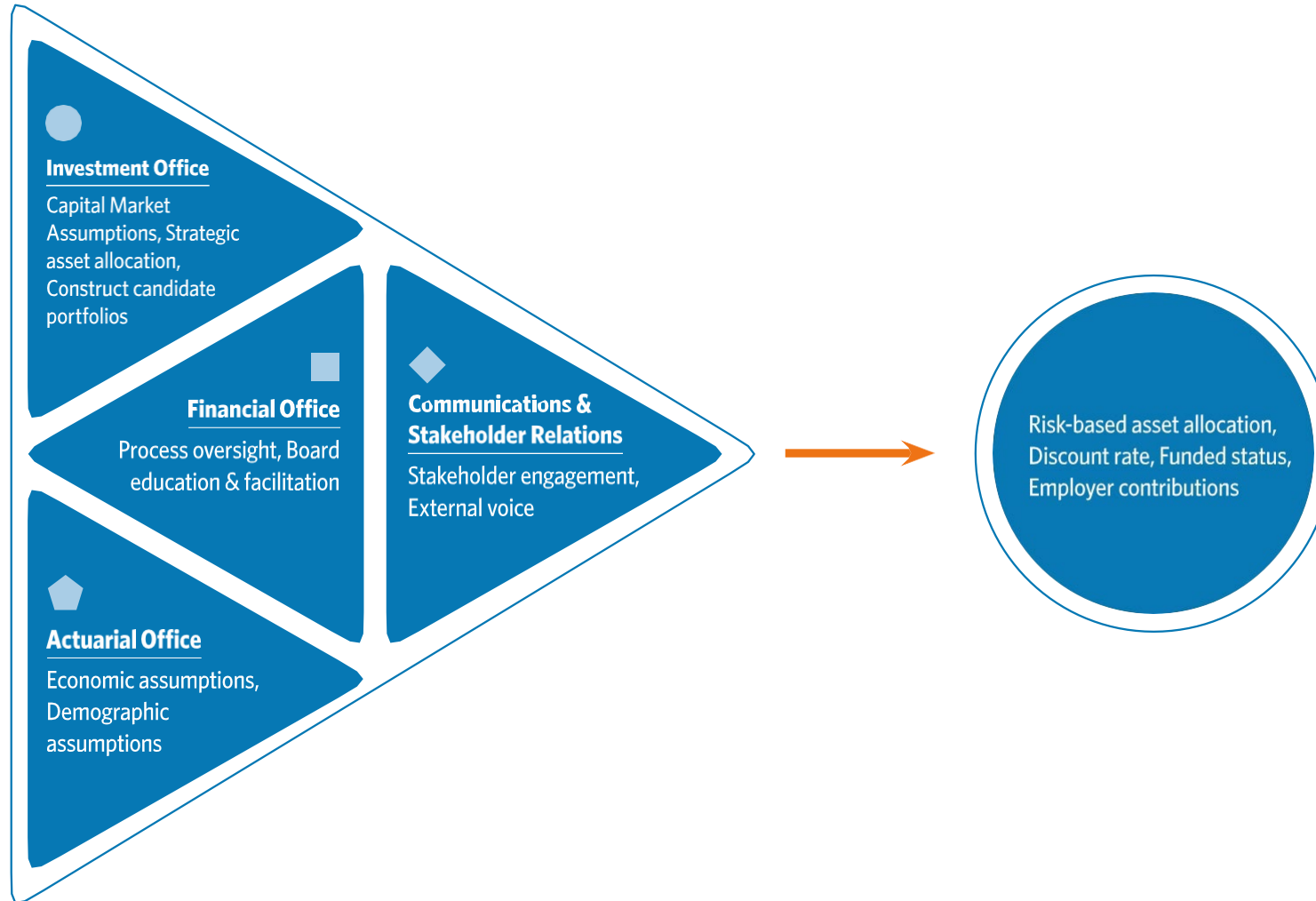


Asset Liability Management Mid-Cycle Review

Sterling Gunn, Managing Investment Director
Total Fund Portfolio Management

November 13, 2023

Key Functions Within the ALM Process

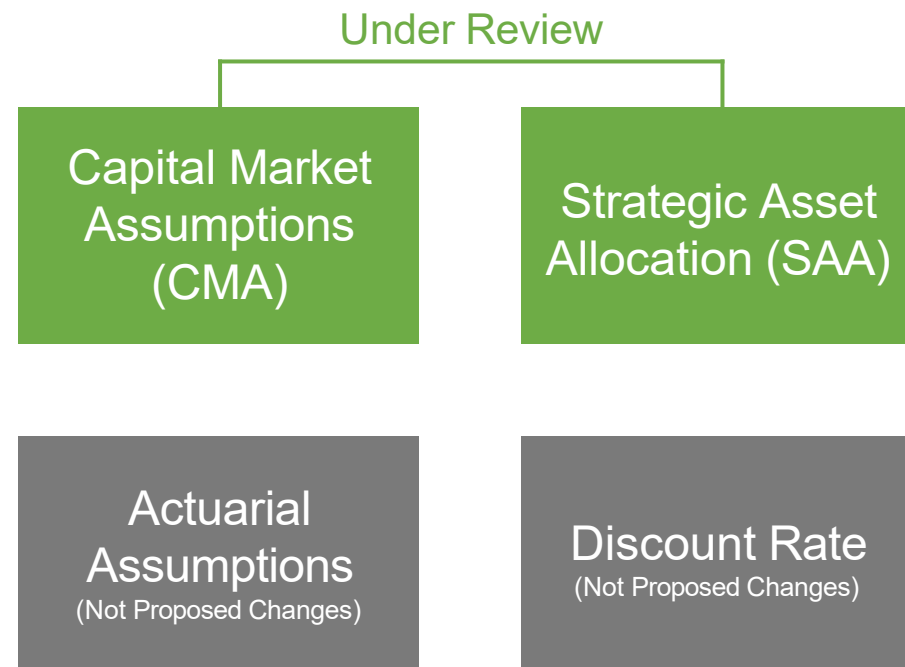


ALM Process Timeline

2021	2022	2023		2024	2025				
November	July*	February	November	March	February	June	July*	September	November
Experience study results	Effective date for strategic asset allocation	Educational sessions: concepts, framework, timeline	Discussion of mid-cycle review	Final approval of mid-cycle review asset allocation	Educational session: concepts, framework, timeline	Capital Market Assumptions	Educational sessions:	Discussion of candidate portfolios with proposed discount rates	Experience study results
Discussion of candidate portfolios with discount rates						Economic Assumptions	ALM process & framework		Discussion of candidate portfolios with discount rates
Final approval of discount rate							Investment funds risk assessment		Final approval of discount rate
Final approval of strategic asset allocation							Gauging the funds' ability to tolerate market risk		Final approval of strategic asset allocation

What is the Mid-Cycle Review

- An opportunity for the board to evaluate if the current financial landscape still aligns with decisions made during the prior ALM cycle.



Overview

The objectives of the Strategic Asset Allocation (SAA):

- Having a reasonable expectation of harvesting returns meeting or exceeding the actuarial discount rate over the long-term
- Minimizing the risk needed to support the harvesting strategy, and that risk being aligned with the Board's risk appetite

Review of key assumptions affecting the SAA:

- The Capital Market Assumptions (CMAs)
- Our objectives, derived from the Constitution of California
- Risk of loss, and staff choice of Conditional Drawdown at Risk (CDaR) as our measure of risk of loss
- Factors affecting portfolio construction, including constraints, choices of asset classes, diversification, and liquidity
- Assessing the effect of uncertainty on return outcomes through a series of stress tests, sensitivity analyses, and scenarios
- Ensuring continuous liquidity to cover member benefits and meet CalPERS expenses and obligations

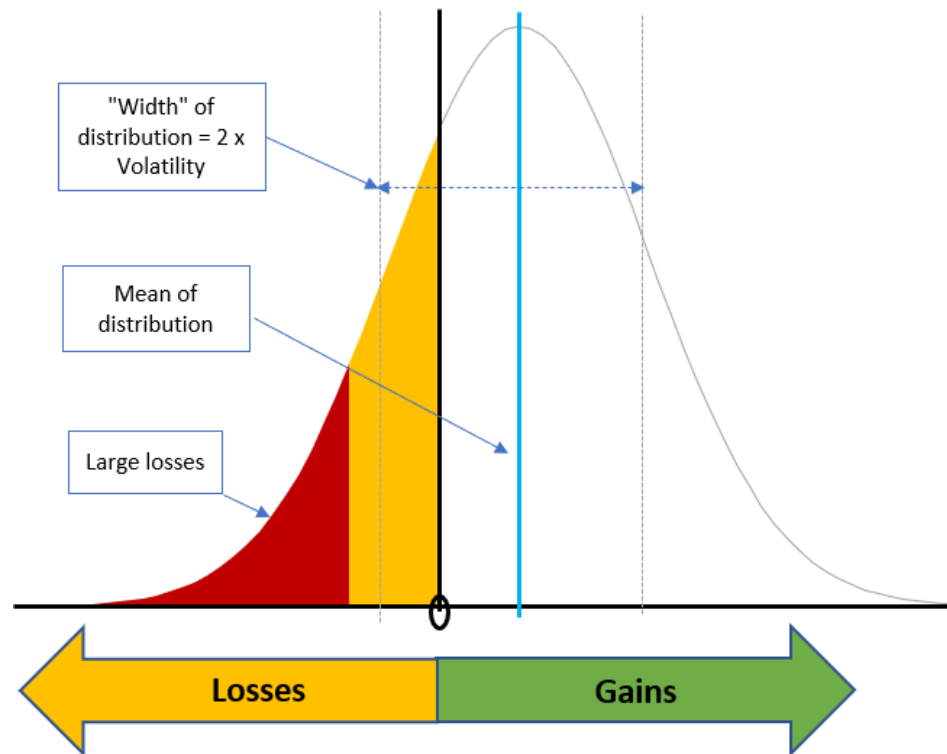
Summary

The 2021 SAA was shaped by constraints, and by the market conditions prevailing at the time. At that time, staff advised the Board that significant changes to these assumptions could lead to a revision of the SAA. In addition, staff advised the private equity allocation was constrained as a result of our limited capacity to originate private assets.

Since that time, our private asset strategies have increased their capacity to originate private assets, and there have been significant changes in market conditions. Staff has evaluated these changes, and is considering potential modifications to the SAA.

Risk of Loss and Risk Appetite

Distribution of Portfolio Returns $X \sim N(6.98\%, 11.2\%)$

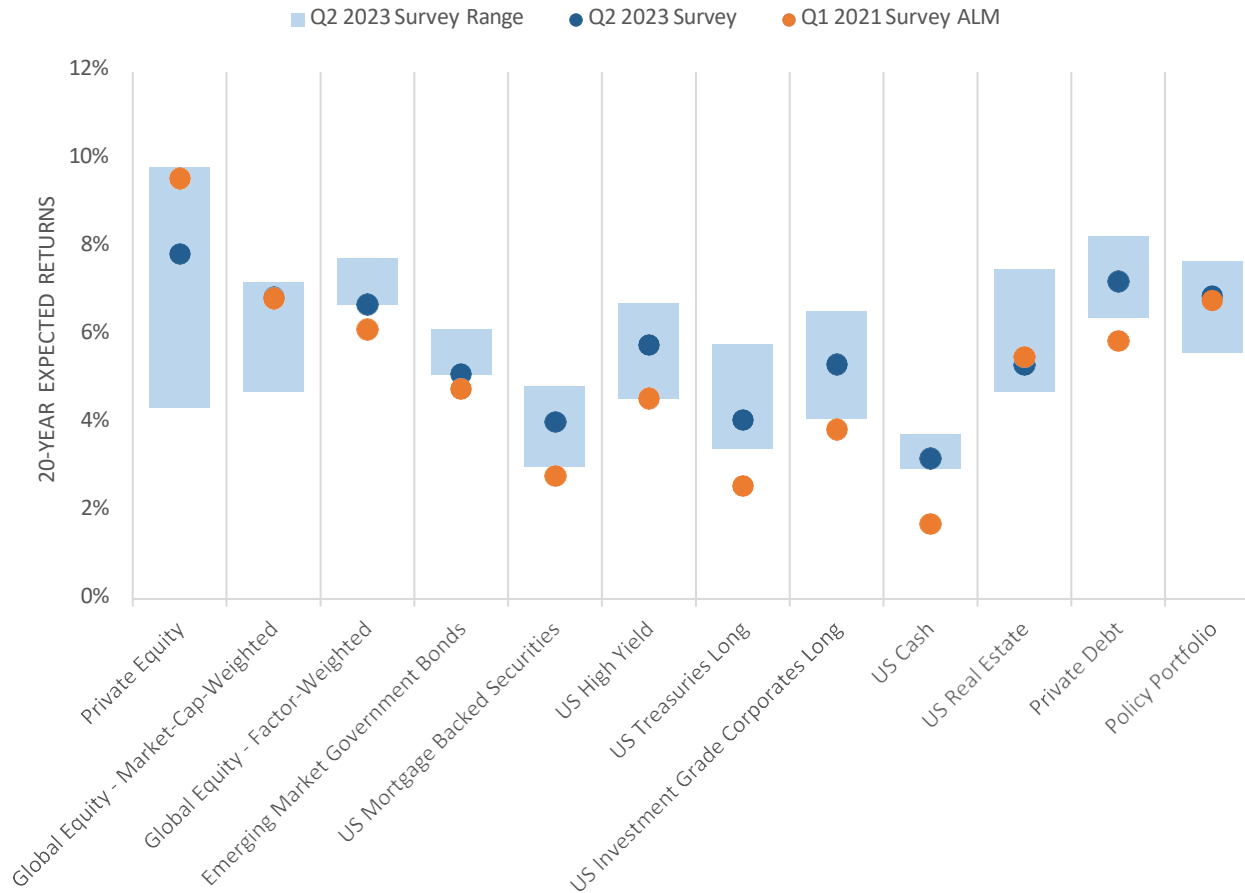


Constitution of California requires us to minimize risk of loss, without telling us how to measure 'risk of loss'. Staff adopted Conditional Drawdown at Risk during the 2021 Asset Liability Management (ALM) cycle.

- Conditional Drawdown at Risk is the average of possible 'large' peak to trough losses that could occur during a three-year period
- INVO staff defines 'large losses' to be the average of the worst ten percent of all losses (the average of the losses in the red area)
- INVO staff uses a simulation method to estimate this average of 'large losses'

INVO staff uses the risk of the current policy portfolio as a statement of Board risk appetite.

Capital Market Assumptions



Our CMAs are based on our quarterly survey of 15 CMA providers, including institutional consultants and asset managers.

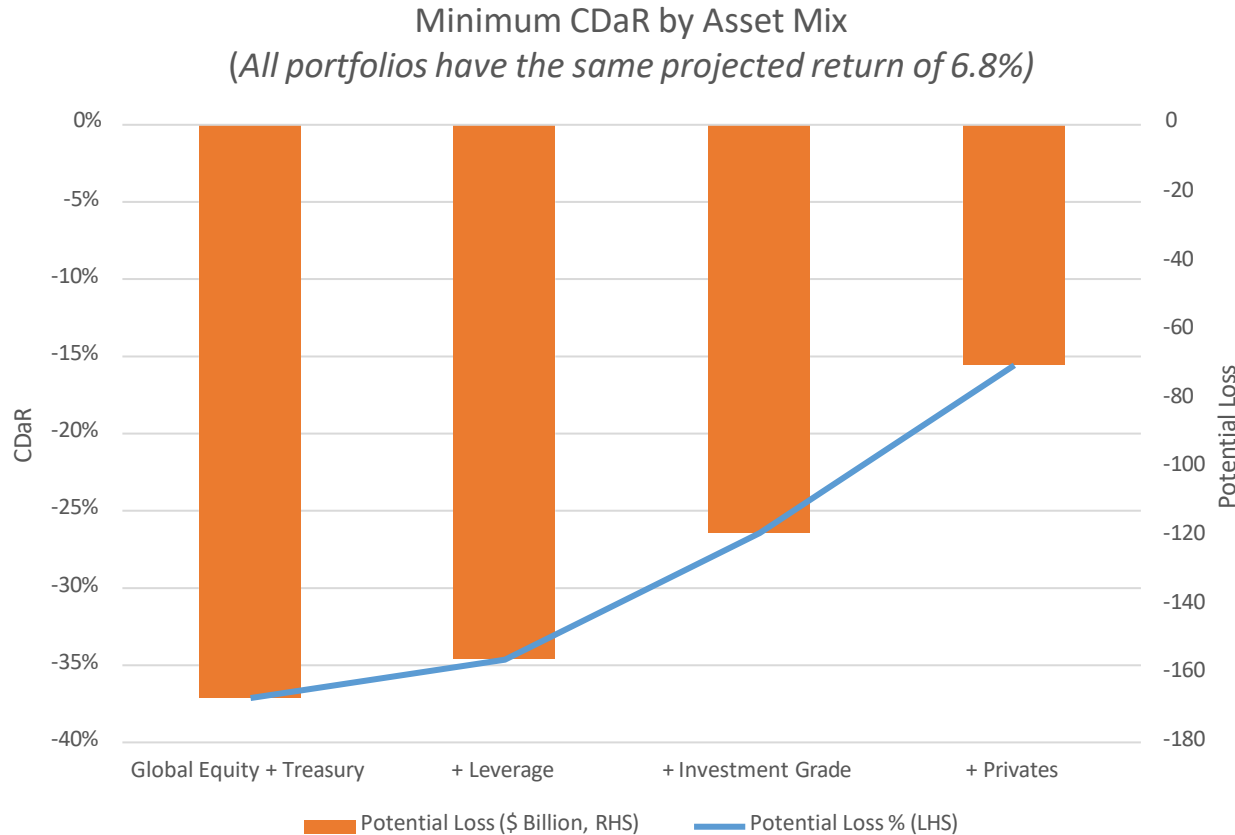
- The light blue box represents the range of responses for asset class returns (diversity of opinion)
- The blue dot represents the median value of the responses for the asset class
- The orange dot represents the median values used in the 2021 ALM analysis

The survey suggests fixed income returns have increased by roughly 2 percent since the 2021 ALM.

At the same time, private equity returns have moved lower, in response to higher borrowing costs. Private equity returns remains attractive and support an increase in the private equity allocation. Our increased capacity to originate private assets leads to a higher allocation.

While PE CMA predominantly focuses on LBO funds, staff has effectively combined LBO, growth equity, VC funds, and co-investments in the implementation.

The Value of Diversification



Diversification reduces drawdown risk by allocating investments across various financial instruments, industries, and geographic locations. Diversity reduces the impact of any single investment’s poor performance on the overall portfolio.

To illustrate, we start with a simple portfolio of public equities and treasuries, then sequentially add diversifying strategies.

- Leverage can improve diversification by increasing exposure to less risky assets, marginally reducing exposures to riskier asset. In this case striking a better balance between equity and treasury risk
- Expanding into additional public asset classes can broaden diversification
- Private assets can provide additional economic diversification. In addition, relative to public assets, private asset valuations are smoothed and lagged, which can reduce realized total portfolio volatility, and therefore reduce contribution volatility

The Role of Included Asset Classes

Asset Class	Purpose	Implementation
Public Equity	<ul style="list-style-type: none"> Efficiently capture the equity risk premia Total return oriented, comprised of price appreciation and cash yields Reliable source of liquidity Consists of a market-cap weighted and non-cap-weighted segment Non-cap-weighted is intended to reduce overall volatility and provide some diversification 	94% internally managed
Fixed Income	<ul style="list-style-type: none"> Long-term economic diversifier to equity risk and reliable source of income and liquidity Consists of multiple segments: Long Treasuries, Agency Mortgage-Backed Securities, Investment Grade Corporates, High Yield, and Emerging Market Sovereign Bonds Segments have different risk and return characteristics and vary on liquidity, income, and diversification 	78% internally managed
Private Equity	<ul style="list-style-type: none"> Active equity exposure to private companies to generate returns greater than public equity Major driver of returns is appreciation, aided by leverage, with negligible cash yield Diversified across investment type, industry segment, investment strategy, geography, vintage year, and underlying portfolio companies 	100% externally managed Focusing on increasing exposures to co-investment
Real Assets	<ul style="list-style-type: none"> Provide stable and predictable cash yield, diversification of equity risk, and some inflation protection Returns predominately derived from stable income under long-term leases with good credit tenants Real Estate targets Core, well-located assets with strong competitive positions and defensive characteristic. Infrastructure targets essential, durable/long-lived assets and interests in portfolio companies 	100% externally managed Majority in separate accounts
Private Debt	<ul style="list-style-type: none"> Invests in privately negotiated, non-traded debt or debt-like instruments typically issued to companies Attractive risk-adjusted return through premia driven by illiquidity and complexity of private loans Complements Private Equity 	100% externally managed Mix of commingled fund, separate account, and co-investment

Analyses

Candidate portfolios are subjected to a wide range of analyses

- **Liquidity:** Staff assess the liquidity of each portfolio and ensure the portfolios have sufficient liquidity now, and in the future.
- **Stress tests:** Staff conducts historic and forward-looking stress tests. Of the historic stress tests, the most challenging is a replay of the Global Financial Crisis (GFC). The candidate portfolios could experience a loss of roughly 40% during the GFC.
- **Sensitivity tests:** Though changes in return assumptions and constraints could materially change asset allocations, total portfolio risk and return do not change materially.
- **Scenarios:** Staff considered various economic scenarios, including climate scenarios reflecting a wide range of global warming and climate policy trajectories. Staff found that long-term returns are influenced by those, often showing an upward bias when considering climate, due to the net positive valuation impact of inflationary effects caused by decarbonization and the shift from traditional energy. As climate data and scenarios evolve, CalPERS will update their integration into the ALM and SAA review process, continuously improving our ability to model and navigate uncertainty.

Candidate Portfolios

- Portfolio A mirrors the risk profile of the current Policy portfolio but offers higher expected returns
- Portfolios B and C deliver expected returns akin to the Policy portfolio while providing lower risk profiles
- The Simple Portfolio requires unrealistic leverage to align with the expected return of the Policy Portfolio

Asset Class	Current Policy	70/30	Policy Target Return: Simple	Candidate Portfolio		
				A	B	C
				Policy Target CDaR: 21.5%	Policy Target Return: 6.9%	Target Return: 6.8%
Public Equity	42%	70%	89%	37%	33%	31%
Private Equity	13%			17%	17%	17%
Fixed Income	30%	30%	48%	28%	32%	34%
Private Debt	5%			8%	8%	8%
Real Assets	15%			15%	15%	15%
Leverage	5%	0%	37%	5%	5%	5%
Geo Return	6.9%	6.3%	6.9%	7.0%	6.9%	6.8%
Survey Return Range	5.6%-7.7%	4.7%-7.0%	5.0%-7.9%	5.7%-7.7%	5.7%-7.7%	5.6%-7.6%
CDaR	21.5%	26.0%	34.6%	21.4%	20.1%	19.5%
Volatility	11.2%	12.6%	16.4%	11.3%	10.9%	10.6%

Actuarial Assumptions

Board approves assumptions during asset-liability management cycle



Actuarial Assumptions

Economic Assumptions

- Long term investment return
- Discount rate
- Inflation

Non-Economic Assumptions

- Pay increases
- Longevity
- Retirement
- Termination
- Other

Actuarial Assumptions



Actuarial Assumptions

Assumptions represent long-term expectations (20+ years)

- Not typically changed due to one or two years of inconsistent experience

Some trends being monitored

- Higher inflation
- Pay increases exceeding expectations

No compelling reason to change before next ALM cycle

Investment Return Comparisons

Current vs. Portfolio A

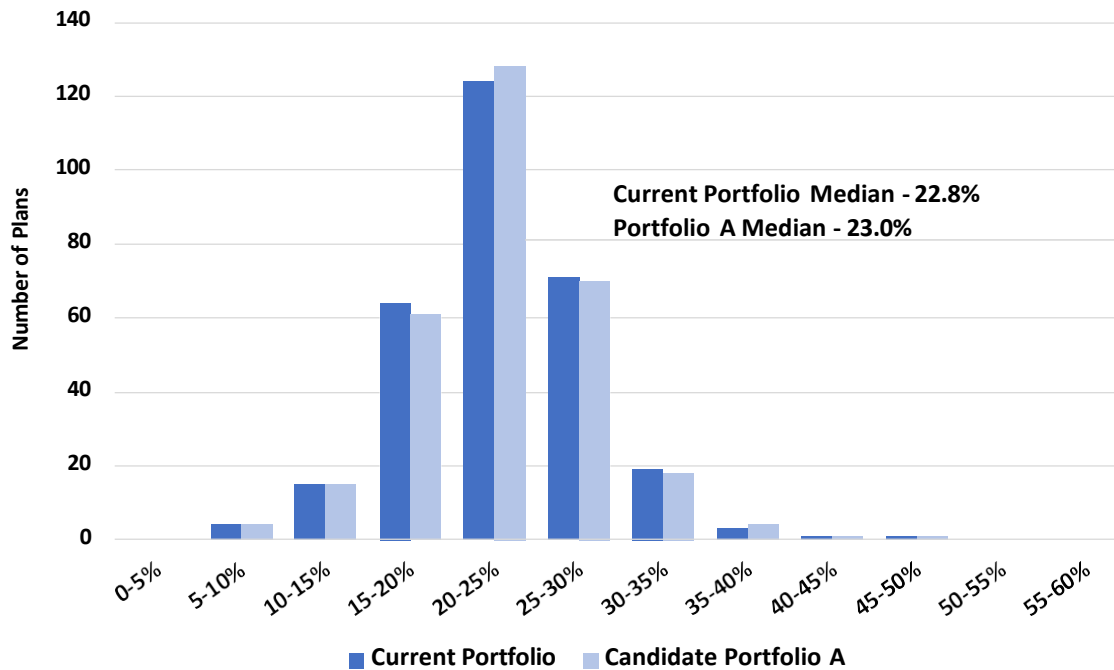
	Estimated Long-Term Return*	Probability of Average Return Exceeding**		
		6.8%	6.9%	7.0%
Current Portfolio	6.9%	49.7%	48.0%	46.4%
Portfolio A	7.0%	51.2%	49.6%	47.9%

* After reduction for assumed administrative expenses.

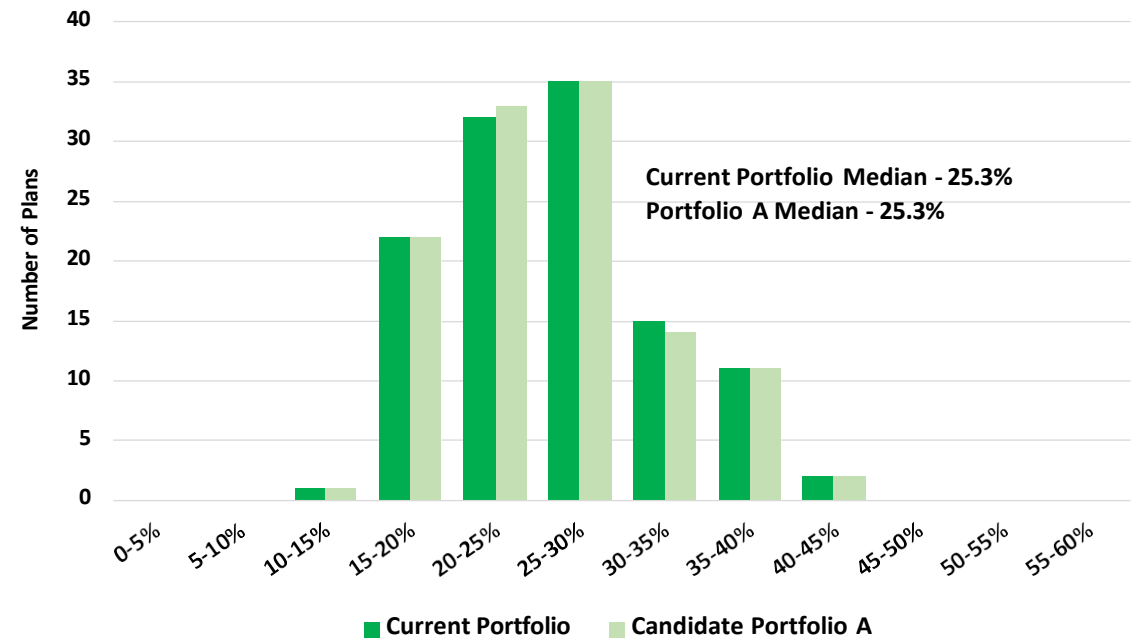
** Over a 20-year period.

Probability of Falling Below 50% Funded

Distribution of Miscellaneous Non-Pooled Plans

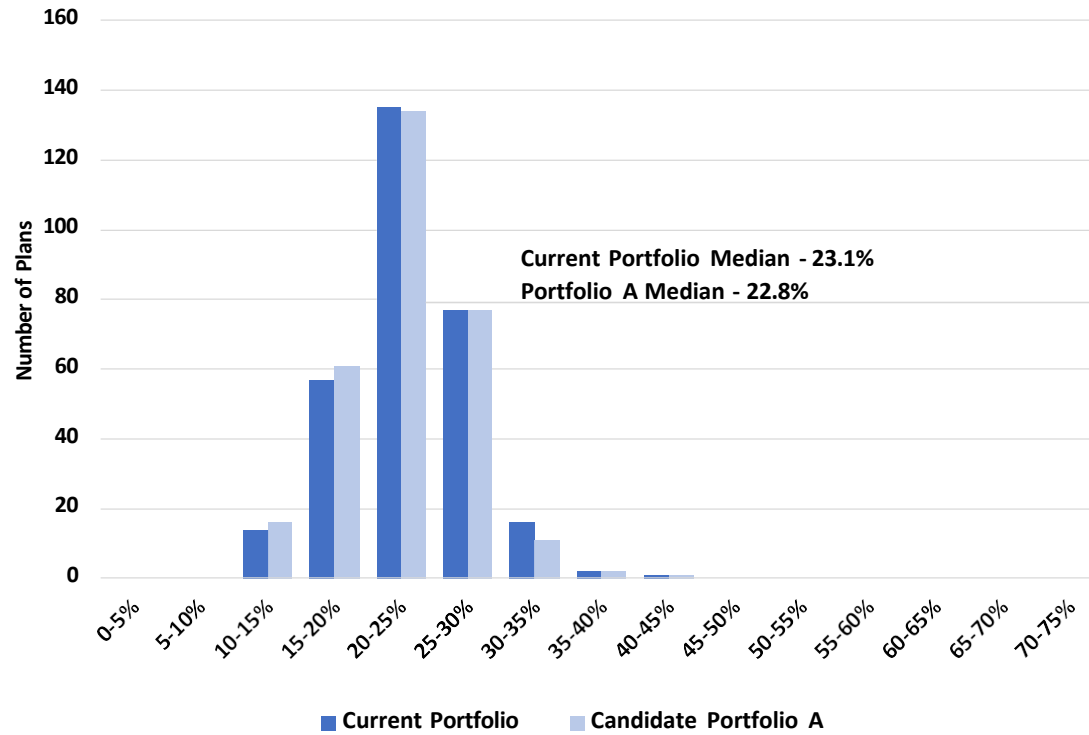


Distribution of Safety Non-Pooled Plans

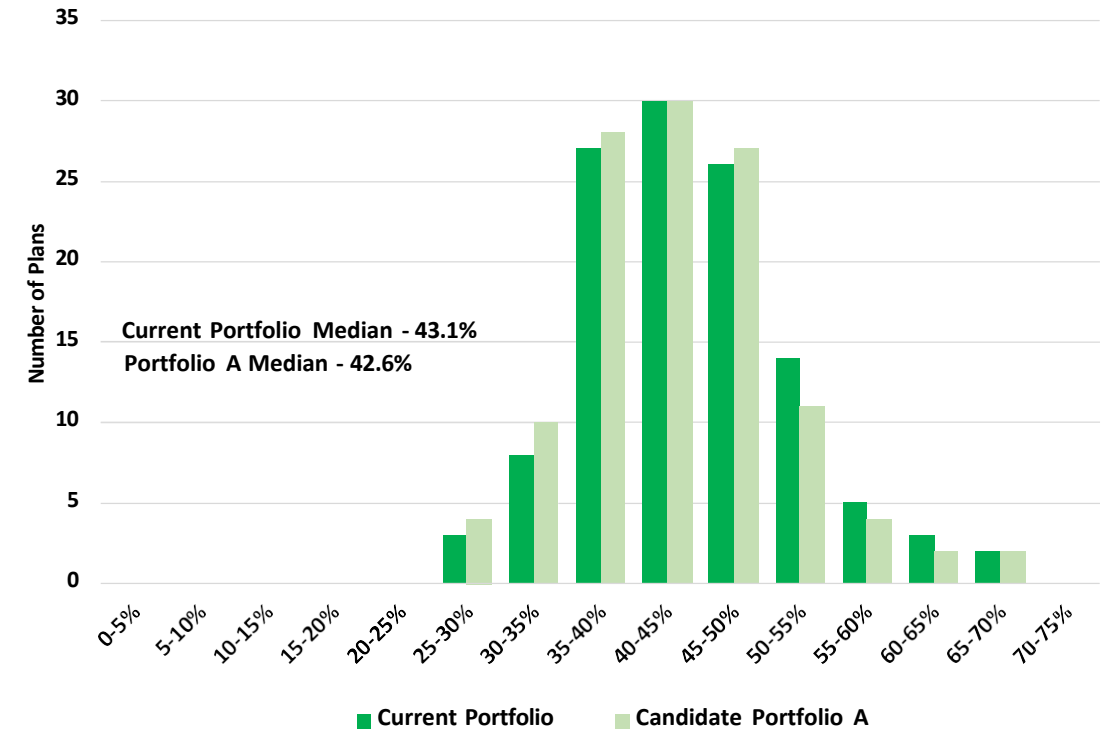


Employer Contribution Rates

Distribution of Miscellaneous Non-Pooled Plans



Distribution of Safety Non-Pooled Plans



Appendix

Glossary

Term	Definition	CalPERS Implementation
Conditional Drawdown at Risk	An estimate of potential for losses (compare with Volatility)	<p>During the 2021 Asset Liability Management process, team members conducted modelling and estimated the potential magnitude of significant losses over any given three-year period. This estimation is referred to as the 'Conditional Drawdown at Risk'. It represents the average of potential 'significant' losses that could transpire within a three-year timeframe. For our purposes, 'significant losses' are defined as the most severe 10% of all losses.</p> <p>CalPERS has a constitutional objective to 'minimize the risk of loss.'</p>
Leverage	Borrowing to acquire additional assets	<p>CalPERS has 5% leverage in its policy benchmarks. Staff have leeway to implement an additional 15% leverage incremental to the Strategic Leverage target ("Active Leverage").</p> <p>A leverage allocation in the strategic asset allocation would improve diversification.</p>
Volatility	An estimate of the width of a return distribution (compare with Downside Risk)	<p>CalPERS 2021 Asset Liability Management uses volatility when estimating the range of return outcomes.</p> <p>As an example, the width of a Bell curve is measured using both the upside and the downside. Risk is related to loss, which involves only downside, which is why we use conditional drawdown to measure downside risk.</p>