



# Benchmarking Education and Review

Public Employees' Retirement Association of Colorado

March 18, 2022

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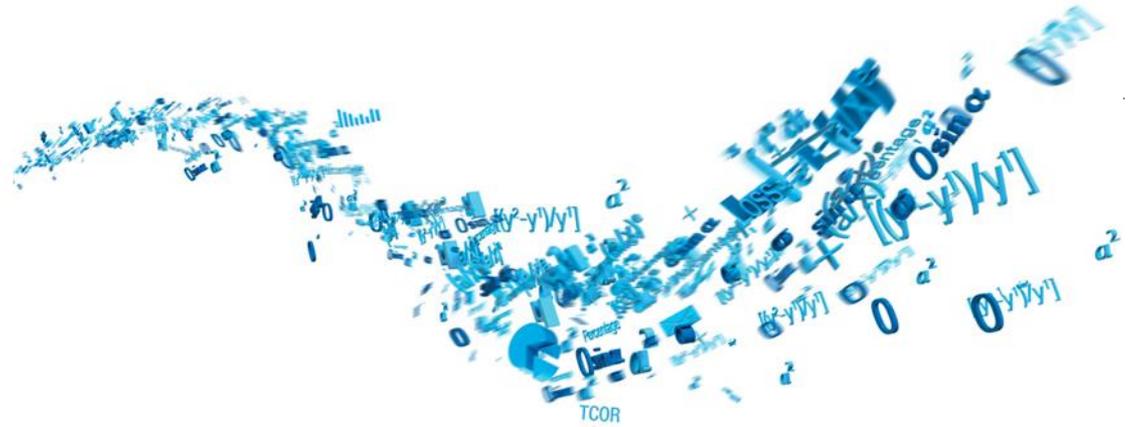
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# Table of Contents

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- **Section 1**            Benchmarking Overview
- **Section 2**            PERA Current Benchmarks
- **Section 3**            Appendix



# Section 1: Benchmarking Overview

# Purpose & Types of Benchmarks

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## Purpose

- Measure performance of achieving objectives of the Total Fund, asset classes, and individual managers over various time periods
- Reflect the market exposures embedded in the strategic asset allocation
- Determine effectiveness of implementation of an investment program

## Types

- There are many types of benchmarks available to analyze relative performance of an investment
  - Broad market (MSCI ACWI IMI Index)
  - Style-specific (S&P 500 Value Index – large cap value)
  - Risk adjusted returns (vs. benchmark Sharpe ratio)
  - Absolute return metric (i.e., 7% return target)
  - Real return target (i.e., CPI + 3%)
  - Peer universe (i.e. Public Funds >\$1 billion)
  - Opportunity cost (typically public markets at policy weights)

Careful attention should be paid to appropriateness when selecting the benchmark for a given asset class, manager, or strategy

# Properties of a Valid Benchmark<sup>1, 2</sup>

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- **Specified in advance:** the benchmark is specified prior to the start of an evaluation period and known to all interested parties
- **Appropriateness:** the benchmark is consistent with the manager's investment style or area of expertise
- **Measurable:** the benchmark's return is readily calculable on a reasonably frequent basis
- **Unambiguous:** the identities and weights of securities constituting the benchmark are clearly defined
- **Reflective of current investment opinions:** the manager has current knowledge of the securities or factor exposures within the benchmark
- **Accountable:** the manager is aware of and accepts accountability for the constituents and performance of the benchmark
- **Investable:** it is possible to forgo active management and simply hold the benchmark

<sup>1</sup> As per CFA Institute's **SAMURAI** characteristics. The criteria commonly referenced as industry standard is based on research conducted by Jeffrey Bailey and others. Mr. Bailey published an initial paper titled "Are Manager Universes Acceptable Performance Benchmarks?" in the May-June, 1992, edition of the *Financial Analysts Journal*.

<sup>2</sup> The criteria listed above mostly apply to publicly traded asset classes. Existing benchmarks for private assets (private equity, private real estate, hedge funds, etc.) lack the attributes of good benchmarks due to the inherent nature of these assets

# Benchmarking Principles

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- Aon's benchmarking philosophy is built on research conducted by William F. Sharpe and others and is consistent with Modern Portfolio Theory which identifies the market portfolio as the most efficient portfolio to own
- We believe the benchmark for any asset class or strategy should include all, or substantially all, the investment opportunities in that particular market and be constructed without bias
- Investors should stray away from the market portfolio only when they believe they are compensated to do so
- It is important to note that there are certain markets, mainly the private markets, where broad published benchmarks either do not exist or are of limited value. In these markets, appropriate benchmarks would represent the opportunity cost of the allocation or a relevant peer group.

# Connecting Asset-Allocation Modeling and Performance Benchmarking

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- **Strategic asset allocation set** to achieve objectives of investment fund based on the asset liability study
- Asset allocation includes exposures to both publicly traded investments which have passive representation *and* private or alternative investments which can only be accessed through active management
  - Risk and return forecasting is intended to best represent the expectations of those investments
- **Performance benchmarking**, ideally, should
  - Be passively investable to reflect an achievable fair market return, and
  - Reflect the market exposures embedded in the strategic asset allocation, but not necessarily attempt to mimic the strategic asset allocation
- Inconsistencies between forward-looking modeling and benchmarking exist within asset classes where only active management exists – i.e., there is no passive implementation method accessible to achieve the expected risk / return
  - For these asset classes, benchmarking options exist, though are often an imperfect representation of asset allocation expectations and performance measurement is nuanced
- Therefore, it is important to balance quantitative *and* qualitative performance evaluation, bearing in mind each asset classes' investment objectives and their contribution to the Total Fund's overall investment objectives

# Total Fund Benchmarking

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- We believe the best Total Fund Policy Benchmark should be a passive representation of the broad asset classes included in the established asset allocation policy
  
- We believe that all benchmarks and policy allocations should be determined in advance
  - Asset transition timelines and weights should be determined in advance
  - If an investor decides to deviate from the policy allocation, the effect of maintaining an asset allocation which deviates from policy should be measured and reported (i.e. measure whether being overweight public equities detracted or added to overall performance for the Total Fund relative to the Policy Benchmark)
  - If the policy allocation is determined to be no longer appropriate, the policy should be amended in advance of the change
  - Changes to the asset class benchmarks should flow through to the Total Fund Policy Benchmark
  
- Other Total Fund Benchmarks (mainly used for long-term periods: 20+ years):
  - Absolute Return Target (i.e. Actuarial Assumed Rate of Return)
  - Real Return Target
  - Opportunity Cost Benchmark (e.g. mix of public stocks and bonds)

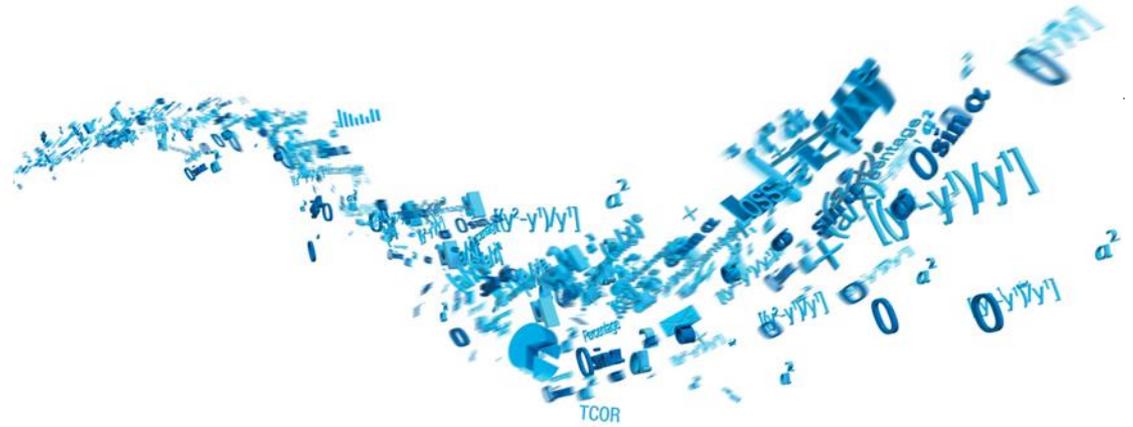
# Alternative Investments Benchmarking

Benchmark Options	Examples	Pros	Cons
<b>Opportunity cost</b> (Public market with/without premium)	<ul style="list-style-type: none"> <li>MSCI ACWI IMI + 300 bps</li> </ul>	<ul style="list-style-type: none"> <li>Captures market/risk exposure</li> <li>Unbiased measure</li> <li>Readily explainable and available</li> <li>Fully transparent</li> <li>Daily performance available with no lag</li> <li>Can be calculated as Internal Rate of Return (IRR)</li> </ul>	<ul style="list-style-type: none"> <li>Potentially meaningful short-term performance deviations</li> <li>Un-investable if premium is included</li> <li>No universally accepted “science” to size of risk premium</li> <li>Not directly related to performance of alternative assets</li> <li>TWRs can produce misleading returns for closed-end funds</li> <li>IRR calculation cannot be aggregated into total fund policy</li> </ul>
<b>Absolute return</b>	<ul style="list-style-type: none"> <li>Absolute return %</li> <li>Cash or Inflation + premium</li> </ul>	<ul style="list-style-type: none"> <li>Reasonable measure of performance for an investment category with broad latitude</li> <li>Not directly related to traditional asset class returns</li> </ul>	<ul style="list-style-type: none"> <li>Does not measure opportunity cost</li> <li>Intended for long-term evaluation</li> <li>Difficult to measure success of implementation of strategies</li> <li>Does not reflect asset class volatility</li> </ul>
<b>Universe (or peer-group) based</b>	<ul style="list-style-type: none"> <li>Burgiss (PE)<sup>1</sup></li> <li>NCREIF ODCE<sup>2</sup> (RE)</li> <li>HFR<sup>3</sup> suite of indices (HFs)</li> </ul>	<ul style="list-style-type: none"> <li>Directly captures performance of (peer) alternative investments</li> <li>Customizable to Client’s portfolio structure if desired</li> <li>IRRs available</li> <li>Appropriate for short and long time horizons</li> </ul>	<ul style="list-style-type: none"> <li>Un-investable</li> <li>Does not measure objective of asset class</li> <li>Limited transparency</li> <li>Database shortcomings and variability</li> <li>Can be notably lagged</li> </ul>

<sup>1</sup> Burgiss Private iQ indices are based on the Burgiss Manager Universe, a quarterly-updated database and provides a wide variety of measures, including standard and public-market comparisons, including ICM, Kaplan-Schoar PME, and Direct Alpha

<sup>2</sup> National Council of Real Estate Investment Fiduciaries (NCREIF) Open-End Diversified Core Equity (ODCE) Index is a capitalization-weighted (of about 30 open-end commingled funds), time-weighted return index that is most widely used to benchmark core private real estate

<sup>3</sup> Hedge Fund Research (HFR) is the global leader in the indexation, analysis and research of the hedge fund industry. With over 150 indices ranging from broad composites down to specific, niche areas of sub-strategy and regional investment focus, the HFR suite of indices are considered the industry standard benchmarks of hedge fund performance



## Section 2: PERA Current Benchmarks

## PERA Total Fund Benchmark

- PERA's Total Fund Policy Benchmark is a weighted average of the asset class benchmarks at the annual policy weight
  - Intended passive representation of the asset allocation policy approved by the Board
  - Weights adjusted annually to reflect the actual exposure and nature of investing in alternatives and private markets
- Investment objective of the PERA Total Fund is to earn the Policy Benchmark, net-of-fees, plus an excess return appropriate to the level of active risk taken by the Total Fund
- Quarterly attribution captures relative performance impact of active management and asset allocation deviations from Policy

Asset Class	2021 Policy Benchmark Weight	2021 Permissible Ranges	Long-Term Target Allocation	Permissible Range
Global Equity	55.5%	49.5% to 61.5%	54%	48% to 60%
Fixed Income	23.5%	18.5% to 28.5%	23%	18% to 28%
Private Equity	8.5%	4% to 13%	8.5%	4% to 13%
Real Estate	8.5%	4% to 13%	8.5%	4% to 13%
Alternatives	4.0%	0% to 12%	6% <sup>1</sup>	0% to 12%
Cash	0%	0% to 3%	0%	0% to 3%
Total Fund	100%	—	100%	—

<sup>1</sup> Maximum allocation to Alternatives. The Policy Benchmark weight will be set yearly based on final 12/31 weights, rounded to the nearest 0.5%. Any uninvested allocation will be re-allocated to the Public Markets Benchmark.

# PERA Benchmark Evaluation

Asset Class	Global Equity	Fixed Income	Real Estate	Private Equity	Alternatives			Cash
Sub -Category					Risk Mitigation	Real Assets	Opportunistic	
Benchmark	MSCI ACWI IMI w/USA Gross	Bloomberg U.S. Aggregate	NFI-ODCE Net + 50 bps	MSCI ACWI IMI w/USA Gross + 150 bps	HFRI FOF Mkt Defensive Index	CPI + 4%	PERA Public Markets + 150bps	ICE BofAML U.S. 3-mo T-Bill Index
• Specified in Advance	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid
• Appropriateness	Valid	Valid	Valid	Nuanced	Nuanced	Nuanced	Invalid	Valid
• Measurable	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid
• Unambiguous	Valid	Valid	Valid	Valid	Nuanced	Valid	Valid	Valid
• Reflective	Valid	Valid	Valid	Nuanced	Nuanced	Nuanced	Nuanced	Valid
• Accountable	Valid	Valid	Valid	Nuanced	Invalid	Nuanced	Nuanced	Valid
• Investable	Valid	Valid	Nuanced	Invalid	Invalid	Invalid	Invalid	Valid

- Property of the benchmark is valid
- Property of the benchmark is nuanced
- Property of the benchmark is not valid

# PERA Benchmark Evaluation: Historical Performance

- Generally strong performance across the Total Fund and asset classes
- Performance relative to benchmarks reflective of expectations based on risk taking and investment structure
- Significant performance dispersion from benchmarks may be warranted, particularly across private and alternative investments where passive representation does not exist and benchmarking is challenging

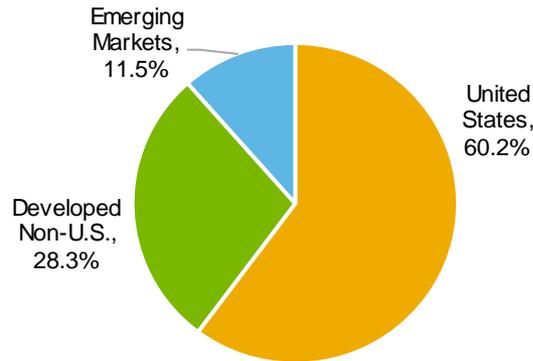
As of 9/30/2021	Performance(%)						
	1 Year	3 Years	5 Years	10 Years	15 Years	Since Inception	Inception Date
<b>Total Fund</b>	20.2	12.4	12.0	10.8	7.9	8.9	01/01/1995
Policy Benchmark	19.6	11.2	10.6	10.2	7.4	-	
Excess Return	0.6	1.2	1.4	0.6	0.5	-	
<b>Global Equity</b>	28.7	14.9	15.4	13.6	8.7	9.5	01/01/1995
Global Equity Custom Benchmark	29.2	12.7	13.3	12.3	7.8	-	
Excess Return	-0.5	2.2	2.1	1.3	0.9	-	
<b>Fixed Income</b>	-0.7	5.7	3.4	3.6	4.7	5.5	01/01/1995
Fixed Income Custom Benchmark	-0.9	5.4	3.2	3.4	4.4	5.6	
Excess Return	0.2	0.3	0.2	0.2	0.3	-0.1	
<b>Real Estate</b>	10.5	7.6	8.8	10.9	7.2	9.7	01/01/1995
Real Estate Custom Benchmark	7.2	4.4	5.7	8.8	5.8	8.1	
Excess Return	3.3	3.2	3.1	2.1	1.4	1.6	
<b>Private Equity</b>	33.6	17.6	16.7	13.6	11.9	13.2	01/01/1995
Private Equity Custom Benchmark	32.0	19.7	17.9	17.6	11.2	11.3	
Excess Return	1.6	-2.1	-1.2	-4.0	0.7	1.9	
<b>Alternatives</b>	11.4	7.0	7.0	4.8	-	4.3	01/01/2008
Alternatives Custom Benchmark	13.9	9.2	8.1	6.4	-	4.2	
Excess Return	-2.5	-2.2	-1.1	-1.6	-	0.1	
<b>Cash</b>	0.0	1.2	1.2	0.7	1.3	2.6	04/01/1995
ICE BofAML 3 Month U.S. T-Bill	0.1	1.2	1.2	0.6	1.0	2.3	
Excess Return	-0.1	0.0	0.0	0.1	0.3	0.3	

# Global Equity: MSCI ACWI IMI with USA Gross

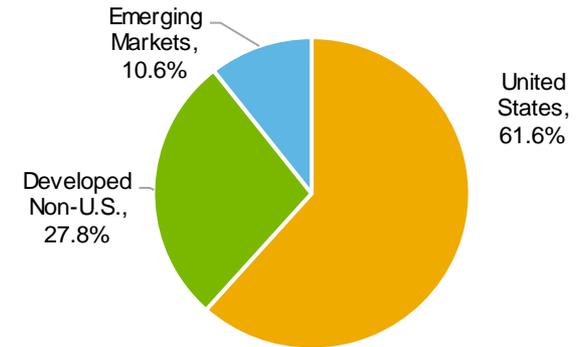
Asset Class	Global Equity
Sub -Category	
Benchmark	MSCI ACWI IMI w/USA Gross
• Specified in Advance	
• Appropriateness	
• Measurable	
• Unambiguous	
• Reflective	
• Accountable	
• Investable	

<span style="color: green;">■</span>	Property of the benchmark is valid
<span style="color: yellow;">■</span>	Property of the benchmark is nuanced
<span style="color: red;">■</span>	Property of the benchmark is not valid

### Benchmark Exposure



### PERA Public Equity Exposure



### Benchmark: MSCI ACWI IMI with USA Gross

- Captures large, mid and small cap representation across 23 Developed Markets and 25 Emerging Markets (EM) countries with 9,226 constituents
- Covers roughly 99% of the global equity opportunity set
- Net daily total returns calculated without deducting withholding taxes for all U.S.-based constituents in the index (reflects gross returns for U.S.-based constituents)

### Key Take-Aways

- Broadest available measure of the investable global equity market
- Most widely used and universally accepted among institutional investors
- Gross version more accurately reflects the tax-exempt status of PERA's U.S. investments
- Aligns with growth role of the public equity asset class

Data as of 12/31/2021

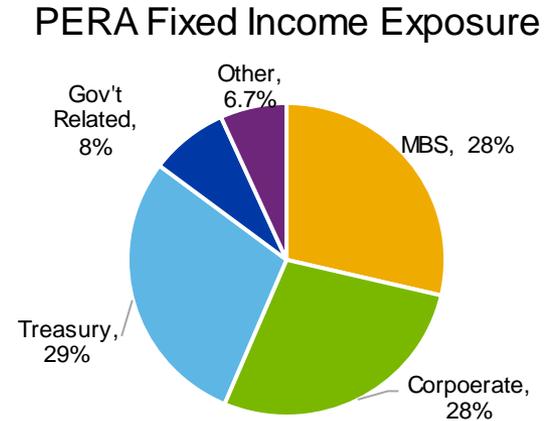
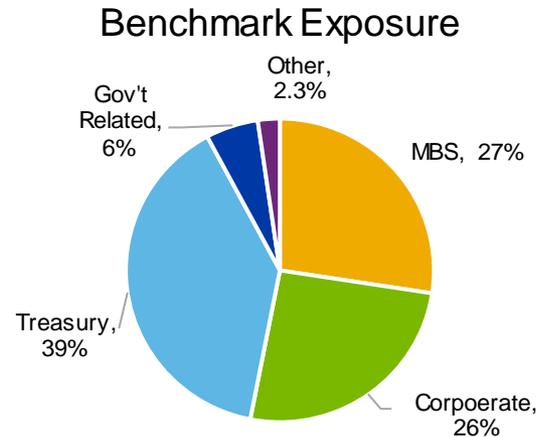
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# Fixed Income: Bloomberg Aggregate Bond Index

Asset Class	Fixed Income
Sub -Category	
Benchmark	Bloomberg U.S. Aggregate
• Specified in Advance	
• Appropriateness	
• Measurable	
• Unambiguous	
• Reflective	
• Accountable	
• Investable	

	Property of the benchmark is valid
	Property of the benchmark is nuanced
	Property of the benchmark is not valid



## Benchmark: Bloomberg U.S. Aggregate Bond Index

- Market value-weighted index consisting of the Bloomberg U.S. Corporate, Government and Securitized Indices.
- Broadest available measure of the aggregate U.S. fixed income market

## Key Take-Aways

- Most widely used and universally accepted among institutional investors
- Most appropriate measures for U.S. investment grade opportunity set
- Aligns with risk-reducing role of fixed income asset class

Data as of 12/31/2021

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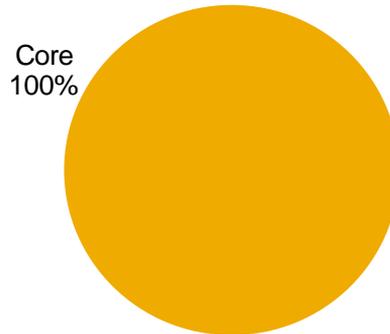
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# Real Estate: NFI-ODCE Net + 50 bps

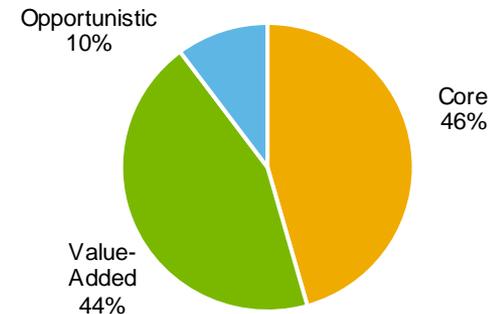
Asset Class	Real Estate
Sub -Category	
Benchmark	NFI-ODCE Net + 50 bps
• Specified in Advance	
• Appropriateness	
• Measurable	
• Unambiguous	
• Reflective	
• Accountable	
• Investable	

- Property of the benchmark is valid
- Property of the benchmark is nuanced
- Property of the benchmark is not valid

NCREIF ODCE Index



PERA Real Estate – Current Exposure\*



## Benchmark: NCREIF Fund Index - Open End Diversified Core Equity (NFI-ODCE Net) + 50 bps

- Capitalization-weighted, time-weighted return series reflecting the net-of-fee performance of 27 open-ended U.S. diversified core real estate funds and 3,182 real estate investments
- 50bps premium added to capture additional return expectations from non-core exposure

## Key Take-Aways

- Most widely used and universally accepted among institutional investors
- Most complete and accurate representation of core private real estate market
- Theoretically investable and inclusive of leverage
- Premium level appropriate given expectations from non-core investments

\*As of 9/30/2021

## Real Estate: Premium Discussion

- Premium added to core benchmark to reflect additional return expectations from investing in value-added (VA) and opportunistic real estate investments
- 50 bps premium continues to be appropriate considering the objectives and risk profile of PERA's real estate portfolio
- Considerations for level of premium:

Consideration	Determination
Forward-looking assumptions	<ul style="list-style-type: none"> <li>• Aon's long-term assumptions reflect 50bps premium for value add and 300 bps premium for opportunistic*</li> <li>• 50 bps premium is reasonable as it falls midway between the lowest risk (0 bps) and highest risk (100 bps) portfolios as denoted in PERA's policies</li> </ul>
Peers	<ul style="list-style-type: none"> <li>• Peer plans' benchmarks typically range from 0 bps premium to 150 bps premium</li> <li>• 50 bps well-within reason</li> <li>• Difficult to directly compare given peers' unknown risk profiles</li> </ul>
Structural Considerations	<ul style="list-style-type: none"> <li>• PERA's policies allow for a minimum risk portfolio of 100% core and a maximum risk portfolio of 40% core, 30% VA and 30% opportunistic</li> <li>• Current RE exposure is roughly in line with the mid-point of the allowable risk spectrum</li> </ul>

\*Based on Aon's 1Q 2022 CMAs

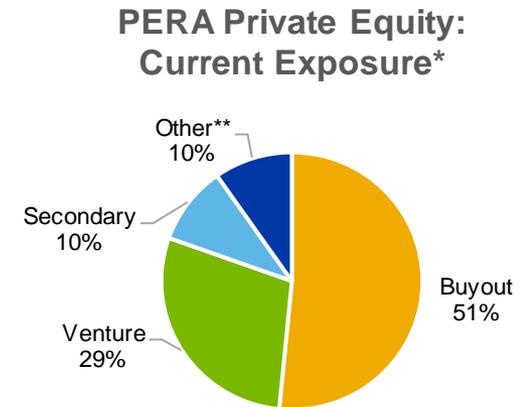
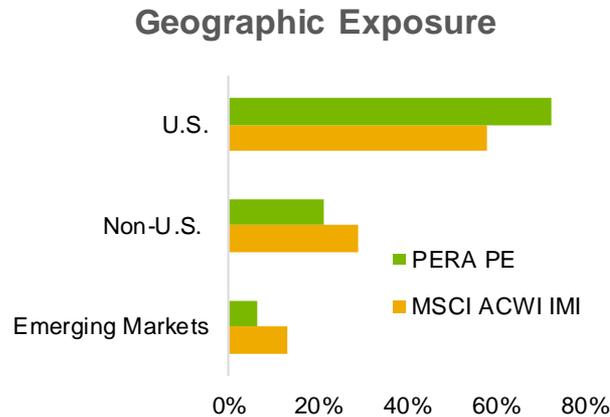
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# Private Equity: MSCI ACWI IMI w/USA Gross + 150 bps

Asset Class	Private Equity
Sub -Category	
Benchmark	MSCI ACWI IMI w/USA Gross + 150bps
• Specified in Advance	Valid
• Appropriateness	Nuanced
• Measurable	Valid
• Unambiguous	Valid
• Reflective	Nuanced
• Accountable	Nuanced
• Investable	Invalid

■ Property of the benchmark is valid  
■ Property of the benchmark is nuanced  
■ Property of the benchmark is not valid



## Benchmark: MSCI ACWI IMI with USA Gross + 150 bps

- Opportunity cost benchmark
- Represents broadly similar economic and financial risks of the asset class
- Premium reflects higher expected returns from illiquidity and investment risk

## Key Take-Aways

- Reflective of the opportunity cost of capital (PERA's public equity exposure)
- A widely used and accepted benchmarking option among institutional investors
- Readily available, explainable and can be calculated on an IRR (PME) basis
- Most appropriate for long-term performance evaluation; expect periods of short-term deviation from public market volatility
- Premium reflective of expected returns above public equities
- Not an investable index due to addition of premium

\*As of 6/30/2021

\*\*Includes Mezzanine, Distressed, Energy and Fund of Funds

## Private Equity: Premium Discussion

- Premium added to public market index to reflect return expectations from illiquidity and investment risk
- 150 bps premium is appropriate considering the objectives and risk profile of PERA's private equity portfolio
- Considerations for level of premium:

Consideration	Determination
Forward-looking assumptions	<ul style="list-style-type: none"> <li>• Aon currently assumes 180 bps of return premium for private equity over global public equity*</li> <li>• Aon's PE assumption reflects a portfolio of 50% Buyout / 25% Venture / 16% Dist. Debt / 6% Mezzanine</li> </ul>
Peers	<ul style="list-style-type: none"> <li>• Peer plans' benchmarks range from 0 bps premium to 400 bps premium</li> <li>• 150 bps well-within reason</li> <li>• Difficult to ascertain given unknown risk profiles of peer plans</li> </ul>
Structural Considerations	<ul style="list-style-type: none"> <li>• PERA's portfolio reflective of a global portfolio</li> <li>• PERA's portfolio currently diversified across buyout (50%), venture (29%), and other diversifying strategies</li> <li>• Misfit risk relative to public markets inherent in private equity investing</li> <li>• Current premium reflective of achievable outperformance of public markets</li> </ul>

\*Based on Aon's 1Q 2022 CMAs

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# Private Equity: Benchmark Calculation

- There are two standard measurement approaches used to calculate private equity returns
- PERA evaluates both on a quarterly basis

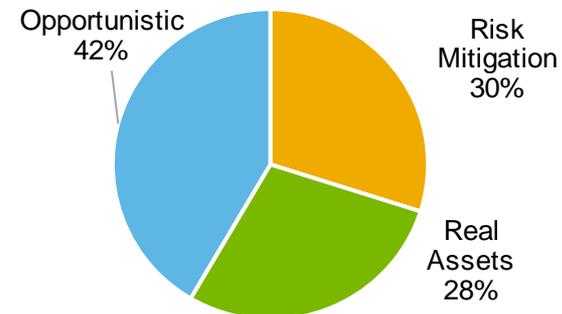
Time-Weighted Return	Internal Rate of Return
Removes impact of cash flows	Includes the impact of the timing and magnitude of cash flows
Most appropriate for <i>publicly</i> traded asset classes	Most appropriate for <i>private</i> markets, a better metric for reflecting manager skill
Necessary for Total Fund analyses, including: <ul style="list-style-type: none"> <li>• Performance reporting and evaluation</li> <li>• Risk and return forecasting</li> </ul>	<ul style="list-style-type: none"> <li>• Most appropriate for evaluating performance on a standalone basis</li> <li>• Cannot be rolled into Total Fund Benchmark</li> </ul>
Uses within PERA's Portfolio	
<i>MSCI ACWI IMI wUSA Gross + 150 bps</i> <ul style="list-style-type: none"> <li>• Rolled into Total Fund Policy Benchmark</li> <li>• Notable tracking error possible, especially over short-term periods</li> <li>• Prefer evaluation over long-term time periods</li> </ul>	<i>MSCI ACWI IMI wUSA Gross + 150 bps</i> <ul style="list-style-type: none"> <li>• Calculated as PME*</li> <li>• Used at the asset class level and for incentive compensation purposes</li> <li>• Most appropriate over long-term time periods</li> </ul>

\*PME (public market equivalent) is an IRR calculation that reflects a direct opportunity cost comparison of how funds invested in private equity would have performed had they been invested in the public index in the same manner over the life of the investment(s)

## Alternatives: Custom Benchmark

- Role of Alternatives: provide improved risk-adjusted returns and diversification
- Purpose is to provide a framework for investing in assets and strategies that do not fit within the traditional asset class structure
- The asset class has been categorized into three sub-strategies, designed to meet the Alternatives' objective over the long-term
- Given the flexibility afforded to this asset class, benchmarking becomes challenging
- Importantly, portfolio constructed to achieve objective noted above, in addition to beating the custom benchmark
- **Custom Benchmark:** Weighted average of the three sub-categories

Current Alternatives Sub-Categories\*



Sub-category	Objective	Risk Factors / Return Drivers	Benchmark
Risk Mitigation	Capital Preservation	Capital Preservation / Low Market Exposure / Low Correlation to Public Equities	HFRI Fund of Funds: Market Defensive Index
Real Assets	Diversification	Alternative Beta / Current Income / Inflation Protection	CPI + 4.0%
Opportunistic	Primarily Return-Seeking	Valuation / Illiquidity Premium / Leverage	PERA Public Market + 1.5%

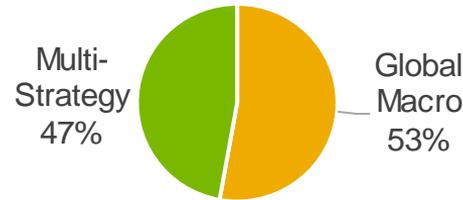
\*As of 9/30/2021

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# Alternatives-Risk Mitigation: HFRI FOF Market Defensive Index

Risk Mitigation – Current Exposure\*



Asset Class	Alternatives
Sub -Category	Risk Mitigation
Benchmark	HFRI FOF Mkt Defensive Index
• Specified in Advance	Valid
• Appropriateness	Nuanced
• Measurable	Valid
• Unambiguous	Nuanced
• Reflective	Nuanced
• Accountable	Invalid
• Investable	Invalid

■ Property of the benchmark is valid  
■ Property of the benchmark is nuanced  
■ Property of the benchmark is not valid

## Benchmark: HFRI Fund Of Funds Market Defensive Index

- Comprised of Fund of Funds (FOFs) classified as 'Market Defensive'
- Includes funds that may engage in short-biased strategies such as short selling, have exposure to trend following such as managed futures and/or show a low or negative correlation to the general market benchmarks (i.e., public equities)
- Funds included in Index expected to exhibit higher returns during down markets than during up markets

## Key Take-Aways

- Intended to reflect performance of funds with similar objectives as PERA's portfolio
- Index can include a wide array of strategies that may be less "market defensive" and perform differently than PERA's portfolio
- HFRI is also self-reported, which lends itself to construction challenges and biases
- Potentially more difficult hurdle as performance likely overstated due to survivorship bias
- Importantly, portfolio constructed to achieve risk mitigation – not to beat this peer index
- Returns relative to peer benchmark should only be one factor in performance evaluation of risk mitigation sub-category

\*As of 9/30/2021

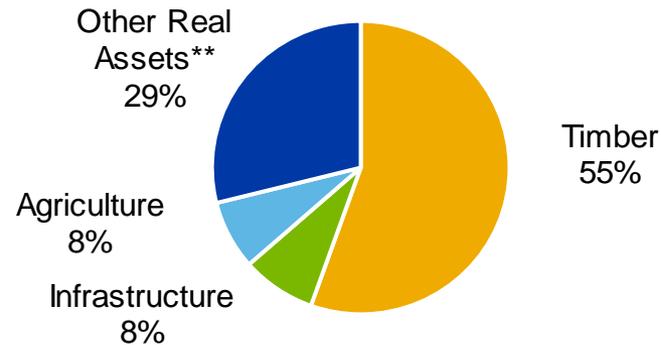
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# Alternatives-Real Assets: CPI + 4%

Asset Class	Alternatives
Sub -Category	Real Assets
Benchmark	CPI + 4%
• Specified in Advance	Property of the benchmark is valid
• Appropriateness	Property of the benchmark is nuanced
• Measurable	Property of the benchmark is valid
• Unambiguous	Property of the benchmark is valid
• Reflective	Property of the benchmark is nuanced
• Accountable	Property of the benchmark is nuanced
• Investable	Property of the benchmark is not valid

- Property of the benchmark is valid
- Property of the benchmark is nuanced
- Property of the benchmark is not valid

## Real Assets - Current Exposure\*



### Benchmark – Consumer Price Index + 4%

- CPI measures the average change in the prices over time of consumer goods and services
- Premium added to reflect the expected returns from active management and illiquidity and risk premiums

### Key Take-Aways

- Aligned with inflation protection, income orientation and diversification objectives
- Common approach across institutional investors
- Real Assets sub-category is more strategically oriented and thus performance should be evaluated over the long-term
- High tracking error over short-time periods expected due to the low volatility of benchmark

\*As of 9/30/2021

\*\*Includes Pinnacle Arcadia Cattle and Natural Resources

# Alternatives-Real Assets: Premium Discussion

- Premium added to CPI to reflect return expectations from active management and illiquidity and risk premiums
- 400 bps premium is appropriate considering the objectives and risk profile of PERA's real assets portfolio
  - Aon's current *long-term* inflation expectations are 2.3%\*
- Considerations for level of premium:

Consideration	Determination
Forward-looking assumptions	<ul style="list-style-type: none"> <li>• Average expected premium across real assets, including infrastructure, timber and agriculture is currently 415 bps*</li> </ul>
Peers	<ul style="list-style-type: none"> <li>• Difficult to decipher due to varying risk and return objectives</li> <li>• Typically see 300-500 bps premiums added</li> </ul>
Structural Considerations	<ul style="list-style-type: none"> <li>• Targeting returns 450 – 650 bps above inflation</li> <li>• Notable weight of timber (&gt;50%) had an influence on determining the premium</li> </ul>

\*Based on Aon's 1Q 2022 CMAs

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# Alternatives Opportunistic: PERA Public Markets + 150 bps

Asset Class	Alternatives
Sub -Category	Opportunistic
Benchmark	PERA Public Markets + 150bps
• Specified in Advance	Valid
• Appropriateness	Invalid
• Measurable	Valid
• Unambiguous	Valid
• Reflective	Nuanced
• Accountable	Nuanced
• Investable	Invalid

■ Property of the benchmark is valid  
■ Property of the benchmark is nuanced  
■ Property of the benchmark is not valid

## PERA's Opportunistic Portfolio

- Current portfolio diversified across 30 funds\*
- Primarily private credit oriented, including (but not limited to) opportunistic, distressed, real estate and special situations

## Benchmark: Public Markets Benchmark (70% Global Equity/30% Fixed Income) + 150 bps

- *Opportunity cost* benchmark reflecting where the assets would otherwise be invested if not invested within the Opportunistic sub-category
- Premium added to reflect the higher return expected from illiquidity, investment risk, and the hurdle to invest away from existing policy

## Key Take-Aways

- Opportunity cost commonly used approach; no market or peer benchmark exists given the truly opportunistic nature of category
- Opportunistic sub-category intended to provide flexibility to invest in investments that will improve the risk/reward profile – therefore, the investments are expected to outperform the readily achievable existing risk/reward profile
- Given likely mismatch between investments and benchmark, expect notable tracking error, especially over short-term time periods
- Diversification benefits should also be factored into performance evaluation
- Performance should be evaluated over the long-term and ideally over full market cycles

\*As of 9/30/2021

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## Alternatives-Opportunistic: Premium Discussion

- Premium added to PERA Public Markets index to reflect return expectations from illiquidity and investment risk, as well as to reflect hurdle for investing away from existing policy allocation
- 150 bps premium is appropriate considering primary objective of return enhancement of the Opportunistic portfolio
  - Long-term expected return of PERA's public market index (70% global equity / 30% fixed income) is 6.2%\*
- Considerations for level of premium:

Consideration	Determination
Forward-looking assumptions	<ul style="list-style-type: none"> <li>• Aon's assumptions expect a 6.2% return* for a 70%/30% global equity/fixed income portfolio</li> <li>• 150 bps premium serves as hurdle to move away from 70%/30% allocation</li> </ul>
Peers	<ul style="list-style-type: none"> <li>• Given the uniqueness of Alternative and Opportunistic allocations, peer comparisons are not as comparable</li> </ul>
Structural Considerations	<ul style="list-style-type: none"> <li>• Current allocation primarily allocated to private credit</li> <li>• Recent public equity returns have created a very high performance hurdle for any investment</li> </ul>

\*Based on Aon's 1Q 2022 CMAs

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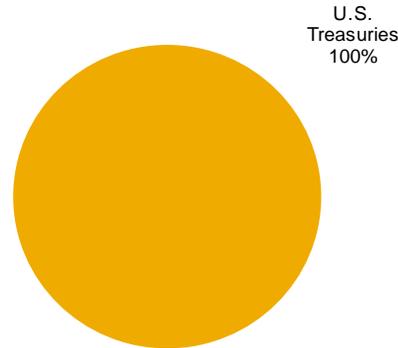
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# Cash: ICE BofAML U.S. 3Mo T-Bill Index

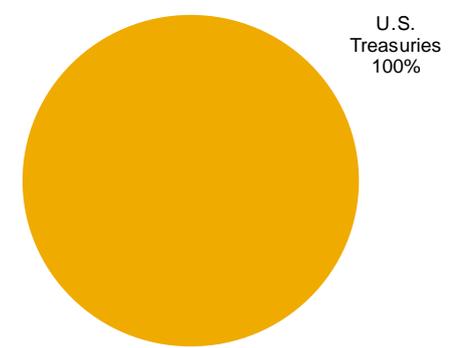
Asset Class	Cash
Sub -Category	
Benchmark	ICE BofAML U.S. 3Mo T-Bill Index
• Specified in Advance	
• Appropriateness	
• Measurable	
• Unambiguous	
• Reflective	
• Accountable	
• Investable	

- Property of the benchmark is valid
- Property of the benchmark is nuanced
- Property of the benchmark is not valid

ICE BofAML U.S. 3Mo T-Bill Index



PERA Portfolio\*



## Benchmark: ICE BofAML U.S. 3Mo T-Bill Index

- Measures the performance of a single issue of outstanding treasury bill which matures closest to, but not beyond, three months from the rebalancing date.

## Key Take-Aways

- Widely used and universally accepted among institutional investors
- Reflects desired risk and liquidity profile

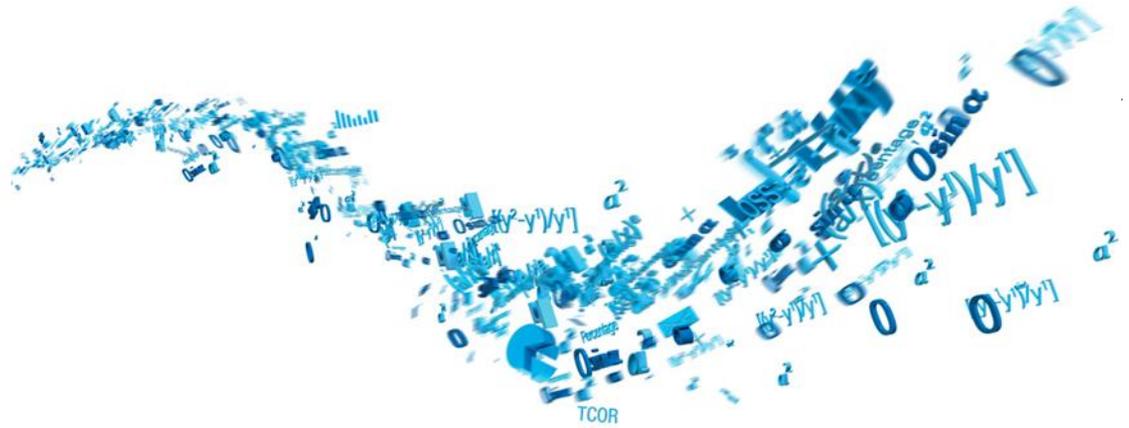
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# Conclusions

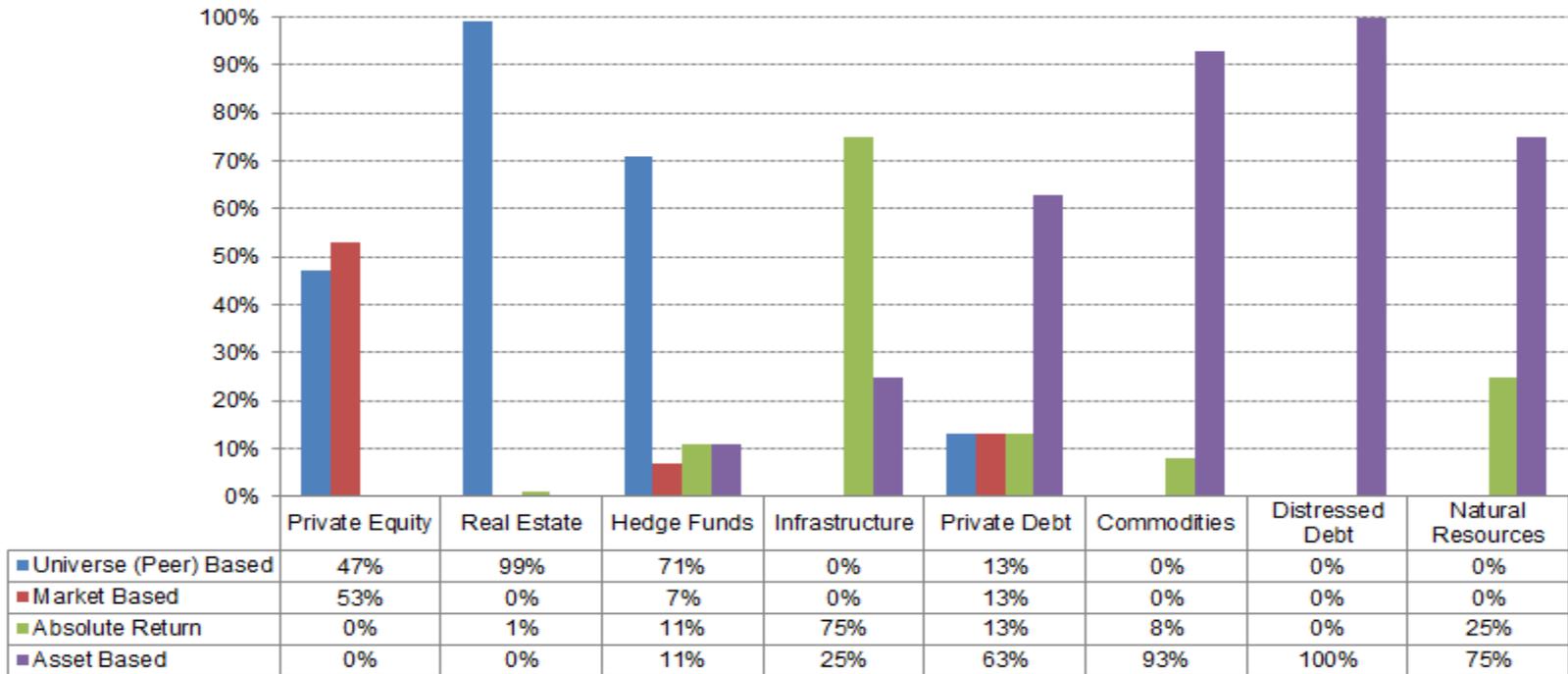
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- Performance benchmarking is an important component to portfolio management, intended to designate the investment mandate and evaluate the success of investment implementation
- PERA's current benchmarks continue to be appropriate given the roles and objectives of each asset class, and are in line with institutional best practices
  - Significant analysis has gone into identifying PERA benchmarks and they are reviewed regularly
- It critical to understand the challenges and short-comings of private market and alternatives performance benchmarking when evaluating performance
  - Quantitative assessment should be balanced with a qualitative review, particularly for those asset classes only accessible via active management
  - PERA's private market benchmarks are appropriate and thoughtfully developed, though may evolve, as needed, over time
- Benchmark should be re-evaluated periodically to ensure validity against the portfolio's asset allocation and the SAMURAI structure
  - Benchmarking often more-thoroughly reviewed following the asset liability study



# Section 3: Appendix

# Alternative Investments Benchmarking in Practice



- Asset owners choose universe-based and asset class-specific benchmarks more frequently than market-based and absolute return-based benchmarks
- The choice is often based more on necessity and the investors' audience than their actual performance
- For private equity, investors are just as likely to choose a market-based benchmark as one that's universe-based (peer group)
- Within private debt, majority of investors use an asset-based benchmark as opposed to other benchmark types

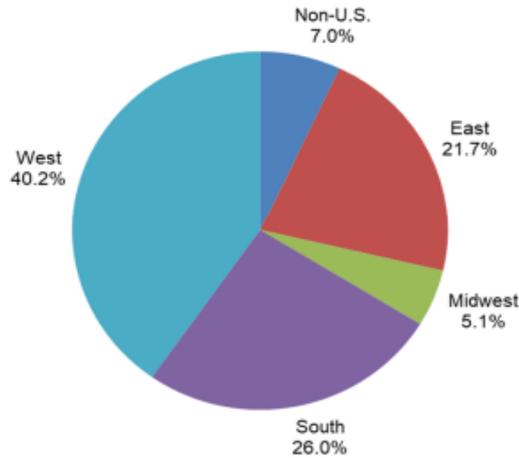
Source: State Street Global Services, *Alternative Benchmarking: The Choices and Challenges of Performance Measurement (July 2016)*. Based on a survey conducted by State Street among a subset of their asset-owner clients

# Private Equity Benchmarking: Typical Approaches and Usage

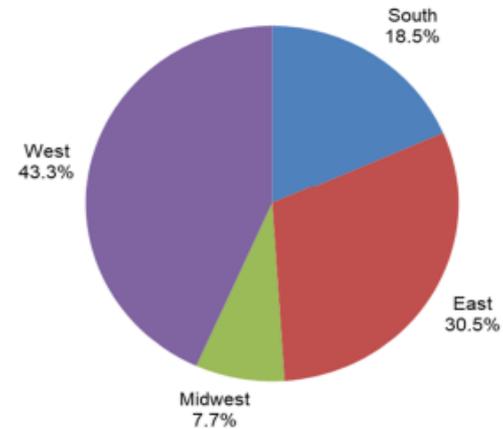
Portfolio Component	Recommended Best Practice (Metric)	What's Being Measured	Pros	Cons
Total Portfolio	Public market + premium (TWR)	Opportunity cost	<ul style="list-style-type: none"> <li>• Can be aggregated into total program performance</li> <li>• Captures market exposure and risk of private equity</li> <li>• Readily explainable and daily performance available with no lag</li> </ul>	<ul style="list-style-type: none"> <li>• TWRs can produce misleading returns for closed-end funds (capital not at work over entire measurement period)</li> <li>• Only meaningful over long time horizons</li> <li>• Not investable</li> </ul>
Total Portfolio	Public market + premium (PME IRR)	Opportunity cost	<ul style="list-style-type: none"> <li>• IRR is a more meaningful metric for private equity</li> </ul>	<ul style="list-style-type: none"> <li>• Can't be aggregated into total program</li> <li>• Only meaningful over long time horizons</li> <li>• Not investable</li> </ul>
Vintage Year Performance	Peer universe by vintage year (IRR, TVPI, DPI)	Portfolio construction relative to opportunity set	<ul style="list-style-type: none"> <li>• Meaningful metrics</li> <li>• Directly captures performance of vintage year peers</li> <li>• Readily explainable</li> <li>• Customizable to Client's portfolio structure if desired</li> </ul>	<ul style="list-style-type: none"> <li>• Not investable</li> <li>• Limited transparency</li> <li>• Database biases and shortcomings</li> </ul>
Fund	Peer universe by strategy, vintage year and geography (IRR, TVPI, DPI)	<ul style="list-style-type: none"> <li>• Fund selection</li> <li>• Fund manager skill</li> </ul>	<ul style="list-style-type: none"> <li>• Meaningful metrics</li> <li>• Directly captures performance of peers by vintage year, geography and strategy</li> <li>• Readily explainable</li> </ul>	<ul style="list-style-type: none"> <li>• Not investable</li> <li>• Limited transparency</li> <li>• Database biases and shortcomings</li> </ul>

# Real Estate: Geographic and Property Type Allocation

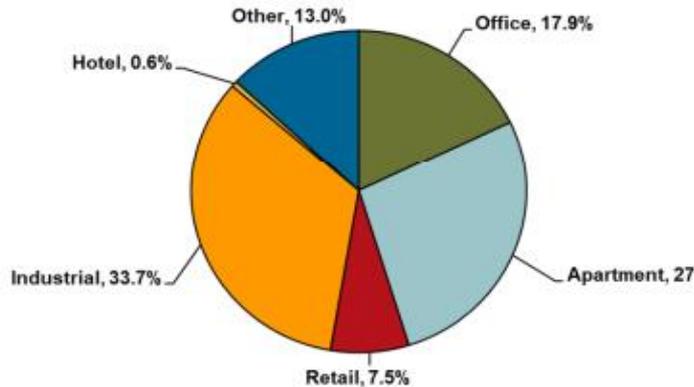
**Real Estate Actual Geographic Allocation**



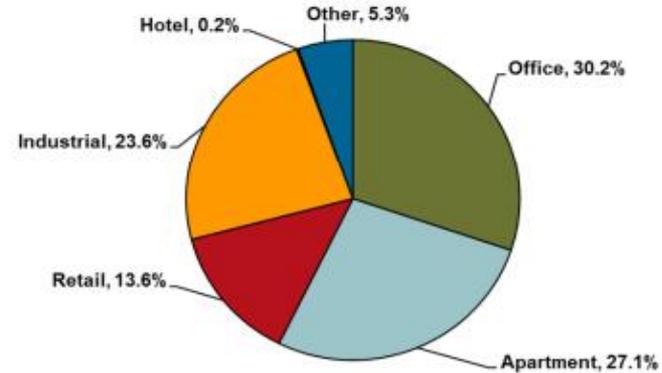
**NCREIF – ODCE Geographic Allocation**



**Real Estate Actual Property Type Allocation**



**NCREIF-ODCE Actual Property Type Allocation**



## Private Real Estate Benchmark: Peer Data\*

- Table below lists the private real estate benchmark used by the largest 30 public funds in the U.S.
  - No single most commonly used benchmark
  - 18 plans use the NCREIF ODCE Index

Fund	Private Real Estate Benchmark
<i>CalPERS</i>	NFI-ODCE Index
<i>CalSTERS</i>	NFI-ODCE Index
<i>New York Common</i>	NCREIF
<i>New York City Retirement</i>	NFI-ODCE Index +100 bps
<i>Texas Teachers</i>	NFI-ODCE Index
<i>New York State Retirement</i>	Private Markets: NCREIF ODCE
<i>Wisconsin Investment Board</i>	NFI-ODCE Index
<i>Ohio Public Employees</i>	NFI-ODCE Index + 85 bps
<i>North Carolina</i>	80% NFI-ODCE Index 20% FTSA/EPRA/NA REIT Global Index
<i>Washington State Board</i>	NCREIF Property Index
<i>New Jersey Division of Investment</i>	Blend of NFI-ODCE Index and Barclays Corp CMBS 2.0 Baa + 100 bps
<i>Virginia Retirement</i>	NFI-ODCE Index
<i>Oregon Public Employees</i>	NCREIF Property Index
<i>Ohio State Teachers</i>	85% NCREIF Property Index 15% FTSE NAREIT Equity REITs Index
<i>Massachusetts PRIM</i>	NCREIF Property Index

Fund	Private Real Estate Benchmark
<i>Michigan Retirement</i>	NCREIF Property Index -130 bps
<i>Minnesota State Board</i>	CPI + 1000 bps
<i>LA County ERS</i>	NFI-ODCE Index +40 bps
<i>Pennsylvania Employees Retirement</i>	Private Core: NFI-ODCE Index Private Non Core: Burgiss Benchmark
<i>Maryland State Retirement</i>	85% NFI-ODCE Index 15% FTSE EPRA/NA REIT Developed (Net)
<i>Teachers' System of Illinois</i>	NCREIF Property Index
<i>Tennessee Retirement System</i>	NCREIF Property Index
<i>Colorado Public Employees</i>	NFI-ODCE Index +50 bps
<i>Missouri Teachers</i>	NFI-ODCE Index
<i>Illinois Municipal Retirement Fund</i>	NFI-ODCE Index
<i>Nevada Public Employees</i>	NCREIF Property Index -75 bps
<i>Arizona State Retirement System</i>	NFI-ODCE Index
<i>Retirement Systems of Alabama</i>	NCREIF Property Index
<i>Connecticut Retirement Plans</i>	NCREIF Property Index
<i>South Carolina Retirement Systems</i>	NFI-ODCE Index +75 bps

\*Last surveyed in 2018

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## Private Equity Benchmark: Peer Data\*

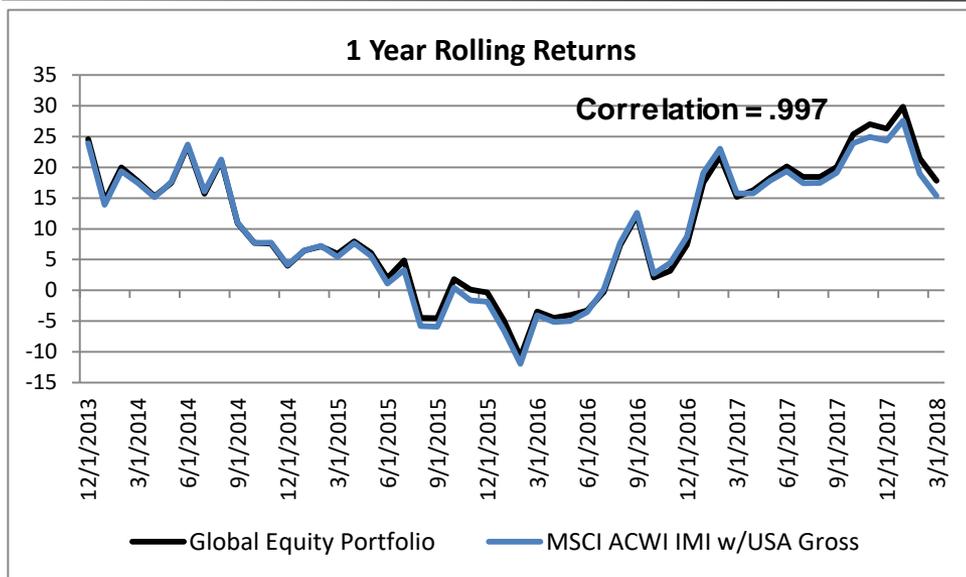
- Surveyed largest 20 public funds that invest in private equity
  - 11 of 20 utilize a public equity market index + premium for performance reporting
  - Average premium decreased to 277 bps, down from 285 bps in 2014

Fund	Primary Benchmark	Premium (bps)
<i>CalPERS</i>	67% FTSE U.S. TMI 33% FTSE AW ex-U.S. TMI	300
<i>CalSTERS</i>	Russell 3000 Index	300
<i>Florida SBA</i>	MSCI ACWI IMI	300
<i>New York Common</i>	Cambridge U.S. Private Equity Index	
<i>New York City Retirement</i>	Russell 3000 Index	300
<i>Texas Teachers</i>	State Street Private Equity Index	--
<i>New York State Retirement</i>	Cambridge U.S. Private Equity Index	--
<i>Wisconsin Investment Board</i>	Blended Benchmark of Burgiss Private Equity benchmarks, Credit Suisse Leveraged Loan Index +1% , and Bloomberg Barclays Duration-Adjusted Baa Corporate plus 20 bps	--
<i>Ohio Public Employees</i>	State Street Private Equity Index	--
<i>North Carolina</i>	Blended Benchmark of Burgiss Private Equity benchmarks	--
<i>Washington State Board</i>	MSCI ACWI IMI	300

Fund	Primary Benchmark	Premium (bps)
<i>New Jersey Division of Investments</i>	Blended benchmark of Cambridge Associates Global Private Equity, Buyout and Growth Equity & Barclays U.S. Corp High Yield Index + 300 bps	--
<i>Virginia Retirement</i>	MSCI ACWI IMI	250
<i>Oregon Public Employees</i>	Russell 3000 Index	300
<i>Ohio State Teachers</i>	Russell 3000 Index	100
<i>Massachusetts PRIM</i>	Russell 3000 Index	300
<i>Michigan Retirement</i>	S&P 500 Index	300
<i>Minnesota State Board</i>	CPI	1000
<i>LA County ERS</i>	Russell 3000 Index	400
<i>Pennsylvania Employees Retirement</i>	Blended Burgiss Benchmarks	--

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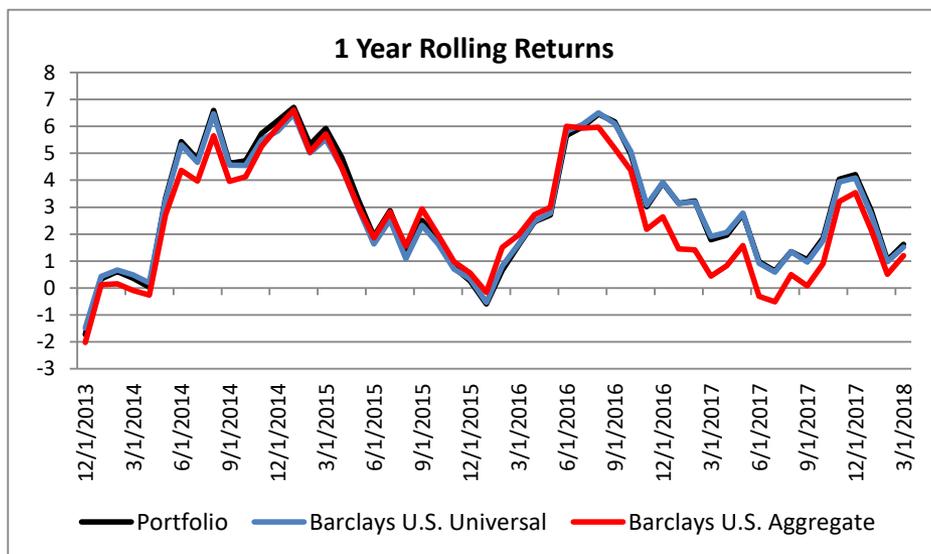
# Global Equity Review – From 2018 Analysis



Benchmarks	Monthly Tracking Error	Monthly Correlation	Market Coverage
MSCI ACWI IMI (Current Benchmark)	0.83%	1.00	99%

We are comfortable with the current benchmark (MSCI ACWI IMI w/USA Gross), given PERA’s broad mandate, very high correlation and relatively low tracking error

## Core Fixed Income – From 2018 Analysis\*

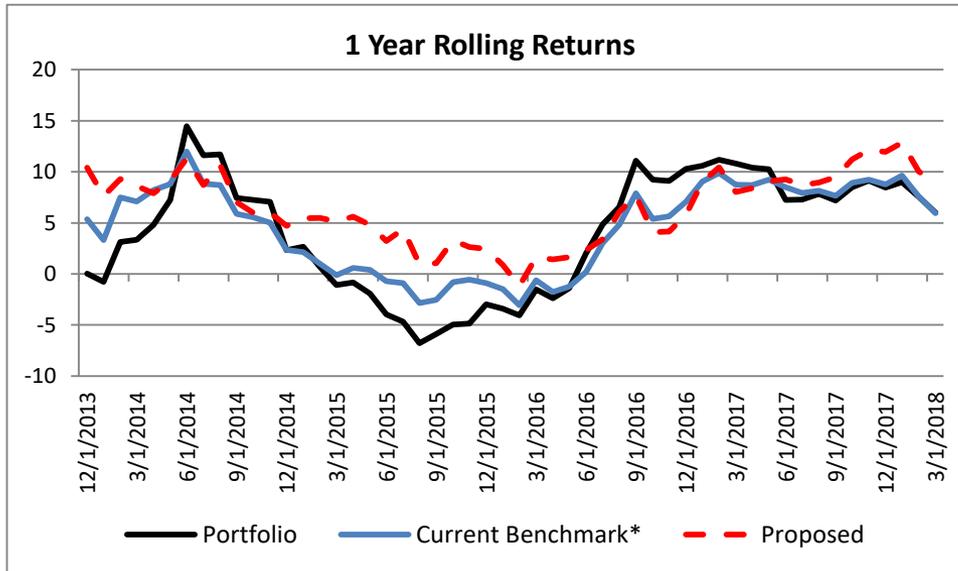


Benchmarks	Monthly Tracking Error	Monthly Correlation
Barclays U.S. Universal (Current Benchmark)	0.19%	1.00
Barclays U.S. Aggregate (Proposed)	0.57%	0.98

Historically, the Barclays U.S. Universal has provided a very tight fit for PERA’s fixed income portfolio. With the change in PERA’s fixed income policy to a core fixed income mandate, we believe the Barclays U.S. Aggregate Bond Index will be a better proxy on a go forward basis.

\*Barclays indices have since been re-named to Bloomberg indices

# Opportunity Fund – From 2018 Analysis\*



Benchmarks	Annualized Tracking Error <sup>1</sup>	Correlation <sup>2</sup>
Current Benchmark*	2.38%	0.93
Proposed Benchmark**	4.34%	0.75

\*As of 3/31/2018 and equals 27.5% NCREIF Timberland Property Index, 23.6% Public Markets Benchmark, 13.5% HFR Macro Total Asset Weight, 7.8% Tactical Opps Benchmark, 6.3% CS Multi-Strategy, 4.4% Credit Opps Benchmark, 1.4% Apollo Aviation Benchmark, 5.7% TSSP Benchmark, 3.4% CRG Benchmark, 2.3% Calmwater Benchmark, 1.9% Hayfin Benchmark, 1.8% Ares Benchmark, 0.3% SSG Benchmark

1) For period 1/31/2013 through 3/31/2018

2) Correlation of rolling annual returns 12/31/2013 through 3/31/2018

\*\*Weightings were derived using the mid-point of the permissible ranges

Tracking error is higher and correlation is lower using the proposed benchmark; however, we believe the purpose of the Opportunity Fund is to add value and enhance the total fund Sharpe ratio rather than focusing on active risk

The current benchmark provides minimal opportunity to add value because it attempts to capture all of the beta exposures which neutralizes rewards for tactical decisions

We realize that the strategy weights or purpose may change, however this framework can be adapted to fit any changes that may occur in the future

\*The Opportunity Fund has since been renamed as Alternatives

# Public Market Benchmark Fit Analysis

R - Squared vs Benchmark 5-year Periods		Sep-12	Sep-13	Sep-14	Sep-15	Sep-16	Sep-17	Sep-18	Sep-19	Sep-20	Sep-21
<b>Total Fund</b>	vs. Policy Benchmark	0.97	0.97	0.99	0.98	0.99	0.99	0.99	0.99	0.98	0.98
<b>Global Equity</b>	vs. Global Equity Custom Benchmark	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.99
<b>Fixed Income</b>	vs. Fixed Income Custom Benchmark	0.97	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99

- R-Squared is a statistical measure of benchmark fit
- An R-squared of 1 means that all movements of the portfolio can be explained by movements in the benchmark over the measured time period
- Strong R-squared results shown above are expected based on the characteristics of the asset classes, available indices, and the risk/reward profiles of the portfolios
- Private markets and alternatives are excluded from the table given the challenges in measuring fit, including benchmark changes over time, shorter available histories (for some categories), lagged valuations, and lack of appropriate 'market' benchmarks
- The Total Fund does include private markets, though given the heavy weighting to global equity and fixed income, the high R-squared results are not surprising

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