OREGON
STATE
TREASURY

Oregon Investment Council

April 21, 2021

John Russell
Chair

Rex Kim
Chief Investment Officer

Tobias Read
State Treasurer

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OREGON INVESTMENT COUNCIL

Agenda

April 21, 2021
9:00 AM

Oregon State Treasury
Investment Division
16290 SW Upper Boones Ferry Road
Tigard, OR 97224

Time	A. Action Items	Presenter	Tab
9:00-9:05	**1. Review & Approval of Minutes** March 10, 2021	**John Russell** *OIC Chair*	**1**
	2. Committee Reports	**Rex Kim** *Chief Investment Officer*	**2**
	B. Information Items		
9:10-9:30	**3. OPERF Risk Survey**	**Allan Emkin** *Managing Principal, Meketa Investment Group* **Mika Malone** *Managing Principal/Consultant, Meketa Investment Group* **Paola Nealon** *Principal/Consultant, Meketa Investment Group*	**3**
9:30-10:00	**4. OPERF Synthetic Overlay Review**	**Karl Cheng** *Senior Investment Officer, Portfolio Risk & Research* **Greg Nordquist, CFA** *Director Overlay Strategies, Russell Investments* **Doug Miller** *Director Relationship Management, Russell Investments*	**4**
10:00-10:20	**5. OPERF Public Equity Currency Hedge Program**	**Karl Cheng** **Jen Plett** *Investment Officer, Portfolio Risk & Research*	**5**

--- BREAK ---

10:25-11:05	**6. Use of Leverage for Asset Allocation**	**Karl Cheng** **Geoff Nolan** *Senior Investment Officer, Fixed Income* **Phil Kivarkis** *North America Head of Investment Policy Services, Aon Investments* **Kristen Doyle** *Partner, Aon Investments* **Raneen Jalajel** *Associate Partner, Aon Investments*	**6**
11:05-11:35	**7. OPERF Liquidity**	**Karl Cheng** **Allan Emkin** **Mika Malone**	**7**
11:35-12:05	**8. Low Interest Rates, Risk Mitigation**	**Karl Cheng** **Colin Bebee** *Managing Principal/Consultant, Meketa Investment Group* **Allan Emkin** **Mika Malone**	**8**
12:05	**9. Asset Allocation & NAV Updates** a. Oregon Public Employees Retirement Fund b. SAIF Corporation c. Common School Fund	**Rex Kim**	**9**
	10. Calendar — Future Agenda Items	**Rex Kim**	**10**
12:10	**11. Open Discussion**	**OIC Member** **Staff** **Consultants**	

C. Public Comment

TAB 1 – REVIEW & APPROVAL OF MINUTES

March 10, 2021 Regular Meeting

OREGON STATE TREASURY

State of Oregon
Office of the State Treasurer

16290 SW Upper Boones Ferry Road

Tigard, Oregon 97224

OREGON INVESTMENT COUNCIL

March 10, 2021

Meeting Minutes

Members Present:	John Russell, Cara Samples, Monica Enand, Tobias Read and Kevin Olineck.
Staff Present:	Rex Kim, John Hershey, Michael Langdon, David Randall, Karl Cheng, Ben Mahon, Geoff Nolan, Tony Breault, Michael Viteri, Rachel Wray and May Fanning.
Staff Participating virtually:	Wil Hiles, Andrey Voloshinov, Roy Jackson, Taylor Bowman, Andrew Coutu, Sam Spencer, Austin Carmichael, Amanda Kingsbury, Krystal Korthals, Andrew Robertson, Aliese Jacobsen, Anna Totdahl, Jen Plett, Ahman Dirks, Angela Schaffers, Andrew Hillis, Lisa Pettinati, Paul Koch, Ian Huculak, Dana Millican, Sommer May, Debra Day, Claire Illo, Tiffany Zahas, Tan Cao, Chris Ebersole, Perrin Lim, Scott Robertson, Mohammed Quraishi, Mark Selfridge, Tyler Bernstein, Eric Messer, Robin Kaukonen, Kenny Bao, Will Hampson, Mike Mueller, Jeremy Knowles, Faith Sedberry, David Elott and Amy Bates
Consultants Present:	Christy Fields, Mika Malone, Allan Emkin, David Glickman, Paola Nealon and Colin Bebee (Meketa Investment Group, Inc.); Stephen Cummings, Kristen Doyle and Raneen Jalajel (Aon Investments); Tom Martin and David Fann, (Aksia/TorreyCove Capital Partners LLC), Steve Kennedy, Albourne
Legal Counsel Present:	Steven Marlowe, Department of Justice

Before proceeding with the OIC meeting, Chief Investment Officer, Rex Kim provided a disclosure pertaining to the virtual set-up of this OIC meeting, informing those in attendance (virtual and in person) of the guidelines in which this meeting will proceed.

The March 10th, 2021 OIC meeting was called to order at 9:00 am by John Russell, OIC Chair.

I. 9:02 am Review and Approval of Minutes

MOTION: Chair Russell asked for approval of the January 28th, 2021 OIC regular meeting minutes. Treasurer Read moved approval at 9:03 am, and Ms. Enand seconded the motion which then passed by a 4/0 vote.

II. 9:03 am Committee Reports

Mr. Kim, gave an update on the following committee actions taken since the January 28th, 2021 OIC meeting:

Opportunity Committee:

March 3, 2021	Whitehorse Liquidity Partners IV, LP	$200M

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Real Estate Committee:
None

Alternatives Portfolio Committee:
None

Private Equity Committee:
None

III. 9:04 am Real Estate Market Overview

Tony Breault, Senior Investment Officer, Real Estate, welcomed and introduced, Mr. Ken Riggs, Vice Chair, RERC, a SitusAMC Company, who then provided the Council and attendees with a Real Estate Market Overview presentation.

IV. 9:54 am OPERF Real Estate Program

Tony Breault, Christy Fields, Managing Principal, Meketa and David Glickman, Executive Vice President, Meketa, presented the OPERF Real Estate Portfolio Annual Review and 2021 Plan.

V. 11:00 am OPERF Alternatives Program

Ben Mahon, Senior Investment Officer, Alternatives and Tom Martin, Head of PE & RA Research, Aksia/TorreyCove, provided the Council with a presentation pertained to the OPERF Alternatives Portfolio 2020 Annual Review and 2021 Plan. This discussion included, the Alternatives Portfolio's background and objectives, and a review of the portfolio's 2020 performance and investment activity.

For the second half of the presentation, Mr. Mahon introduced, Albourne's, Steve Kennedy, Partner, Portfolio Analyst. The initial three-year contract term with two pre-negotiated two-year extensions with Albourne as the Diversifying Strategies Consultants, was approved by the Council in October 2020. Mr. Kennedy then provided a comprehensive introduction to Albourne.

VI. 12:05 pm Capital Markets Assumptions

Karl Cheng, Senior Investment Officer, Portfolio Risk & Research, along with Colin Bebee, Managing Principal, Consultant, Meketa Investment Group, Kristen Doyle, Partner, Aon Investments and Raneen Jalajel, Senior Consultant, Aon Investments provided a discussion on Capital Markets Assumptions, that included an introduction to the 2021 Capital Markets Assumptions, current market environment, and the CMA development process.

VII. 12:49 pm Q4 OPERF Performance

Mika Malone, Managing Principal, Consultant, Meketa Investment Group, began by pointing to the newly developed summary concept with respect to performance reporting and noted, that the goal is to create these executive summaries in a way that helps Council members focus on the higher level and most critical points in order to efficiently execute their job-related responsibilities. Paola Nealon, Principal, Consultant, Meketa Investment Group, then delivered the summary of the quarterly OPERF investment performance and risk report for the calendar year and cumulative period ended December, 31 2020.

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VIII. 1:17 pm Asset Allocation & NAV Updates

Mr. Kim reviewed asset allocations and NAVs across OST-managed accounts for periods ended January 31, 2021.

IX. 1:19 pm Calendar – Future Agenda Items

A calendar listing of future OIC meetings and scheduled agenda topics was included in the Council's meeting material.

X. 1:20 pm Open Discussion

Treasurer Read expressed his appreciation of the ongoing efforts leading up to the OIC/PERS joint meeting in June, particularly in relation to the conversation around the asset classes and the way they relate to each other, in addition to the new format of reporting, Meketa debuted during today's meeting. Ms. Enand seconded that thought. Along those same lines, Vice-Chair Samples requested that if there were any communications as staff is going through this asset allocation study, to provide those to the Council in the interim in order for everyone to be prepared to have a high-quality discussion.

Chair Russell raised questions about the general topic of flexibility for institutions of our size. The Council had a brief discussion with Mr. Kim and Vice-Chair Samples expressing their perspectives.

XI. 1:25 pm Public Comments

None.

Mr. Russell adjourned the meeting at 1:25 pm.

Respectfully submitted,

May Fanning
Executive Support Specialist

TAB 2 – Committee Reports

April 21, 2021

Oregon Investment Council

Committee Reports

Rex T. Kim, Chief Investment Officer

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TAB 3 – OPERF Risk Survey

MEKETA
INVESTMENT GROUP

Oregon Investment Council

April 2021

Risk Survey Results

Introduction and Background

- This presentation is the initial step in the 2022, study of OPERF's assets and liabilities. The comprehensive 2022 asset/liability study will address, in depth, the following elements:

  1) Capital market assumptions by asset class, which include expected returns, volatilities and correlations; Along with the selection of which asset classes/strategies (ie. leverage) to model.

  2) Proposed asset mixes using various portfolio modeling/construction techniques;

  3) OPERF's liability structure, funded status and liquidity needs; and

  4) Recommended strategic asset allocation targets and a rebalancing framework.

- Over the course of 2021, the Council - with input from Staff and Consultant(s) - will review several topics relevant to these elements ahead of the 2022 A/L study timeline. The 2021 asset allocation review is intended to be a "fine tuning" of the current asset allocation and a vehicle to initiate discussion and debate on issues that will be comprehensively addressed next year.

- This Risk Survey seeks to understand the Council's key concerns, risk tolerance levels and portfolio attributes. There is no "right" answer as risk may mean different things to different people. Importantly, this is intended to solicit the types and the levels of risk the Board deems appropriate, commensurate with the return target to be achieved.

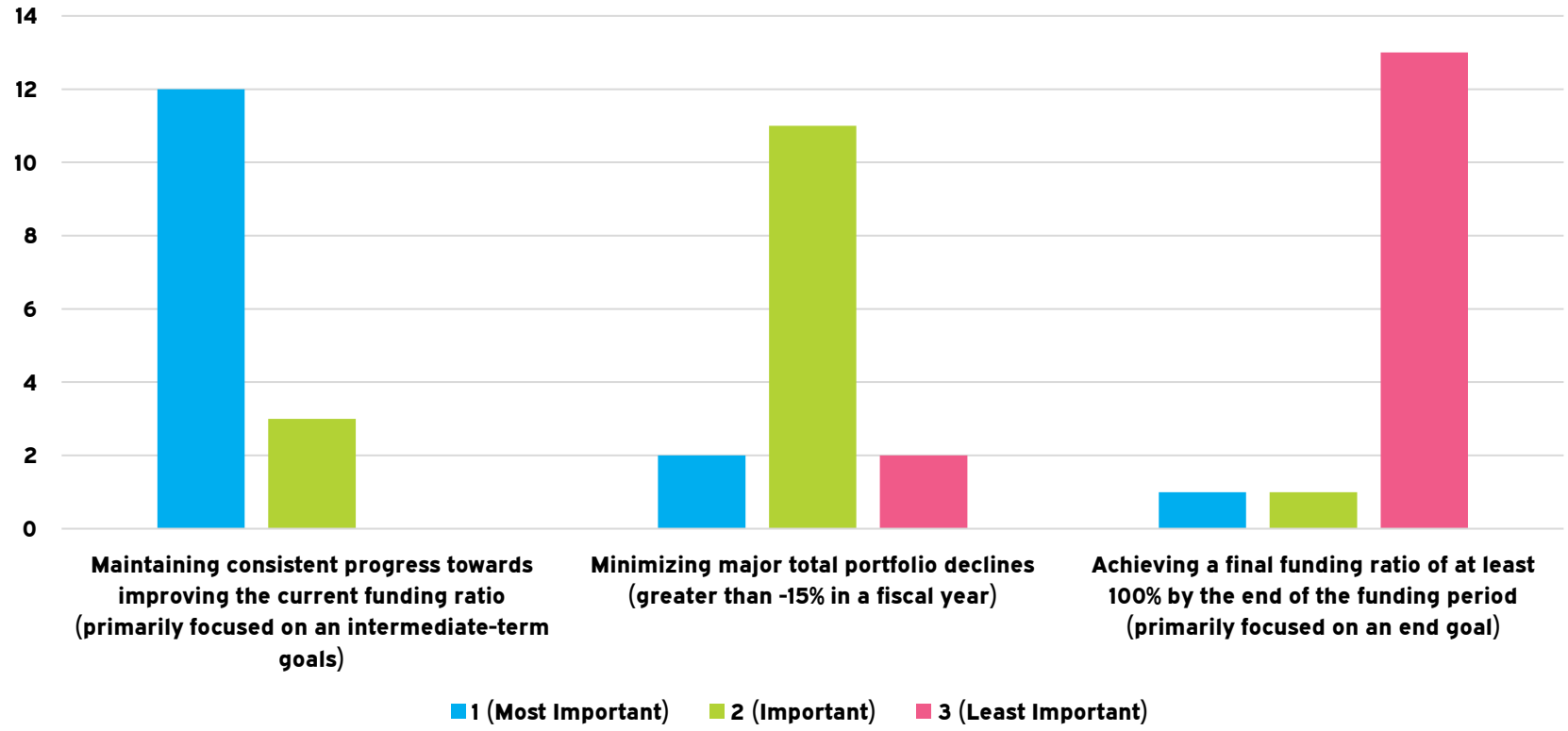
Risk Survey Highlights

- Funding progress is important but 100% funding is less so, minimizing drawdowns of -15% is important.
- Comfort level with existing level of risk is high.
- Concern is focused on declining funded ratios.
- Most believe diversifying strategies will work.
- Cash flow / liquidity is important.
- No consensus on tactical asset allocation..
- Strong sentiment that opportunistic has potential to add value.
- Most agree that net of fee performance is most important.
- Consistent with investment beliefs, illiquid assets have a premium that can be harvested.
- Peer performance is not a leading driver behind portfolio decisions.

Next Steps:

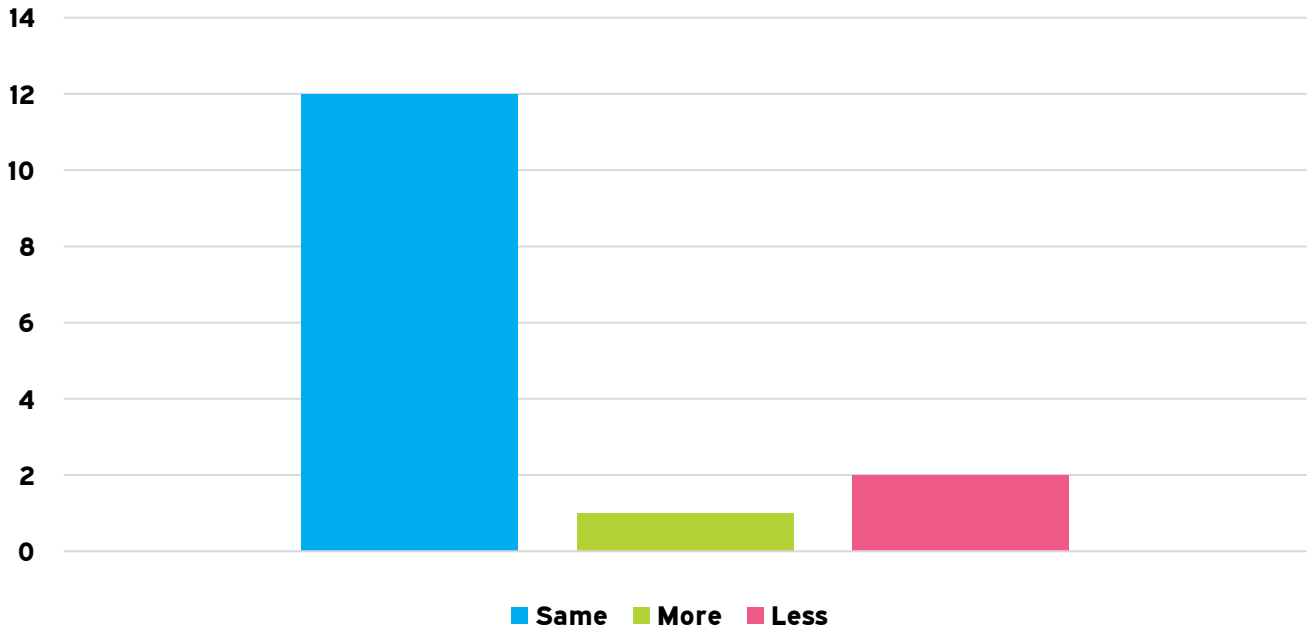
- Forthcoming meetings address the interaction of various portfolio mixes with key risk factors identified by the Council.

1. Please rank the following objectives in order of importance with 1 being most important and 3 being least important.



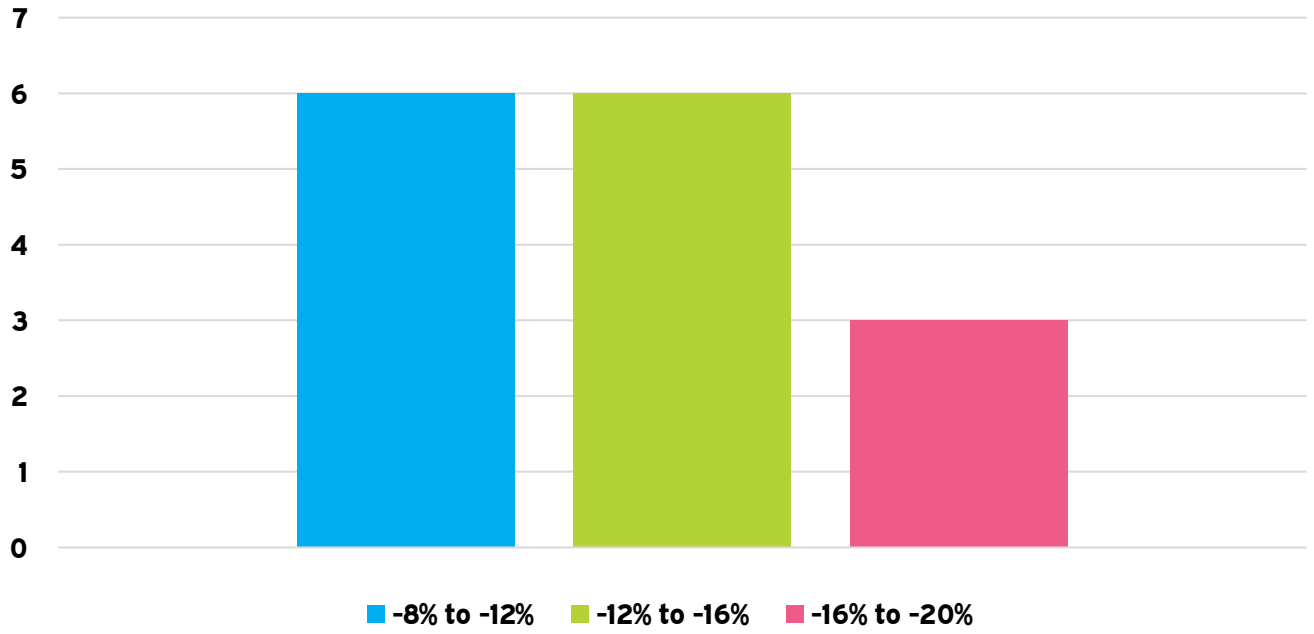
- The majority of respondents, roughly 87%, believe achieving a final funding ratio of at least 100% by the end of the funding period is least important.
- 100% of the respondents believe maintaining progress towards improving the current funding ratio to be either important or most important.

2. To achieve long-term goals, should OIC be taking more, less, or the same amount of investment risk in the portfolio?



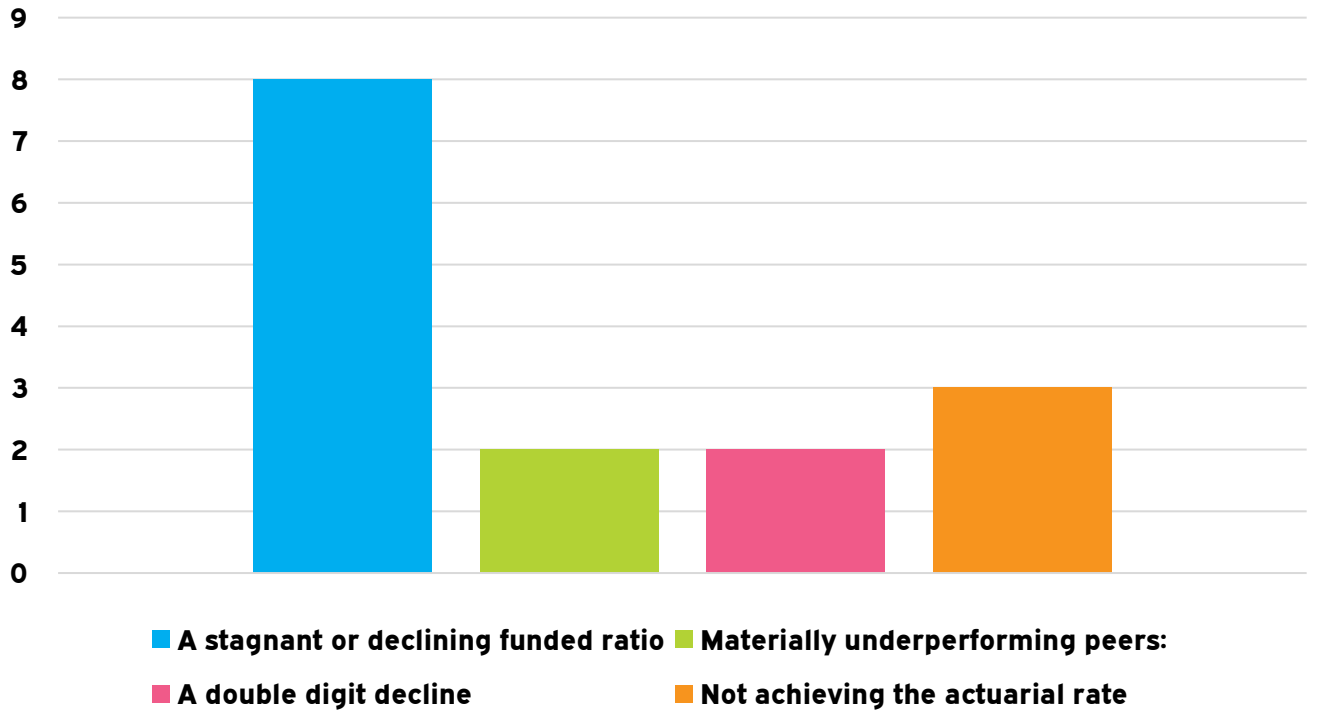
- The majority of respondents -80% - believe OPERF is taking on enough risk necessary to achieve long-term goals. OPERF's policy target for total equity (public + private) stands at 52.5% today.

3. What is considered to be a bad but not necessarily a catastrophic year to the respondent?



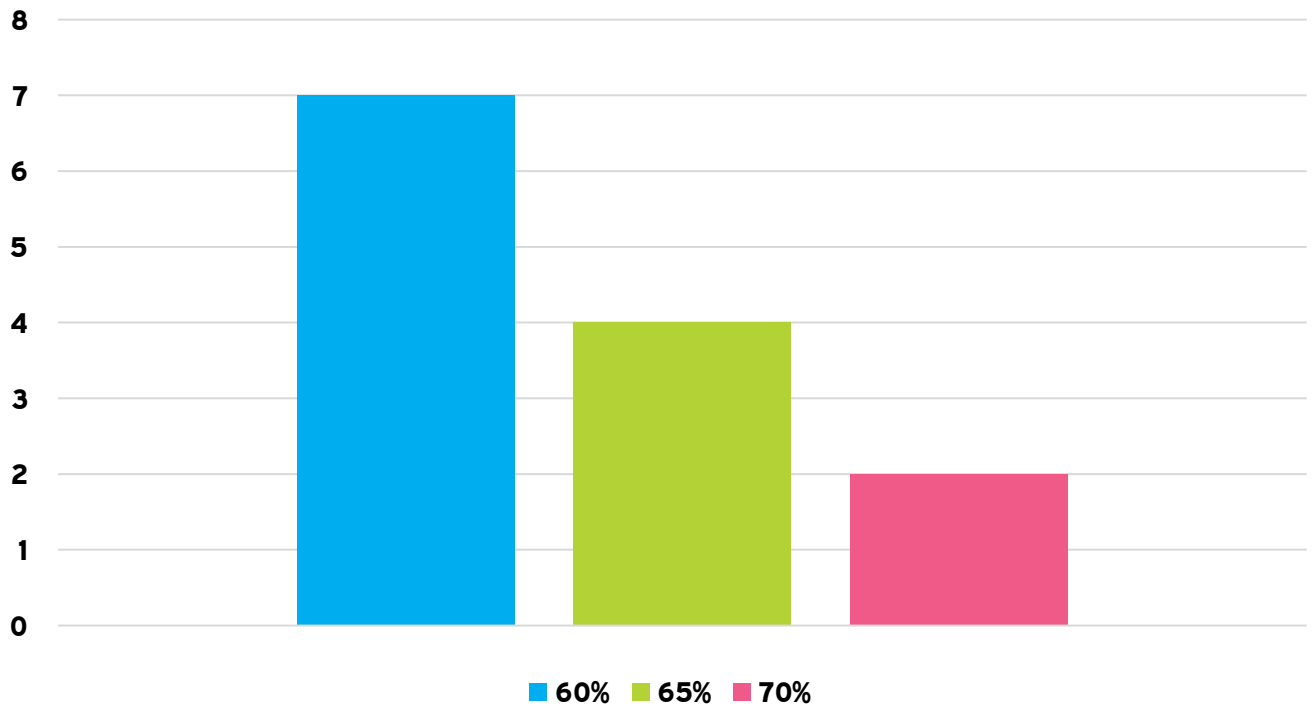
- Risk tolerance ranges were broad-based in nature with 80% of respondents believing a -8% to -16% return year would be, “bad,” but not necessarily catastrophic, and the remaining 20% believing a -16% to -20% return would be considered, “bad,” but not necessarily catastrophic year.

4. Which of the following outcomes is of the greatest concern over the next 10 years?



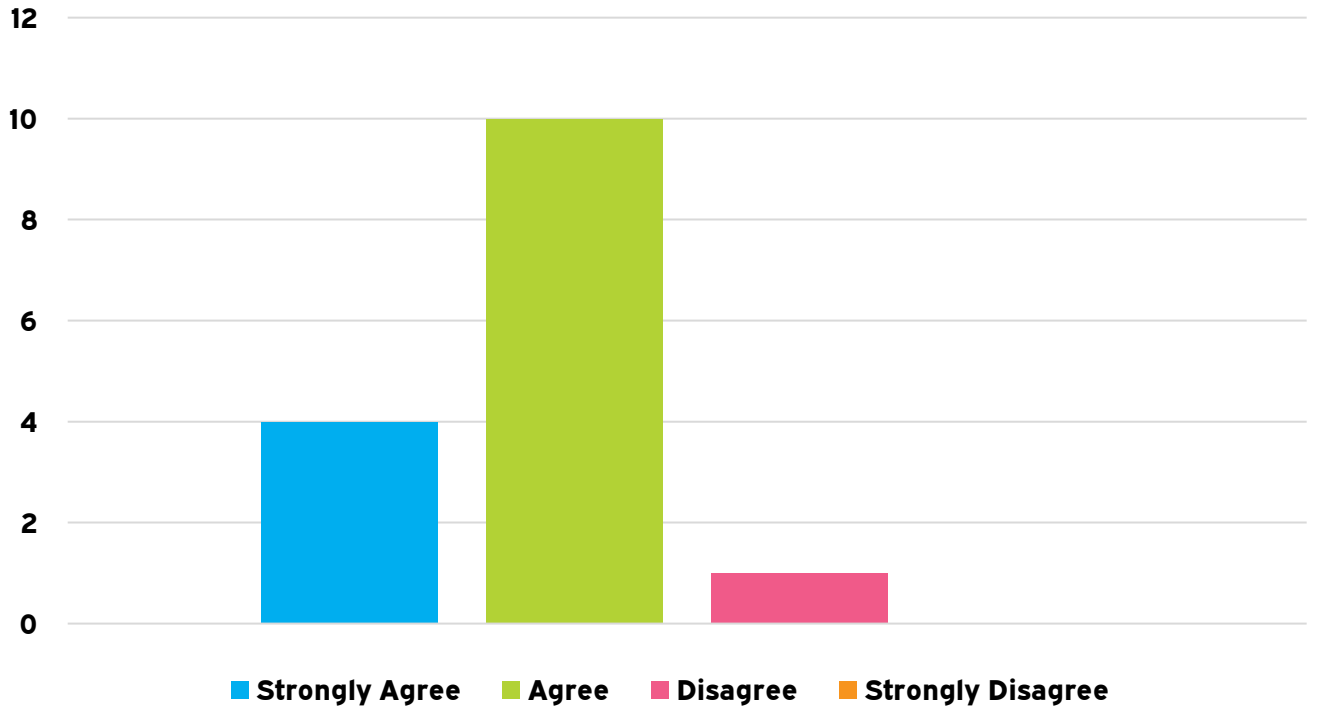
- Roughly half of the respondents identified a stagnant or declining funded ratio as the greatest concern to OPERF. This is in-line with respondents' views to question #1 which observed 80% of respondents' key concern being that of maintaining consistent progress towards improving the funded ratio.

5. What is the minimum funded ratio that the respondent is willing to accept in a market crisis scenario? (i.e., very rapid deterioration in economic conditions)



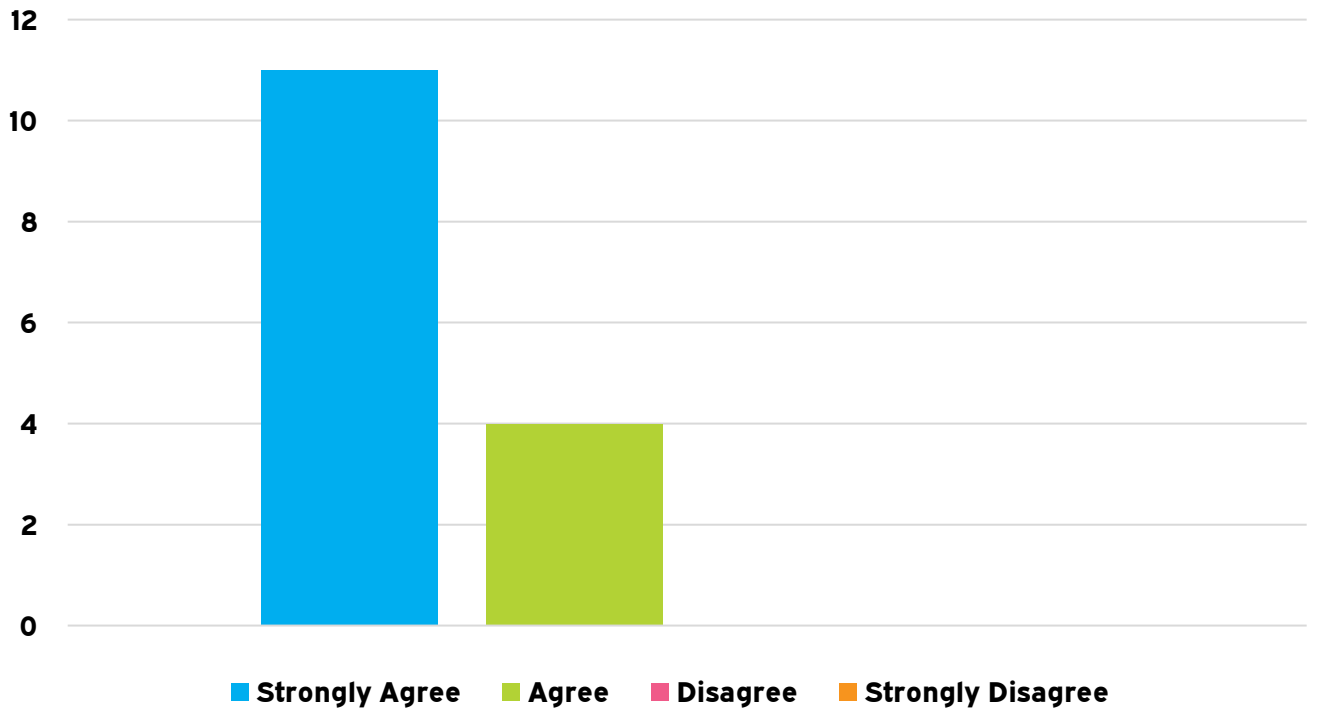
- A larger majority of respondents were willing to accept the lower minimum funded ratio of 60% under a market crisis scenario.

6. Diversifying strategies can provide stability in funding ratio levels over time.



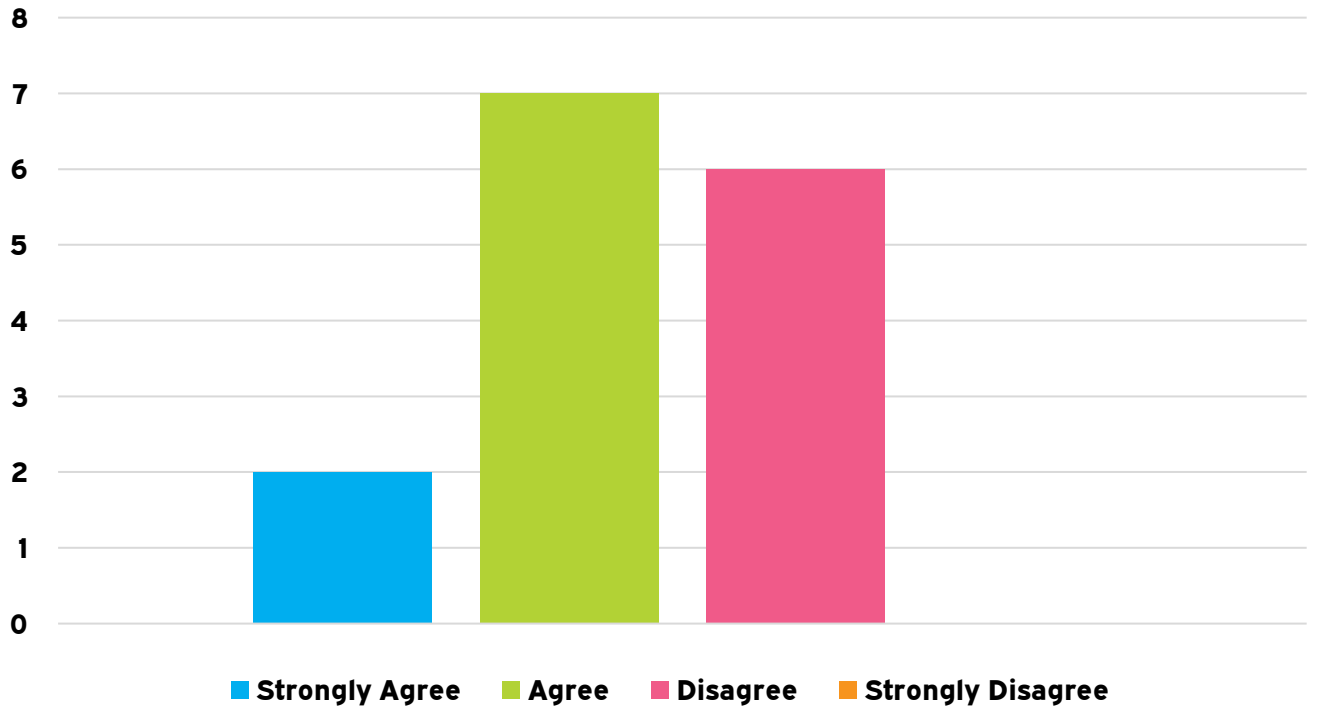
- With the exception of one respondent, most believe diversifying strategies to provide stability in funding ratios over time.

7. The cash-flow position of the Fund (e.g., net positive contributions or net negative benefit payments) is an important consideration when constructing an investment portfolio.



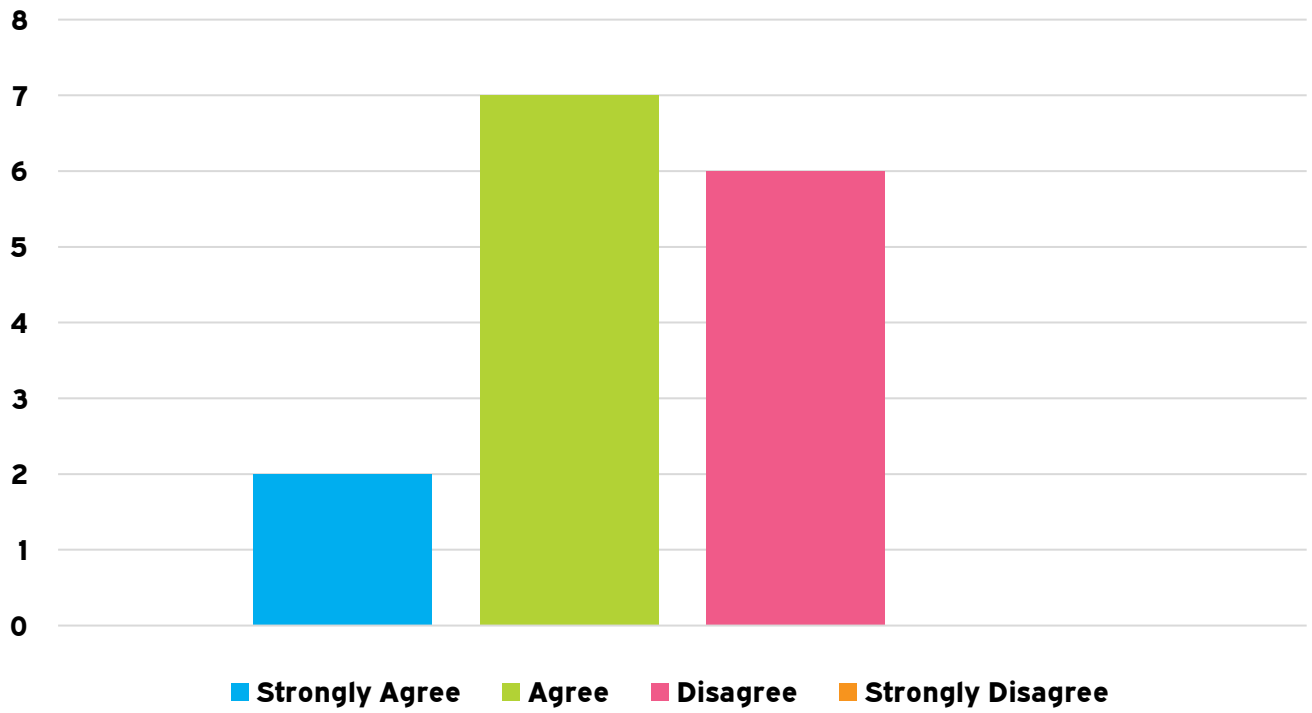
- All respondents either strongly agreed or agreed that OPERF's cash-flow position was an important consideration in constructing the investment portfolio.

8. Shifting asset allocation away from policy (i.e., tactical allocations) from time-to-time adds value.



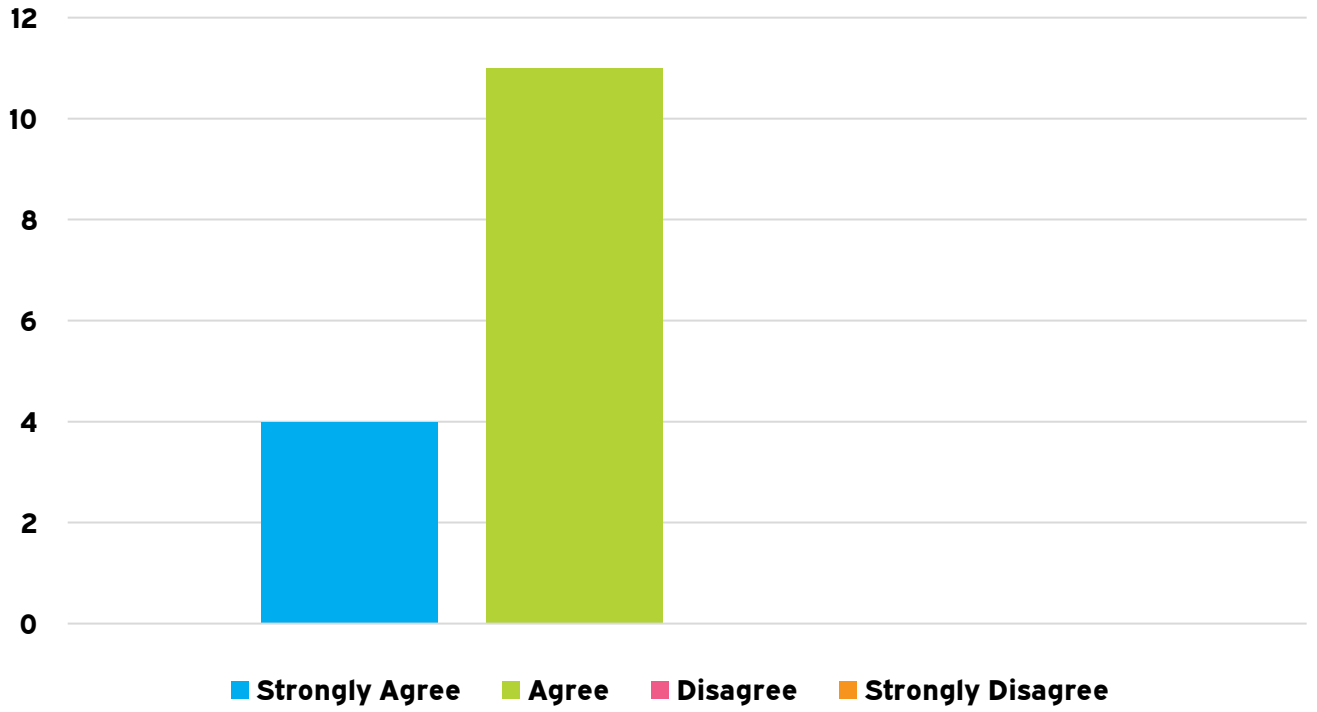
- 60% of respondents believe tactical positioning to add value, with the remaining 40% of respondents disagreeing.

9. Different strategies and/or asset classes may be interchangeable if they share similar risk factor exposures and portfolio functions.



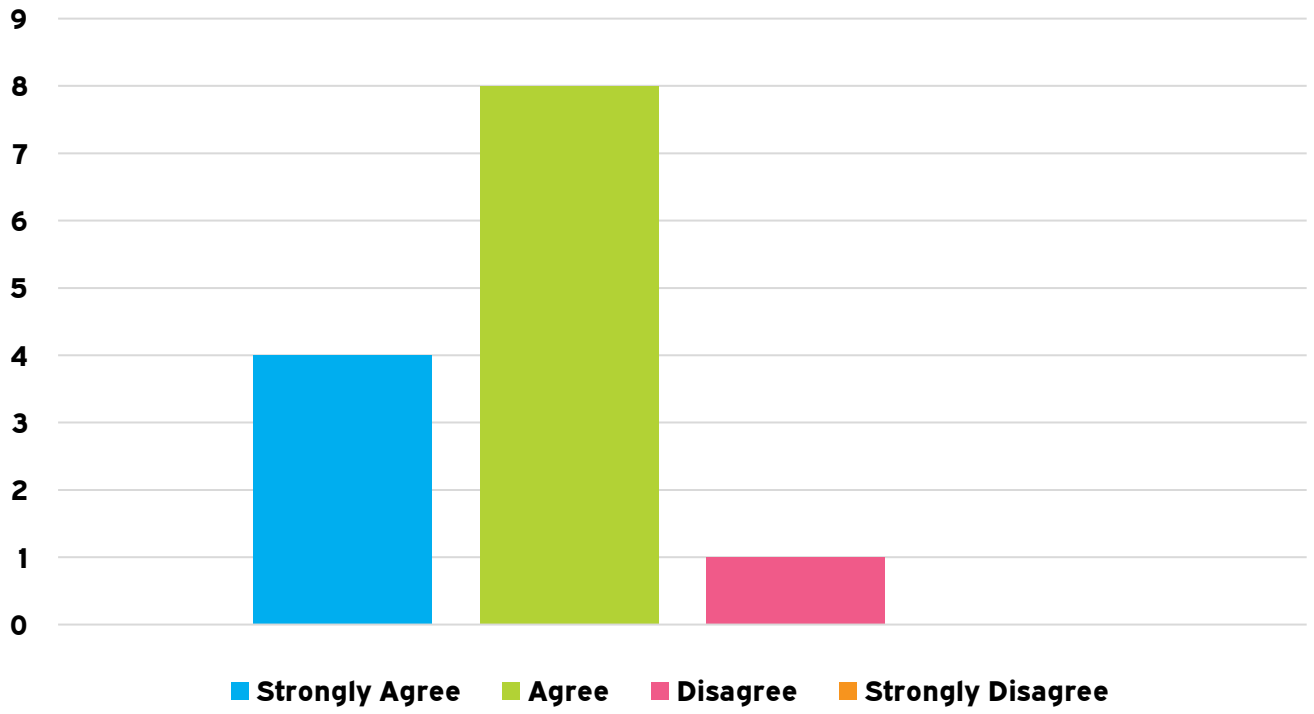
- Respondents were split 60/40 when asked whether different strategies offering similar factor exposures should or could be interchangeable.

10. Opportunistic investments have the potential to add value.

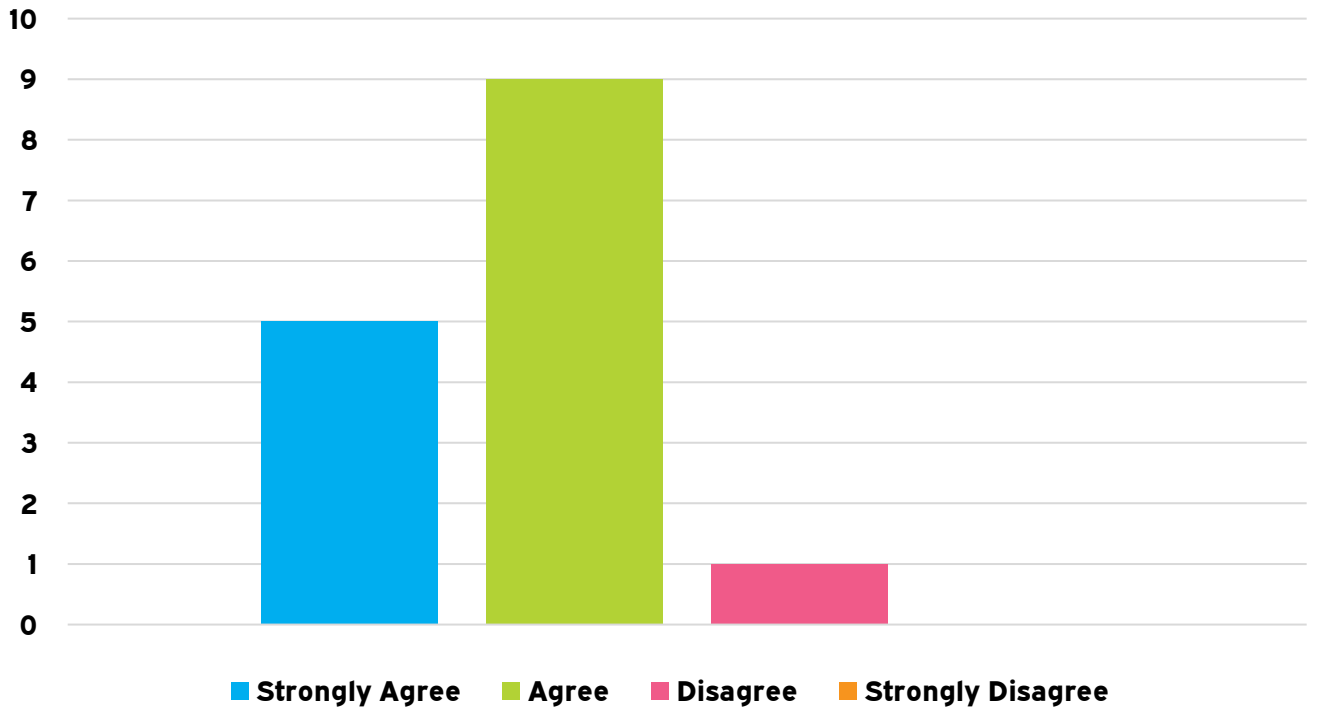


- All respondents either agreed, or strongly agreed in the value add behind opportunistic investments.

11. High fee strategies are worthwhile if they produce high net-of-fee returns. (e.g., a strategy with a 1% management fee and a 9% expected net-of-fee return is preferred to a strategy with a 20 basis point management fee and an 8.0% expected net-of-fee return).

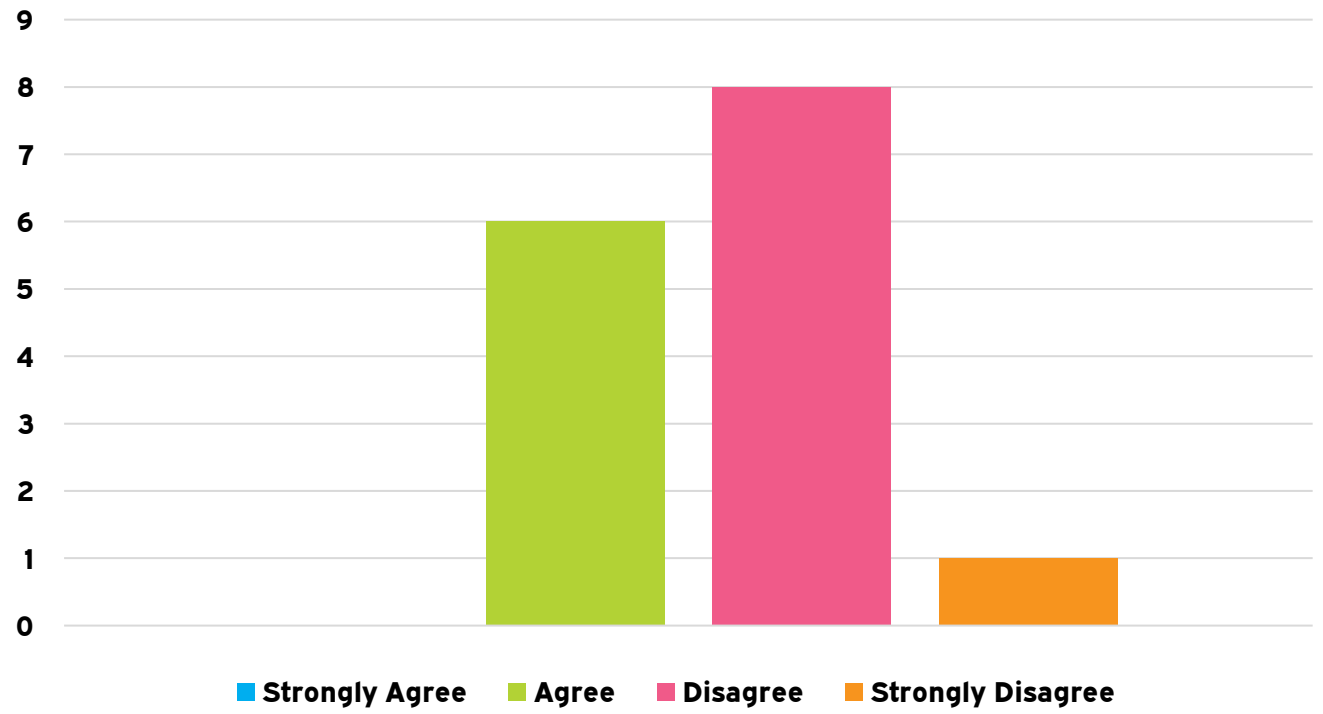


12. Illiquid strategies typically return more than similar-risk, liquid strategies (e.g., private equity typically returns more than public equity on a risk-adjusted basis).



- The majority of respondents (93%) believe in an illiquidity premium.

13. Producing a return pattern that is different than peers is important (given the same long-term return).



- 60% of respondents surveyed do not believe that producing a return pattern different than peers is particularly important.

1. Please rank the following objectives in order of importance with 1 being most important and 3 being least important.

   Achieving a final funding ratio of at least 100% by the end of the funding period (primarily focused on an end goal)

   1: 1
   2: 1
   3: 13

   Maintaining consistent progress towards improving the current funding ratio (primarily focused on an intermediate-term goals)

   1: 12
   2: 3
   3: 0

   Minimizing major total portfolio declines (greater than -15% in a fiscal year)

   1: 2
   2: 11
   3: 2

2. To achieve long-term goals, should OIC be taking more, less, or the same amount of investment risk in the portfolio?

   Same: 12
   More: 1
   Less: 2

3. What is considered to be a bad but not necessarily a catastrophic year to the respondent?

   -8% to -12%: 6
   -12% to -16%: 6
   -16% to -20%: 3

4. Which of the following outcomes is of the greatest concern over the next 10 years?

   A stagnant or declining funded ratio: 8
   Materially underperforming peers: 2
   A double digit decline: 2
   Not achieving the actuarial rate: 3

5. What is the minimum funded ratio that the respondent is willing to accept in a market crisis scenario (i.e., very rapid deterioration in economic conditions)?

   60%: 7
   65%: 4
   70%: 4

6. Diversifying strategies can provide stability in funding ratio levels over time.

   Strongly Agree: 4
   Agree: 10
   Disagree: 1
   Strongly Disagree: 0

7. The cash-flow position of the Fund (e.g., net positive contributions or net negative benefit payments) is an important consideration when constructing an investment portfolio.

   Strongly Agree: 11
   Agree: 4
   Disagree: 0
   Strongly Disagree: 0

8. Shifting asset allocation away from policy (i.e., tactical allocations) from time-to-time adds value.

   Strongly Agree: 2
   Agree: 7
   Disagree: 6
   Strongly Disagree: 0

9. Different strategies and/or asset classes may be interchangeable if they share similar risk factor exposures and portfolio functions.

   Strongly Agree: 2
   Agree: 8
   Disagree: 3
   Strongly Disagree: 2

10. Opportunistic investments have the potential to add value.

    Strongly Agree: 4
    Agree: 11
    Disagree: 0
    Strongly Disagree: 0

11. High fee strategies are worthwhile if they produce high net-of-fee returns. (e.g., a strategy with a 1% management fee and a 9% expected net-of-fee return is preferred to a strategy with a 20 basis point management fee and an 8.0% expected net-of-fee return).

    Strongly Agree: 6
    Agree: 8
    Disagree: 1
    Strongly Disagree: 0

12. Illiquid strategies typically return more than similar-risk, liquid strategies (e.g., private equity typically returns more than public equity on a risk-adjusted basis).

    Strongly Agree: 5
    Agree: 9
    Disagree: 1
    Strongly Disagree: 0

13. Producing a return pattern that is different than peers is important (given the same long-term return).

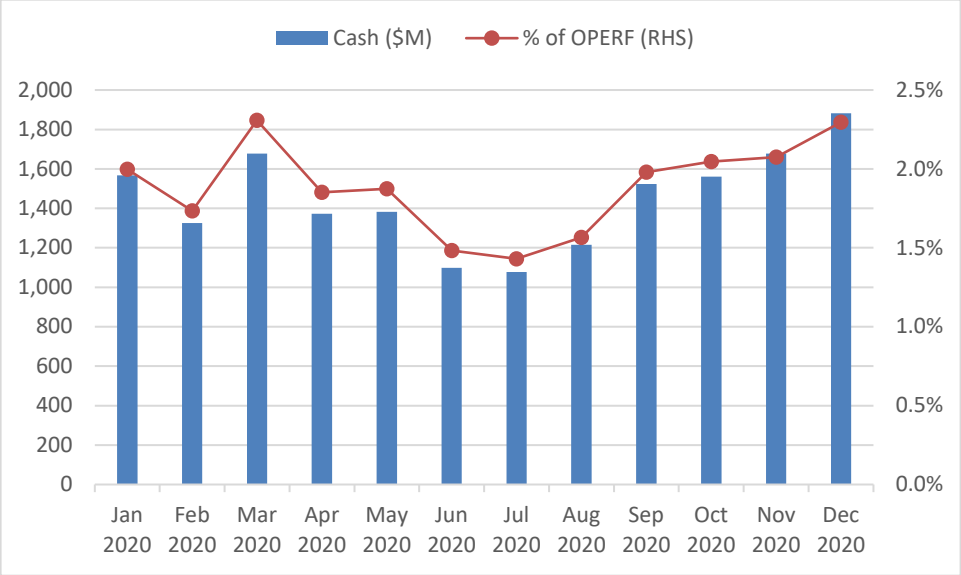
    Strongly Agree: 0
    Agree: 6
    Disagree: 8
    Strongly Disagree: 1

TAB 4 – OPERF Synthetic Overlay Review

OPERF Policy Implementation
Overlay Manager Annual Update

Purpose
To provide the OIC an update on the OPERF overlay program, managed by Russell Investments.

Background
Although OPERF does not have a strategic allocation to cash, it has a cash balance that is primarily invested in the Oregon Short Term Fund (OSTF). This cash balance is used to make regularly-scheduled PERS benefit payments as well handle episodic capital calls and distributions associated with OPERF's private market investments. The chart below shows OPERF's monthly cash balance invested in OSTF, as well as the cash in the overlay program.



Since it does not have a strategic allocation target, the OPERF cash balance may be the source of "cash drag" in that it is not invested in investments with greater potential return. The OIC retained Russell Investments to implement an overlay program to minimize cash drag. Specifically, Russell Investments monitors and, if necessary, equitizes and/or bondizes excess cash held by public equity & REIT managers and any other idle OPERF cash. The firm uses highly-liquid futures contracts with margin requirements much smaller than the contracts' "face" or "notional" values. As part of its process, Russell Investments also a) monitors OPERF's asset allocation relative to its OIC-established strategic targets (see the "Rebalancing" section in the attached *OIC Policy INV 1203: Statement of Investment Objectives and Policy Framework for OPERF*) and b) trades equity and fixed income futures contracts as necessary to align the Fund's overall asset allocation with these OIC-established targets. For perspective on the overlay program, OIC members receive update on the program's overlay exposures in the asset allocation section of the regular OIC meeting materials.

As December 31, 2020, the OPERF overlay program was long $2.87 billion in fixed income contracts and short $1.07 billion in global equity contracts for a total gross notional exposure of $1.80 billion.

Staff Recommendation
None, information only.

OREGON STATE TREASURY

Origination:	*02/2002*
Last Approved:	*07/2020*
Last Revised:	*07/2020*
Next Review:	*07/2021*
Owner:	*Rex Kim: Chief Investment Officer*
Policy Area:	*Investments*
References:	

INV 1203: Statement of Investment Objectives and Policy Framework for the Oregon Public Employees Retirement Fund

INTRODUCTION & OVERVIEW

Summary Policy Statement

This Statement of Investment Objectives and Policy Framework (the "Statement") summarizes the philosophy, objectives and policies approved by the *Oregon Investment Council* (the "OIC" or the "Council") for the investment of *Oregon Public Employees Retirement Fund* ("OPERF" or the "Fund") assets.

1. The Statement has been prepared with six audiences in mind: 1) incumbent, new and prospective Council members; 2) *Oregon State Treasury ("OST")* staff; 3) the Public Employees Retirement Board ("PERB"); 4) active and retired Oregon Public Employees Retirement System (PERS) members; 5) the Oregon State Legislature and Governor; and 6) agents engaged by the Council to manage and administer Fund assets.
2. The Council approved these objectives and framework after careful consideration of PERS benefit provisions, and the implications of alternative objectives and policies.
3. The Statement summarizes more detailed policy and procedure documents prepared and maintained by staff, and numerous other documents that govern the day-to-day management of OPERF assets including agent agreements, individual investment manager mandates and limited partnership documents.
4. The Council regularly assesses the continued suitability of its approved investment objectives and policies, initiates change as necessary and updates these documents accordingly.

Applicability

Classified represented, management service, unclassified executive service.

Authority

ORS Chapter 293.

POLICY PROVISIONS

Definitions

Actuarial Discount Rate ("ADR"): The interest rate used to calculate the present value of a defined benefit plan's future obligations and determine the size of the plan sponsor's annual contribution. The ADR currently approved by the PERB is 7.2%.

Alternatives: Investments that are considered non-traditional or emerging in nature. Presently, the following investment types are included within the OPERF alternatives allocation: hedge funds; infrastructure; natural resources; and commodities.

Asset Class: A collection of securities that have conceptually similar claims on income streams and have returns that are highly correlated with each other. The most frequently referenced asset classes include equities, fixed income, real estate and cash.

Basis Point: This refers to a common unit of financial measurement. One basis point equals 0.01%. One hundred basis points equal 1% or one percentage point.

Benchmark: A standard by which investment performance can be measured and evaluated. For example, the performance of U.S. equity managers is often measured and evaluated relative to the Russell 3000 Index. In this case, the Russell 3000 Index serves as or represents the U.S. equity benchmark.

Benchmark Exposure: The proportion that a given stock represents within a benchmark, such as the Russell 3000 Index of U.S. equity securities. Allows investors to measure the extent to which a portfolio or specific investment strategy is over- or under-exposed to a particular stock or investment characteristic (e.g., market capitalization) relative to a benchmark.

Bloomberg Barclays U.S. Aggregate Index: This index covers the U.S. investment-grade fixed rate bond market, and includes government, corporate, mortgage pass-through and asset-backed securities. These major sectors are subdivided into more specific indices that are calculated and reported on a regular basis. Its constituents are SEC-registered, taxable, dollar-denominated securities that conform to specific parameters.

Bloomberg Barclays U.S. Treasury Index: This index is a sub-component of the Bloomberg Barclays Aggregate Index and includes public obligations of the U.S. Treasury with remaining maturities of more than one year that conform to specific parameters.

Co-investment: Although used loosely to describe any two parties that invest alongside one another in the same company, this term has a special meaning in the context of an investment fund's limited partners. By having co-investment rights, a limited partner can invest directly in a company that is simultaneously backed by the fund's general partner. In this way, the limited partner has two separate stakes in the company: the first, an indirect investment through its participation in the general partner's fund; the second, a direct investment alongside the general partner. While the direct, co-investment opportunity is usually offered at terms and conditions more favorable than the fund investment, the direct, concentrated nature of the co-investment opportunity implies higher risk for the limited partner.

Core: Real estate investment strategies which exhibit "institutional" qualities, such as superior location, high occupancy and premium design and construction quality.

Credit: Used most often in a fixed income context, the measure of an organization's ability to re-pay borrowed money. Organizations with the highest credit rating (i.e., those most likely to re-pay borrowed money) are assigned a AAA credit rating.

Distressed Debt: A private equity investment strategy that involves purchasing discounted bonds of a financially-distressed firm. Distressed debt investors frequently convert their holdings into equity and become actively involved in the management of the distressed firm.

Diversification: Reducing risk without a commensurate reduction in expected return by combining assets and/or investment strategies with low or uncorrelated return and volatility profiles. For example, a decline in the price of one asset (e.g., oil stocks) is offset by an increase in the price of another asset (e.g., airline stocks). In lay terms, this principal is often described as "putting your eggs in more than one basket".

Diversifying Strategies: Investment strategies that attempt to systematically capture certain risk premia beyond traditional equity and fixed income market exposures using alternative investment techniques.

Duration: A financial measure used by investors to estimate the price sensitivity of a fixed income security relative to changes in interest rates. For example, if interest rates increase by 1 percentage point, a 5-year duration bond will decline in price by approximately 5 percent.

Efficient Market: A market in which security prices rapidly reflect all information germane to the price discovery process. A primary implication of an efficient market is that active management efforts often fail to produce results that consistently beat the performance of an index fund or other passive strategy net of fees, transactions costs and other expenses.

Equities: Investments that represent ownership in a company and therefore a proportional share of company profits.

Fixed Income: Debt obligations that specify the precise repayment of previously borrowed money. Typically, repayment takes the form of a series of fixed-amount, semi-annual interest payments and a single, final repayment of principal.

Funded Status: A comparison of a pension plan's assets and liabilities where the latter are often referred to as the plan's projected benefit obligation ("PBO"). When a plan's assets exceed its PBO, the plan is considered overfunded. Conversely, if a plan's assets are less than its PBO, the plan is considered underfunded and the plan sponsor has a net liability position with respect to its pension plan.

Fund-of-funds: Often organized by an investment advisor or investment bank, a fund that invests in other funds rather than directly in securities, operating firms or other assets.

Growth Stock: Stocks exhibiting faster-than-average earnings growth with expectations that such growth will continue. Growth stocks usually have high price-to-earnings ratios, high price-to-book ratios and low to no dividend yields.

Hedged: A term applied to one, more or an entire portfolio of assets indicating that the base country value of such assets is partially or wholly protected from foreign currency fluctuations. Forward currency contracts are typically used to hedge or offset the effects of these fluctuations.

Index Fund: A portfolio management strategy that seeks to match the composition and performance of a select index such as the Russell 3000 or S&P 500.

Leverage Buyout (LBO): A strategy in which debt financing is use to acquire a firm or business unit, typically in a mature industry. LBO debt is usually repaid according to a strict schedule that absorbs most of the acquired firm's cash flow.

Liability: A claim on assets by individuals or companies. In a pension context, liabilities represent the claim on fund assets by active and retired plan beneficiaries.

MSCI All Country World Investable Market Index (ACWI-IMI): A capitalization-weighted index that includes approximately 9,000 publicly-traded equity securities and is designed to measure equity market performance across developed and emerging markets. This index consists of over 40 separate developed and emerging market country indices.

MSCI World Ex-U.S. Index: A subset of the MSCI All Country World Index that contains only securities from developed market countries, excluding those from the U.S.

Market Capitalization: The value of a corporation as determined by multiplying the price of its shares by the number of shares outstanding. In general, the share prices of smaller capitalized companies are more volatile than those of larger capitalized companies.

Mezzanine: Either a private equity financing undertaken shortly before an initial public offering, or an investment strategy that employs subordinated debt (which has fewer privileges than bank debt but more standing than equity) and often is issued with attached equity warrants.

NCREIF Fund Index – Open End Diversified Core Equity (NFI-ODCE): The NFI-ODCE is an investment performance composite published quarterly by the National Council of Real Estate Investment Fiduciaries (NCREIF). This index is a capitalization-weighted index of approximately 30 open-ended, commingled funds pursuing a "core" investment strategy and conform to specific parameters.

Oregon State Treasury: Headed by the State Treasurer, the Oregon State Treasury is responsible for managing the day to day investment operations of the state pension fund (and other funds), issuing all state debt, and serving as the central bank for state agencies. Within the Oregon State Treasury, the Investment Division also manages investment programs for the state's deferred compensation and college savings plans, and serves as staff to the Oregon Investment Council.

Opportunistic: Higher risk but higher expected return real estate investments that are usually illiquid, produce little or no current income and are often focused on distressed and/or highly leveraged properties.

Opportunity Portfolio: Includes non-traditional and/or concentrated investment strategies that may provide enhanced diversification and/or unique sources of return relative to the other asset classes included in the OIC's approved policy mix. The Opportunity Portfolio's objectives are pursued by investing in strategies that fall outside the boundaries of "strategic" or approved policy mix allocations including new or innovative strategies across a wide range of potential investment opportunities and with few limitations or constraints.

Oregon Investment Council: Oregon Revised Statutes ("ORS") 293.706 establishes the OIC, which consists of five voting members, four of whom are appointed by the Governor and subject to Senate confirmation (the Treasurer serves as an ex-officio member, and is therefore not subject to confirmation). The members appointed by the Governor must be qualified by training and experience in the field of investment or finance. In addition, the Director of the Oregon Public Employees Retirement System is a non-voting ex-officio member of the OIC. ORS 293.721 and 293.726 establish the OIC's investment objectives and standards of judgment and care.

Oregon Public Employees Retirement Fund: Holds the assets of beneficiaries of PERS, which is a state-wide, defined benefit retirement plan for units of state government, political subdivisions, community colleges and school districts. PERS is administered under ORS chapters 237, 238, 238A, and applicable provisions of the Internal Revenue Code by the PERB. Participation by state government units, school districts, and community colleges is mandatory. Participation by most political subdivisions is optional, but irrevocable if elected. All system assets accumulated for the payment of benefits may legally be used to pay benefits to any of the plan members or beneficiaries of the system. PERS is responsible for administrating the management of the plan's

liability and participant benefits.

Oregon Short Term Fund (OSTF): The state's commingled cash investment pool managed internally by Treasury staff. The OSTF includes all excess state agency cash, as required by law, as well as cash invested by local governments on a discretionary basis. The OSTF is invested in accordance with investment guidelines recommended by the state's Oregon Short Term Fund Board and approved by the OIC.

Overlay Manager: An investment advisor retained by the OIC to monitor daily cash balances in OPERF and execute trades in the equity and fixed income futures markets to adjust OPERF's overall asset allocation closer to its OIC-approved targets.

Overweight: A stock, sector or capitalization exposure that is higher than the corresponding exposure in a given asset class benchmark, such as the Russell 3000 Index.

Private Equity: Venture Economics ("VE") uses the term to describe the universe of all venture investing, buyout investing and mezzanine investing. Fund-of-funds investing and secondaries are also included in this term's broadest interpretation. VE is not using the term to include angel investors or business angels, real estate investments or other investing scenarios outside of the public market. See also *Alternatives*.

Real Estate Investments: Investments in land, buildings or other real property.

Real Estate Investment Trusts ("REITs"): A real estate portfolio managed by an investment company for the benefit of the trust unit holders. The units of most REITs are publicly-traded.

Regular Account: That portion of OPERF that excludes the Variable Account (defined below). A diversified investment portfolio for which the asset allocation and general investment policies are established and approved by the OIC. Tier One participants are guaranteed a minimum rate of return based on the long-term interest rate used by the actuary. Tier Two participants have no guaranteed rate of return and receive benefits that reflect the Regular Account's actual or realized investment return.

Return: The gain or loss in value of an investment over a given period of time expressed as a percentage of the original amount invested. For example, an initial investment of $100 that grows to $105 over one year has produced a 5% return.

Risk: The probability of losing money or not achieving the expected investment outcome.

Russell 3000 Index: Measures the investment performance of a composite comprised of stocks issued by the approximately 3,000 largest U.S. companies. Based on total market capitalization, this index represents approximately 98% of the investable U.S. equity market.

S&P Risk Parity Index – 12% Target Volatility: An index designed to proxy the performance of a generic risk parity strategy using public equity, fixed income, and commodity exchange-traded futures, levered to target a 12% return volatility. Because there is no widely-accepted approach to risk parity, this index is not representative of the “market” but can still serve as a benchmark.

Secondaries: The purchase and sale of existing limited partnership commitments to other limited partners and/or fund sponsors.

Sector: A particular group of stocks or bonds that usually characterize a given industry or economic activity. For example, "pharmaceuticals" is the name given to stocks issued by companies researching, manufacturing and selling over-the-counter and prescription medicines. "Corporates" is the name given to fixed income instruments issued by private and public companies.

Sector Funds: A pooled investment product that focuses on a particular industry or economic activity. For

example, pooled funds that invest principally in technology stocks would be termed a technology sector fund.

Tracking Error: The amount by which an investor's investment performance differed from a corresponding or assigned benchmark. Usually measured and expressed as the standard deviation of returns relative to a pre-specified benchmark.

Unhedged: A term indicating that the value of one, more or an entire portfolio of assets may be affected by foreign currency fluctuations and that no deliberate attempt has been made to protect against such fluctuations.

Value Added: As used in real estate, may include office, retail, industrial and apartment properties, but may target structured investments in alternative property types such as hotels, student housing, senior housing and specialized retail uses. Portfolios or strategies that are positioned as Value Added are expected to produce returns between Core and Opportunistic portfolios/strategies. For example, a Value Added property may exhibit some "institutional" qualities such as good location and high design and construction quality, but may need significant leasing improvements to stabilized and enhance its value. Value Added investments may also include development opportunities with balanced risk/return profiles.

Value Stock: Stocks that appear to be undervalued for reasons other than low potential earnings growth. Value stocks usually have low price-to-earnings ratios, low price-to-book ratios and a high dividend yield.

Variable Account: An account established for a PERS member who participated in the VAP (defined below).

Variable Annuity Program ("VAP"): a program that allowed active PERS members to allocate a portion of their yearly, employee retirement contributions to a domestic equity portfolio. No such contributions were allowed after December 31, 2003. Active members who participated in the VAP had part of their balance invested in the Regular Account and part invested in the Variable Account. Unless a member explicitly elected to participate in the VAP, all of that member's employee contributions were invested in the Regular Account. This "primary" election allowed members to place 25 percent, 50 percent or 75 percent of their employee contributions in the Variable Account. Variable Account balances increase or decrease depending on the investment performance of the variable fund, and individual participant accounts are credited for any amount (gain or loss) available for distribution. The OIC's asset allocation policy purview only applies to the Regular Account since the OIC cannot control the investment option elections of VAP participants.

Venture Capital: Independently managed, dedicated pools of capital that focus on equity or equity-linked investments in privately held, high growth companies. Outside of the United States, the term venture capital is used as a synonym for all types of alternative or private equity.

Vintage Year: The calendar year in which an investment fund's first closing occurs. For example, the 1995 vintage year for venture capital includes all venture capital funds that held a first closing in 1995.

POLICY STATEMENTS

Introduction

1. Subject to ORS 293.721 and 293.726, the Council believes, based on the assumptions outlined herein, that the investment policies summarized in this document will provide the highest possible *return* at a level of *risk* that is appropriate for active and retired OPERF members. The Council evaluates risk in terms of both short-term asset price volatility and long-term plan viability.
2. This objective further contemplates a consecutive ten-year forecast horizon, and the Council also understands that estimates of forward-looking OPERF returns are a primary consideration during PERB's

biennial determination of its ADR.

3. Historically, PERS members were allowed to direct up to 75% of their annual, employee retirement contributions to the *Variable Account*. While no longer receiving new contributions, the Variable Account's objective remains investment performance consistent with the *MSCI All Country World Investable Market Index*.
4. The Council has established investment objectives for individual asset classes that are also summarized in this Statement.

0.1. Policy Asset Mix, Diversification, and Return Expectations

1. The OIC undertakes a rigorous study of OPERF's assets and liabilities every three to five years (or more frequently, if desired). These asset-liability studies include the following elements for OIC consideration: 1) capital market assumptions by asset class, which include expected returns, volatilities and correlations; 2) proposed asset mixes using various portfolio modeling/construction techniques; 3) OPERF's *liability* structure, *funded status* and liquidity needs; and 4) recommended strategic asset allocation targets and a rebalancing framework. The Council's approved asset mix policy for the Regular Account is summarized in Exhibit 1.
2. Of total Fund assets, 50 percent of OPERF is targeted for investment in *equities*, inclusive of *private equity*. Equity investments have generated the highest returns over long time periods, but can also produce low and even negative returns over shorter time periods. The risk of low returns over shorter time periods makes 100% equity policies unsuitable for most pension funds, including OPERF. By investing across multiple equity asset classes, and in lower return but less risky *fixed income*, *real estate* and *alternatives* asset classes, the Council manages and diversifies the Fund's overall risk.
3. Specific asset class exposures are maintained within the ranges outlined in Exhibit 1.

Exhibit 1: Policy Mix and Return Expectations for the OPERF Regular Account

Asset Class	**Target Allocation (%)**	**Re-balancing Range (0%)**	**Expected Annual Policy Return[1] (%)**
Public Equity	32.5	27.5-37.5	7.3
Private Equity	17.5	14.0-21.0	9.2
Total Equity	50.0	45.0-55.0	
Fixed Income	20.0	15.0-25.0	2.8
Risk Parity	2.5	0.0-2.5	6.3
Real Estate	12.5	9.5-15.5	7.0
Alternatives	15.0	7.5-17.5	7.0
Total Fund[2]	**100.0**		**7.1**

1. Based on capital market forecasts developed by the Council's investment consultant, Callan LLC.

2. Total Fund expected returns are calculated *geometrically* using the investment consultant's forecasts for the *arithmetic* returns and co-variances of the asset classes. Accordingly, the Total Fund's expected returns are not equivalent to the weighted average of individual asset class returns listed in Exhibit 1.

4. The policy mix's 7.1% average annual return expectation was developed with reference to observed long-term relationships among major asset classes, adjusted to account for current market conditions. The Council believes this return expectation is reasonable, but recognizes that *realized* returns can deviate significantly from expectations – both positively and negatively.
5. The OIC has allocated up to 5.0% of total Fund assets for investment in an *Opportunity Portfolio,* the objective of which is to enhance OPERF returns and/or diversification. Investments in the Opportunity Portfolio are expected to comprise a combination of both shorter-term (1-3 year) and longer-term holdings. The Opportunity Portfolio has no strategic target since, by definition, eligible investments are only pursued on an opportunistic or episodic basis; moreover, the Opportunity Portfolio allocation shall not result in an allocation range breach for any of the other five, primary asset class allocations.
6. OPERF cash balances are invested in the *Oregon Short Term Fund* and managed to levels that are deliberately minimized but still sufficient to cover OPERF's short-term cash flow needs.
7. In an effort to minimize cash balances at both the Fund and manager level, the OIC has retained an overlay manager to more closely align the actual Fund portfolio with the approved policy mix, generally through the purchase and sale of futures contracts to increase or decrease specific asset class exposures, as necessary.
8. The Council shall review, at least biennially, its expectations for asset class and active management performance, and assess how the updated expectations affect the probability that the Regular Account will achieve its investment objective.

0.2. Rebalancing

1. In the absence of any other considerations, the optimal rebalancing strategy would suggest continually rebalancing back to OPERF's strategic asset allocation targets. Rebalancing ensures that the return objectives and risk tolerance parameters approved by the OIC are consistently and effectively reflected in the Fund. However, rebalancing involves transactions costs such as brokerage fees and market impact. As a result of these costs, ranges are established around the strategic asset allocation targets in order to balance the desirability of achieving precise target allocations with the various and often material transactions costs associated with these same rebalancing activities. In addition, the overlay manager is expected to minimize cash exposures at both the Fund and individual manager level.
2. With OIC oversight, OST staff implements the approved rebalancing framework, although the illiquid nature of many private market assets may exempt those assets from staff's short-term rebalancing activities. Rebalancing should be implemented by the most cost-effective means available. For example, cash flows into and out of OPERF will first be used to rebalance back toward asset class targets, whenever possible.
3. A breach of any of the established asset allocation ranges triggers a review and possible rebalancing back to established targets with due consideration given to the liquidity of the affected investments, all anticipated transaction costs and the current portfolio structure within each asset class.

0.3. Passive and Active Management

1. Passive management uses lower cost *index funds* to access the return streams available from the world's capital markets. Active management tries to earn higher returns than those available from index funds through the application of manager skill in the form of sector and security selection as well as market and/or asset mix timing decisions.
2. The Council uses passive management to control costs, evaluate active management strategies, capture exposure to *efficient market* segments, manage *tracking error* and facilitate policy mix re-balancing activities.
3. The Council approves active management of Fund assets when proposed active strategies offer sufficiently high expected incremental returns, net of fees, and when the magnitude of potential under-performance can be estimated, monitored and managed.
4. Public equity and fixed income asset classes are managed using both passive and active management strategies. Active management of the Fund's public market equity and fixed income allocations is expected to earn annual return premiums of 0.50% and 0.15%, respectively, over rolling, consecutive five-year periods (and relative to those allocation's respective benchmarks). The Council recognizes that unsuccessful active management can reduce total Fund returns.
5. The Council must accept active management in those asset classes for which there are no passive management alternatives; in particular, private real estate, private equity and other alternative and opportunistic investment strategies.

0.4. Public Equity Strategy

1. OPERF's public equity allocation is managed with the objective of earning at least **50 *basis points*** in annualized net excess return relative to the MSCI All Country World Investable Market Index (ACWI IMI – net) (unhedged) over rolling, consecutive five-year periods. **Relative to that same benchmark, active risk shall be managed to a 0.75 to 2.0 percent annualized tracking error target.**
2. Key elements of the strategy include the following:
    a. In an effort to enhance return, strategy will include maintaining an over-weight to small capitalization stocks and other well supported sources of return premia. These strategic overweights or "tilts" are based on and supported by robust empirical research that historically links persistent and pervasive evidence of excess returns to systematic "factor exposures" such as size (i.e., small cap), value and momentum. Implementation of other factor tilts may be considered at the manager, strategy or mandate level upon approval of both the Chief Investment Officer (CIO) and OIC.
    b. Multiple, specialist active managers with complementary investment styles are employed. For example, some OPERF managers focus on growth stocks, some on value stocks, some on large capitalization stocks and others on small capitalization stocks. This diversified approach produces more excess return opportunities and minimizes the Fund's exposure to any single investment organization.
    c. Aggregate exposures to countries, economic sectors, investment styles and market capitalization tiers are monitored and managed relative to corresponding benchmark exposures.

0.5. Fixed Income Strategy

1. OPERF's fixed income allocation is managed with the objective of earning **15 basis points** in annualized,

net excess returns relative to the *Bloomberg Barclays U.S. Aggregate Index* over rolling, consecutive five-year periods. **Relative to that same benchmark, active risk within the OPERF fixed income allocation is managed to up to 1.0 percent annualized tracking error target.**

2. Key elements of the strategy include the following:
    a. A significant proportion of the OPERF fixed income allocation is actively managed due to performance and cost considerations. Specifically, excess returns from active fixed income management are likely as many investors hold fixed income securities to meet regulatory and liability matching objectives, and hence are not total return oriented. This market dynamic produces systematic opportunities in fixed income securities that skilled investment managers can exploit. Active fixed income management fees are also much lower than active equity management fees.
    b. Aggregate exposures to duration, credit and sectors are monitored and managed relative to corresponding exposures in the fixed income allocation benchmark.

0.6. Risk Parity Strategy

1. OPERF's risk parity allocation will be managed with the objective of earning a net total return comparable to an equal risk weighting of traditional asset class indices such as *Bloomberg Barclays U.S. Treasury Index* and the *MSCI ACWI IMI*, using the *S&P Risk Parity Index - 12% Target Volatility* as the policy benchmark over rolling, consecutive five-year periods.
2. Key elements of the strategy include the following:
    a. Risk Parity is 100% actively managed because there is no widely-accepted definition of a passive implementation of risk parity.
    b. Risk parity strategies provide long-only levered exposures to major publicly-traded asset classes, such as public equity, fixed income (sometimes separating credit from interest rate), and commodities. Since risk parity strategies typically balance asset class exposures by risk versus nominal exposures, they are levered to target some return objective comparable to a generic balanced exposures. Because each asset class in a risk parity portfolio delivers approximately the same level of risk, as opposed to equity providing the vast majority of the risk in a generic balanced portfolio, the expectation is a risk parity portfolio would deliver a higher risk-adjusted return over a full market cycle.

0.7. Real Estate Strategy

1. OPERF's real estate allocation is managed with the objective of earning at least **50 basis points** in annualized, net excess returns relative to the *NCREIF Fund Index* – Open End Diversified Core Equity (NFI-ODCE), net of management fees, over rolling, consecutive five-year periods.
2. Key elements of the strategy include the following:
    a. Real Estate is 100% actively managed because a passive replication of the full breadth and depth of the real estate asset class is not viable.
    b. *Core* property investments represent 55% of the Fund's real estate allocation, with a range of 45% to 65%. Risk is diversified by investing across the following major property types: office; apartments; retail; and industrial. The OPERF real estate allocation may also include structured investments in alternative property types with Core-like risk and return attributes.
    c. Exchange-traded real estate investment trusts (REITs) represent 5% of the Fund's real estate

allocation, with a range of 0% to 10%. Up to 50% of the REIT exposure may be invested in markets outside the United States.

d. *Value Added* property investments represent 20% of the OPERF real estate allocation, with a range of 10% to 30%, and may include direct investments in each of the property types listed above, as well as structured investments in alternative property types. Risk is diversified by property type and geography.

e. *Opportunistic* property investments represent 20% of the OPERF real estate allocation, with a range of 10% to 30%. Relative to Core and Value Added strategies, real estate investments will be characterized as "opportunistic" based on higher risk/return expectations and other prevailing market conditions.

f. Within its real estate allocation, the Fund may participate in *co-investment* opportunities.

0.8. Private Equity Strategy

1. OPERF's private equity allocation is managed with the objective of earning at least **300 basis points** in annualized, net excess returns relative to the Russell 3000 Index over very long time horizons, typically rolling, consecutive 10-year periods.
2. Key elements of the strategy include the following:
   a. Private Equity is 100% actively managed because private equity index funds are not available.
   b. Risk within OPERF's private equity allocation is diversified by investing across different fund types and strategies including *venture capital, leverage buyout, mezzanine debt, distressed debt, sector funds, secondaries* and *fund-of-funds*.
   c. OPERF's private equity allocation is further diversified by investing across *vintage year*, industry sectors, investment size, development stage and geography.
   d. OPERF's private equity investments are managed by external managers operating as general partners. Considerations for private equity manager selection include access to transactions (i.e., "deal flow"), specialized areas of operating expertise, established or promising net of fees performance track records, unique or differentiated investment methodologies and transparent/ verifiable reporting processes.
   e. Within its private equity allocation, the Fund may participate in co-investment opportunities.

0.9. Alternatives Strategy

1. OPERF's allocation to Alternatives is managed with the objective of earning at least **400 basis points** in annualized, net excess returns relative to *CPI* over rolling, consecutive ten-year periods.
2. Key elements of the strategy include the following:
   a. Alternatives are 100% actively managed because index funds replicating the broad alternatives market are not available.
   b. *Infrastructure* investments represent 20% of the Fund's alternatives allocation, with a range of 15% to 25%. Risk is diversified by investment type, size and geography. Specific infrastructure sector exposures will likely include energy, transportation, ports and water in both domestic and international markets and comprising both mid-size and large capitalization enterprises.
   c. *Natural Resource* investments represent 30% of the Fund's alternatives allocation, with a range of

25% to 35%. Risk is diversified by investing across multiple industry sectors including oil and gas, agriculture, timberland, mining and commodities.

d. *Diversifying Strategies* represent 50% of the Fund's alternatives allocation, with a range of 45% to 55%. Diversifying Strategies investments may include relative value, macro, arbitrage and long/short equity strategies. The objective of this sleeve is to invest in strategies with returns uncorrelated with those of the broader Fund. Risk is diversified by investing in multiple managers and across several strategies.

e. *Other* investments may represent 5% of the Fund's alternatives allocation, with a range of 0% to 10%. Investment strategies will be characterized as "other" based on prevailing market conditions as well as a specific strategy's unique "value proposition" or investment thesis.

f. Within its alternatives allocation, the Fund may also participate in *co-investment* opportunities.

0.10. Performance Monitoring and Evaluation

1. The Council and OST staff use a variety of verification and performance measurement tools to monitor, measure and evaluate the management of OPERF assets. Monitoring, reporting and evaluation frequencies range from daily to annually, although quarterly is the most commonly used reporting frequency.
2. The Council directs staff to develop a performance monitoring and evaluation system that validates whether the assets are prudently managed. More specifically, whether Fund investment performance improved benefit security, and capital market risk in general and active management in particular have been sufficiently rewarded.
3. One of many reports used by the Council to satisfy the above requirements is a simple comparison of Regular Account investment performance relative to the Council's assigned total Fund benchmark over rolling, consecutive multi-year periods. Other reports help the Council assess whether or not the Fund was rewarded for its allocations to higher return, higher risk equity investments and whether or not the active management strategies utilized added or subtracted from policy returns on a net of fees basis.
4. The reporting described in this section gives the Council a consolidated or "big picture" view of Regular Account investment performance. Regular Account investment performance across primary asset allocation categories will also be reported to the OIC. Upon request and if available, staff will also provide the Council more granular performance reporting, e.g., at the individual manager level.
5. The OST Compliance program will a) monitor and evaluate portfolios and asset classes and determine compliance with OST policies and contractual obligations; b) identify instances of non-compliance and develop and execute appropriate resolution strategies; c) provide relevant compliance information and reports to OST management and the Fund, as appropriate; and d) when applicable, verify resolution by the appropriate individual or manager within the appropriate time frame.

Exceptions

None.

Failure to Comply

Failure to comply with this policy may be cause for disciplinary action up to and including dismissal.

PROCEDURES and FORMS

None.

ADMINISTRATION

Review

Annually.

Feedback

Your comments are extremely important to improving the effectiveness of this policy. If you would like to comment on the provisions of this policy, you may do so by e-mailing the Policy Analyst. To ensure your comments are received without delay, *please list the policy number and name in your e-mail's subject*. Your comments will be reviewed during the policy revisions process and may result in changes to the policy.

Attachments

No Attachments

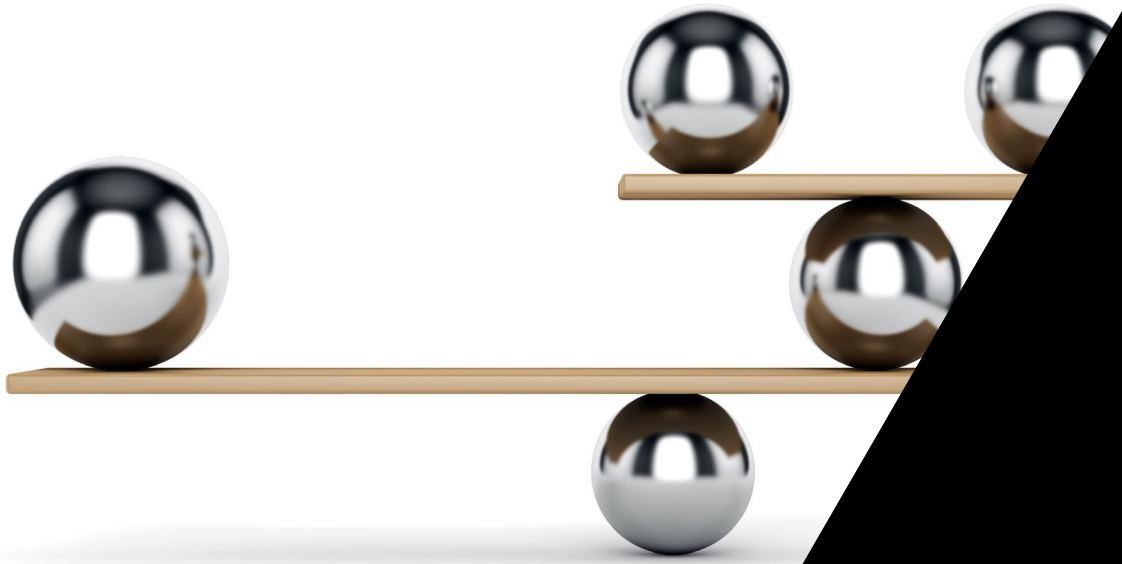
Approval Signatures

Step Description	Approver	Date
Oregon Investment Council	Rex Kim: Chief Investment Officer	07/2020
	Deena Bothello: General Counsel	07/2020
PolicyStat Admin	Carmen Leiva: Operations Analyst	07/2020
	Rex Kim: Chief Investment Officer	06/2020

Total Fund Overlay

Russell Investments

State of Oregon
2020 Year in Review



Doug Miller – Director,
Relationship Management

Greg Nordquist, CFA
Director, Overlay Strategies

April 21, 2021

Discussion topics

> Overlay Introduction

> Review of 2020

> Appendix

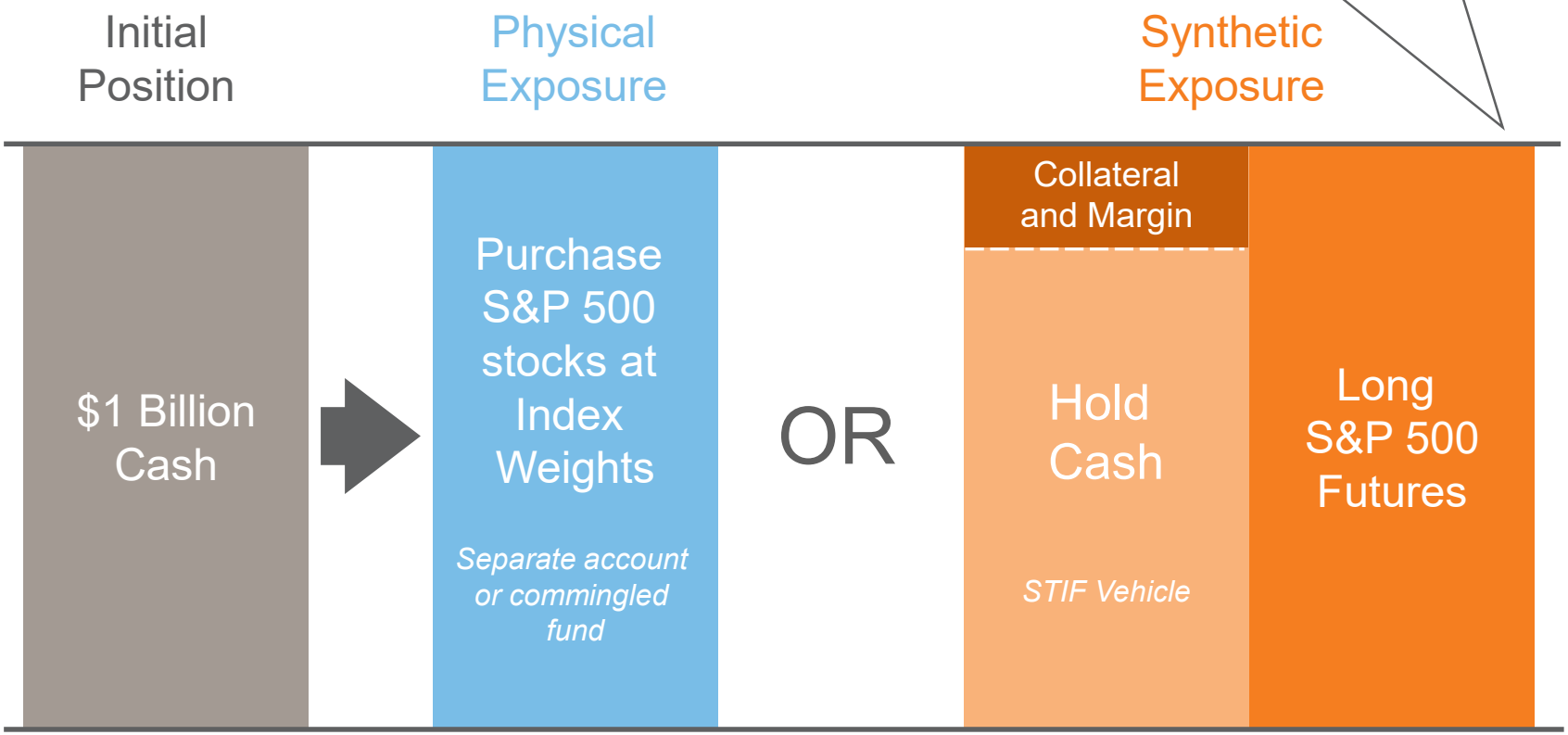
Overlay Introduction

Russell Investments

Example

Physicals vs Futures – Day 1

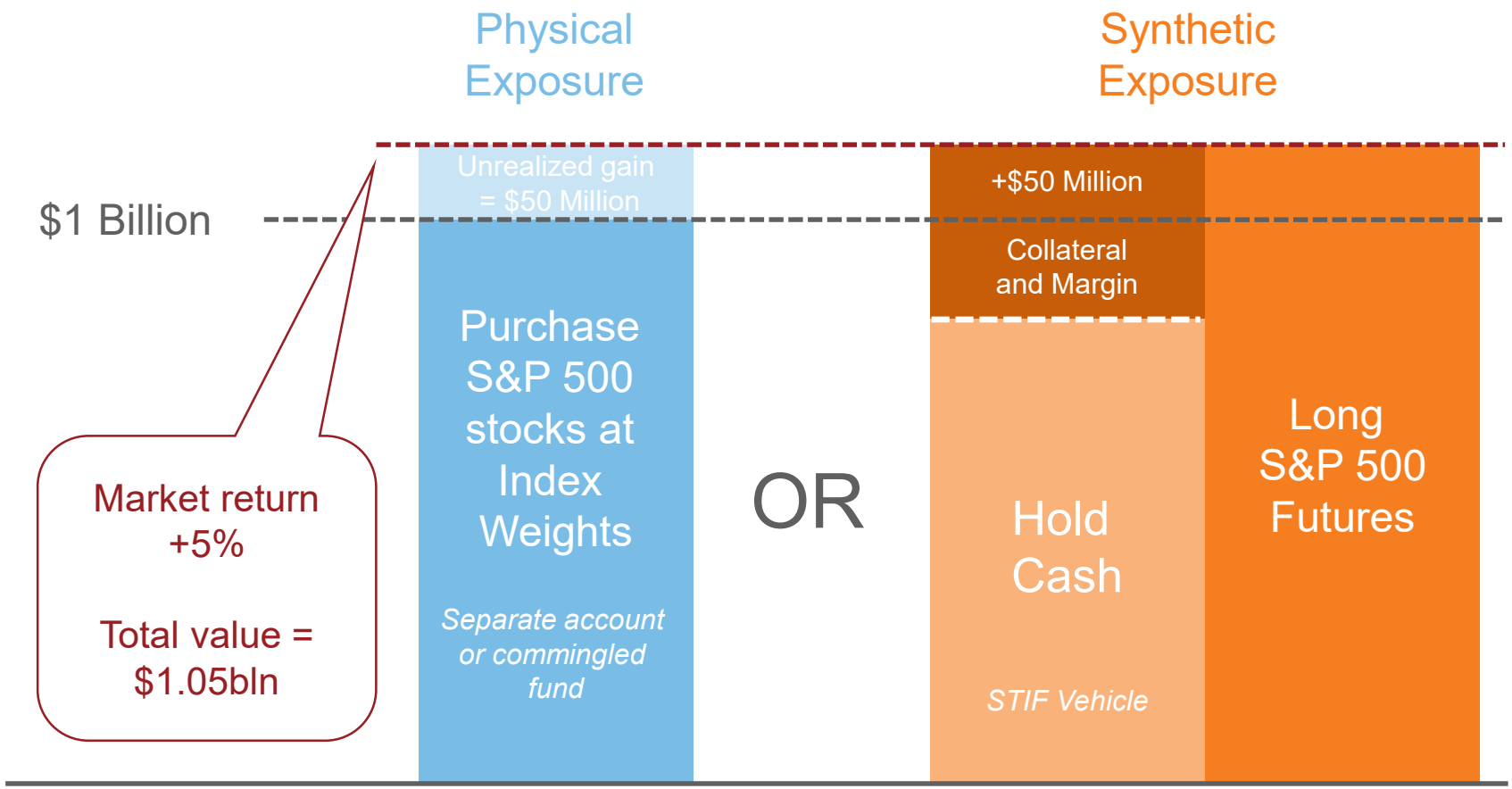
Note: Futures = Liquid Exposure (NOT Leverage)



For illustrative purposes only.
Indexes are unmanaged and cannot be invested in directly.

Example

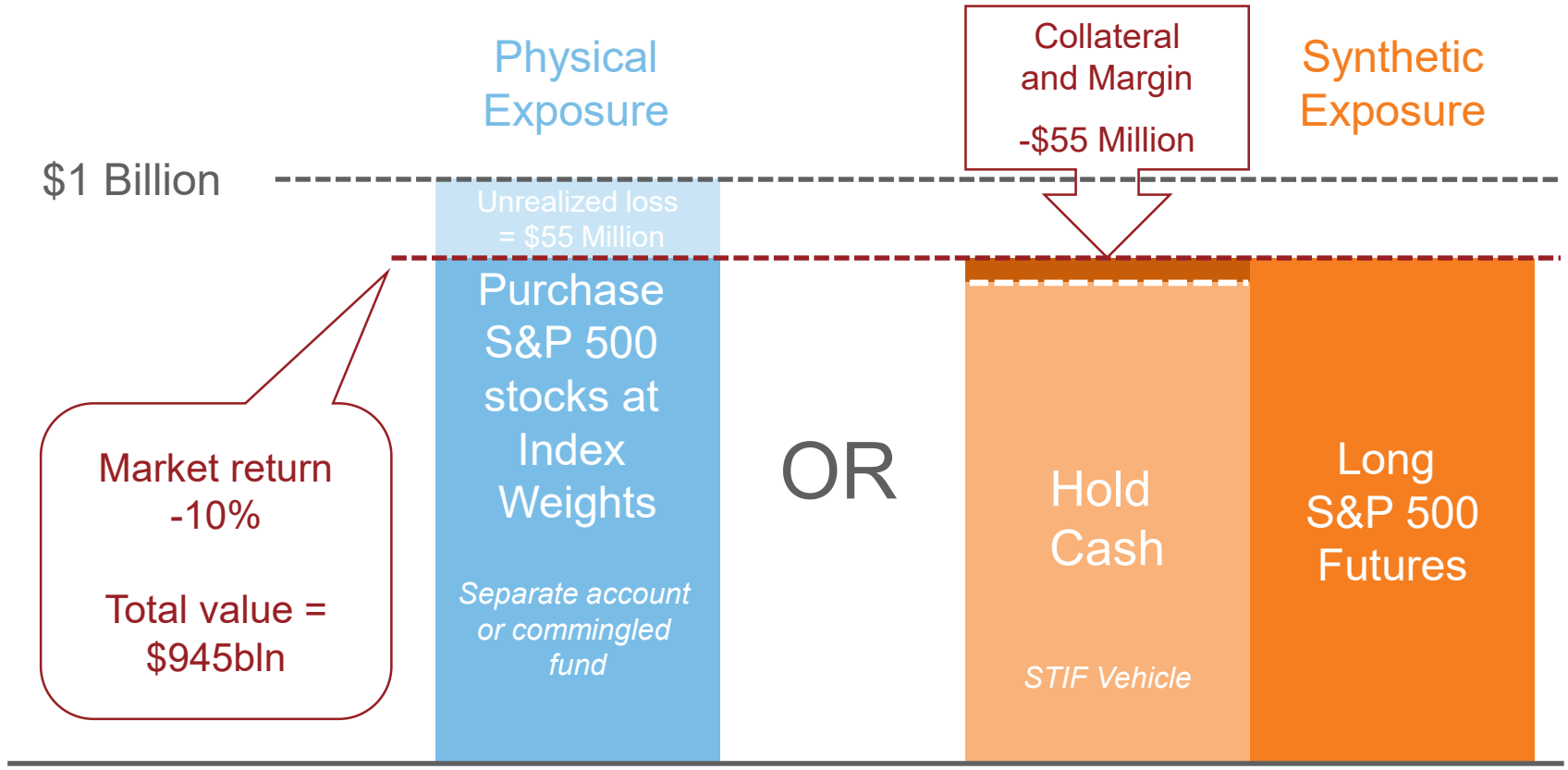
Physicals vs Futures – Day 2



For illustrative purposes only.
Indexes are unmanaged and cannot be invested in directly.

Example

Physicals vs Futures – Day 3



For illustrative purposes only.
Indexes are unmanaged and cannot be invested in directly.

Why use an Overlay?

RISK REDUCTION

Unintended exposures add risk, disciplined rebalancing can reduce this risk by approximately 70%[1]

COST REDUCTION

Costs to trade futures is approximately 25%[2] of the cost to trade physical securities

RETURN ENHANCEMENT

Cash reduces long-term performance; Overlays allow for market risk premium or beta to be matched with derivatives

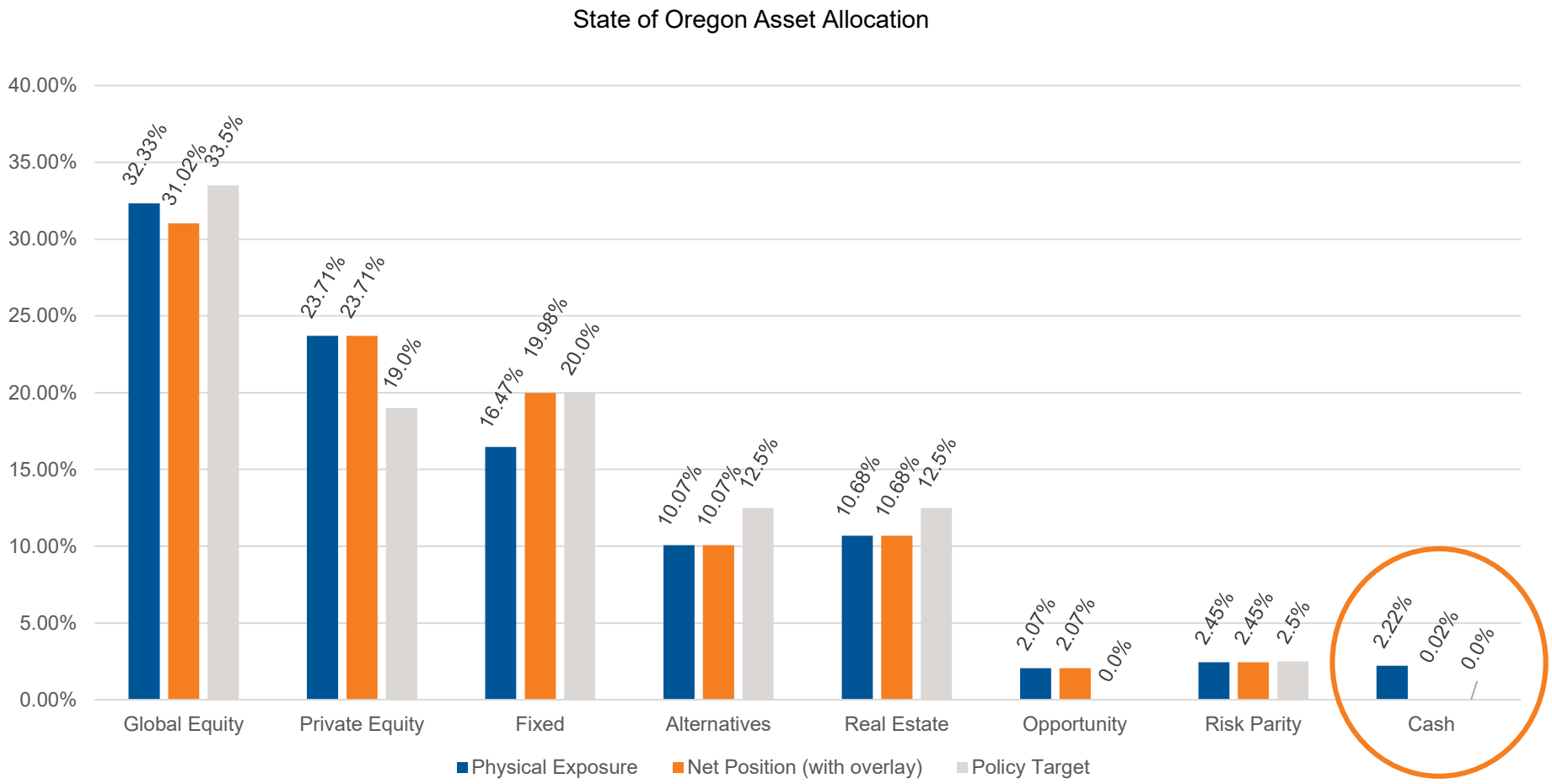
SIMPLIFICATION

Overlays make running multi-manager portfolios easier and more efficient

1. Source: Russell Investments; Average annual tracking error calculated over Russell Investments' US Overlay client universe from 1 Jan 2010 – 31 December 2020 is 73.3%
2. Source: Russell Investments as at September 2020; S&P 500 physical trade cost is 5 bps; Costs of futures trading is 0.6 bps. MSCI World trading cost comparison of 10bps vs 2ps

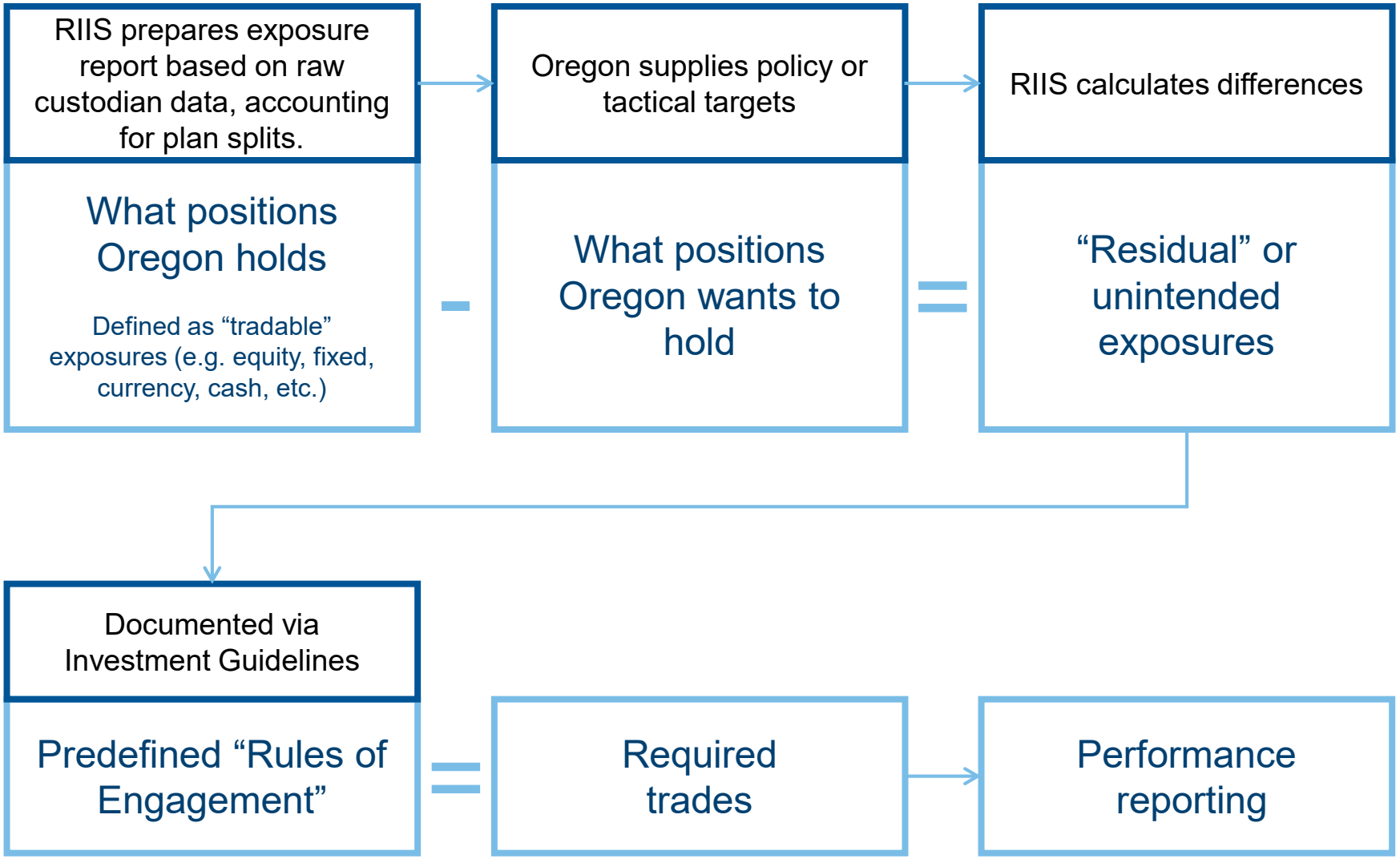
Reduce cash drag

No strategic allocation to cash



As of December 31, 2020. Past performance is not a guarantee of future results.

Investment process

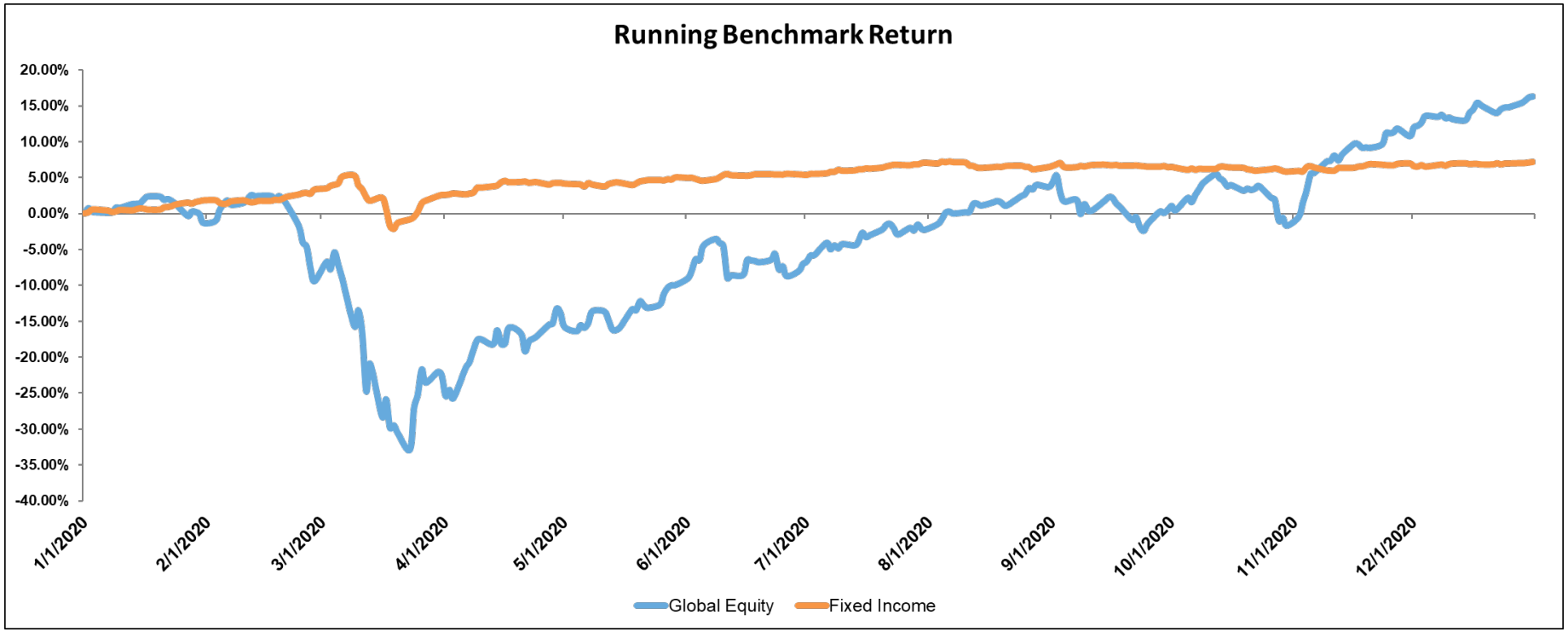


For illustrative purposes only.

Review of 2020

Russell Investments

2020 Benchmark Returns



Past performance is not a guarantee of future results.

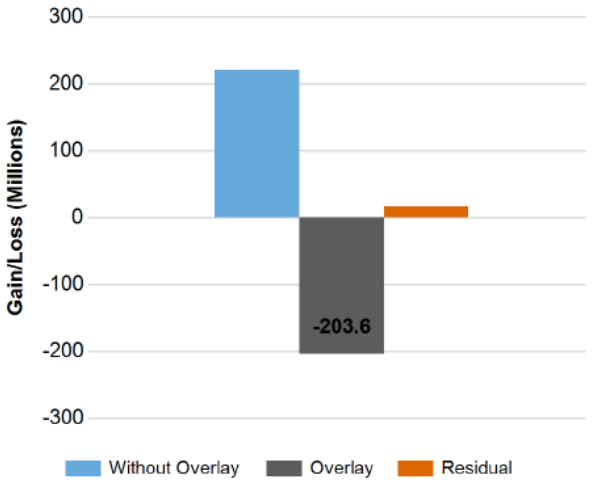
Overlay Highlights

Oregon - Oregon

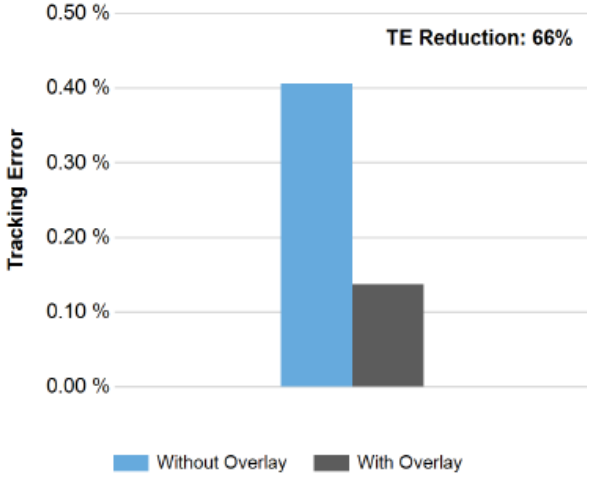
01-Jan-2020 to 31-Dec-2020

Russell Investments

Performance Impact vs. Target

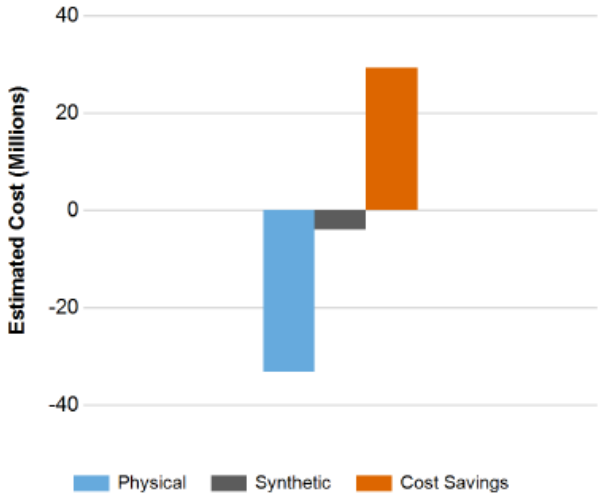


Tracking Error Impact

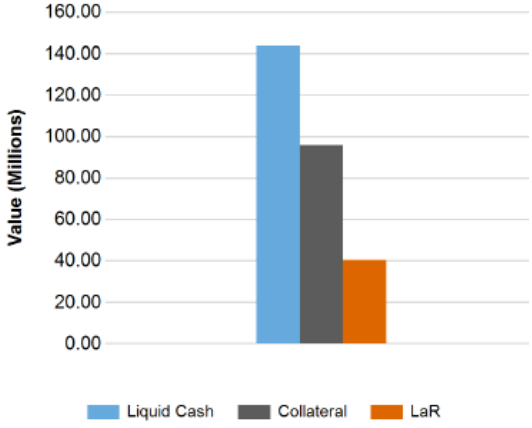


Performance vs. Perfect Implementation

Transaction Cost Savings

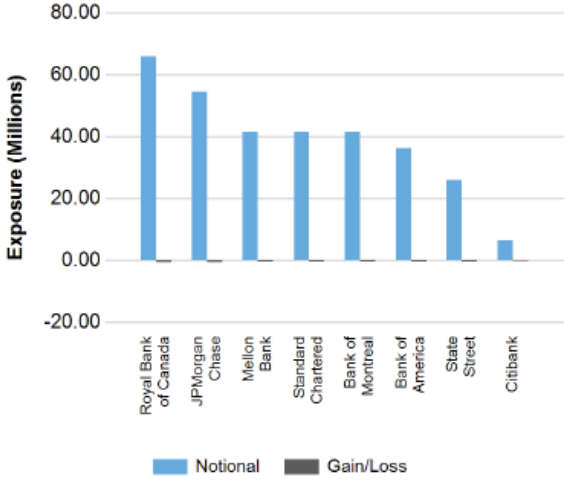


Liquidity at Risk (LaR)*



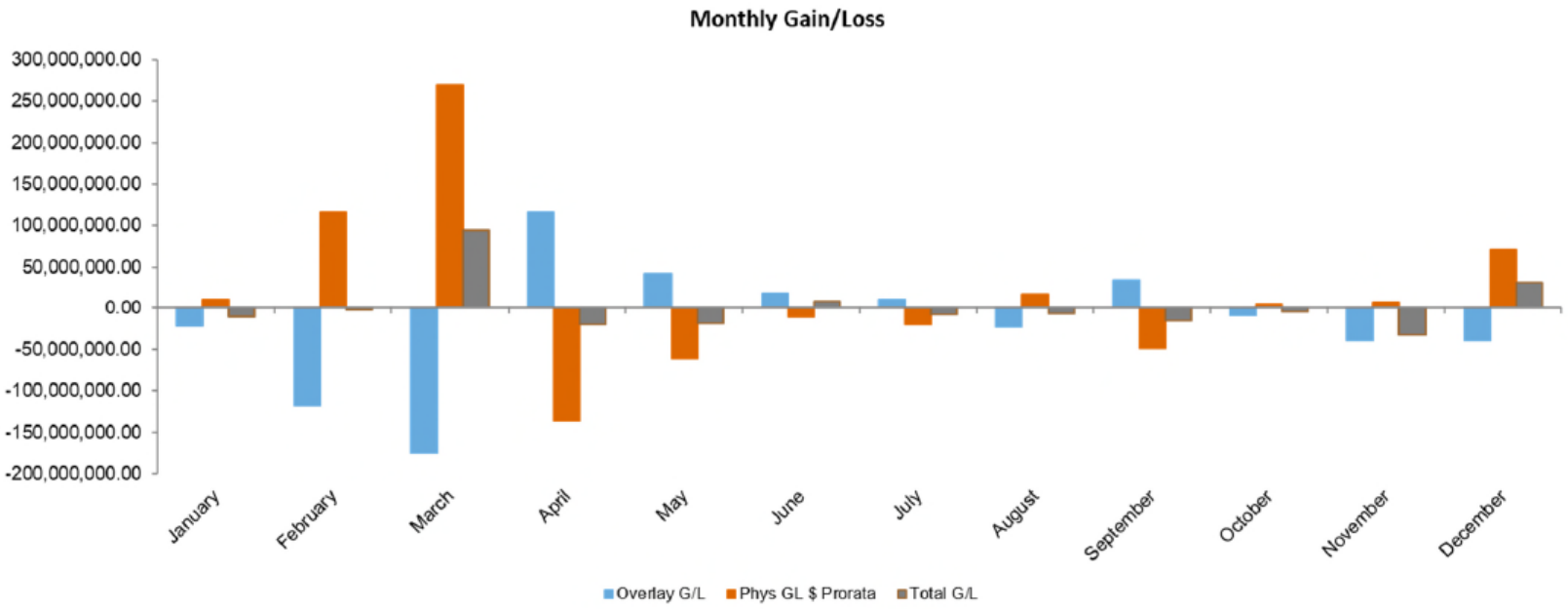
*Assumes 3 day returns over 5 years at 95% probability

Counterparty Exposure



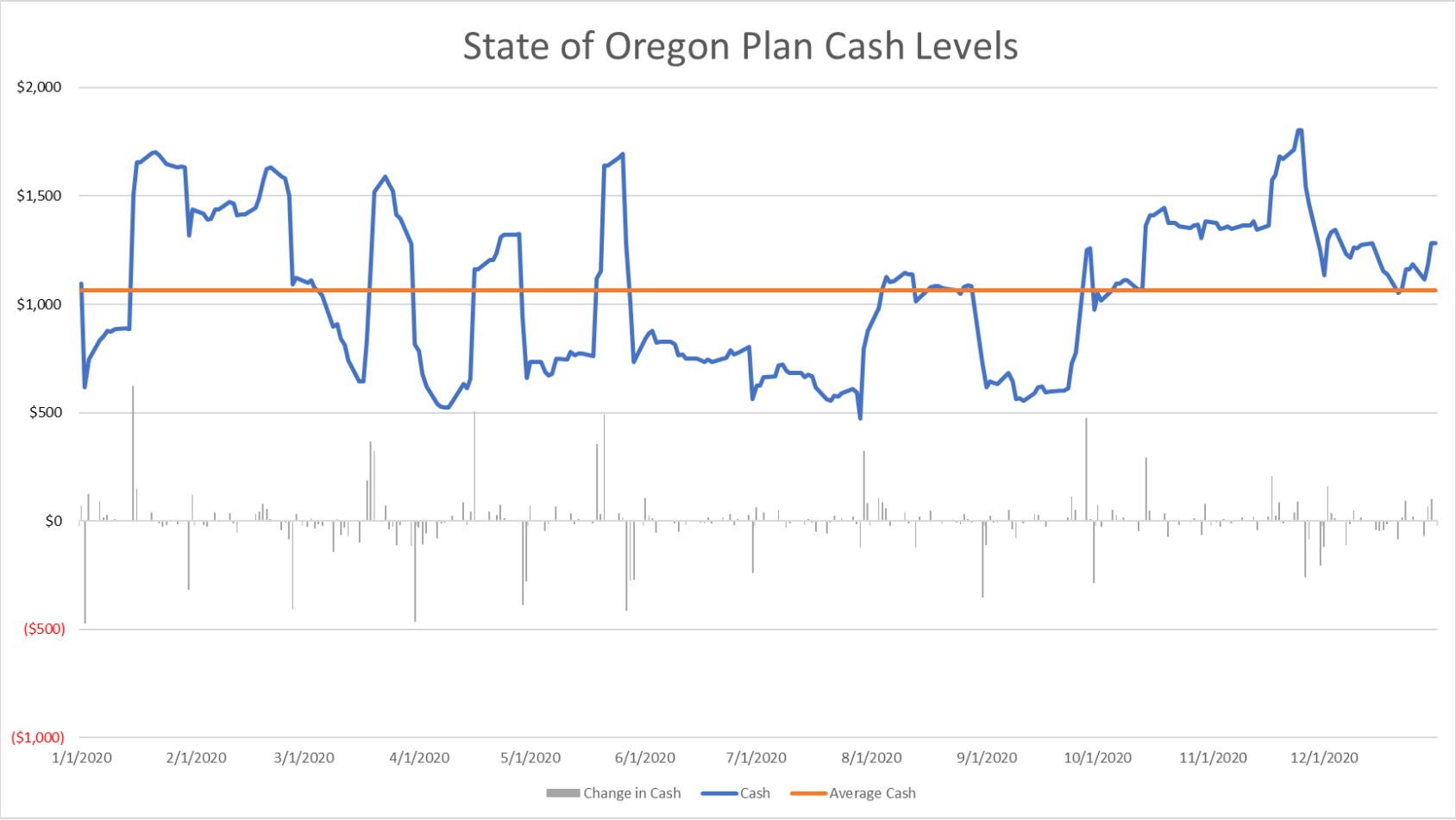
Risk Reduction

Goal of Overlay is to offset unintended deviations in physical assets



Reduce cash drag

The plan had ~ $16.5 Billion in aggregate cash flows over the course of the year (2020)

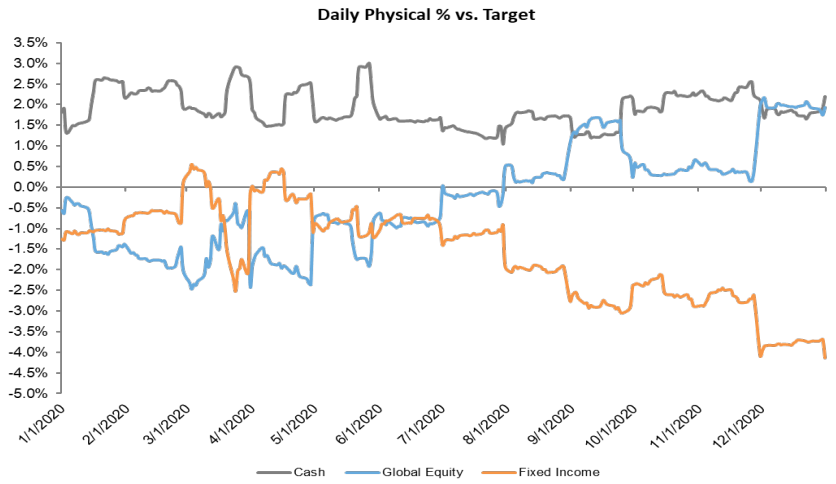


Past performance is not a guarantee of future results.

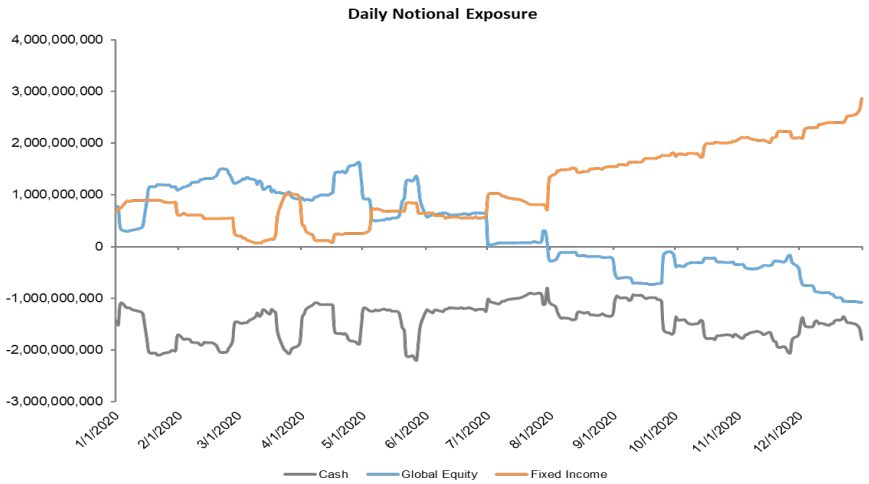
Reduce risk

Deviations from policy exposures

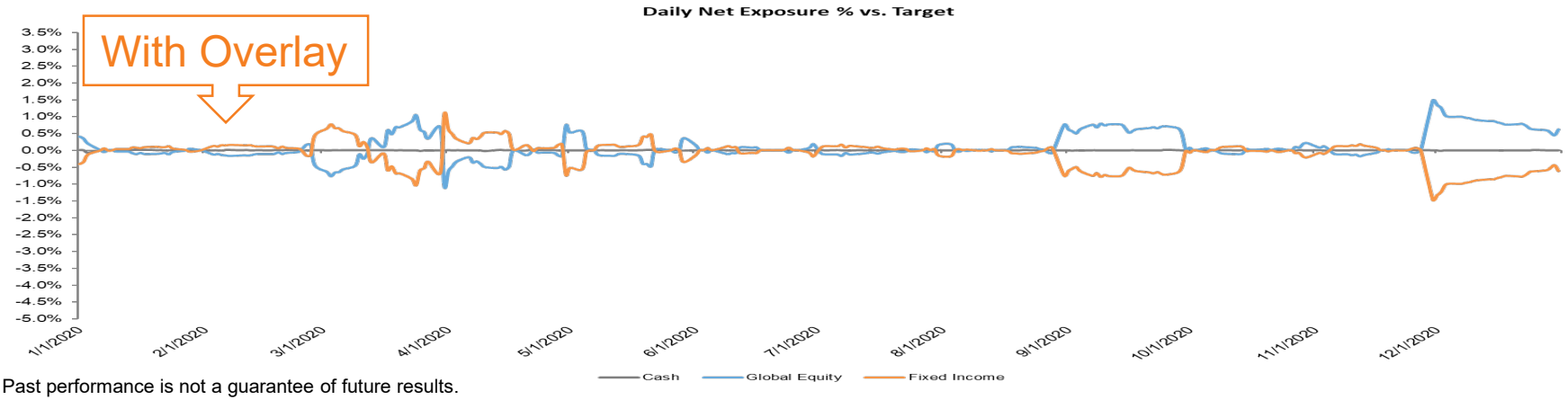
Without Overlay



Notional



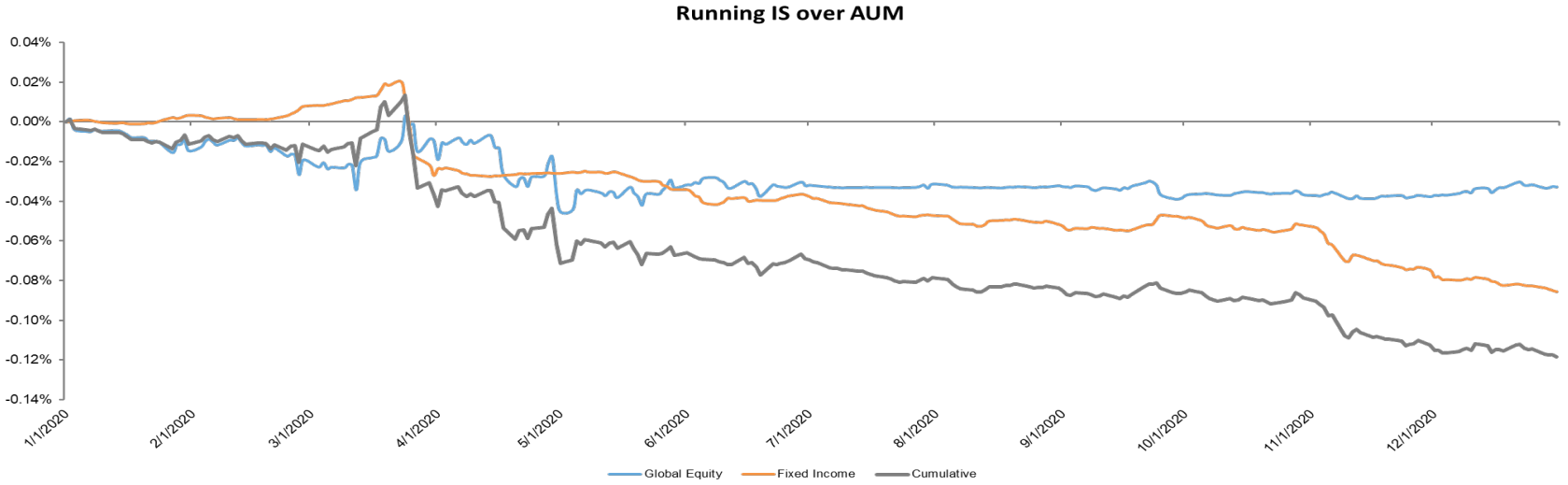
With Overlay

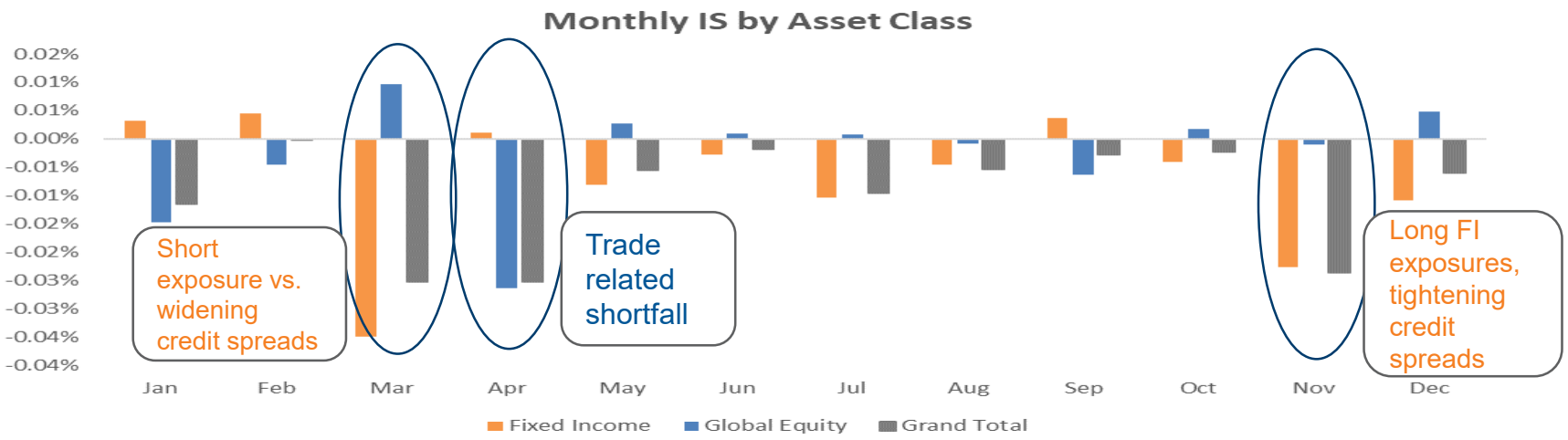


Past performance is not a guarantee of future results.

Performance vs. Perfect Implementation

Running Implementation Shortfall (IS)

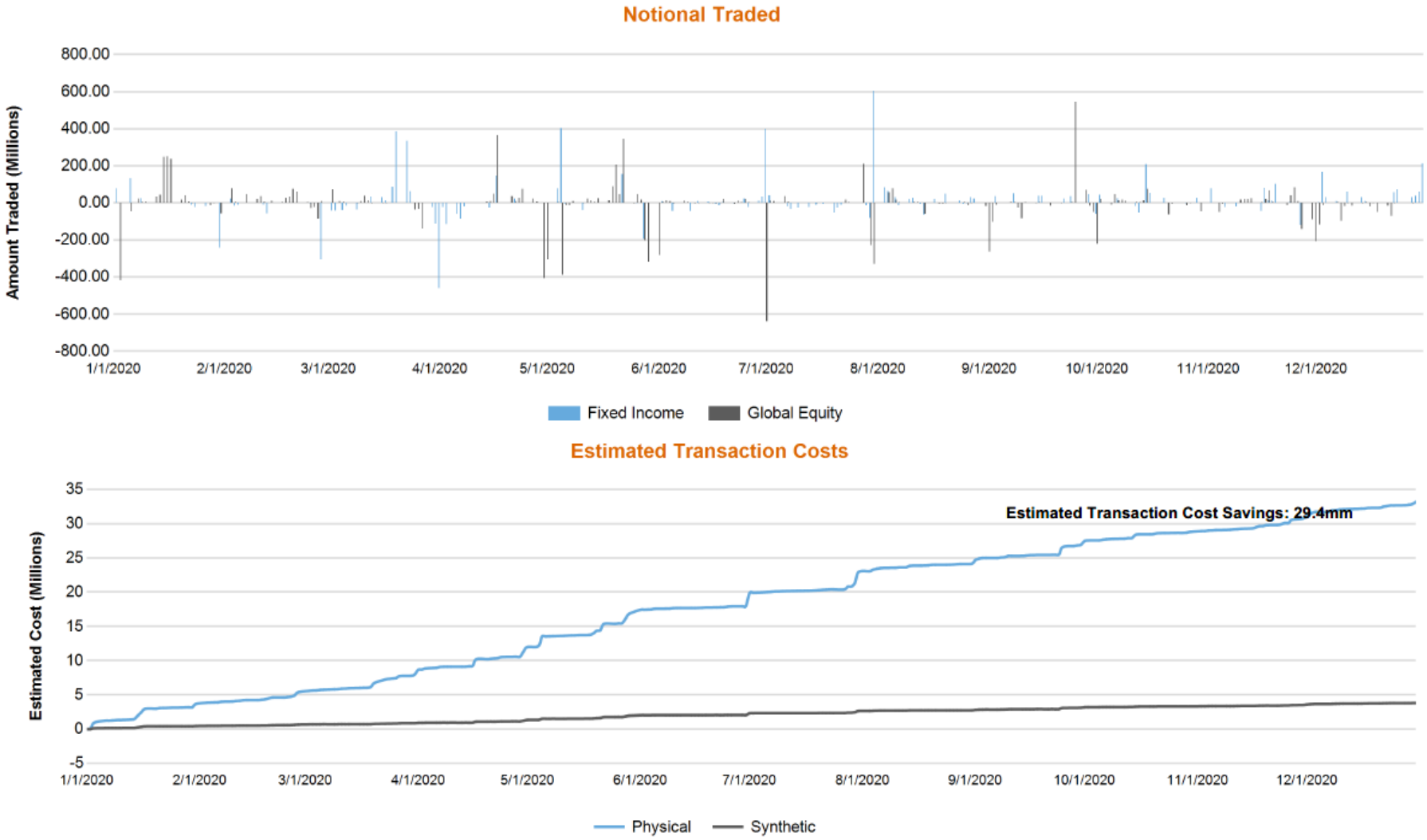




Past performance is not a guarantee of future results.

Reduce transaction cost

Daily traded flows & estimated transaction costs (2020)



Past performance is not a guarantee of future results.

Daily Asset Summary report

Oregon - Oregon

Asset Summary

Balance Date: 2/23/2021

Russell Investments

Asset Class	Physical Exposure		Synthetic Exposure		Net Position		Overlay Target		Policy Target	
Total Market Value	**83,561.9**	**100.0 %**	**0.0**	**0.0 %**	**83,561.9**	**100.0 %**	**83,561.9**	**100.0 %**	**83,561.9**	**100.00 %**
Cash	**1,654.8**	**2.0 %**	**-1,646.4**	**-2.0 %**	**8.4**	**0.0 %**	**8.3**	**0.0 %**	**0.0**	**0.00 %**
Cash	1,654.8	2.0 %	-1,646.4	-2.0 %	8.4	0.0 %	8.3	0.0 %	0.0	0.00 %
Equity	**47,489.9**	**56.8 %**	**-1,169.9**	**-1.4 %**	**46,320.0**	**55.4 %**	**46,237.7**	**55.3 %**	**43,869.9**	**52.50 %**
Global Equity	28,086.1	33.6 %	-1,169.9	-1.4 %	26,916.2	32.2 %	26,833.8	32.1 %	27,993.2	33.50 %
Private Equity	19,403.9	23.2 %	0.0	0.0 %	19,403.9	23.2 %	19,403.9	23.2 %	15,876.8	19.00 %
Fixed	**13,789.9**	**16.5 %**	**2,816.3**	**3.4 %**	**16,606.2**	**19.9 %**	**16,688.7**	**20.0 %**	**16,712.4**	**20.00 %**
Fixed Income	13,789.9	16.5 %	2,816.3	3.4 %	16,606.2	19.9 %	16,688.7	20.0 %	16,712.4	20.00 %
Other	**20,627.3**	**24.7 %**	**0.0**	**0.0 %**	**20,627.3**	**24.7 %**	**20,627.3**	**24.7 %**	**22,979.6**	**27.50 %**
Alternatives	8,054.8	9.6 %	0.0	0.0 %	8,054.8	9.6 %	8,054.8	9.6 %	10,445.2	12.50 %
Opportunity	1,803.1	2.2 %	0.0	0.0 %	1,803.1	2.2 %	1,803.1	2.2 %	0.1	0.00 %
Real Estate	8,734.9	10.5 %	0.0	0.0 %	8,734.9	10.5 %	8,734.9	10.5 %	10,445.2	12.50 %
Risk Parity	2,034.6	2.4 %	0.0	0.0 %	2,034.6	2.4 %	2,034.6	2.4 %	2,089.0	2.50 %

Includes daily download of all manager NAV and Cash balances from the custodian

Suite of data validations reviewed daily. Adjustments for stale managers, mis-booked cash flows, real-time activity provided by staff, transition activity, etc.

Overlay program holds highly liquid financial futures contracts to complete the portfolio

Net position keeps the portfolio very close to target allocations

Data is historical and is not an indication of future performance.

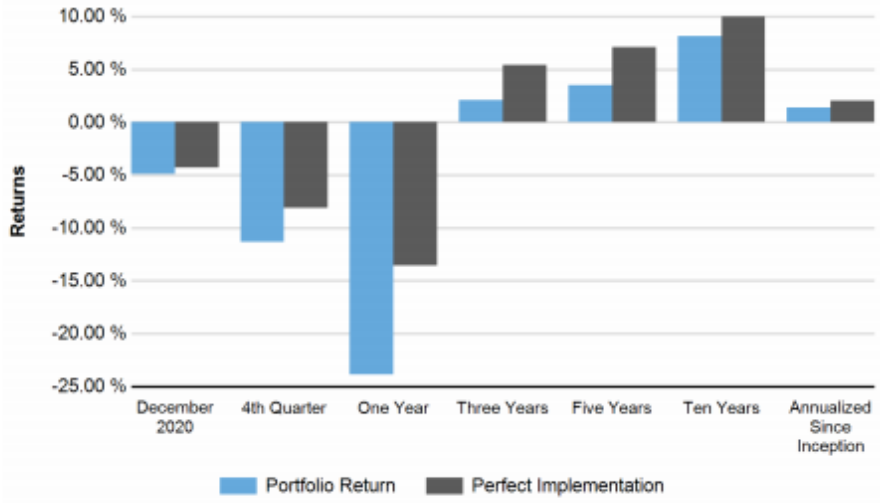
Client Performance

Oregon - Oregon

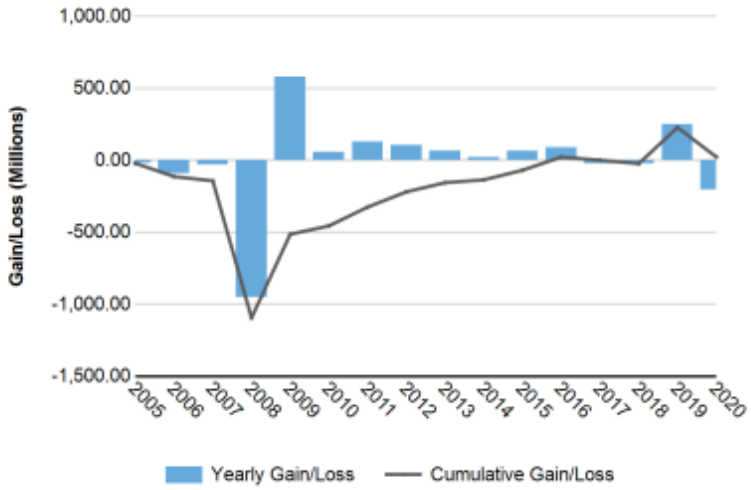
As of 31-Dec-2020

Time Period	Gain/Loss	Portfolio Return*	Perfect Implementation*
December 2020	-39,696,521.43	-0.05 %	-0.04 %
4th Quarter	-88,948,564.25	-0.11 %	-0.08 %
One Year	-203,638,433.70	-0.24 %	-0.14 %
Three Years	23,636,811.97	0.02 %	0.05 %
Five Years	93,008,214.96	0.04 %	0.07 %
Ten Years	479,458,808.35	0.08 %	0.10 %
Annualized Since Inception	1,610,811.87	0.01 %	0.02 %
Cumulative Since Inception	24,532,885.47	0.21 %	0.31 %

Portfolio Return vs Perfect Implementation



Yearly Gain/Loss vs Cumulative



Inception Date: 11-Oct-2005

*Annualized if greater than one year.

Perfect Implementation assumes all trades at the prior day close, no transaction costs, and returns equal to physical benchmark(s). In addition, 3-month LIBOR (daily calculated) is subtracted from the total return benchmark in the calculation of the perfect implementation benchmark.

Appendix

Russell Investments

Biography

Douglas Miller

Director, Relationship Management
Russell Investments

Doug Miller is director of relationship management for Russell Investments' Americas Institutional business. He represents Russell Investments best thinking across consulting, implementation services and our global investment division. His understanding of the global capital markets and objective oriented investment solutions helps Russell Investments build strategic partnerships with clients, delivering unique investment solutions. He is responsible for managing relationships with the largest corporate and public retirement plans and other large pools of capital in the Western United States.

In Doug's previous role with Russell Investments, he was responsible for establishing new investment management relationships throughout the Mid-West /South-West United States. Working as a strategic partner with client and retirement advisory committees and chief financial officers, Doug helped them understand the scope of the firm's investment solutions and comprehensive OCIO relationships.

Doug also worked within Russell Investments' Index division, where he worked with Russell Investments' investment management clients in the Northeast to establish licensing relationships when Russell Investments owned the index business.

Doug also worked with Parametric Portfolio Associates and Silver Creek Capital in business development roles.

Before joining Russell Investments, Doug was a regional director of U.S. sales for Bank of New York Mellon Corporation. He worked as a strategic partner to plan sponsors, leveraging peer group universe data, and risk and analytics tools to monitor investment managers and overall fund performance.

Prior to entering the investment management industry, Doug held sales, sales management and senior management roles with various firms in the technology industry.

B.A., University of Washington
Licensed Registered Representative, FINRA Series 7 and 63 (Russell Investments Implementation Services, LLC, member FINRA)

Biography

Gregory S. Nordquist, CFA

Director, Overlay Strategies

Russell Investments Implementation Services, LLC

Greg Nordquist is a director, overlay strategies on the overlay services team for Russell Investments. This team manages custom overlays for large institutional investors. Assignments include equitization, policy implementation, portable alpha, and liability based solutions as well as client-directed hedges. Through these assignments, Russell Investments strives to improve the implementation of existing investment strategies by reducing slippage inherent in most portfolios and provide an efficient platform for implementing newer strategies such as portable alpha and interest rate hedging. From 1996 to 2006 Greg was with Russell Investments' U.S. consulting group, the final eight years as a consultant. In that role Greg provided advice to large institutional fund clients on all aspects of their investment programs including governance, asset allocation, investment structure, manager selection and performance monitoring. Greg was also involved in researching global tactical asset allocation strategies, a team leader on U.S. and international equity strategy and served on Russell's index content committee.

Greg joined Russell Investments' trust operations in 1990 as a technical assistant. In 1993 Greg moved to the firms investment management group as a portfolio specialist, where his responsibilities included executing trades for money market funds, short-term investment funds and various custom assignment fixed income funds.

Greg served as a member of FTSE America's Regional Index Committee from 2002 to 2006.

Greg is a director, overlay strategies for overlay services of Russell Investments Implementation Services, LLC, Russell Investments' global trading firm. Russell Investments Implementation Services, LLC is an SEC registered investment adviser and FINRA member firm.

BB.A., Finance and Accounting, University of Puget Sound

CFA Charterholder, CFA Institute, 1997

Thank you

Any questions?

TAB 5 – OPERF Public Equity Currency Hedge Program

April 21, 2021

Oregon Investment Council

OPERF Currency Overlay Program Review

Jiangning (Jen) Plett
Karl Cheng
Portfolio Risk and Research

OREGON
STATE
TREASURY

Agenda

		OIC Investment and Management Beliefs Mapping																	
Section	Pages	1A	1B	1C	1D	2A	2B	3A	4A	4B	5A	5B	6A	6B	7A	7B	8A	8B	9A	9B
Agenda	2																			
Executive Summary	3			■	■		■													
Timeline	4			■	■		■													
Rationales	5 - 7			■	■		■													
Goal	8			■	■		■													
Program Profile	9			■	■		■													
Performance	10			■	■		■													
Since Inception Results	11-12			■	■		■													
Appendix	13-15			■	■		■													

	LEGEND: OIC INVESTMENT AND MANAGEMENT BELIEFS
1	**THE OIC SETS POLICY AND IS ULTIMATELY RESPONSIBLE FOR THE INVESTMENT PROGRAM**
A.	Investment management is dichotomous -- part art and part science.
B.	The OIC is a policy-setting council that largely delegates investment management activities to the OST and qualified external fiduciaries.
■ C.	The OIC is vested with the authority to set and monitor portfolio risk. Both short-term and long-term risks are critical.
■ D.	To exploit market inefficiencies, the OIC should be long term, contrarian, innovative, and opportunistic in its investment approach.
2	**ASSET ALLOCATION DRIVES RISK AND RETURN**
A.	Asset allocation is the OIC's primary policy tool for managing the investment program's long-term risk/return profile.
■ B.	Portfolio construction, including diversification and correlation considerations, is essential to maximizing risk-adjusted returns.
3	**THE EQUITY RISK PREMIUM WILL BE REWARDED**
A.	Over the long-term, equity-oriented investments provide reliable return premiums relative to risk-free investments.
4	**PRIVATE MARKET INVESTMENTS CAN ADD SIGNIFICANT VALUE AND REPRESENT A CORE OIC/OST COMPETENCY**
A.	The OIC can capitalize on its status as a true, long-term investor by making meaningful allocations to illiquid, private market investments.
B.	Dispersion in private market investment returns is wide; accordingly, top-quartile manager selection, diversification across vintage year, strategy type, and geography, and careful attention to costs are paramount.
5	**CAPITAL MARKETS HAVE INEFFICIENCIES THAT CAN BE EXPLOITED**
A.	Inefficiencies that can be exploited by active management may exist in certain segments of the capital markets.
B.	Passive investment management in public markets will outperform the median active manager in those markets over time.
6	**COSTS DIRECTLY IMPACT INVESTMENT RETURNS AND SHOULD BE MONITORED AND MANAGED CAREFULLY**
A.	All fees, expenses, commissions, and transaction costs should be diligently monitored and managed in order to maximize net investment returns.
B.	External incentive structures should be carefully evaluated to ensure proper alignment with investment program objectives.
7	**FAIR AND EFFICIENT CAPITAL MARKETS ARE ESSENTIAL FOR THE LONG-TERM INVESTMENT SUCCESS**
A.	The OIC recognizes that the quality of regulation and corporate governance can affect the long-term value of its investments.
B.	The OIC also recognizes that voting rights have economic value.
8	**THE INTEGRATION OF ENVIRONMENTAL, SOCIAL AND GOVERNANCE (ESG) FACTORS, SIMILAR TO OTHER INVESTMENT FACTORS, MAY HAVE A BENEFICIAL IMPACT ON THE ECONOMIC OUTCOME OF AN INVESTMENT AND AID IN THE ASSESSMENT OF RISKS ASSOCIATED WITH THAT INVESTMENT**
A.	The consideration of ESG factors within the investment decision-making framework is importantin understanding the near-term and long-term impacts of investment decisions.
B.	Over time, there has been an evolution of multi-factor, or more holistic approaches, to identify opportunities and remediate risks, in a large globally-diversified investment portfolio.
9	**DIVERSITY, IN ALL ASPECTS, IS ACCRETIVE TO MEETING OIC OBJECTIVES**
A.	By embracing and enhancing diversity and inclusion efforts, the OIC ensures that the investment program will be exposed to and informed by a wide range of perspectives, ideas and opinions.

Executive Summary

- Empirical research shows that unmanaged currency exposure is a source of uncompensated risk in the long run.
- Since its launch in January 2018, OPERF Currency Overlay Program (the "Program") achieved the goal of reducing currency-related portfolio volatility.
- Since the start of the global pandemic, we have seen elevated volatility in the currency markets. The Program protected the Public Equity Portfolio against its downside risk to the embedded foreign currency exposure at the height of the pandemic in March and April 2020.
- The Program has three external currency overlay managers with a total size of $6 billion notional exposure.
- The Program comprises about 60% of the OPERF Public Equity Portfolio's non-U.S. currency exposure.

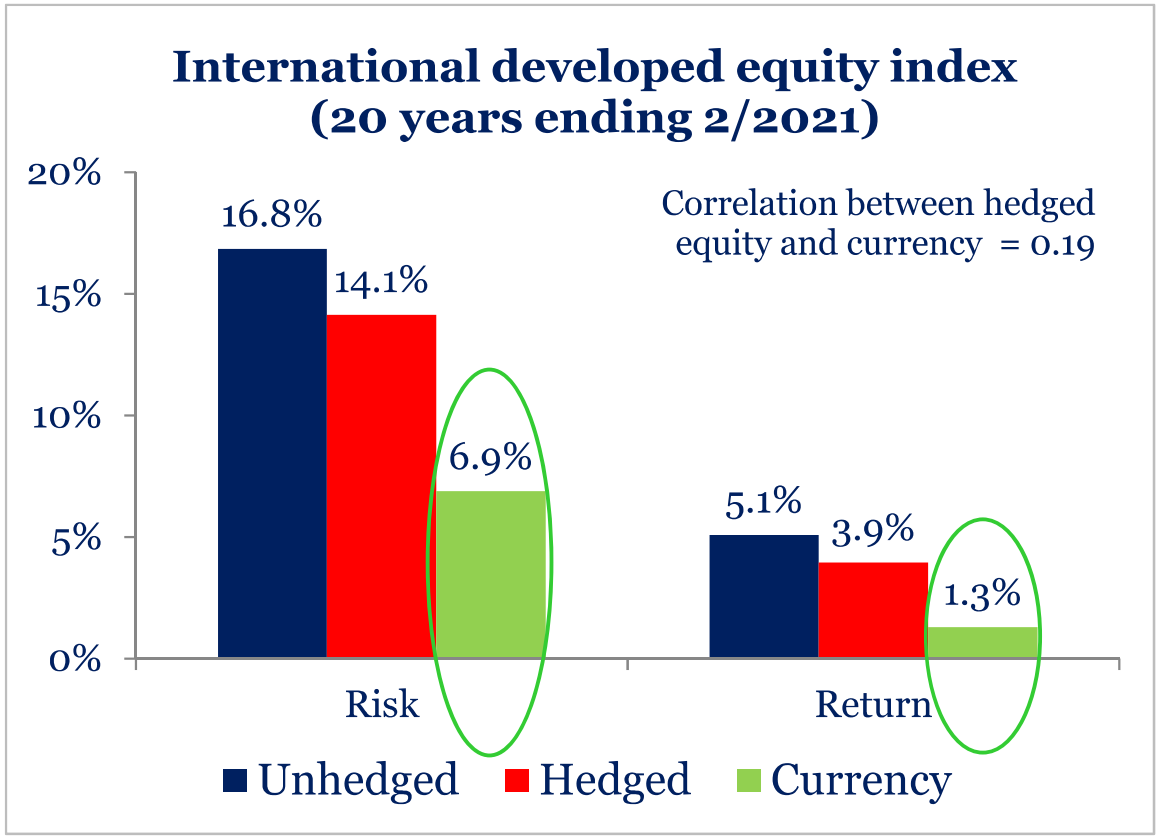
Timeline

12/7/2016	Staff introduced currency management to OIC.
3/15/2017	Staff provided an update on different approaches to currency management.
8/9/2017	OIC adopted the OPERF Foreign Currency Risk Policy ("Policy").
11/1/2017	OIC hired its 1st currency overlay manager, Adrian Lee & Partners ("ALP").
1/2/2018	The Program was launched with $2 billion notional managed by ALP.
10/30/2019	OIC approved expanding the Program up to $6 billion by hiring two new currency overlay managers, P/E Global ("P/E") and Aspect Capital ("Aspect").
Q1 2020	The Program was expanded to $4 billion with P/E and Aspect each managing $1 billion notional.
7/1/2021	The Program was ramped up to $6 billion with an additional $2 billion notional.
10/28/2020	OIC approved the revised Policy and approved adding emerging market ("EM") currency hedging to the Program.
Q1 2021	Staff implemented EM currency hedging.

Rationales

- Asset vs. liability: OPERF is a U.S.-based asset owner investing in diversified global assets. However, OPERF has a U.S. Dollar (USD) liability in the form of its benefit payment obligations.
- OPERF's base currency, the U.S. Dollar, is the world's No. 1 reserve currency and considered as a "safe haven" currency.
- OPERF has sizable foreign currency (FX) exposure due to its investments in non-U.S. assets. As of 2/28/2021, OPERF's Public Equity Portfolio has approximately $8 billion and $2.5 billion in non-U.S. developed market currency and in EM currency exposure respectively.
- Currency fluctuations contribute meaningfully to OPERF's total risk.
- Empirical research shows that unmanaged currency exposure is a source of uncompensated risk in the long run.

Rationale - Uncompensated Currency Risk

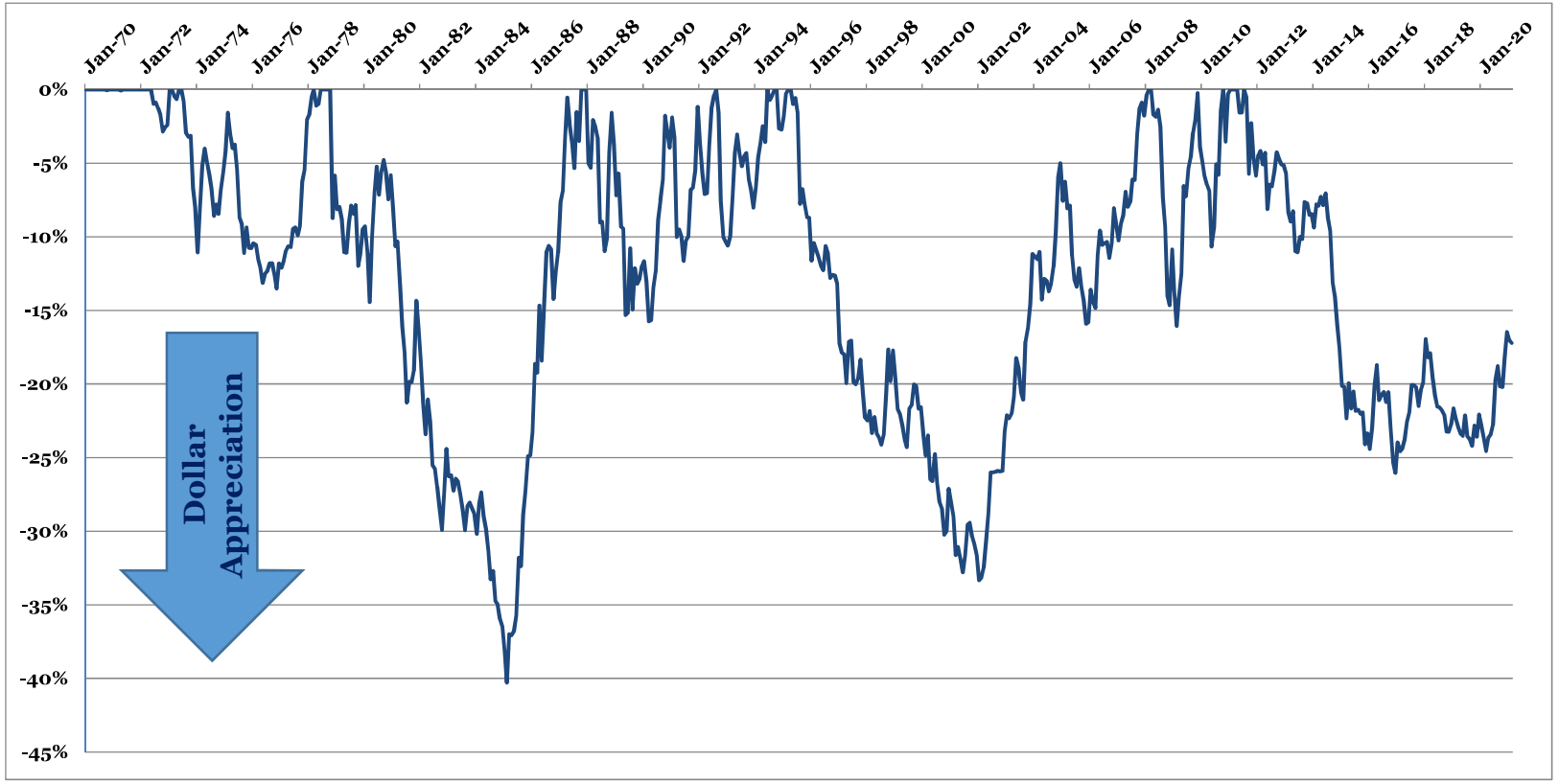


Source: OST staff calculation, MSCI

OREGON STATE TREASURY

Rationale – Drawdown Risk

- Currency component returns associated with the MSCI World ex-U.S. Index have historically been pro-cyclical, particularly during stressed environments (e.g., 1998, 2001, 2008, 2014-2015).
- Currency's historical maximum loss from peak to trough is -40%, which occurred in February 1985.



Source: MSCI, OST staff calculation

OREGON STATE TREASURY

Goal

INV 217: OPERF Foreign Currency Risk Policy

- "The goal of the Currency Overlay Program is to strategically manage foreign currency risk to reduce volatility in U.S. Dollar-denominated value as a result of movements in foreign exchange rates while preserving the diversification benefits of OPERF's foreign-denominated investments."

Program Profile

Considerations	Program Parameters
Objective	To hedge currency risk in OPERF's Public Equity Portfolio
Inception date	January 2nd, 2018
Total Notional amount	$6 billion
Target portfolio	Currency mix comprised by the MSCI World ex-U.S. Index
FX overlay managers	Adrian Lee & Partners, Aspect Capital and P/E Global
Base currency	U.S. Dollar
Benchmark	The currency return component of a 50%-hedged MSCI World ex-U.S. Index
Permitted currencies	Currencies that constitute the MSCI All Country World Index ex-U.S.
Range of hedge ratios	0% to 100%
Active volatility target	2%

Program Performance

Period ending 2/28/2021	Notional Value in $million	YTD	1 Yr	2 Yr	3 Yr	Since Inception
OPERF Currency Overlay Program	**$6,027**	**0.71%**	**-3.87%**	**-1.08%**	**0.51%**	**0.03%**
50%-Hedged MSCI World ex-U.S.		0.48%	-3.41%	-0.78%	0.70%	0.37%
Excess		0.23%	-0.46%	-0.30%	-0.19%	-0.33%

Calendar Year	2020	2019	2018
OPERF Currency Overlay Program	**-3.44%**	**0.79%**	**2.14%**
50%-Hedged MSCI World ex-U.S.	-2.75%	0.70%	2.80%
Excess	-0.70%	0.09%	-0.67%

Period ending 2/28/2021	Market Value in $million	YTD	1 Yr	2 Yr	3 Yr	Since Inception
OPERF EQ With Currency Overlay	$27,684	4.17%	29.18%	14.52%	9.02%	8.82%
OPERF EQ Unhedged	$27,657	4.00%	30.32%	14.92%	9.18%	9.00%
FX Overlay Program's Return impact on EQ		**0.17%**	**-1.14%**	**-0.40%**	**-0.16%**	**-0.18%**

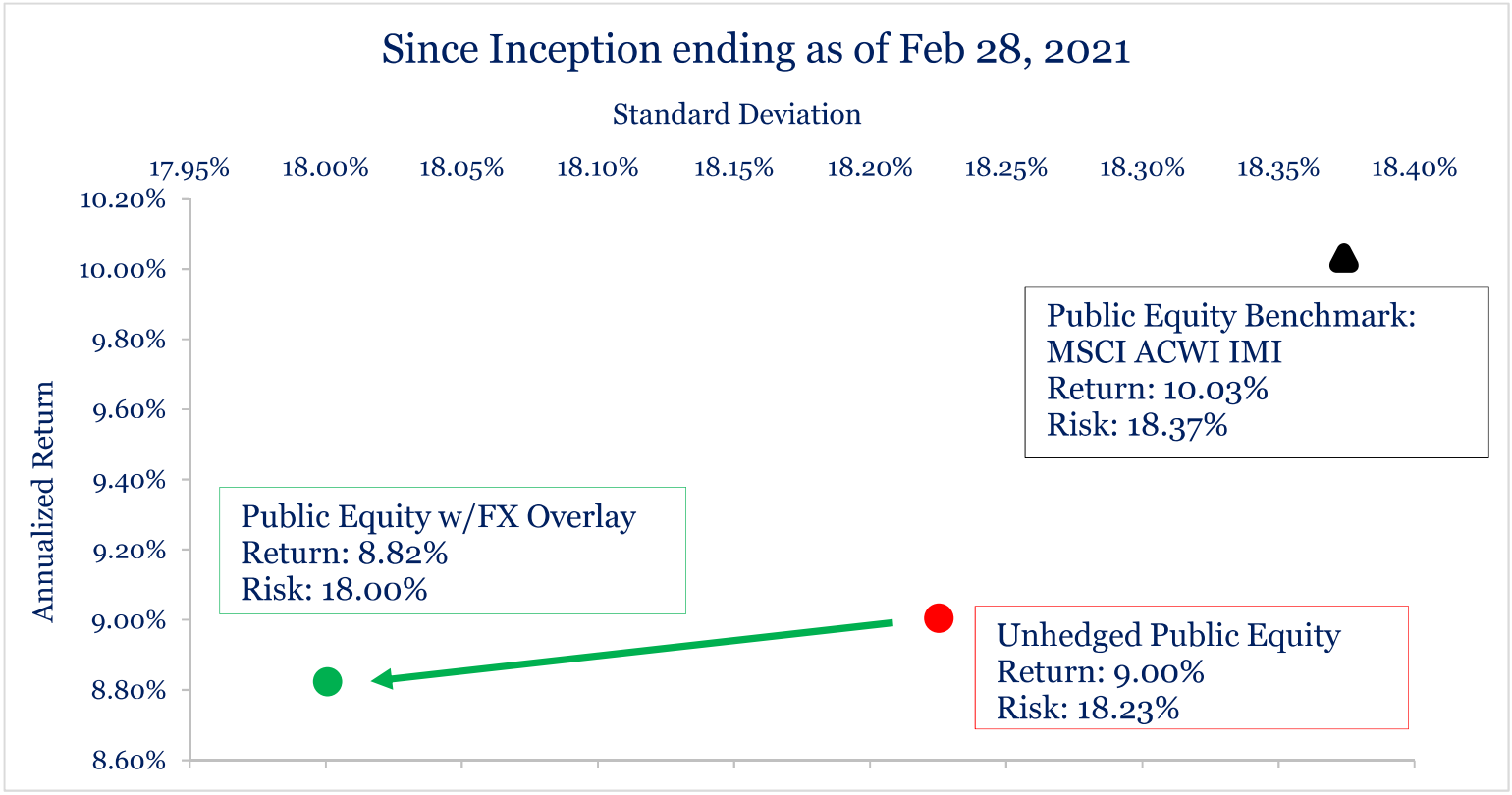
Calendar Year	2020	2019	2018
OPERF EQ With Currency Overlay	11.65%	25.32%	-10.33%
OPERF EQ Unhedged	12.66%	25.25%	-10.47%
FX Overlay Program's Return impact on EQ	**-1.01%**	**0.08%**	**0.14%**

Source: State Street

OREGON STATE TREASURY

Since Inception Results: Return vs. Risk

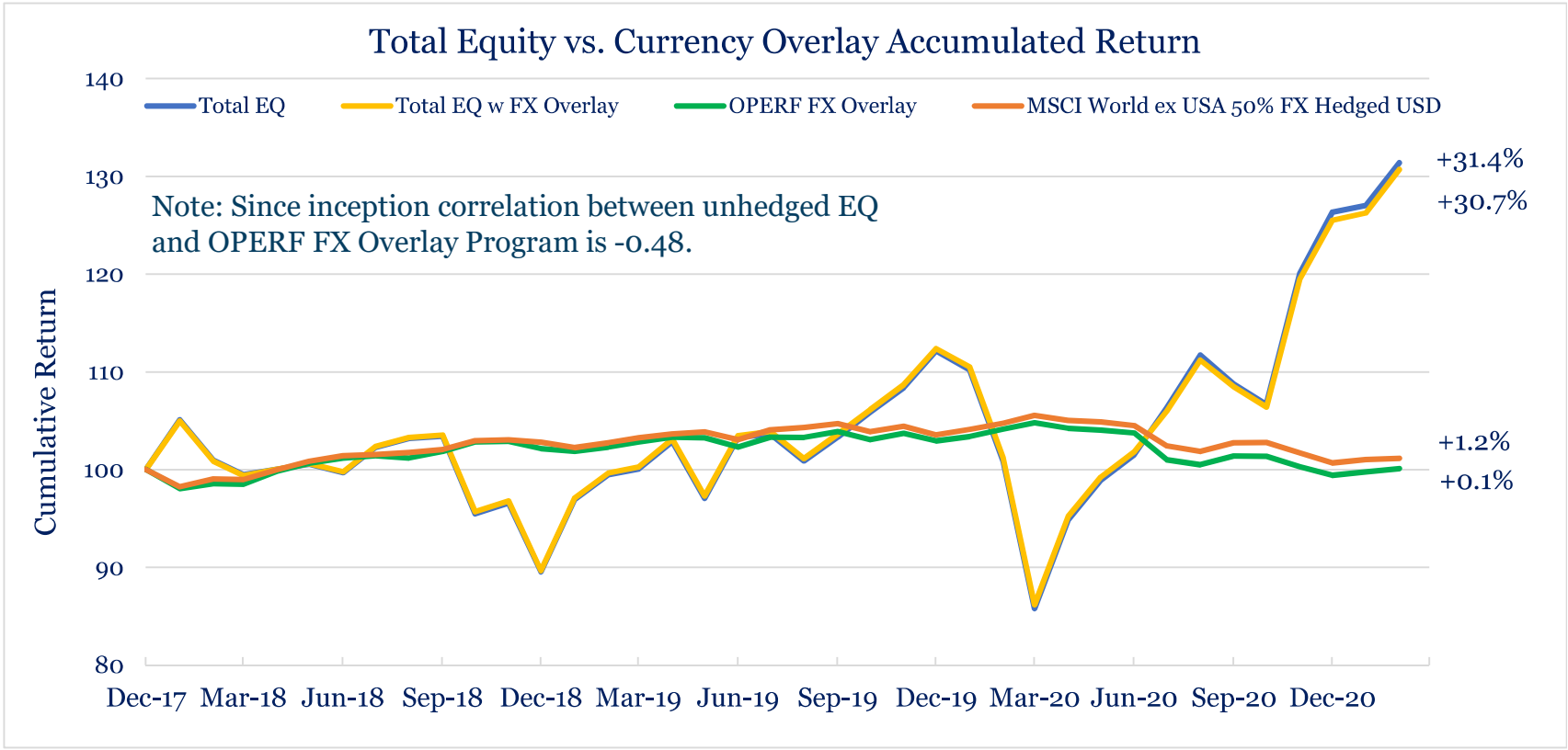
Compared to unhedged results, OPERF's Public Equity Portfolio risk has been reduced by 22 bps since the currency overlay program's introduction, while portfolio return was lowered by 18 bps.



Source: State Street

OREGON STATE TREASURY

Since Inception Results – 50% Hedged Performance



Source: State Street

Appendix 1 – Currency Exposure Profile of OPERF's Public Equity Portfolio

	As of February 28, 2021	MSCI ACWI IMI	EQ without Currency Hedge	EQ with Currency Hedge	FX Overlay Hedge Impact on EQ
1	U.S. Dollar (USD)	58.5%	61.8%	75.4%	13.6%
2	Euro (EUR)	8.4%	7.2%	2.5%	-4.7%
3	Japanese Yen (JPY)	7.0%	6.6%	2.7%	-3.9%
4	British Pound (GBP)	4.1%	3.3%	2.4%	-0.9%
5	Hong Kong Dollar (HKD)	3.6%	3.4%	3.1%	-0.3%
6	Canadian Dollar (CAD)	2.8%	1.5%	1.0%	-0.6%
7	Swiss Franc (CHF)	2.3%	1.9%	-0.2%	-2.0%
8	Australian Dollar (AUD)	2.0%	2.3%	1.3%	-1.0%
9	Taiwan Dollar (TWD)	1.9%	1.1%	1.1%	0.0%
10	South Korean Won (KRW)	1.8%	2.3%	2.3%	0.0%
11	Indian Rupee (INR)	1.3%	1.2%	1.2%	0.0%
12	Swedish Krona (SEK)	1.1%	1.0%	0.3%	-0.7%
	Other Currencies	5.2%	6.5%	7.0%	0.5%
		100.0%	100.0%	100.0%	0.0%

Source: BlackRock Aladdin

OREGON STATE TREASURY

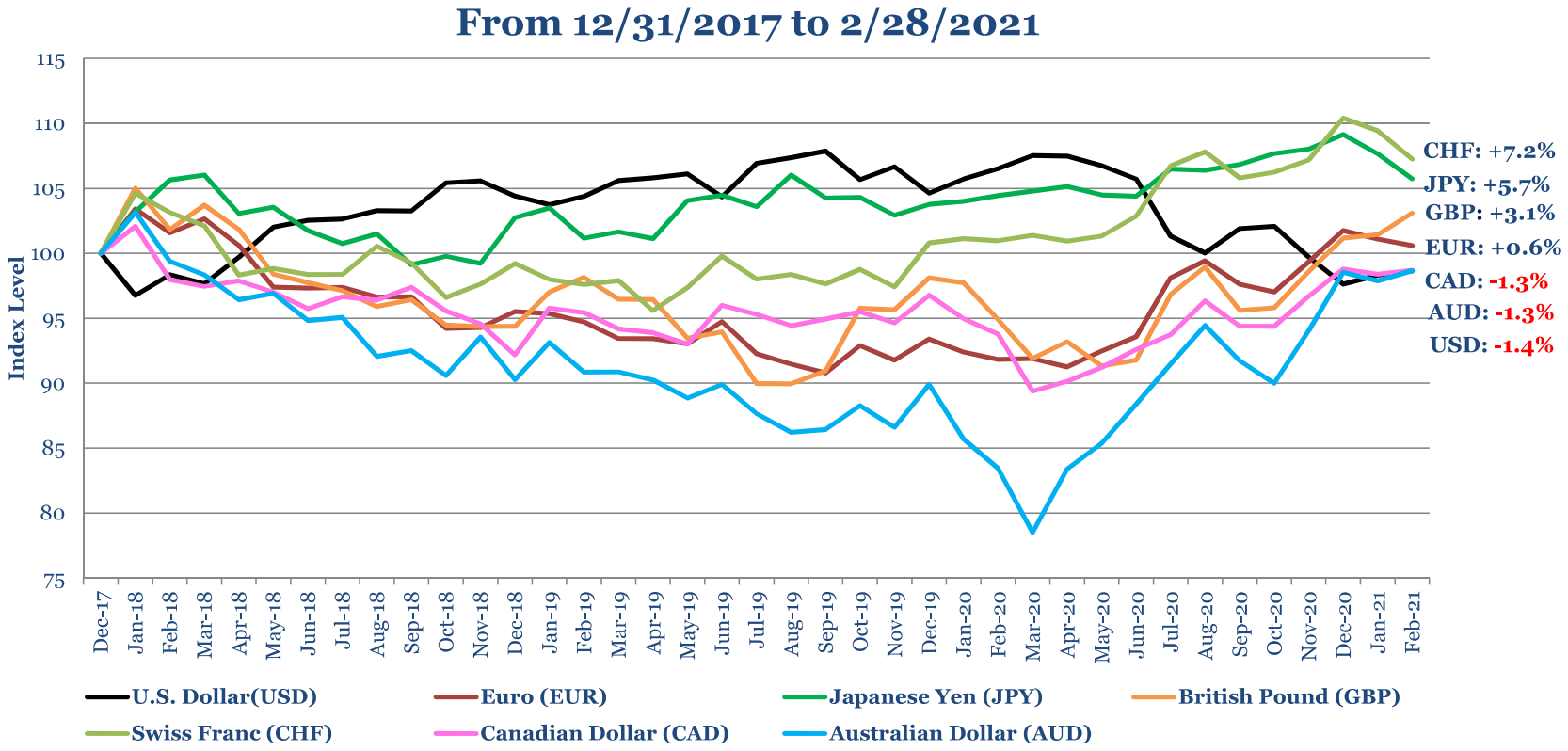
Appendix 2 – Currency Exposure Within OPERF's International Public Equity Composite

	As of February 28, 2021	MSCI World ex-U.S.	MSCI ACWI ex-U.S. IMI	Int'l EQ without Currency Hedge	Int'l EQ with Currency Hedge	FX Overlay Hedge Impact on Int'l EQ
1	Euro (EUR)	29.2%	19.3%	17.6%	3.8%	-13.8%
2	Japanese Yen (JPY)	22.8%	16.1%	13.4%	2.1%	-11.3%
3	British Pound (GBP)	12.9%	9.3%	8.9%	6.2%	-2.6%
4	Canadian Dollar (CAD)	9.5%	6.5%	3.8%	2.1%	-1.7%
5	Swiss Franc (CHF)	8.3%	5.4%	4.0%	-2.0%	-6.0%
6	Australian Dollar (AUD)	6.5%	4.7%	4.6%	1.8%	-2.9%
7	Swedish Krona (SEK)	3.2%	2.6%	2.5%	0.4%	-2.1%
8	Hong Kong Dollar (HKD)	3.0%	8.3%	7.4%	6.4%	-0.9%
9	Danish Krone (DKK)	2.2%	1.4%	2.3%	1.7%	-0.6%
10	Singapore Dollar (SGD)	1.0%	0.7%	0.6%	0.9%	0.4%
11	Norwegian Krone (NOK)	0.5%	0.5%	0.3%	1.4%	1.1%
12	U.S. Dollar (USD)	0.5%	4.2%	10.8%	50.6%	39.9%
13	Israeli Shekel (ILS)	0.3%	0.3%	0.3%	-0.1%	-0.3%
14	New Zealand Dollar (NZD)	0.2%	0.2%	0.4%	1.5%	1.1%
	South Korean Won (KRW)	0.0%	4.1%	6.2%	6.2%	0.0%
	Taiwan Dollar (TWD)	0.0%	4.4%	3.5%	3.5%	0.0%
	Indian Rupee (INR)	0.0%	3.1%	2.8%	2.8%	0.0%
	Brazilian Real (BRL)	0.0%	1.3%	1.7%	1.7%	0.0%
	South African Rand (ZAR)	0.0%	1.1%	1.1%	1.1%	0.0%
	Other EM Currencies	0.0%	6.3%	7.7%	7.6%	0.0%
		100.0%	100.0%	100.0%	100.0%	0.0%

- The MSCI World ex-U.S. Index is a non-U.S. developed market equity index containing 14 currencies.
- The currency return component of a 50%-hedged MSCI World ex-U.S. Index is the benchmark for the OPERF Currency Overlay Program.
- The MSCI All Country World Index ex-U.S. Investable Market Index (MSCI ACWI ex-U.S. IMI) is a global equity index covering both non-U.S. developed markets and emerging markets countries. It comprises 38 currencies, and also serves as the benchmark for OPERF's International Public Equity Composite.

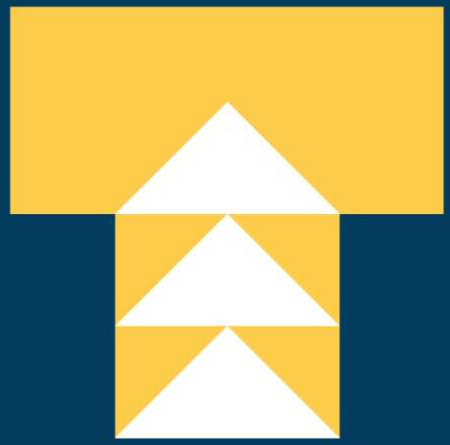
Source: BlackRock Aladdin, MSCI

Appendix 3 – Recent Currency Market Performance



Source: Bloomberg

OREGON STATE TREASURY



OREGON STATE TREASURY

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TAB 6 – Use of Leverage for Asset Allocation

The Use of Leverage in Building Portfolios

Oregon Public Employees Retirement Fund
April 2021

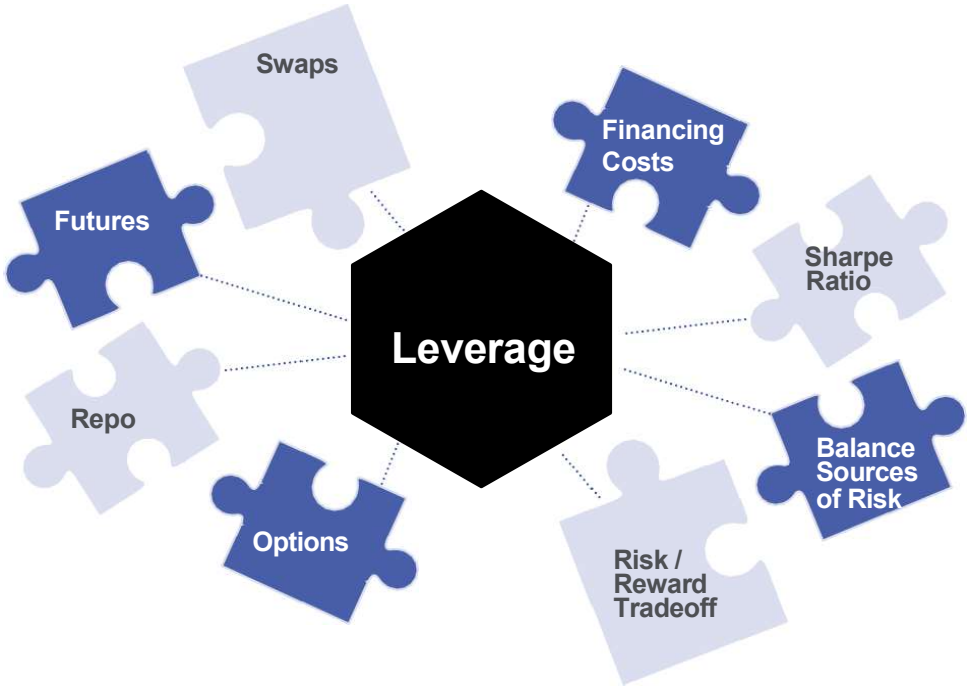
Empower Results®

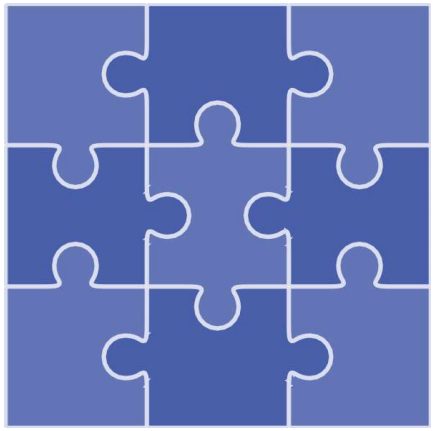
Table of Contents

Background

Leverage

- How Do All the Pieces Fit Together?



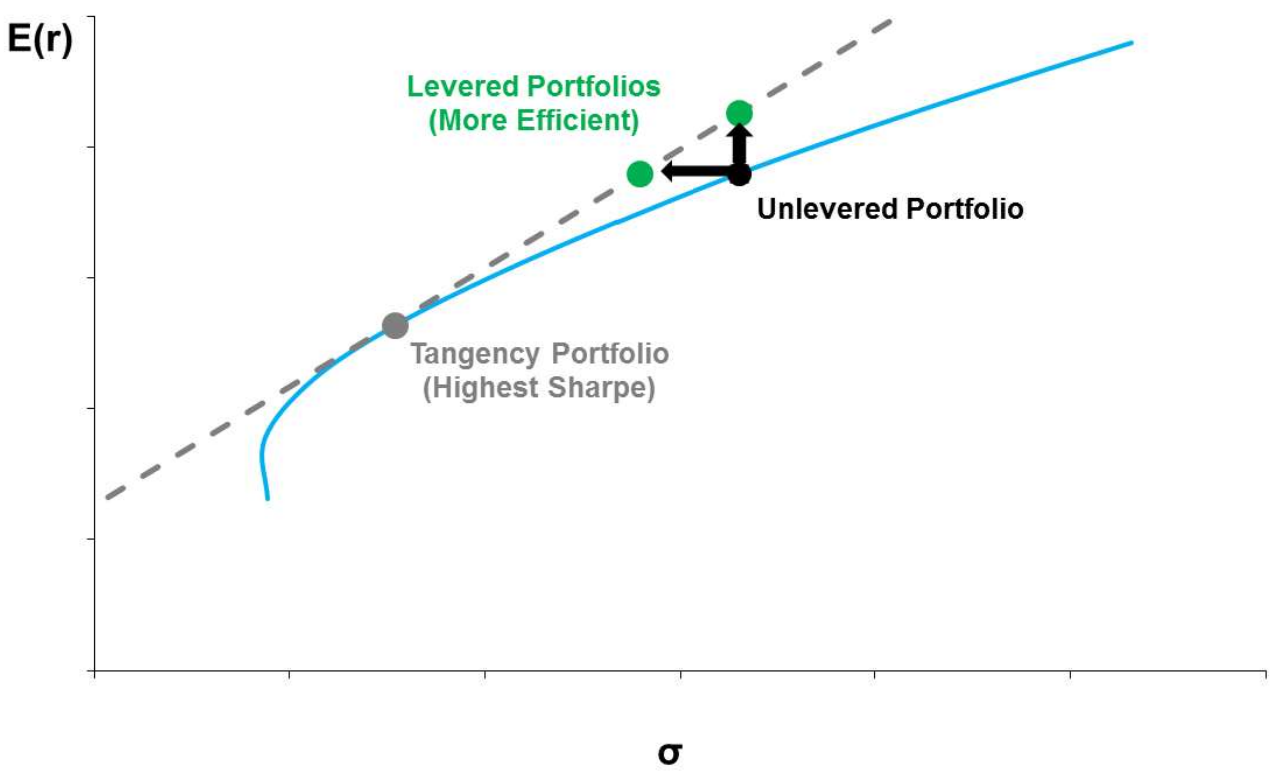


What is Leverage?

- Leverage is borrowing assets either explicitly (line of credit) or implicitly through financial instruments with embedded leverage (swaps and futures)
  - Can take on many forms such as explicit leverage at the total fund level, implicit leverage in funds, or embedded leverage in individual securities
  - Leverage in funds and individual securities is already present in Oregon's portfolio; this presentation focuses on explicit leverage at the total fund level
  - Leverage is a portfolio tool that investors use to expand the ability to build more efficient portfolios
  - Leverage relaxes the constraint on the amount of assets to be invested
  - Leverage enables the investor to build more efficient portfolios from a risk/reward perspective (Sharpe Ratio)
  - Leverage aids in portfolio construction by:
    - Enabling further risk reduction
    - Balancing the contributions to portfolio risk
    - Improving diversification
    - Improving total return for the same level of risk

Modern Portfolio Theory

- ***Tobin's Separation Theorem*** suggests that levering the tangency portfolio will produce more efficient portfolios
- Main weaknesses of this theory includes assumptions of
  - normally distributed returns
  - unlimited ability to invest in illiquid assets and borrow at the risk-free rate



Public Funds Universe Using Leverage at the Policy Level*

Plan Name	Policy Level Leverage
Ontario Teachers' Pension Plan	46%
Missouri State Employees' Retirement System (MOSERS)	40%
Nova Scotia Health Employees' Pension Plan	~40%
Missouri Local Government Employees' Retirement System (LAGERS)	35%
Healthcare of Ontario Pension Plan	~30%
California Public Employees' Retirement System (CalPERS)	20%
Canada Pension Plan Investment Board (CPPIB)	20%
Ohio Police and Fire Pension Fund	20%
Ontario Municipal Employees' Pension Plan	~20%
OPTrust – OPSEU Pension Plan	~17%
Pennsylvania Public School Employees Retirement System (PSERS)	13%
State of Wisconsin Investment Board (SWIB)	10%
Teacher Retirement System of Texas	6%

* Based on publicly available information

Leverage Overview

1. What are Advantages and Disadvantages of Leverage?

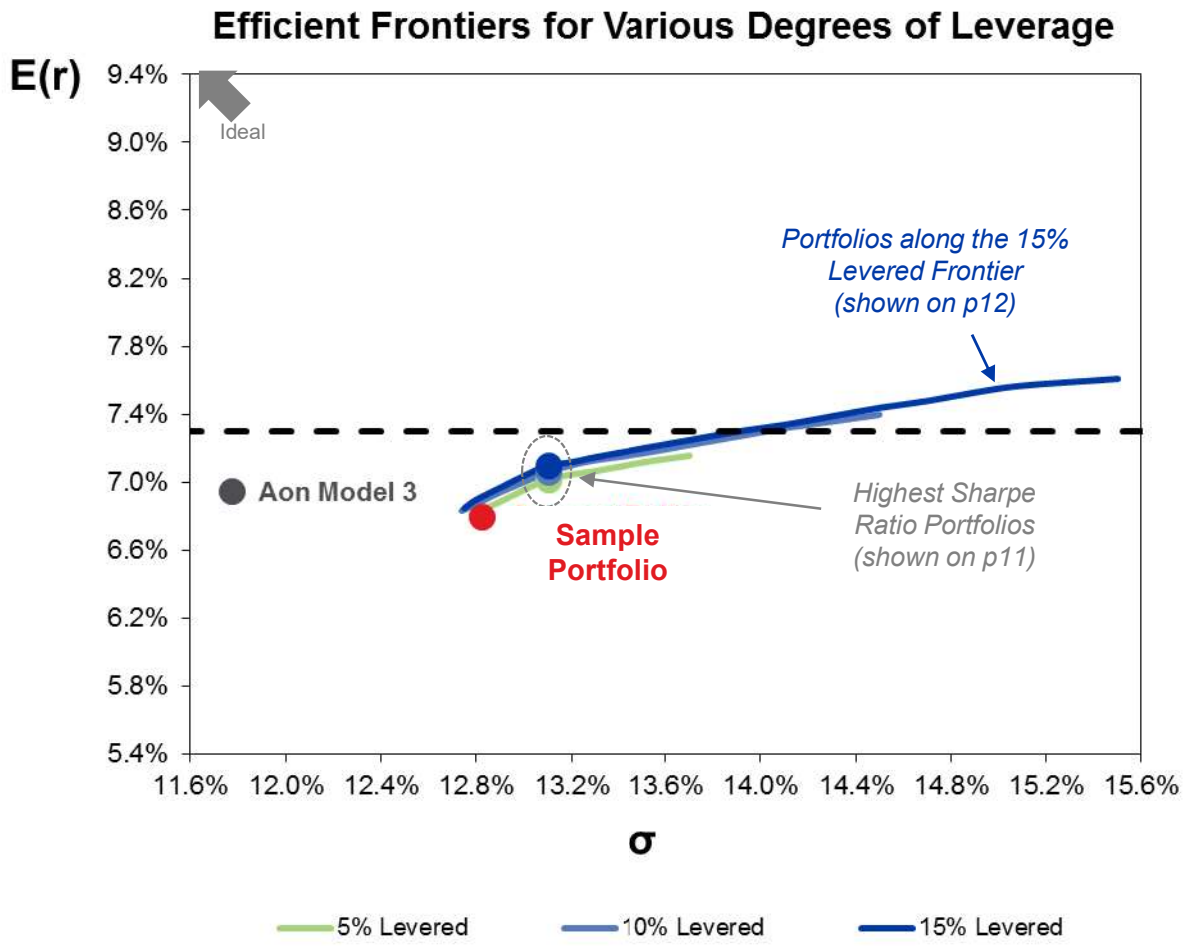
- Allows investors to own more of what they like
- Can enhance returns as (current) borrowing costs are very low
- Is optimal from the perspective of the efficient frontier
- Leverage can be used as a tool to improve implementation/execution (in addition to using it as a tool to improve performance)
- Lever up the Sharpe

- Leverage introduces additional complexities and requires sophisticated governance and risk management frameworks
- Depending on how leverage is utilized, the downsides can become apparent at the worst times
- Leverage becomes unattractive when borrowing costs are high (as the potential for returns on leveraged assets can fall below financing costs, if costs are heightened)
- Can introduce liquidity risk because of capital calls
- Headline risk

2. How to Determine the Amount of Leverage?

Client objectives implicate the amount of leverage to consider and where to apply such leverage

- Maximize the portfolio Sharpe ratio?
- Target a specific return expectation such as the actuarial assumed rate of return?
- Re-distribute sources of portfolio risk similar to a risk parity strategy?
- Other objectives?



2. How to Determine the Amount of Leverage?

Illustrative - Portfolios That Achieve The Highest Sharpe Ratio

	Sample Portfolio	Levered Portfolios			Aon Model Portfolio[3]	Optimization Constraints
		5%	*10%*	*15%*		
Public Equity	47%	47%	47%	47%	35%	70% Max
Private Equity	12%	12%	12%	12%	15%	15% Max
Liquid Alternatives	3%	**5%**	**6%**	**5%**	10%	15% Max
Real Assets	3%	**6%**	**6%**	**7%**	5%	7% Max
Real Estate	7%	7%	7%	7%	10%	10% Max
Return Seeking Credit	9%	9%	9%	9%	5%	15% Max
Core Fixed Income	14%	14%	**18%**	**23%**	20%	
Cash	5%	5%	5%	5%	0%	
Leverage (LIBOR)	*0%*	*(5%)*	*(10%)*	*(15%)*	*0%*	
Total	100%	100%	100%	100%	100%	
Portfolio Metrics[1]						
- Expected Rate of Return	6.80%	7.02%	7.06%	7.10%	6.95%	
- Volatility	12.82%	13.10%	13.10%	13.10%	11.77%	
- Sharpe Ratio	0.421	0.429	0.432	0.435	0.472	
Total Alternative Assets[2]	32%	37%	38%	38%	48%	

Note:

- Leveraged scenarios determined by achieving portfolios with enhanced returns & maximized Sharpe Ratios
- Optimizations were run based on the constraints listed to arrive at portfolios with the highest Sharpe.

Red = Asset classes where allocations increased from current targets

[1] Based on Aon's Q1 2021 30-year capital market assumptions
[2] Alternatives capped at 38% alternatives include private equity, liquid alternatives, real assets, and private debt
[3] Aon's Model Portfolios represent a baseline asset allocation of our best ideas for a public pension plan.

2. How to Determine the Amount of Leverage?

Illustrative - Levered Asset Classes Evolve Based on Risk Tolerance

	Sample Portfolio	Levered Portfolios (Portfolios Along the 15% Levered Efficient Frontier)					Optimization Constraints
Public Equity	47%	47%	47%	**49%**	**53%**	**58%**	70% Max
Private Equity	12%	12%	12%	12%	12%	**15%**	15% Max
Liquid Alternatives	3%	**4%**	**5%**	3%	3%	3%	15% Max
Real Assets	3%	3%	**7%**	**7%**	**7%**	3%	7% Max
Real Estate	7%	7%	7%	**9%**	**9%**	**8%**	10% Max
Return Seeking Credit	9%	9%	9%	9%	9%	9%	15% Max
Core Fixed Income	14%	**28%**	**23%**	**21%**	**17%**	14%	
Cash	5%	5%	5%	5%	5%	5%	
Leverage (LIBOR)	*0%*	*(15%)*	*(15%)*	*(15%)*	*(15%)*	*(15%)*	
Total	100%	100%	100%	100%	100%	100%	
Portfolio Metrics[1]							
- Expected Rate of Return	6.80%	6.87%	7.10%	7.25%	7.44%	7.61%	
- Volatility	12.82%	12.75%	13.10%	13.70%	14.50%	15.50%	
- Sharpe Ratio	0.421	0.429	0.435	0.427	0.416	0.401	
Total Alternative Assets[2]	32%	33%	38%	38%	38%	36%	

Highest Sharpe Portfolio on Prior Page

[1] Based on Aon's Q1 2021 30-year capital market assumptions
[2] Alternatives capped at 38% alternatives include private equity, liquid alternatives, real assets, and private debt

Note:

- The frontier of portfolios illustrates how leverage taken on different asset classes can alter the risk/reward characteristics of the Plans

Red = Asset classes where allocations increased from current targets

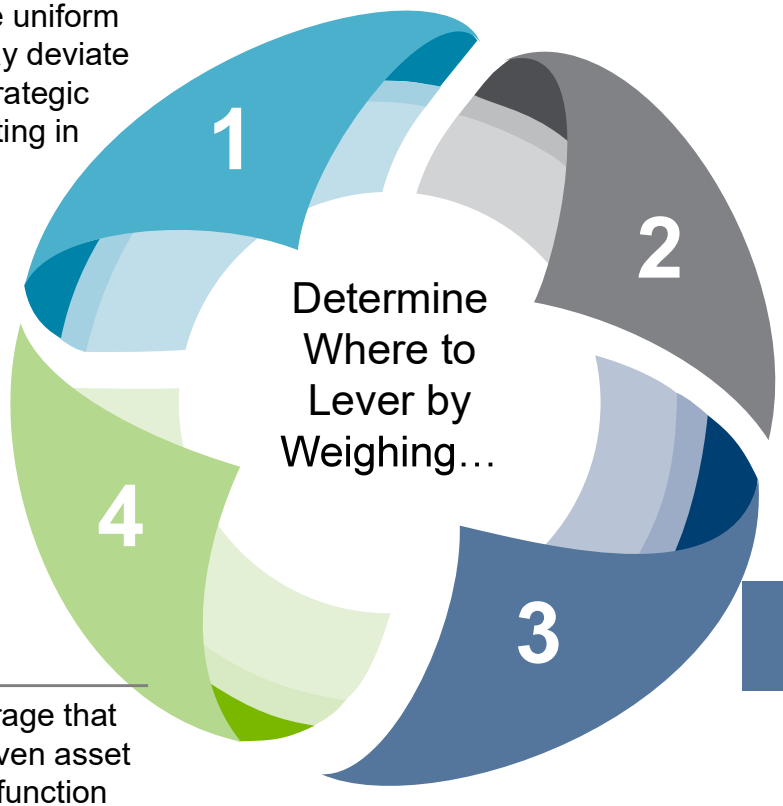
3. How to Determine Where Leverage Should Be Taken?

Basis Risk vs. Benchmark Investment

- Futures are more uniform and therefore may deviate away from the strategic benchmark resulting in basis risk

Financing Cost (Implied and Explicit)

- Implied financing costs are embedded in futures pricing while explicit costs are borrowing loan rates



Leveragability

- The amount of leverage that can be taken in a given asset class is generally a function of the volatility of the asset class
- 4x plus for U.S. Treasuries vs. 2-3x for public equity

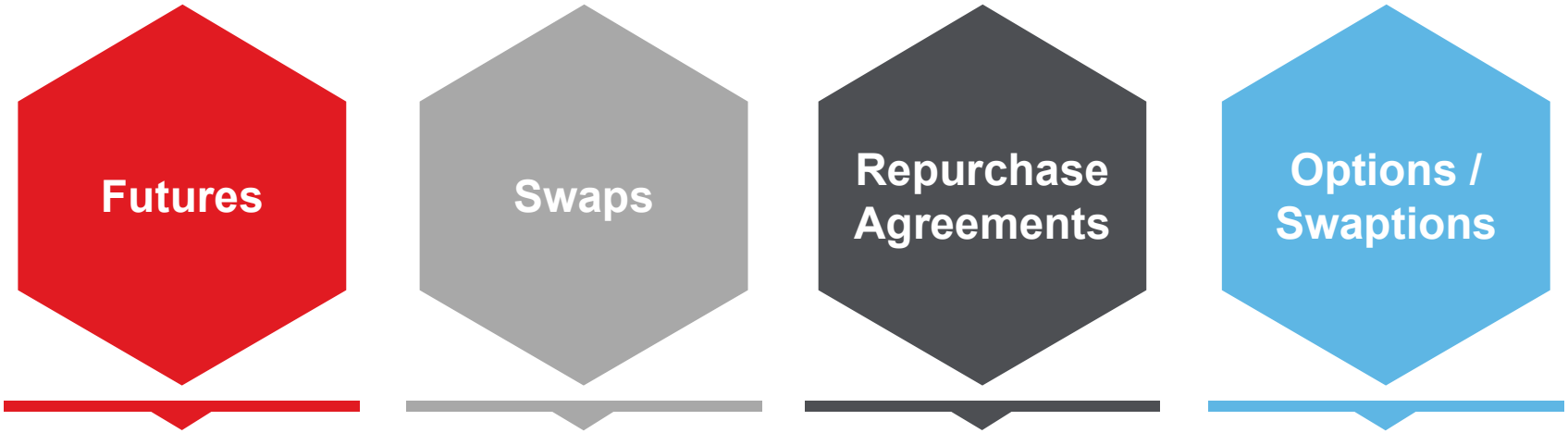
Alpha Give-Up

- Alpha give-up can occur if exposure to active strategies are reduced to effectively buy passive exposure through derivatives

4. What Are the Trade-offs of Using a Credit Line vs. Derivatives?

- Credit line is tailored to the borrower while derivatives are more uniform, particularly where centrally cleared
- Credit line is not limited to only leveraging synthetically replicate-able assets
- Credit lines have covenant / callability considerations
- Financing terms of credit line are different then implicit / explicit financing costs of derivatives
- Potential differences in assets subject to creditors' claims
- Tax implications (if applicable)

5. What Are the Trade-offs of Different Derivative Instruments?



- Centrally cleared
- Lowest documentation level
- Least customizable
- Mark to market cash settled daily
- Requires quarterly rolling of exposures
- Broader access can make implied financing costs more expensive

- International Swaps and Derivatives Association (ISDA) needed
- Vanilla interest rate swap basis risk with U.S. government bonds
- More customizable
- Can often improve financing costs (vs. futures) via total return swaps

- Additional operational work
- Limited to leveraging U.S. government bonds

- Pay theta decay but provides non-recourse leverage
- Theta decay refers to the rate of decline in the value of an option due to the passage of time or as time moves closer to the maturity of the option

6. What Are Considerations For Implementing Internally vs. Externally?

- **Internal** management requires
  - Derivative expertise
  - Risk and governance capabilities

- **External** management options
  - Overlay-only mandate
    - Allows holistic portfolio control over total portfolio betas
    - If leveraging multiple betas, diversification can lower collateral requirements
    - May achieve leverage with higher fees

  - Overlay tied to manager mandate
    - May allow for lower collateralization level / more leverage if manager controls other assets
    - Unless implemented separately, can only lever the manager's exposure
    - Rebalancing of leverage occurs more automatically within manager's account instead of total portfolio level, which may be undesirable in certain markets
      - This can slow the process down as compared to a total portfolio overlay where exposures can be quickly changed
    - Leverage ceases if manager is fired

7. What Are Other Considerations When Using Leverage?

- Monthly performance reporting challenges
  - Need to incorporate financing costs into benchmarks & performance reporting
  - Leverage heavily distorts individual account performance and can produce misleading results
  - Monitoring challenges for derivatives, i.e. converting custodial derivative feeds into asset class exposures

Key Takeaways

Key Takeaways

- An investment program can improve its risk/reward profile through (1) asset allocation adjustments and or through (2) leverage
  - During the asset allocation study, we should assess the impacts of both within the appropriate ranges and constraints to determine the value add
  - The Highest Sharpe Portfolio referenced on slide 11 and 12 illustrates that a portfolio can use leverage as a tool to allocate further to diversifying asset classes leading to an enhanced return profile and improvement in risk adjusted returns
- Some key considerations around leverage are:
  - It introduces additional complexities and requires sophisticated governance and risk management frameworks
  - Depending on how leverage is utilized, the downside can become apparent at the worst of times
  - Leverage becomes unattractive when borrowing costs are high (as the potential for returns on leveraged assets can fall below financing costs, if cost are heightened)
  - Can introduce liquidity risk because of capital calls
- A deep dive on each of the topics reviewed in this presentation along with cost and stress testing should be fully evaluated to determine the appropriateness of adding leverage at the total portfolio level

Appendix

- Capital Market Assumptions

Capital Market Assumption Methodology

- The Aon Asset Model and Economic Scenario Generator (ESG) creates 5,000 simulations of key economic variables and total returns.
- We believe the model is complete and consistent. All the major markets and asset classes are modeled within a consistent framework allowing for the interactions between them to be properly taken into account.
- It is arbitrage free and captures the fact that extreme market events do occur more frequently than would be predicted by simpler statistical models.
- The ESG models the full yield curve as this allows for accurate treatment of liabilities and realistic modeling of the future distribution of interest rates and inflation. This allows us to assess the sensitivities of assets and liabilities to changes in interest and inflation rates.
- The model is calibrated to Aon's globally-consistent Capital Market assumptions every quarter.
- Nominal and real government interest rates are projected using an extended two factor Black-Karasinki model and a 2 factor Vasicek model respectively. The models are mean reverting starting with current yield curves and reverting towards our long-term fair values over the very long-term.
- Credit spreads are modeled stochastically using a Markov based model to determine the probabilities of transition between various credit rating and default, and a stochastic parameter reflecting the level of risk aversion in the market.
- Return seeking assets (including equities) are modeled using an individual asset class model with its own returns and volatilities but no correlations to other asset classes, and exposure to 6 other economic models to gain the correct correlation structures between returns for each asset class.

Aon Investments' Capital Market Assumptions

As of December 31, 2020 (30 Years)

		Expected Real Return[1]	Expected Nominal Return[1]	Expected Nominal Volatility
	Equity			
1	Large Cap U.S. Equity	4.1%	6.3%	17.0%
2	Small Cap U.S. Equity	4.6%	6.8%	23.0%
3	Global Equity IMI	5.0%	7.2%	18.5%
4	International Equity (Developed)	5.2%	7.4%	20.0%
5	Emerging Markets Equity	5.3%	7.5%	27.0%
	Fixed Income			
6	Cash (Gov't)	-0.7%	1.4%	1.5%
7	TIPS	-0.5%	1.6%	3.5%
8	Core Fixed Income	-0.1%	2.0%	4.5%
9	Intermediate Gov't Bonds (4-Year Duration)	-0.7%	1.4%	3.5%
10	Intermediate Corporate Bonds (4-Year Duration)	0.2%	2.3%	4.5%
11	Market-Duration (5-Yr) Non-Govt Bonds	0.4%	2.5%	6.0%
12	High Yield Bonds	1.7%	3.8%	12.5%
13	Bank Loans	2.5%	4.7%	7.5%
14	Emerging Market Bonds	1.5%	3.6%	14.5%
15	Emerging Market Bonds (Corporate USD)	1.2%	3.3%	11.5%
16	Emerging Market Bonds (Sov. Local)	1.3%	3.4%	14.5%
17	Multi-Asset Credit[4]	2.8%	5.0%	10.0%
	Alternatives			
18	Hedge Funds Universe[2,4]	1.2%	3.3%	10.0%
19	Hedge Funds Buy List[2,4]	2.4%	4.5%	9.5%
20	Direct Hedge Funds[3,4]	3.8%	6.0%	9.5%
21	Non-Core Real Estate	5.2%	7.4%	25.0%
22	Core Real Estate	3.4%	5.6%	15.0%
23	US REITs	3.7%	5.9%	18.5%
24	Private Equity	6.8%	9.0%	25.0%
25	Infrastructure	6.0%	8.2%	14.5%
26	Insurance Linked Securities	1.7%	3.8%	7.5%
27	Private Debt	4.1%	6.3%	17.5%
	Inflation			
28	Inflation	0.0%	2.1%	1.5%

Notes:

1. All expected returns are geometric (long-term compounded; rounded to the nearest decimal) and net of investment fees.
2. Fund of hedge funds
3. Diversified portfolio of Direct hedge fund investments
4. Alpha incorporated in Expected Nominal Return

Aon Investments' Capital Market Assumptions

As of December 31, 2020

	Nominal Correlations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	Large Cap U.S. Equity	**1.00**	0.92	0.96	0.79	0.73	0.08	-0.03	0.02	-0.07	0.05	0.10	0.60	0.46	0.43	0.42	0.47	0.57	0.68	0.55	0.54	0.48	0.38	0.66	0.69	0.39	0.02	0.37	0.09
2	Small Cap U.S. Equity	0.92	**1.00**	0.91	0.72	0.67	0.07	-0.03	0.02	-0.07	0.05	0.09	0.55	0.43	0.39	0.38	0.41	0.52	0.62	0.50	0.50	0.45	0.35	0.61	0.65	0.36	0.02	0.35	0.08
3	Global Equity IMI	0.96	0.91	**1.00**	0.90	0.85	0.07	-0.04	0.02	-0.07	0.05	0.10	0.65	0.48	0.47	0.47	0.55	0.63	0.66	0.53	0.53	0.50	0.39	0.64	0.67	0.38	0.02	0.40	0.09
4	International Equity (Developed)	0.79	0.72	0.90	**1.00**	0.75	0.04	-0.03	0.01	-0.08	0.03	0.08	0.57	0.43	0.43	0.44	0.59	0.58	0.57	0.46	0.46	0.45	0.35	0.54	0.56	0.31	0.01	0.35	0.09
5	Emerging Markets Equity	0.73	0.67	0.85	0.75	**1.00**	0.06	-0.03	0.02	-0.06	0.04	0.10	0.64	0.46	0.48	0.47	0.53	0.61	0.48	0.39	0.38	0.42	0.32	0.50	0.53	0.29	0.01	0.38	0.08
6	Cash (Gov't)	0.08	0.07	0.07	0.04	0.06	**1.00**	0.53	0.45	0.57	0.49	0.37	0.13	-0.04	0.18	0.07	0.04	0.08	0.00	0.00	0.00	0.12	0.13	0.08	0.08	0.11	0.24	-0.16	0.52
7	TIPS	-0.03	-0.03	-0.04	-0.03	-0.03	0.53	**1.00**	0.55	0.61	0.52	0.46	0.06	-0.10	0.16	0.01	-0.02	0.02	-0.10	-0.08	-0.08	0.03	0.04	-0.01	-0.02	0.04	0.12	-0.15	0.26
8	Core Fixed Income	0.02	0.02	0.02	0.01	0.02	0.45	0.55	**1.00**	0.90	0.97	0.95	0.29	0.13	0.48	0.16	0.13	0.26	0.01	0.01	0.01	0.04	0.05	0.02	0.02	0.05	0.12	0.05	0.06
9	Intermediate Gov't Bonds (4-Year Duration)	-0.07	-0.07	-0.07	-0.08	-0.06	0.57	0.61	0.90	**1.00**	0.84	0.73	0.03	-0.22	0.25	0.00	0.00	-0.02	-0.22	-0.18	-0.18	0.01	0.02	-0.03	-0.05	0.01	0.14	-0.25	0.13
10	Intermediate Corporate Bonds (4-Year Duration)	0.05	0.05	0.05	0.03	0.04	0.49	0.52	0.97	0.84	**1.00**	0.96	0.34	0.24	0.51	0.20	0.15	0.32	0.09	0.07	0.07	0.06	0.07	0.05	0.05	0.06	0.13	0.13	0.11
11	Market-Duration (5-Yr) Non-Govt Bonds	0.10	0.09	0.10	0.08	0.10	0.37	0.46	0.95	0.73	0.96	**1.00**	0.48	0.40	0.61	0.28	0.22	0.46	0.21	0.17	0.17	0.08	0.07	0.08	0.09	0.08	0.10	0.28	0.05
12	High Yield Bonds	0.60	0.55	0.65	0.57	0.64	0.13	0.06	0.29	0.03	0.34	0.48	**1.00**	0.86	0.74	0.61	0.59	0.93	0.64	0.51	0.51	0.32	0.25	0.40	0.44	0.26	0.03	0.70	0.16
13	Bank Loans	0.46	0.43	0.48	0.43	0.46	-0.04	-0.10	0.13	-0.22	0.24	0.40	0.86	**1.00**	0.50	0.56	0.42	0.83	0.67	0.54	0.53	0.24	0.18	0.30	0.36	0.19	-0.01	0.83	0.08
14	Emerging Market Bonds	0.43	0.39	0.47	0.43	0.48	0.18	0.16	0.48	0.25	0.51	0.61	0.74	0.50	**1.00**	0.68	0.64	0.77	0.53	0.42	0.42	0.23	0.18	0.28	0.30	0.18	0.05	0.39	0.07
15	Emerging Market Bonds (Corporate USD)	0.42	0.38	0.47	0.44	0.47	0.07	0.01	0.16	0.00	0.20	0.28	0.61	0.56	0.68	**1.00**	0.62	0.72	0.57	0.46	0.46	0.21	0.16	0.27	0.28	0.15	0.02	0.45	0.07
16	Emerging Market Bonds (Sov. Local)	0.47	0.41	0.55	0.59	0.53	0.04	-0.02	0.13	0.00	0.15	0.22	0.59	0.42	0.64	0.62	**1.00**	0.73	0.49	0.40	0.39	0.19	0.11	0.29	0.21	0.11	0.01	0.34	0.01
17	Multi-Asset Credit	0.57	0.52	0.63	0.58	0.61	0.08	0.02	0.26	-0.02	0.32	0.46	0.93	0.83	0.77	0.72	0.73	**1.00**	0.67	0.54	0.54	0.29	0.21	0.37	0.39	0.22	0.02	0.68	0.11
18	Hedge Funds Universe	0.68	0.62	0.66	0.57	0.48	0.00	-0.10	0.01	-0.22	0.09	0.21	0.64	0.67	0.53	0.57	0.49	0.67	**1.00**	0.74	0.73	0.31	0.24	0.44	0.46	0.25	0.00	0.55	0.09
19	Hedge Funds Buy List	0.55	0.50	0.53	0.46	0.39	0.00	-0.08	0.01	-0.18	0.07	0.17	0.51	0.54	0.42	0.46	0.40	0.54	0.74	**1.00**	0.99	0.25	0.19	0.36	0.37	0.21	0.00	0.44	0.07
20	Direct Hedge Funds	0.54	0.50	0.53	0.46	0.38	0.00	-0.08	0.01	-0.18	0.07	0.17	0.51	0.53	0.42	0.46	0.39	0.54	0.73	0.99	**1.00**	0.25	0.19	0.36	0.36	0.21	0.00	0.44	0.07
21	Non Core Real Estate	0.48	0.45	0.50	0.45	0.42	0.12	0.03	0.04	0.01	0.06	0.08	0.32	0.24	0.23	0.21	0.19	0.29	0.31	0.25	0.25	**1.00**	0.97	0.49	0.38	0.22	0.03	0.18	0.10
22	Core Real Estate	0.38	0.35	0.39	0.35	0.32	0.13	0.04	0.05	0.02	0.07	0.07	0.25	0.18	0.18	0.16	0.11	0.21	0.24	0.19	0.19	0.97	**1.00**	0.45	0.32	0.18	0.03	0.14	0.10
23	US REITs	0.66	0.61	0.64	0.54	0.50	0.08	-0.01	0.02	-0.03	0.05	0.08	0.40	0.30	0.28	0.27	0.29	0.37	0.44	0.36	0.36	0.49	0.45	**1.00**	0.47	0.26	0.01	0.24	0.07
24	Private Equity	0.69	0.65	0.67	0.56	0.53	0.08	-0.02	0.02	-0.05	0.05	0.09	0.44	0.36	0.30	0.28	0.21	0.39	0.46	0.37	0.36	0.38	0.32	0.47	**1.00**	0.32	0.02	0.29	0.08
25	Infrastructure	0.39	0.36	0.38	0.31	0.29	0.11	0.04	0.05	0.01	0.06	0.08	0.26	0.19	0.18	0.15	0.11	0.22	0.25	0.21	0.21	0.22	0.18	0.26	0.32	**1.00**	0.03	0.15	0.08
26	Insurance Linked Securities	0.02	0.02	0.02	0.01	0.01	0.24	0.12	0.12	0.14	0.13	0.10	0.03	-0.01	0.05	0.02	0.01	0.02	0.00	0.00	0.00	0.03	0.03	0.01	0.02	0.03	**1.00**	-0.04	0.13
27	Private Debt	0.37	0.35	0.40	0.35	0.38	-0.16	-0.15	0.05	-0.25	0.13	0.28	0.70	0.83	0.39	0.45	0.34	0.68	0.55	0.44	0.44	0.18	0.14	0.24	0.29	0.15	-0.04	**1.00**	0.00
28	Inflation	0.09	0.08	0.09	0.09	0.08	0.52	0.26	0.06	0.13	0.11	0.05	0.16	0.08	0.07	0.07	0.01	0.11	0.09	0.07	0.07	0.10	0.10	0.07	0.08	0.08	0.13	0.00	**1.00**

Aon Investments' Capital Market Assumptions

Explanation of Capital Market Assumptions—Q1 2021

The following capital market assumptions were developed by Aon's Global Asset Allocation Team and represent the long-term capital market outlook (i.e., 30 years) based on data at the end of the fourth quarter of 2020. The assumptions were developed using a building block approach, reflecting observable inflation and interest rate information available in the fixed income markets as well as Consensus Economics forecasts. Our long-term assumptions for other asset classes are based on historical results, current market characteristics, and our professional judgment.

Inflation – Expected Level (2.1%)

Based on Consensus Economics long-term estimates and our near-term economic outlook, we expect U.S. consumer price inflation to be approximately 2.1% during the next 30 years.

Real Returns for Asset Classes

Fixed Income

- **Cash (-0.7%) –** Over the long run, we expect the real yield on cash and money market instruments to produce a real return of -0.7% in a moderate to low-inflationary environment.
- **TIPS (-0.5%) –** We expect intermediate duration Treasury Inflation-Protected Securities to produce a real return of about -0.5%.
- **Core Fixed Income (i.e., Market Duration) (-0.1%) –** We expect intermediate duration Treasuries to produce a real return of about -0.7%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 0.6%, resulting in a long-term real return of -0.1%.
- **Long Duration Bonds – Government and Credit (0.0%) –** We expect Treasuries with a duration comparable to the Long Government Credit Index to produce a real return of -0.4%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 0.4%, resulting in an expected real return of 0.0%.

Aon Investments' Capital Market Assumptions

Explanation of Capital Market Assumptions—Q1 2021

- **Long Duration Bonds – Credit (0.4%) –** We expect Treasuries with a duration comparable to the Long Credit Index to produce a real return of -0.4%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 0.8%, resulting in an expected real return of 0.4%.
- **Long Duration Bonds – Government (-0.4%) –** We expect Treasuries with a duration of ~12 years to produce a real return of -0.4% during the next 30 years.
- **High Yield Bonds (1.7%) –** We expect intermediate duration Treasuries to produce a real return of about -0.7%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 2.4%, resulting in an expected real return of 1.7%.
- **Bank Loans (2.5%) –** We expect LIBOR to produce a real return of about -0.3%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults) to be 2.8%, resulting in an expected real return of 2.5%.
- **Non-US Developed Bonds: 50% Hedged (-0.5%) –** We forecast real returns for non-US developed market bonds to be -0.5% over a 30-year period after adjusting for a 50% currency hedge. We assume a blend of one-third investment grade corporate bonds and two-thirds government bonds. We also produce assumptions for 0% hedged and 100% hedged non-US developed bonds.
- **Emerging Market Bonds (Sovereign; USD) (1.5%) –** We forecast real returns for emerging market sovereign bonds denominated in US dollars to be 1.5% over a 30-year period.
- **Emerging Market Bonds (Corporate; USD) (1.2%) –** We forecast real returns for emerging market corporate bonds denominated in US dollars to be 1.2% over a 30-year period.
- **Emerging Market Bonds (Sovereign; Local) (1.3%) –** We forecast real returns for emerging market sovereign bonds denominated in local currency to be 1.3% over a 30-year period.
- **Multi Asset Credit (MAC) (2.8%) –** We assume real returns from beta exposure to high yield, bank loans and emerging market debt to add 2.0% plus 0.8% from alpha (net of fees) over a 30-year period.
- **Private Debt-Direct Lending (4.1%) –** The base building block is bank loans 2.5% + spread 1.6% (net of management fees and performance incentives). There is 100% leverage included in the assumption with the nominal cost of financing at LIBOR + 2.5%.

Aon Investments' Capital Market Assumptions

Explanation of Capital Market Assumptions—Q1 2021

Equities

- **Large Cap U.S. Equity (4.1%) –** This assumption is based on our 30-year outlook for large cap U.S. company dividends and real earnings growth. Adjustments are made for valuations as needed.
- **Small Cap U.S. Equity (4.6%) –** Adding a 0.5% return premium for small cap U.S. equity over large cap U.S. equity results in an expected real return of 4.6%. This return premium is theoretically justified by the higher risk inherent in small cap U.S. equity versus large cap U.S. equity, and is also justified by historical data. In recent years, higher small cap valuations relative large cap equity has reduced the small cap premium.
- **Global Equity (Developed & Emerging Markets) (5.0%) –** We employ a building block process similar to the U.S. equity model using the developed and emerging markets that comprise the MSCI All-Country World Index. Our roll-up model produces an expected real return of 5.0% for global equity.
- **International (Non-U.S.) Equity, Developed Markets (5.2%) –** We employ a building block process similar to the U.S. equity model using the non-U.S. developed equity markets that comprise the MSCI EAFE Index.
- **Emerging Market Stocks (5.3%)** - We employ a building block process similar to the U.S. equity model using the non-U.S. emerging equity markets that comprise the MSCI Emerging Markets Index.
- **Equity Risk Insurance Premium Strategies-High Beta (3.9%) –** We expect real returns from 50% equity + 50% cash beta of 2.0% plus 1.9% insurance risk premium over the next 30 years.

Alternative Asset Classes

- **Hedge Fund-of-Funds Universe (1.2%) –** The generic category "hedge funds" encompasses a wide range of strategies accessed through "fund-of-funds" vehicles. We also assume the ***median*** manager is selected and also allow for the additional costs associated with Fund-of-Funds management. A top-tier portfolio of funds (hedge fund-of-funds buy-list) could add an additional 1.2% in return at similar volatility based on alpha, lower fees and better risk management.

Aon Investments' Capital Market Assumptions

Explanation of Capital Market Assumptions—Q1 2021

- **Hedge Fund-of-Funds Buy List (2.4%) –** The generic category of top-tier "hedge funds" encompasses a wide range of strategies accessed through "fund-of-funds" vehicles. We assume additional costs associated with Funds-of-Funds management. To use this category the funds must be buy rated or we advise on manager selection.
- **Broad Hedge Funds Universe (2.5%) –** Represents a diversified portfolio of direct hedge fund investments. This investment will tend to be less diversified than a typical "fund-of-funds" strategy as there will be fewer underlying managers and will not include the extra layer of fees found in a Fund-of-Funds structure.
- **Broad Hedge Funds Buy List (3.8%) –** Represents a diversified portfolio of top-tier direct hedge fund investments. This investment will tend to be less diversified than a typical "fund-of-funds" strategy as there will be fewer underlying managers and will not include the extra layer of fees found in a Fund-of-Funds structure. To use this category the funds must be buy rated or we advise on manager selection.
- **Core Real Estate (3.4%)** -- Our real return assumption for core real estate is based a gross income of about 3.5%, management fees of roughly 1%, 25% leverage and future capital appreciation near the rate of inflation during the next 30 years. We assume a portfolio of equity real estate holdings that is diversified by property and by geographic region.
- **Non-Core Real Estate (5.2%)** -- Core real estate is levered approximately 100% as the base building block for this assumption. We subtract financing costs for the leverage and 2% management costs. We also assume nominal alpha of 3%. We assume a 50/50 mix of value-add and opportunistic investments.
- **U.S. REITs (3.7%) –** Our real return assumption for U.S. REITs is based on income of about 3.7% and future capital appreciation near the rate of inflation during the next 30 years. REITs are a sub-set of U.S. small/mid cap equity universe.
- **Commodities (1.7%) –** Our commodity assumption is for a diversified portfolio of commodity futures contracts. Commodity futures returns are composed of three parts: spot price appreciation, collateral return, and roll return (positive or negative change implied by the shape of the future curve). We believe that spot prices will converge with CPI over the long run (i.e., 2.1%). Collateral is assumed to be LIBOR cash (-0.3%). Also, we believe the roll effect will be near zero, resulting in a real return of about 1.5% for commodities.

Aon Investments' Capital Market Assumptions

Explanation of Capital Market Assumptions—Q1 2021

- **Private Equity (6.8%) –** Our private equity assumption reflects a diversified fund of funds with exposure to buyouts, venture capital, distressed debt, and mezzanine debt.
- **Infrastructure (6.0%) –** Our infrastructure assumption is formulated using a cash flow based approach that projects cash flows (on a diversified portfolio of assets) over a 30-year period. Income and capital growth as well as gearing levels, debt costs and terms, relevant tax and management expenses are all taken into consideration. Our approach produces an expected real return of 6.0% for infrastructure.
- **Equity Risk Insurance Premium Strategies-Low Beta (2.7%) –** We assume real returns from cash of -0.7% + 3.4% from alpha.
- **Alternative Risk Premia (ARP) (3.6%) –** Real return target LIBOR -0.3% plus 3.9% alpha (net of fees)

Volatility / Correlation Assumptions

Assumed volatilities are formulated with reference to implied volatilities priced into option contracts of various terms, as well as with regard to historical volatility levels. For asset classes which are not marked to market (for example real estate), we "de-smooth" historical returns before calculating volatilities. Importantly, we consider expected volatility trends in the future – in recent years we assumed the re-emergence of an economic cycle and a loss of confidence in central bankers would lead to an increase in volatility. Correlation assumptions are generally similar to actual historical results; however, we do make adjustments to reflect our forward-looking views as well as current market fundamentals.

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April 21, 2021

OPERF Leverage

OREGON
STATE
TREASURY

Leverage Definitions

- Company-level leverage. Leverage embedded within the underlying component investments. For example, the S&P 500 has a total-debt-to-market-cap ratio of 0.20[1].
- Investment-level leverage. Leverage embedded within the investment vehicle. For example, every $1.00 invested in a risk parity strategy provides approximately $2.50 of exposure to traditional betas (e.g., equities, fixed income, commodities).
- Fund-level leverage. Leverage through subscription line financing, term loans, repurchase agreements, and/or other approaches. Leverage could be implemented through the asset class portfolios.

Leverage in OPERF

Asset Class	Company-Level	Investment-Level	Fund-Level
Public Equity	Yes	Yes	No
Fixed Income	Yes	No	**Yes**
Private Equity	*Yes*	*No*	No
Real Estate	Yes	Yes	No
Alts – RAP	*Yes*	*No*	No
Alts – DSP	Yes	Yes	No
Risk Parity	Yes	Yes	No

- Fixed Income received OIC approval for *Fund-Level Leverage* at the December 2019 meeting.
- The Fixed Income Portfolio is allowed to utilize up to 25% of leverage as follows:
  - Up to 12.5%: used to allocate across other fixed income asset classes.
  - Additional 12.5%: reserved for scenarios such as extended market downturns or private market capital calls.
    - Use of leverage beyond initial 12.5% subject to governance and control restrictions as outlined in the Appendix.

Governance & Control Considerations

- Board Responsibilities:
  - Set appropriate parameters, via policy, for use of leverage for internal and external portfolios.
  - Delegate “day-to-day” implementation to Staff with periodic reporting requirements to OIC/CIO.
- Staff Responsibilities:
  - Recommend to OIC/CIO leverage parameters for internal and external portfolios:
    - Amount / use / type of leverage, how leverage implemented / maintained, risk parameters, risk management oversight and reporting.
  - Oversee “day to day” implementation & oversight of use of leverage:
    - Within approved limits, implement, monitor and report on use of leverage in both internal and external portfolios.

Use of Leverage Warrants Appropriate Controls by Senior Management

Implementation Considerations

- Risk Management:
  - Appropriate risk management tools required to properly manage leverage; and
  - Monitor & control counterparty risk.
- Maintain Appropriate Levels of Liquidity:
  - During times of market turbulence, liquidity will be required to fund:
    - OPERF benefit payments and private market capital call activities; and
    - Margin & collateral requirements resulting from use of leverage.
- Balance Guardrails with Flexibility:
  - Given uncertainty surrounding market forecasting, minimize proscribed processes that may limit Staff's ability to act quickly.

Appendix

Additional Leverage Guidelines from 12/2019 Fixed Income Strategic Review

Strategic Review: Additional Leverage Guidelines

- Utilization of Additional Leverage beyond 12.5%
  - Remaining leverage of ~12.5% to be reserved for scenarios such as the following:
    - extended down market timeframes; and
    - capital calls associated with OST Private Markets activities.
  - For governance and control purposes, use of leverage above 12.5% would require the approval of:
    - Chief Investment Officer; and
    - Director of Capital Markets.

- Leveraging Sequencing Guidelines
  - Given the uncertainty surrounding forecasting down markets (e.g., timing, depth, duration, etc.), OPERF plan needs at the time as well as future fixed income and OPERF portfolio composition, a pre-set proscribed leveraging sequence is not advisable.

  - However, in an extended down market scenario, the following factors would need to be considered:
    - Expected length and/or severity of the downturn;
    - Amount of US treasuries (most liquid, easily sold assets) as well as leverage to hold in reserve in case market downturn extends and/or becomes more severe;
    - Ease and practicality of selling cash securities vs. leveraging via US treasury futures; and
    - Maintaining a reasonable risk level at the asset class and total plan level.

Additional Use of Leverage Warrants Appropriate Controls by Senior Management

OREGON STATE TREASURY

Tobias Read
Oregon State Treasurer

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Tigard, OR 97224

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TAB 7 – OPERF Liquidity

April 21, 2021

OPERF Liquidity

OREGON
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TREASURY

Agenda

		OIC Investment and Management Beliefs Mapping																	
Section	Pages	1A	1B	1C	1D	2A	2B	3A	4A	4B	5A	5B	6A	6B	7A	7B	8A	8B	9A	9B
Agenda	2																			
Introduction	3			■		■	■		■											
OPERF Maturity	4 - 5			■		■														
OPERF Allocation Over Time	6					■	■		■											
Cash Sources & Uses	7																			
State of the Pension Fund	8			■																
GFC Stress Test	9 - 10			■		■	■													
Takeaways	11			■		■	■		■											

	LEGEND: OIC INVESTMENT AND MANAGEMENT BELIEFS
1	**THE OIC SETS POLICY AND IS ULTIMATELY RESPONSIBLE FOR THE INVESTMENT PROGRAM**
	A. Investment management is dichotomous -- part art and part science.
	B. The OIC is a policy-setting council that largely delegates investment management activities to the OST and qualified external fiduciaries.
■	C. The OIC is vested with the authority to set and monitor portfolio risk. Both short-term and long-term risks are critical.
	D. To exploit market inefficiencies, the OIC should be long term, contrarian, innovative, andopportunistic in its investment approach.
2	**ASSET ALLOCATION DRIVES RISK AND RETURN**
■	A. Asset allocation is the OIC's primary policy tool for managing the investment program's long-term risk/return profile.
■	B. Portfolio construction, including diversification and correlation considerations, is essential to maximizing risk-adjusted returns.
3	**THE EQUITY RISK PREMIUM WILL BE REWARDED**
	A. Over the long-term, equity-oriented investments provide reliable return premiums relative to risk-free investments.
4	**PRIVATE MARKET INVESTMENTS CAN ADD SIGNIFICANT VALUE AND REPRESENT A CORE OIC/OST COMPETENCY**
■	A. The OIC can capitalize on its status as a true, long-term investor by making meaningful allocations to illiquid, private market investments.
	B. Dispersion in private market investment returns is wide; accordingly, top-quartile manager selection, diversification across vintage year, strategy type, and geography, and careful attention to costs are paramount.
5	**CAPITAL MARKETS HAVE INEFFICIENCIES THAT CAN BE EXPLOITED**
	A. Inefficiencies that can be exploited by active management may exist in certain segments of the capital markets.
	B. Passive investment management in public markets will outperform the median active manager in those markets over time.
6	**COSTS DIRECTLY IMPACT INVESTMENT RETURNS AND SHOULD BE MONITORED AND MANAGED CAREFULLY**
	A. All fees, expenses, commissions, and transaction costs should be diligently monitored and managed in order to maximize net investment returns.
	B. External incentive structures should be carefully evaluated to ensure proper alignment with investment program objectives.
7	**FAIR AND EFFICIENT CAPITAL MARKETS ARE ESSENTIAL FOR THE LONG-TERM INVESTMENT SUCCESS**
	A. The OIC recognizes that the quality of regulation and corporate governance can affect the long-term value of its investments.
	B. The OIC also recognizes that voting rights have economic value.
8	**THE INTEGRATION OF ENVIRONMENTAL, SOCIAL AND GOVERNANCE (ESG) FACTORS, SIMILAR TO OTHER INVESTMENT FACTORS, MAY HAVE A BENEFICIAL IMPACT ON THE ECONOMIC OUTCOME OF AN INVESTMENT AND AID IN THE ASSESSMENT OF RISKS ASSOCIATED WITH THAT INVESTMENT**
	A. The consideration of ESG factors within the investment decision-making framework is importantin understanding the near-term and long-term impacts of investment decisions.
	B. Over time, there has been an evolution of multi-factor, or more holistic approaches, to identify opportunities and remediate risks, in a large globally-diversified investment portfolio.
9	**DIVERSITY, IN ALL ASPECTS, IS ACCRETIVE TO MEETING OIC OBJECTIVES**
	A. By embracing and enhancing diversity and inclusion efforts, the OIC ensures that the investment program will be exposed to and informed by a wide range of perspectives, ideas and opinions.

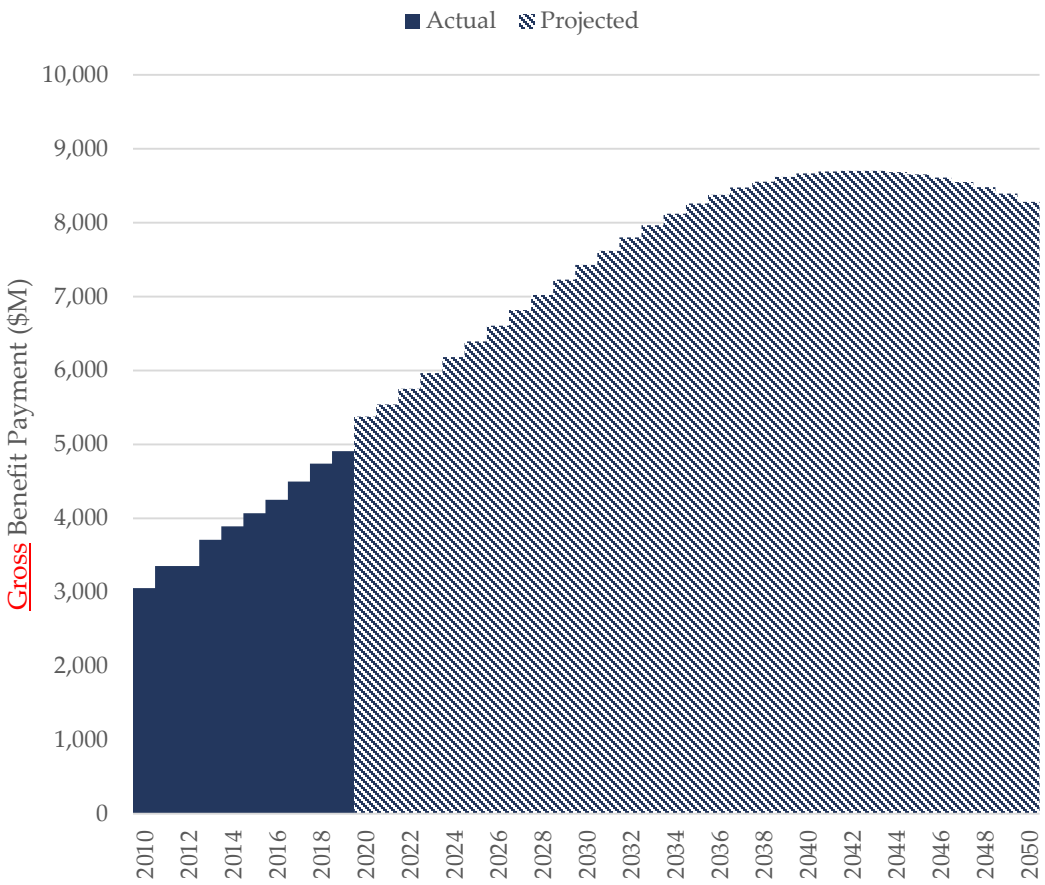
Introduction

- OPERF is a mature, “cash flow negative” pension fund, i.e., it pays out more in benefits than it receives in contributions (“net pension payment”).
- OPERF’s liquidity profile warrants analysis and attention because of its substantial net pension payment and a large strategic allocation to illiquid investments.
- OPERF’s cash raises have mainly been through liquidations of public equity securities, making the Fund vulnerable to market downturns.
- As of December 31, 2020, $5.6 billion or 6.8% of OPERF is invested in an internally-managed Bloomberg Barclays Treasury mandate, which should mitigate equity market volatility and provide liquidity at the total Fund level.

OPERF Maturity

Calendar Year	OPERF ex-IAP ($B)	Net Pension Payout ($B)	Payout Ratio (B_t/A_{t-1})	Actuarial Accrued Liability ($B)	Funded Ratio (A / D)
	A	B	C	D	E
2004	46.7				
2005	51.6	-1.2	-2.5%	49.3	105%
2006	57.5	-1.9	-3.8%	51.3	112%
2007	61.2	-1.9	-3.2%	52.9	116%
2008	43.1	-2.1	-3.4%	54.3	79%
2009	48.8	-2.2	-5.0%	56.8	86%
2010	52.2	-2.5	-5.2%	59.3	88%
2011	50.8	-2.7	-5.1%	61.2	83%
2012	55.5	-2.4	-4.7%	60.4	92%
2013	61.3	-2.7	-4.9%	62.6	98%
2014	62.8	-2.8	-4.6%	73.5	85%
2015	61.2	-2.8	-4.5%	76.2	80%
2016	62.4	-3.2	-5.2%	81.0	77%
2017	68.5	-3.3	-5.3%	84.1	81%
2018	65.7	-2.9	-4.3%	86.6	76%
2019	71.3	-2.6	-4.0%	89.4	80%
2020	74.6	-3.0	-4.2%	???	???

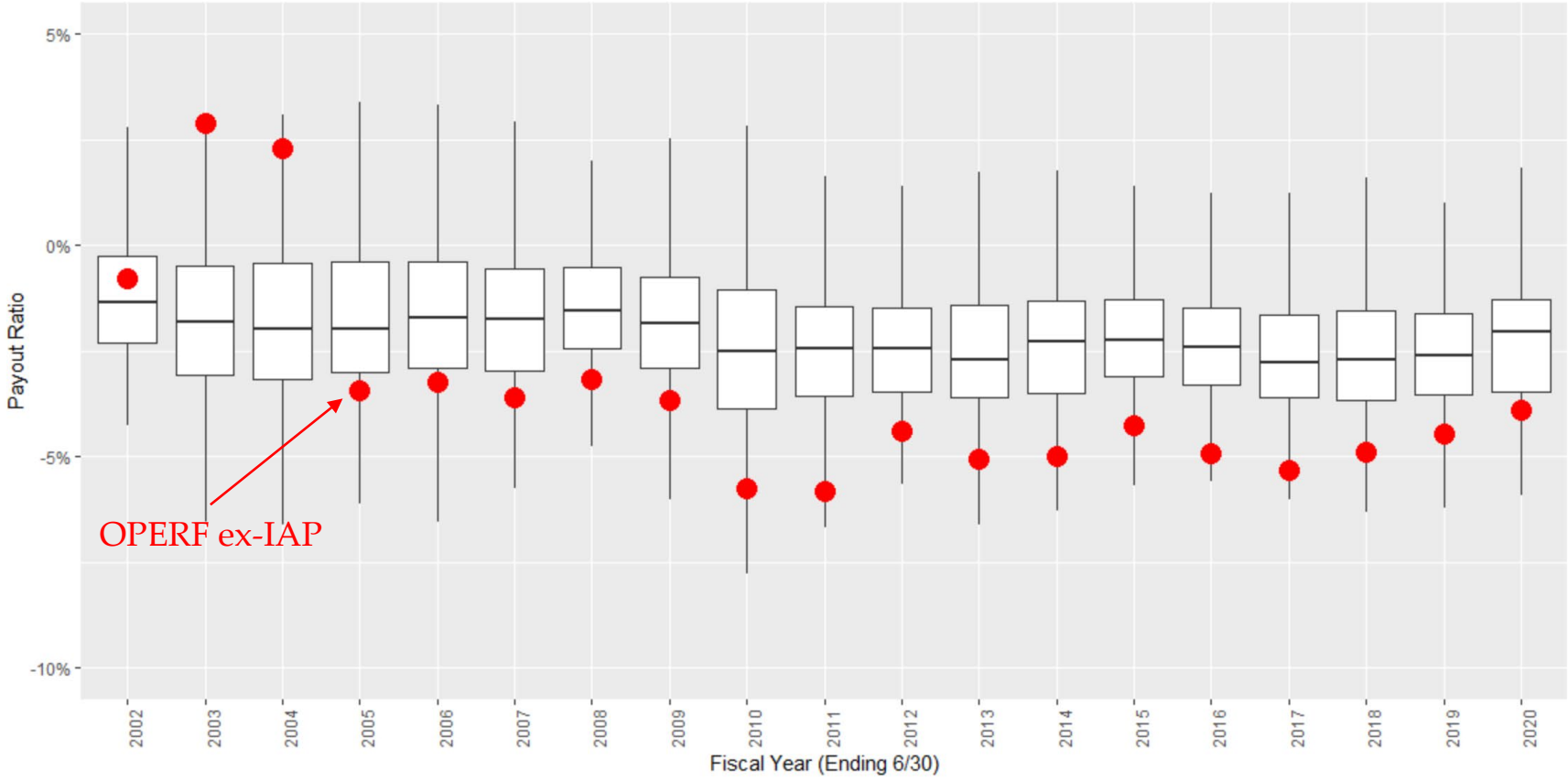
Source: State Street, PERS, and OST

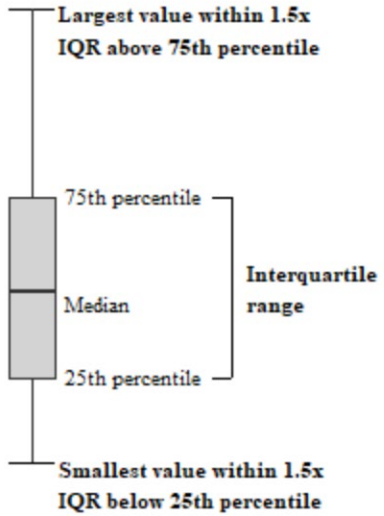


Source: PERS and Milliman

OREGON STATE TREASURY

OPERF Maturity Relative to Peers
Distribution of Payout Ratio by Year

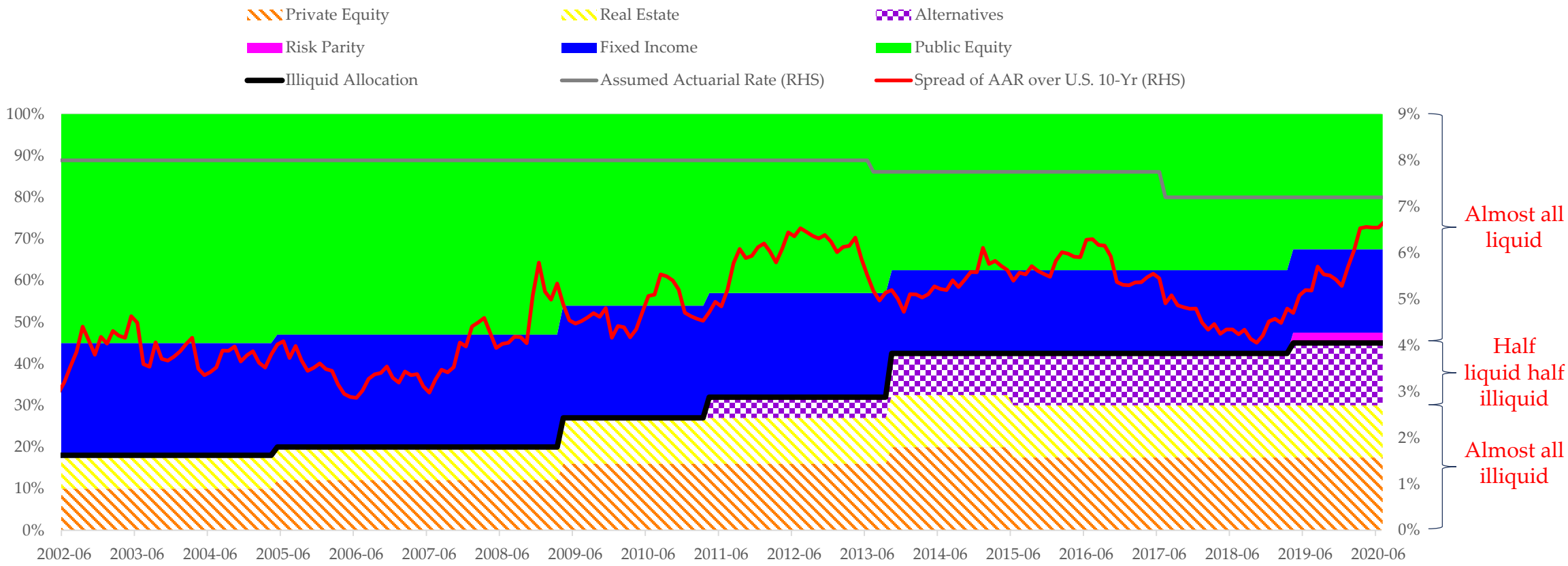




Source: Public Plans Data

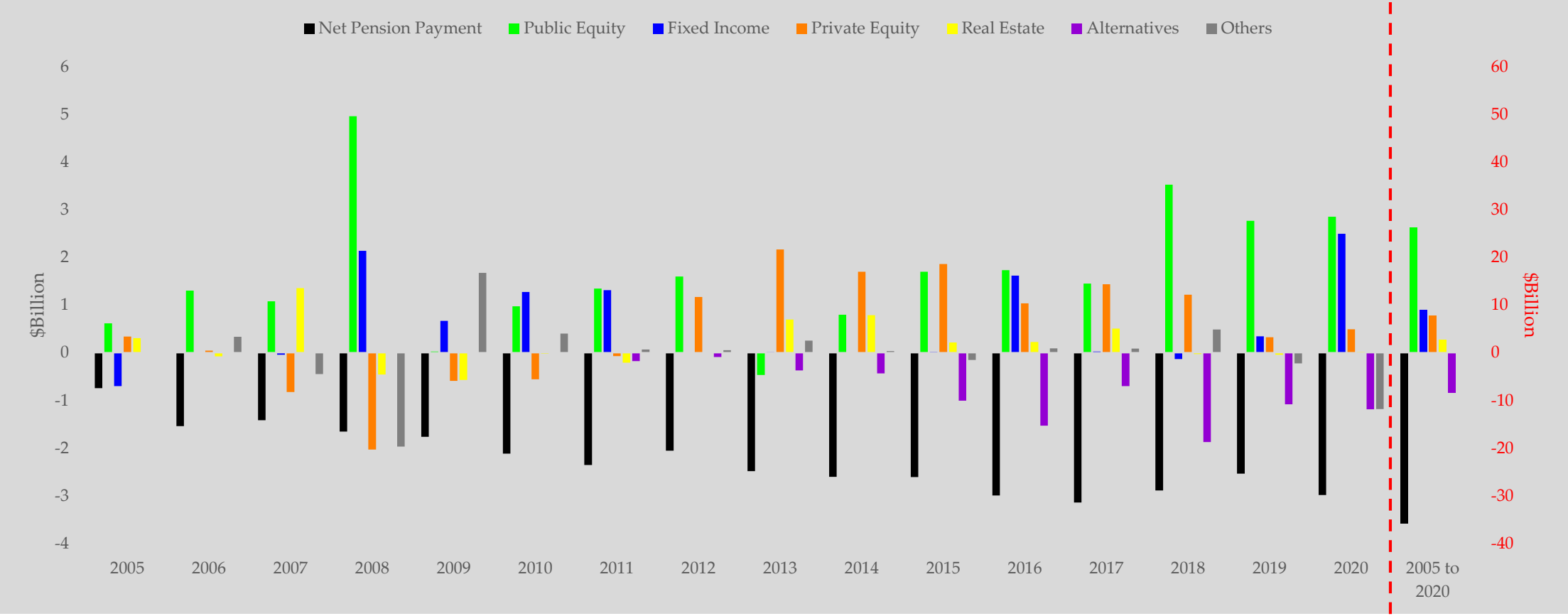
OREGON STATE TREASURY

OPERF Target Allocations & Liquidity Over Time



OREGON STATE TREASURY

Cash Sources and Uses



OREGON STATE TREASURY

State of the Pension Fund (OPERF ex-IAP)

- The Fund:
  - Seeks a high return in excess of 10-Year Treasury (5.3% as of December 2019);
  - Is a mature fund (approximately 3.8% payout ratio); and
  - Has a funded ratio of approximately 80%.

- Therefore:
  - Has a large allocation to high returning, illiquid investments;
  - Has an annual net cash outflow of approximately $3 billion; and
  - Is sensitive to downside market events that could diminish the corpus.

Global Financial Crisis (GFC) Liquidity

	In $Billions					Calendar Year Return					Asset Class Weight				
OPERF Asset Class	**2006**	**2007**	**2008**	**2009**	**2010**	**2006**	**2007**	**2008**	**2009**	**2010**	**2006**	**2007**	**2008**	**2009**	**2010**
Public Equity	33.6	33.1	15.2	20.8	23.0	18.9%	8.9%	-42.6%	36.9%	15.7%	56.3%	52.3%	38.2%	43.0%	41.7%
Fixed Income	14.9	15.6	11.9	13.2	13.3	5.8%	4.8%	-9.9%	25.7%	10.8%	26.8%	25.9%	26.5%	25.6%	25.4%
Risk Parity	0.0	0.0	0.0	0.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cash and Cash Overlay	0.7	0.6	2.1	1.3	1.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	-0.2%	0.1%	-0.2%	0.0%
Total Liquid	49.1	49.4	29.1	35.2	37.3						83.3%	78.0%	64.8%	68.4%	67.0%
Private Equity	5.8	8.8	9.8	9.8	12.0	23.1%	28.1%	-8.4%	-4.4%	16.4%	9.8%	13.9%	21.9%	19.1%	21.5%
Real Estate	4.0	4.7	5.3	5.4	5.3	27.3%	10.2%	-13.6%	-9.4%	-1.9%	6.8%	7.4%	11.7%	10.5%	9.6%
Alternatives	0.0	0.0	0.0	0.0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Opportunity	0.0	0.4	0.7	1.0	1.1	0.0%	3.0%	-24.8%	37.5%	12.4%	0.1%	0.7%	1.6%	2.0%	1.9%
Total Illiquid	9.8	13.9	15.9	16.3	18.4						16.7%	22.0%	35.2%	31.6%	33.0%
Total	**59.0**	**63.3**	**45.0**	**51.5**	**55.7**	**16.0%**	**9.9%**	**-26.9%**	**19.4%**	**12.6%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Synthetic Exposure	**2006**	**2007**	**2008**	**2009**	**2010**
Public Equity	-0.3	0.0	2.0	1.4	0.2
Fixed Income	0.9	0.7	0.0	0.0	0.8
Cash	-0.5	-0.7	-2.1	-1.4	-1.0
Contribution	0.6	0.8	0.6	0.6	0.4
Benefits & Expenses	-2.6	-2.7	-2.8	-2.9	-3.1
Net Pension Payout	-2.0	-1.9	-2.2	-2.3	-2.7
Payout Ratio		**-3.3%**	**-3.5%**	**-5.1%**	**-5.2%**

Apply (some) GFC returns to current asset values and net pension payouts as a liquidity stress test.

OREGON STATE TREASURY

GFC Stress Test

	Calendar Year Return					In $Billions (ex-IAP and Including Synthetic Exposure)						Asset Class Weight					
OPERF Asset Class	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	***Year 0***	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	***Year 0***	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Public Equity	-42.6%	0.0%	0.0%	0.0%	0.0%	*23.0*	13.2	11.7	9.7	7.7	5.7	*31.2%*	23.0%	21.6%	18.9%	16.0%	12.6%
Fixed Income	0.0%	0.0%	0.0%	0.0%	0.0%	*14.7*	11.8	10.7	9.7	8.8	7.9	*19.9%*	20.5%	19.6%	19.0%	18.2%	17.4%
Risk Parity	0.0%	0.0%	0.0%	0.0%	0.0%	*1.8*	1.8	1.4	1.3	1.2	1.1	*2.4%*	3.1%	2.5%	2.5%	2.5%	2.5%
Cash and Cash Overlay	0.0%	0.0%	0.0%	0.0%	0.0%	*0.1*	0.0	0.0	0.0	0.0	0.0	*0.1%*	0.0%	0.0%	0.0%	0.0%	0.0%
Total Liquid						*39.5*	26.7	23.7	20.7	17.7	14.7	*53.6%*	46.6%	43.7%	40.4%	36.7%	32.5%
Private Equity	-12.4%	0.0%	0.0%	0.0%	0.0%	*17.3*	15.2	15.2	15.2	15.2	15.2	*23.5%*	26.4%	27.9%	29.5%	31.4%	33.4%
Real Estate	-13.6%	0.0%	0.0%	0.0%	0.0%	*7.9*	6.8	6.8	6.8	6.8	6.8	*10.7%*	11.8%	12.5%	13.2%	14.1%	15.0%
Alternatives	0.0%	0.0%	0.0%	0.0%	0.0%	*7.5*	7.5	7.5	7.5	7.5	7.5	*10.1%*	13.0%	13.8%	14.6%	15.5%	16.5%
Opportunity	-24.8%	0.0%	0.0%	0.0%	0.0%	*1.5*	1.2	1.2	1.2	1.2	1.2	*2.1%*	2.0%	2.1%	2.3%	2.4%	2.6%
Total Illiquid						*34.2*	30.6	30.6	30.6	30.6	30.6	*46.4%*	53.4%	56.3%	59.6%	63.3%	67.5%
Total						***73.7***	**57.3**	**54.3**	**51.3**	**48.3**	**45.3**	***100.0%***	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Net Pension Payout							-3.0	-3.0	-3.0	-3.0	-3.0						

A lot of assumptions!

- 0% returns for Fixed Income, Risk Parity, and Alternatives during the stress event.
- An L-shaped market for the subsequent four years.
- Zero net cash flow from the illiquid investments for five years.
- Constant net pension payout for five years.

Takeaways

- "OPERF" is a mature, cash flow negative pension system with projected increasing gross benefit payments for the next 20 years.
- Due to a high return objective in an environment of decreasing interest rates, OPERF asset allocation has steadily tilted towards illiquid investments.
- OPERF likely has sufficient liquidity in a five-year, L-shaped stress event but the asset class allocations would have large variances against targets.
- The OIC must balance the following three portfolio attributes in its OPERF asset allocation deliberations: Long-Term Return; Short-Term Risk; and Liquidity. The first two attributes affect OPERF's funded ratio and employer contribution rates, while Liquidity influences OPERF's capacity to meet pension obligations and capital calls without negatively impacting Return and Risk.

OREGON STATE TREASURY

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TAB 8 – Low Interest Rates, Risk Mitigation

MEKETA
INVESTMENT GROUP

Oregon Investment Council

April 2021

Diversification in a Low Interest Rate Environment

Introduction

- US Treasury interest rates have declined significantly and steadily over the last 40 years.
  - Rates hit historical lows in 2020.
  - Despite ticking upwards to start 2021, they remain at very low levels.

- Historically, high quality investment grade bonds have been a staple in institutional investment portfolios.
  - Their forward-looking relevance and attractiveness is an ongoing discussion.

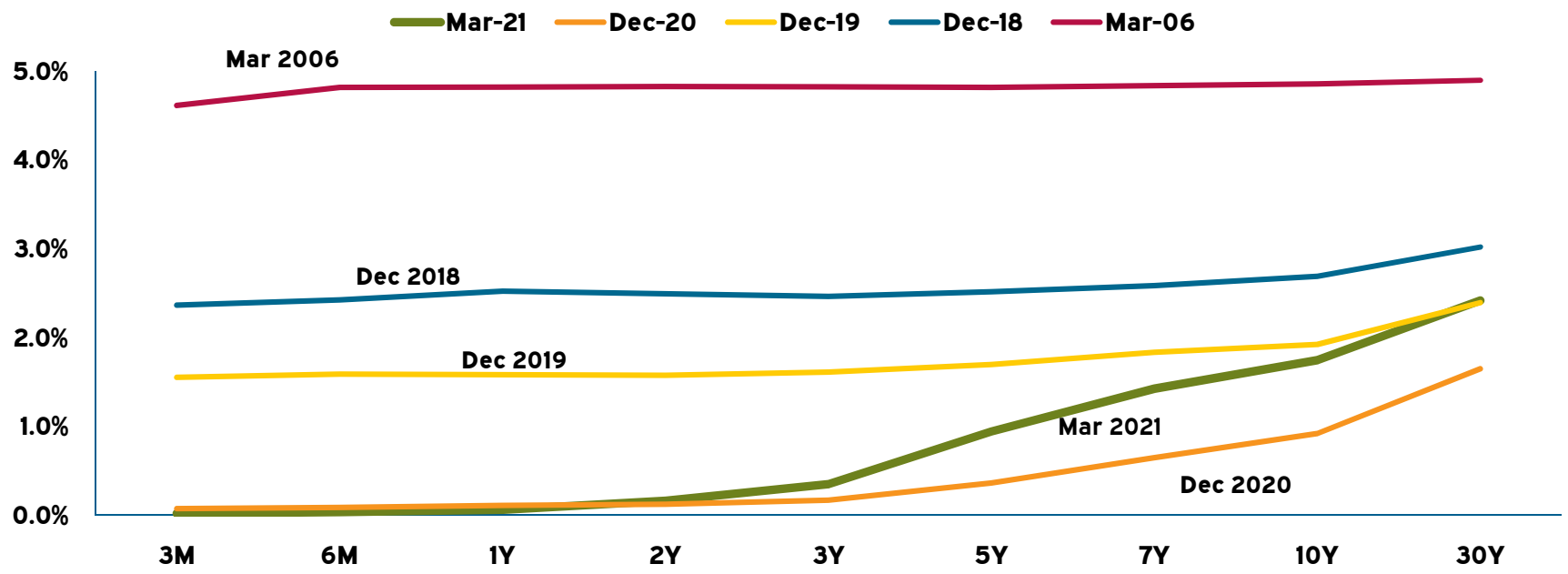
- This presentation seeks to accomplish two objectives:
  1. Examine interest rates in a historical context.
  2. Introduce corresponding considerations for the OPERF portfolio.

Historical Context

A Low Interest Rate Environment

- Due in large part to COVID, interest rates compressed to historically low levels in 2020.
  - Monetary policy lowered yields in shorter maturities, while flight-to-quality flows, low inflation, and lower growth expectations generally drove the changes in longer-dated maturities.
- Despite modestly higher rates in 2021, they remain at very low levels.

US Yield Curve – Points in Time[1]

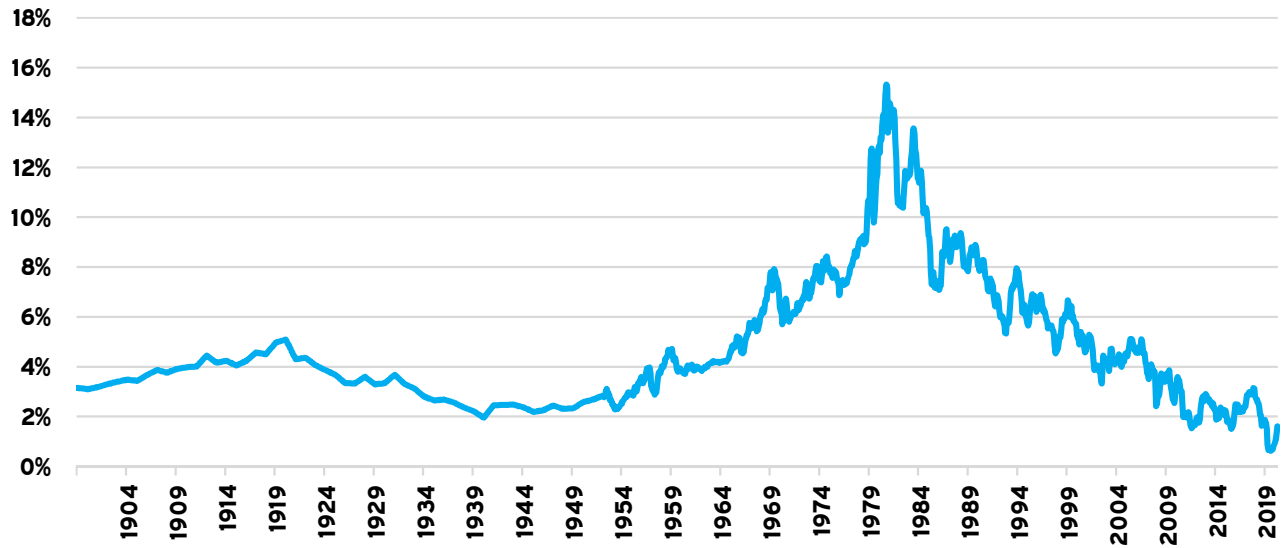


[1] Source: Bloomberg.

How Low, and for How Long?

- US interest rates have essentially reached all-time lows.
- It is quite possible they are going to stay low.
  - If the Fed thinks stimulating economic growth will require low rates across the curve, they may continue to intervene and manage the yield curve.
  - The Fed actively managed the Treasury Yield Curve in the 1940s (during WWII).[1]

US Treasury 10-Year Rates[2]



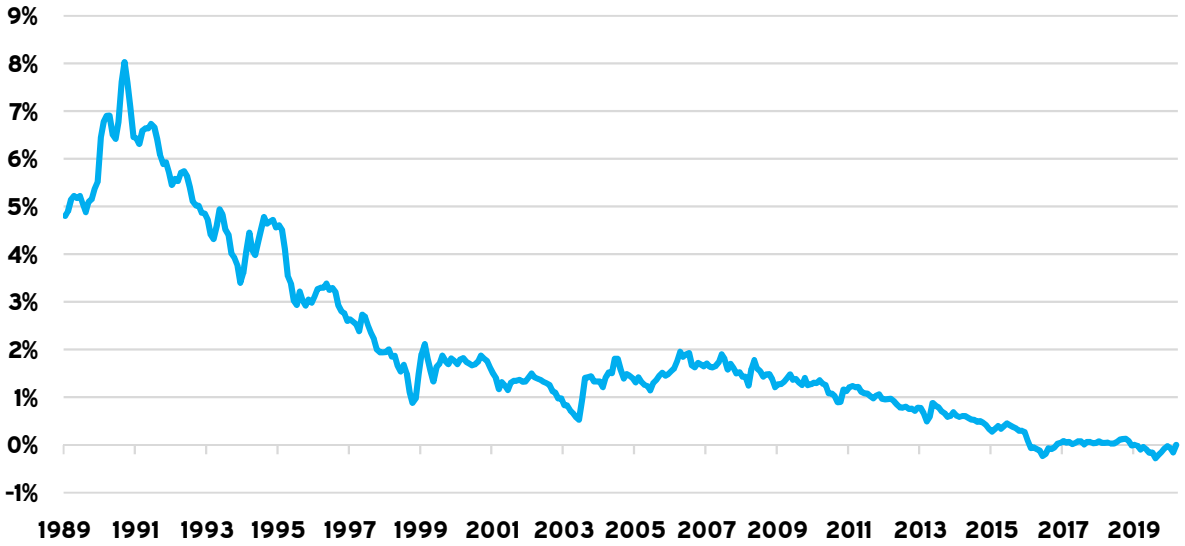
[1] Source: Kenneth D. Garbade, "How the Fed Managed the Treasury Yield Curve in the 1940s," Federal Reserve Bank of New York Liberty Street Economics, April 6, 2020, https://libertystreeteconomics.newyorkfed.org/2020/03/how-the-fed-managed-the-treasury-yield-curve-in-the-1940s.html

[2] Source: FRED, Multpl.com

How Low, and for How Long (continued)

- There is global precedent for rates staying low for a long time.
  - Japan has been experiencing very low rates for the past 20+ years.
- It may even be possible that rates move lower.
  - US rates could theoretically push past what many once considered a zero bound.
  - Foreign rates have gone negative in recent years, and not just in Japan.[1]

Japanese 10-Year Rates



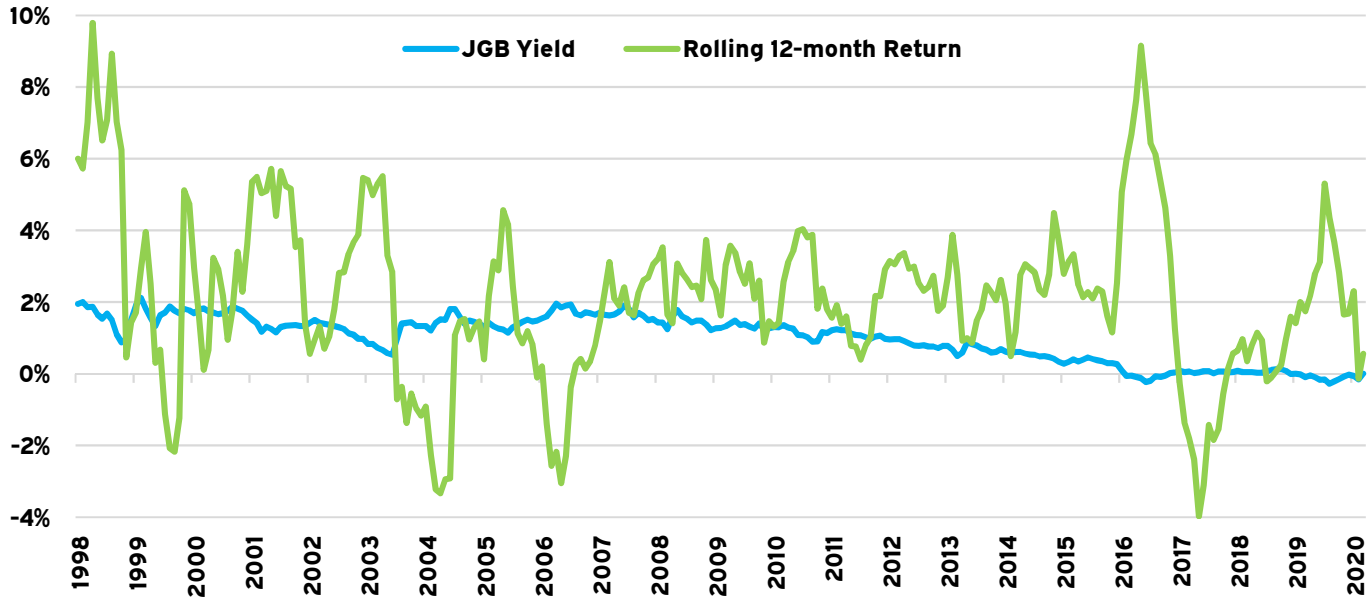
- The most likely reason for the Fed to reverse course on rates would be to fight inflation.

[1] Germany, Japan, Denmark, Sweden, Switzerland, Spain, France, Ireland, Portugal, and Austria have all experienced negative rates at some point since 2016.

Should we fear bonds when rates are low?

- If the Fed wants to keep rates steady, they can, implying limited downside to bonds.
- A good case study is Japan, who instituted a Zero Interest Rate Policy (ZIRP) in 1999.
- Since the inception of ZIRP in Japan, government bonds have produced fairly steady, if modest, returns.
  - The average annual return was 1.9%, and the worst 12-month decline was a -4% drawdown.

Japanese Government Bond Yields and Returns[1]



[1] Data Source for JGB returns is the ICE BofA Japan Government Index and its components. 10-year rates fell and stayed below 2% in 1998, hence we used this as the inception point for our analysis.

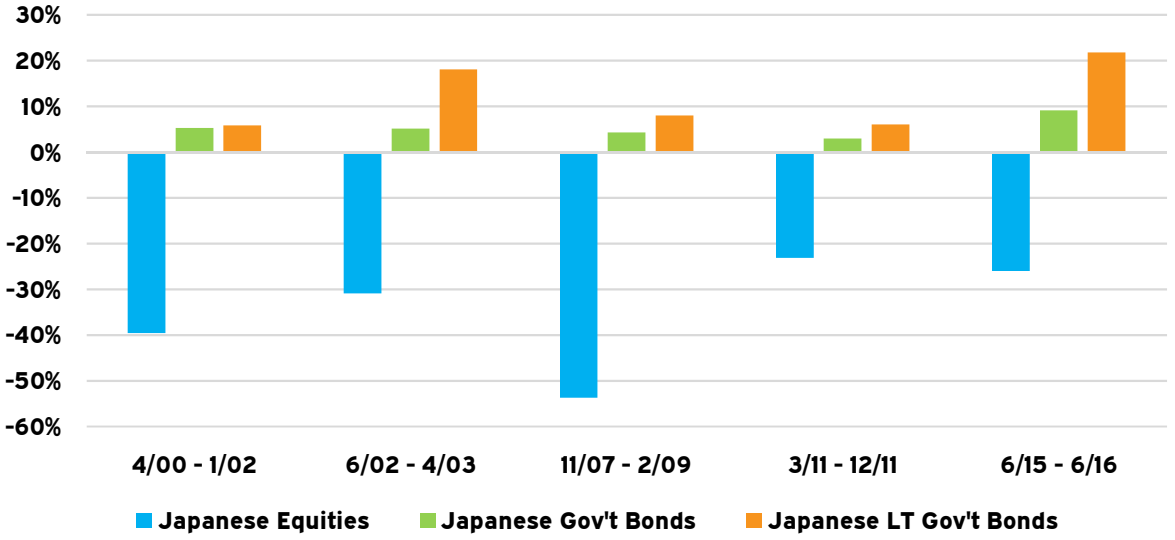
Should we fear bonds when rates are low? (continued)

- If the Fed is going to manage the yield curve to be normally sloped, it reduces the risk of rising rates, particularly for longer-term bonds.
  - Hence, investors should not be afraid to hold intermediate and longer duration bonds.
    - The carry trade will be their friend.
- The most likely cause of rising rates would be the Fed raising them to fight inflation.
- Even still, there is some (unknown) tolerance for inflation that the Fed will probably be willing to accept.
  - It is likely (much) higher than the stated 2% target.
  - It would probably be tolerated for an extended period, depending on its magnitude and side effects (e.g., impact on employment).

But can bonds still provide a hedge?

- There is an unknown level below which rates cannot fall, perhaps -1.0%.
  - This places a limit on how good of a hedge bonds, especially long bonds, can provide.
- During the worst drawdowns in Japan, government bonds consistently served as a hedge.
  - Long-term government bonds served as a better hedge, despite the low starting yield.

Worst Drawdowns during ZIRP (Cumulative Return)[1]



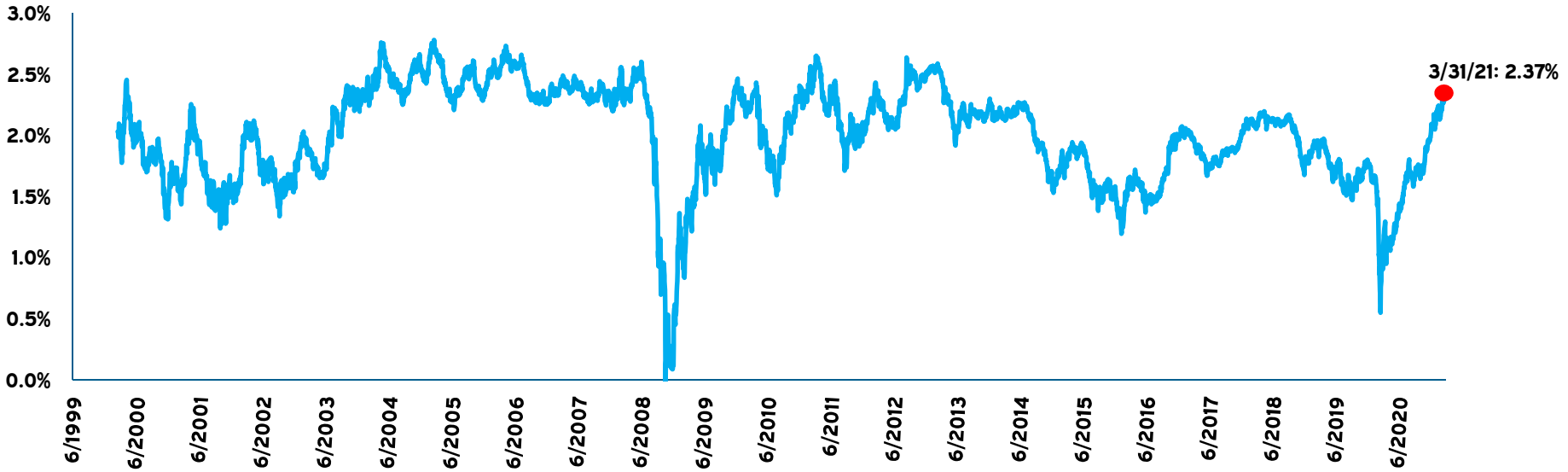
- The 2015-16 drawdown is particularly informative, as the 10-year rate at the start of the period was just 0.46% and it declined to -0.23%.

[1] Data Source for JGB returns is the ICE BofA Japan Government Index and its components; for equities, the source is MSCI Japan (local currency).

Inflation: looming on the horizon?

- There are two massive, naturally opposed forces right now:
  - Current-day deflationary forces from the pandemic, as well as more secular deflationary forces from technology, globalization, and demographics.
  - Inflationary fiscal and monetary forces from the unprecedented level of stimulus. The reversal of secular deflationary forces (e.g., demographics, globalization, etc.) may also increase inflation.
- The market is assuming inflation will remain low/moderate:

10-Year Breakeven Inflation[1]



[1] Source: Bloomberg.

Long US Treasuries as a Diversifier
S&P 500 Corrections (peak-to-trough timeframe) | 1958-present

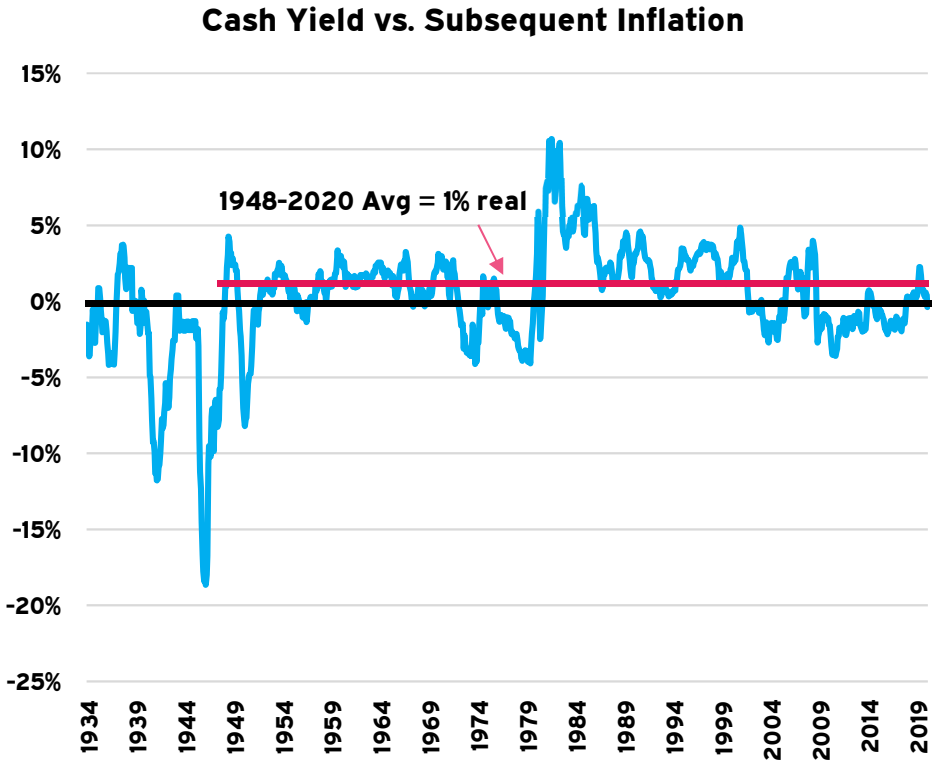
Start	Trough	S&P TR	Avg Infl Rate	High/Low Infl	LT US Tsy TR	Notes
12/31/1961	6/30/1962	-22.3%	1.5%	Low	4.0%	Protective
1/31/1966	9/30/1966	-15.6%	2.2%	Low	-0.2%	Flat
11/30/1968	6/30/1970	-29.3%	5.9%	High	-8.0%	Not protective
12/31/1972	9/30/1974	-42.6%	5.1%	High	-4.0%	Flat
12/31/1976	2/28/1978	-14.1%	6.3%	High	-0.9%	Flat
11/30/1980	7/31/1982	-16.9%	10.0%	High	15.9%	Protective
8/31/1987	11/30/1987	-29.5%	4.3%	High	2.6%	Flat
5/31/1990	10/31/1990	-14.7%	5.2%	High	2.3%	Flat
8/31/2000	9/30/2002	-44.7%	2.6%	Low	28.9%	Protective
10/31/2007	2/28/2009	-50.9%	2.2%	Low	16.8%	Protective
12/31/2019	3/31/2020	-19.6%	2.1%	Low	20.7%	Protective
High inflation >= 3%, low < 3%		**Not protective <= -5% LT US Tsy TR, -5% < Flat < +5%, Protective >= +5%**				

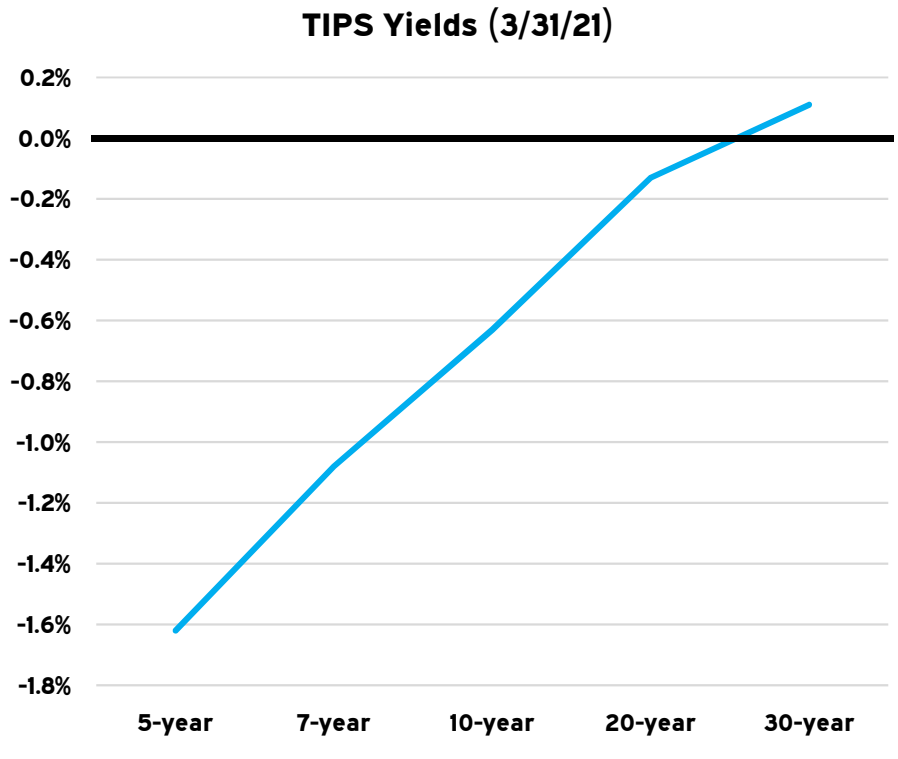
Source: Bloomberg

- Treasury bonds may still serve as a valuable hedge during stressed periods, regardless of the level of inflation.
- The reality is, the *average correlation does not matter*. Rather, it is the correlation during periods of market stress that is paramount.
- We conclude that Treasuries have played, and are expected to play, an important hedging role in equity-dominated portfolios during stressed periods for equities (i.e., as a "safe haven").
  - However, institutional investors should examine other forms of "first responder" protection.

Negative Real Yields

- Since 1948, cash yields have generally been higher than subsequent inflation (i.e., positive real yield).
- Currently, almost the entire real yield US Treasury curve (i.e., TIPS) is in negative territory.





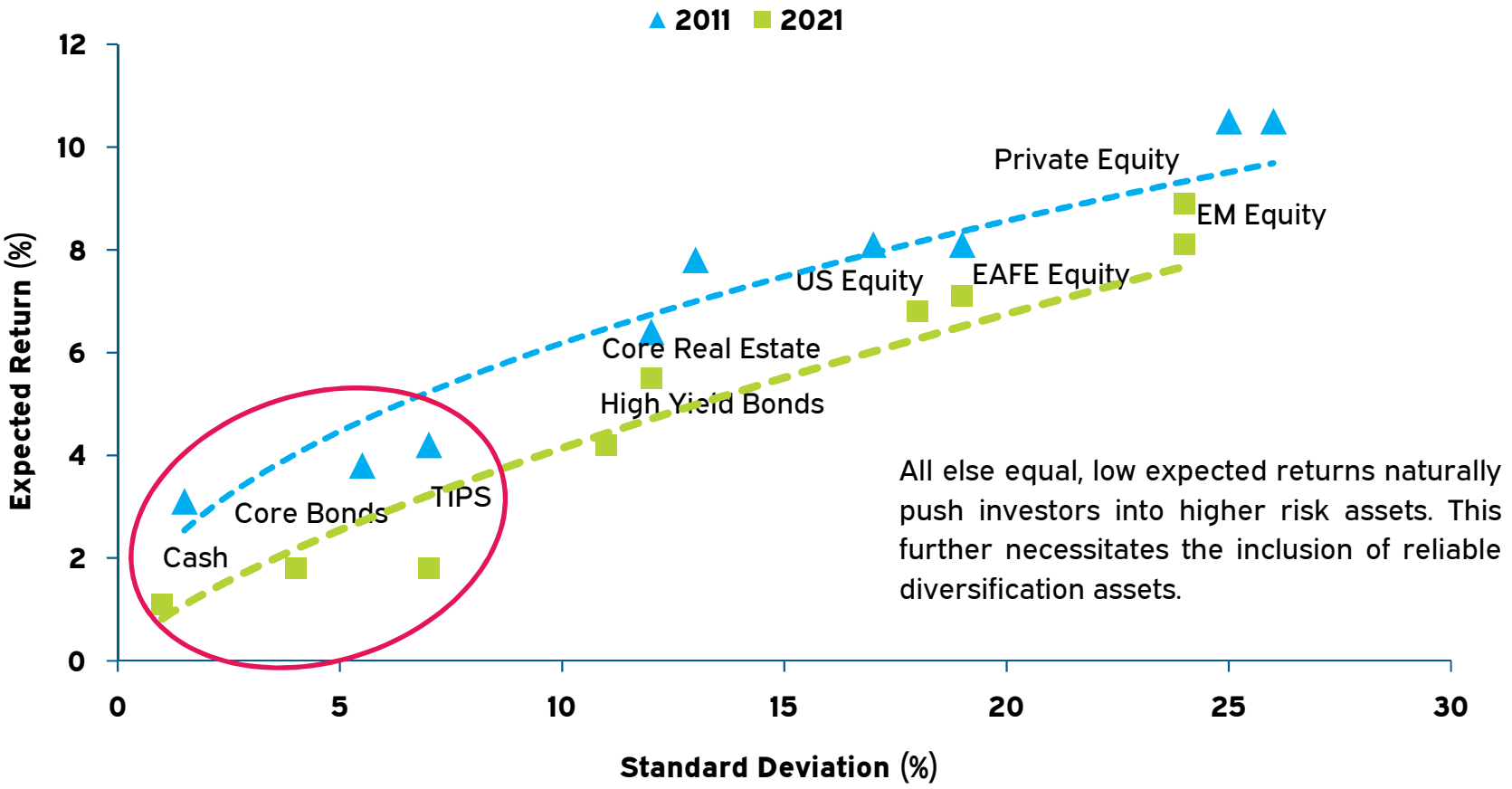
Source: Federal Reserve

- Investors in TIPS are effectively locking in negative real returns. Investors in nominal bonds are likely locking in negative real returns.

Considerations for the OPERF Portfolio

Low rates = low future returns

- Interest rates naturally influence the expected returns of all asset classes.



Role of Fixed Income

Fixed Income has historically exhibited three key characteristics:

1. Principal protection (i.e., liquidity and low volatility)

   For shorter duration securities, this likely will remain true in nominal terms. As highlighted earlier, high quality fixed income is expected to produce negative real returns in the short to intermediate terms.

2. Diversification relative to equity (i.e., low-to-negative correlation)

   Meketa expects US Treasury notes/bonds to continue to protect during certain equity drawdowns, albeit with less responsiveness than what has occurred over the last 40 years.

   If inflation drives an equity drawdown, Meketa would not expect US Treasuries to offer protection.

3. Modest return/yield

   US Treasuries currently offer little to no nominal return. Real returns are even worse.

   In order for fixed income portfolios to generate a reasonable level of return, they must take on material credit risk.

Summary

- Rates are incredibly low. This does not bode well for future returns.
- It will be more difficult than ever for institutional investors to achieve their target returns.
  - While doing so will prove challenging, it is not impossible.
- The reliability and potency of investment grade bonds (e.g., US Treasuries) as an equity hedge/diversifier may be challenged going forward.
- Meketa and OST Staff recommend exploring other strategies to help serve this portfolio function (i.e., "first responder" during equity drawdowns).
  - For portfolio management/diversification purposes, it may still be prudent to maintain an allocation to US Treasury bonds.
  - Inflation remains the largest risk to holding US Treasury bonds. This topic deserves a dedicated discussion.
- Potential enhancements will be explored and presented to the OIC over time.
- The importance of drawdown protection, and thus the need to complement US Treasury exposure, will be discussed during the ongoing asset allocation process.

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TAB 9 – Asset Allocation & NAV Updates

Asset Allocations at February 28, 2021

OPERF	Policy	Target[1]	Regular Account $ Thousands	Pre-Overlay	Overlay	Net Position	Actual	Target Date Funds $ Thousands	Variable Fund $ Thousands	Total Fund $ Thousands
Public Equity	27.5-37.5%	32.5%	27,657,566	33.2%	(1,284,026)	26,373,540	31.6%	1,191,615	434.397	27,999,551
Private Equity	13.5-21.5%	17.5%	19,800,002	23.7%		19,800,002	23.7%			19,800,002
Total Equity	**45.0-55.0%**	**50.0%**	**47,457,568**	**56.9%**	**(1,284,026)**	**46,173,542**	**55.4%**			**47,799,553**
Opportunity Portfolio	**0-5%**	**0.0%**	**1,804,087**	**2.2%**		**1,804,087**	2.2%			**1,804,087**
Fixed Income	**15-25%**	**20.0%**	**13,735,893**	**16.5%**	**2,812,160**	**16,548,052**	19.8%	1,868,935		**18,416,987**
Risk Parity	**0.0-2.5%**	**2.5%**	**1,999,308**	**2.4%**		**1,999,308**	2.4%			**1,999,308**
Real Estate	**9.5-15.5%**	**12.5%**	**8,739,545**	**10.5%**	**(1,000)**	**8,738,545**	10.5%			**8,738,545**
Alternative Investments	**7.5-17.5%**	**15.0%**	**8,119,127**	**9.7%**		**8,119,127**	9.7%			**8,119,127**
Cash[2]	**0-3%**	**0.0%**	**1,565,362**	**1.9%**	**(1,527,133)**	**38,229**	0.0%		6,952	**45,181**
TOTAL OPERF		**100%**	**$ 83,420,890**	**100.0%**	**$ -**	**$ 83,420,890**	**100.0%**	**$ 3,060,549**	**$ 441,349**	**$ 86,922,788**

[1]Targets established in April 2019. Interim policy benchmark effective July 1, 2020, consists of: 33.5% MSCI ACWI IMI Net, 20% Custom FI Benchmark, 19% Russell 3000+300bps (1 quarter lagged), 12.5% NCREIF ODCE net (1 quarter lagged), 12.5% CPI+400bps, & 2.5% S&P Risk Parity - 12% Target Volatility.

[2]Includes cash held in the policy implementation overlay program.

SAIF	Policy	Target	$ Thousands	Actual
Total Equity	**7-13%**	**10.0%**	**588,671**	**11.6%**
Fixed Income	**80-90%**	**85.0%**	**4,303,839**	**84.7%**
Real Estate	**0-7%**	**5.0%**	**161,529**	**3.2%**
Cash	**0-3%**	**0.0%**	**26,934**	**0.5%**
TOTAL SAIF			**$ 5,080,974**	**100.0%**

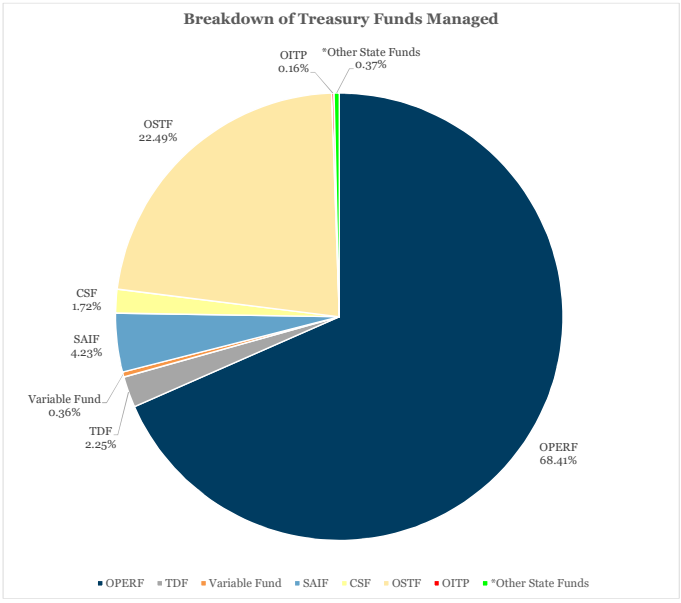
CSF	Policy	Target	$ Thousands	Actual
Global Equities	40-50%	45.0%	1,102,300	53.0%
Private Equity	8-12%	10.0%	209,443	10.1%
Total Equity	**58-62%**	**55.0%**	**1,311,743**	**63.1%**
Fixed Income	**25-35%**	**25.0%**	**515,982**	**24.8%**
Real Estate	**8-12%**	**10.0%**	**132,254**	**6.4%**
Alternative Investments	**8-12%**	**10.0%**	**94,477**	**4.5%**
Cash	**0-3%**	**0.0%**	**24,908**	**1.2%**
TOTAL CSF			**$ 2,079,364**	**100.0%**

SOUE	Policy	Target	$ Thousands	Actual
Global Equities	**0-65%**	**N/A**	2,234	**75.8%**
Fixed Income	**35-100%**	**N/A**	711	**24.1%**
Cash	**0-3%**	**N/A**	2	**0.1%**
TOTAL SOUE			**$ 2,947**	**100.0%**

WOUE	Policy	Target	$ Thousands	Actual
Global Equities	**30-65%**	**55.0%**	691	**56.2%**
Fixed Income	**35-60%**	**40.0%**	478	**38.9%**
Cash	**0-25%**	**5.0%**	61	**4.9%**
TOTAL WOUE			**$ 1,230**	**100.0%**

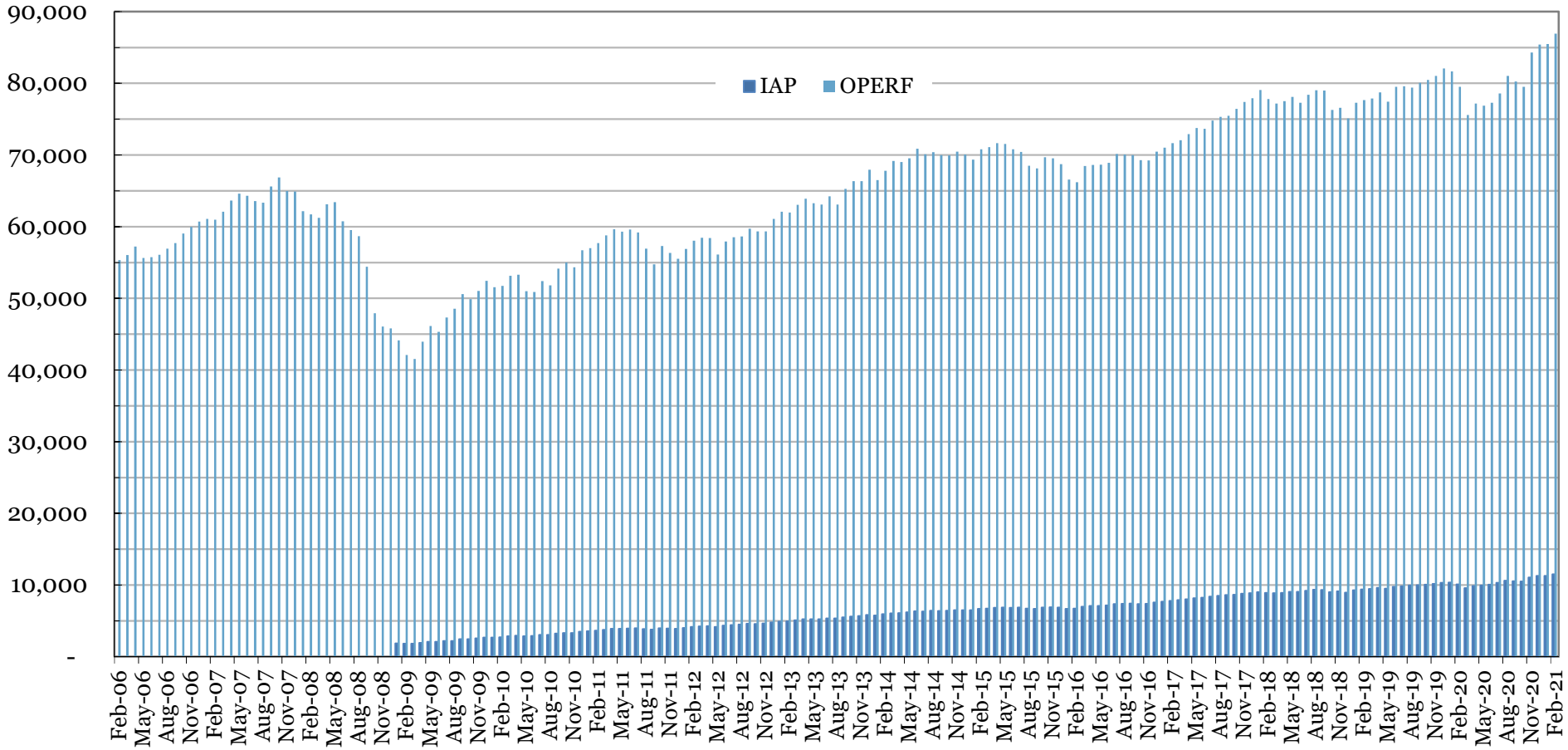
OSTF, OITP & Other State Funds*	$ Thousands	Actual
OSTF	26,846,824	**92.2%**
OITP	200,665	**0.7%**
DAS Insurance Fund	141,311	**0.5%**
DCBS Operating Fund	170,107	**0.6%**
DCBS Workers Benefit Fund	173,999	**0.6%**
DCHS - Elderly Housing Bond Sinking Fund	1,652	**0.0%**
DCHS - Other Fund	16,157	**0.1%**
Oregon Lottery Fund	124,060	**0.4%**
DVA Bond Sinking Fund	115,184	**0.4%**
ODOT Fund	887,492	**3.0%**
OLGIF	249,976	**0.9%**
OPUF	193,840	**0.7%**
Total OSTF & Other State Funds	**$ 29,121,267**	**100.0%**
Total of All Treasury Funds**	**$ 119,366,909**	

**Balances of the funds include OSTF or OITP investments, which is why total does not foot.

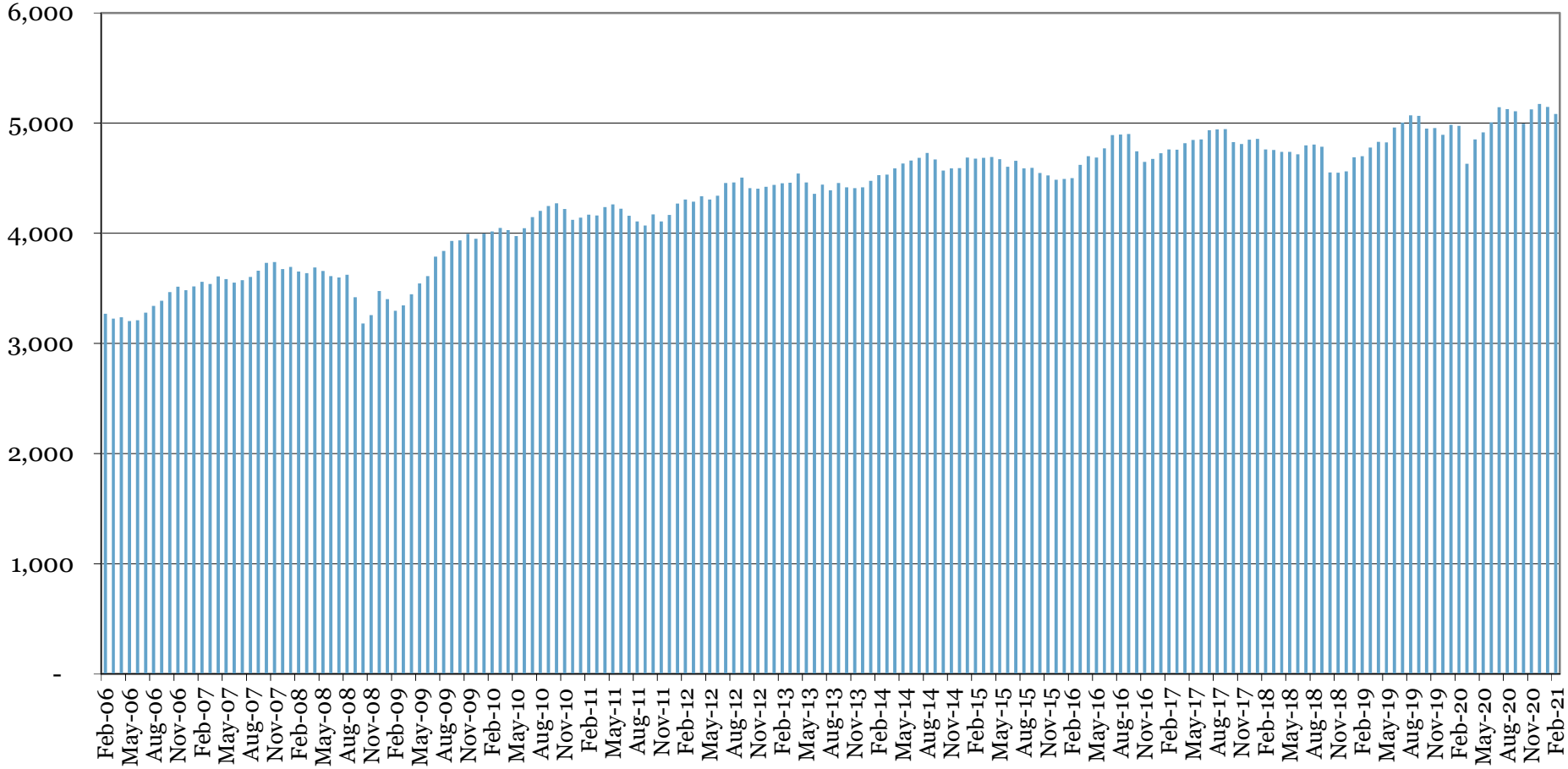


*Other State Funds include DAS Insurance Fund, DCBS Operating Fund, DCBS Workers Benefit Fund, DCHS - Elderly Housing Bond Sinking Fund, DCHS - Other Fund, Oregon Lottery Fund, DVA Bond Sinking Fund, ODOT Fund, OLGIF, & OPUF.

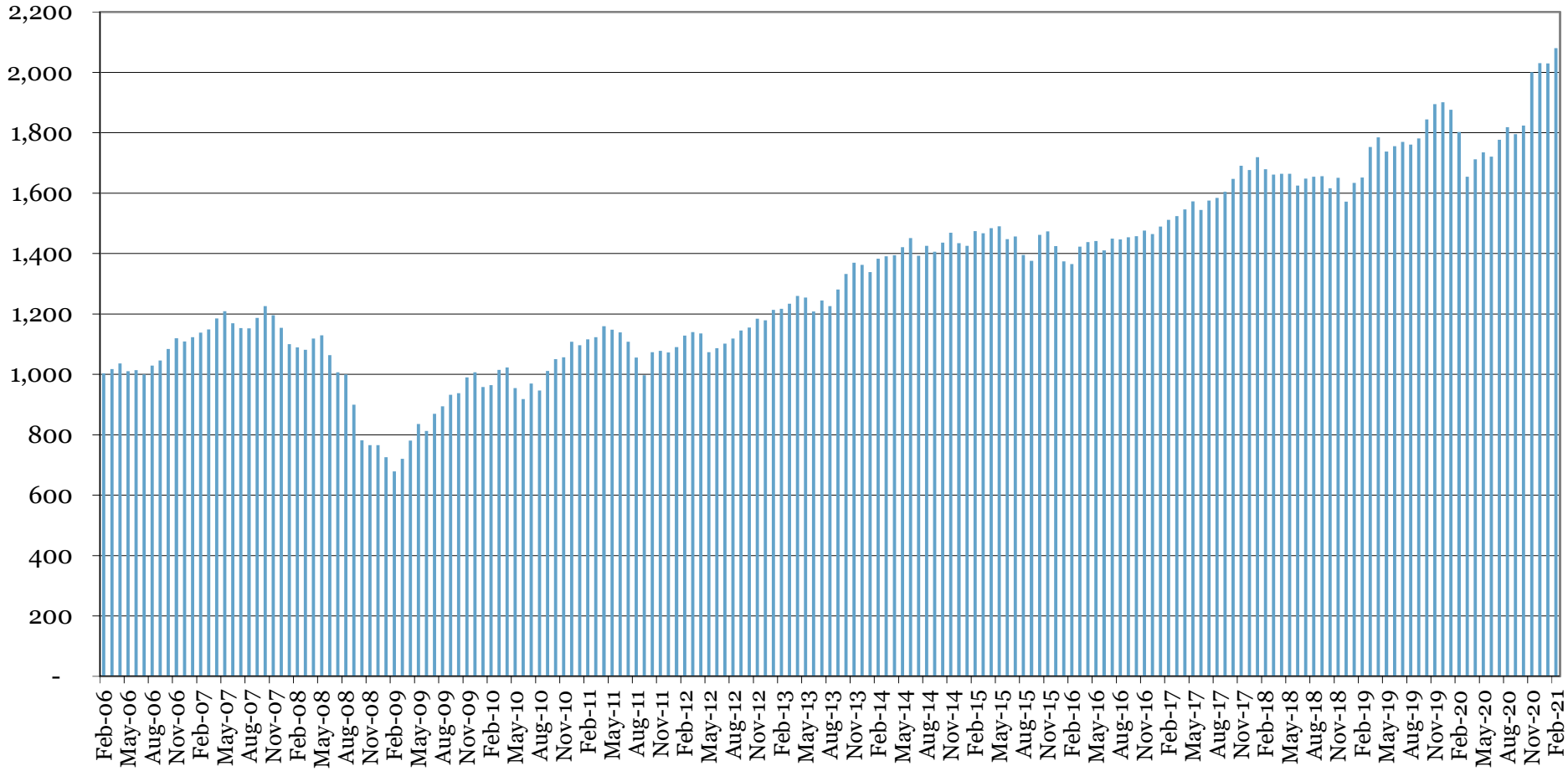
OPERF NAV
15 years ending February 28, 2021
($ in Millions)



SAIF NAV
15 years ending February 28, 2021
($ in Millions)



CSF NAV
15 years ending February 28, 2021
($ in Millions)



TAB 10 – Calendar — Future Agenda Items

2021/22 OIC Forward Calendar and Planned Agenda Topics

June 2, 2021	OIC, PERS Joint Session OPERF Asset Allocation IAP Program Review Operational Annual Review Q1 OPERF Performance & Risk Review
September 8, 2021	ESG Annual Review Corporate Governance, Proxy Voting Securities Lending CEM Benchmarking Q2 OPERF Performance & Risk Review
October 27, 2021	SAIF Annual Review OSGP Annual Review Common School Fund Annual Review
December 8, 2021	Public Equity Program Review Fixed Income Program Review Q3 OPERF Performance & Risk Review
January 26, 2022	Private Equity Program Review Opportunity Portfolio Program Review Placement Agent Report 2023 OIC Calendar Approval
March 9, 2022	Real Estate Portfolio Review Alternatives Program Review Q4 OPERF Performance & Risk Review
April 20, 2022	Leverage Liquidity Risk Review (Currency, Overlay)