
TIPS	0.0%
Private Real Assets	6.0%
	15.0%
Opportunistic	
	0.0%
Total	**100.0%**

Mostly broken out by traditional asset class labels
— Not broken out by risk factors and functionality
— Except for Real Assets
— Separation between traditional and alternative asset classes

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SCERS asset allocation analysis – functional sub-asset class labels

	Policy
Global Equity	
Domestic Equity	
US Large	18.2%
US Small Cap	3.2%
US REITs	1.1%
International Equity	
International Developed	16.0%
EM Equity	5.4%
International REITs	1.1%
Private Equity	10.0%
	55.0%
Global Fixed Income	
Return Generating Fixed Income	
High Yield Credit/Bank Loan	2.0%
Diversifying Fixed Income	
US Treasury	0.0%
Core Fixed Income	5.0%
Core Plus Fixed Income	10.0%
Global Fixed Income	3.0%
	20.0%
Absolute Return	
Growth Oriented Absolute Return	6.5%
Diversifying Absolute Return	3.5%
	10.0%
Real Assets	
Real Estate	7.0%
Commodities	2.0%
TIPS	0.0%
Private Real Assets	6.0%
	15.0%
Opportunities	
	0.0%
Total	**100.0%**

Asset classes are not homogenous entities – they are multidimensional and have various roles and outcomes

Re-allocate and re-classify portions of SCERS' current asset allocation according to the roles that segments play in the portfolio

— Blending of traditional and alternative asset classes
— Public Equities and Private Equity tied to similar high growth and low/moderate inflationary environment
— Fixed Income plays varying roles
    — Returns will vary depending on the environment
    — Return generation - high yield
    — Diversifying – core/core plus
— Absolute Return – also plays varying roles
    — Growth oriented (correlated) – equity/fixed income long/short; event driven; activist; credit arbitrage
    — Diversifying (uncorrelated) – global macro systematic/discretionary; market neutral; relative value; multi-strategy

SCERS asset allocation analysis – functional asset class labels

	Policy
Growth	
Domestic Equity	
US Large	18.2%
US Small Cap	3.2%
US REITs	1.1%
International Equity	
International Developed	16.0%
EM Equity	5.4%
International REITs	1.1%
Growth Oriented Absolute Return	6.5%
Private Equity	10.0%
Return Generating Fixed Income	
High Yield/Bank Loan	2.0%
Private Credit	0.0%
	63.5%
Diversifying	
Diversifying Fixed Income	
US Treasury	0.0%
Core Fixed Income	5.0%
Core Plus Fixed Income	10.0%
Global Fixed Income	3.0%
Diversifying Absolute Return	3.5%
	21.5%
Real Return	
Core Real Estate	7.0%
Commodities	2.0%
TIPS	0.0%
Private Real Assets	6.0%
	15.0%
Total	**100.0%**

Further re-allocation leads to a functional and outcome based approach

— Move away from conventional asset class labels

— Growth assets tend to dominate in capital allocation and risk allocation

— Tied to high growth and low/moderate inflationary environment

— Equity risk dominates (credit risk also)

— Need these segments to achieve actuarial return assumption

— Include growth oriented absolute return and return oriented fixed income

— Separate private credit from private equity

— Diversification to minimize loss of capital is a key plan objective

— Importance of ample allocation to low correlated, diversifying assets, that have less sensitivity to GDP growth

— Diversifying fixed income and absolute return

— Protect capital but also have positive return profiles

— Real Return

— Inflation protection, contracted cash flows and diversification are primary roles

Asset allocation analysis

— SCERS Current Policy Allocation vs. 70/30 Equity – Bond portfolio

— Higher expected return and Sharpe Ratio relative to a simple stock/bond portfolio

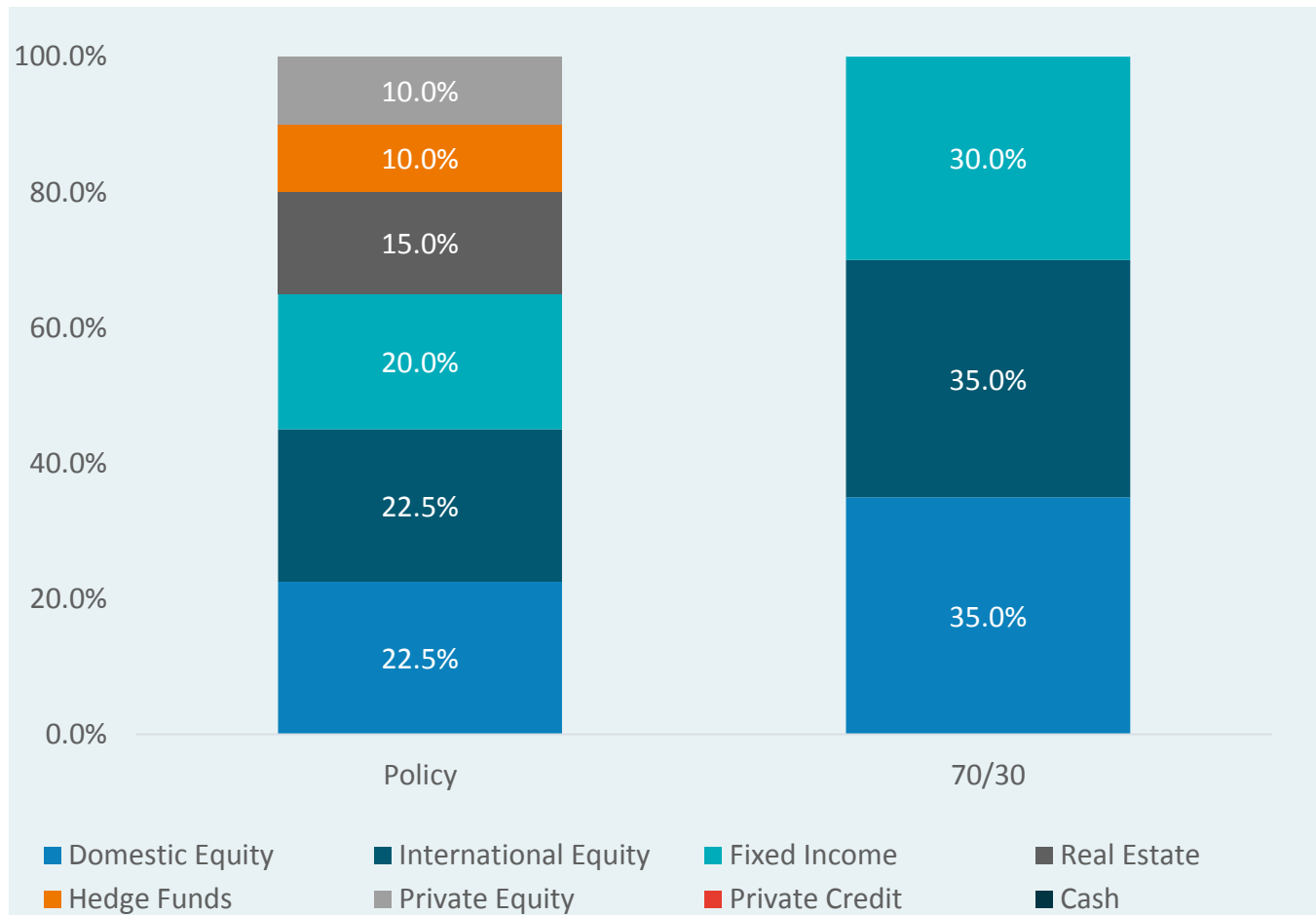|	Policy	70/30
Mean Variance Optimizer Analysis		
Forecast 10 year Return	**7.18**	**6.72**
Forecast 10 year Real Return	**5.18**	**4.72**
Standard Deviation	12.01	11.56
Return/Std. Deviation	0.60	0.58
Sharpe Ratio	0.48	0.45

3% target policy allocation for Infrastructure is represented in Core Real Estate

Scenario Analysis utilizes April 2016 Verus Capital Market Assumptions

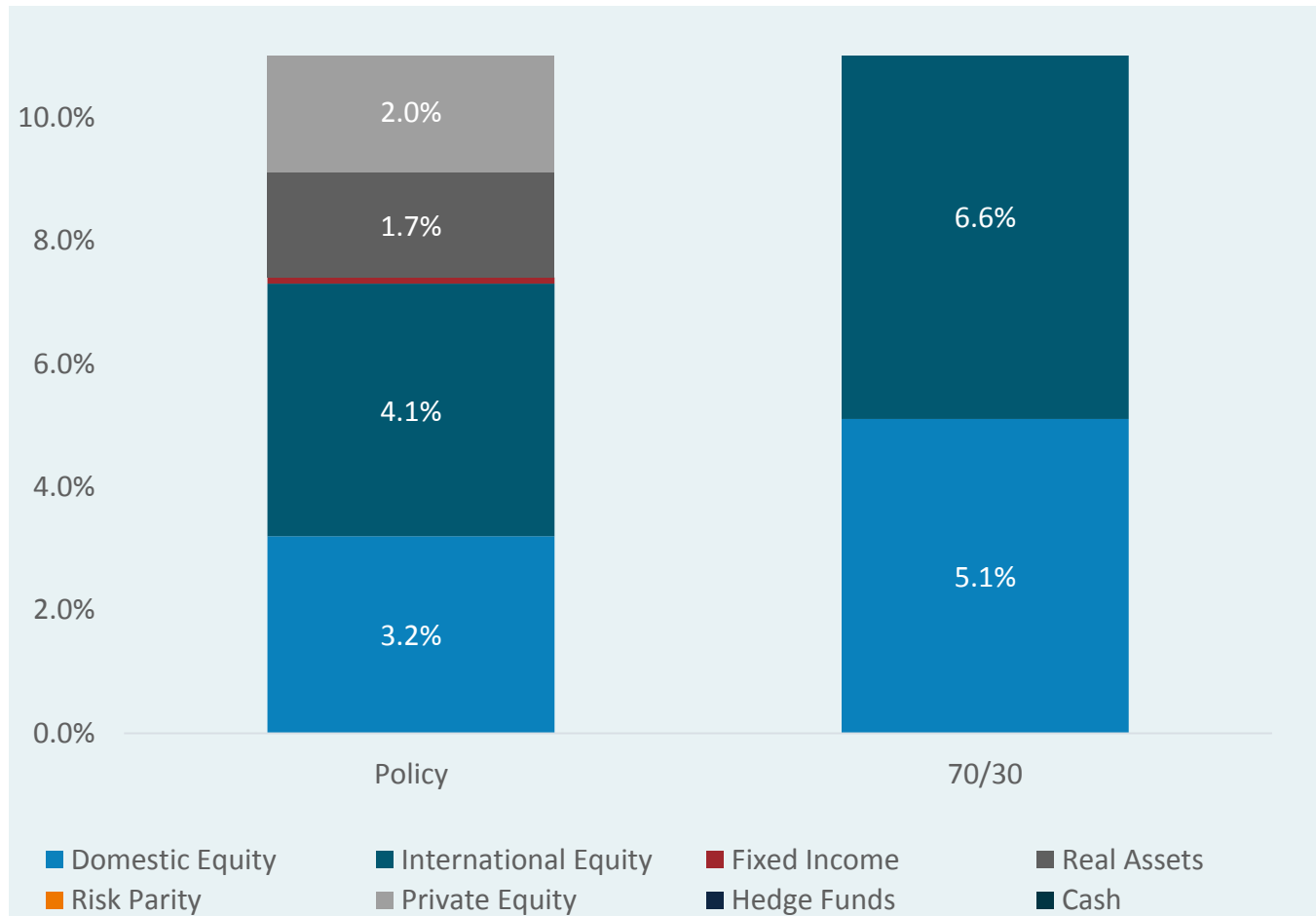*Verus' capital market assumptions incorporates an inflation rate of 2.1%*

Asset allocation by asset class

SCERS' POLICY HAS EXPOSURE TO A LARGER NUMBER OF ASSET CLASSES
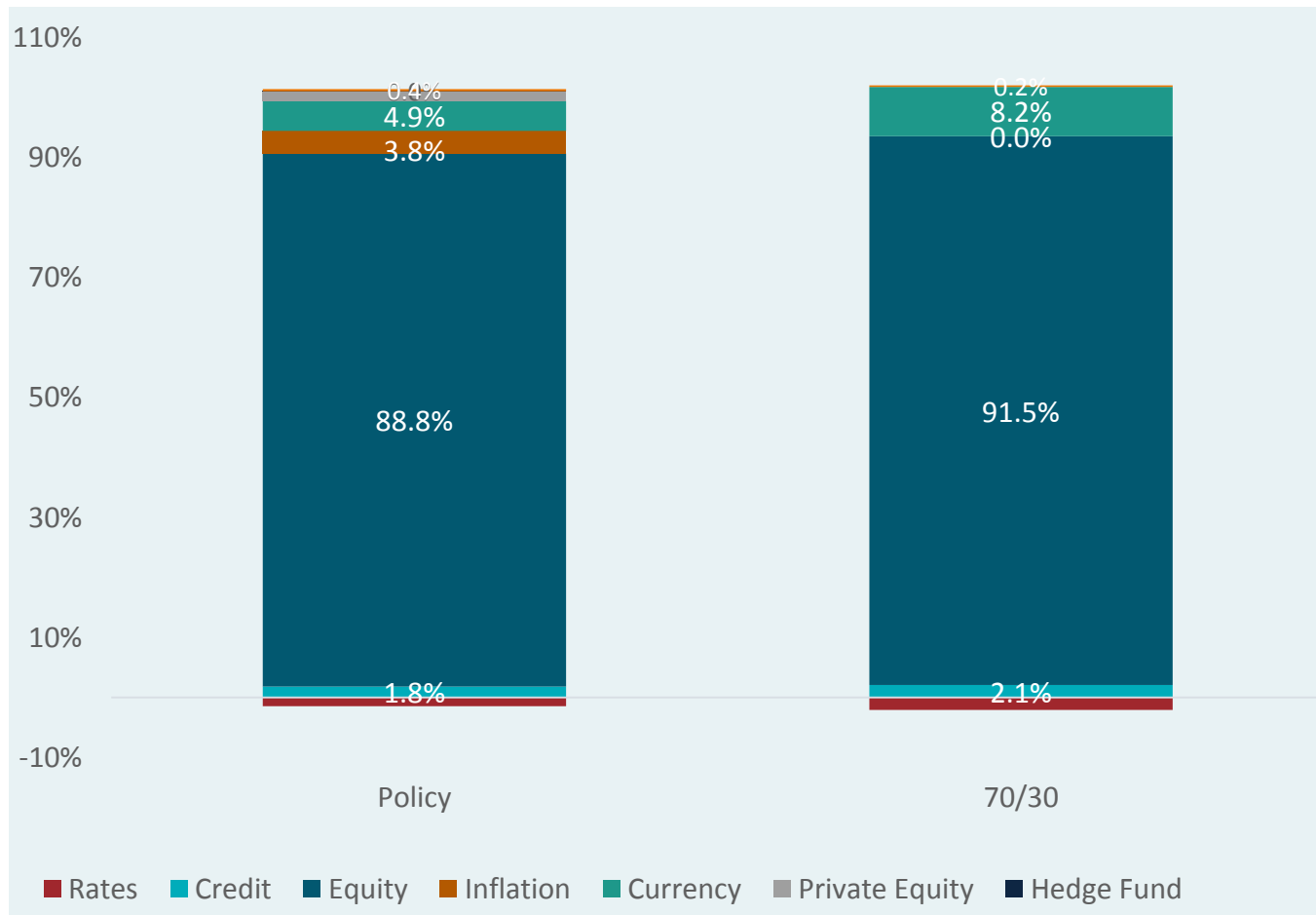
Risk contribution by asset class

PUBLIC EQUITY STILL DRIVES THE BULK OF THE RISK TO BOTH SCERS' POLICY ALLOCATION AND A 70/30 PORTFOLIO

Legend:
- Domestic Equity
- International Equity
- Fixed Income
- Real Assets
- Risk Parity
- Private Equity
- Hedge Funds
- Cash

Risk contribution based on Verus' Capital Market Assumptions

Risk contribution by risk factor

Hedge Funds and Private Equity contribute mostly equity risk. SCERS' implementation in these asset classes is expected to be more diversified.

Risk contribution based on MSCI BarraOne's Capital Market Assumptions

Conclusion – Going Forward

— Understanding risks in the portfolio is key

— Thinking beyond traditional asset class definitions will help to identify and rationalize interim portfolio adjustments

— Going forward, the next step will be to provide policy portfolio alternatives with varying degrees of risk diversification and return expectations

— And integrate those portfolios with SCERS' liability projections

— Objective is to construct a portfolio based on SCERS' overall plan objectives – less about constructing a portfolio solely to achieve an assumed rate of return

— Portfolio diversification remains an objective for what will remain a growth biased portfolio