



# Board of Retirement Regular Meeting

## Sacramento County Employees' Retirement System

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### Agenda Item 21

**MEETING DATE:** December 9, 2020

**SUBJECT:** Education: Asset Liability Modeling Study

**SUBMITTED FOR:**  Consent  **Deliberation and Action**  **Receive and File**

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### RECOMMENDATION

Staff recommends that the Board receive and file the Asset Liability Modeling (ALM) Study education presentation by SCERS' general investment consultant, Verus Advisory.

### PURPOSE

This agenda item represents education that will kick off SCERS' next ALM study, and supports SCERS' Master Investment Policy Statement, which calls for an ALM study to be conducted at least every five years.

### INTRODUCTION

SCERS last conducted an asset liability modeling study in 2016, which concluded early in 2017 with the approval of the current strategic asset allocation (SAA). During the course of the next several months, Verus will be working with the Board and Staff on an ALM study, with assistance from SCERS' alternative assets consultant, Cliffwater, and SCERS' real estate consultant, Townsend.

At the December Board meeting, Verus and Staff will provide an education session, which will serve as an introduction to the upcoming ALM study. The presentation will recap the last ALM study, provide some concepts into the drivers of asset allocation modeling, and go over the steps in the ALM process that Verus uses.

The ALM process is an iterative one that will progress over the next three quarters. The ALM process includes:

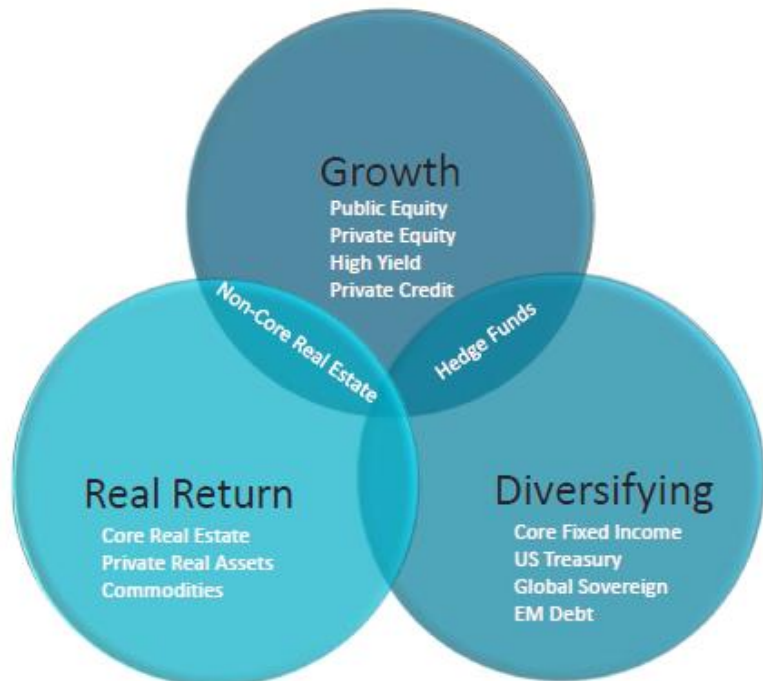
- Enterprise risk tolerance (ERT) analysis and discussion
- Analyzing asset allocation alternatives
- Developing a liability model
- Combing asset and liability data to model asset portfolio mixes
- Reviewing ALM results and approving a strategic asset allocation

- Updating investment policy statements

## **2017 ALM RECAP**

SCERS last completed an ALM study in 2017 with Verus. The outcome of the study was an evolution of the prior asset allocation; however, a significant change was the method by which the asset allocation was being presented, including viewing the portfolio through a functional asset allocation framework, rather than by conventional asset classes.

Within a functional asset class framework, segments of SCERS' asset allocation were re-grouped and re-classified in order to better identify the risk factors that particular segments are exposed to, and the roles that various segments play within SCERS' overall portfolio across economic environments. The regrouping blended traditional and alternative asset classes, and linked 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. The functional regrouping took a simplified approach at the asset category level, by breaking the portfolio into three asset categories, with greater complexity reserved at the asset class level. The asset categories include: (1) Growth; (2) Diversifying; and, (3) Real Return.



The Growth asset category includes those segments of the portfolio that tend to perform best in a high growth and low/moderate inflationary environment, including most equity and credit investments. In contrast, they tend to perform poorly during recessionary periods, when GDP growth is contracting, or during certain periods when unexpected inflation arises. Growth assets tend to comprise the dominant allocation within most institutional investment portfolios, including that of SCERS. The Diversifying asset category includes those segments of the portfolio which are expected to protect capital and perform better than the Growth asset category during dislocated and stressed market environments, including traditional fixed income and diversifying absolute return strategies. The Real Return asset category includes those segments of the portfolio that protect against inflation, generate cash flow, and provide further portfolio diversification, including private real estate, infrastructure, energy, and agriculture investments, as well as liquid real return investments.

Compared to the prior asset allocation, the 2017 SAA was considered to be a more risk-balanced asset allocation than the prior allocation, with a reasonable return profile. It had a lower standard deviation, and narrower range of potential outcomes, making it less susceptible to negative

returns during down markets. It was also expected to produce greater cash flows for SCERS' plan, in an environment where cash flows are necessary to meet benefit payment obligations and to ensure plan sustainability. It had a moderately lower liquidity profile than the prior asset allocation; however, a liquidity analysis conducted by Verus demonstrated that SCERS' overall liquidity profile would remain reasonable for the revised asset allocation. As part of the cash management policy that was approved in 2019, a formal liquidity analysis is conducted annually, and will be conducted for any asset allocation mix being considered during the 2021 ALM study.

Overall, the following significant changes were incorporated across SCERS' portfolio:

Asset Category/Asset Class	Prior SAA	Current SAA	Changes
<b>Growth</b>	<b>63%</b>	<b>59%</b>	<b>-4%</b>
Public Equities	45%	41%	-4%
Private Equity	10%	9%	-1%
Public Credit	2%	2%	0%
Private Credit	0%	4%	4%
Growth Absolute Return	6%	3%	-3%
<b>Diversifying</b>	<b>22%</b>	<b>25%</b>	<b>3%</b>
Core Plus Fixed Income	15%	10%	-5%
U.S. Treasury	0%	5%	5%
Global Fixed Income	3%	3%	0%
Diversifying Absolute Return	4%	7%	3%
<b>Real Return</b>	<b>15%</b>	<b>16%</b>	<b>1%</b>
Real Estate	7%	7%	0%
Real Assets	6%	7%	1%
Commodities	2%	2%	0%
<b>Opportunities</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>
	100%	100%	

Significant changes included:

1. Growth assets decreased by 4%, highlighted by a decrease in public equities, the addition of a private credit asset class, and a reduction in the growth absolute return segment.
2. Diversifying assets increased by 3%, highlighted by the addition of a dedicated U.S Treasury allocation (funded by a reduction in core plus fixed income) and increasing exposure to the diversifying absolute return segment.
3. Real Return increased by 1%, particularly the real Assets class, which also transitioned more heavily from energy to infrastructure assets.

Included in the presentation on page 7, Verus demonstrates how the current asset allocation has performed versus expectations from 2017 to 2020. The portfolio as a whole has generated returns ahead of projections with lower risk (as measured by Standard Deviation). The portfolio was put to the test and weathered the major COVID-19 related dislocation in March of 2020. Looking at a more granular level shows that the Growth asset category has significantly

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outperformed projections, Diversifying has marginally outperformed projections, and Real Return has underperformed meaningfully. The underperformance of Real Return is driven by energy exposure, which saw a precipitous and dramatic decline in early 2020. Other Real Assets segments such as real estate and infrastructure have fared much better.

Subsequent to the approval of the 2017 SAA, each major asset class was revised/restructured along with SCERS' investment policy statements (at the total portfolio level (Master IPS) and for each asset category). Implementation of the current SAA has made significant progress over the past four years, with traditional asset classes (equity and fixed income) becoming fully implemented in 2017 and 2018, and meaningful progress being made within the alternative asset classes. The absolute return portfolio is near its target allocation, private equity and real estate are at target, and real assets and private credit are making progress toward their target allocations.

During 2019, SCERS made two adjustments to the 2017 approved SAA:

- Created a dedicated 1% cash allocation by reducing domestic equity by 1%
- Converted the 2% commodities allocation to a 2% liquid real return allocation

### **APPROACHES TO ALM**

Given that the strategic asset allocation, as well as underlying asset class structures, contribute to the majority of portfolio performance, a clear understanding of the process and the various approaches to ALM is important. There have historically been several approaches to conducting an ALM study, and many of these have evolved time, particularly since the Global Financial Crisis (GFC). There is not one approach that works best and fits all, and though the modeling is quantitative and process oriented, the final outcome is as much art as it is science.

Mean variance optimization (MVO) has historically been considered the foundation to asset liability modeling and designing a strategic asset allocation. 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. 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 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.

In the aftermath of the GFC, alternative approaches and perspectives to asset allocation became more prevalent in constructing asset allocations, and particularly in measuring risk. Verus has

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evolved its approach to asset liability modeling over the past decade to incorporate these alternative approaches, including better understanding exposure to risk factors and economic environments, as well as measuring liquidity risk. This holistic approach, which was used in the 2017 SCERS ALM study, does a better job of uncovering hidden risks within the portfolio and views asset allocation through multiple lenses compared to traditional modeling approaches, in order to better diversify a portfolio.

Common systematic risk factors that a portfolio is exposed to include equity risk, interest rates, credit, inflation, and currency. Under this lens, risk is defined as exposure to risk factors and diversification can be interpreted as a portfolio that better balances and allocates risk across these factors.

Common economic environments include rising growth, falling growth (recession), rising inflation, and falling inflation. Under this lens, it is assumed that economic environments will largely determine the return of a segment of the portfolio. 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 inflation, and equity risk is the prevalent risk factor. This typically translates to higher allocations to growth-oriented investments, equity investments in particular. Viewing the portfolio through multiple lenses, including exposure to risk factors and economic environments, helps to better insure 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.

Other tools that Verus uses to conduct an ALM study include incorporating (1) stochastic projections (using Monte Carlo models to develop capital market assumptions); (2) deterministic projections (using actuarial assumptions to determine funded status outcomes); and (3) stress tests.

### **ENTERPRISE RISK TOLERANCE SURVEY**

During the 2017 ALM study, Verus conducted an enterprise risk tolerance (ERT) analysis and discussion with the Board. The analysis is one aspect of assessing a client's enterprise risk tolerance, and is used as a guide in designing and recommending SAA mixes for the Board to consider. It is conducted to assess a plan's ability and the Board's willingness to accept risk.

As part of the ERT analysis, Verus and Staff develop a survey where the Board is asked a series of questions with a variety of answer formats, including ranked and binary responses. The survey will be broken out into key topics, with several sub-categories around these topics. Key topics that were included during the last ERT analysis in 2016 included: (1) high level SCERS plan objectives; (2) a risk assessment across SCERS' plan (at the portfolio/plan level, environmental level and organization level); and (3) SCERS' investment philosophy and approach (as it relates to portfolio complexity, the alternative asset classes and the traditional asset classes).

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An ERT analysis will be conducted as part of next year's ALM study, during the first quarter of 2021. For the upcoming analysis, in addition to a survey, Verus also expects to conduct virtual interviews with SCERS Board members in order to gain greater insight around the survey responses. The results of the survey and analysis will be presented to the Board, most likely during the March Board meeting. An objective of the ERT presentation and discussion will be to identify key themes around Board members responses. Results of the ERT analysis and discussion will be used in the ALM study.

### **2021 ALM EXPECTATIONS**

The Board recently approved a reduction in the actuarial rate of return from 7% to 6.75%. While SCERS models its investment portfolio with a mix of assets that is expected to meet SCERS' actuarial rate of return, the reality is that actual outcome falls with a range of outcomes that can vary significantly from what is 'expected'.

SCERS has historically viewed the ALM process not to identify a target rate of return and then construct a portfolio designed to reach that return. Instead, the approach has been to identify a portfolio designed to meet SCERS' plan objectives, such as improving funded status, better protecting against significant drawdowns, and reducing volatility around contributions, and then determining a reasonable and realistic expected investment return for such a portfolio. SCERS should also be cognizant of its liquidity profile, and ensuring the fund's ability to pay benefit payment obligations, particularly given SCERS' meaningful allocation to illiquid private market assets.

The last asset allocation study concluded with significant changes to SCERS' portfolio, which are still being implemented today. Against that backdrop, it is anticipated that recommended changes as a result of this ALM study should be less significant, and will build upon the 2017 study by retaining a functional asset allocation framework. Potential changes could focus on sizing of existing assets classes and portfolio construction modifications within asset classes.

### **NEXT STEPS:**

Looking ahead, the Board, Staff, and SCERS' investments consultants will work together to determine the best asset allocation approach to take for SCERS given the Board's desired objectives and risk tolerances, in combination with SCERS' actuarial liability characteristics. This will be an iterative process that is expected to occur over the next three quarters, and which starts with the ERT analysis after the New Year.

### **ATTACHMENTS**

- Verus ALM Board Education Presentation

Prepared by:

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Chief Investment Officer

Reviewed by:

/S/

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Chief Executive Officer



**PERSPECTIVES  
THAT DRIVE  
ENTERPRISE  
SUCCESS**



DECEMBER 2020

ALM Board Education

**Sacramento County Employees' Retirement Association**

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# I. Review of 2017 ALM study

# Review of 2017 Asset Liability Study

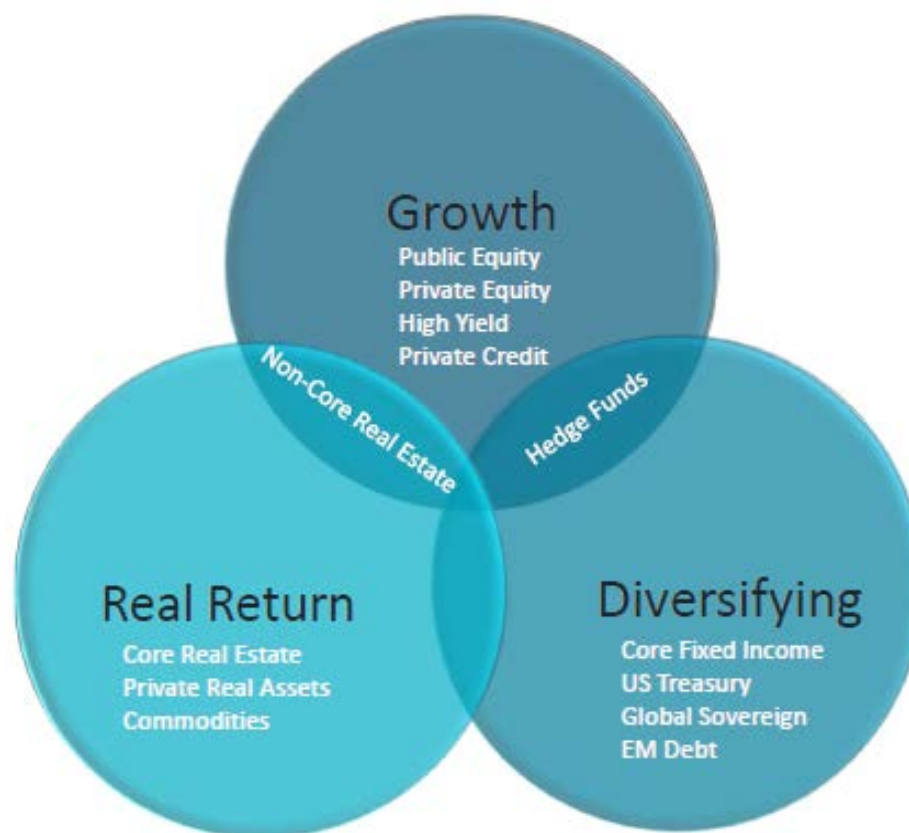
SCERS combined Mean Variance framework with alternative risk-based approaches

## Evolved Approach to A/L Modeling

- 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
  - Liquidity risk
- 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

# Introduction of functional labels

- Segments of the asset allocation re-grouped and re-classified
  - Assists in improving diversification across risk factors and exposure to economic environments
  - Better identifies the roles that various segments play in SCERS' portfolio
- Blends traditional and alternative asset classes
- Simplified approach at asset category level
  - Growth
  - Diversifying
  - Real Return



# Executive Summary

- At the January 2017 Board Meeting, the Board chose a new asset allocation policy

SCERS' New Target Policy Allocation				
Asset Category/Class	Prior Policy Allocation	New Policy Allocation	Changes	
<b>Growth</b>	63.0%	59.0%	<b>-4.0%</b>	
Public Equities	45.0%	41.0%	<b>-4.0%</b>	
Private Equity	10.0%	9.0%	<b>-1.0%</b>	
Public Credit	2.0%	2.0%	0.0%	
Private Credit	0.0%	4.0%	4.0%	
Growth Oriented Absolute Return	6.0%	3.0%	<b>-3.0%</b>	
<b>Diversifying</b>	22.0%	25.0%	3.0%	
Core/Core Plus Fixed Income	15.0%	10.0%	<b>-5.0%</b>	
U.S. Treasury	0.0%	5.0%	5.0%	
Global Fixed Income	3.0%	3.0%	0.0%	
Diversifying Absolute Return	4.0%	7.0%	3.0%	
<b>Real Return</b>	15.0%	16.0%	1.0%	
Real Estate	7.0%	7.0%	0.0%	
Private Real Assets	6.0%	7.0%	1.0%	
Commodities	2.0%	2.0%	0.0%	
Opportunities	0.0%	0.0%	0.0%	

- Reduction in Growth; increases in Diversifying and Real Return
- Similar expected return with lower range of outcomes – more risk balanced
- Increase in cash flow generating strategies

# How Did SCERS Do?

2017-2020<sup>1</sup>

	Projected	Actual (gross)	Met expectations?
Total Fund	7.2%	8.6%	Yes
Growth	8.1%	10.3%	Yes
Diversifying	4.0%	4.3%	Yes
Real Return	7.8%	5.8%	No
Inflation	2.0%	1.5%	No
Risk (standard deviation)	10.4%	7.5%	Yes
Max Drawdown	-13.6% (2x standard deviation)	-10.5% (Covid drawdown)	Yes

Overall, SCERS' portfolio exceeded the projected returns from the 2016 ALM study

<sup>1</sup> March 2017-September 2020

# II. Asset allocation concepts overview

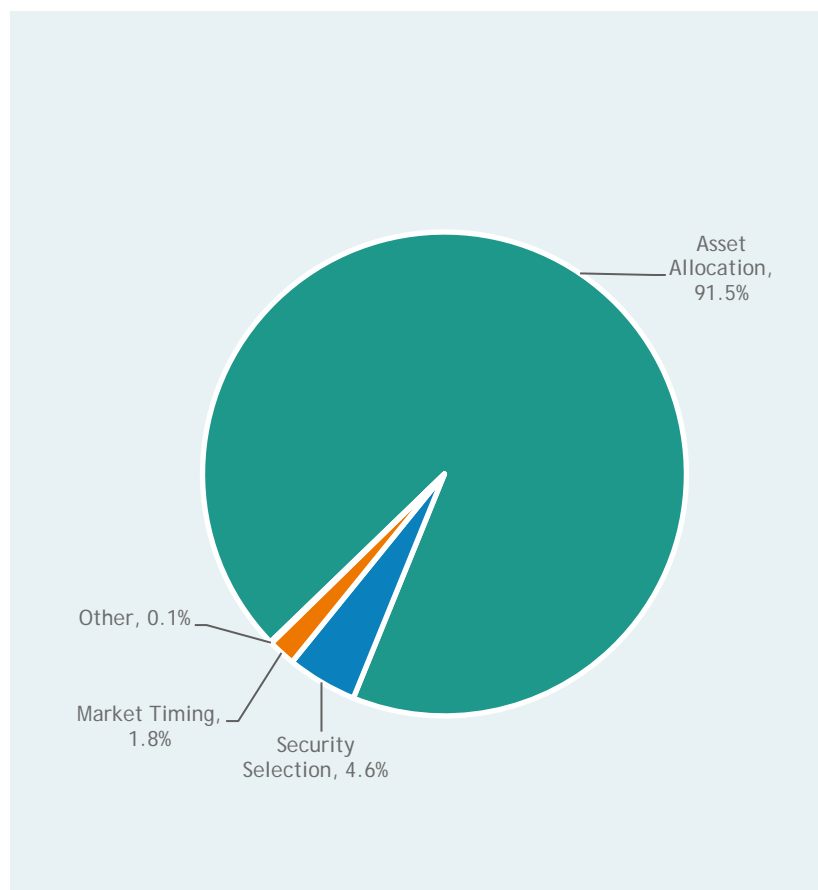
# Asset allocation decision

Asset allocation drives the bulk of the variation in portfolio returns over time

## ACADEMIC SUPPORT:

- Gary P. Brinson, L. Randolph Hood, and Gilbert L. Beebower. "Determinants of Portfolio Performance". Financial Analysts Journal, July/August 1986.
- Gary P. Brinson, Brian D. Singer, and Gilbert L. Beebower. "Determinants of Portfolio Performance II: An Update". Financial Analysts Journal, 47, 3 (1991).
- Roger G. Ibbotson and Paul D. Kaplan. "Does Asset Allocation Policy Explain 40%, 90%, or 100% of Performance?" Financial Analysts Journal, January/February 2000.

PERCENT OF VARIATION EXPLAINED

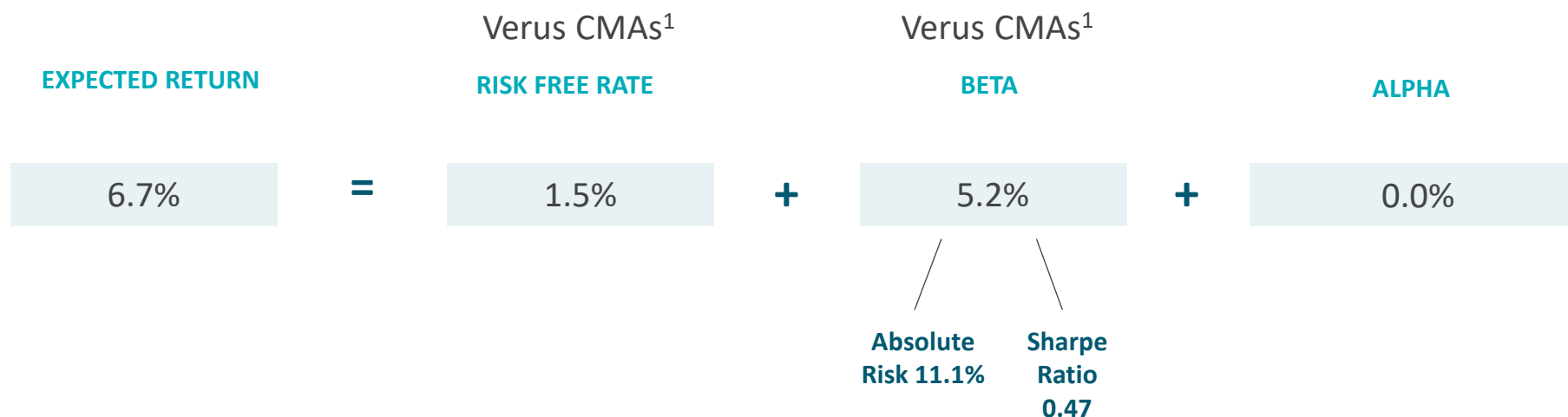


Asset allocation is usually the most important decision we make as investors

Source: Brinson, Singer & Beebower: Determinants of Portfolio Performance II: An Update

# Drivers of return

- The expected return is a function of the risk-free interest rate, expected beta, and alpha.
  - Risk free rate is determined using ten-year forward looking Verus capital market assumptions.
  - Beta is determined using ten-year forward looking Verus capital market assumptions.
  - Alpha is impacted by manager selection and asset allocation tilts. We don't include an alpha assumption in our ALM study forecasts.
- We expect Absolute/active, Sharpe ratio, and Information ratios will fluctuate over time



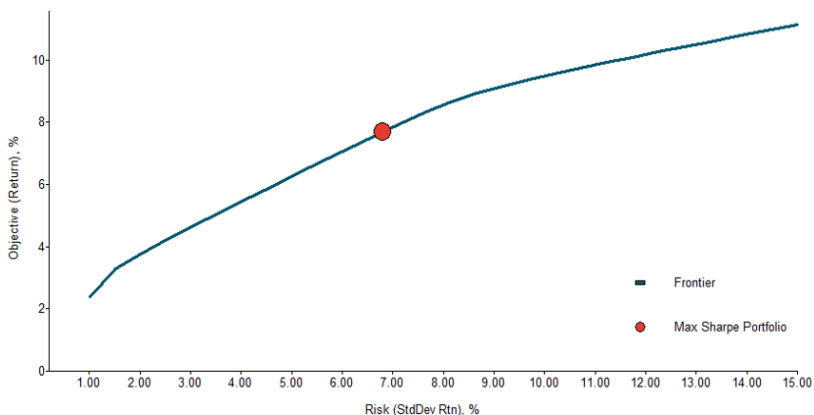
<sup>1</sup>CMA = Capital Market Assumptions. Risk and Sharpe Ratio based on SCERS' 2019 Policy Adjustment study.



# Solving the asset allocation question

Requires using multiple lenses

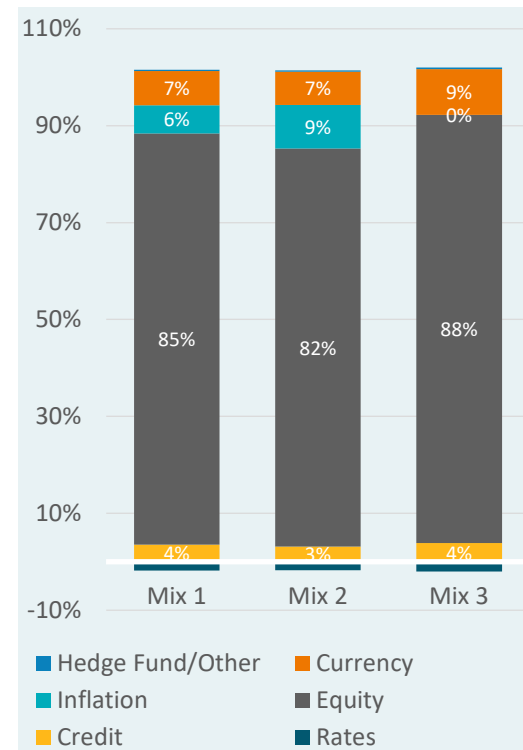
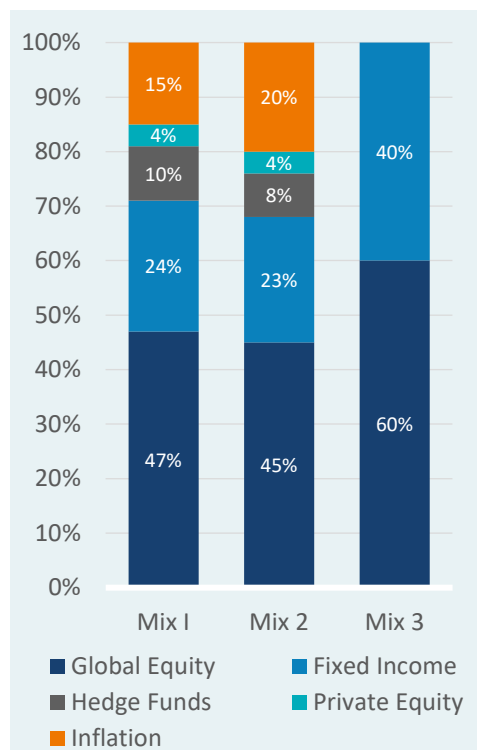
## MEAN-VARIANCE ANALYSIS & OPTIMIZATION



- Established in 1952, MVO<sup>1</sup> is the cornerstone of Modern Portfolio Theory, and was the primary method by which most asset allocations were determined for decades.
- For a given set of expected returns, correlations, and standard deviations, an investor can maximize return per unit of risk, and determine a single “efficient portfolio”
- MVO requires precise inputs, which is a practical limitation.

<sup>1</sup> MVO = Mean-variance optimization

## RISK FACTOR ALLOCATION



- Decomposing asset classes by sources of risk can provide additional perspective.
- Over-reliance on equity risk can create significant tail-risk.

# Economic conditions & asset class returns



**Rising Growth**

Equities	Emerging Market Debt
Commodities	Real Estate
Corporate Bonds	Infrastructure



**Falling Growth**

Government Bonds	Inflation Linked Bonds
Corporate Bonds	
Emerging Market Debt	



**Rising Inflation**

Inflation Linked Bonds	Infrastructure
Commodities	
Real Estate	



**Falling Inflation**

Equities	Emerging Market Debt
Government Bonds	
Corporate Bonds	

Diversification by economic regime is another approach to answering the same question

# 'Functional' asset allocation

Think outside the optimizer to identify the role of asset classes

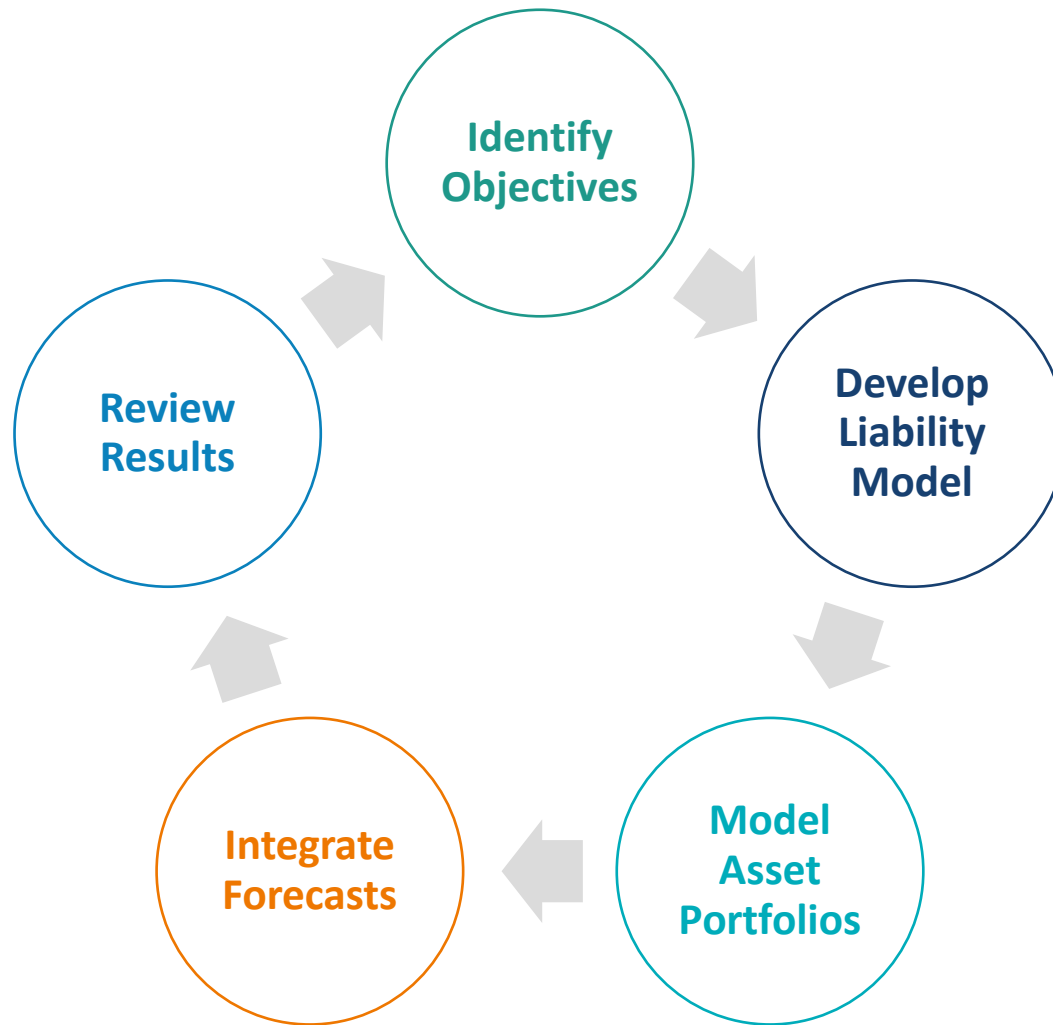
- Why do we invest in various asset classes?
- What is it we practically expect them to contribute to the portfolio over time?
- What will determine whether or not they serve the desired role?

	RETURN ROLES				DIVERSIFICATION & VOLATILITY ROLES			HOW MACRO OUTLOOK/GDP AFFECTS ROLE	
	Benefit from GDP Growth	Earn Risk Premium	Produce Stable Income	Hedge Against Inflation	Low Absolute Volatility	Low Corr. To Other Assets	Reduce Portfolio Volatility	Elements of Return for Asset Class	Sensitivity of Role to GDP
Public Equities	●	◐	◑	◑	○	◑	◑	PEs, Dividends, Earnings Growth	●
Private Equities	●	●	○	○	◑	◑	◑	PEs (exits), Financing, Opportunity Set	◐
Fixed (Treasury)	○	○	●	◑	●	◑	●	Direct Link to Yields	◑
Fixed (Credit)	◑	◑	●	◑	◑	◑	◑	Direct Link to Yields, Credit Spreads	◐
Hedge Funds (Perceived role)	○	◑	○	○	●	●	●	PEs, Credit Spreads, Fat Tails	◑
Real Estate	◑	◑	◑	●	◑	◑	◑	Unemployment, Vacancies, Cap Rates	●

Magnitude: ● High ◐ Med-High ◑ Medium ◒ Low ○ None

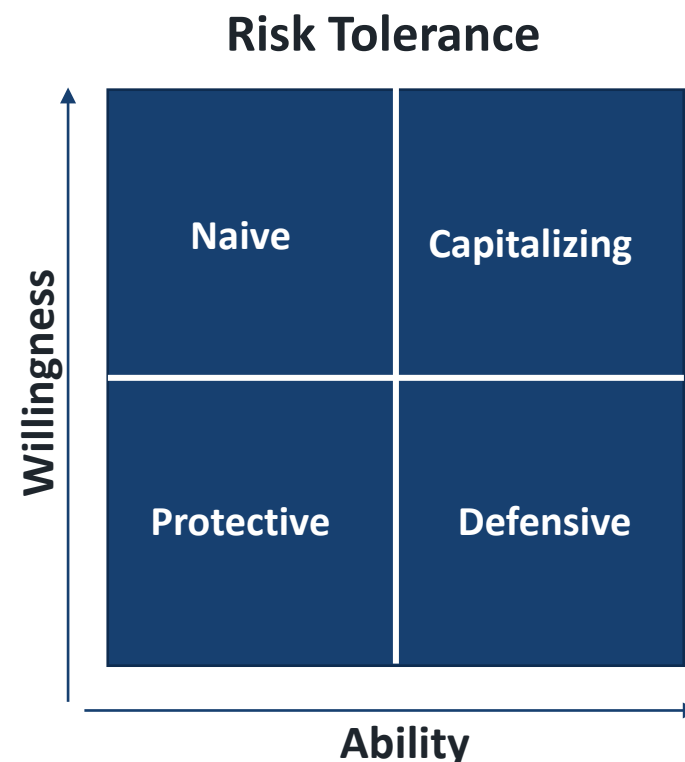
# Steps in the ALM process

# Asset-liability modeling process



# Enterprise risk tolerance in context

- Properly assessing Enterprise Risk Tolerance has important and practical implications for investment strategy development.
- It involves assessing the Plan's ability and the Board's willingness to accept risk.
- Although the Board's fiduciary duty is to the Members, understanding how the County's financial situation impacts its ability to make contributions cannot be overlooked.
- We plan to conduct an electronic survey and virtual interviews with each of the SCERS Board members.



# Risk tolerance examples

## The four quadrants explained

### “NAIVE”: HIGH WILLINGNESS/LOW ABILITY

- Low ability could imply the sponsor has financial challenges and the current level of contributions is not sustainable, or the plan itself is challenged, with low funded status and negative outflows.
- In this case, the high-risk tolerance of the Board needs to be reconciled with education about downside risks.
- Most likely this plan will invest aggressively at its own peril.

### “CAPITALIZING”: HIGH WILLINGNESS/HIGH ABILITY

- High ability is generally characterized by a high funded ratio, a healthy plan sponsor(s), and stable cash flows.
- High willingness reflects Board or stakeholder sentiment that is in line with current ability.
- In this case since both are aligned, a more aggressive portfolio is likely warranted.

### “PROTECTIVE”: LOW WILLINGNESS/LOW ABILITY

- Low ability could imply the sponsor has financial challenges and the current level of contributions is not sustainable, or the plan itself is challenged, with low funded status and negative outflows.
- Since the Board’s willingness aligns with the ability, a lower risk portfolio is the most likely outcome. The long-term health of the plan will require higher future contributions at some point.

### “DEFENSIVE”: LOW WILLINGNESS/HIGH ABILITY

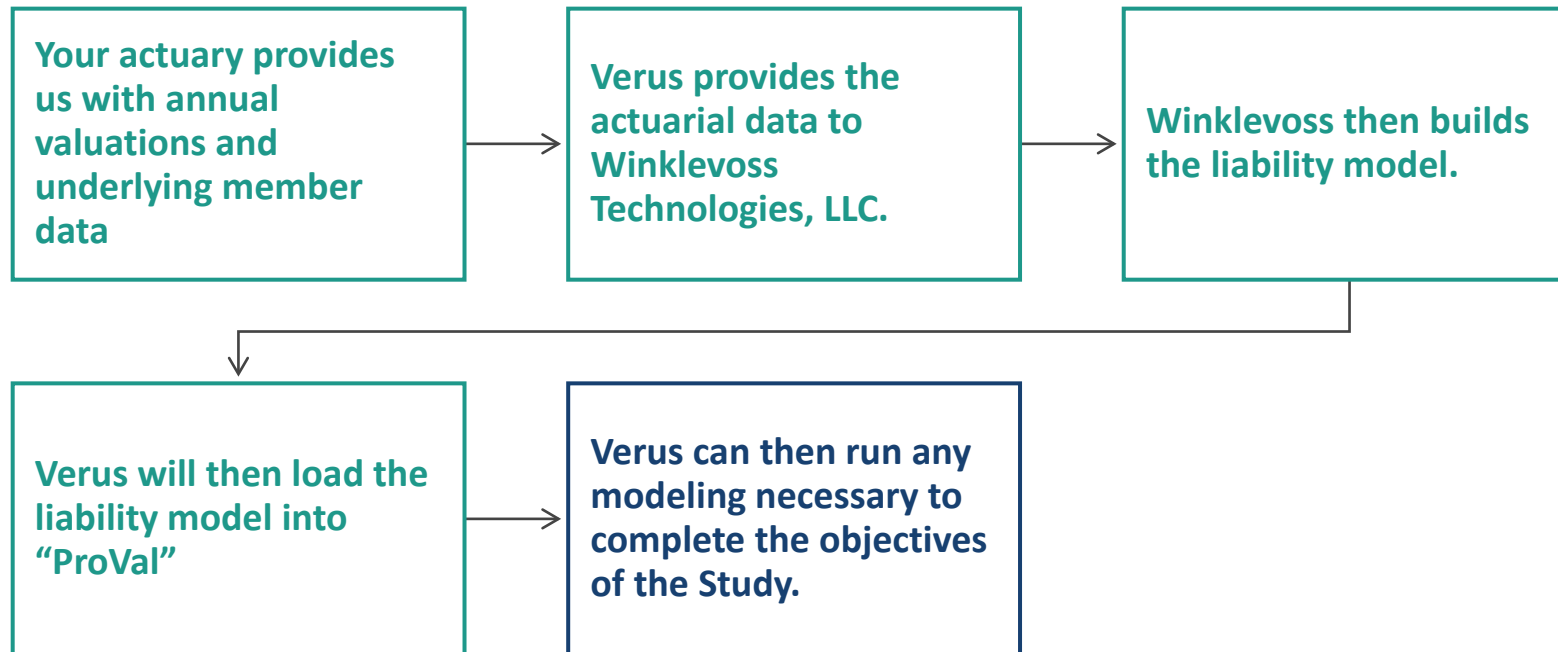
- High ability is generally characterized by a high funded ratio, a healthy plan sponsor(s), and stable cash flows.
- Low willingness reflects a risk-adverse Board.
- Absent a reconciliation of willingness, this plan may be able to capitalize on high ability in other ways (i.e. lower the assumed return or fund a contingent reserve)

# Develop Liability Model



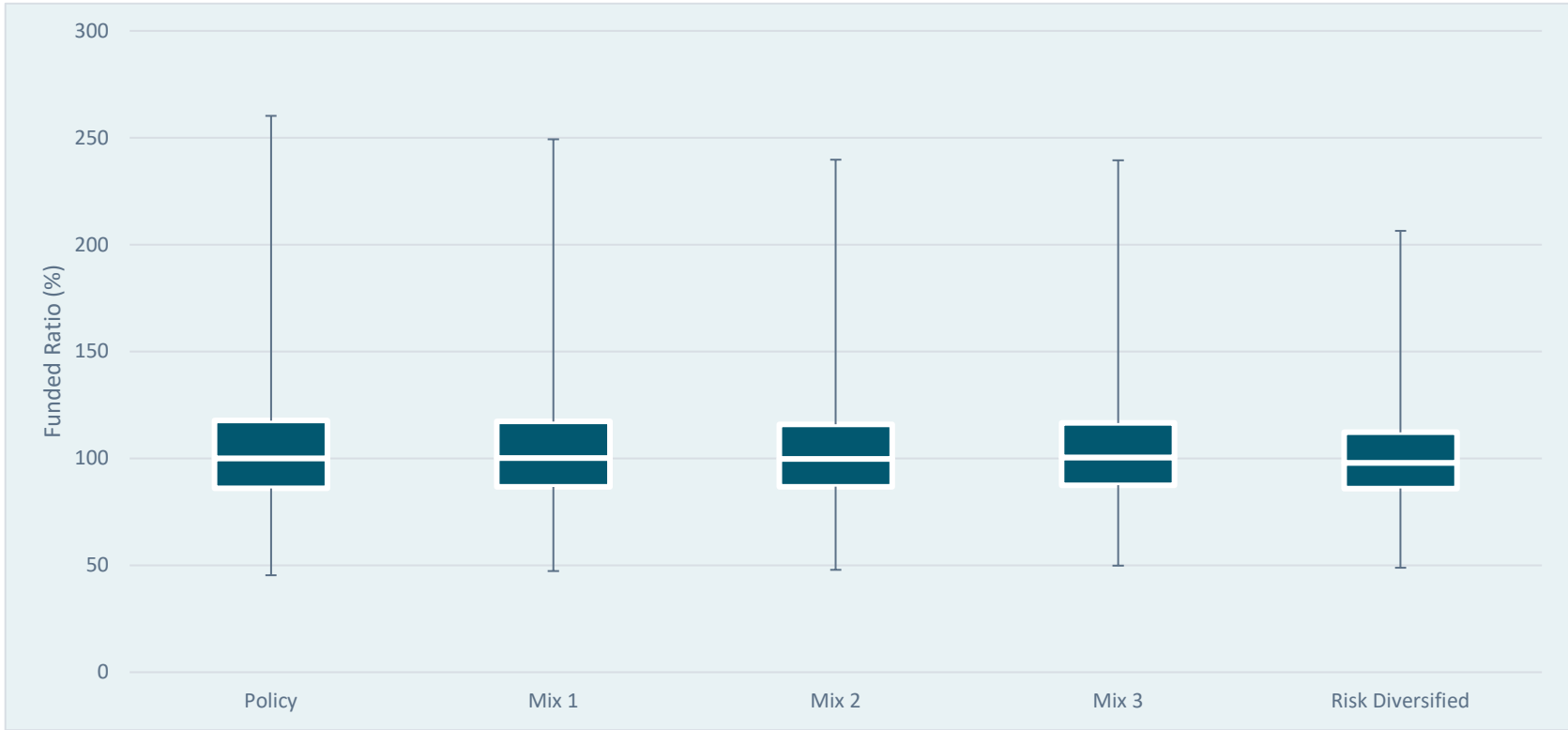
# Develop Liability Model

- We partner with an industry-leading firm that specializes in actuarial valuation models.
- This enables us and our clients to obtain the necessary expertise to accurately capture all of the applicable data and assumptions at the individual participant level.



# Expected funded ratio - *example*

FUNDED RATIO SIMULATION FOR PLAN YEAR ENDING 2025

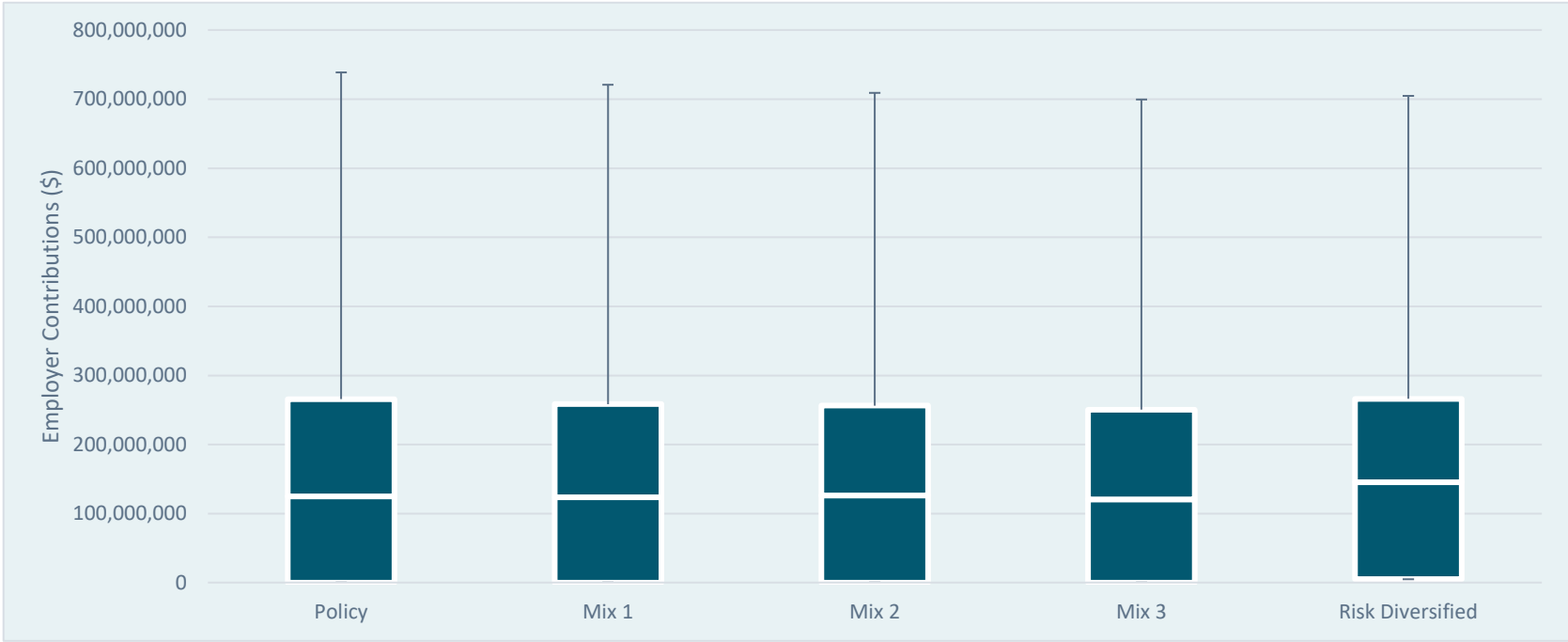


	Policy	Mix 1	Mix 2	Mix 3	Risk Diversified
Best Case	260	249	240	240	207
Median	100	100	100	100	98
Worst Case	41	39	39	38	37

Based on 5,000 independent simulations. Best case defined as 100<sup>th</sup> percentile. Worst case defined as 0<sup>th</sup> percentile. Median outcome is the 50<sup>th</sup> percentile.

# Expected employer contributions - *example*

EMPLOYER CONTRIBUTION SIMULATION FOR PLAN YEAR ENDING 2025



	Policy	Mix 1	Mix 2	Mix 3	Risk Diversified
Best Case	-	-	-	-	-
Median	125,056,000	123,864,000	126,310,000	120,658,000	120,649,000
Worst Case	738,548,000	721,062,000	709,075,000	699,371,000	704,682,118

Based on 5,000 independent simulations. Best case defined as 0<sup>th</sup> percentile. Worst case defined as 100<sup>th</sup> percentile. Median outcome is the 50<sup>th</sup> percentile.

# Model Asset Portfolios

# Investment models - *example*

	Policy	Mix 1	Mix 2	Mix 3	Risk Diversified
<b>Asset Class</b>					
US Equity	22.5%	21.0%	21.0%	19.0%	17.5%
International Equity	17.5%	17.0%	16.0%	15.0%	13.5%
Emerging Equity	5.0%	5.0%	4.0%	4.0%	4.0%
Private Equity	10.0%	9.0%	9.0%	8.0%	5.0%
Public Credit	2.0%	2.0%	2.0%		5.0%
Private Credit		2.0%	4.0%	4.0%	5.0%
CW-Growth Oriented Absolute Return/HF*	6.0%	6.0%	3.0%	6.0%	
<b>Growth</b>	<b>63.0%</b>	<b>62.0%</b>	<b>59.0%</b>	<b>56.0%</b>	<b>50.0%</b>
Core/Core Plus Fixed Income	15.0%	10.0%	10.0%	8.0%	
US Treasury		5.0%	5.0%	5.0%	15.0%
Global Sovereign ex US	2.0%		2.0%		
EM Debt	1.0%	2.0%	1.0%	3.0%	5.0%
CW-Diversifying Absolute Return/HF*	4.0%	6.0%	7.0%	7.0%	
Absolute Return/HF					5.0%
<b>Diversifying</b>	<b>22.0%</b>	<b>23.0%</b>	<b>25.0%</b>	<b>23.0%</b>	<b>25.0%</b>
Real Estate	7.0%	7.0%	7.0%	9.0%	20.0%
CW-Private Real Assets*	6.0%	6.0%	7.0%	9.0%	
Commodities	2.0%	2.0%	2.0%	3.0%	5.0%
<b>Real Return</b>	<b>15.0%</b>	<b>15.0%</b>	<b>16.0%</b>	<b>21.0%</b>	<b>25.0%</b>
<b>Opportunities**</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

These mixes were taken from the SCERS ALM study in 2016

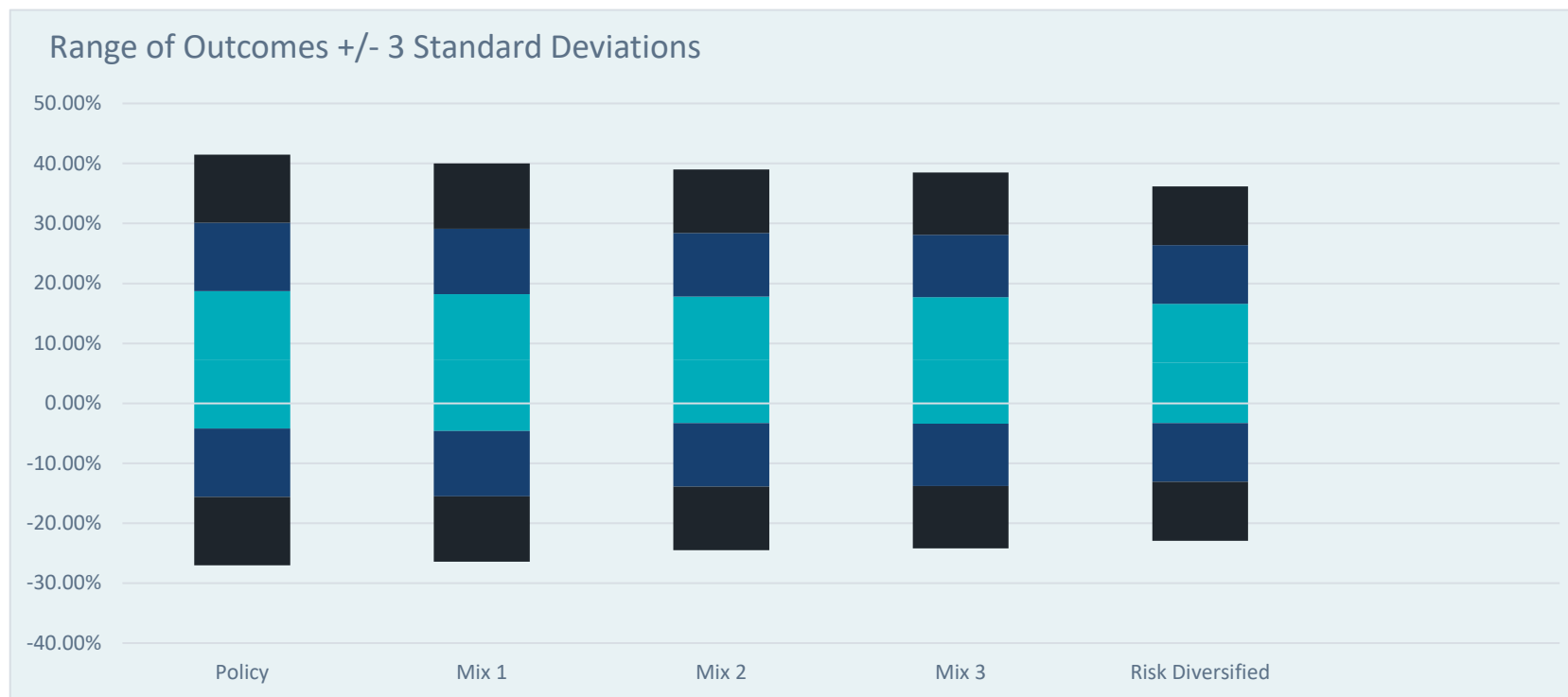
\*Cliffwater assumptions were used for Real Assets and Hedge Funds

\*\*Opportunities has a target of 0%, but can range between 0% and 5%, and is sourced from the asset class with the closest risk and return profile

# Investment model forecasts - *example*

	Policy	Mix 1	Mix 2	Mix 3	Risk Diversified
<b>Mean Variance Analysis</b>					
<b>Forecast 10 Year Return</b>	<b>7.3%</b>	<b>7.3%</b>	<b>7.2%</b>	<b>7.3%</b>	<b>6.8%</b>
Standard Deviation	11.4%	10.9%	10.6%	10.4%	9.8%
<i>Return/Std. Deviation</i>	0.64	0.67	0.68	0.70	0.70
Sharpe Ratio	0.51	0.53	0.54	0.56	0.54

Mix 3 on paper looks to be the most attractive portfolio

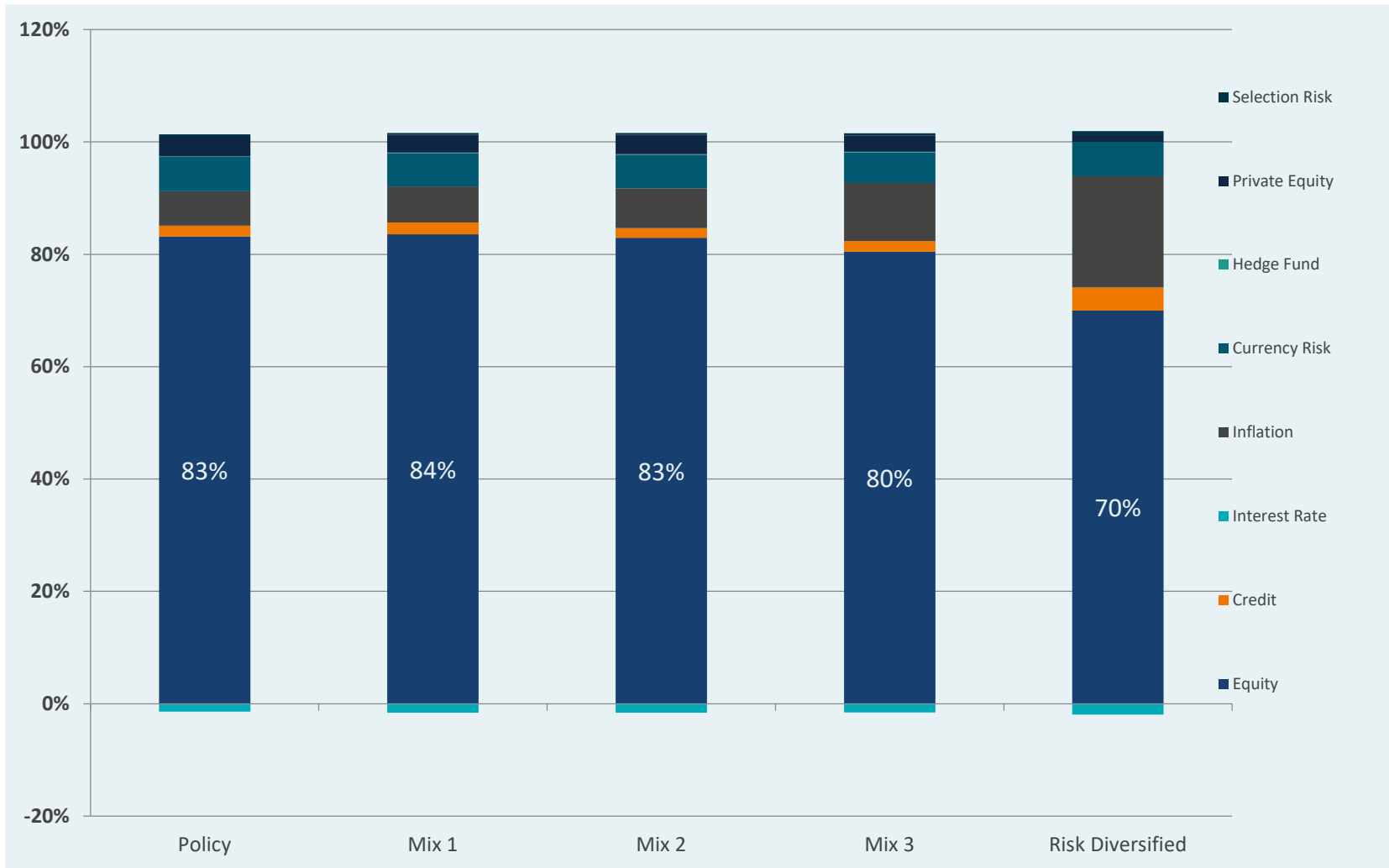


SCERS chose Mix 2 which we believe was the right decision

*\*Cliffwater assumptions were used for Real Assets and Hedge Funds*

*Risk/Return Analysis done in ProVal*

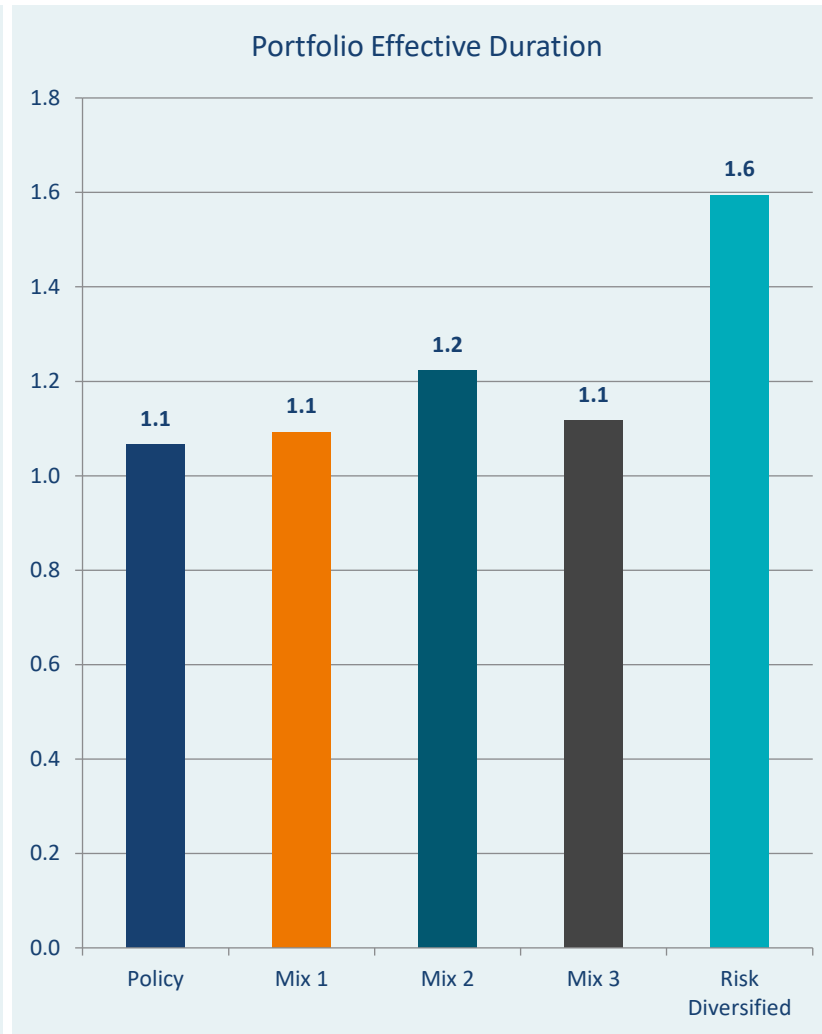
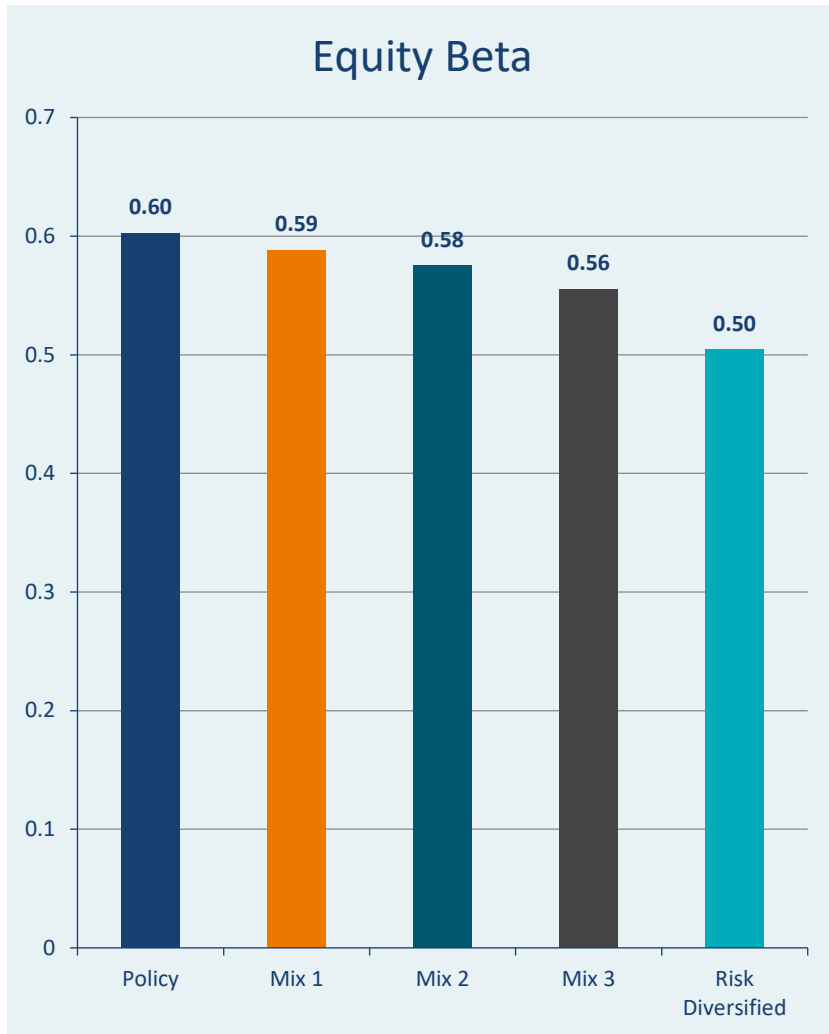
# Risk decomposition - *example*



Source: MSCI BARRA

Note: Selection Risk is the risk attributable to unassigned factors

# Sources of risk - *example*



Equity beta measures the sensitivity to the risks of the broad equity market.

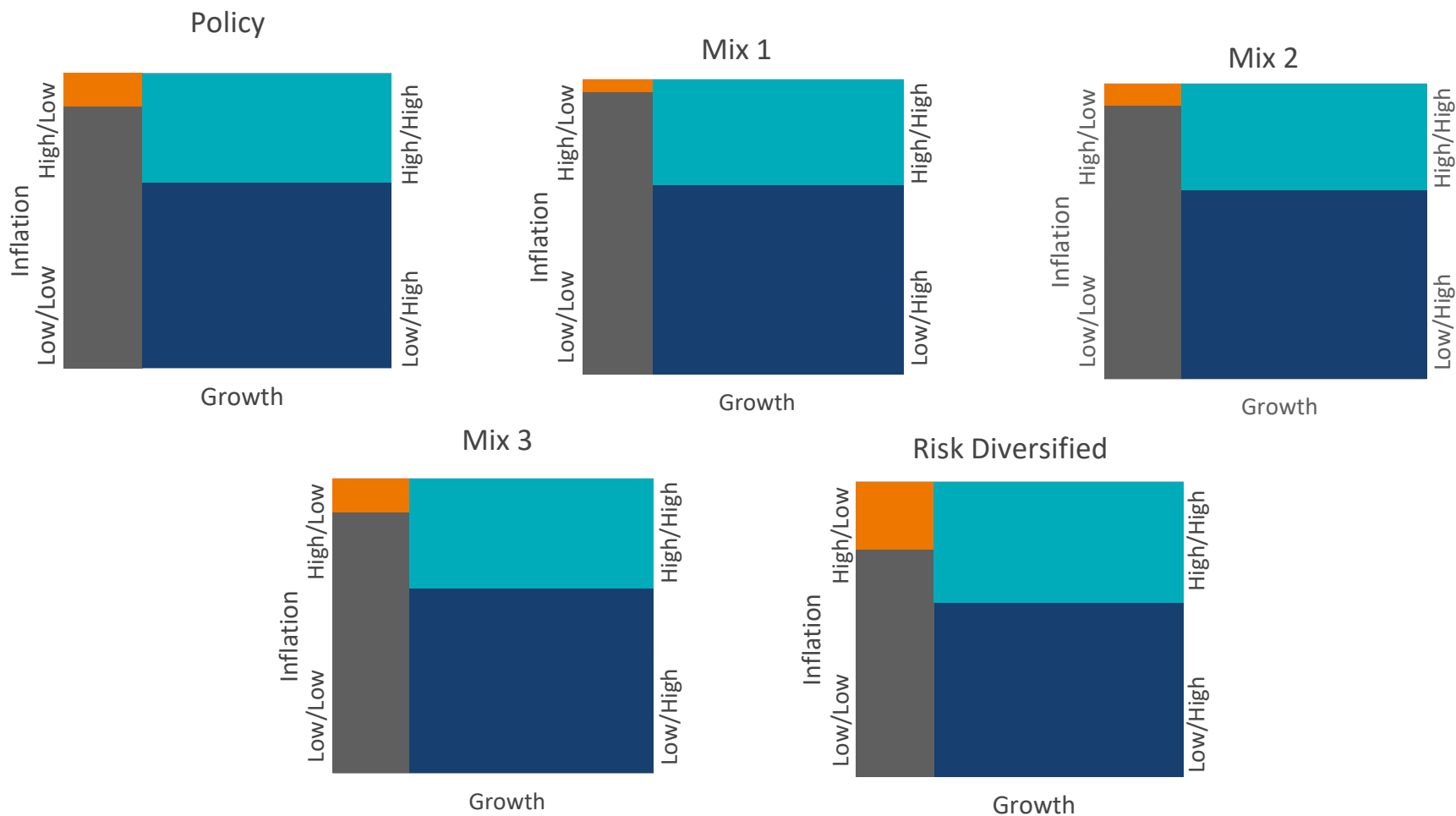
Duration measures the sensitivity of the portfolio to a change in interest rates.

Source: MSCI BARRA

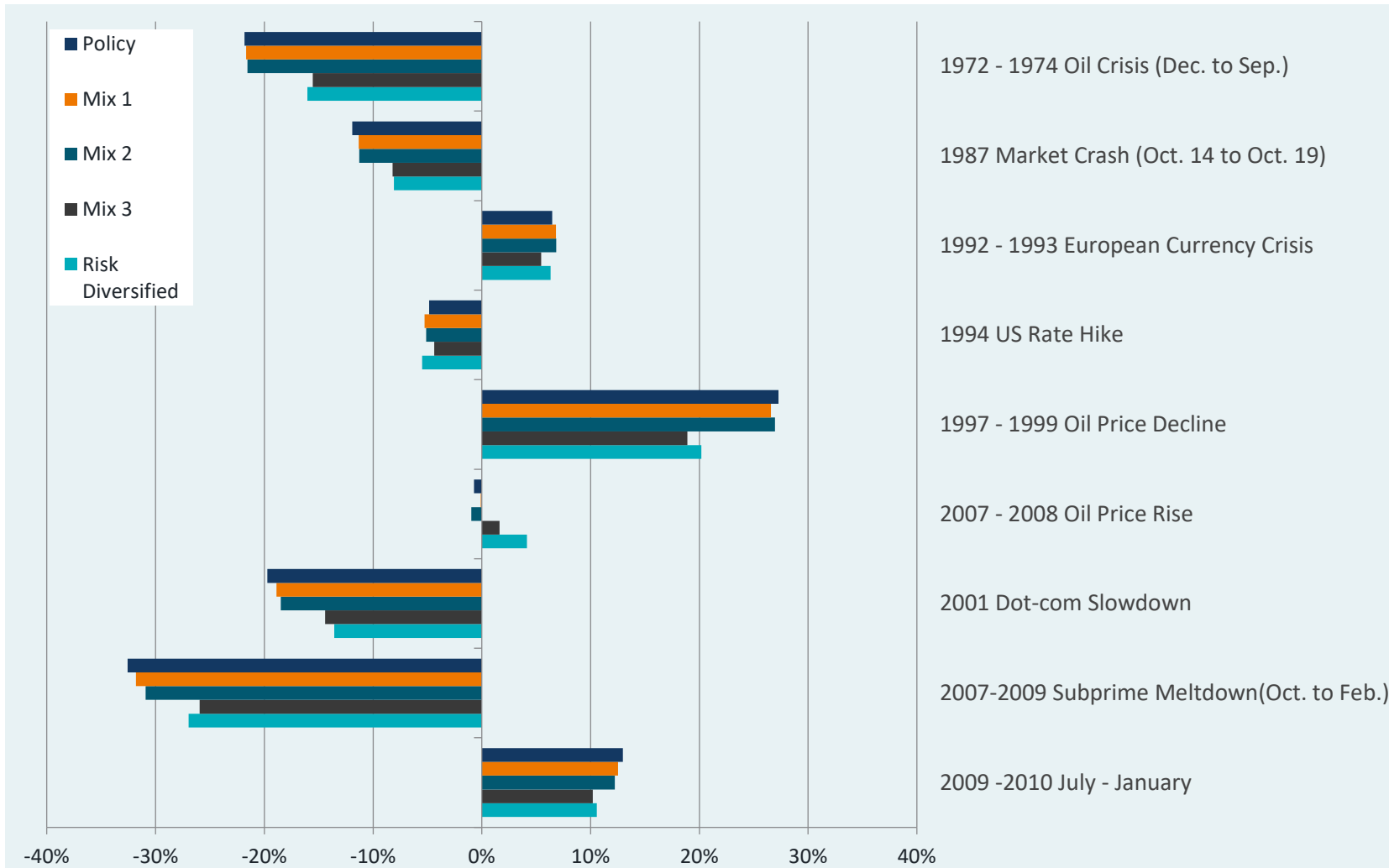


# Economic diversification - *example*

Most portfolios have a bias towards high a growth / low inflation regime.



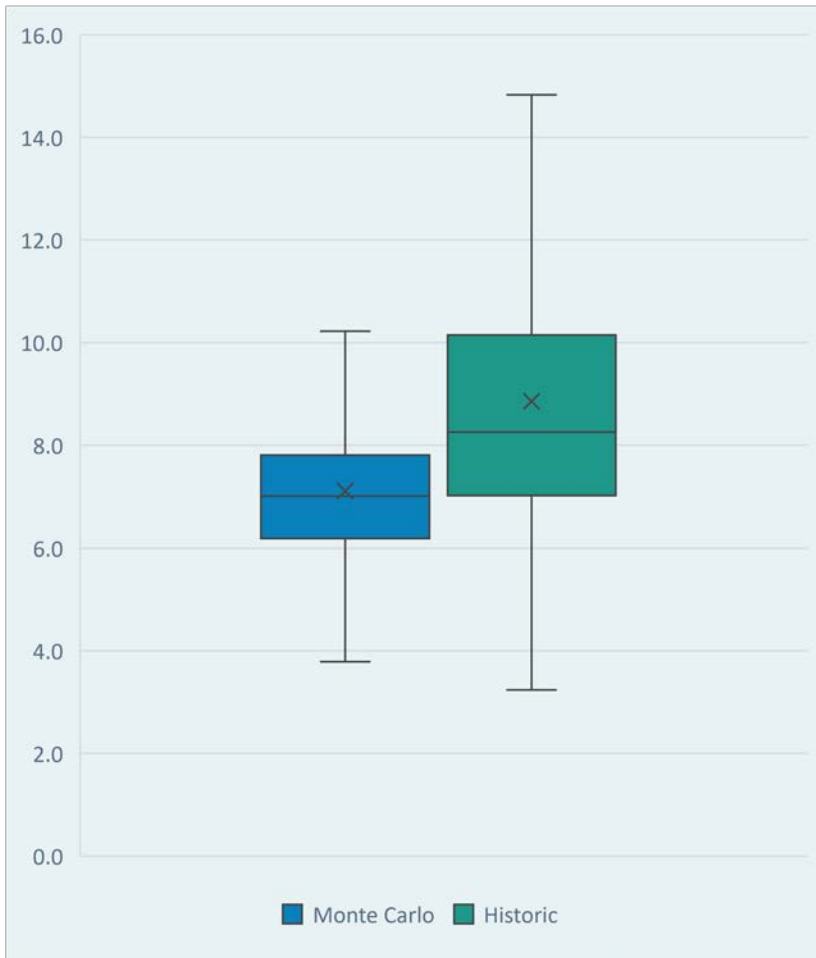
# Scenario Analysis - *example*



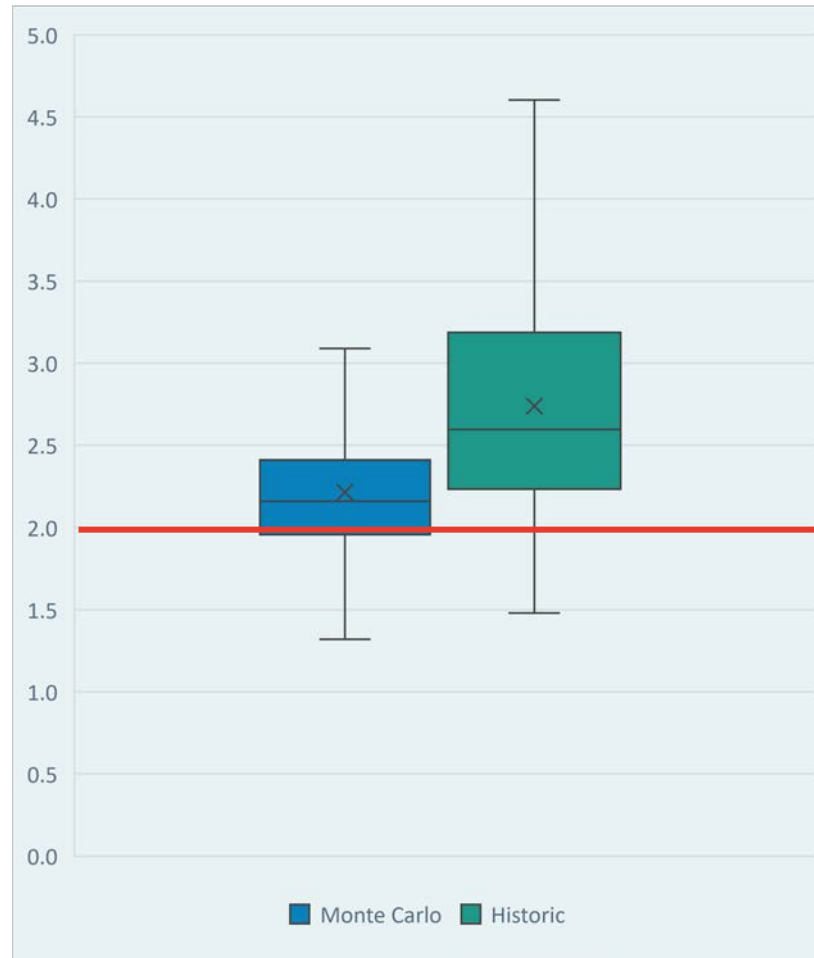
Source: MSCI BARRA

# Liquidity Coverage Ratio – LCR - *example*

1-YEAR LCR



5-YEAR LCR



5-year LCR median outcome is 2.2 with 50% of all observations between 1.9-2.4

- Actuarial information provided by Segal
- Private market projections for capital calls and distributions provided by Cliffwater and Townsend

# Review Results

# Review Results

- While ProVal is very effective for modeling, it is more of a calculator than a presentation tool.
- Verus compiles the output into a comprehensive presentation to facilitate actionable discussion.
- Each presentation is tailored around the specific objectives of the study.
- This is often an iterative process. Reviewing the results may lead us to identify additional questions we need to be asking.

# ALM Process Timeline

<b>Current Meeting Dates</b>	<b>Deliverable</b>
December	ALM Process Discussion
February	Enterprise Risk Tolerance Discussion
April	Asset Allocation Alternatives
June	Liability Model Results
July	Asset Liability Results/Review
September	Investment Policy Update