Oregon Investment Council

October 26, 2016
9:00 AM

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

Katy Durant
Chair

John Skjervem
Chief Investment Officer

Ted Wheeler
State Treasurer

OREGON INVESTMENT COUNCIL

Agenda

October 26, 2016
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 Meeting Minutes** September 14 and September 30, 2016	**Katy Durant** *OIC Chair*	**1**
	Committee Reports	**John Skjervem** *Chief Investment Officer*	
9:05-9:20	**2. General Consultant Recommendation** *OPERF*	**Karl Cheng** *Investment Officer, Portfolio Risk & Research*	**2**
9:20-10:00	**3. MBK Partners IV, L.P.** *OPERF Private Equity Portfolio*	**Michael Langdon** *Senior Investment Officer, Private Equity* **Tom Martin** *Managing Director, TorreyCove Capital Partners* **Michael ByungJu Kim** *Partner, MBK Partners*	**3**
10:00-10:40	**4. AQR Managed Futures Strategy** *OPERF Alternatives Portfolio*	**Ben Mahon** *Senior Investment Officer, Alternatives* **Karl Cheng** **Jim Callahan** *Executive Vice President, Callan Associates* **Yao Hua Ooi** *Principal, AQR Capital Management, LLC*	**4**

10:40-10:50 ---------- **BREAK** ----------

Katy Durant	Rukaiyah Adams	Rex Kim	John Russell	Ted Wheeler	Steve Rodeman
Chair	Vice Chair	Member	Member	State Treasurer	PERS Director

10:50-11:10 **5. Public Equity Review** **Michael Viteri** **5**
OPERF Public Equity Portfolio
Senior Investment Officer, Public Equity
Paola Nealon
Investment Officer, Public Equity
Janet Becker-Wold
Senior Vice President, Callan Associates
Uvan Tseng
Senior Vice President, Callan Associates

11:10-12:00 **6. Public Equity Portfolio Restructuring** **Michael Viteri** **6**
OPERF Public Equity Portfolio
Paola Nealon
Janet Becker-Wold
Uvan Tseng

Acadian Asset Management
Mark Birmingham
Vice President, Portfolio Manager, Managed Volatility Strategies
Ross Dowd
Executive Vice President, Head of Global Marketing & Client Service
Jim Klapman
Senior Vice President, Relationship Manager

Arrowstreet Capital, LP
Alex Ogan
Partner, Senior Portfolio Manager
Jon Simon, CFA
Client Relationship Manager

Los Angeles Capital Management
Hal Reynolds, CFA
Chief Investment Officer
Fanesca Young, PhD, CFA
Director of Quantitative Research
Edward Rackham, PhD
Co-Director of Research

AQR Capital Management, LLC
Shaun M. Fitzgibbons
Vice President, Global Stock Selection Group
Bill Latimer
Managing Director, Client Strategies Team
Iwan Djanali
Vice President, Client Service

12:00-12:15	**7. International Risk Premia Strategy** *OPERF Public Equity Portfolio*	**Michael Viteri** **Paola Nealon** **Janet Becker-Wold** **Uvan Tseng**	**7**

B. Information Items

12:15-12:35	**8. CEM Benchmarking Report** *OPERF*	**Karl Cheng** **Bruce Hopkins** *Vice President, CEM Benchmarking Inc.*	**8**
12:35-12:40	**9. Asset Allocations & NAV Updates** a. Oregon Public Employees Retirement Fund b. SAIF Corporation c. Common School Fund d. Southern Oregon University Endowment Fund	**John Skjervem**	**9**
	10. Forward Calendar		**10**

C. Public Comment Invited
10 Minutes

TAB 1 – REVIEW & APPROVAL OF MINUTES

September 14, 2016 Regular Meeting

OST Committee Reports – Verbal

JOHN D. SKJERVEM
CHIEF INVESTMENT OFFICER
INVESTMENT DIVISION

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STATE OF OREGON
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OREGON INVESTMENT COUNCIL
SEPTEMBER 14, 2016
MEETING MINUTES

Members Present:	Rukaiyah Adams, Katy Durant, Rex Kim, Steve Rodeman, John Russell, Ted Wheeler
Staff Present:	John Skjervem, Deena Bothello, Karl Cheng, May Fanning, Karl Hausafus, Michael Langdon, Perrin Lim, Paola Nealon, Jen Plett, Jen Peet, David Randall, Priyanka Shukla, James Sinks, Michael Viteri, Lisa Massena, Garrett Cudahey, Andy Hayes, Tony Breault, Amanda Kingsbury, Kristin Johnson, Tom Lofton, Sam Green, Austin Carmichael, Dana Millican, Byron Williams, Kim Olson, Ricardo Lopez, William Hiles, Andrew Coutu, Connie Lelack, Tom Rinehart
Consultants Present:	Tom Martin (TorreyCove); Christy Fields, John Linder and David Glickman (PCA); Janet Becker-Wold and James Callahan (Callan)
Legal Counsel Present:	Dee Carlson, Oregon Department of Justice
PERS Board Members:	Stephen Buckley, Lawrence Furnstahl, Krystal Gema, John Thomas, Pat West

The September 14th, 2016 OIC meeting was called to order at 9:01 am by Katy Durant, Chair.

I. 9:01 am Review and Approval of Minutes

MOTION: Treasurer Wheeler moved approval of the August 10, 2016 meeting minutes, which then passed by a 5/0 vote.

Committee Reports

John Skjervem, OST Chief Investment Officer gave an update on the following committee actions taken since the August 10, 2016 OIC meeting:

Private Equity Committee:
None

Alternatives Committee:

August 17, 2016	EMR Capital Resources Fund II, L.P.	$125 million
August 17, 2016	Northern Shipping Fund III, L.P.	$100 million to $125 million

Opportunity Portfolio Committee:
None

Real Estate Committee:
None

DRAFT

II. 9:02 am Consultant Recommendation – *OST Private Equity Program*

Michael Langdon, Senior Investment Officer, Private Equity and Andy Hayes, Investment Officer, Private Equity addressed the Council's existing contract for Private Equity consultant services ending December 31, 2016. Subject to satisfactory negotiation of all terms and conditions with Staff working in concert with legal counsel, the private equity consultant search committee (the "Committee") recommended that the OIC pursue a non-discretionary private equity consulting contract with TorreyCove Capital Partners, LLC ("TorreyCove") beginning January 1, 2017.

Differentiating factors in support of the Committee's recommendation included the following:

- Cultural fit -- TorreyCove's culture is characterized by candor and transparency, which marries well with the working style of the OIC and OST Staff;
- Philosophical fit -- Throughout the RFP process, it became apparent TC's market and investing views were best aligned with OIC and OST Staff. TorreyCove understands the nuances of the OIC/PE staff/consultant dynamic. As a result, TC is well placed to maintain an effective and open dialogue with the OIC while also maintaining a collaborative relationship with OST staff;
- Non-conflicted business model -- TorreyCove's sole line of business is non-discretionary consulting. As a result, the firm's clients are insulated from the inevitable conflicts of interest that arise when a consultant also manages discretionary mandates. This conflict-free approach is core to TC's market positioning, and the firm seems committed to maintaining this model as a key element of its value proposition; and
- Fee Proposal -- TorreyCove put forward a highly competitive fee proposal which became more attractive as the process unfolded and the candidate alternatives narrowed.

The Committee further recommended pursuing a three-year initial contract term with two, pre-negotiated 24-month extensions available at the Council's discretion.

MOTION: Ms. Adams moved approval of the staff recommendation. Mr. Kim seconded the motion, which then passed by a 5/0 vote.

III. 9:06 am Fund Restructuring and Policy Update - *Public University Fund*

Tom Lofton, Investment Officer, Fixed Income spoke about Public University Fund ("PUF" or the "Fund") participants' desire to revise the Fund's investment guidelines consistent with the following, proposed changes:

Current Structure

Strategy	Allocation	Constraint
Liquidity	Oregon Short Term Fund	Not less than approximately six (6) months of average monthly operating expenses
Core	Oregon Intermediate Term Fund Benchmark: Barclays U.S. Aggregate 3-5 Year	Should not exceed $300 million
	PUF Long-Term Fund Benchmark: Barclays U.S. Aggregate 5-7 Year	Should not exceed $120

Revised Structure

Strategy	Allocation	Constraint
Liquidity	Oregon Short Term Fund	Not less than approximately six (6) months of average monthly operating expenses
Core	Benchmark: 75% Barclays U.S. Aggregate 3-5 Year 25% Barclays U.S. Aggregate 5-7 Year	

After discussion with PUF participants' designated representative and consultant, OST investment staff also proposed updating Fund investment guidelines to reflect OST's improved risk management capabilities and to allow for more efficient investment management relative to the Core portfolio's custom benchmark.

Staff recommended OIC approve revisions to PUF's Investment Policy as submitted.

MOTION: Mr. Kim moved approval of the staff recommendation. Mr. Russell seconded the motion which then passed by a vote of 5/0.

IV. 9:10 am Policy Updates – *OPERF and other OST-managed Accounts*

Mr. Skjervem and Kim Olson, OST Policy Analyst, led a discussion in connection with several OIC Policies (listed below) submitted for Council consideration and approval. Continuing work that was first introduced at the September 2015 OIC meeting, primary objectives of these proposed revisions include a systematic segregation of policy and procedure as well as conforming Council policies with Treasury's new PolicyStat application.

- INV 101: Duties of the OIC
- INV 102: Development of the Agenda for OIC Meetings
- INV 103: OIC and Staff Duties
- INV 202: Investment Trading Authority
- INV 204: Investment Performance Reports
- INV 205: Consideration of Investments
- INV 206: Divestiture Initiatives
- INV 207: Open Door Policy to Investment Proposals
- INV 208: Negotiation and Execution of Contracts
- INV 214: Equal Opportunity
- INV 209: Rotating Internal Control and Operational Reviews
- INV 211: Minimizing Losses
- INV 212: Sudan and Iran Divestiture
- INV 213: External Manager Watchlist
- INV 216: Securities Lending
- INV 607: Equity Investments: Manager Monitoring

MOTION: Mr. Russell moved approval of all staff recommendations except for Policies 204 and 205 which were referred back to staff for further revision. Treasurer Wheeler seconded the motion which then passed by a vote of 5/0.

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V. 9:31 am NCREIF-ODCE Primer - *OST Real Estate Program*

Tony Breault, Senior Investment Officer, Real Estate introduced NCREIF founder Blake Eagle who gave a presentation on the National Council of Real Estate Investment Fiduciaries (NCREIF) and the Open-End Diversified Core Equity (ODCE) Index.

VI. 10:12 am Operational Review – *OPERF*

Byron Williams, OST Chief Audit Executive, presented a summary of the operational review which is a statutory requirement of the OIC and is conducted at least every four years. The operational review Mr. Williams reported on covered the period from July 2012 to June 2016, and contained two primary points of emphasis: first, how is the Council doing as a whole in meeting its fiduciary responsibilities; and second, how does the OST Alternatives investment program compare relative to industry best practices and other relevant benchmarks? Finally, Mr. Williams shared with the Council an update on progress made relative to findings from the previous operational review presented to the OIC in January 2013.

VII. 10:42 am PERS Presentation and Joint Board Discussion – *OPERF/Individual Account Program*

Steve Rodeman, PERS Director presented summary valuation results for the Tier 1/Tier 2 and OPSRP retirement programs as well as the Retiree Health Insurance Account (RHIA) and Retiree Health Insurance Premium Account (RHIPA) programs as of December 31, 2015. He indicated these results help determine the 2017-2019 employer contribution rates scheduled for discussion and subsequent adoption at the September 30, 2016 PERS board meeting.

Mr. Rodeman then shared slides illuminating the PERS system's $21.28 billion current funding liability and its composition by member category. Ms. Durant inquired about the magnitude of the current liability if benefit obligations are discounted at prevailing market rates. In response, Mr. Rodeman shared a slide detailing likely contribution rates under various return scenarios.

Ms. Adams interjected that from a taxpayer's perspective, the PERS liability is growing even though employers' contributions are constrained by the collar methodology explained by Mr. Rodeman. Ms. Durant agreed and added concern for the intergenerational inequity that is building between younger Oregonians and older PERS beneficiaries.

Mr. Stephen Buckley, PERS board member informed OIC members about the creation of a bipartisan working group by Senators Johnson and Knopp to investigate issues and potential solutions in connection with the growing PERS liability. Mr. Buckley also noted that the PERS funding issue is becoming better understood as systemic, but noted that neither the OIC nor PERS Board can effect funding policy decisions.

The next opportunity for the OIC to discuss the OPERF assumed rate will be at its April 2017 meeting at which staff and consultants are scheduled to present asset allocation recommendations and updated capital market assumptions. In addition, OIC and PERS Board members agree to continue their OPERF funding discussion at another joint meeting, perhaps as soon as the next PERS Board meeting on September 30th, 2016.

Following the joint OIC/PERS Board discussion and presentation, Karl Cheng, Investment Officer, Portfolio Risk & Research and David Randall, Director of Investment Operations provided an overview of the Individual Account Program (IAP), challenges associated with its current structure and demographics and possible solutions currently being evaluated by both OST and PERS staff.

VIII. 12:07 pm OPERF Performance & Risk Update – *Q2 2016 Report*

Mr. Cheng presented and discussed an updated view of the OPERF risk dashboard, while Janet Becker-Wold from Callan Associates provided a corresponding update on OPERF performance for the period ended June 30, 2016.

IX. 12:31 pm Asset Allocation & NAV Updates

Mr. Skjervem reviewed asset allocations and NAVs across OST-managed accounts for the period ended July 31, 2016.

X. 12:31 pm Calendar – Future Agenda Items

Mr. Skjervem presented and briefly discussed the OIC's forward meeting calendar and scheduled agenda topics.

XI. 12:31 pm Other Items

None

12:31 pm Public Comments
None

Ms. Durant adjourned the meeting at 12:32 pm.

Respectfully submitted,

May Fanning
Executive Support Specialist

JOHN D. SKJERVEM
CHIEF INVESTMENT OFFICER
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PUBLIC EMPLOYEES RETIREMENT SYSTEM / OREGON INVESTMENT COUNCIL
SEPTEMBER 30, 2016
MEETING SUMMARY

OIC Members Present:	Katy Durant, Rukaiyah Adams, Rex Kim, Steve Rodeman, Ted Wheeler
Staff Present:	John Skjervem, Kristin Dennis
Consultants Present:	Matt Larrabee and Scott Preppernau (Milliman)
Legal Counsel Present:	n/a
PERS Board Members:	John Thomas, Pat West, Stephen Buckley, Lawrence Furnstahl, Krystal Gema, Steve Rodeman

The September 30th, 2016 PERS Board meeting was called to order at 1:00 pm by Chair John Thomas.

I. <u>02:25 pm PERS/OIC Roundtable Discussion</u>

Following the conclusion of the regular PERS Board meeting agenda, Chair Thomas invited members of the Oregon Investment Council (OIC) to participate with PERS Board members in a roundtable discussion regarding the Oregon Public Employees Retirement Fund (OPERF) and its currently deficient funded ratio. PERS Board member, Mr. Lawrence Furnstahl led a discussion regarding the issuance of pension obligation bonds (POBs) as a potential and/or partial remedy to OPERF's current under-funded status. In support of that discussion, OIC Chair Katy Durant shared material illustrating OPERF's prospective funded ratio across various assumed earnings rate scenarios. The discussion included remarks from several participants noting that neither the PERS Board nor OIC had authority for POBs and that the current low rate, low return environment would likely exacerbate OPERF's under-funded status.

PERS Chair Mr. John Thomas adjourned the roundtable discussion at 3:25 pm.

Respectfully submitted,

May Fanning
Executive Support Specialist

TAB 2 – General Consultant Recommendation

OPERF

Renewal of OIC General Consulting Contracts

Purpose

To address the OIC's two general consulting contracts, both of which expire on December 31, 2016.

Background

Callan Associates Inc. (Callan) and Pension Consulting Alliance LLC (PCA) were both initially retained with three-year contracts that began on January 1, 2014. Under ***OST Policy INV 210: Consulting Contracts***, new contracts are awarded for three-year periods and a) can be renewed no more than twice and b) are limited to a final expiration date not more than four years beyond the contracts' original expiration date. At the end of seven years, contracts must be re-bid and a new seven-year cycle can begin. Additionally, the OIC retains the contractual right to terminate such contracts, at any time, upon written notice.

Staff Recommendation

In recognition of the value-add contributions made by both Callan and PCA during the initial contract period, and with the expectation that similar contributions will be made on a going-forward basis, Staff proposes that the OIC extend its current contracts with both Callan and PCA, subject to existing terms and conditions, for an additional two-year period beginning January 1, 2017 and ending December 31, 2018.

Origination:	*12/2010*
Last Approved:	*09/2015*
Last Revised:	*09/2015*
Next Review:	*09/2016*
Owner:	*John Skjervem: Chief Investment Officer*
Policy Area:	*Investments*
References:	*OST Policy 4.01.13*

INV 210: Consulting Contracts

OREGON INVESTMENT COUNCIL POLICY

INTRODUCTION & OVERVIEW

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Summary Policy Statement

This policy outlines the requirements and limitations of written contracts between the Oregon Investment Council (OIC) and external consultants.

Purpose and Goals

The goal of this policy is to establish the parameters within which the OIC may engage and enter into contractual agreements with external consultants.

Applicability

Classified represented, management service, unclassified executive service

POLICY PROVISIONS

Definitions

Placement Agent: includes any third party, affiliated or unaffiliated with an investment manager, investment advisory firm, or a general partnership, that is a party to an agreement or arrangement (whether oral or written) with an investment manager, investment advisory firm, or a general partnership for the direct or indirect payment of a Placement Fee in connection with an OIC investment.

Placement Fee: includes any compensation or payment, directly or indirectly, of a commission, finder's fee, or any other consideration or benefit paid to Placement Agent.

Policy Statements

1. The OIC shall engage consultants using written contracts. Consultants include, but are not limited to, full-service consultants and specific asset class advisors (e.g., real estate, private equity, etc.).
2. Consulting contracts shall have specified expiration dates, termination clauses and renewal/extension terms. Staff shall undertake a formal "request for proposal" (RFP) process before the end of the contract term (including any renewals or extensions) for the purpose of identifying new candidates, upgrading services, ensuring competitive pricing and acquiring any other information or benefits considered relevant to staff and the Council.
3. Consulting contracts shall be negotiated and executed in compliance with Council policy INV 208: Negotiation and Execution of Contracts.
4. Consulting contracts shall expire on a date not to exceed three years from the effective date of the contract.
5. Consulting contracts shall include a "no-cause" termination clause with a maximum 90-day notice period.
6. The Council directs staff to regularly review and evaluate the work of all contractors on an annual basis.
7. Consulting contracts are limited to a) two renewals or extensions beyond the original expiration date, and b) a final expiration date no more than four years beyond the original expiration date.
8. Upon final expiration of the original contract, or whenever directed by the Council, staff shall undertake and complete an RFP process to include the following:
    a. Identification of potential consulting candidates qualified to provide the required services;
    b. Creation of an RFP which shall include, but not be limited to:
        1. Description of services requested;
        2. Description of the potential or preliminary standards required of the candidates; and
        3. Request for pricing or fee schedule information.
9. Consultants under contract with the Council shall disclose, in written recommendations delivered to the Council, any Placement Agent contact Consultants may have had in connection with such Council recommendations.

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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

ADMINISTRATION

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

Committee	Approver	Date
Oregon Investment Council	John Skjervem: Chief Investment Officer	09/2015
	Kim Olson: Policy Analyst	08/2015
	Mike Mueller	08/2015

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TAB 3 – MBK Partners IV, L.P.

OPERF Private Equity Portfolio

MBK Partners Fund IV, L.P.

Purpose
Staff recommends approval of a $200 million commitment to MBK Partners Fund IV, L.P. ("Fund IV" or the "Fund") for the OPERF Private Equity portfolio, subject to the satisfactory negotiation of all terms and conditions with Staff working in concert with legal counsel. This proposed commitment would establish a new general partner relationship with MBK Partners.

Background
MBK Partners ("MBK" or the "Firm") is forming the Fund to target control-oriented investments in Korea, Japan and Greater China (collectively, "North Asia"). Michael Kim and four additional founding partners created the Firm in April 2005. The founding partners, who spun out of Carlyle Asia Partners and Carlyle Japan Partners, have now worked together for an average of 17 years. MBK has supplemented these partners with 33 additional investment professionals operating from offices in Seoul, Tokyo, Shanghai and Hong Kong. Each country team is entirely comprised of individuals native to their respective markets. MKB has invested $4.2 billion of capital in 24 transactions across their first three funds, while also generating an additional $4.4 billion of co-investment.

Since 2005, MBK has raised over $5.7 billion across three prior funds. The Firm is now targeting $3.5 billion for Fund IV, with a $4.0 billion stated hard cap.

Strategy
MBK will further define their North Asia investment strategy to target defensive industries, underpinned by safe domestic consumption plays, and the partners believe their investment teams' local relationships are essential to generating high quality deal flow. MBK will focus on acquiring control positions in companies through industry roll-ups, public-to-privates, strategic partnerships, corporate divestitures and management-led buyouts. MBK will continue to target companies with enterprise values between $400 and $700 million, as the Firm considers these businesses large enough to have durable business models yet offer substantial opportunities for growth and improved operational performance. MBK Partners expects to make 10-12 investments with Fund capital, including five in Korea, and three to four in both Japan and Greater China.

Issues to Consider
Attributes:

- *Local team.* MBK professionals are ingrained in the local cultures in which they invest. These roots and local ties in their respective countries will continue to provide MBK differentiated deal flow and access to capital market tools and other diligence information which may not be available to foreign firms.
- *Team continuity.* The Firm has experienced a very low level of turnover among its investment professionals. The founding partners are still leading the Firm, and the most senior level departure in the past five years was a director-level professional.
- *Focus on control-oriented deals.* As mentioned above, the Firm will continue to focus on control-oriented transactions. This control should enable MBK to add value and navigate exits in a timely fashion.
- *North Asia focus.* MBK believes North Asian economies possess an attractive combination of economic scale and activity which will continue to allow for successful buyout transactions. According to the Firm, on a combined basis, the region has a GDP approximately equal to the United States. Furthermore, while Korea has historically embraced the buyout industry, the Japanese and Chinese markets have only recently followed suit. The opening of these two markets to buyout transactions should further enhance MBK's ability to consummate deals.

- *Portfolio fit.* OPERF's private equity portfolio has been relatively underweight Japan and Korea. This commitment presents an opportunity to meaningfully increase exposure to these economically vibrant geographies.

Concerns:

- *Political risk.* Investing in emerging markets comes with an additional level of uncertainty tied to elevated political risk. Additionally, while MBK does not invest in North Korea, that country's belligerent, bellicose and unpredictable leadership creates heightened volatility in the region. [Mitigant: The diversification across the entire OPERF portfolio should help minimize this risk.]
- *China & Japan buyouts.* While MBK has a successful history consummating buyout transactions in Japan and China, the cultures in those two countries have been slow to accept the industry. Historically, private equity managers have focused on growth-oriented transactions in both Japan and China. MBK may find it difficult to deploy the necessary capital in these countries. [Mitigant: Founder/owners of family-run companies and management of large conglomerates, in both countries, have increasingly looked to private equity for help solving transition and organizational efficiency problems. The more success the industry has in the region, the more willing target companies will be to engage with private equity firms.]
- *Key person.* Michael Kim is the clear leader of the Firm and has no specific succession plan at this time. While Mr. Kim has not led a great number of deals, he runs the Firm and ensures a strong focus on culture and diligence. [Mitigant: The Limited Partnership Agreement provides a strong key-person term related to Mr. Kim.]

Terms

Fund terms include a traditional management fee, carry and preferred return; moreover, all transaction and monitoring fees are subject to a 100% management fee offset. See TorreyCove memo for further details. Credit Suisse is serving as a placement agent in connection with this offering and has had contact with staff regarding the proposed OPERF commitment.

Conclusion

MBK Partners Fund IV, L.P. represents an attractive opportunity to invest with a high-quality North Asian buyout partner and increase the OPERF private equity portfolio's Asian exposure.

TORREYCOVE
CAPITAL PARTNERS

MEMORANDUM

TO: Oregon Public Employees Retirement Fund ("OPERF")

FROM: TorreyCove Capital Partners ("TorreyCove")

DATE: October 11, 2016

RE: MBK Partners Fund IV, L.P. (the "Fund")

Strategy:

The Fund will acquire companies in a variety of situations, including management-led buyouts, corporate divestitures, and public to private transactions. Additionally, MBK will partner with strategic buyers to acquire target companies, as well as purchase platform companies to enact industry roll-ups. Importantly, the Fund will continue to pursue the same strategy since inception, primarily making control-oriented investments in North Asia, with a focus on defensive industry themes underpinned by safe domestic consumption plays.

Please see attached investment memorandum for further detail on the investment opportunity.

Allocation:

A new commitment to the Fund would be allocated 100% to the Corporate Finance investment sub-sector and will further be categorized as an International investment. As of the June 30, 2016 report, OPERF's allocation to Corporate Finance is listed in the table below. It is important to note that since allocation is based on fair market value, a commitment to the Fund would not have an immediate impact on OPERF's current portfolio allocation. Commitments to the Fund are complementary to OPERF's existing fund commitments and provide the overall portfolio with a further degree of diversification.

As of June 30, 2016	Target	FMV	FMV + Unfunded
Corporate Finance	65-85%	65%	67%

Conclusion:

The Fund offers OPERF an opportunity to participate in a differentiated portfolio of private equity investments with relatively attractive overall terms. TorreyCove's review of the General Partner and the proposed Fund indicates that the potential returns available justify the risks associated with an investment in the Fund. TorreyCove recommends that OPERF consider a commitment of up to $200 million to the Fund. TorreyCove's recommendation is contingent upon the following:

(1) Satisfactory negotiation or clarification of certain terms of the investment;

(2) Satisfactory completion of legal documents;

(3) Satisfactory continuation and finalization of due diligence;

(4) No material changes to the investment opportunity as presented; and

(5) Confidentiality maintained regarding the commitment of OPERF to the Partnership until such time as all the preceding conditions are met.

TAB 4 – AQR Managed Futures Strategy

OPERF Alternatives Portfolio

AQR Capital Management Managed Futures Strategy

Purpose

Staff and Callan recommend a $250 million commitment to the AQR Capital Management Managed Futures Strategy for the Diversifying Strategies sleeve of the OPERF Alternatives Portfolio, subject to the satisfactory negotiation of terms and conditions with Staff working in concert with legal counsel.

Background

In January 2011, OIC approved the creation of the Alternatives Portfolio, with a target allocation of 5% of total OPERF assets and a portfolio mix of approximately 75% Real Assets[1] and 25% Diversifying Strategies[2]. Consistent with the expansion potential outlined in the original proposal, the target allocation for the Alternatives Portfolio has increased twice since its inception: first, in June 2013, when the overall target allocation was doubled to 10% of total OPERF assets, and second, in June 2015, when the Diversifying Strategies sleeve was increased to 5% of total OPERF assets (resulting in an overall 12.5% target allocation for the Alternatives Portfolio and a 60% Real Assets/40% Diversifying Strategies mix). More detail on the background and objectives of the Alternatives Portfolio can be found in the **Appendix**.

AQR Capital Management ("AQR" or the "Firm") was established in 1998 by Cliff Asness and several other members of Goldman Sachs Asset Management. Although the Firm now manages investment products across the asset class spectrum, the common thread running throughout AQR's strategies is a systematic, model-driven approach towards asset allocation and security selection that is grounded in fundamental economic principles and supported by contemporary, empirical research. The Firm has grown to one of the largest global managers of alternative assets, with total assets under management (AUM) of $159.2 billion, split between traditional equities ($69.4 billion) and alternatives ($89.9 billion).

The OIC/OST relationship with AQR dates back to 2006 with a U.S. small cap value mandate in the OPERF Public Equities Portfolio. Alternatives Portfolio investments with AQR date back to 2011, when OIC committed $100 million of OPERF capital to the AQR DELTA Fund ("DELTA"). The OIC made a subsequent $200 million Alternatives Portfolio commitment to the AQR Style Premia Fund ("SPF") in 2013. Along with an additional $750 million commitment, both DELTA and SPF were consolidated into the Oregon Strategic Partnership in 2015.

Of note, OPERF has approximately $54 million of existing exposure to the AQR Managed Futures Strategy through the DELTA portion of the Oregon Strategic Partnership.

Discussion/Investment Considerations

A future is an exchange-listed derivative instrument (it *derives* its value from the price of a referenced asset) that is traded between two parties to buy or sell the referenced asset at a specified future time. The asset can be almost any physical or financial instrument, such as soybean meal, the 10-Year U.S. Treasury note, or the Japanese yen/U.S. dollar exchange rate. Futures are liquid securities that provide cost-effective exposures to myriad referenced assets. For example, hundreds of billions of dollars' worth of S&P 500 exposure are traded *per day* through futures. Besides liquidity, futures are cost-effective because little cash

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[1] Using current OIC/OST nomenclature, *Real Assets* is synonymous with the illiquid elements of the Alternatives Portfolio (e.g., infrastructure, natural resources, etc.).

[2] Using current OIC/OST nomenclature, *Diversifying Strategies* is synonymous with the liquid elements of the Alternatives Portfolio.

is transferred when futures are traded. An initial margin is posted to the exchange (the ultimate counterparty) when the contract is traded and a daily "variation margin," or cash transfer, occurs between the exchange and the investor's account to adjust for subsequent market movements.

Managed futures strategies have existed in some iteration since futures exchanges expanded the breadth of available-traded contracts in the 1970s. The underlying basis for these strategies is trend-following or momentum investing: buying a future (or some other derivative instrument) when prices are rising and selling when prices are falling. These strategies profit when prices continue their trends but may suffer in directionless markets. A number of explanations have been proposed as to why trend-following and momentum investing have generated positive returns over time and across asset classes, including under-reaction to news, herding, and pro-cyclical fund flows.

While Staff expects the AQR Managed Futures Strategy to perform well over a full market cycle, the strategy's potential to deliver positive returns in declining markets makes it a unique and attractive diversifier. AQR evaluates individual price trends for over 100 futures and other derivatives across commodities, currencies, equities, and fixed income. The strategy is uncorrelated with global equities over a full market cycle, but it would be long (short) beta in trending up (down) markets. In periods of sustained declining prices (e.g., the 2008 Global Financial Crisis), the strategy would short a number of these instruments, which would partially offset OPERF's otherwise long equity exposure.

Staff continues to evaluate other managers offering similar strategies and will likely make recommendations for additional managed futures strategies in the future.

<u>Attributes</u>:

- *Trusted partner*. As an existing manager of approximately $1.2 billion of OPERF's Public Equity Portfolio and approximately $1.1 billion of its Alternatives Portfolio (as well as a successful opportunistic convertible arbitrage strategy that has since been liquidated), Staff holds AQR in high regard, and OST and OIC have to date enjoyed a successful, productive relationship with the Firm.
- *Uncorrelated returns*. While difficult to find, truly uncorrelated returns (i.e., uncorrelated relative to OPERF's other, conventional asset class exposures) provide valuable diversification benefits. Accordingly, a commitment to the AQR Managed Futures Strategy is intended to improve OPERF's risk-adjusted return while adding diversification and incremental improvements to OPERF's downside risk profile. Since inception, the AQR Managed Futures Strategy has a realized correlation of 0.0 to OPERF and 0.1 to the U.S. equity market (as measured by the Russell 3000 Index).
- *Enhanced transparency*. Unlike many hedge fund managers, AQR provides OPERF and its other investors complete position-level transparency, detailed insights into their investment models, and in-depth performance attribution.
- *Liquidity*. Managed futures strategies historically never gated their investors, even during the worst part of the 2008 Global Financial Crisis. Staff expects AQR would maintain the Managed Futures Strategy's liquidity window through any similar, future market downturns.

<u>Concerns:</u>

- *Significant assets under management*. AQR's AUM have grown significantly over the past several years. This growth has the potential to strain the Firm's existing investment team and internal infrastructure. [Mitigant: As an existing manager, Staff has tracked AQR's growth and level of supporting resources, the latter of which has increased meaningfully; moreover, the fund management process at AQR is very scalable.]
- *Managed futures strategies have periods of underperformance.* Managed futures strategies tend to perform poorly in markets without clear trends, which may last several years, or when there are

sharp inflection points. [Mitigant: While the AQR Managed Futures Strategy will detract from performance at times, as an uncorrelated investment, it is expected that other OPERF investments would contribute positive performance during those periods.]

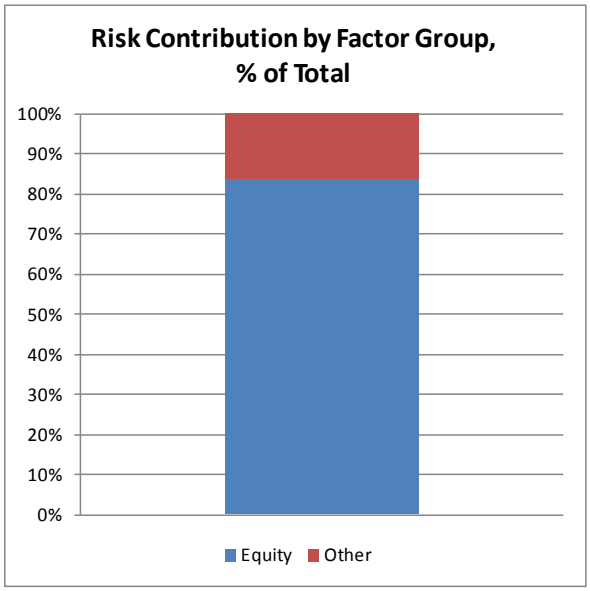
- *Significant use of leverage and shorting*. By design, AQR uses leverage and shorting in this strategy. [Mitigant: The AQR Managed Futures Strategy will only invest in highly-liquid instruments while maintaining relatively high cash levels. AQR has extensive capabilities and experience in managing complex portfolios and operating risks.]
- *Manager concentration risk***.** Although the build-out of the Diversifying Strategies sleeve is expected to take several years, this commitment would increase manager concentration risk. [Mitigant: While this commitment would be the second to AQR in the Alternatives Portfolio in as many years, it remains Staff's expectation that manager concentration in the Diversifying Strategies sleeve will decrease over time. In addition, Staff expects to recommend at least one more managed futures strategy for the Diversifying Strategies sleeve.]

Conclusion

The Alternatives Portfolio target allocation to Diversifying Strategies is 40%, or approximately $3.5 billion at current OPERF NAV. To date, OPERF has a total of $1.2 billion invested in this category, the vast majority of which is with AQR. While this commitment will add exposure to AQR, the Firm is a trusted investment partner with significant depth and experience, and remains at the center of thought and industry leadership, particularly in liquid alternative strategies. Accordingly, Staff believes AQR is the best manager to build out an initial investment in managed futures.

Appendix

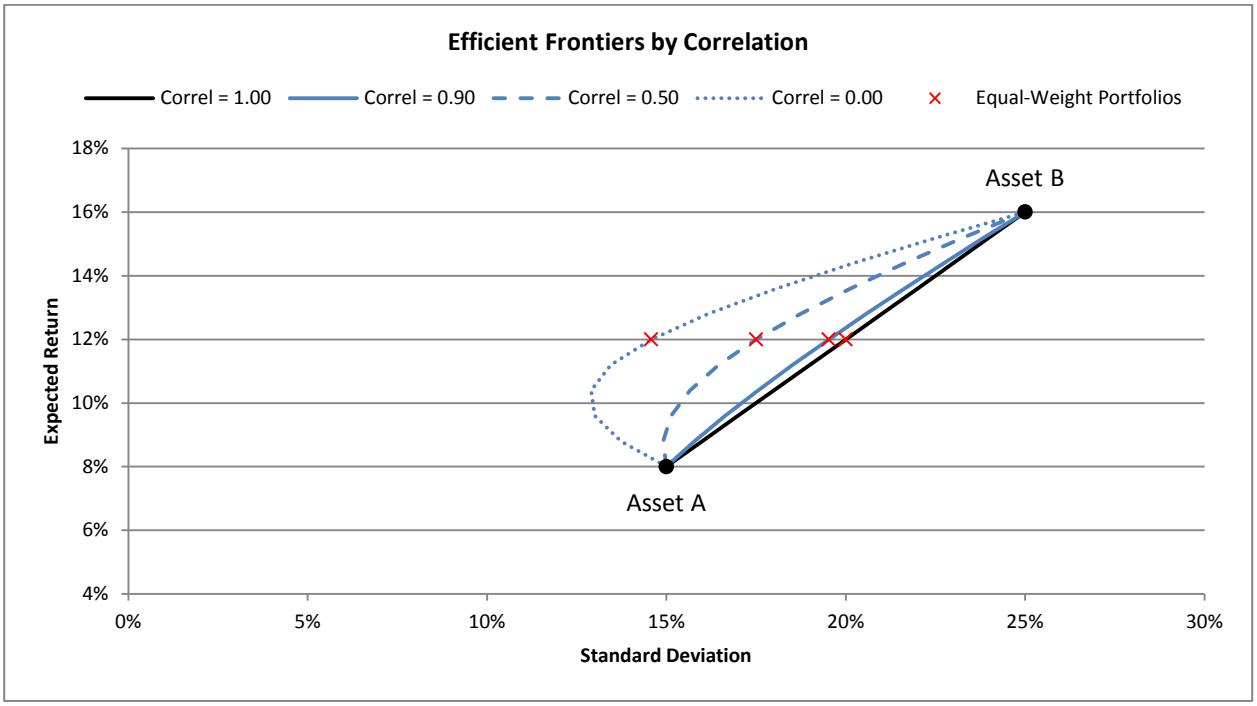
The Alternative Portfolio's primary objective is to provide a source of diversification for OPERF, seeking less correlated returns, diversifying risk premia, and inflation hedges. In large part, this objective was formed in recognition of OPERF's large equity risk concentration. As of June 2016, Aladdin's enterprise-wide risk management module estimates the equity factor group contributes 84% of OPERF's forecasted standard deviation of returns, or volatility, a proxy for risk.



Importantly, the consideration of diversification and correlation is enumerated in OIC's Investment Beliefs[3] and the Alternatives Portfolio is constructed according to the tenets of modern portfolio theory (MPT). MPT traces its roots back to 1952, when Harry Markowitz created a Nobel Prize-winning framework for constructing securities portfolios by quantitatively considering each investment's potential return, correlation and volatility in the context of a portfolio rather than in isolation. The key observation from MPT is that investors can maintain a certain rate of return while reducing their portfolio's risk level by combining assets or strategies with returns less than perfectly correlated with one another. The efficient frontier is the curve that encompasses all of the best portfolio combinations (i.e., the lowest risk portfolios for a given level of return).

These concepts are illustrated in the following example. Two-asset portfolios are created using combinations of Asset A, with an expected return of 8% and a standard deviation of 15%, and Asset B, with an expected return of 16% and a standard deviation of 25%. The expected rate of return for a portfolio is the weighted average of the expected individual asset returns, while the volatility of that portfolio is a function not only of the individual asset volatilities but also of the correlations *between* the individual asset returns. In this example, four sets of portfolios are created, using different correlations between Assets A and B: 1.00, 0.90, 0.50, and 0.00.

[3] *Statement of OIC Investment and Management Beliefs*, Belief 2A: "Portfolio construction, including diversification and correlation considerations, is essential to maximizing risk-adjusted returns."



Portfolios of perfectly-correlated assets (i.e., correlation = 1.00), represented by the black line in the chart, exhibit a linear relationship between expected return and volatility. Portfolios of assets that are less than perfectly correlated (i.e., correlation less than 1.00), represented by the blue curves, exhibit non-linear relationships between expected return and volatility. For every given set of portfolio weights, such as an equally-weighted portfolio of 50% Asset A and 50% Asset B, as the correlation between the assets falls, the volatility of the portfolio declines. Even for a modest decrease in correlation from 1.00 to 0.90, the volatility of the equally-weighted portfolio drops from 20.0% to 19.5%.

In brief, the above can be summarized as follows: **portfolios comprised of less than perfectly correlated assets are better, because, all else equal, lower correlations reduce portfolio volatility without sacrificing return.**

Conclusion

The preceding example serves to answer the question "why diversify?" As the only "free lunch" in finance, the most reliable way to reach a given return target is with a diversified portfolio. Hence, in seeking the most consistent risk-adjusted returns, the conclusion is to diversify as much as prudently possible.

TAB 5 – Public Equity Program Review

OPERF Public Equity Portfolio

Oregon Investment Council
OPERF Public Equity Portfolio -- Annual Review
October 26, 2016

Purpose

Provide an annual review of the Oregon Public Employees Retirement Fund (OPERF) Public Equity portfolio.

Background

The strategic role of OPERF public equity investments is outlined in **OIC INV 1201** – *Statement of OIC Investment and Management Beliefs* and **OIC Policy INV 601** – *Strategic Role of Public Equity Securities within OPERF.* As outlined in those policy documents, the strategic role of public equity is to generate a return premium relative to risk-free investments, while providing diversification benefits and liquidity in support of OPERF's cash flow requirements. Return and risk objectives for the Public Equity Portfolio (outlined in OIC Policy INV 601 – *Strategic Role of Public Equity Securities within OPERF*) are as follows:

1) To achieve an excess portfolio return of 0.75 percent or more above the MSCI All Country World Investable Market Index (net) over a market cycle of three to five years on a net-of-fee basis; and
2) To manage active risk to a targeted annualized tracking error of 0.75 to 2.0 percent, relative to the MSCI ACWI IMI (net).

As of September 30, 2016, the capitalization-based MSCI All Country World Index - IMI was comprised of 52.5 percent U.S. equities, 36.5 percent international developed-market equities, and 11 percent emerging-market equities. To achieve a similar allocation to the benchmark within the OPERF public equity portfolio, staff uses a mix of 38 differentiated investment strategies, managed by 24 distinct managers, organized across style (core/growth/value), capitalization range (large/mid/small/micro) and geography (country/region/global). The 38 investment strategies are broadly categorized as follows:

- **14 U.S. Equity strategies**, comprised of 5 indexed strategies (three of which are internally-managed) and 9 active and/or systematic strategies (one of which is internally-managed); and
- **24 International Equity strategies**, comprised of 17 international developed-market strategies (one of which is indexed), 6 dedicated emerging-market strategies and 1 global-equity strategy.

Public Equity Management Highlights

Although results of the Public Equity review are detailed in a report from OIC general consultant Callan Associates (for the period ending June 30, 2015), staff wishes to highlight the following key points which have been updated for the period ending September 30, 2016:

- ***Public Equity Policy Objective*** – Although the OIC's public equity policy objective (75 basis points [bps] of excess return) has not been achieved over the three year period (Exhibit 1), the objective has been achieved on a five-year, net-of-fee basis. Moreover, this excess performance has been achieved by utilizing only half the policy's 200 bps tracking error (active risk) allowance.

Exhibit 1

Period Ending 9/30/2016	Market Value	3 Months	1 Year	3 Years	5 Years
OPERF Public Equity Returns	$ 26,401,853,950	5.91%	12.16%	5.50%	11.69%
MSCI ACWI IMI Net		5.57%	12.25%	5.24%	10.87%
Excess Return (0.75% Target)		**0.34%**	**-0.10%**	**0.26%**	**0.82%**
OPERF Public Equity Tracking Error (2.0% Maximum)		**N/A**	**0.88%**	**0.97%**	**0.91%**
Information Ratio (Excess Return/Tracking Error)		N/A	**-0.11**	**0.27**	**0.90**

Source: State Street

- ***Internally-Managed Equity Portfolios*** – All internally-managed public equity portfolios (current and terminated mandates) have out-performed their corresponding benchmarks since inception (Appendix A).

- ***Manager Meetings*** – Staff continually scans the marketplace for promising investment managers. The most efficient venue is through visits with prospective managers in OST offices. For the one-year period ending September 2016, staff conducted 85 in-person meetings in the Tigard offices, 39 conference calls in connection with Low Volatility strategies, and regular quarterly conference calls and annual on-site diligence meetings with existing OPERF equity managers. Staff maintains files on all manager meetings, and uses a broad range of third-party databases and analytical tools to assist in the tracking and evaluation of current and prospective manager strategies.

- ***Portfolio Rebalances*** – OIC Policy INV 601 and INV 602 give staff authority, with CIO approval, to terminate and rebalance among existing public equity mandates. For the 15 months ending September 30, 2016, staff reallocated $5.5 billion in public equity assets of which $2.95 billion was raised for OPERF pension payments and private market capital calls, while the residual $2.55 billion was reallocated amongst existing OPERF equity mandates (Appendix B). These actions include terminating three externally-managed active mandates (a U.S. Large Cap, U.S. Small Cap, and U.S. SMid Cap) and two internally-managed mandates (OST-Tiered Emerging Markets Strategy and OST-Russell Fundamental Strategy). Staff rationale in terminating both internally-managed strategies was to make Public Equity staff capacity available for a proposed internally-managed OPERF International Equity strategy.

Background

At the November 2014 OIC meeting, staff proposed to gradually restructure OPERF's U.S. equity portfolio toward low-cost, systematic or "engineered" strategies that tilt to size, value and perhaps other, discreet risk-factor exposures (e.g., momentum, profitability, etc.).

The rationale behind the recommended restructure was that consistent long-term excess returns from traditional, discretionary active management in the OPERF domestic equity portfolio have become increasingly difficult to achieve. Although the total Public Equity portfolio continued to meet the OIC's 75 basis points of excess return policy objective while utilizing only half the policy's 200 bps tracking error allowance, the objective had been achieved mainly through the success of the International equity portfolios as seen in Exhibit 2:

Exhibit 2

Period Ending 6/30/14	Market Value	1 year	3 year	5 year
OPERF Total Public Equity	$ 29,203,480,930.00	24.17%	11.21%	15.68%
MSCI ACWI IMI Net		23.35%	10.37%	14.77%
Excess		0.81%	0.84%	0.90%

Active Risk (Realized)		0.98%	0.93%	0.87%
Information Ratio		0.83	0.90	1.03

Period Ending 6/30/14	Market Value	1 year	3 year	5 year
OPERF Domestic Equity	$ 13,437,002,272.00	24.75%	15.71%	19.38%
RUSSELL 3000		25.22%	16.46%	19.33%
Excess		-0.47%	-0.75%	0.05%

Period Ending 6/30/14	Market Value	1 year	3 year	5 year
OPERF International Equity	$ 14,781,996,732.00	23.18%	7.49%	12.83%
MSCI ACWI IMI X-US Net		22.28%	5.88%	11.50%
Excess		0.90%	1.61%	1.33%

Source: State Street

Historically, OPERF achieved exposure to domestic public equity markets by assigning specific mandates (e.g., large cap, small cap, micro cap, growth, value, etc.) to active managers who attempted to outperform their respective benchmarks. This traditional implementation resulted in a large roster of active managers, often with high associated costs. The positive excess returns (if any) produced by these managers were labelled "alpha" and were commonly believed to be evidence of manager skill. However, empirical studies on U.S. mutual funds and a growing literature on institutional asset management have demonstrated that a large portion of "alpha" is not manager skill but rather is attributable to certain factor exposures[1] such as size, value and momentum. In other words, well-known common factor exposures – rather than stock picking abilities – are often the main driver of active management "alpha" among U.S. public equity managers. The implication of these academic studies is that pension funds have been paying substantive fees for common factor exposures that can otherwise be captured through more cost-effective systematic strategies.

Pursuant to the 2014 recommendation approved by the OIC, staff continues to opportunistically restructure OPERF's U.S. equity portfolio away from traditional active mandates and reallocate proceeds in favor of low-cost systematic or "engineered" strategies (both internally- and externally-managed). This restructuring has complemented the portfolio's long-standing overweight to small cap stocks with systematic tilts toward other factors that are supported by robust empirical evidence as persistent and pervasive sources of excess return. Staff continues to believe that this restructuring approach has a higher probability of long-term success for the OPERF U.S. equity portfolio than traditional, higher cost active management implementations.

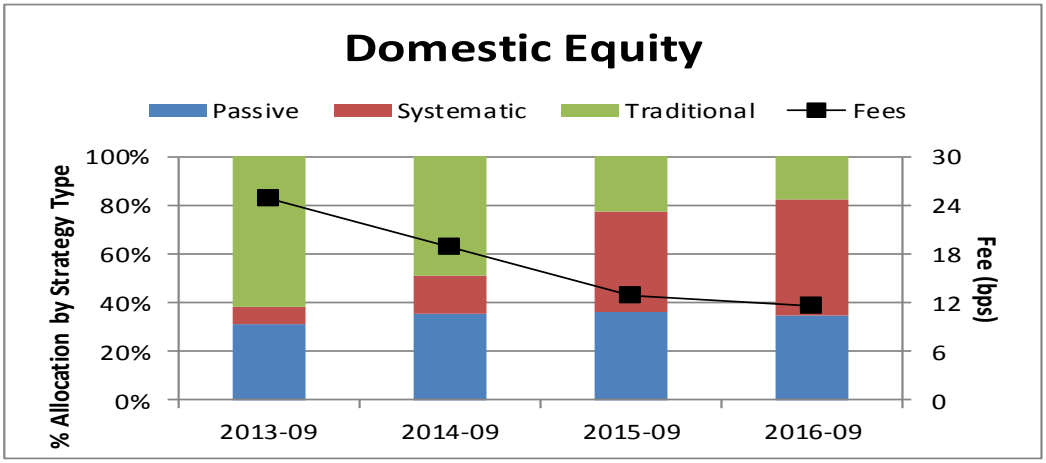
Update on Domestic Equity Restructuring

From June 30, 2015 through September 30, 2016, public equity staff, with CIO approval, terminated four domestic active equity managers and reallocated the resultant assets in lower cost internal and external systematic strategies. These actions have a) reduced the number of traditional active managers employed in the OPERF public equity portfolio, b) increased that portfolio's allocation to systematic

[1] These exposures or "tilts" can be deliberate in a discretionary active management process, but instead are usually just a residual consequence of traditional security selection algorithms.

strategies that tilt towards factors associated with persistent return premia, and c) lowered the portfolio's management costs by more than 50 percent (from 24.6 bps to 11.1 bps per annum).

Exhibit 3 – OPERF US Equity Allocation and Fees by Strategy Type



Source: OST Portfolio Risk & Research

The continued restructuring of the domestic equity portfolio is consistent with **OIC INV 1201** - *Statement of OIC Investment and Management Beliefs:*

> *Section 5.A. - Inefficiencies that can be exploited by active management may exist in certain segments of the capital markets.*
>
> - *While largely efficient, select segments of the capital markets can sometimes be exploited by skilled active management.*
> - *The nature (i.e., perceived magnitude and likely duration) of such inefficiencies should inform the proposed active management strategy (e.g., discretionary or systematic).*
>
> *and*
>
> *Section 6.A. - All fees, expenses, commissions and transaction costs should be diligently monitored and managed in order to maximize net investment returns.*
>
> 1. *Active management should therefore be a deliberate choice and applied only to those public market strategies/managers in which the OIC enjoys a high degree of confidence that such strategies/managers will be sufficiently rewarded on a risk-adjusted basis and net of all fees and related transactions costs.*

Appendix A

Internally Managed Equity Performance (Period Ending 9/30/16, unless otherwise noted)

Period Ending 9/30/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
OST 400 Portfolio	$ 532,520,632	12.70%	15.69%	8.40%	9.63%	13.96%	16.77%	14.26%
S&P 400 Index		12.40%	15.33%	8.14%	9.35%	13.66%	16.51%	13.96%
Excess		0.29%	0.37%	0.27%	0.27%	0.30%	0.26%	0.30%
Inception Date of Oct. 1, 2009	**Tracking Error = 30 bps**	**Target Excess Return: 10 bps**						

Period Ending 9/30/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
OST 500 Portfolio	$ 1,953,966,495	7.83%	15.47%	7.16%	11.21%	13.20%	16.41%	13.23%
S&P 500 Index		7.84%	15.43%	7.11%	11.16%	13.15%	16.37%	13.17%
Excess		0.00%	0.04%	0.05%	0.04%	0.04%	0.04%	0.056%
Inception Date of Oct 1, 2009	**Tracking Error = 10 bps**	**Target Excess Return: 5 bps**						

Period Ending 9/30/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
Russell 2000 Synthetic	$ 384,147,678	12.74%	17.06%	9.31%	7.73%	13.12%	16.92%	12.39%
Russell 2000 Index		11.46%	15.47%	8.12%	6.71%	12.12%	15.82%	11.39%
Excess		1.28%	1.59%	1.19%	1.02%	1.00%	1.10%	1.00%
Inception Date of April 1, 2010	**Tracking Error = 50 bps**	**Target Excess Return: 30 bps**						

Period Ending 9/30/15	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
TEMS	$ 180,449,700	-16.55%	-22.43%	-9.25%	-6.42%	-0.92%	-4.08%	9.01%
MSCI EM Index		-15.48%	-19.28%	-8.25%	-5.27%	-0.15%	-3.24%	8.87%
Excess		-1.07%	-3.15%	-1.01%	-1.15%	-0.77%	-0.85%	0.14%
Inception Date of Feb 1, 2009	**Tracking Error = 400 bps**	**Target Excess Return: 200 bps**				**TERMINATED SEPTEMBER 30, 2015**		

Period Ending 8/31/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
RUSSELL RAFI LC	$ 1,371,571,346	10.27%	13.81%	4.97%	11.23%	14.23%	N/A	14.65%
RAFI LC Index		*10.06%*	*13.54%*	*4.90%*	*11.21%*	*14.21%*	*N/A*	*14.62%*
RUSSELL 1000		7.83%	11.69%	5.89%	12.02%	13.93%	N/A	14.46%
Excess		2.43%	2.11%	-0.93%	-0.79%	0.31%	N/A	0.19%
Inception Date of Nov 1, 2011	**Tracking Error = 300 bps**	**Target Excess Return: 150 bps**				**TERMINATED AUGUST 31, 2016**		

Period Ending 9/30/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
RISK PREMIA	$ 2,145,793,982	7.06%	14.65%	8.27%	N/A	N/A	N/A	8.90%
MSCI Risk Premia Index		*7.02%*	*14.76%*	*8.35%*	*N/A*	*N/A*	*N/A*	*8.93%*
MSCI USA		7.78%	14.97%	6.93%	N/A	N/A	N/A	8.04%
Excess		-0.72%	-0.33%	1.34%	N/A	N/A	N/A	0.87%
Inception Date of Jan 1, 2014	**Tracking Error = 300 bps**	**Target Excess Return: 150 bps**						

Source: State Street

Appendix B

OPERF Public Equity Portfolio Rebalancing
(June 30, 2015 – September 30, 2016)

Date(s)	Manager	Sub-Asset Class	Market Value	Purpose
August-15	Jackson Square Partners	U.S. Large Cap	$ (828,000,000)	Termination - Rebalancing
August-15	Dimensional Fund Advisors	U.S. Large Cap	$ 828,000,000	Rebalance - Additional Funding
August-15	Next Century	Micro Cap Growth	$ (82,000,000)	Termination - Rebalancing
September-15	OST - Russell 2000 Synthetic	U.S. Small Cap	$ 5,000,000	Rebalance - Additional Funding
September-15	OST - Risk Premia Portfolio	U.S. Large Cap	$ 10,000,000	Rebalance - Additional Funding
September-15	Westwood Global	Emerging Markets	$ 100,000,000	Rebalance - Additional Funding
September-15	OST - Tiered Emerging Markets Strategy	Emerging Markets	$ (180,000,000)	Termination - Rebalancing
October-15	Blackrock R1000G Index Fund	U.S. Large Cap	$ (300,000,000)	Cash Raise/Rebalance
October-15	Blackrock R1000V Index Fund	U.S. Large Cap	$ (200,000,000)	Cash Raise/Rebalance
November-15	State Street Global Advisors	International Developed	$ (500,000,000)	Cash Raise/Rebalance
December-15	Blackrock R1000V Index Fund	U.S. Large Cap	$ (250,000,000)	Cash Raise/Rebalance
December-15	Next Century SCG	U.S. Small Cap Growth	$ (97,700,000)	Termination
December-15	AQR Capital Management	International Developed	$ (100,000,000)	Cash Raise/Rebalance
December-15	Pyramis Global Advisors	International Equity	$ (150,000,000)	Cash Raise/Rebalance
December-15	Pyramis Global Advisors	International Small Cap	$ (50,000,000)	Cash Raise/Rebalance
December-15	Alliance Bernstein	Global Value	$ (150,000,000)	Cash Raise/Rebalance
July-16	Columbia Wanger	US SMID Cap Core	$ (741,000,000.00)	Termination
July-16	Genesis	Emerging Markets	$ (50,000,000.00)	Cash Raise/Rebalance
July-16	Lazard	Developed & Emerging Markets	$ (100,000,000.00)	Cash Raise/Rebalance
July-16	Pyramis	Developed & Emerging Markets	$ (250,000,000.00)	Cash Raise/Rebalance
July-16	Walter Scott	International Developed	$ (100,000,000.00)	Cash Raise/Rebalance
July-16	Dimensional Fund Advisors	Large Cap US	$ 240,000,000.00	Rebalance - Additional Funding
September-16	OST - Russell Fundamental Strategy	Large Cap US	$ (1,371,571,000.00)	Termination
September-16	OST - MSCI Risk Premia Strategy	Large Cap US	$ 1,371,571,000.00	Rebalance - Additional Funding

Callan
FORTY YEARS

October 26, 2016

Oregon Investment Council

OPERF Public Equity Review

Public Equity Portfolio

Summary Observations

- The Total Public Equity portfolio has performed well and has exceeded the MSCI ACWI IMI (Net) Index over periods three years and longer.
  - However, the majority of the outperformance continues to come from the non-U.S. equity portfolio.
- The public equity portfolio currently employs 41 strategies.
  - The U.S. equity portfolio has 9 traditional active strategies (~12.5% of the total public equity portfolio), 5 traditional passive strategies (~17.3%), and 3 factor-oriented fundamental strategies (~22.2%).
  - The non-U.S. equity portfolio has 23 traditional active strategies (~43.3%) of the total public equity portfolio) and 1 traditional passive strategy (~4.8%).
- The portfolio is diversified across regions, countries, styles, capitalizations, and sectors.
- Total tracking error for the public equity portfolio is 1.05% for the 10 years ended June 30, 2016, which remains on the lower end of the 0.75%-2.00% policy range.
- While the majority of the portfolio is invested in actively-managed strategies, many of which have higher tracking error targets, the active share of the total public equity portfolio is only around 33% (meaning only about 33% of the total portfolio is different from the benchmark).
- Earlier this year, Staff communicated it's intention to gradually shift 25% of total public equities to a low-volatility approach, with the first 12.5% move to take place in the next few months.
  - We are generally supportive of this decision given the more aggressive profile of the Total Regular Account. However, there are many considerations that must be taken into account as part of this decision.

Timeline of Recent Activity

4Q 2014

- Large cap mandates with MFS (~$1.1B) and Wells Capital (~$900M) were terminated and DFA Large Cap Core was funded (~$2B)
- OST Risk Premia Portfolio was funded with an additional $15M

1Q 2015

- NTRS Non-U.S. Equity mandate (~$288.5M) terminated and ~$90M was liquidated from the SSgA Non-U.S. Equity mandate
- Additional funding made into Lazard CEF (~$100M) and Wells Cap CEF (~$50M) mandates

2Q 2015

- PIMCO Large Core mandate (~$600M) terminated
- DFA Large Core funded with an additional $600M
- Additional funding made into Lazard CEF (~$165M), Wells Cap CEF (~$50M), and William Blair EM ($25M) mandates
- AQR US Small Cap and Arrowstreet International Core converted to 130/30 mandates

3Q 2015

- Jackson Square Partners Large Cap Growth mandate (~828M) terminated
- DFA Large Core funded with an additional $828M
- Next Century Micro Cap Growth mandate (~82M) was terminated

4Q 2015

- Next Century Small Cap Growth mandate (~98M) was terminated

1Q 2016

- OST Planning to begin shifting 25% of total public equities to a low volatility approach

2Q 2016

- Columbia Wanger SMID Core mandate (~$741M) terminated
- DFA Large Core funded with an additional $240M

Strategic Role and Policy Objectives of Public Equities

Strategic Role

- Provide enhanced returns, diversification, and liquidity to meet cash flow needs.
- Target allocation is 37.5% of the Total Fund.
- The investable universe can be categorized as U.S., Non-U.S. and emerging market countries.

Policy Objectives

- Provide one of the highest expected returns of the OPERF major asset classes.
- Over the long term, the return should exceed inflation by 6.0%.
  - Portfolio return of 4.6% over trailing 10 years ended June 30, 2016 exceeds inflation by approximately 2.9% annualized.
- Achieve a portfolio return of 0.75% or more above the MSCI All Country World Index Investable Market Index (ACWI IMI) (net) over a market cycle of 3 to 5 years on a net-of-fee basis.

	Last Year	Last 3 Years	Last 5 Years
Total Public Equity	**(4.41%)**	**6.50%**	**6.00%**
- MSCI ACWI IMI Net*	(3.87%)	6.13%	5.43%
Excess Return	**(0.54%)**	**0.37%**	**0.56%**

- Active risk will be managed to a targeted annualized tracking error of 0.75% to 2.00% relative to the MSCI ACWI IMI (net).
  - Portfolio tracking error for trailing 5 years ended June 30, 2016 was 0.95%, near the low end of the range.

*Public equity benchmark transitioned to the MSCI ACWI IMI in 2008

Public Equity Managers

	June 30, 2016 Market Value	% of Total Fund
Public Equity	**$25,942,480,717**	**37.66%**
Domestic Equity	**$13,069,214,441**	**18.97%**
Large Cap Growth	**$898,777,719**	**1.30%**
BlackRock Russell 1000 Growth	898,777,719	1.30%
Large Cap Value	**$1,837,504,195**	**2.67%**
Aronson, Johnson & Ortiz	1,139,978,903	1.65%
BlackRock Russell 1000 Value	697,525,291	1.01%
Small Cap Growth	**$119,181,712**	**0.17%**
EAM MicroCap Growth	119,181,712	0.17%
Small Cap Value	**$764,622,062**	**1.11%**
AQR Capital Management	211,276,000	0.31%
Boston Company Asset Management	241,312,828	0.35%
DFA MicroCap Value	187,747,254	0.27%
Callan US Microcap Value	124,285,979	0.18%
Market Oriented	**$9,433,667,035**	**13.69%**
PIMCO (liquidating)	1,011,507	0.00%
Russell Fundamental LC OST managed	1,334,599,878	1.94%
DFA Large Cap Core	3,493,632,978	5.07%
Wanger Asset Management	737,166,676	1.07%
Wellington Mgmt - Domestic Equity	376,162,323	0.55%
Russell 2000 Synthetic - OST managed	351,054,452	0.51%
S&P 500 - OST managed	1,880,911,502	2.73%
S&P 400 - OST managed	510,728,635	0.74%
OST Risk Premia Strategy	748,399,082	1.09%
Other		
Transitional & Closed Accounts	2,562,323	0.00%
Shott Capital Management	12,899,393	0.02%
Shott Annex	3	0.00%

	June 30, 2016 Market Value	% of Total Fund
International Equity	**$12,091,365,408**	**17.55%**
International Market Oriented (Core)	**$6,040,879,365**	**8.77%**
Northern Trust Non-US Eq (liquidating)	194,621	0.00%
Arrowstreet Capital	1,199,111,196	1.74%
Arrowstreet Capital (liquidating)	1,316,224	0.00%
Lazard Asset Management	923,327,136	1.34%
Pyramis Global Advisors	841,178,931	1.22%
Wells Cap International CEF	387,587,334	0.56%
Lazard International CEF	581,748,072	0.84%
AQR Capital Management	904,489,590	1.31%
SSgA MSCI World ex US Net Index	1,201,926,260	1.74%
International Value	**$1,642,848,373**	**2.38%**
Acadian Asset Management	837,143,690	1.22%
Brandes Investment Partners	805,704,683	1.17%
International Growth	**$1,391,800,562**	**2.02%**
TT International	632,551,194	0.92%
Walter Scott Management	759,241,712	1.10%
UBS Global Asset Mgmt Americas	7,655	0.00%
International Small Cap	**$1,301,120,218**	**1.89%**
DFA International Small Cap	261,230,660	0.38%
Harris Associates	255,141,774	0.37%
Fidelity Select Small Cap	300,426,529	0.44%
Victory Capital Management	233,063,898	0.34%
EAM Int'l Micro Cap	122,016,372	0.18%
DFA Int'l MicroCap	129,240,986	0.19%
Emerging Markets	**$1,714,716,891**	**2.49%**
Genesis Emerging Markets	602,321,390	0.87%
Arrowstreet Emerging Market	401,305,449	0.58%
Westwood Global Investment EM	260,546,191	0.38%
William Blair EM	192,993,778	0.28%
DFA Emerging Market Small Cap	122,709,008	0.18%
William Blair Emr Mkt Sm Cap	134,841,074	0.20%
Global Equity	**$781,900,867**	**1.14%**
AB Global Value	781,900,867	1.14%

Total Public Equity Exposures

Holdings-Based Analysis as of June 30, 2016

By Size*

Style Exposure Matrix
Holdings as of June 30, 2016

	Value	Core	Growth	Total
Large	20.7% (286) 22.4% (281)	21.4% (272) 24.8% (272)	19.7% (320) 23.1% (315)	**61.8% (878)** **70.3% (868)**
Mid	6.6% (407) 5.3% (484)	9.2% (575) 6.9% (605)	8.4% (534) 6.9% (648)	**24.2% (1516)** **19.1% (1737)**
Small	3.5% (823) 2.8% (1078)	4.0% (1004) 3.3% (1252)	3.0% (598) 2.9% (1146)	**10.5% (2425)** **8.9% (3476)**
Micro	1.2% (1396) 0.6% (983)	1.6% (2529) 0.6% (911)	0.8% (517) 0.4% (712)	**3.5% (4442)** **1.7% (2606)**
Total	**31.9% (2912)** **31.0% (2826)**	**36.2% (4380)** **35.7% (3040)**	**31.9% (1969)** **33.3% (2821)**	**100.0% (9261)** **100.0% (8687)**

By Region

Style Exposure Matrix
Holdings as of June 30, 2016

	Value	Core	Growth	Total
Europe/ Mid East	6.5% (465) 6.4% (481)	4.9% (482) 5.3% (476)	9.0% (344) 8.6% (487)	**20.4% (1291)** **20.4% (1444)**
N. America	18.9% (850) 16.6% (769)	23.8% (1075) 23.2% (1133)	14.4% (629) 16.5% (908)	**57.0% (2554)** **56.3% (2810)**
Pacific	3.0% (829) 4.3% (618)	3.7% (613) 3.9% (582)	4.5% (371) 4.3% (528)	**11.1% (1813)** **12.5% (1728)**
Emerging/ FM	3.6% (768) 3.7% (958)	3.8% (2210) 3.2% (849)	4.0% (625) 3.9% (898)	**11.4% (3603)** **10.9% (2705)**
Total	**31.9% (2912)** **31.0% (2826)**	**36.2% (4380)** **35.7% (3040)**	**31.9% (1969)** **33.3% (2821)**	**100.0% (9261)** **100.0% (8687)**

- **OPERF Public Equity**
- **MSCI ACWI IMI**

- Total public equity portfolio is underweight large cap (61.8% vs. 70.3%) but overweight mid, small, and micro cap (38.2% vs. 29.7%) and exhibits a slight value bias relative to the MSCI ACWI IMI.
- Regional allocations remain approximately in-line with the benchmark.

*The capitalization segments in the matrices above are dictated by capitalization decile breakpoints. The style segments are determined using the Combined Z Score, based on the eight fundamental factors used in the MSCI stock scoring system.

U.S. Equity Style Exposures

Exposures as of June 30, 2016

Style Exposure Matrix
Holdings as of June 30, 2016

	Value	Core	Growth	Total
Large	21.9% (98) 22.4% (97)	25.8% (115) 31.7% (114)	14.4% (102) 21.0% (98)	**62.1% (315)** **75.1% (309)**
Mid	8.1% (189) 5.4% (188)	9.2% (244) 6.5% (240)	7.1% (194) 5.3% (190)	**24.5% (627)** **17.2% (618)**
Small	3.4% (287) 1.9% (328)	4.5% (359) 2.7% (493)	3.0% (205) 2.3% (417)	**10.8% (851)** **6.9% (1238)**
Micro	0.9% (249) 0.3% (268)	1.2% (222) 0.3% (359)	0.5% (80) 0.2% (183)	**2.5% (551)** **0.8% (810)**
Total	**34.3% (823)** **30.0% (881)**	**40.7% (940)** **41.2% (1206)**	**25.0% (581)** **28.8% (888)**	**100.0% (2344)** **100.0% (2975)**

- **OPERF U.S. Equity**
- **Russell 3000**

- The U.S. equity portfolio is underweight large cap (62.1% vs.75.1%) but overweight mid, small, and micro cap equity (37.8% vs. 24.9%) and exhibits a value tilt relative to the Russell 3000.

Non-U.S. Equity

Exposures as of June 30, 2016

Style Exposure Matrix
Holdings as of June 30, 2016

	Value	Core	Growth	Total
Large	16.2% (157) 19.7% (155)	15.4% (140) 16.9% (137)	24.2% (189) 23.5% (181)	55.8% (486) 60.1% (473)
Mid	6.3% (214) 6.0% (277)	9.2% (302) 8.0% (346)	12.5% (355) 10.3% (458)	28.1% (871) 24.3% (1081)
Small	4.2% (423) 4.0% (714)	4.4% (466) 4.6% (815)	3.8% (263) 3.9% (764)	12.3% (1152) 12.4% (2293)
Micro	1.2% (994) 1.2% (879)	1.6% (959) 1.2% (833)	0.9% (243) 0.8% (638)	3.7% (2196) 3.2% (2350)
Total	27.9% (1788) 30.9% (2025)	30.7% (1867) 30.6% (2131)	41.4% (1050) 38.5% (2041)	100.0% (4705) 100.0% (6197)

Style Exposure Matrix
Holdings as of June 30, 2016

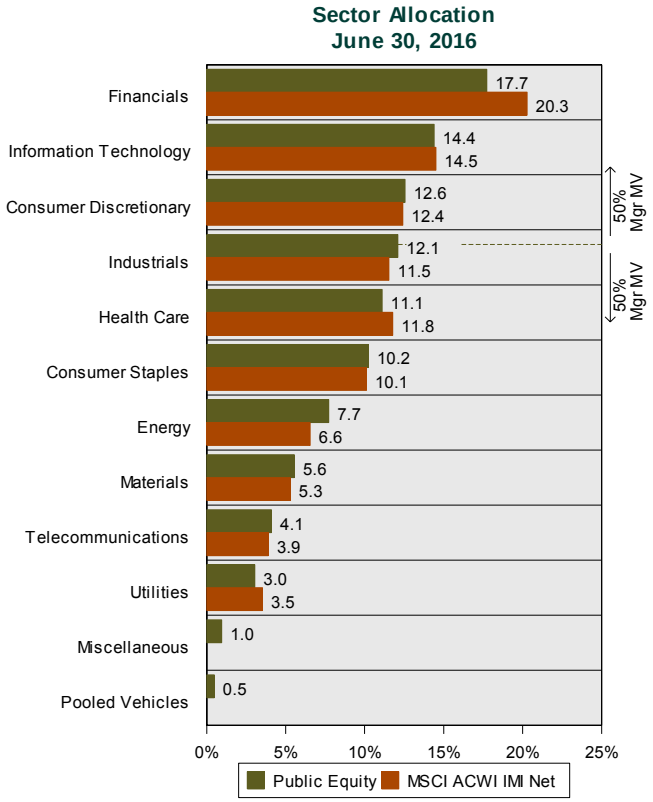
	Value	Core	Growth	Total
Europe/ Mid East	13.2% (443) 12.7% (454)	11.8% (496) 12.1% (495)	20.0% (347) 18.4% (495)	45.0% (1286) 43.2% (1444)
N. America	1.7% (74) 2.5% (83)	2.1% (101) 2.6% (141)	1.8% (61) 2.1% (98)	5.5% (236) 7.3% (322)
Pacific	6.1% (795) 8.7% (579)	8.0% (599) 8.4% (611)	10.6% (374) 9.4% (538)	24.8% (1768) 26.5% (1728)
Emerging/ FM	6.9% (476) 7.1% (909)	8.8% (671) 7.5% (884)	9.0% (268) 8.5% (910)	24.7% (1415) 23.0% (2703)
Total	27.9% (1788) 30.9% (2025)	30.7% (1867) 30.6% (2131)	41.4% (1050) 38.5% (2041)	100.0% (4705) 100.0% (6197)

- **OPERF Non-U.S. Equity**
- **MSCI ACWI ex-U.S. IMI**

- The non-U.S. equity portfolio is slightly underweight large cap (55.8% vs. 60.1%) and overweight mid, small, and micro cap (44.1% vs. 39.9%) relative to the MSCI ACWI ex-U.S. IMI Index.
- Regional allocations are approximately in-line with benchmark.

Public Equity

Portfolio Characteristics



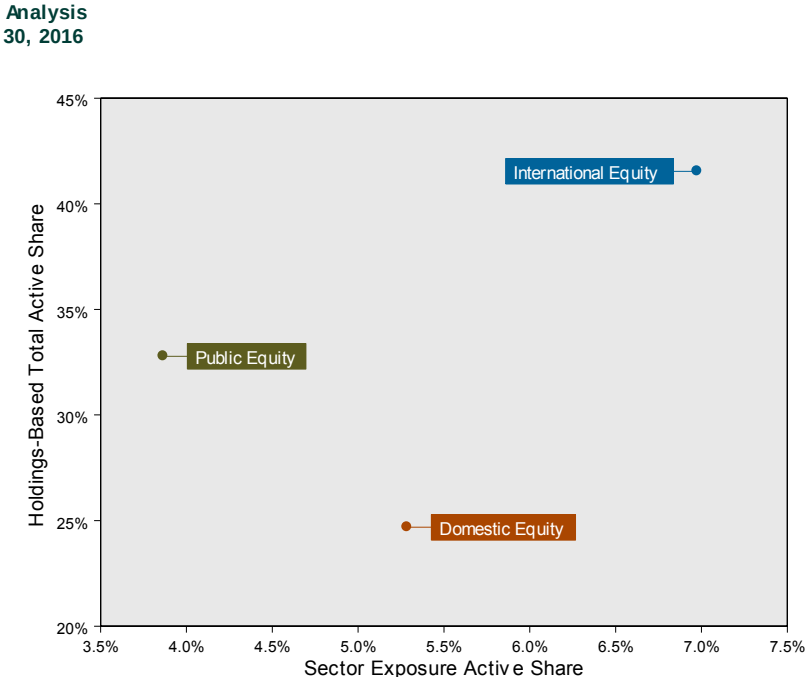
Portfolio Characteristics
As of June 30, 2016

	Wtd. Median Mkt Cap	Price/Earn.	Price/Book	Forecasted Earn. Growth	Div yield	MSCI Combined Z-Score
Total Public Equity	20.29	14.98	1.82	10.85	2.40	-0.07
MSCI ACWI IMI	30.36	15.53	1.90	11.05	2.57	-0.02

- Sector exposures are approximately in-line with the benchmark. The most significant difference is in Financials where the portfolio is underweight nearly 3%.
- Weighted median market cap shows a smaller cap bias compared to the benchmark but other characteristics are approximately in-line.

Active Share Analysis

As of June 30, 2016



	Weight %	Index	Total Act Share	Non-Idx Act Share	Sector Act Share	Number Securities
Public Equity	100.00%	MSCI ACWI IMI	32.78%	2.37%	3.87%	9814
Domestic Equity	50.35%	Russell 3000	24.68%	0.80%	5.29%	2451
International Equity	46.64%	MSCI ACWI ex US IMI	41.54%	3.59%	6.98%	7381
Global Equity	3.02%	MSCI ACWI	92.28%	4.71%	12.08%	67

- The public equity portfolio is 78% actively managed and 22% passively implemented.
- Total active share for the public equity portfolio, which looks at how different a portfolio is from its index on a holdings basis, remained at approximately 33% as of June 30, 2016.

Total Public Equity Portfolio Risk Analysis

Rolling 12 Quarter Tracking Error vs MSCI ACWI IMI Net

5 Years Ended June 30, 2016

	Sharpe Ratio	Excess Return Ratio	Standard Deviation	Tracking Error
Total Public Equity	0.44	0.87	14.19	0.95
MSCI ACWI IMI	0.39	0.00	13.65	0.00
U.S. Equity	0.76	(0.56)	14.04	1.33
Russell 3000	0.86	0.00	13.34	0.00
Non-U.S. Equity	0.15	2.54	15.06	0.79
MSCI ACWI ex-U.S. IMI	0.02	0.00	15.06	0.00

Asset Class Performance – U.S. Equity

Net of Fee Returns as of June 30, 2016

	Last Year	Last 3 Years	Last 5 Years	Last 10 Years
Domestic Equity	**(0.28%)**	**9.95%**	**10.54%**	**6.90%**
- Russell 3000 Index	2.14%	11.13%	11.60%	7.40%
Excess Return	**(2.41%)**	**(1.18%)**	**(1.06%)**	**(0.49%)**
- Lg Public >10 B DE	1.38%	10.76%	10.99%	7.21%
Market Oriented	**0.16%**	**9.82%**	**10.34%**	**-**
- Russell 3000 Index	2.14%	11.13%	11.60%	7.40%
Excess Return	**(1.98%)**	**(1.30%)**	**(1.26%)**	**-**
- CAI All Cap: Broad DB	(3.26%)	8.88%	9.18%	6.58%
Large Cap Growth	**3.73%**	**12.64%**	**11.52%**	**-**
- Russell 1000 Growth Index	3.02%	13.07%	12.35%	8.78%
Excess Return	**0.71%**	**(0.44%)**	**(0.83%)**	**-**
- CAI Lrg Cap Growth Style	(0.06%)	12.70%	11.67%	8.28%
Large Cap Value	**(3.34%)**	**7.36%**	**9.91%**	**-**
- Russell 1000 Value Index	2.86%	9.87%	11.35%	6.13%
Excess Return	**(6.20%)**	**(2.51%)**	**(1.44%)**	**-**
- CAI Large Cap Value Style	(0.41%)	9.21%	10.68%	5.98%
Small Cap Growth	**(21.06%)**	**2.13%**	**5.01%**	**-**
- Russell 2000 Growth Index	(10.75%)	7.74%	8.51%	7.14%
Excess Return	**(10.30%)**	**(5.61%)**	**(3.50%)**	**-**
- CAI Sm Cap Growth Style	(10.88%)	7.01%	8.13%	7.17%
Small Cap Value	**(1.84%)**	**7.10%**	**8.52%**	**-**
- Russell 2000 Value Index	(2.58%)	6.36%	8.15%	5.15%
Excess Return	**0.75%**	**0.75%**	**0.37%**	**-**
- CAI Small Cap Value Style	(2.74%)	8.38%	10.01%	6.89%

- The U.S. equity portfolio has trailed the Russell 3000 Index on a net of fee basis over all periods measured above.

Asset Class Performance – Non-U.S. Equity

Net of Fee Returns as of June 30, 2016

	Last Year	Last 3 Years	Last 5 Years	Last 10 Years
International Equity	**(8.14%)**	**3.13%**	**2.03%**	**3.49%**
MSCI ACWI ex-US IMI Index (Net)	(9.61%)	1.65%	0.39%	2.31%
Excess Return	**1.48%**	**1.48%**	**1.65%**	**1.18%**
Lg Public >10 B IE	(8.30%)	2.55%	1.35%	2.87%
International Market Oriented (Core)	**(8.61%)**	**3.46%**	**2.59%**	**-**
MSCI World ex-US IMI Net	(8.99%)	2.45%	1.54%	1.90%
Excess Return	**0.39%**	**1.00%**	**1.05%**	**-**
CAI Core Int'l Equity	(9.31%)	3.15%	2.81%	2.76%
International Value	**(8.66%)**	**3.03%**	**2.41%**	**-**
MSCI ACWI ex-US IMI Value	(13.31%)	(0.24%)	(0.94%)	1.27%
Excess Return	**4.65%**	**3.27%**	**3.35%**	**-**
CAI Core Value Int'l Equity Style	(11.11%)	2.37%	1.99%	2.20%
International Growth	**(5.12%)**	**3.89%**	**2.33%**	**-**
MSCI World ex US Growth	(5.25%)	3.94%	2.58%	2.75%
Excess Return	**0.13%**	**(0.06%)**	**(0.24%)**	**-**
CAI Core Growth Int'l Equity Style	(7.62%)	3.61%	3.41%	3.82%
International Small Cap	**(5.89%)**	**5.41%**	**3.92%**	**-**
ACWI Sm Cap ex US	(5.46%)	4.93%	2.28%	4.08%
Excess Return	**(0.43%)**	**0.48%**	**1.64%**	**-**
CAI Int'l Small Cap Style	(3.90%)	7.48%	6.28%	5.79%
Emerging Markets	**(9.82%)**	**0.03%**	**(1.42%)**	**-**
EM IMI Index	(12.16%)	(1.36%)	(3.59%)	3.87%
Excess Return	**2.34%**	**1.38%**	**2.17%**	**-**
CAI Emerging Markets Equity DB	(8.55%)	0.91%	(0.91%)	5.34%
Global Equity	**(10.41%)**	**7.21%**	**5.11%**	**-**
MSCI ACWI Value Net Index	(4.78%)	4.15%	4.18%	3.47%
Excess Return	**(5.62%)**	**3.05%**	**0.93%**	**-**
CAI Global Eq Broad Style	(4.12%)	7.10%	6.86%	5.63%

- The non-U.S. equity portfolio has outperformed the custom non-U.S. benchmark (ACWI ex-U.S. Gross through May 31, 2008, and the ACWI ex-U.S. IMI net thereafter) over all periods measured above.

OST Managed Strategies

As of June 30, 2016

Portfolio Benchmark	**S&P 500** S&P 500 Index	**S&P 400** S&P 400 Index	**R2000 Synthetic** Russell 2000 Index	**Fundamental LC** Russell 1000	**Risk Premia** MSCI USA Index
Portfolio Return (1 yr)	3.99%	1.58%	-5.68%	4.97%	4.25%
Benchmark Return (1 yr)	3.99%	1.33%	-6.73%	2.93%	3.18%
Excess Return	0.00%	0.25%	1.05%	2.04%	1.07%
Portfolio Return (Inception)	13.11%	14.12%	11.30%	14.75%	8.01%
Benchmark Return (Inception)	13.06%	13.82%	10.33%	14.47%	7.19%
Excess Return	0.05%	0.30%	0.97%	0.28%	0.82%
Tracking Error*	0.06	0.09	0.24	2.2	N/A
Excess Return Ratio*	0.50	2.42	3.79	0.11	N/A
Inception Date	10/01/2009	10/01/2009	04/01/2010	11/01/2011	01/01/2014
Managed By	Michael Viteri	Paola Nealon	Michael Viteri	Michael Viteri	Michael Viteri

- On a since inception basis, the internally managed strategies have all performed well versus their respective benchmarks.

*Risk statistics are calculated using 5 years worth of quarterly data unless the track record is less than 5 years, in which case it is calculated on a since inception basis (provided that there is at least 3 years worth of data).

Low Volatility Proposal

Overview

- OST Staff is proposing to gradually shift 25% of total public equities to a low-volatility approach, with the first 12.5% move to take place in the next few months.
- We are supportive of this decision, driven mainly by the more aggressive profile of the Total OPERF Portfolio. However, there are many factors considerations that must be taken into account as part of this decision.
- Staff is currently considering new global low or managed volatility mandates with Acadian, Arrowstreet, AQR, and LA Capital Management ("LACM"), the latter of which is not a manager the OPERF currently has a relationship with.
- Out of these four managers, Acadian is the one with the longest track record. LACM has a three year track record. Arrowstreet and AQR are creating custom mandates for the OPERF and therefore do not have live track records for their respective strategies.
- Callan has performed due diligence on all four proposed managers (see evaluations under separate cover) and has a positive opinion of all four
- We have constructed a 75% current Total Public Equity and 25% MSCI ACWI Minimum Volatility Index model portfolio to show back-tested performance, risk statistics, and portfolio characteristics to illustrate how the portfolio would have behaved and been structured.

Differences Between MSCI ACWI and MSCI ACWI Min Vol

As of 06/30/2016

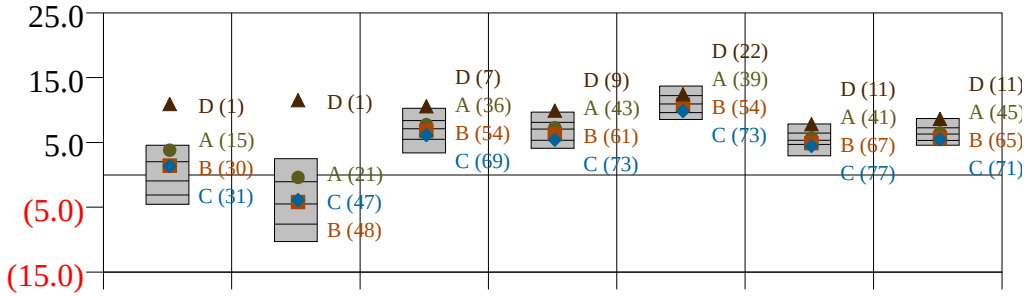
	Weighted Median Market Cap	Price/Earnings	Price/Book	Earnings Growth	Dividend Yield	Z-Score	Sharpe Ratio	Standard Deviation
Total Public Equity	20.31	17.44	1.82	7.31	2.41	-0.08	0.44	14.19
MSCI ACWI IMI	30.36	18.08	1.90	7.39	2.57	-0.02	0.39	13.65
MSCI ACWI Min Vol	24.75	22.20	2.60	5.40	2.63	-0.03	1.17	8.41

For the 5 years ended 06/30/2016

Low Volatility Model

Cumulative Performance

Returns
for Periods Ended June 30, 2016
Group: CAI Global Equity Broad Style



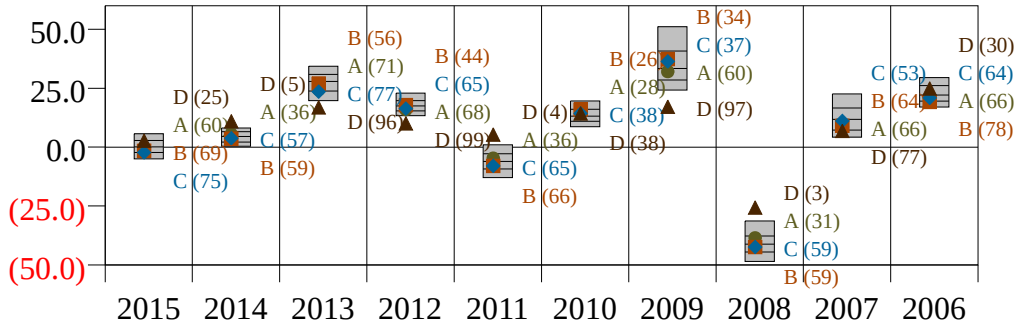
		Year to Date	Last Year	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years	Last 15 Years
10th Percentile		4.60	2.52	10.29	9.70	13.73	7.90	8.72
25th Percentile		2.06	(1.02)	8.38	8.14	12.24	6.47	7.29
Median		(0.92)	(4.47)	7.16	7.08	10.98	5.37	6.31
75th Percentile		(3.06)	(7.57)	5.51	5.37	9.63	4.72	5.34
90th Percentile		(4.54)	(10.29)	3.42	4.11	8.56	2.96	4.60
OPERF 75/25 Model	● A	3.82	(0.37)	7.78	7.28	11.34	5.72	6.51
OPERF Total Public Equity	■ B	1.46	(4.16)	6.79	6.31	10.86	4.92	5.70
MSCI:ACWI IMI	◆ C	1.36	(3.87)	6.13	5.43	9.85	4.48	5.48
MSCI:ACWI Min Vol Index	▲ D	10.96	11.55	10.62	9.95	12.49	7.85	8.67

- Assuming a model portfolio comprised of 75% current Total Public Equities and 25% MSCI ACWI Minimum Volatility Index, the OPERF Model Portfolio outperforms the current Total Public Equities Portfolio and the MSCI ACWI IMI Net Index over all time periods shown.
- However, it is important to note the end point sensitivity of these back-tested results as the MSCI ACWI Minimum Volatility Index has had a tremendous run over the last 10 quarters.

Low Volatility Model

Calendar Year Returns

Returns
for Calendar Years
10 Years Ended December 31, 2015
Group: CAI Global Equity Broad Style



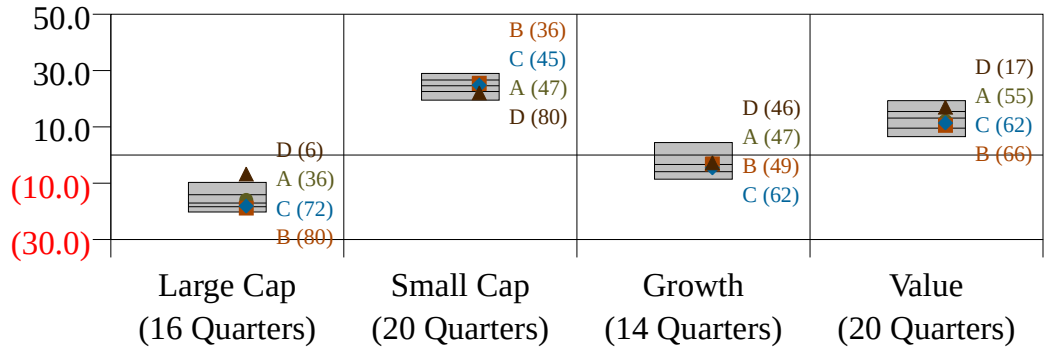
		2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
10th Percentile		5.66	8.13	34.41	22.96	1.02	19.59	51.16	(31.27)	22.67	29.58
25th Percentile		2.85	6.59	30.88	19.82	(2.79)	16.14	40.82	(37.62)	16.64	26.18
Median		0.17	4.57	27.98	17.49	(6.04)	13.21	33.43	(41.20)	11.78	22.18
75th Percentile		(2.21)	2.22	23.83	15.41	(9.21)	11.02	28.53	(44.47)	7.27	19.56
90th Percentile		(4.97)	0.38	19.77	13.38	(12.92)	8.73	24.28	(48.48)	4.34	17.00
OPERF 75/25 Model	● A	(0.41)	5.41	24.50	15.93	(4.65)	15.73	32.11	(38.44)	8.59	20.62
OPERF Total Public Equity	■ B	(1.49)	3.61	27.05	17.84	(7.93)	16.07	37.37	(42.35)	9.11	19.21
MSCI:ACWI IMI	◆ C	(2.19)	3.84	23.55	16.38	(7.89)	14.34	36.42	(42.34)	11.16	20.91
MSCI:ACWI Min Vol Index	▲ D	2.76	10.95	16.91	10.06	5.34	14.32	17.16	(25.57)	6.95	24.89

- On a calendar year basis over the last 10 years, the Model Portfolio outperforms the current Total Public Equities portfolio in 2014-2015, 2011, 2008, and 2006; but trails in 2012-2013, 2009-2010, and 2007.

Low Volatility Model

Performance in Stylistically Extreme Periods

Returns
for Stylistically Extreme Periods
(July 1, 2001 - June 30, 2016)
Group: CAI Global Equity Broad Style



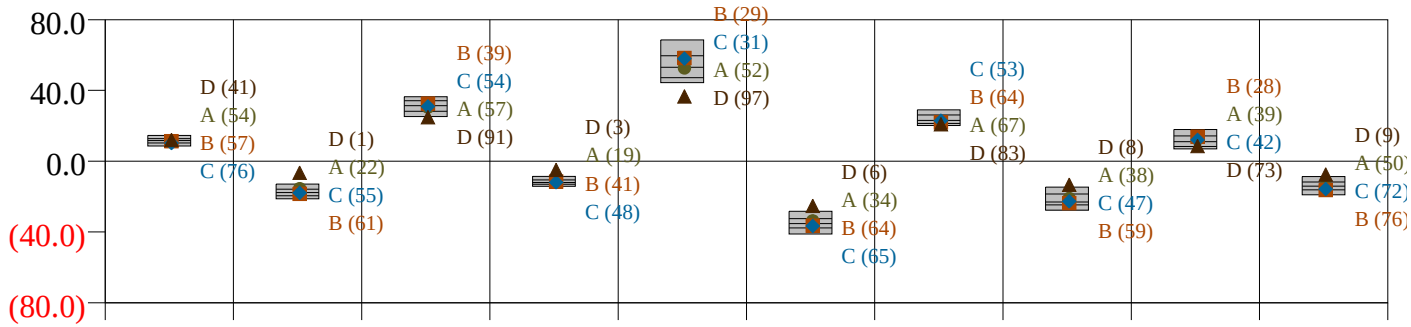
		Large Cap (16 Quarters)	Small Cap (20 Quarters)	Growth (14 Quarters)	Value (20 Quarters)
10th Percentile		(9.64)	29.00	4.52	19.33
25th Percentile		(14.05)	26.71	0.05	15.54
Median		(16.99)	24.68	(3.30)	13.15
75th Percentile		(18.33)	22.60	(5.88)	9.58
90th Percentile		(20.20)	19.55	(8.52)	6.63
OPERF 75/25 Model	● A	(15.87)	24.72	(2.93)	12.23
OPERF Total Public Equity	■ B	(18.82)	25.49	(3.09)	10.55
MSCI:ACWI IMI	◆ C	(18.10)	24.85	(4.49)	11.41
MSCI:ACWI Min Vol Index	▲ D	(6.70)	22.08	(2.74)	17.05

- Given the MSCI ACWI Minimum Volatility Index's tilt towards value and large- and mid-cap, the Model Portfolio underperformed in extreme periods that favored growth and small cap.

Low Volatility Model

Performance in Rising/Declining US Equity Markets

Returns
for Domestic Equity Rising/Declining Periods
15 Years Ended June 30, 2016
Group: CAI Global Equity Broad Style

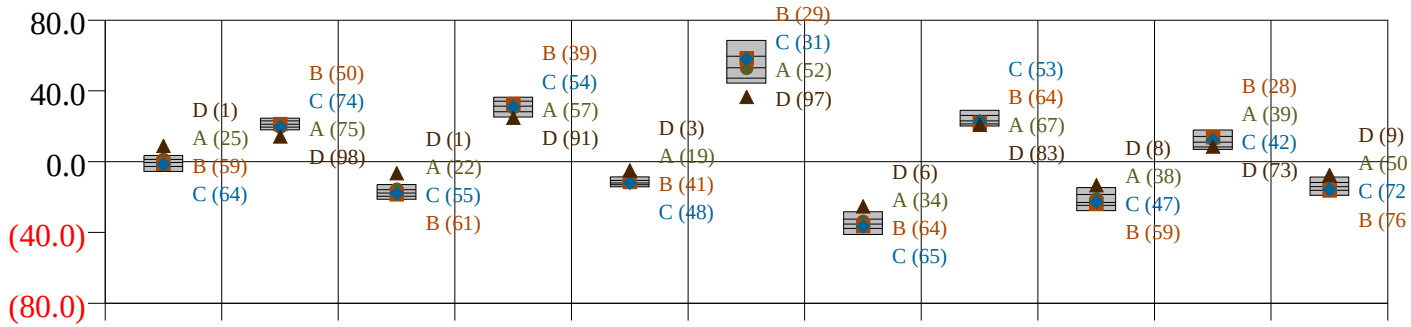


	Rising Period 10/1/11 to 6/30/16	Declining Period 7/1/11 to 9/30/11	Rising Period 7/1/10 to 6/30/11	Declining Period 4/1/10 to 6/30/10	Rising Period 4/1/09 to 3/31/10	Declining Period 10/1/07 to 3/31/09	Rising Period 4/1/03 to 9/30/07	Declining Period 4/1/02 to 3/31/03	Rising Period 10/1/01 to 3/31/02	Declining Period 7/1/01 to 9/30/01
10th Percentile	14.64	(12.87)	36.49	(8.55)	68.70	(28.25)	29.13	(14.55)	17.99	(8.67)
25th Percentile	12.84	(15.79)	34.28	(10.43)	59.66	(32.43)	26.24	(18.51)	14.43	(11.68)
Median	11.73	(17.64)	31.45	(11.98)	53.19	(35.23)	23.14	(22.93)	11.09	(14.09)
75th Percentile	10.35	(19.52)	28.28	(13.01)	47.28	(37.64)	21.42	(24.58)	8.43	(16.15)
90th Percentile	8.61	(21.22)	25.35	(14.20)	44.44	(41.06)	20.20	(27.62)	7.03	(18.93)
OPERF 75/25 Model ● A	11.56	(15.50)	30.69	(9.83)	52.85	(33.65)	21.88	(21.05)	12.61	(14.05)
OPERF Total Public Equity ■ B	11.31	(18.39)	32.58	(11.46)	58.51	(36.37)	22.14	(23.64)	13.89	(16.20)
MSCI:ACWI IMI ◆ C	10.21	(17.89)	31.00	(11.86)	58.03	(36.54)	22.96	(22.66)	12.12	(15.73)
MSCI:ACWI Min Vol Index ▲ D	12.08	(6.49)	24.90	(4.88)	36.69	(25.17)	21.01	(13.20)	8.68	(7.39)

Low Volatility Model

Performance in Rising/Declining Non-US Equity Markets

Returns
for International Equity Rising/Declining Periods
15 Years Ended June 30, 2016
Group: CAI Global Equity Broad Style

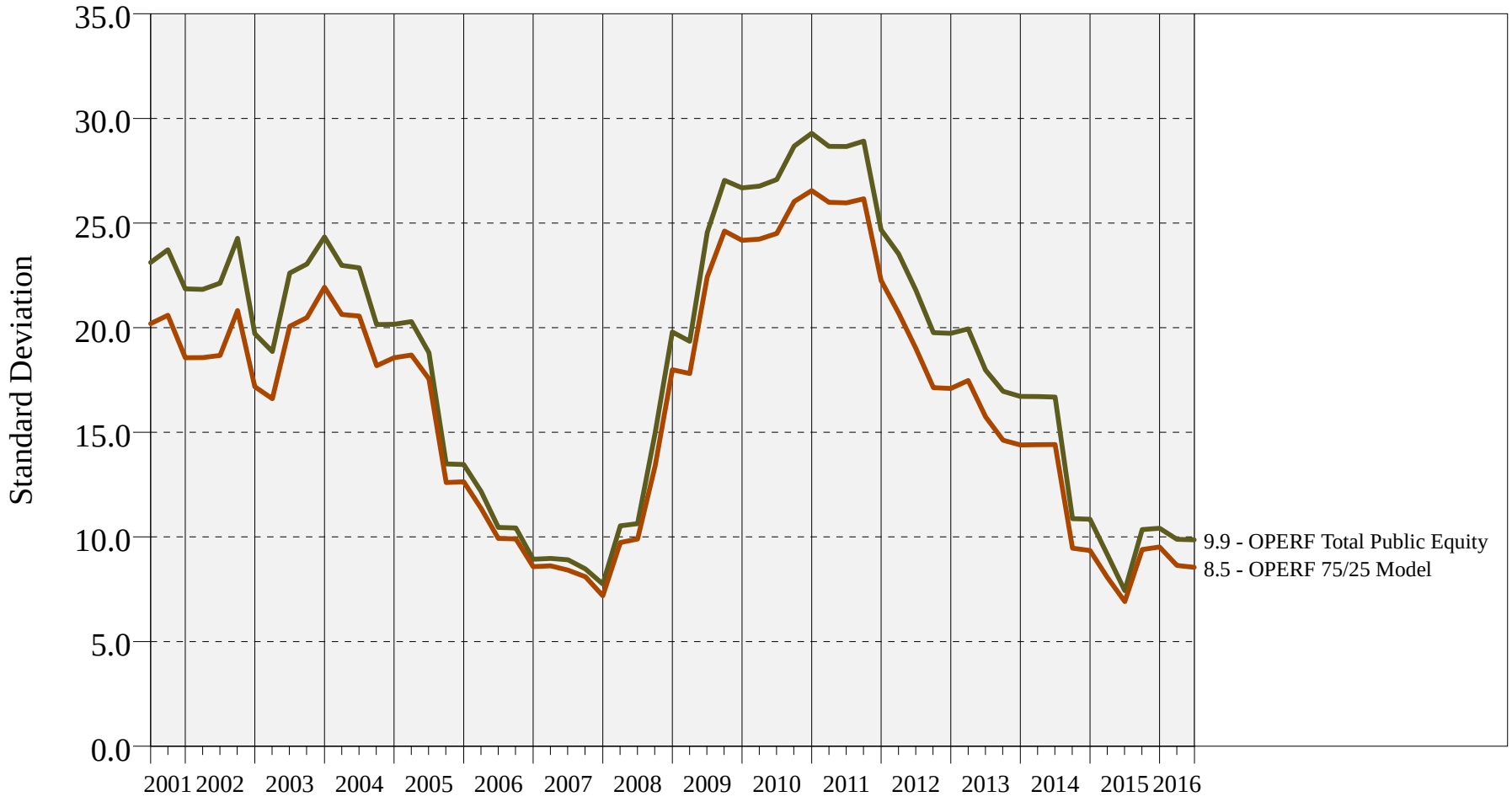


	Declining Period 7/1/14 to 6/30/16	Rising Period 10/1/11 to 6/30/14	Declining Period 7/1/11 to 9/30/11	Rising Period 7/1/10 to 6/30/11	Declining Period 4/1/10 to 6/30/10	Rising Period 4/1/09 to 3/31/10	Declining Period 10/1/07 to 3/31/09	Rising Period 4/1/03 to 9/30/07	Declining Period 4/1/02 to 3/31/03	Rising Period 10/1/01 to 3/31/02	Declining Period 7/1/01 to 9/30/01
10th Percentile	3.67	24.69	(12.87)	36.49	(8.55)	68.70	(28.25)	29.13	(14.55)	17.99	(8.67)
25th Percentile	1.39	23.20	(15.79)	34.28	(10.43)	59.66	(32.43)	26.24	(18.51)	14.43	(11.68)
Median	(0.41)	21.24	(17.64)	31.45	(11.98)	53.19	(35.23)	23.14	(22.93)	11.09	(14.09)
75th Percentile	(2.68)	19.59	(19.52)	28.28	(13.01)	47.28	(37.64)	21.42	(24.58)	8.43	(16.15)
90th Percentile	(5.43)	18.03	(21.22)	25.35	(14.20)	44.44	(41.06)	20.20	(27.62)	7.03	(18.93)
OPERF 75/25 Model ● A	1.39	19.60	(15.50)	30.69	(9.83)	52.85	(33.65)	21.88	(21.05)	12.61	(14.05)
OPERF Total Public Equity ■ B	(1.10)	21.30	(18.39)	32.58	(11.46)	58.51	(36.37)	22.14	(23.64)	13.89	(16.20)
MSCI:ACWI IMI ◆ C	(1.56)	19.64	(17.89)	31.00	(11.86)	58.03	(36.54)	22.96	(22.66)	12.12	(15.73)
MSCI:ACWI Min Vol Index ▲ D	9.04	14.33	(6.49)	24.90	(4.88)	36.69	(25.17)	21.01	(13.20)	8.68	(7.39)

Low Volatility Model

Standard Deviation

Rolling 12 Quarter Standard Deviation
for 15 Years Ended June 30, 2016



Low Volatility Model

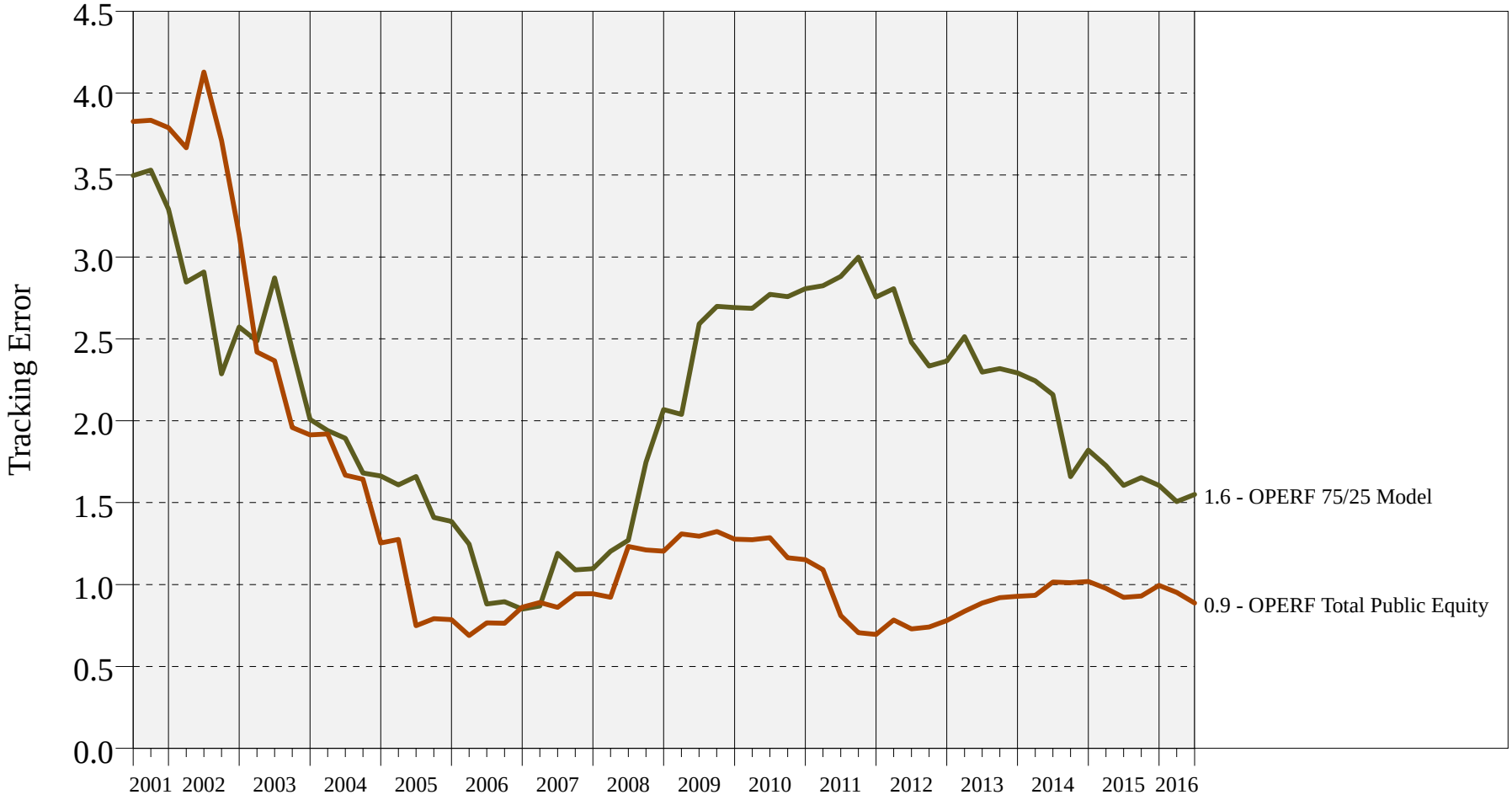
Sharpe Ratio

Rolling 12 Quarter Sharpe Ratio
for 15 Years Ended June 30, 2016

Low Volatility Model

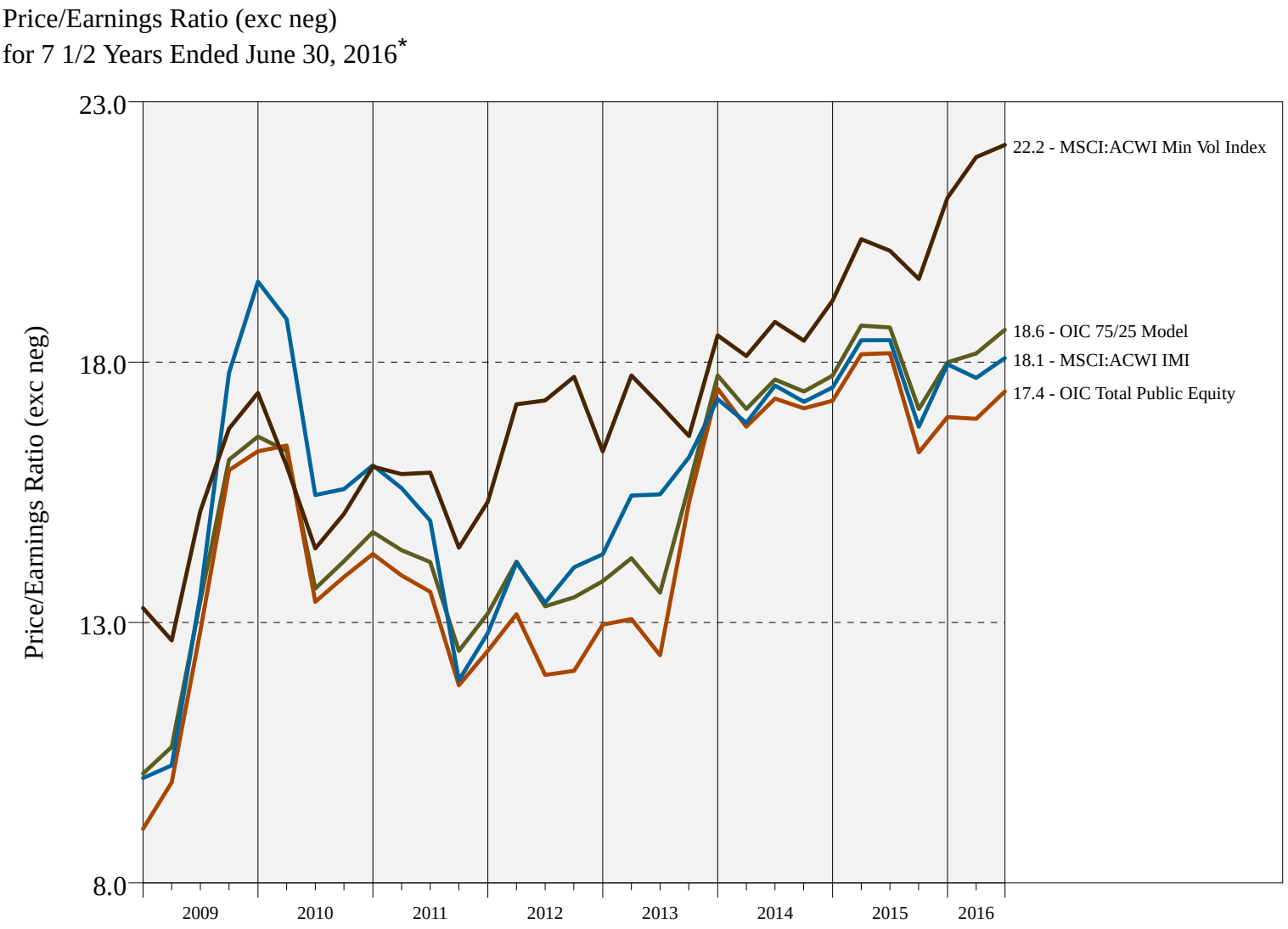
Tracking Error

Rolling 12 Quarter Tracking Error Relative To MSCI:ACWI IMI
for 15 Years Ended June 30, 2016



Low Volatility Model

Price/Earnings Ratio

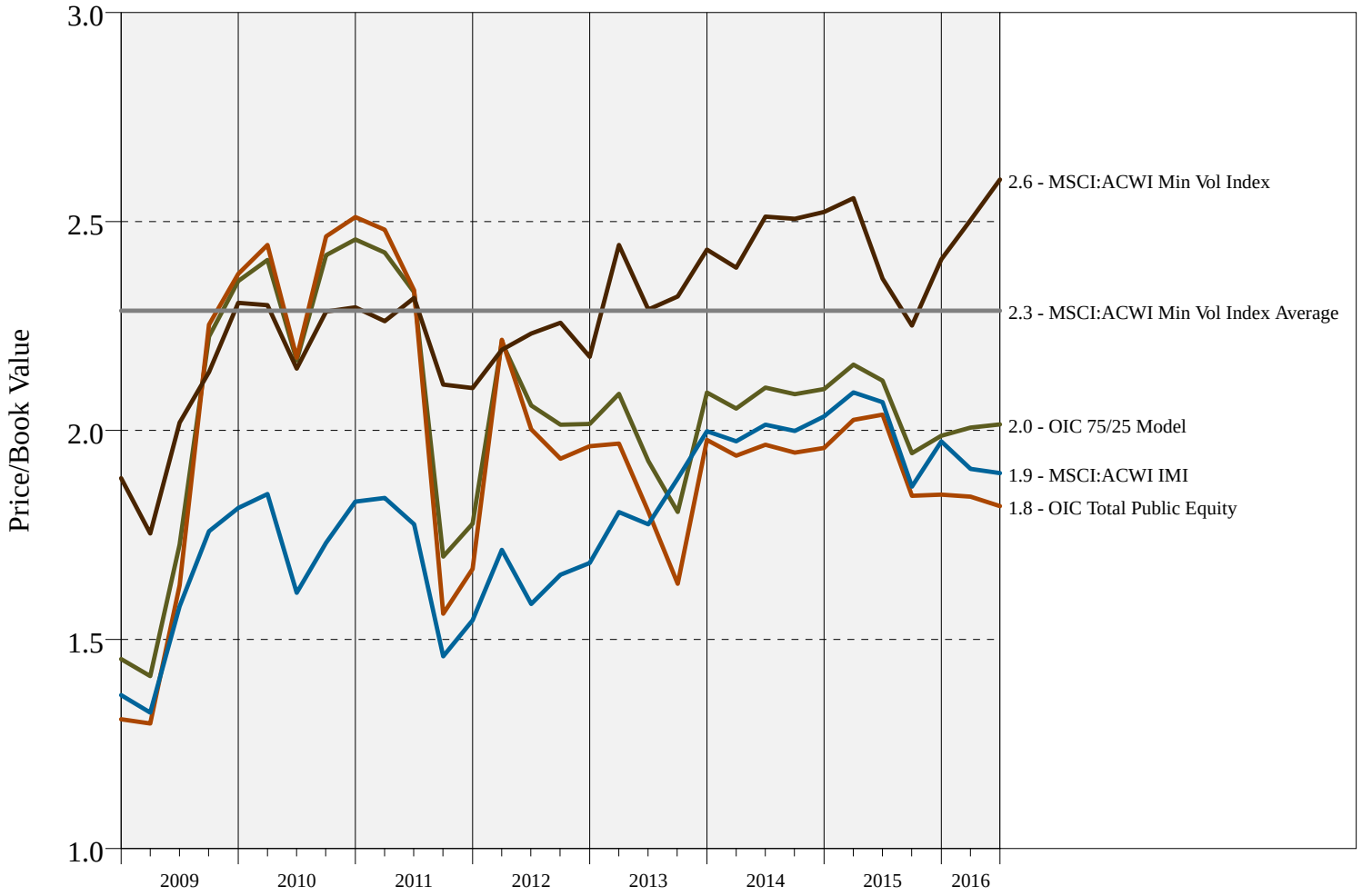


*Callan only has 7.5 years of holdings data for the OIC Total Public Equity portfolio

Low Volatility Model

Price/Book Ratio

Price/Book Value
for 7 1/2 Years Ended June 30, 2016*

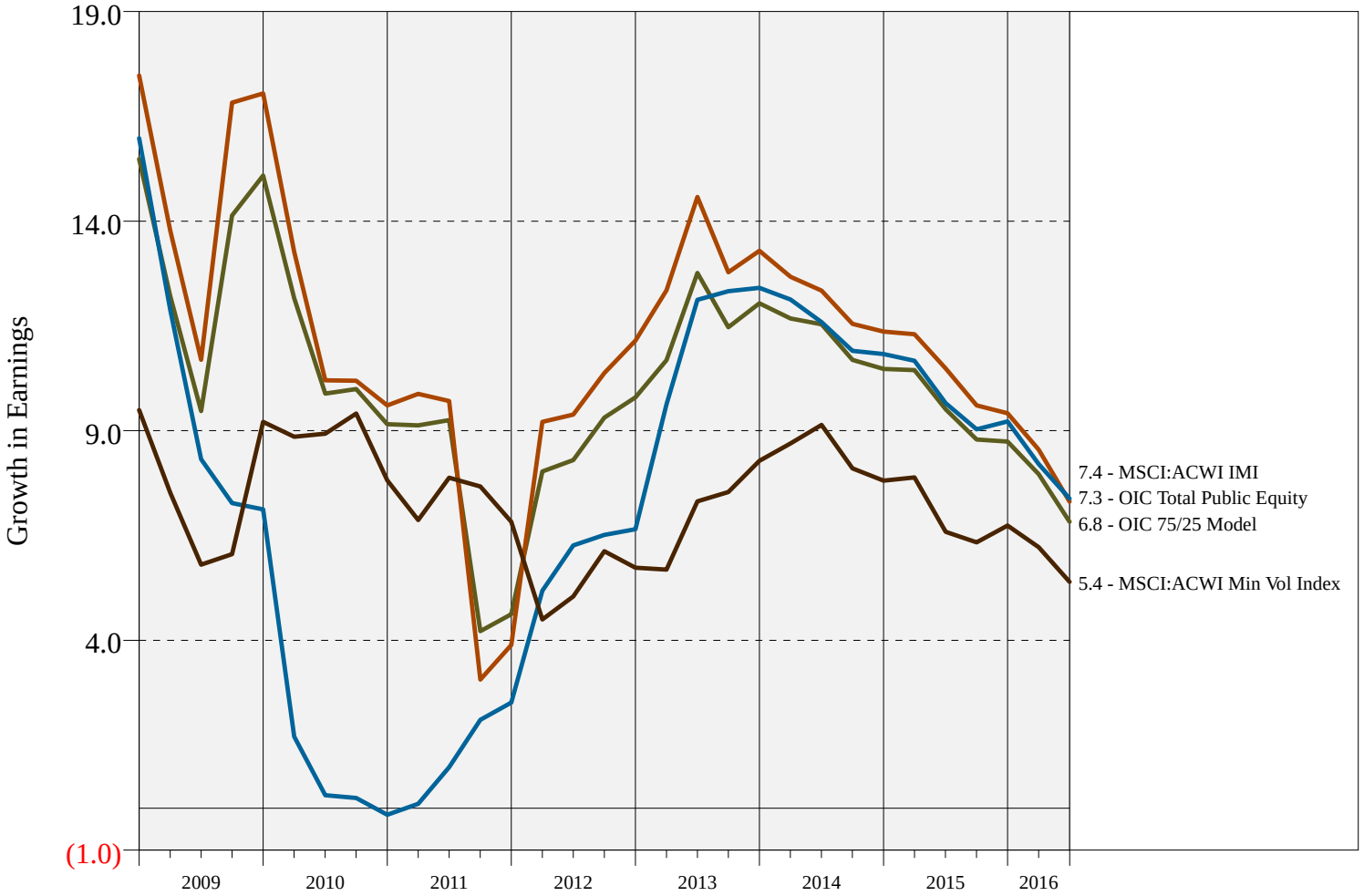


*Callan only has 7.5 years of holdings data for the OIC Total Public Equity portfolio

Low Volatility Model

Growth in Earnings

Growth in Earnings
for 7 1/2 Years Ended June 30, 2016*

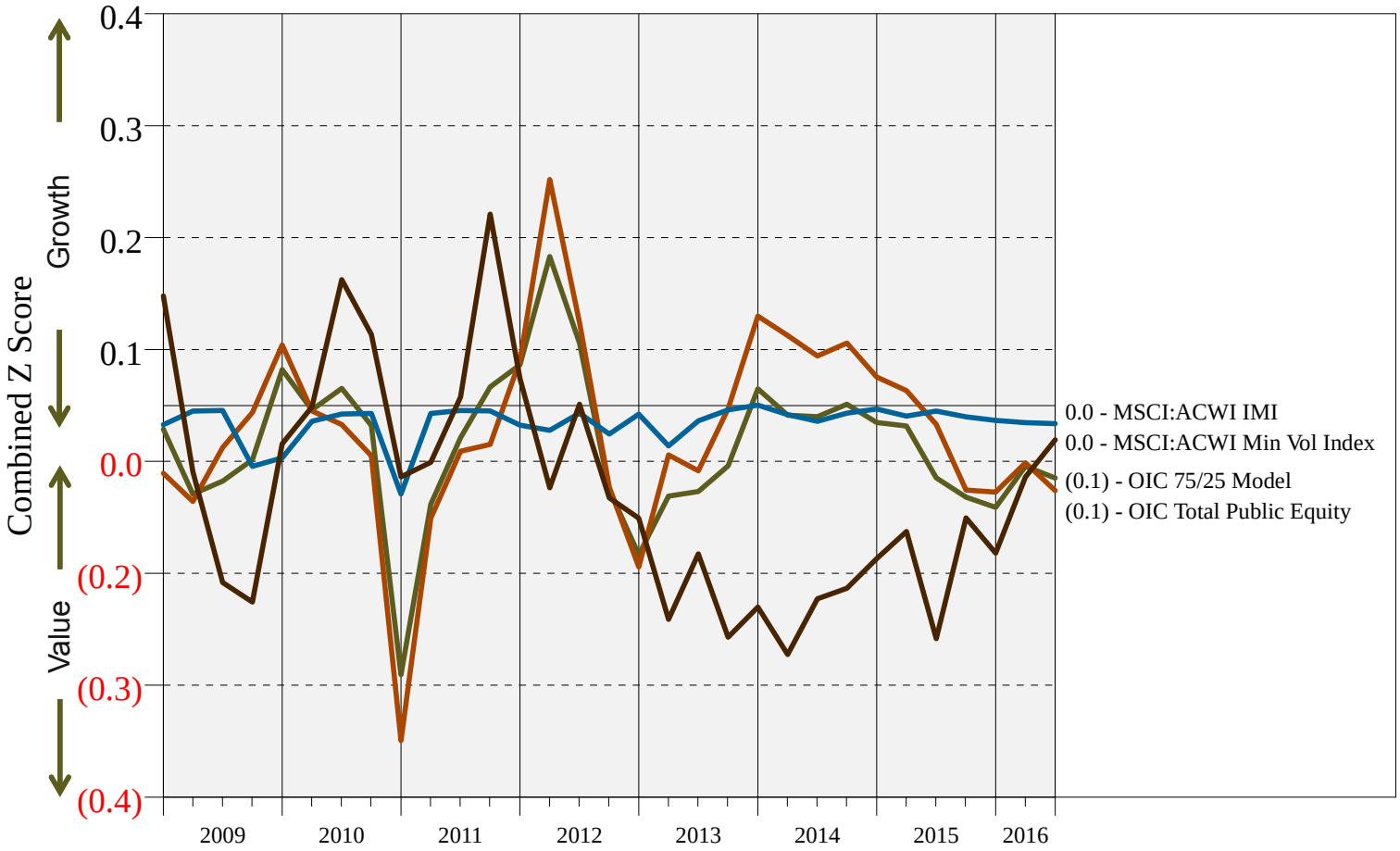


*Callan only has 7.5 years of holdings data for the OIC Total Public Equity portfolio

Low Volatility Model

Z-Score

Combined Z Score
for 7 1/2 Years Ended June 30, 2016*

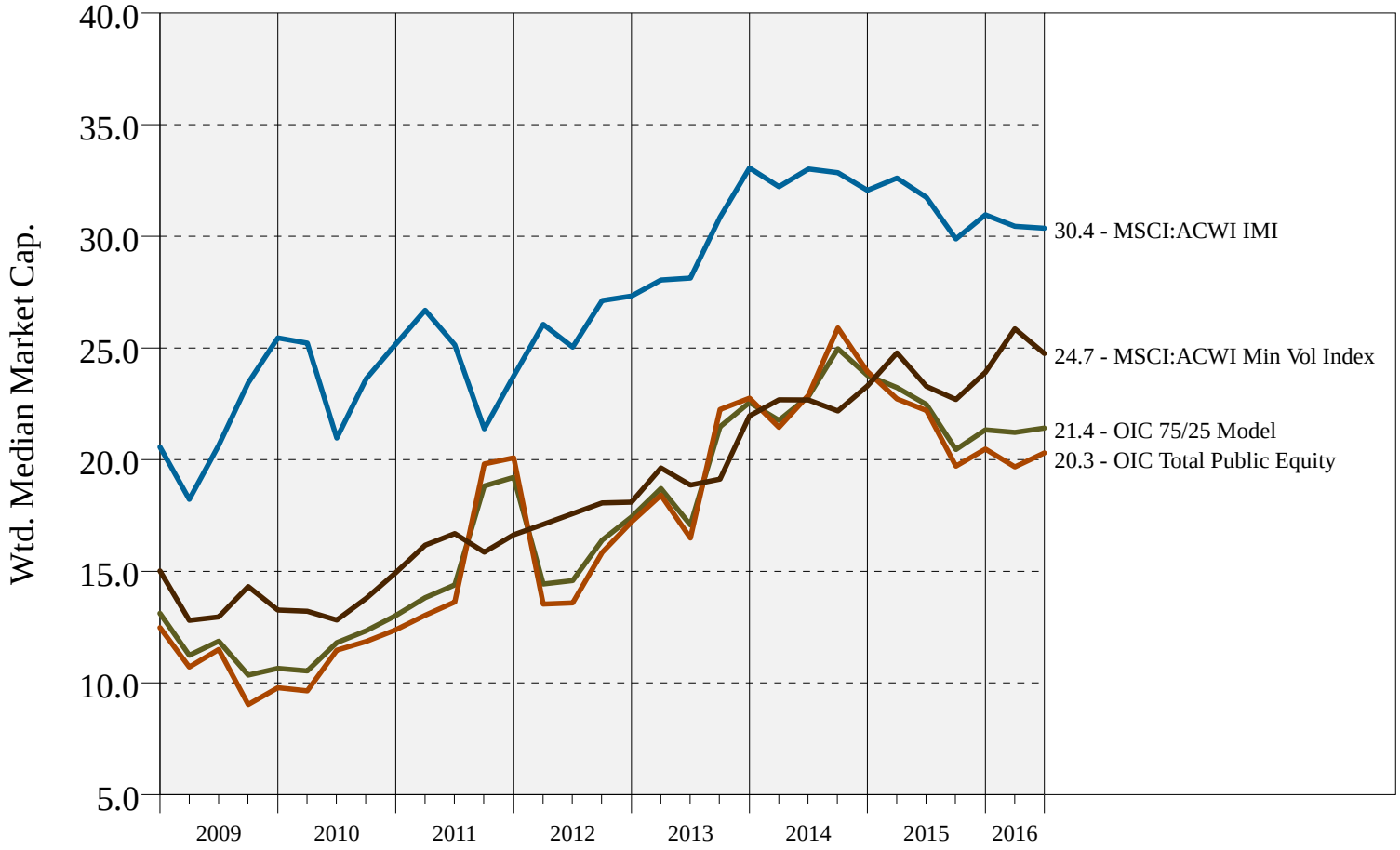


*Callan only has 7.5 years of holdings data for the OIC Total Public Equity portfolio

Low Volatility Model

Weighted Median Market Cap

Wtd. Median Market Cap.
for 7 1/2 Years Ended June 30, 2016*

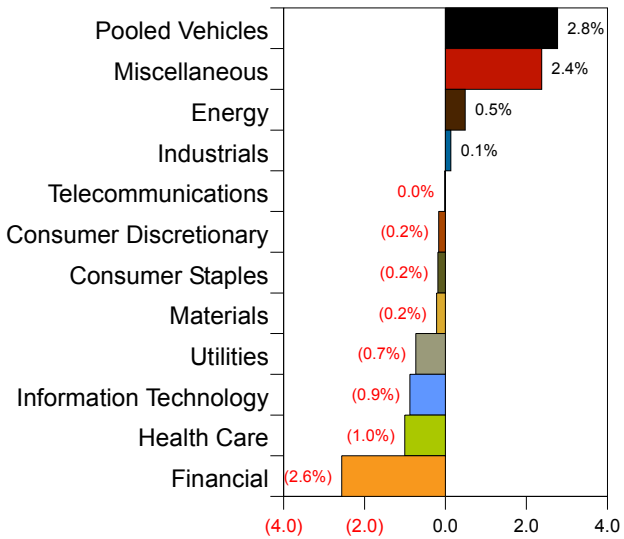


*Callan only has 7.5 years of holdings data for the OIC Total Public Equity portfolio

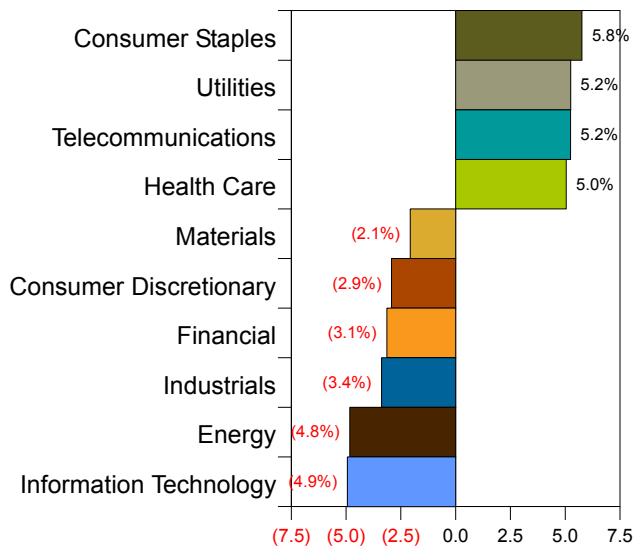
Low Volatility Model

Sector Weightings

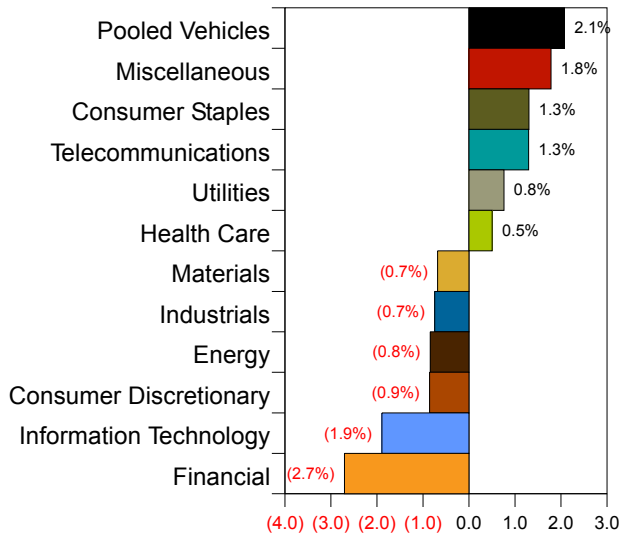
Equity Sector Exposure
as of June 30, 2016
OPERF Total Public Equity
Relative To MSCI:ACWI IMI



Equity Sector Exposure
as of June 30, 2016
MSCI:ACWI Min Vol Index
Relative To MSCI:ACWI IMI



Equity Sector Exposure
as of June 30, 2016
OPERF 75/25 Model
Relative To MSCI:ACWI IMI



Low Volatility Model

Summary Comments

- While back-tested performance for the Model Portfolio is strong, it is important to note that low volatility investments have had a tremendous run over the last 2 ½ years due to the continued low yield environment, causing investors to snatch up dividend paying stocks (which tend to be less volatile), and to investor desire to protect against any impending volatility and market correction after a 7 year (and counting) market rally.
- As expected, the Model Portfolio has a heavier weighting to Consumer Staples, Telecommunications, Utilities, and Health Care; sectors more commonly associated with dividends and defensive trading rather than for growth.
- Given the run up in these sectors, there is a lot of concern over their valuation. And, in looking at the price-to-book ratio chart (slide 26), we can see that the MSCI ACWI Minimum Volatility Index is currently trading well above its 7 year average.
- So, there is concern that in making this move now, OPERF would be “buying high”; however, this move also makes long term strategic sense given the more aggressive nature of the Total OPERF Portfolio and the continual efforts to better diversify and de-risk the portfolio.

Callan

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Memorandum

To: Oregon Investment Council
From: Janet Becker-Wold, James Callahan, and Uvan Tseng, Callan Associates
Date: October 2016
Subject: OPERF Public Equity Portfolio

The purpose of this memo is to provide an overview of the OPERF Public Equity portfolio.

The role of public equity is to achieve long-term capital appreciation and exploit the higher expected total return over fixed income. We believe public equities provide broad, deep, liquid exposure around the globe and across the capitalization spectrum.

The total fund policy target for public equities is 37.5% and accounted for approximately 37.7% of the total fund as of June 30, 2016, within policy ranges. The public equity portfolio currently employs 41 strategies (17 domestic and 24 international), with OST staff managing 5 internally. The U.S. equity portfolio has nine traditional active strategies (~24.1% of the U.S. equity portfolio), five traditional passive strategies (~33.2%), and three factor-oriented fundamental strategies (~42.7%). The non-U.S. equity portfolio has 23 traditional active strategies (~90.1% of the non-U.S. equity portfolio) and 1 traditional passive strategy (~9.9%).

Total tracking error for the public equity portfolio is 0.95% for the 5 years ended June 30, 2016, on the lower end of the 0.75%- 2.00% policy range. From a characteristics and style exposure perspective relative to the global equity benchmark (MSCI ACWI IMI Index), the total public equity portfolio is underweight large cap equity (61.8% vs. 70.3%) and maintains an overweight allocation to mid, small, and micro-cap equity (38.2% vs. 29.7%). These capitalization exposures are consistent with the strategic objective to overweight smaller capitalization stocks relative to the benchmark. The total public equity portfolio also has a very moderate value tilt based on MSCI style factors.

The public equity portfolio benchmark transitioned from the MSCI ACWI Index to the MSCI ACWI IMI Index in 2008. The portfolio has performed reasonably well since this change, exceeding the MSCI ACWI IMI on a net of fees basis on a trailing three and five year basis as of June 30, 2016. However, the portfolio has fallen short of the 0.75% performance hurdle objective over these periods.

	Last Year	Last 3 Years	Last 5 Years
Total Public Equity	-4.41%	6.50%	6.00%
MSCI ACWI IMI (net)	-3.87%	6.13%	5.43%
Excess Return	-0.54%	0.37%	0.56%

The net-of-fee outperformance of the total global portfolio relative to the benchmark over these periods has been driven by the International Equity component of the portfolio. The International Equity portfolio has far exceeded its return objective over the trailing three and five year periods, while the domestic equity portfolio has underperformed its objective over these periods.

	Last Year	Last 3 Years	Last 5 Years	Last 10 Years
Domestic Equity	-0.28%	9.95%	10.54%	6.90%
Russell 3000 Index	2.14%	11.13%	11.60%	7.40%
Excess Return	-2.41%	-1.18%	-1.06%	-0.49%
Large Public >10 B DE	1.38%	10.76%	10.99%	7.21%
International Equity	-8.14%	3.13%	2.03%	3.49%
MSCI ACWI ex USA IMI Index (net)	-9.61%	1.65%	0.39%	2.31%
Excess Return	1.48%	1.48%	1.65%	1.18%
Large Public >10 B DE	-8.30%	2.55%	1.35%	2.87%

Given the pricing efficiency of U.S. large cap equities, the challenges that active managers in general have faced since the financial crisis (with stimulus efforts benefitting lower quality stocks more, and in turn boosting the returns of broad market indices), the low yield environment that has boosted dividend paying stocks, and the challenges that exist with investing a large pool of assets, the U.S. equity portfolio has struggled.

Additionally, while 78% of the total public equity portfolio is invested in actively managed strategies, many with higher tracking error targets, the active share of the total public equity portfolio is only around 33% (meaning only 33% of the total equity portfolio is different from the MSCI ACWI IMI benchmark) as of June 30, 2016. This is not uncommon for a large plan that employs a combination of active and passive management. The large sum of assets under management requires the Plan to engage multiple managers within each asset class for diversification purposes, in some cases due to capacity constraints. The conundrum in structuring a large portfolio is that once all of these higher tracking portfolios are aggregated, the total portfolio runs the risk of behaving more like an index fund, albeit it one with active

management fees. It is for this reason as well as others that OST Staff has been streamlining the number of managers employed in the U.S. equity portfolio over the last two years while moving the portfolio to a more risk-factor driven approach.

Since the 2014 Public Equity Review, where OST Staff communicated its intent to gradually shift the U.S. equity portfolio away from traditional active management and towards this risk-factor tilted approach, Staff has been liquidating certain mandates and rebalancing the portfolio.

A timeline of recent activity is provided below:

- Q1 2014 – $200 million AQR Style Premia and $500 million internally managed U.S. Equity Risk Premia mandates were funded.
- Q4 2014 – Traditional large cap mandates with MFS (~$1.1B) and Wells Capital (~$900M) were terminated and a $2 billion factor tilted large cap core mandate with DFA was funded.
  - An additional $15 million was funded into the internally managed risk premia mandate.
- Q1 2015 – Traditional non-U.S. equity mandate with NTRS ($288.5M) was terminated and $90.0 million was redeemed from the SSgA non-U.S. equity mandate.
  - Additional funding made into Lazard CEF (~$100M) and Wells Cap CEF (~$50) mandates.
- Q2 2015 – PIMCO Large Core mandate (~$600M) terminated; AQR US Small Cap and Arrowstreet International Core converted to 130/30 mandates.
  - DFA Large Core funded with an additional $600M.
  - Additional funding made into Lazard CEF (~$165M), Wells Cap CEF (~$50), and William Blair EM ($25M) mandates.
- Q3 2015 – Jackson Square Partners Large Growth mandate (~$828M) terminated; Next Century Micro Cap Growth mandate (~$82M) was terminated; OST Tiered Emerging Markets mandate (~$180M) terminated.
  - DFA Large Core funded with an additional $828M.
  - Additional funding made into OST Russell 2000 Synthetic (~$5M), OST Risk Premia(~$10M), and Westwood Global (~$100M).
- Q4 2015 – Next Century Small Cap Growth mandate (~$98M) terminated.
- Q2 2016 – Columbia Wanger Small/Mid Core mandate (~$741M) terminated.
  - DFA Large Core funded with an additional $240M.

Callan continues to support the gradual movement away from traditional active management in the U.S. equity portfolio towards a risk-factor tilted approach. However, it is important to be aware that there can be prolonged periods of time where one or more of the factors will underperform the broad market. Academic research that supports the use of factor tilting is generally proven over very long periods of time. However, there can be significant stretches of time over a long-term horizon where multiple factors can underperform. We have actually seen this since the philosophical change to the portfolio. Value and small factors have significantly underperformed and have been the largest contributors to the lackluster performance of the domestic equity portfolio.

Forward Looking Initiatives

Earlier this year, OST Staff indicated that it was considering moving 25% of the Total Public Equity portfolio to low volatility mandates. The expectation was for this transition to occur in two tranches - the first 12.5% targeted by year end 2016, and the second sometime in 2017.

The theory behind low volatility or minimum variance strategies is well researched and documented, and has been thoroughly evaluated by OST Staff. ***Callan is supportive of the decision to transition a percentage of the global equity portfolio to mix of low volatility approaches, primarily given the more aggressive profile of the OPERF total portfolio and the continual efforts to better diversify and de-risk the portfolio.*** However, as is the case with any strategic changes, there are many considerations that must be taken into account as part of this decision.

One of the major implications of the wide sweeping, global monetary intervention by central banks and the accompanying historic decline in interest rates has been a far reaching search for yield among global investors. As such, dividend paying equity securities, which are typically a meaningful component of low volatility strategies, have performed well in recent periods. Additionally, with the macro-economic and political uncertainty that is currently dominating headlines, and the fact that the current bull market is coming up on a nine year run, many investors have been flocking to low or managed volatility strategies as a way to potential insulate their portfolios against an equity decline.

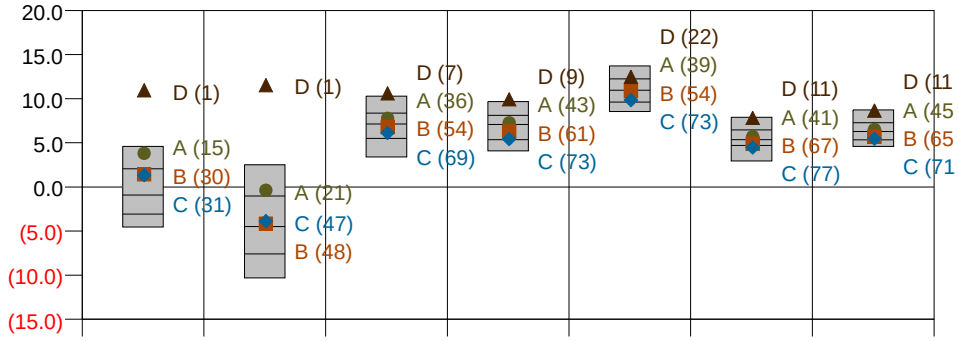
The search for yield and lower volatility has buoyed such sectors as Consumer Staples, Utilities, Telecommunications, and Health Care, which have seen their valuations surge as of late. We are not in a position to predict the timing and magnitude of the equity market cycles, however any change in strategy towards low volatility mandates must be made with the understanding that many of these securities have experienced a tremendous run up over the last two to three years. In fact, the MSCI ACWI Minimum Volatility Index was up 16.3% for the 12 months ended September 30, 2016 versus the 12.3% for the MSCI ACWI IMI Index. For the trailing five years ended September 30, 2016, the Index is up an

annualized 11.4% versus 10.9% for the MSCI ACWI IMI. With this said, a ‘tranched” approach to funding to the proposed target has appeal from our perspective.

Staff has been in discussions with several managers regarding low volatility mandates over the last few months and is targeting four managers for the first funding tranche: Acadian, Arrowstreet, AQR, and LA Capital Management; please see appendix for individual manager write-ups. While Acadian has a 5 year track record for the proposed strategy, the other managers either have shorter track records or have been tasked to create a custom strategy for the OPERF. Given the lack of longer-term live track records for all four proposed managers, Callan ran some analysis creating a model portfolio that is allocated historically to 75% of the OPERF Total Public Equities portfolio and 25% to the MSCI ACWI Minimum Volatility Index.

In the exhibits below, the model portfolio’s performance compares well versus the Total Public Equity portfolio and the MSCI AWCI IMI Index through June 30, 2016. This is unsurprising given the strong performance of the MSCI ACWI Minimum Volatility Index over the last 10 quarters.

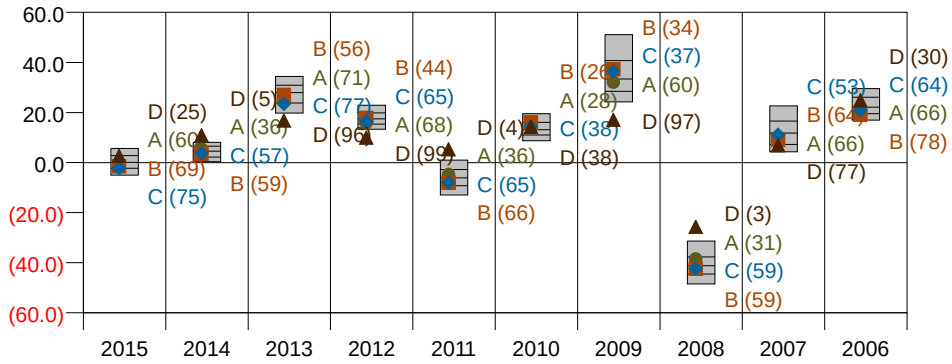
Returns for Periods Ended June 30, 2016
Group: CAI Global Equity Broad Style



		Year to Date	Last Year	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years	Last 15 Years
10th Percentile		4.60	2.52	10.29	9.70	13.73	7.90	8.72
25th Percentile		2.06	(1.02)	8.38	8.14	12.24	6.47	7.29
Median		(0.92)	(4.47)	7.16	7.08	10.98	5.37	6.31
75th Percentile		(3.06)	(7.57)	5.51	5.37	9.63	4.72	5.34
90th Percentile		(4.54)	(10.29)	3.42	4.11	8.56	2.96	4.60
OPERF 75/25 Model	● A	3.82	(0.37)	7.78	7.28	11.34	5.72	6.51
OPERF Total Public Equity	■ B	1.46	(4.16)	6.79	6.31	10.86	4.92	5.70
MSCI:ACWI IMI	◆ C	1.36	(3.87)	6.13	5.43	9.85	4.48	5.48
MSCI:ACWI Min Vol Index	▲ D	10.96	11.55	10.62	9.95	12.49	7.85	8.67

On a calendar year basis, the model portfolio has tended to trail in strong up markets but protected in downturns and years with heightened volatility.

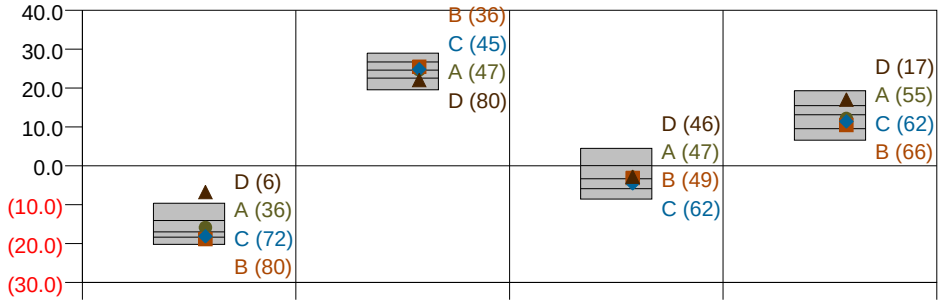
Returns for Calendar Years
10 Years Ended December 31, 2015
Group: CAI Global Equity Broad Style



		2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
10th Percentile		5.66	8.13	34.41	22.96	1.02	19.59	51.16	(31.27)	22.67	29.58
25th Percentile		2.85	6.59	30.88	19.82	(2.79)	16.14	40.82	(37.62)	16.64	26.18
Median		0.17	4.57	27.98	17.49	(6.04)	13.21	33.43	(41.20)	11.78	22.18
75th Percentile		(2.21)	2.22	23.83	15.41	(9.21)	11.02	28.53	(44.47)	7.27	19.56
90th Percentile		(4.97)	0.38	19.77	13.38	(12.92)	8.73	24.28	(48.48)	4.34	17.00
OPERF 75/25 Model	● A	(0.41)	5.41	24.50	15.93	(4.65)	15.73	32.11	(38.44)	8.59	20.62
OPERF Total Public Equity	■ B	(1.49)	3.61	27.05	17.84	(7.93)	16.07	37.37	(42.35)	9.11	19.21
MSCI:ACWI IMI	◆ C	(2.19)	3.84	23.55	16.38	(7.89)	14.34	36.42	(42.34)	11.16	20.91
MSCI:ACWI Min Vol Index	▲ D	2.76	10.95	16.91	10.06	5.34	14.32	17.16	(25.57)	6.95	24.89

Also, given the MSCI ACWI Minimum Volatility Index's tilt towards value and large- and mid-cap, we can see that the Model Portfolio would have underperformed in extreme periods that favored growth and small cap.

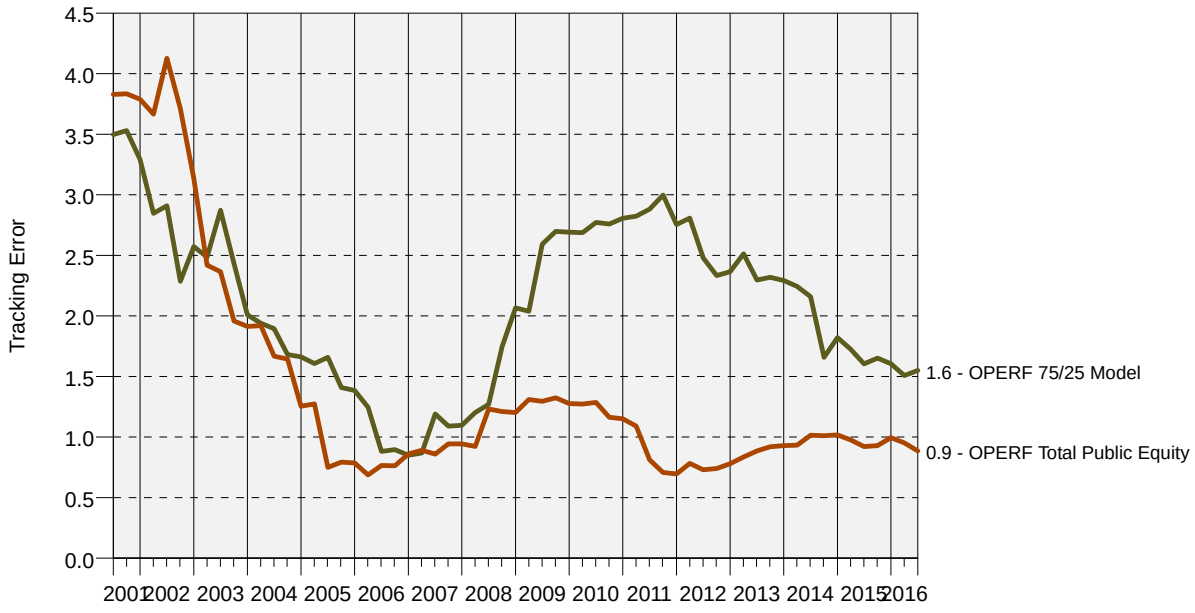
Returns for Stylistically Extreme Periods
(July 1, 2001 - June 30, 2016)
Group: CAI Global Equity Broad Style



		Large Cap (16 Quarters)	Small Cap (20 Quarters)	Growth (14 Quarters)	Value (20 Quarters)
10th Percentile		(9.64)	29.00	4.52	19.33
25th Percentile		(14.05)	26.71	0.05	15.54
Median		(16.99)	24.68	(3.30)	13.15
75th Percentile		(18.33)	22.60	(5.88)	9.58
90th Percentile		(20.20)	19.55	(8.52)	6.63
OPERF 75/25 Model	● A	(15.87)	24.72	(2.93)	12.23
OPERF Total Public Equity	■ B	(18.82)	25.49	(3.09)	10.55
MSCI:ACWI IMI	◆ C	(18.10)	24.85	(4.49)	11.41
MSCI:ACWI Min Vol Index	▲ D	(6.70)	22.08	(2.74)	17.05

From a risk budgeting standpoint, The Total Public Equity portfolio has remained at the lower end of the allowable tracking error range of 0.75% to 2.00% over the last 10 years (as shown in the following chart), ranging between approximately 0.70% and 1.30%. The model portfolio ranged between 0.80% and 3.00% over the same time period. To the extent the risk budgeting policy of 0.75% to 2.00% for the public equity portfolio remains the same, OST Staff will need to ensure the addition of 25% of low volatility does not cause the portfolio to press on the top end of the range.

Rolling 12 Quarter Tracking Error Relative To MSCI:ACWI IMI for 15 Years Ended June 30, 2016

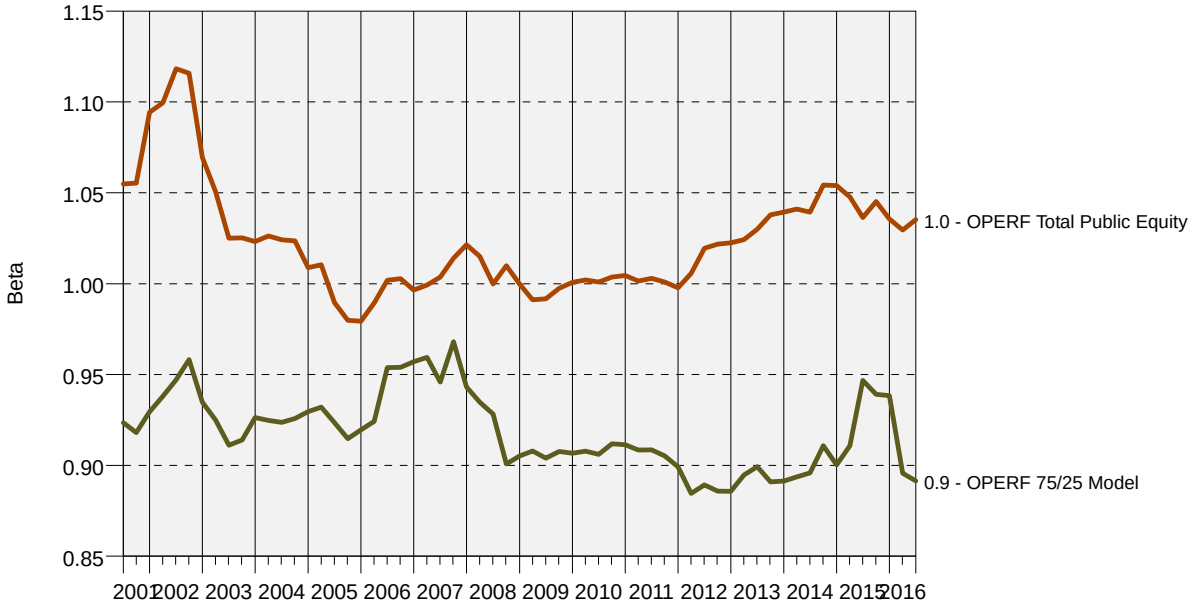


From a risk perspective, the model portfolio has a lower standard deviation than the current Total Public Equity portfolio, which is to be expected.

Rolling 12 Quarter Standard Deviation
for 15 Years Ended June 30, 2016

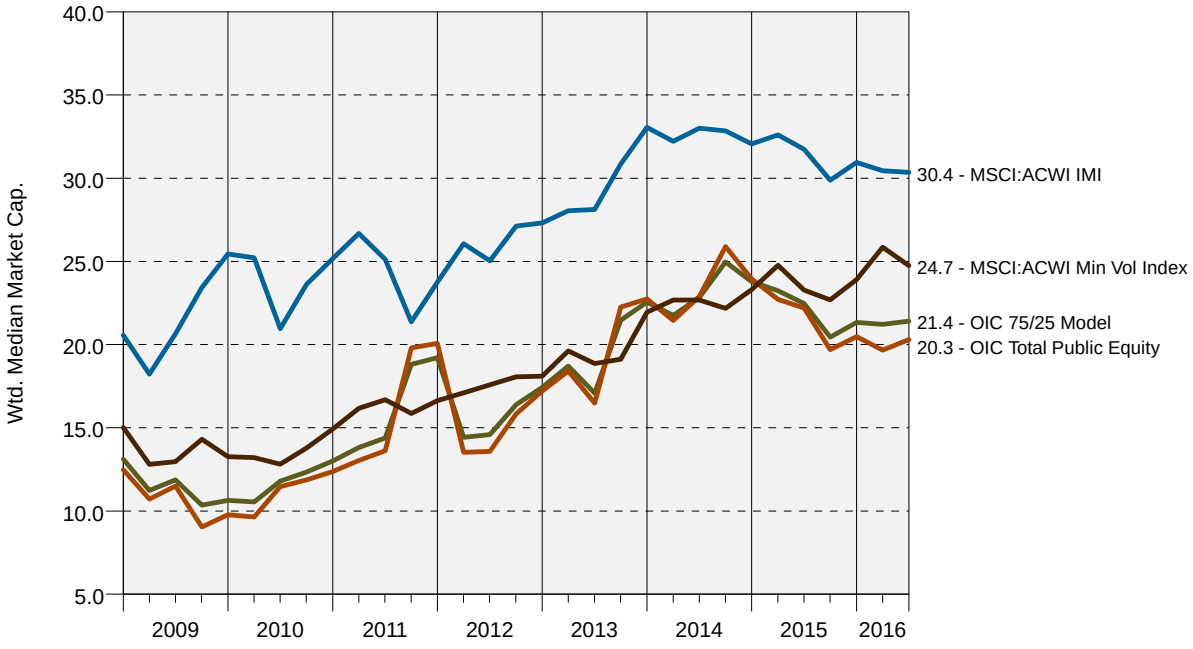
Looking at another measure of volatility and risk, we can see that the beta of the model portfolio is lower than the beta of the Total Public Equity portfolio, which is in line with the lower volatility approach.

Rolling 12 Quarter Beta Relative To MSCI:ACWI IMI
for 15 Years Ended June 30, 2016



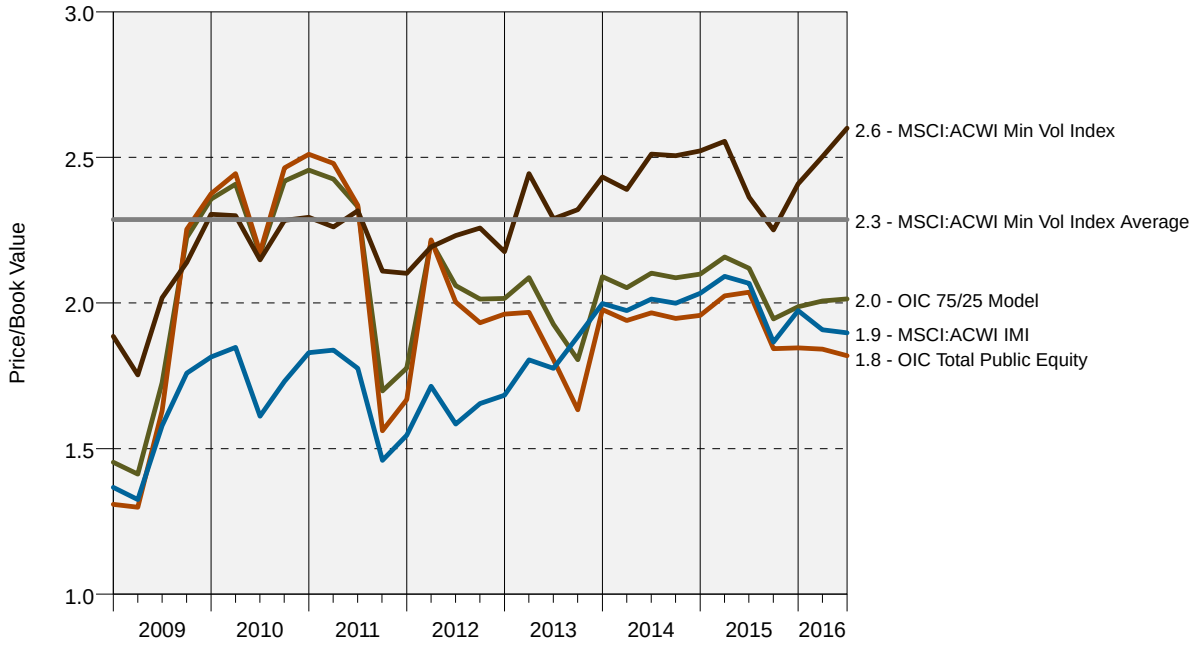
In the following chart, we compare the weighted median market cap for the two portfolios as well as the two indices. As the chart shows, the weighted median market cap for the Total Public Equity Portfolio and for the model portfolio are both lower than the MSCI ACWI IMI given the small cap tilt coming from the MSCI ACWI Min Volatility Index. More telling perhaps is the closing of the capitalization gap between the two MSCI Indices as the Min Volatility Index performance has surged.

Wtd. Median Market Cap. for 7 1/2 Years Ended June 30, 2016



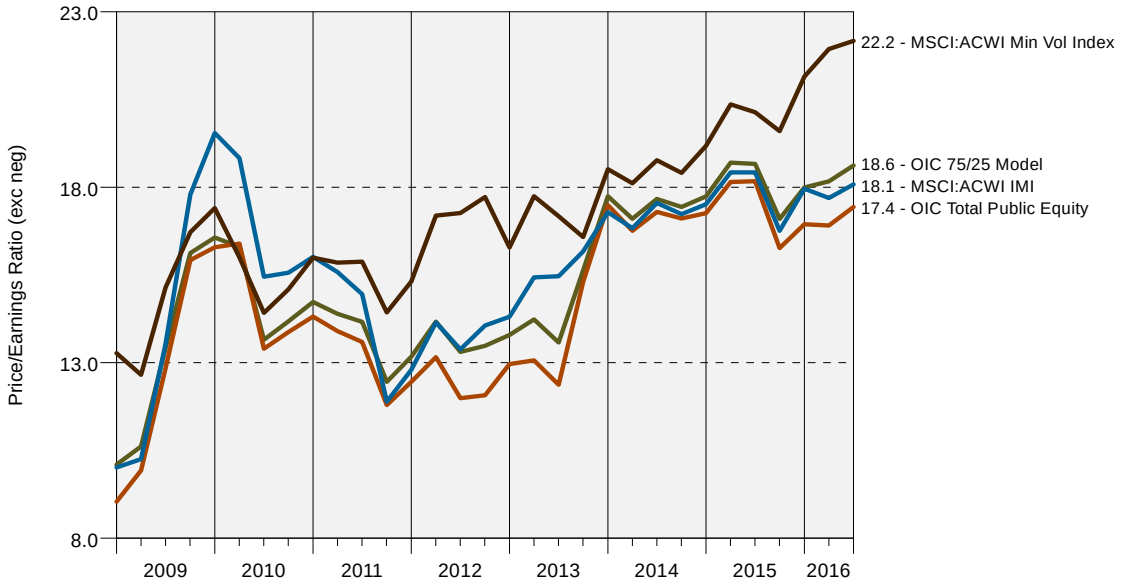
As mentioned above, the recent surge in popularity of low volatility investing (and the search for yield) has driven up valuations for many of the stocks that fall in that category. Looking at the Price/Book Value ratio for the MSCI ACWI Minimum Volatility Index, we can see that the ratio has been above its historical average over the last few years.

Price/Book Value for 7 1/2 Years Ended June 30, 2016

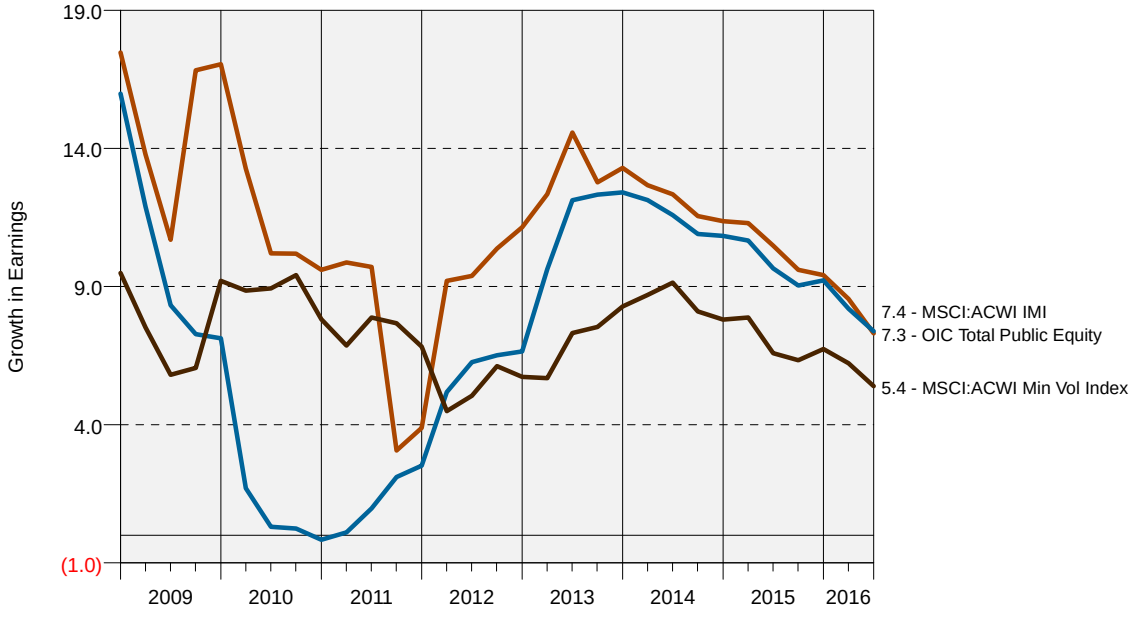


Looking at valuation from another measure, the price to earnings ratio also indicates that the MSCI ACWI Minimum Volatility Index P/E ratio has risen since 2011 (please see below) and has really pulled away over the last year. And with earnings growth for the MSCI ACWI Minimum Volatility Index coming in at 5.4% (please see below), it is startling to see that it is trading at 22.2x earnings.

Price/Earnings Ratio (exc neg) for 7 1/2 Years Ended June 30, 2016



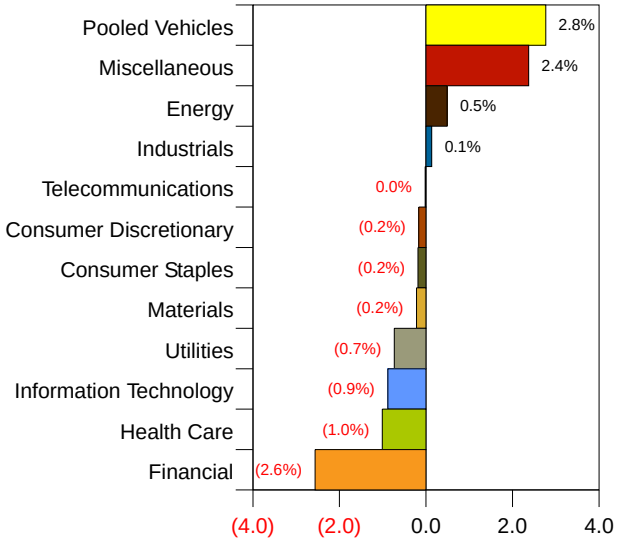
Growth in Earnings for 7 1/2 Years Ended June 30, 2016



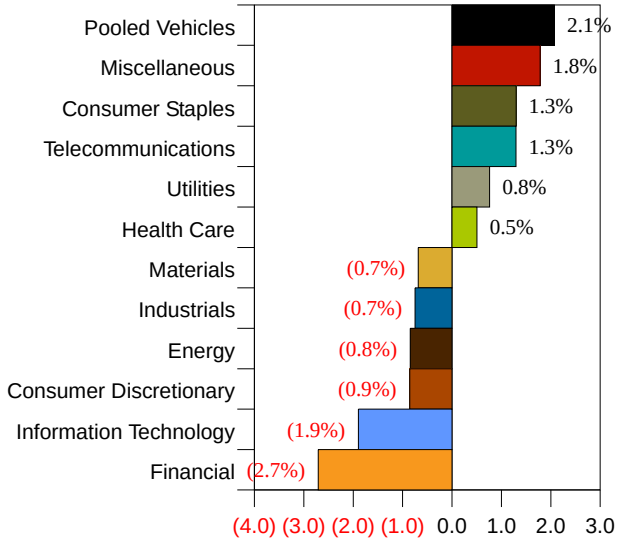
Lastly, it is important to note the shift in sector exposure that would result from a move towards low volatility strategies. As mentioned above, the search for yield over the last few years and the recent surge in popularity for low volatility strategies has seen investors piling into lower growth, dividend paying sectors.

The left-hand chart below shows the Total Public Equity portfolios' sector exposure relative to the MSCI ACWI IMI, and on the right, we show the same data for the model portfolio. As expected, there is a shift in allocation from an underweight to overweight in Consumer Staples, Telecommunications, Utilities and Health Care. Conversely, Energy and Industrials go from a slight overweight to an underweight position.

Equity Sector Exposure
as of June 30, 2016
OPERF Total Public Equity
Relative To MSCI:ACWI IMI



Equity Sector Exposure
as of June 30, 2016
OPERF 75/25 Model
Relative To MSCI:ACWI IMI



In summary, Callan would emphasize that both the theories and back-tested behavior for the model portfolio have strong rationale for OPERF and we expect the modified portfolio to exhibit lower absolute risk characteristics in the future (while increasing tracking error versus the policy benchmark). We are mindful of the end point sensitivity of this analysis and while we are not in a position to make market timing calls, any strategic change to the global equity portfolio has a timing element. The recent popularity of low volatility investing (and the search for yield) has driven up the valuation of these securities, so there

is concern that in making this move now OPERF would be “buying high”. However, we ultimately believe this move is prudent from a long term strategic perspective given the more aggressive nature of the Total OPERF Portfolio. It is with this broader total fund strategic perspective in mind that we are supportive of this move, and believe OST Staff’s intention to shift the portfolio in two phases is appropriate given the size of the transition as well as current market conditions.

In the appendix, we provide individual research notes for each of the managers under consideration for the first funding tranche:

Acadian Asset Management – All Country Managed Volatility Equity
AQR Capital Management LLC – Proposed Integrated Strategy (Low Volatility)
Arrowstreet Capital L.P. – Global Minimum Volatility
Los Angeles Capital Management – Global Managed Volatility Equity

APPENDIX

OPERF Public Equity Portfolio
2016 Annual Review

Michael Viteri, Senior Investment Officer, Public Equity
Paola Nealon, Investment Officer, Public Equity

October 26, 2016

AGENDA

Section	Pages	OIC Investment and Management Beliefs Mapping															
		1A	1B	1C	1D	1E	2A	2B	3A	4A	4B	5A	5B	6A	6B	7A	7B
Agenda	2																
OPERF Public Equity - Strategic Role	3						■		■			■	■	■			
OPERF Public Equity Benchmark	4						■	■	■			■	■	■			
OPERF DE Restructure Recap & Update	5 - 7							■	■			■	■	■			
Low Volatility	8-14							■	■			■	■	■	■		
Internally Managed World X-US Risk Premia	15-19							■	■			■	■	■			

LEGEND: OIC INVESTMENT AND MANAGEMENT BELIEFS

1 **THE OIC SETS POLICY AND IS ULTIMATELY RESPONSIBLE FOR THE INVESTMENT PROGRAM**

- A. The OIC is a policy-setting council that largely delegates investment management activities to the OST and qualified external fiduciaries.
- B. The OIC has authority to set and monitor portfolio risk. Both short-term and long-term risks are critical.
- C. To exploit market inefficiencies, the OIC must be contrarian, innovative and opportunistic in its investment approach.
- D. Internal incentive structures should be carefully evaluated to ensure proper alignment with specific investment objectives.
- E. Adequate resources are required to successfully compete in global capital markets.

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 and vintage year diversification 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 **TRANSPARENT CAPITAL MARKETS ARE ESSENTIAL FOR THE LONG-TERM SUCCESS OF OIC/OST INVESTMENT ACTIVITIES**

- 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 and therefore must be treated as a fund or beneficiary asset.

OPERF Public Equity – Strategic Role

The strategic role of OPERF public equity investments is outlined in **OIC INV 1201** – *Statement of OIC Investment and Management Beliefs* and **OIC Policy INV 601** – *Strategic Role of Public Equity Securities within OPERF.* As outlined in those policy documents, the strategic role of public equity is to generate a return premium relative to risk-free investments, while providing diversification benefits and liquidity in support of OPERF's cash flow requirements. Return and risk objectives for the Public Equity Portfolio (outlined in OIC Policy INV 601 – *Strategic Role of Public Equity Securities within OPERF*) are as follows:

1) To achieve an excess portfolio return of 0.75 percent or more above the MSCI All Country World Investable Market Index (net) over a market cycle of three to five years on a net-of-fee basis; and

2) To manage active risk to a targeted annualized tracking error of 0.75 to 2.0 percent, relative to the MSCI ACWI IMI (net).

Public Equity Policy Objective – Although the OIC's public equity policy objective (75 basis points [bps] of excess return) has not been achieved over the three-year period ending September 30, 2016, the objective has been achieved on a five-year, net-of-fee basis. Moreover, this excess performance has been achieved by utilizing only half the policy's 200 bps tracking error (active risk) allowance.

Period Ending 9/30/2016	Market Value	3 Months	1 Year	3 Years	5 Years
OPERF Public Equity Returns	$ 26,401,853,950	5.91%	12.16%	5.50%	11.69%
MSCI ACWI IMI Net		5.57%	12.25%	5.24%	10.87%
Excess Return (0.75% Target)		**0.34%**	**-0.10%**	**0.26%**	**0.82%**
OPERF Public Equity Tracking Error (2.0% Maximum)		**N/A**	**0.88%**	**0.97%**	**0.91%**
Information Ratio (Excess Return/Tracking Error)		N/A	**-0.11**	**0.27**	**0.90**

Source: State Street

OPERF Public Equity Policy Benchmark

MSCI All Country World Investible Market Index (MSCI ACWI IMI)

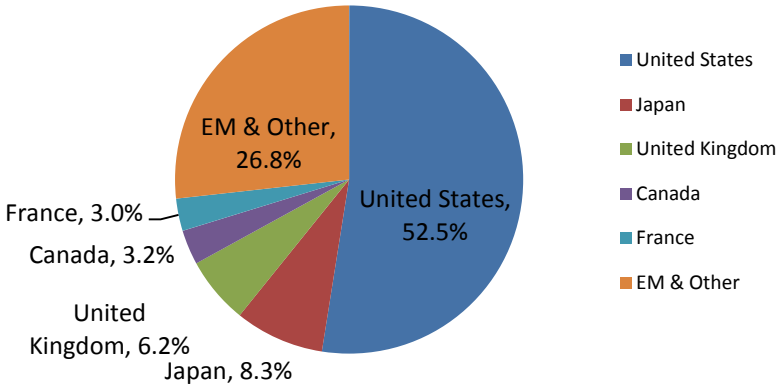
- Coverage of 46 countries:
  - U.S. market comprises 52.5 percent;
  - International Developed markets comprise 36.5 percent (22 countries); and
  - Emerging Markets comprise 11 percent (23 countries).
- Holds approximately 8,600 stocks, weighted by market capitalization (float adjusted).

Source: MSCI

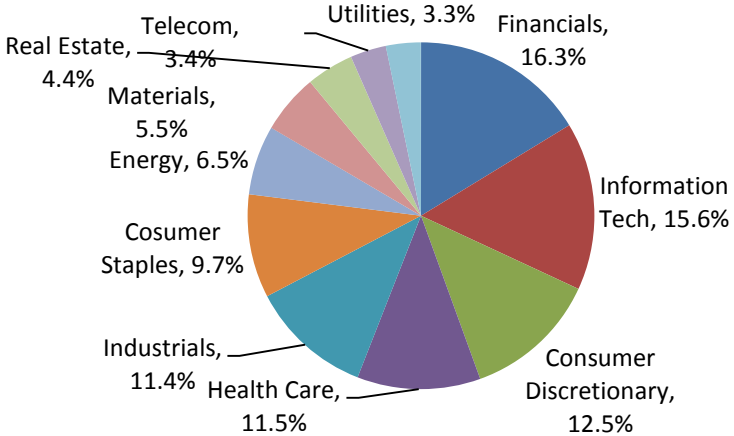
TOP 10 CONSTITUENTS **(as of 9/30/16)**

	Country	Mkt Cap (USD BB)	Index Wt. (%)	Sector
APPLE	US	619.22	1.43	Info Tech
MICROSOFT CORP	US	430.12	1.00	Info Tech
EXXON MOBIL CORP	US	361.62	0.84	Energy
AMAZON.COM	US	335.81	0.78	Cons Discr
JOHNSON & JOHNSON	US	324.93	0.75	Health Care
FACEBOOK A	US	296.54	0.69	Info Tech
GENERAL ELECTRIC	US	272.38	0.63	Industrials
NESTLE	CH	251.78	0.58	Cons Staples
AT&T	US	250.01	0.58	Telecom
JPMORGAN CHASE & CO	US	243.5	0.56	Financials

MSCI ACWI IMI Country Weights



MSCI ACWI IMI Sector Weights



OPERF Domestic Equity Portfolio 2014 Restructure Recap

Period Ending 6/30/14	Market Value	1 year	3 year	5 year
OPERF Total Public Equity Returns	$ 29,203,480,930.00	24.17%	11.21%	15.68%
MSCI ACWI IMI Net		23.35%	10.37%	14.77%
Excess		0.81%	0.84%	0.90%

Active Risk (Realized)		0.98%	0.93%	0.87%
Information Ratio		0.83	0.90	1.03

Period Ending 6/30/14	Market Value	1 year	3 year	5 year
OPERF Domestic Equity Returns	$ 13,437,002,272.00	24.75%	15.71%	19.38%
RUSSELL 3000		25.22%	16.46%	19.33%
Excess		-0.47%	-0.75%	0.05%

Period Ending 6/30/14	Market Value	1 year	3 year	5 year
OPERF International Equity Returns	$ 14,781,996,732.00	23.18%	7.49%	12.83%
MSCI ACWI IMI X-US Net		22.28%	5.88%	11.50%
Excess		0.90%	1.61%	1.33%

Source: State Street

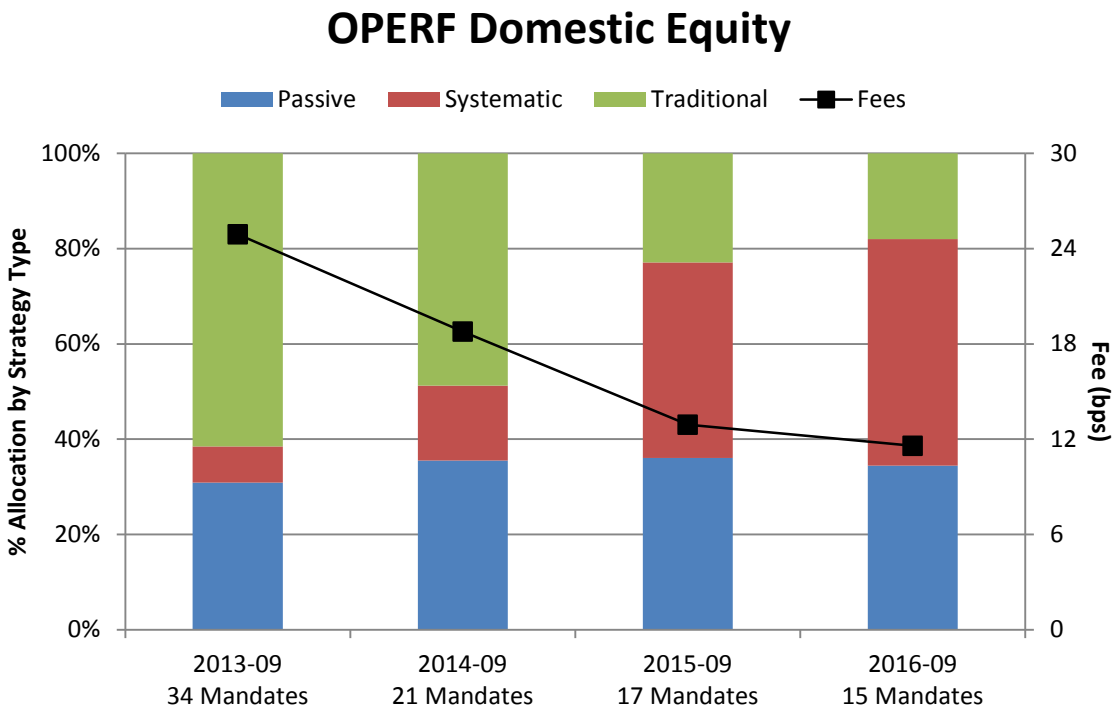
OPERF Domestic Equity

- Strong evidence to move away from traditional active management in U.S. market.
- Small Cap strategic over-weight has added value in the U.S. equity portfolio.
- Staff believes it prudent to diversify U.S. equity portfolio exposures away from Size (small cap) to other well known return premia which are supported by abundant and robust empirical evidence as persistent sources of excess, relative return.

OPERF International Equity

- Traditional active management has contributed to relative performance for International Equity.
- Strong evidence to increase exposure to active management within International Equity (i.e. decrease passive) but prudent to monitor the environment.

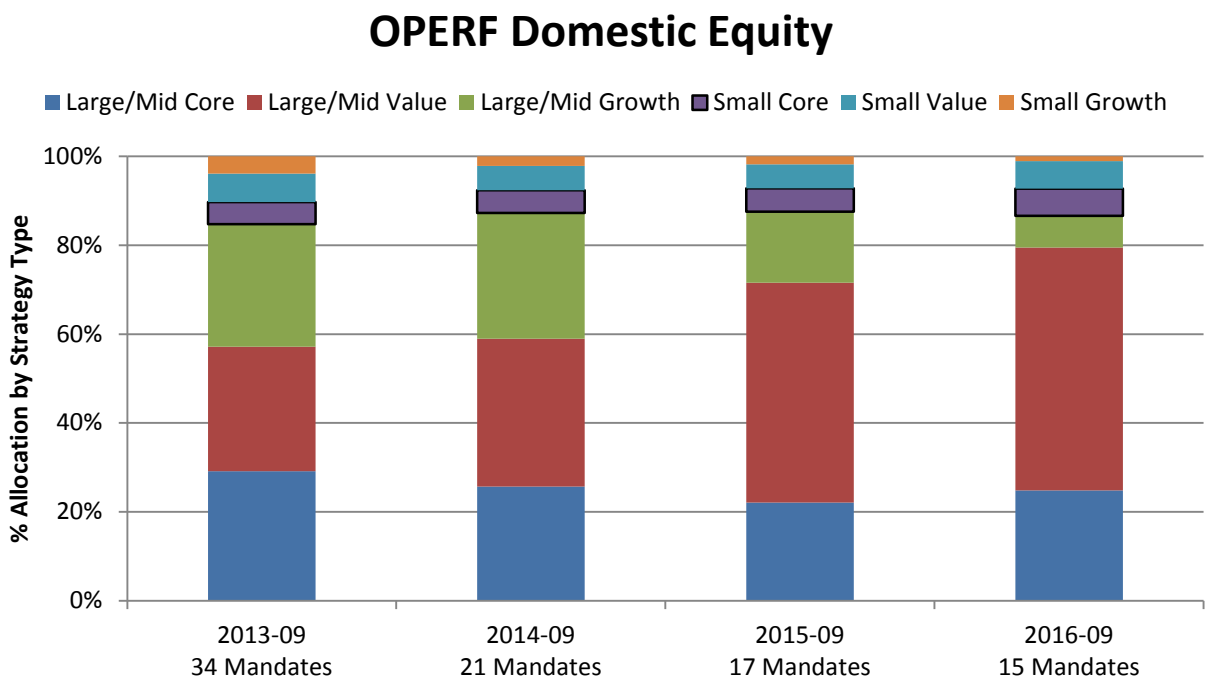
OPERF Domestic Equity Restructuring (Fees & Mandates)



- 2013 34 mandates (including a U.S. manager-of-manger program comprised of 12 individual manager mandates).
- 2014 Terminated U.S. manager-of-manger program and a large cap active (traditional) mandate, added the internally-managed Risk Premia strategy (systematic).
- 2015 Terminated 5 active (traditional) mandates, added one systematic strategy.
- 2016 Terminated 2 active (traditional) mandates.

Portfolio Management costs reduced by more than 50 percent (from 24.6 bps to 11.1 bps/annum), number of individual mandates decreased from 34 to 15.

OPERF Domestic Equity Restructuring (factor tilts)



- 2013 34 mandates (including a U.S. manager-of-manger program comprised of 12 individual manager mandates).
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- 2015 Terminated 5 active (traditional) mandates, added one systematic strategy.
- 2016 Terminated 2 active (traditional) mandates.

Decreased Small Cap/Small Cap Growth exposure in favor of systematic tilts towards Value, Quality and Momentum.

Low Volatility

Low Volatility

- In 2014, at the time staff recommended the internally-managed, multi-factor U.S. MSCI Risk Premia portfolio to the OIC, staff also identified low volatility as another desirable factor exposure for consideration and possible implementation. Since then, staff has performed additional research on the "Low Vol" or low beta factor and now believes it too should be included in OPERF's public equity portfolio. As illustrated in the following table, Low Beta (a.k.a. Low Vol) has historically exhibited superior risk-adjusted returns (as defined by the Sharpe Ratio) relative to other univariate factor exposures.

U.S. Return Premium*	Average Premium (Annualized)	Average Volatility/Risk (Annualized)	Sharpe Ratio (Return/Risk)
Market	4.3%	15.6%	0.28
Illiquidity (1968-2013)	4.4%	12.2%	0.36
Small	2.5%	10.8%	0.23
Quality (Novy-Marx)	3.9%	7.9%	0.49
Momentum	7.5%	14.9%	0.50
Low Beta (1963-2011)	10.4%	11.2%	**0.93**
Value	4.1%	10.1%	0.41

* 1963-2012 unless otherwise noted.

Low Volatility

- The MSCI USA Min Vol index has historically exhibited a lower beta, less volatility and a robust Sharpe Ratio relative to its parent, cap-weighted index, the MSCI USA Index. Over the near three-decade period covered (May 1998 through August 2016), the domestic Min Vol strategy has produced market-like returns with approximately 25% percent less volatility.

Period Ending 9/30/16	1 year	3 year	5 year	10 Year	Since 5/1988	Div Yld	P/E	P/E Fwd	P/BV
MSCI USA Min Vol Index	17.47%	13.50%	15.97%	9.10%	10.86%	2.41	25.83	19.17	3.40
MSCI USA Index	15.12%	10.94%	16.33%	7.34%	10.27%	2.09	23.19	17.24	2.87
Excess	2.35%	2.56%	-0.36%	1.76%	0.59%				

INDEX RISK CHARACTERISTICS - Std Dev

Period Ending 9/30/16		3 year	5 year	10 Year		Beta	Tracking Error	Turnover	Sharpe Ratio (Since 5/1988)
MSCI USA Min Vol Index		8.87%	8.73%	12.07%		0.73	5.73	20.92	0.65
MSCI USA Index		10.89%	11.21%	15.30%		1.00	-	2.46	0.51

Source: MSCI

- Similar to the MSCI USA Min Vol Index, the MSCI World Min Vol Index has also historically exhibited a lower beta, less volatility and a robust Sharpe Ratio relative to its parent, cap-weighted index, the MSCI World Index. Over the near three-decade period covered (May 1998 through September 2016), the global Min Vol strategy (Exhibit 2) has produced significant, excess returns with approximately 25% less volatility.

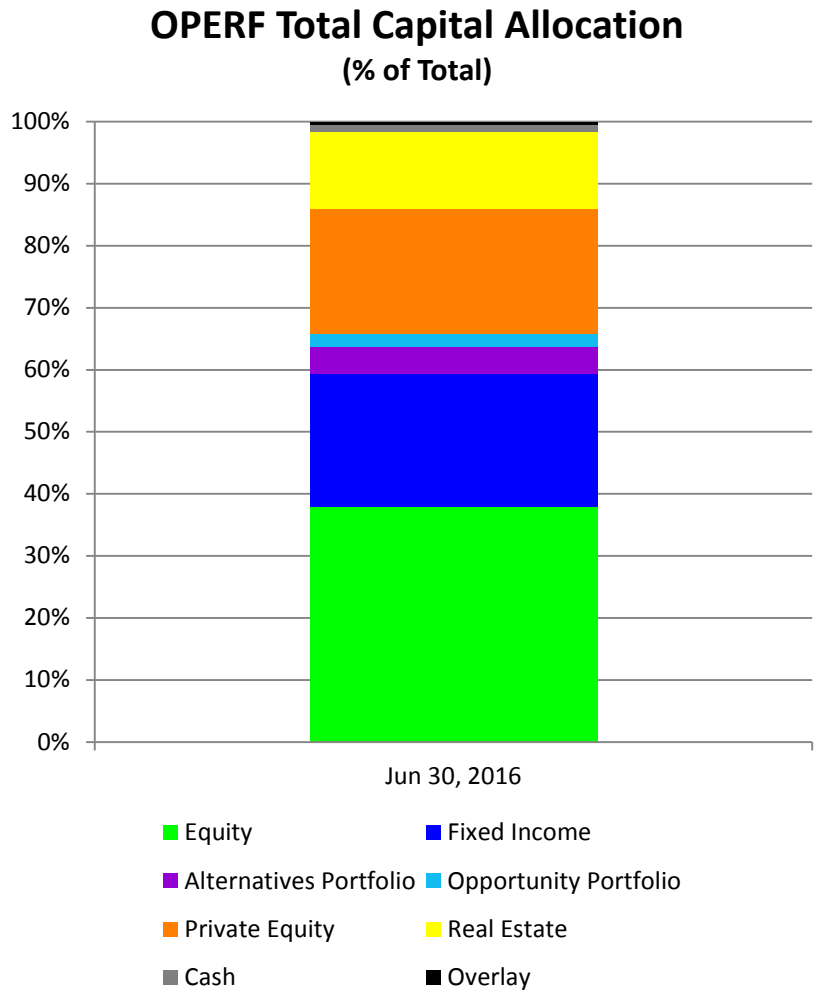
Period Ending 9/30/16	1 year	3 year	5 year	10 Year	Since 5/1988	Div Yld	P/E	P/E Fwd	P/BV
MSCI World Min Vol Index (USD)	16.68%	10.43%	11.86%	6.45%	7.92%	2.66	23.52	18.78	2.81
MSCI World Index (USD)	11.36%	5.85%	11.63%	4.47%	6.74%	2.57	21.50	16.09	2.16
Excess	5.32%	4.58%	0.23%	1.98%	1.18%				

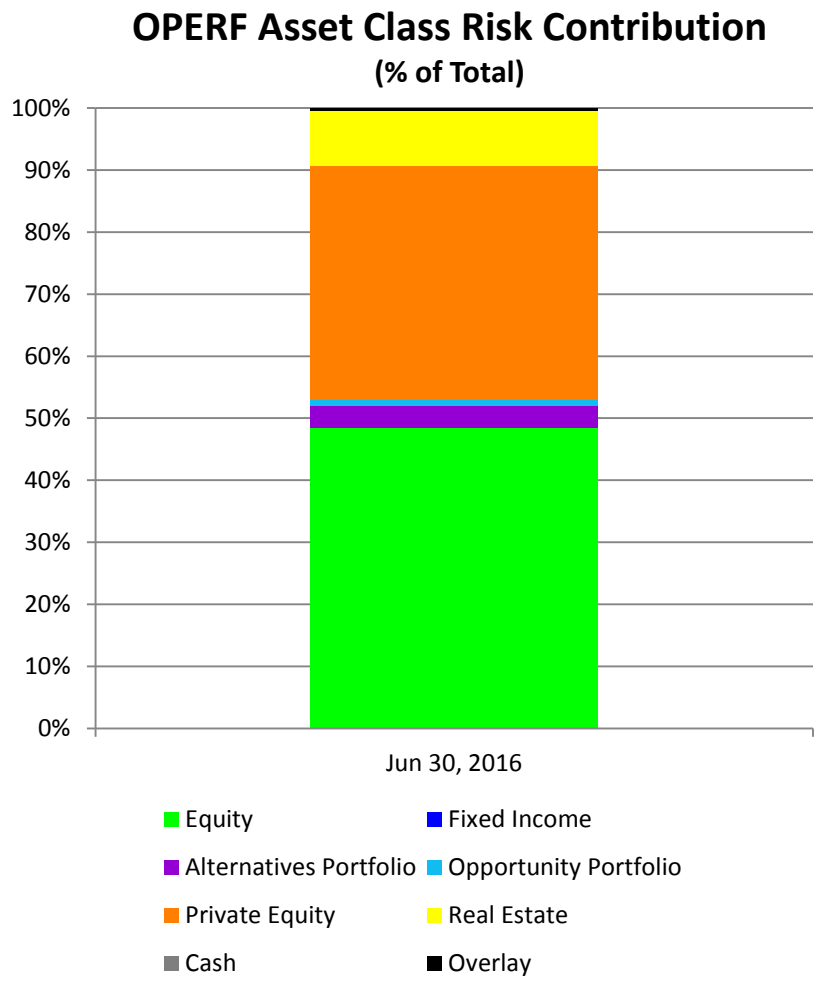
INDEX RISK CHARACTERISTICS - Std Dev

Period Ending 9/30/16		3 year	5 year	10 Year		Beta	Tracking Error	Turnover	Sharpe Ratio (Since 5/1988)
MSCI World Min Vol Index (USD)		8.33%	8.64%	11.89%		0.68	6.69	20.89	0.42
MSCI World Index (USD)		11.17%	12.00%	16.53%		1.00	-	2.49	0.27

Source: MSCI

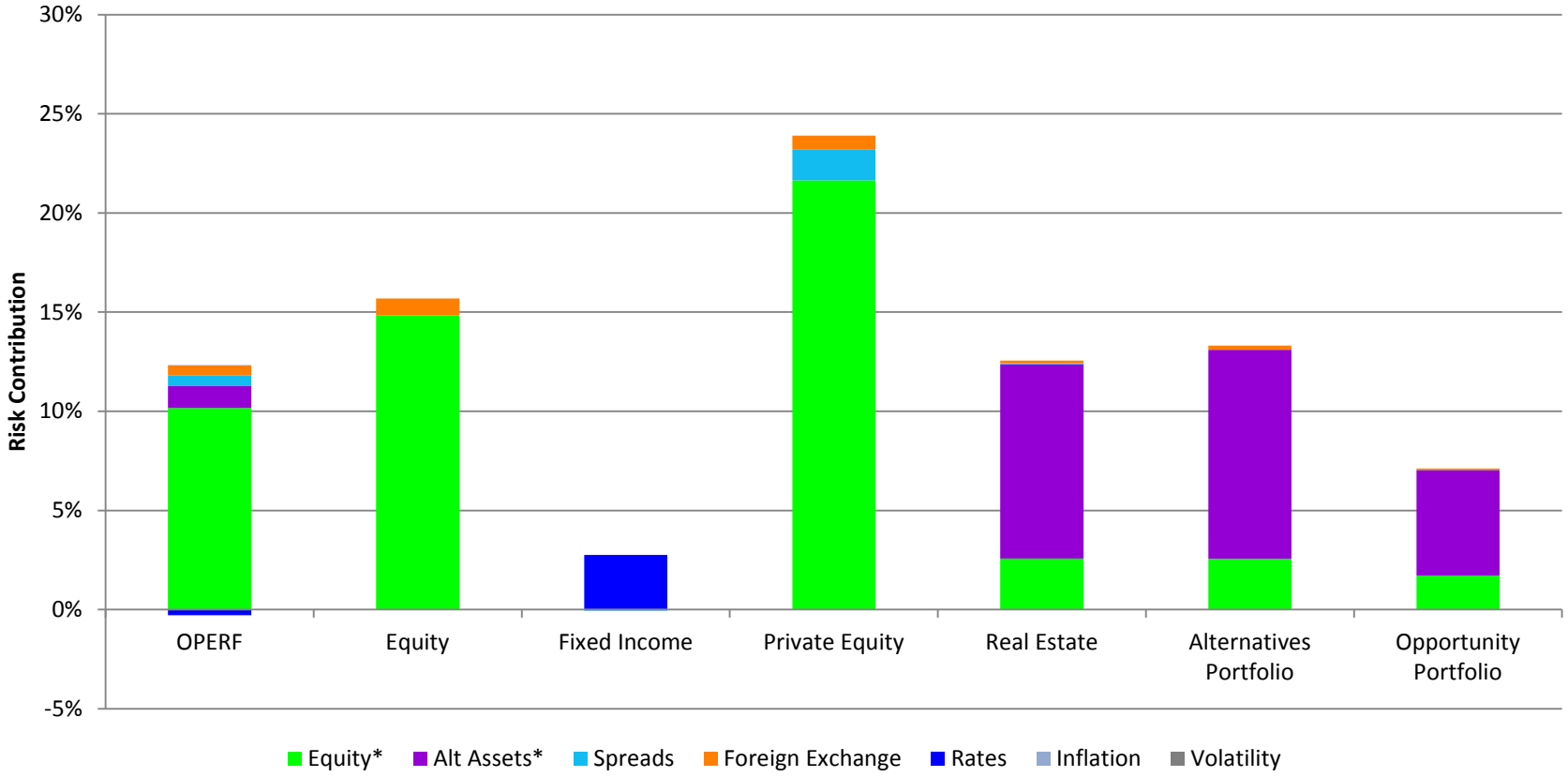
Low Volatility
Scaled Capital Allocation & Asset Class Risk Contribution





Source: BlackRock Aladdin & OST Risk & Research

Low Volatility
Asset Class Risk Contribution by Factor Group



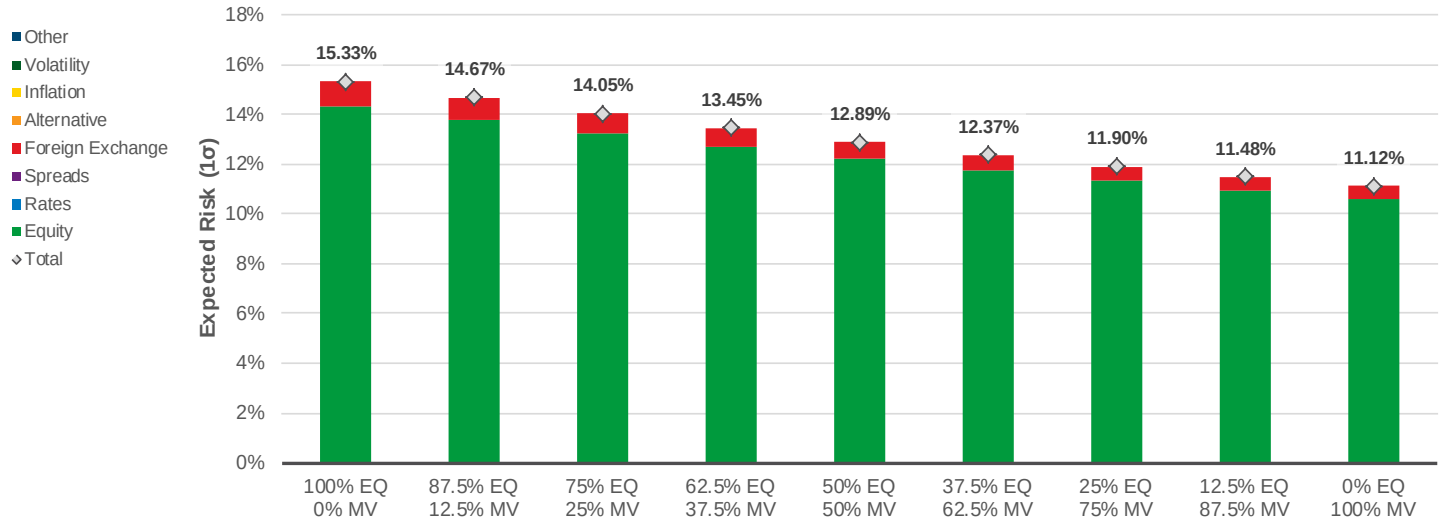
*Aladdin's Alternative risk factor group includes Private Equity, Real Estate, and Hedge Fund risk factors; however, Private Equity risk factors are highly correlated to Public Equity risk factors. In the above chart, Equity includes both Public & Private Equity while Alt Assets includes all other Alternative risk factors.

Source: BlackRock Aladdin & OST Risk & Research

Sizing Low Volatility

- Staff believes that a 25 percent allocation to Low Vol strategies provides a reasonably sufficient allocation in that total risk within the OPERF Public Equity portfolio would drop by approximately 10 percent (from 15.33% to 14.05%). In addition, risk at the total OPERF level would also drop a meaningful amount (from 11.71% to 11.24%).

Pro-Rata Allocation of *MSCI ACWI Minimum Volatility Index (MV)* in OPERF Public Equity Sleeve (EQ)



	100% EQ 0% MV	87.5% EQ 12.5% MV	75% EQ 25% MV	62.5% EQ 37.5% MV	50% EQ 50% MV	37.5% EQ 62.5% MV	25% EQ 75% MV	12.5% EQ 87.5% MV	0% EQ 100% MV
OPERF Public Equity Sleeve	100%	87.5%	75%	62.5%	50%	37.5%	25%	12.5%	0%
MSCI ACWI Min Vol Index	0%	12.5%	25%	37.5%	50%	62.5%	75%	87.5%	100%
Total Risk (EQ)	***15.33%***	***14.67%***	***14.05%***	***13.45%***	***12.89%***	***12.37%***	***11.90%***	***11.48%***	***11.12%***
Total Risk (OPERF)	***11.71%***	***11.47%***	***11.24%***	***11.01%***	***10.79%***	***10.57%***	***10.36%***	***10.16%***	***9.97%***

Source: MSCI & BlackRock Aladdin

Sizing Low Volatility

- Since June 2016, public equity staff met with 37 managers showcasing 39 Low Vol strategies (roughly 85% of the eVestment database Low Vol universe).

	Low Vol Stock Based	Geography	Date
1	Wellington (Quant)	Global	6/20/2016
2	Martingale (Quant)	US Only	6/29/2016
3	AJO (Quant)	US Only	6/29/2016
4	Acadian (Quant)	Global	7/1/2016
5	Arrowstreet (Quant)	Global	7/18/2016
6	AB (Quant/Fundamental)	Global	7/18/2016
7	Analytic (Quant)	Global	7/20/2016
8	BlackRock (Index)	Global	7/21/2016
9	Fidelity (Quant/Fundamental)	Global	7/21/2016
10	Victory Newbridge (Quant)	Global	7/22/2016
11	Panagora (Quant)	Global	7/22/2016
12	Wellington (Quant/Fundamental)	Global	7/22/2016
13	Lazard (Quant)	Global	7/25/2016
14	QS Investors (Quant)	Global	7/26/2016
15	SSgA (Index)	Global	7/26/2016
16	Intech (Quant)	Global	7/26/2016
17	London Company (Quant/Fundamental)	US Only	7/27/2016
18	Jacobs Levy (Quant)	US Only	7/28/2016
19	JP Morgan (Quant/Fundamental)	US Only	7/29/2016
20	LA Capital (Quant)	Global	7/29/2016
21	Numeric (Quant)	Global	8/1/2016
22	Invesco (Quant)	Global	8/1/2016
23	MFS (Quant/Fundamental)	Global	8/1/2016
24	LSV (Quant)	Global	8/2/2016
25	Epoch (Quant/Fundamental)	Global	8/2/2016
26	AQR (Quant)	Global	8/3/2016
27	BMO (Quant)	Global	8/5/2016
28	Clearbridge (Fundamental)	US Only	8/5/2016
29	AXA Rosenberg (Quant)	Global	8/16/2016
30	Calamos (Fundamental)	Global	8/16/2016
31	Quantum (Quant/Fundamental)	US Only	8/22/2016

	Low Vol Options Based	Geography	Date
1	Russell Investments	US Only	7/11/2016
2	RJA	US Only	7/20/2016
3	Analytic	US Only	7/25/2016
4	Parametric (old Clifton)	Global	7/28/2016
5	Neuberger Berman	Global	8/4/2016
6	AQR	Global	8/8/2016
7	DGV	US Only	8/11/2016
8	Gateway Investment	US Only	9/21/2016

OST Existing Managers in blue

Internally-Managed, World X-U.S. Risk Premia Equity Mandate

World X-U.S. Risk Premia Equity Mandate

Staff proposes an internally-managed World X-U.S. Risk Premia portfolio that provides a low cost, systematic exposure to common risk factors (value, momentum, profitability, low volatility) and their associated expected return premiums.

World X-U.S. Risk Premia Equity Mandate

Period Ending 9/30/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
OST 400 Portfolio	$ 532,520,632	12.70%	15.69%	8.40%	9.63%	13.96%	16.77%	14.26%
S&P 400 Index		12.40%	15.33%	8.14%	9.35%	13.66%	16.51%	13.96%
Excess		0.29%	0.37%	0.27%	0.27%	0.30%	0.26%	0.30%
Inception Date of Oct. 1, 2009	**Tracking Error = 30 bps**	**Target Excess Return: 10 bps**						

Period Ending 9/30/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
OST 500 Portfolio	$ 1,953,966,495	7.83%	15.47%	7.16%	11.21%	13.20%	16.41%	13.23%
S&P 500 Index		7.84%	15.43%	7.11%	11.16%	13.15%	16.37%	13.17%
Excess		0.00%	0.04%	0.05%	0.04%	0.04%	0.04%	0.056%
Inception Date of Oct 1, 2009	**Tracking Error = 10 bps**	**Target Excess Return: 5 bps**						

Period Ending 9/30/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
Russell 2000 Synthetic	$ 384,147,678	12.74%	17.06%	9.31%	7.73%	13.12%	16.92%	12.39%
Russell 2000 Index		11.46%	15.47%	8.12%	6.71%	12.12%	15.82%	11.39%
Excess		1.28%	1.59%	1.19%	1.02%	1.00%	1.10%	1.00%
Inception Date of April 1, 2010	**Tracking Error = 50 bps**	**Target Excess Return: 30 bps**						

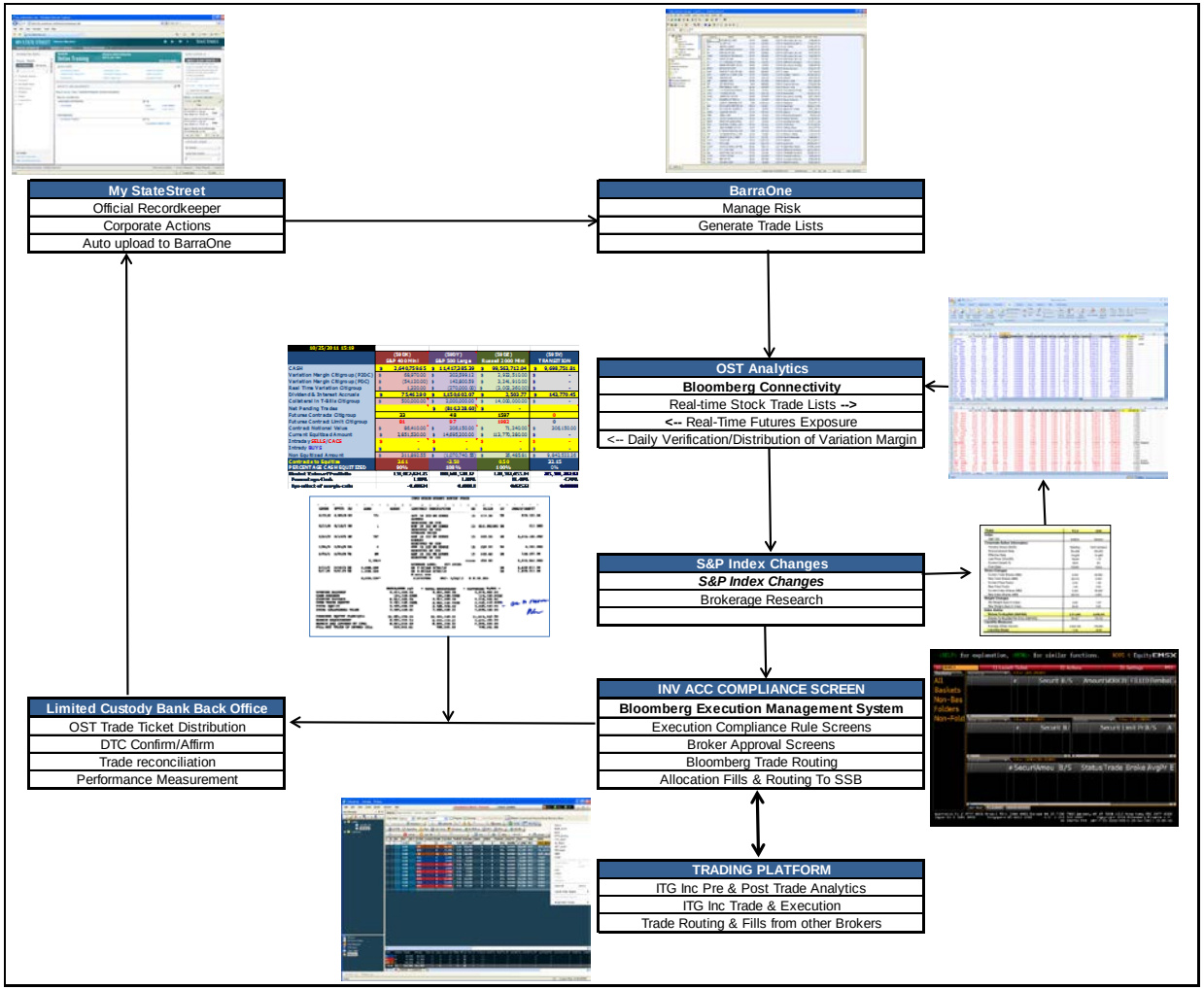
Period Ending 9/30/15	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
TEMS	$ 180,449,700	-16.55%	-22.43%	-9.25%	-6.42%	-0.92%	-4.08%	9.01%
MSCI EM Index		-15.48%	-19.28%	-8.25%	-5.27%	-0.15%	-3.24%	8.87%
Excess		-1.07%	-3.15%	-1.01%	-1.15%	-0.77%	-0.85%	0.14%
Inception Date of Feb 1, 2009	**Tracking Error = 400 bps**	**Target Excess Return: 200 bps**				**TERMINATED SEPTEMBER 30, 2015**		

Period Ending 8/31/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
RUSSELL RAFI LC	$ 1,371,571,346	10.27%	13.81%	4.97%	11.23%	14.23%	N/A	14.65%
RAFI LC Index		*10.06%*	*13.54%*	*4.90%*	*11.21%*	*14.21%*	*N/A*	*14.62%*
RUSSELL 1000		7.83%	11.69%	5.89%	12.02%	13.93%	N/A	14.46%
Excess		2.43%	2.11%	-0.93%	-0.79%	0.31%	N/A	0.19%
Inception Date of Nov 1, 2011	**Tracking Error = 300 bps**	**Target Excess Return: 150 bps**				**TERMINATED AUGUST 31, 2016**		

Period Ending 9/30/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
RISK PREMIA	$ 2,145,793,982	7.06%	14.65%	8.27%	N/A	N/A	N/A	8.90%
MSCI Risk Premia Index		*7.02%*	*14.76%*	*8.35%*	*N/A*	*N/A*	*N/A*	*8.93%*
MSCI USA		7.78%	14.97%	6.93%	N/A	N/A	N/A	8.04%
Excess		-0.72%	-0.33%	1.34%	N/A	N/A	N/A	0.87%
Inception Date of Jan 1, 2014	**Tracking Error = 300 bps**	**Target Excess Return: 150 bps**						

Source: State Street

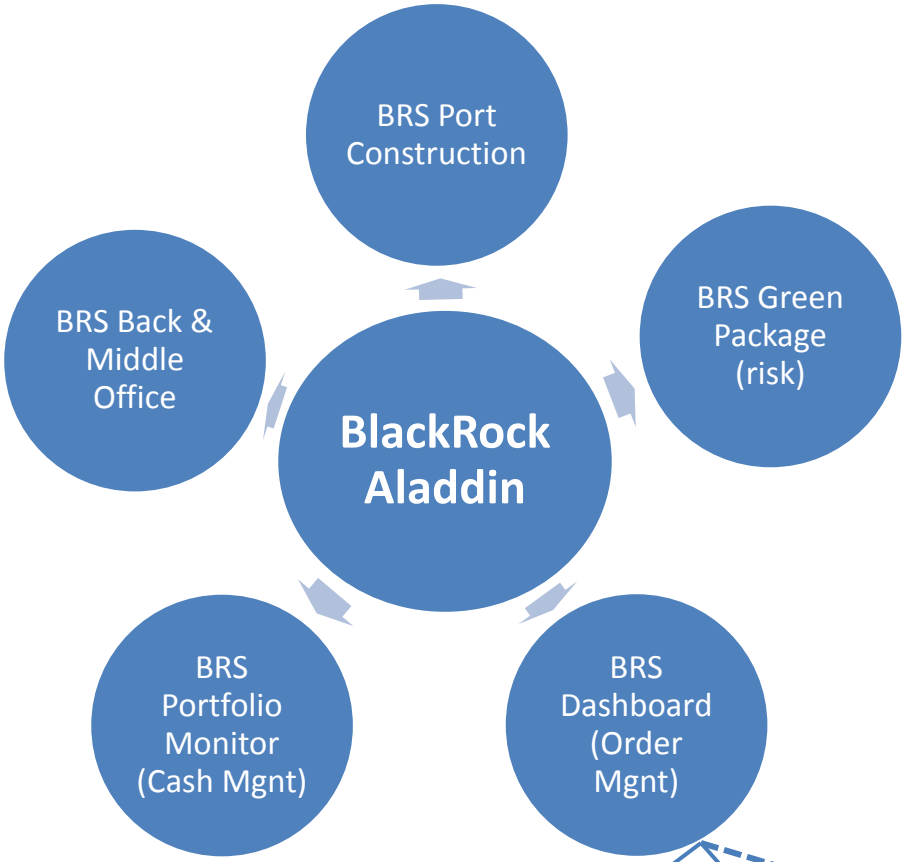
OST Internally-Managed Equity workflow (pre-BRS Aladdin)



Seven Disparate Systems

1) State Street (holdings data);
2) Citigroup (Futures, Daily VM);
3) Barra One (risk platform);
4) Internal spreadsheets for managing real-time stock trade lists and Futures daily cash management;
5) Bloomberg (Order routing);
6) ITG Triton (Execution of trades);
7) Staff held middle & back office functionality.

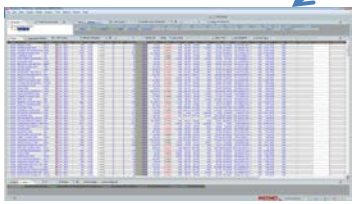
Public Equity Internally Managed Work Flow
(post-BRS Aladdin)



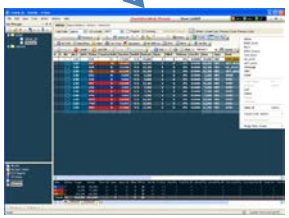
One Investment Ecosystem:
BRS Portfolio Construction (trade lists & risk);
BRS Dashboard (order routing);
BRS Green Package (OPERF Pub Eq level risk);
BRS Portfolio Monitor (cash management);
BRS Back & Middles Office

+

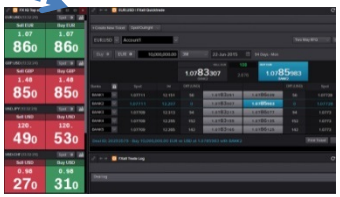
External Trading Platforms
ITG & INSTINET(Execution of trades);
FX All (Execution of Foreign Exchange)



Instinet (Equity)



ITG (Equity & Futures)



FX ALL (Foreign Exchange)
Under Construction

TAB 6 – Public Equity Portfolio Restructuring

OPERF Public Equity Portfolio

Oregon Investment Council
OPERF Public Equity Portfolio – Low Volatility Restructuring
STAFF RECOMMENDATION
October 26, 2016

Purpose

Staff recommends a 25% restructuring of the OPERF Public Equity portfolio to create a Low Volatility strategies sleeve.

Background

Modern Portfolio Theory, specifically the Capital Asset Pricing Model (CAPM) asserts that investors who buy higher volatility stocks should receive higher returns for bearing the additional risk of more volatility. However, this relationship has not held over time; in fact, low volatility stocks have generated similar or superior returns relative to higher volatility alternatives. Moreover, this low volatility anomaly persists in both U.S. and international equity markets.

The table below (Exhibit 1) shows performance of the MSCI USA Min Vol index over a 28-year period (May 1988 through September 2016). This "Min Vol" index has historically exhibited a lower beta, less volatility and a robust Sharpe Ratio relative to its parent, cap-weighted index, the MSCI USA Index. Over the near three-decade period covered (May 1998 through August 2016), the domestic Min Vol strategy has produced market-like returns with approximately 25% percent less volatility.

Exhibit 1

INDEX PERFORMANCE - Gross Returns

Period Ending 9/30/16	1 year	3 year	5 year	10 Year	Since 5/1988	Div Yld	P/E	P/E Fwd	P/BV
MSCI USA Min Vol Index	17.47%	13.50%	15.97%	9.10%	10.86%	2.41	25.83	19.17	3.40
MSCI USA Index	15.12%	10.94%	16.33%	7.34%	10.27%	2.09	23.19	17.24	2.87
Excess	2.35%	2.56%	-0.36%	1.76%	0.59%				

INDEX RISK CHARACTERISTICS - Std Dev

Period Ending 9/30/16		3 year	5 year	10 Year		Beta	Tracking Error	Turnover	Sharpe Ratio (Since 5/1988)
MSCI USA Min Vol Index		8.87%	8.73%	12.07%		0.73	5.73	20.92	0.65
MSCI USA Index		10.89%	11.21%	15.30%		1.00	-	2.46	0.51

Source: MSCI

Exhibit 2 shows performance for the MSCI World (developed countries including the U.S.) Min Vol Index over the same 28-year period. Similar to the MSCI USA Min Vol Index, the MSCI World Min Vol Index has also historically exhibited a lower beta, less volatility and a robust Sharpe Ratio relative to its parent, cap-weighted index, the MSCI World Index. Over the near three-decade period covered (May 1998 through September 2016), the global Min Vol strategy (Exhibit 2) has produced significant, excess returns with approximately 25% less volatility.

Exhibit 2

INDEX PERFORMANCE - Net Returns

Period Ending 9/30/16	1 year	3 year	5 year	10 Year	Since 5/1988	Div Yld	P/E	P/E Fwd	P/BV
MSCI World Min Vol Index (USD)	16.68%	10.43%	11.86%	6.45%	7.92%	2.66	23.52	18.78	2.81
MSCI World Index (USD)	11.36%	5.85%	11.63%	4.47%	6.74%	2.57	21.50	16.09	2.16
Excess	5.32%	4.58%	0.23%	1.98%	1.18%				

INDEX RISK CHARACTERISTICS - Std Dev

Period Ending 9/30/16		3 year	5 year	10 Year		Beta	Tracking Error	Turnover	Sharpe Ratio (Since 5/1988)
MSCI World Min Vol Index (USD)		8.33%	8.64%	11.89%		0.68	6.69	20.89	0.42
MSCI World Index (USD)		11.17%	12.00%	16.53%		1.00	-	2.49	0.27

Source: MSCI

While minimum-variance and managed volatility equity strategies have been around since the early 1990s, these strategies began garnering real attention after the Global Financial Crisis as institutional investors became increasingly risk averse.

Regarding the decades-long persistence of the low volatility anomaly, several explanations exist. The first is that investors prefer a high-return portfolio, but are reluctant to utilize (or are prohibited from using) leverage. In the absence of leverage, high return seeking investors prefer high beta stocks, which increases demand for risky (i.e., high beta) stocks relative to lower beta stocks. This increased demand pushes valuations on high beta stocks up, and subsequently pushes future expected returns on those same stocks down.

The second explanation is an agency-based theory predicated on the observation that long-only retail mutual fund managers prefer high beta stocks due to those stocks' positive effect on mutual fund inflows during bull markets. The majority of net, new mutual fund inflows occur during bull markets; moreover, most of these inflows go to funds with the best, recent absolute performance. Assets in retail mutual funds are also very sticky so that poor performance does not result in proportionately large outflows as retail investors typically make withdrawals based on their own personal liquidity needs, not relative mutual fund performance. This retail fund flow dynamic incents mutual fund managers to invest in stocks that do well in bull markets (i.e., high beta stocks) in order to gather more assets which increases those fund managers' compensation.

The third explanation is based on the use of equity benchmarks for institutional active managers. Low volatility stocks often have low betas, and overweighting low beta stocks in a portfolio leads to higher tracking error relative to cap-weighted benchmarks. Active managers prefer using their active risk budget (i.e., tracking error) for stocks they believe contain excess return potential (i.e., alpha). By focusing on alpha-seeking opportunities, active managers attempt to outperform their assigned benchmark. Although low beta stocks often produce better risk-adjusted return portfolios, active managers don't get compensated for risk reduction and instead often get penalized or terminated for relative performance lags during bull markets.

A factor (such as low volatility) can be thought of as any attribute that helps explain the return and risk characteristics of one or more securities. Certain factors generate excess return premiums that have historically proved a) persistent (though not uniform) through time and b) pervasive across markets and geographies. Investment strategies that seek return premiums on a systematic basis (i.e., not as a function of stock-picking or other traditional active management techniques) can generally be classified into two broad categories: 1) strategies that pursue excess returns through deliberate factor tilts (e.g., size, value or momentum); and 2) strategies that pursue market returns at lower levels of volatility.

OPERF's domestic public equity portfolio has had a strategic overweight or tilt toward small cap stocks for many years. This tilt was originally introduced with the belief that research and trading inefficiencies in and among small cap stocks produce better alpha-seeking opportunities for active managers. A more contemporary view supports this tilt as an appropriate approach for harvesting the size premium -- the excess returns associated with systematic small cap strategies. With the 2011 introduction of the internally managed Russell RAFI Fundamental strategy, staff introduced a second deliberate factor tilt: value. Then, in 2013, staff recommended (and the OIC approved) an internally-managed, multi-factor systematic strategy, the MSCI Risk Premia portfolio which includes deliberate exposures to several factors including value, momentum and quality.

At the time it recommended the multi-factor MSCI Risk Premia portfolio, staff had also identified low volatility as another desirable factor exposure for consideration and possible implementation. Since then, staff has performed additional research on the "Low Vol" or low beta factor and now believes it too should be included in OPERF's public equity portfolio. As illustrated in the following table (Exhibit 3), low beta has historically exhibited superior risk-adjusted returns (as defined by the Sharpe Ratio) relative to other univariate factor exposures.

Exhibit 3

U.S. Return Premium*	Average Premium (Annualized)	Average Volatility/Risk (Annualized)	Sharpe Ratio (Return/Risk)
Market	4.3%	15.6%	0.28
Illiquidity (1968-2013)	4.4%	12.2%	0.36
Small	2.5%	10.8%	0.23
Quality (Novy-Marx)	3.9%	7.9%	0.49
Momentum	7.5%	14.9%	0.50
Low Beta (1963-2011)	10.4%	11.2%	**0.93**
Value	4.1%	10.1%	0.41

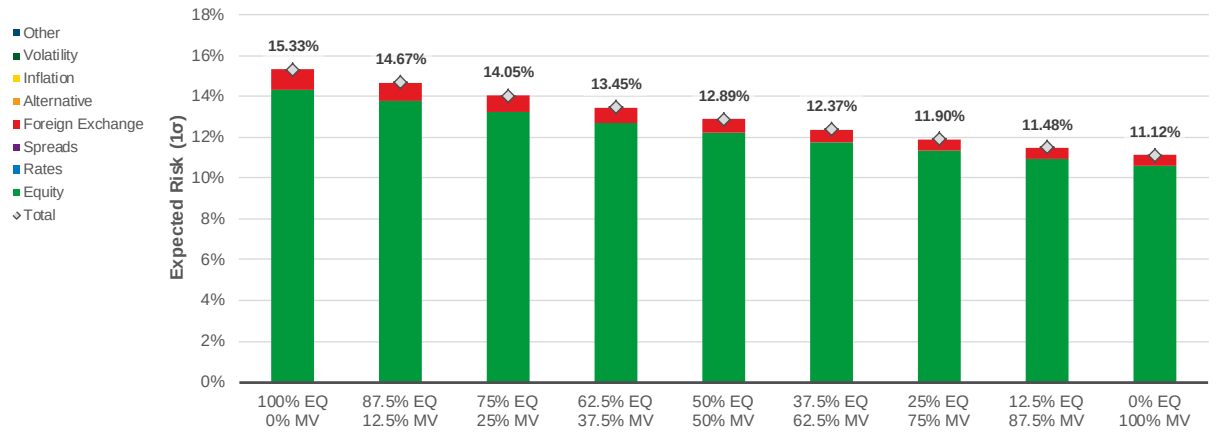
* 1963-2012 unless otherwise noted.

Low Volatility Sizing

Equity exposure is necessary to meet OPERF's expected return hurdle. Having said that, staff believes that incorporating Low Vol strategies alongside the existing equity strategies will prove complementary. Determining the amount of Low Vol within the OPERF Public Equity portfolio is a subjective decision that balances the "too much" exposure with the "not enough to move the needle" outcome. Exhibit 4 provides a forward looking continuum of allocations between the current OPERF Public Equity portfolio and the MSCI ACWI Minimum Volatility index (as a proxy for Low Vol implementation). This data was modeled using BlackRock Solutions Aladdin ("Aladdin") risk tools.

Exhibit 4

Pro-Rata Allocation of *MSCI ACWI Minimum Volatility Index (MV)* in OPERF Public Equity Sleeve (EQ)



	100% EQ 0% MV	87.5% EQ 12.5% MV	75% EQ 25% MV	62.5% EQ 37.5% MV	50% EQ 50% MV	37.5% EQ 62.5% MV	25% EQ 75% MV	12.5% EQ 87.5% MV	0% EQ 100% MV
OPERF Public Equity Sleeve	100%	87.5%	75%	62.5%	50%	37.5%	25%	12.5%	0%
MSCI ACWI Min Vol Index	0%	12.5%	25%	37.5%	50%	62.5%	75%	87.5%	100%
Total Risk (EQ)	***15.33%***	***14.67%***	***14.05%***	***13.45%***	***12.89%***	***12.37%***	***11.90%***	***11.48%***	***11.12%***
Total Risk (OPERF)	***11.71%***	***11.47%***	***11.24%***	***11.01%***	***10.79%***	***10.57%***	***10.36%***	***10.16%***	***9.97%***

Staff believes that a 25 percent allocation to Low Vol strategies provides a reasonably sufficient allocation in that total risk within the OPERF Public Equity portfolio would drop by approximately 10 percent (from 15.33% to 14.05%). In addition, risk at the total OPERF level would also drop a meaningful amount (from 11.71% to 11.24%).

<u>Process</u>

Since June 2016, public equity staff has met with 37 managers (Exhibit 8) showcasing 39 Low Vol strategies (roughly 85% of the eVestment database Low Vol universe), has evaluated the merits of each manager and considered how each manager might fit within the OPERF Public Equity portfolio. Low Vol strategies can be implemented passively or actively, and come in various styles such as those reviewed by staff over the last two months:

- Index Based;
- Quantitative;
- Fundamental;
- Fundamental/Quantitative Combined; and
- Options-Based.

Staff had previously met with a majority of these managers over the years through Oregon State Treasury's Open Door Policy. In addition, and as high-lighted below in blue, several of OPERF's current public equity managers provide Low Vol strategies.

Exhibit 5

	Low Vol Stock Based	Geography	Date
1	Wellington (Quant)	Global	6/20/2016
2	Martingale (Quant)	US Only	6/29/2016
3	AJO (Quant)	US Only	6/29/2016
4	Acadian (Quant)	Global	7/1/2016
5	Arrowstreet (Quant)	Global	7/18/2016
6	AB (Quant/Fundamental)	Global	7/18/2016
7	Analytic (Quant)	Global	7/20/2016
8	BlackRock (Index)	Global	7/21/2016
9	Fidelity (Quant/Fundamental)	Global	7/21/2016
10	Victory Newbridge (Quant)	Global	7/22/2016
11	Panagora (Quant)	Global	7/22/2016
12	Wellington (Quant/Fundamental)	Global	7/22/2016
13	Lazard (Quant)	Global	7/25/2016
14	QS Investors (Quant)	Global	7/26/2016
15	SSgA (Index)	Global	7/26/2016
16	Intech (Quant)	Global	7/26/2016
17	London Company (Quant/Fundamental)	US Only	7/27/2016
18	Jacobs Levy (Quant)	US Only	7/28/2016
19	JP Morgan (Quant/Fundamental)	US Only	7/29/2016
20	LA Capital (Quant)	Global	7/29/2016
21	Numeric (Quant)	Global	8/1/2016
22	Invesco (Quant)	Global	8/1/2016
23	MFS (Quant/Fundamental)	Global	8/1/2016
24	LSV (Quant)	Global	8/2/2016
25	Epoch (Quant/Fundamental)	Global	8/2/2016
26	AQR (Quant)	Global	8/3/2016
27	BMO (Quant)	Global	8/5/2016
28	Clearbridge (Fundamental)	US Only	8/5/2016
29	AXA Rosenberg (Quant)	Global	8/16/2016
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	Low Vol Options Based	Geography	Date
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5	Neuberger Berman	Global	8/4/2016
6	AQR	Global	8/8/2016
7	DGV	US Only	8/11/2016
8	Gateway Investment	US Only	9/21/2016

Staff qualitatively and quantitatively ranked all strategies, then performed more extensive research on the leading candidates. In many cases, staff requested holdings from managers to model on Aladdin and gauge impacts to the broader OPERF Public Equity portfolio. Staff concurrently scheduled conference calls with OIC general consultant Callan Associates to further discuss the merits of the various strategies reviewed. Unsurprisingly, some of the most compelling Low Vol strategies are offered by existing OPERF equity managers. Although staff is recommending a 25 percent allocation to Low Vol strategies, staff plans to implement only 12.5 percent of this allocation initially. Additional Low Vol strategies are being considered (e.g., derivative-based Low Vol strategies), and will be presented for OIC consideration at a later date.

Low Volatility Manager Finalists

Arrowstreet

Arrowstreet was founded in 1999, and is privately owned and controlled by senior management. The firm is headquartered in Boston, and employs over 200 professionals firm-wide. As of June 30, 2016, Arrowstreet managed $65 billion in a variety of equity products, including active extension (130/30) offerings.

Arrowstreet believes that markets are inefficient, and that inefficiencies can be exploited through an investment process that is guided by investment intuition, is disciplined yet opportunistic, and incorporates a diverse set of investment signals. Arrowstreet's process is one that involves evaluating securities on an integrated basis taking into consideration direct effects (stock level characteristics) and indirect, or spillover effects (country, sector, related companies, etc.). Measuring and including indirect

effects and the influence of related securities can have meaningful implications in evaluating (or forecasting) the security in question. In many cases, the information and signals from groups of related securities are less crowded and more influential than are the direct effects of that stock. The use of indirect effects is a key differentiator for the firm. Its Low Vol strategy applies this same core process while targeting a lower beta exposure in the optimization phase. Arrowstreet's research efforts are on-going, and the firm maintains strong ties to the finance academic communities**.**

Staff is very familiar with Arrowstreet as the firm currently manages multiple public equity mandates for both OPERF and the Common School Fund.

Acadian

Acadian's predecessor firm (Financial Research) was founded in 1977. In 1978 Acadian designed, developed and implemented the first international index-matching strategy and later an active country selection strategy for State Street Bank and Trust Company. In 1987, Acadian Asset Management was formed. The firm, headquartered in Boston, employs over 300 employees worldwide, and has regional offices in London, Singapore, Sydney and Tokyo. The firm is a subsidiary of OMAM Affiliate Holdings LLC, and as of May 31, 2016, managed $69.3 billion across a variety of domestic and international equity products.

Acadian's investment philosophy is based on the belief that markets are inefficient, and that such inefficiencies are caused in part by investors' repetitive behavioral mistakes as well as certain structural market features. Acadian applies fundamental insights in an objective and systematic manner to find attractive investment opportunities and exploit corresponding security mispricings. These insights, gleaned from a systematic evaluation of over 60 individual factors (e.g., price to intrinsic value, cash flow quality, earnings surprise, price momentum, etc.) have been tested by rigorous statistical and economic analysis prior to model inclusion. Using a broad factor universe provides a diverse set of security characteristics for examination and testing across different time periods and market environments.

Acadian has a long history of research and innovation, testing over 700 unique factors and numerous prospective enhancements to the firm's investment process over the past 25 years. Acadian's research team is led by Chief Investment Officer, John Chisolm, as well as Malcolm Baker and Wes Chan, Research Consultant and Director of Stock Selection Research, respectively. The research team consists of a diverse group of subject matter experts, analysts, portfolio managers, data specialists and system programmers. Further, Acadian is an early pioneer of Low Vol investing and has been managing its Low Vol strategy since 2006.

Staff is very familiar with Acadian as the firm has managed an international value strategy (initiated January 1992) for OPERF that goes back nearly 25 years.

AQR

Applied Quantitative Research (AQR) was founded in 1998 by Clifford S. Asness, Ph.D., David G. Kabiller, Robert J. Krail and John M. Liew, Ph.D. The team members' relationship dates back over 20 years to when Asness, Liew and Krail met in the University of Chicago's Ph.D. program, and where the foundations of AQR's investment philosophy were established. All three investment professionals would later join Goldman Sachs where they met Kabiller. Today, the firm, headquartered in Greenwich, CT, employs nearly 700 professionals globally. In addition, AQR has regional offices in Chicago, Los

Angeles, Sydney and Bermuda. As of June 30, 2016, AQR managed $159 billion across a variety of alternative and traditional investment strategies.

AQR's investment philosophy is based on three core principles: 1) **a systematic approach** that identifies long-term, repeatable sources of expected returns grounded in sound economic theory and implemented in a disciplined manner to reduce subjective biases; 2) **diversification** across multiple dimensions to reduce overall risk and improve risk-adjusted returns; and 3) seek additional alpha through **risk consideration** in portfolio construction, risk management and proprietary trading technology. All of the firm's investment strategies reflect AQR's basic investment philosophy that seeks to identify potential sources of return through their applied research efforts, which combine economic theory and intuition, and are informed by decades of data across geographies and asset groups.

AQR's Low Vol strategy, Defensive Equity, is an extension of the stock selection strategies applied across various regions and capitalization ranges. In building the firm's Defensive Equity portfolio, AQR combines a multi-dimensional approach of minimizing market risk by tilting toward low-beta stocks, as well as minimizing fundamental risk by tilting towards companies with higher quality characteristics.

AQR has a long history of research and innovation, and the firm employs several academics, many who maintain official affiliations with leading universities. Approximately half of the firm's employees hold advanced degrees.

Staff is very familiar with AQR as the firm manages five OPERF mandates for the OIC with current commitments totaling in excess of $2.2 billion across alternative and traditional strategies.

Los Angeles Capital Management (LACM)

LACM was co-founded in 2002 by Thomas Stevens and Hal Reynolds, both formerly of Wilshire Asset Management. The firm is a corporation and 100% employee owned. Headquartered in Los Angeles, LACM currently has 28 employee owners and over 70 employees overall. As of June 30, 2016, LACM managed $20.2 billion across a variety of equity products.

The firm's investment philosophy is based on its proprietary concept of Investor Preference Theory®, a concept unique to LACM and developed by its founders. Central to this concept is a view that a stock's expected return is a function of both its risk characteristics and the price (or expected risk premium) assigned (by the market) to each characteristic. Rather than making static assumptions about the risk characteristics of superior investments, the firm's philosophy recognizes that investor preferences for specific risk characteristics evolve with changing economic and market conditions. In other words, rather than rely on historical observations to price risk, the firm has developed a dynamic, forward-looking approach to pricing risk characteristics.

The firm's co-founders bring over 30 years of experience to their portfolio management processes, experience that includes work with multiple models in various market environments. In the 1970s, the founders were early developers of dividend discount models (DDMs) to estimate security level returns, and discovered that DDMs consistently underperformed due to an inability to shift views under changing economic conditions. In the 1980s, the founders helped build out the now ubiquitous Style Indexes (i.e., growth, value, and size factors) to facilitate a multi-variate approach to security selection. While an improvement, the associated factor risk premiums were weighted using backward-looking models yet used to estimate future returns. In the 1990s, based on lessons learned about investor

preference shifts and behavioral biases, the founders developed their forward-looking Dynamic Alpha Model® that drives much of the firm's investment process today. Specific to LACM's Low Vol strategy, the firm incorporates additional factor forecasts that it believes will influence Low Vol stock returns.

This is Staff's first recommendation of Los Angeles Capital Management, following many years spent researching the firm and its portfolio management processes. While historically there has been limited opportunity to warrant a replacement within the existing roster of quantitative managers, the strategic introduction of a Low Vol sleeve allows for a timely consideration of LACM.

Issues to Consider

Pros

- Staff has high regard for all four managers and believes each will bring important differentiation and complementarity to the proposed Low Vol sleeve.
- Improved diversification benefits by including an additional factor exposure in the Public Equity portfolio (i.e., complement the portfolio's current size, value, quality and momentum tilts with dedicated Low Vol exposure).
- Reduce equity risk at the total OPERF level and achieve higher risk-adjusted returns through an improved Sharpe Ratio construct.

Cons

- Due to a Low Vol strategy's emphasis on downside protection, these mandates will likely under-perform during strong bull market episodes. [Mitigant: the multi-manager structure of OPERF's Public Equity Portfolio offsets this impact by way of higher beta mandates in other parts of the portfolio].
- Low volatility assets can be more expensive to trade due to their often smaller cap composition relative to a parent, cap-weighted index. [Mitigant: All proposed managers perform sophisticated transaction cost modeling as a component of their portfolio management processes.]
- Recent research suggests Low Vol strategies are extended and vulnerable to negative tail risk. Over the last twelve months, wide-spread interest in Low Vol strategies has driven valuation multiples on Low Vol assets to levels some investors deem unjustified by fundamentals. [Mitigant: Staff's view is that the low beta anomaly will be cyclical but ultimately persistent over the long-term. Accordingly, this recommendation is strategic with less consideration to near-term market timing issues. Although staff is recommending a 25 percent allocation to Low Vol strategies, it plans to implement only 12.5 percent of the allocation initially.]
- Low Vol strategies are more highly correlated with fixed income securities than standard cap-weighted equity indices. This high correlation is driven in part by Low Vol strategies' overweight to interest rate sensitive sectors such as Utilities. Following the Great Financial Crisis of 2008, Low Vol stocks have performed in the subsequent and persistently low interest rate environment. However, in a rising rate environment, Low Vol strategies may be adversely affected as income-focused investors shift their attention to more attractive bond yields. [Mitigant: This high correlation with fixed income is well understood by Low Vol managers; moreover, recommending ACWI Low Vol mandates hedges rising rate risks at the country level due to unsynchronized credit and monetary policy cycles across markets and geographies. Finally, this recommendation is strategic with less consideration to near-term credit and/or monetary policy timing issues.]

Finally, the proposed restructuring of the OPERF Public Equity portfolio (i.e., adding a dedicated Low Vol sleeve) is consistent with **OIC INV 1201** - *Statement of OIC Investment and Management Beliefs:*

> *Section 5.A. - Inefficiencies that can be exploited by active management may exist in certain segments of the capital markets.*
>
> - *While largely efficient, select segments of the capital markets can sometimes be exploited by skilled active management.*
> - *The nature (i.e., perceived magnitude and likely duration) of such inefficiencies should inform the proposed active management strategy (e.g., discretionary or systematic).*
>
> *and*
>
> *Section 6.A. - All fees, expenses, commissions and transaction costs should be diligently monitored and managed in order to maximize net investment returns*.
>
> 1. *Active management should therefore be a deliberate choice and applied only to those public market strategies/managers in which the OIC enjoys a high degree of confidence that such strategies/managers will be sufficiently rewarded on a risk-adjusted basis and net of all fees and related transactions costs.*

<u>Recommendation</u>

1) Staff and Callan recommend funding Arrowstreet, Acadian, AQR and Los Angeles Capital Management with approximately $750 mm - $800 mm each to populate a dedicated Low Vol sleeve within the OPERF Public Equity portfolio.
2) Amend OIC policy INV 601 (Public Equity Investments: Strategic Role of Public Equity Securities within OPERF) accordingly.

ACADIAN

OREGON PUBLIC EMPLOYEES RETIREMENT FUND

ALL-COUNTRY MANAGED VOLATILITY EQUITY

OCTOBER 26, 2016

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ACADIAN PRESENTATION TEAM

Ross A. Dowd – Executive Vice President, Global Head of Marketing and Client Service

Ross joined Acadian in 2004 and is currently the Global Head of Marketing and Client Service. He manages the combined global client service and marketing effort for Acadian, with responsibility for global business development and institutional consultant and client service relationships. He is a member of Acadian's Board of Managers, the Acadian Executive Committee, the firm's Operating Committee, Compliance Committee and IT Steering Committee. He has oversight responsibility for our global operations through his role on the boards of Acadian Asset Management (Singapore) Pte. Ltd., Acadian Asset Management (UK) Limited, Acadian Asset Management (Japan), and Acadian Asset Management (Australia) Ltd. Prior to joining Acadian, Ross served in various roles including portfolio management, investment strategy, business development and client relationship management with Barclays Global Investors. Education: B.A., University of California at Santa Barbara; M.B.A., University of Chicago.

Mark J. Birmingham, CFA – Vice President, Portfolio Manager

Mark Birmingham is a Vice President, Portfolio Manager, working on Acadian's Managed Volatility strategies. Before joining Acadian in 2013, he was a vice president and quantitative analyst within the Quantitative Investment Group at Wellington Management Co. Mark also served as Director, U.S. Equity Sales and Trading at Nomura Securities International, Inc. prior to his work at Wellington. He is a CFA charterholder and a member of the Boston Security Analysts Society. Education: A.B., Computer Science, Princeton University.

James E. Klapman – Senior Vice President, Relationship Manager

Jim joined Acadian in 1996 and is a member of Acadian's Marketing and Client Service Team, responsible for servicing our clients in North America. Jim previously worked with Acadian's clients in the Middle-East, Asia and Australia. From 2005 to 2009, he was Head of Portfolio Construction for Acadian Asset Management (Australia). Education: B.A., Economics and Government/Legal Studies, Bowdoin College; M.B.A., concentration in Finance, Northeastern University.

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WHY ACADIAN FOR MANAGED VOLATILITY?

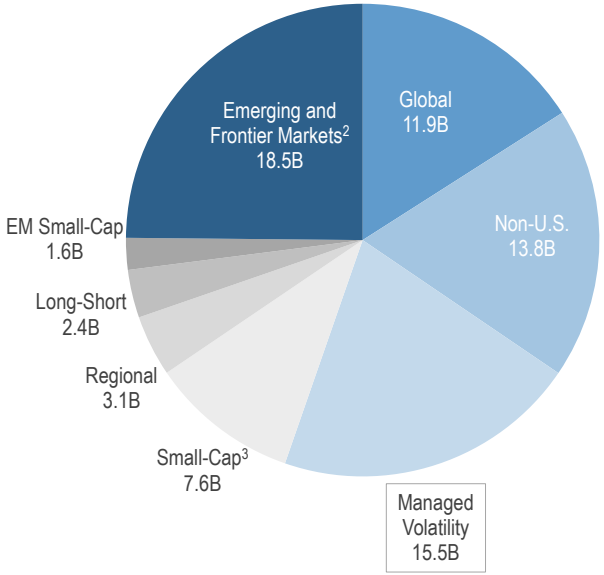
- Pioneer in global quantitative, risk-focused investing, since 1986
- Pioneer in Managed Volatility investing, since 2006
- Dedicated and experienced Managed Volatility team, leading research

ACADIAN ORGANIZATIONAL OVERVIEW

SEPTEMBER 30, 2016

- Founded in Boston in 1986
- Offices in Boston, London, Singapore, Sydney, and Tokyo[1]
- 326 employees worldwide

USD 74.5B AUM



Worldwide Presence[1]

The individual strategy level assets under management (AUM) are rounded to the nearest decimal point.
There is no rounding applied to the total firm AUM which includes $853.1 million in model advisory contracts where Acadian does not have trading authority.

[1] Please refer to affiliate office disclosures on the Legal Disclaimer page.
[2] Includes $730.4 million in Frontier Markets Equity.
[3] Includes $1825.4 million in Smid-Cap and $5.6 million in Micro-Cap.

OREGON PORTFOLIO

PERFORMANCE (RETURNS IN USD – AFTER MANAGEMENT FEES)

Time Period	Portfolio*	Benchmark	Value-Added vs. Benchmark
1992 (inception: Feb 3, 1992)	(13.0)%	(11.0)%	(2.0)%
1993	35.2	32.6	2.6
1994	4.9	7.8	(2.9)
1995	15.4	11.2	4.2
1996	12.5	6.4	6.1
1997	(6.3)	0.6	(6.9)
1998	0.1	13.0	(12.9)
1999	14.0	32.2	(18.2)
2000	(2.2)	(14.2)	12.0
2001	(11.6)	(18.0)	6.4
2002	(2.1)	(12.8)	10.7
2003	52.3	46.4	5.9
2004	28.9	25.1	3.8
2005	26.8	16.5	10.3
2006	30.7	29.7	1.0
2007	16.8	12.3	4.5
2008	(53.4)	(45.7)	(7.7)
2009	35.9	46.3	(10.4)
2010	17.2	9.6	7.6
2011	(11.5)	(13.9)	2.4
2012	19.6	17.4	2.2
2013	21.8	15.7	6.1
2014	(3.7)	(5.0)	1.3
2015	(7.3)	(8.9)	1.6
2016 through September	11.3	6.0	5.3
One Year Annualized Return	14.2	7.8	6.4
Three Year Annualized Return	2.1	(1.3)	3.4
Five Year Annualized Return	8.1	5.1	3.0
Since-Inception Annualized Return	7.0	5.8	1.2
Since-Inception Annualized Standard Deviation	17.5	17.1	
Since-Inception Active Risk			5.2
Since-Inception Information Ratio			0.2

* Returns that include the most recent month are preliminary.

Portfolio: Oregon. **Benchmark:** MSCI ACW ex-U.S. IMI Value (net 2008-06-01 To 2016-09-30,MSCI AC World ex-U.S. Value (net) 2003-07-01 To 2008-06-01,90percent Salomon BMI ex-US 10percent S&P IFCI blend 1996-10-01 To 2003-07-01,MSCI EAFE (net) 1992-02-03 To 1996-10-01

The information provided has been prepared by Acadian from our internal records. It is not intended to replace the official records of your account that you receive directly from the custodian. You are encouraged to compare the information provided to you by Acadian to that provided by the custodian and to contact us with any questions. Reference to the benchmark is for comparative purposes only and is not intended to indicate that the portfolio will contain the same investments as the benchmark. Investors have the opportunity for losses as well as profits. Past performance is no guarantee of future returns. The complete performance disclosure can be found in the composite performance disclosure page attached. Index Source: MSCI Copyright MSCI 2016. All Rights Reserved. Unpublished. PROPRIETARY TO MSCI. Index Source: S&P Copyright (c) 2016, Standard & Poor's Financial Services LLC. All rights reserved.

MANAGED VOLATILITY TEAM AND CLIENTS

Team

Ryan Taliaferro, Ph.D. Senior Vice President, Portfolio Manager	Ph.D. Business Economics (Finance) from Harvard University; A.M. in Economics from Harvard University; A.M. and A.B. in Physics from Harvard University; M.B.A. in Finance and Economics from the University of Chicago; Member of the advisory board of the Journal of Portfolio Management
Mark Birmingham, CFA Vice President, Portfolio Manager	A.B. Computer Science from Princeton University; CFA charterholder
Dan Le, CFA Assistant Vice President, Associate Portfolio Manager	B.A. Psychology from Brown University; CFA charterholder and a member of the Boston Security Analysts Society
Steve Zaffrann Analyst, Research	B.S. Computer Engineering from the University of Wisconsin
Wan Hua Tan, CFA Analyst, Research	M.S.E. Biomedical Engineering from John Hopkins University B.A.Sc Engineering Science from the University of Toronto

Representative Managed Volatility Client List

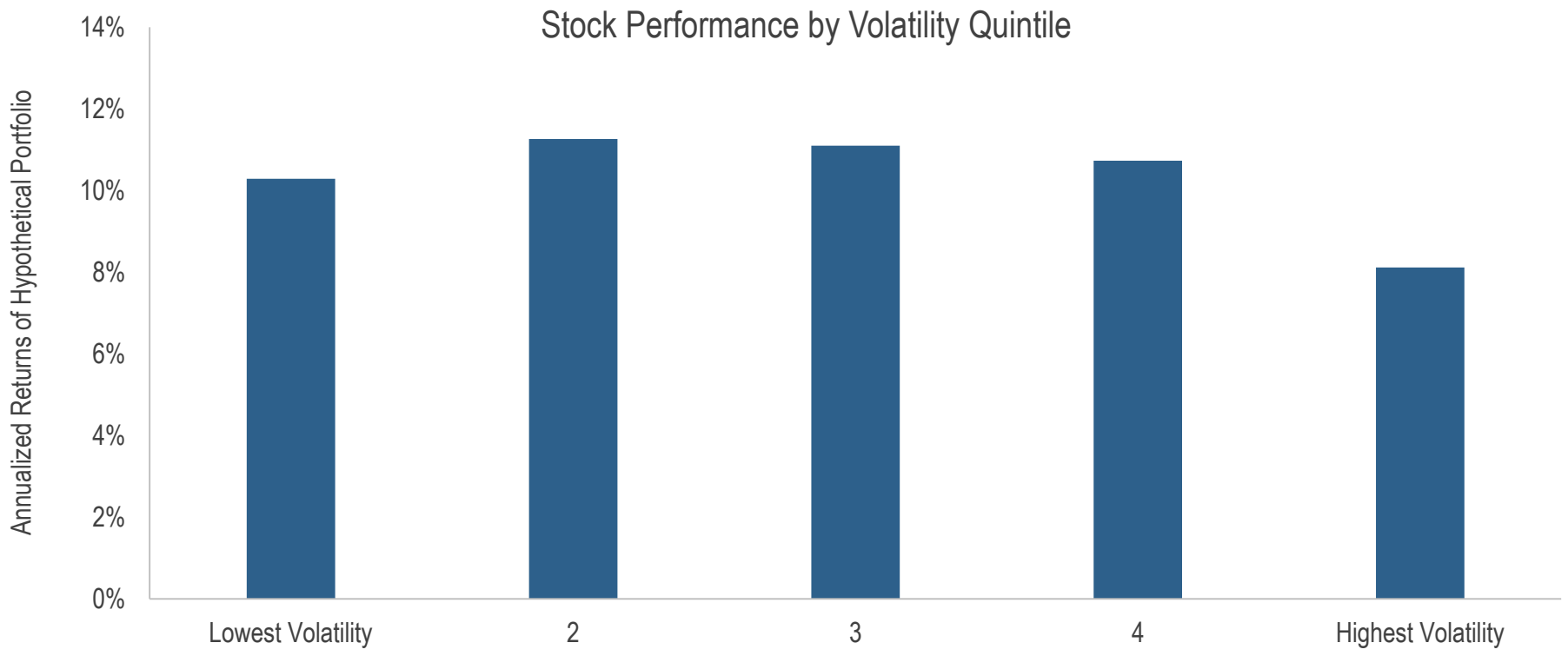
- Colonial First State Investments Ltd
- Employees' Retirement Fund of the City of Dallas
- LGT Capital Partners
- Mine Wealth + Wellbeing
- Pfizer
- PKA A/S
- Public School & Education Employee Retirement Systems of Missouri
- SEI

Managed Volatility Strategies	AUM (USD) 9/30/2016	Inception
Global Managed Volatility	9,197 M	August 2006
Kokusai Managed Volatility	39 M	May 2009
Emerging Markets Managed Volatility	1,827 M	March 2011
U.S. Managed Volatility	558 M	April 2011
All-Country Managed Volatility	1,925 M	June 2011
European Managed Volatility	227 M	October 2011
Australian Managed Volatility	433 M	February 2012
EAFE Managed Volatility	315 M	April 2012
Pacific Managed Volatility	15 M	March 2013
EAFE + Canada Managed Volatility	552 M	March 2015
All-Country World ex-U.S. Managed Volatility	29 M	October 2015
All-Country Managed Volatility ex-AU	386 M	March 2016
Total	15,504 M	

The All-Country Managed Volatility ex-AU strategy is a model advisory contract where Acadian has no trading authority. Client names appearing on this representative list were selected by Acadian Asset Management LLC from the group of our clients who permit Acadian Asset Management LLC to utilize their name based upon their name recognition and to reflect the range of client types we service. Client names appearing on this list were not selected based on account performance and do not constitute an endorsement or recommendation of Acadian Asset Management LLC or our services.

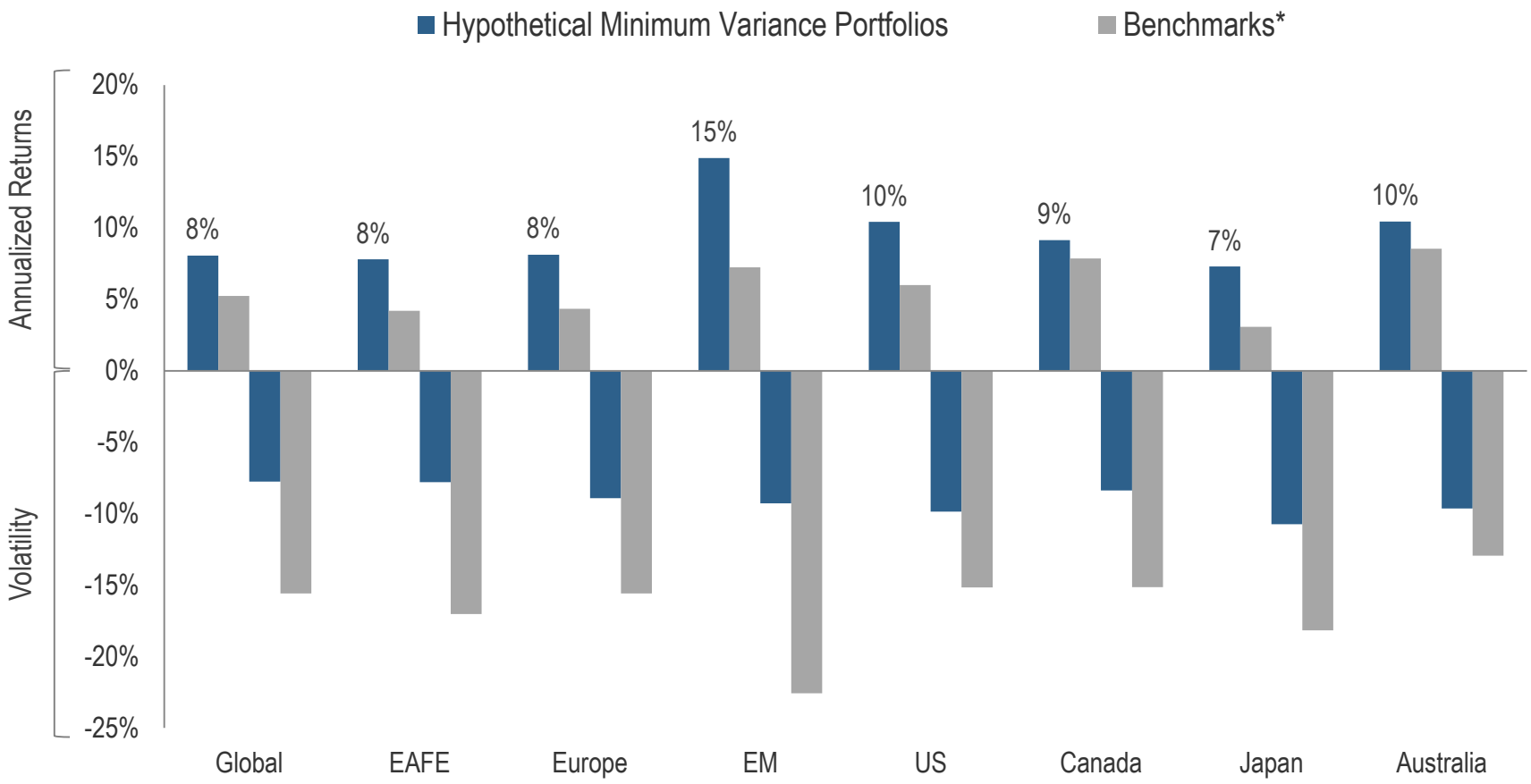
WHAT ARE MANAGED VOLATILITY STRATEGIES?

- Finance theory says investors should be compensated for holding riskier stocks with higher average returns
- The empirical reality is that low risk stocks have realized similar returns but with less risk



Source: Acadian Asset Management LLC, CRSP®, Center for Research in Security Prices. Graduate School of Business, The University of Chicago. Used with permission. All rights reserved. crsp.uchicago.edu
Methodology: all of the U.S. stocks within the CRSP Universe. Equal sized quintiles, cap weighted, from 1968 – 2015. For illustrative purposes only. This is meant to be an educational illustrative example and is not intended to represent investment returns generated by an actual portfolio. They do not represent actual trading or an actual account, but were achieved by means of using the CRSP universe of securities as a whole. Results do not reflect transaction costs, other implementation costs and do not reflect advisory fees or their potential impact. Hypothetical results are not indicative of actual future results. Every investment program has the opportunity for loss as well as profit.

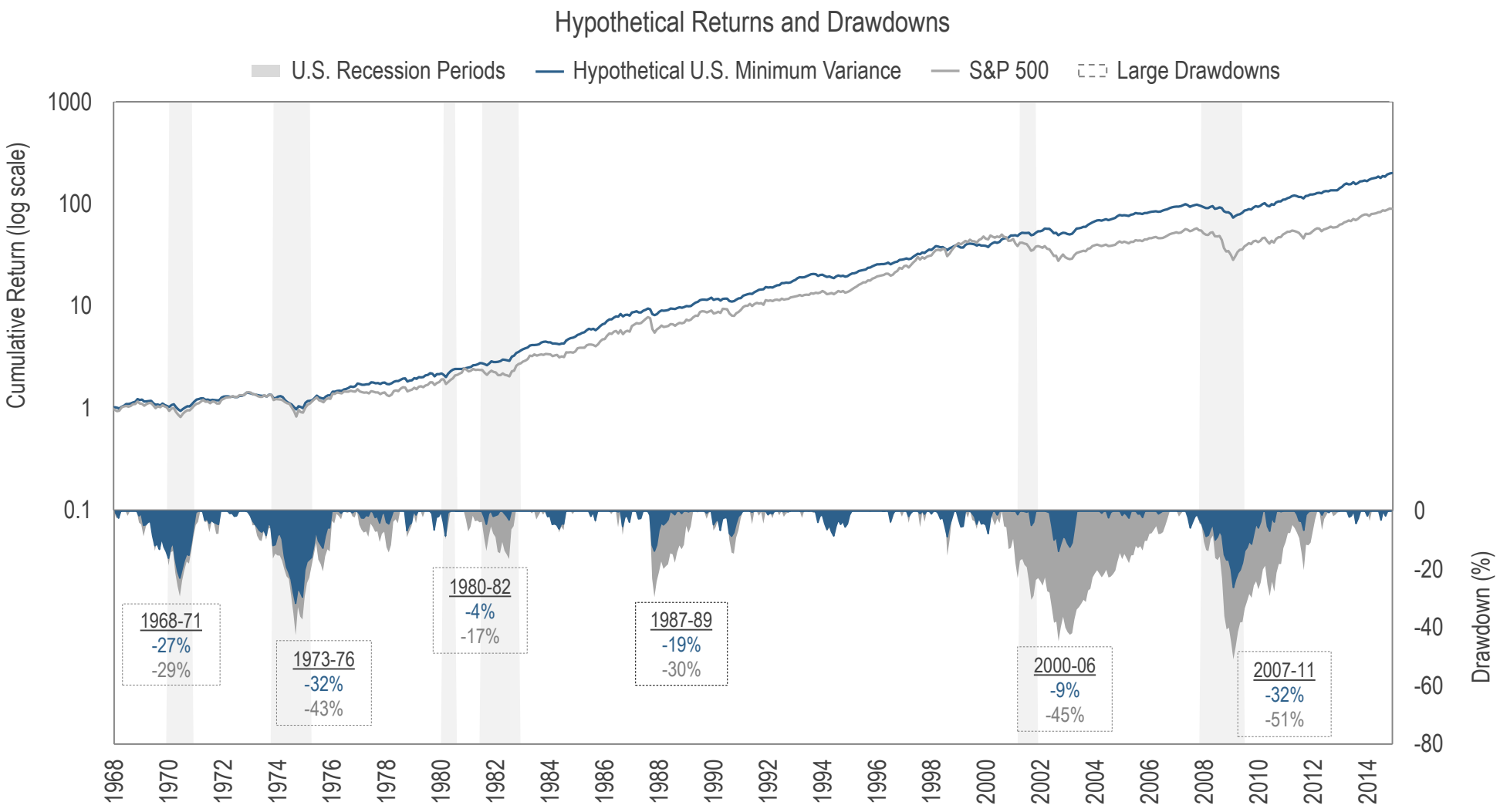
THE LOW VOLATILITY ANOMALY IS APPARENT AROUND THE WORLD



Source: Acadian Asset Management LLC, *MSCI World, MSCI EAFE, MSCI Europe, MSCI EM, MSCI US, MSCI Canada, MSCI Japan, and MSCI Australia.
Methodology: Hypothetical portfolios period covers October 1998 – December 2015, except EM, which covers January 2004 – December 2015. The data was produced from the Acadian universe of securities, using the respective MSCI benchmark weights and countries. For illustrative purposes only. This is meant to be an educational illustrative example and is not intended to represent investment returns generated by an actual portfolio. The Hypothetical Minimum Variance Portfolios we have created for educational illustrations do not include constraints on exposures to industries or, where relevant, countries and regions, nor do they manage toward a target for total portfolio risk. The hypothetical results do not represent actual trading or an actual account, but were achieved by means of retroactive application of a model designed with the benefit of hindsight for the period specified above. Results are gross and would be reduced by advisory fees. Results do not reflect transaction costs, other implementation costs and do not reflect advisory fees or their potential impact. Reference to the benchmark is for comparative purposes only. Hypothetical performance is not indicative of actual future results. Every investment program has the opportunity for loss as well as profit. Index Source: MSCI Copyright MSCI 2016. All Rights Reserved. Unpublished. PROPRIETARY TO MSCI.

LONG-TERM RETURNS AND DRAWDOWNS

U.S. MINIMUM VARIANCE



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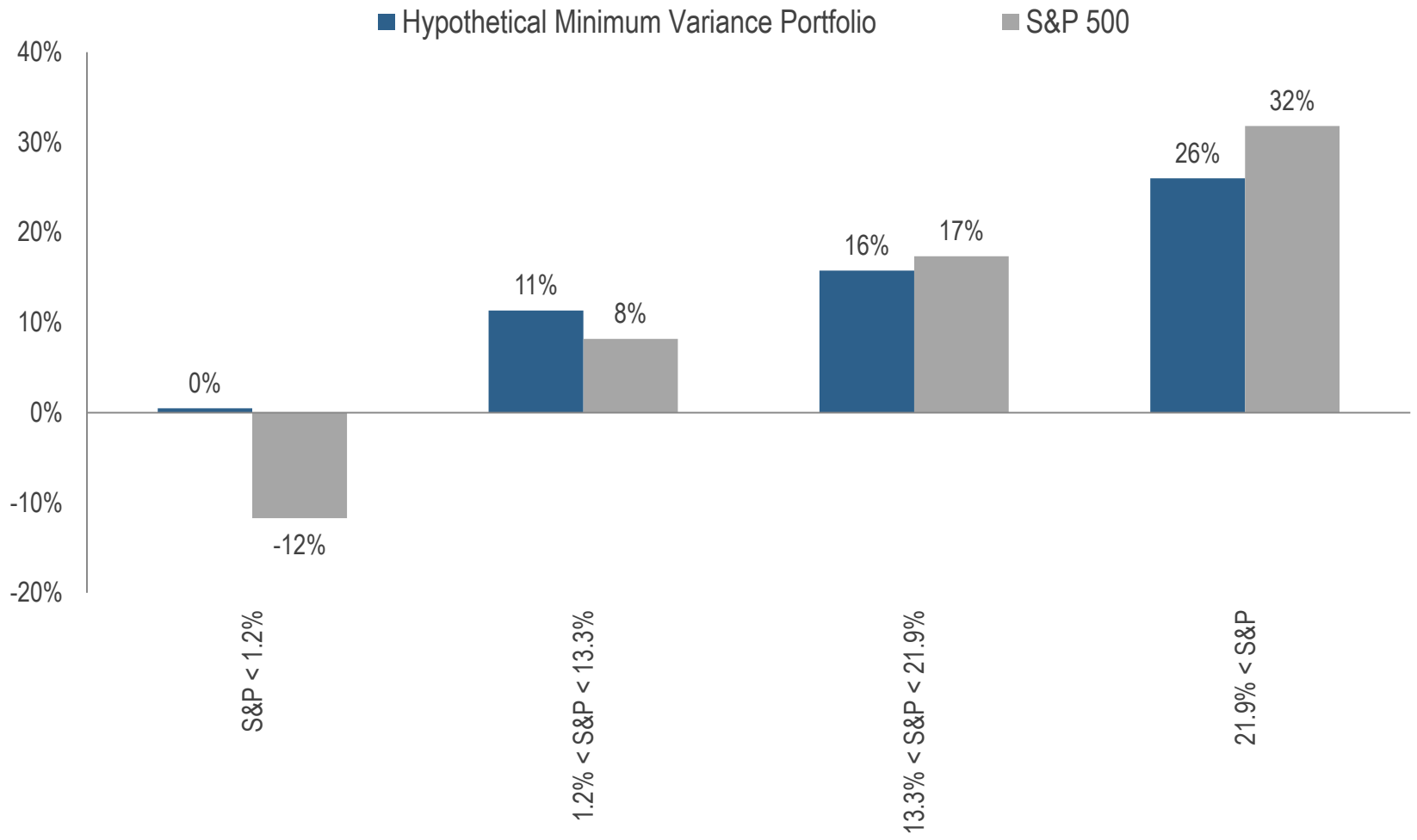
PERFORMANCE UNDER VARIOUS MARKET CONDITIONS

1969 – 2015



Source: Acadian Asset Management LLC, CRSP®, Center for Research in Security Prices. Graduate School of Business, The University of Chicago. Used with permission. All rights reserved. crsp.uchicago.edu , S&P Universe of Securities. Methodology: S&P Return Quartiles, Rolling 12 Month Returns, 1969 – 2015.

For illustrative purposes only. This is meant to be an educational illustrative example and is not intended to represent investment returns generated by an actual portfolio. They do not represent actual trading or an actual account, but were achieved by means of using the CRSP universe of securities as a whole. Results do not reflect transaction costs, other implementation costs and do not reflect advisory fees or their potential impact. Hypothetical results are not indicative of actual future results. Every investment program has the opportunity for loss as well as profit. Index Source: Copyright © 2016, Standard & Poor's Financial Services LLC. All rights reserved.

BENCHMARKS AS LIMITS TO ARBITRAGE: UNDERSTANDING THE LOW-VOLATILITY ANOMALY

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Benchmarks as Limits to Arbitrage: Understanding the Low-Volatility Anomaly

Malcolm Baker, Brendan Bradley, and Jeffrey Wurgler

Contrary to basic finance principles, high-beta and high-volatility stocks have long underperformed low-beta and low-volatility stocks. This anomaly may be partly explained by the fact that the typical institutional investor's mandate to beat a fixed benchmark discourages arbitrage activity in both high-alpha, low-beta stocks and low-alpha, high-beta stocks.

Among the many candidates for the greatest anomaly in finance, a particularly compelling one is the long-term success of low-volatility and low-beta stock portfolios. Over 1968–2008, low-volatility and low-beta portfolios offered an enviable combination of high average returns and small drawdowns. This outcome runs counter to the fundamental principle that risk is compensated with higher expected return. In our study, we applied principles of behavioral finance to shed light on the drivers of this anomalous performance and to assess the likelihood that it will persist.

Behavioral models of security prices combine two ingredients. The first is that some market participants are irrational in some particular way. In the context of the low-risk anomaly, we believe that a preference for lotteries and the well-established biases of representativeness and overconfidence lead to a demand for higher-volatility stocks that is not warranted by fundamentals.

The second ingredient is limits on arbitrage, which explain why the "smart money" does not offset the price impact of any irrational demand. With respect to the low-risk anomaly, we examined whether the underappreciated limit on arbitrage is benchmarking. Many institutional investors in a position to offset the irrational demand for risk have fixed-benchmark mandates (typically capitalization weighted), which, by their nature, discourage investments in low-volatility stocks. Drawing out the implications of Brennan's (1993) model of agency and asset prices, we looked at whether traditional fixed-benchmark mandates with a leverage constraint cause institutional investors to pass up the superior risk–return trade-off of low-volatility portfolios; we also examined the appropriateness of a leverage constraint assumption. Rather than being a stabilizing force on prices, the typical institutional contract for delegated portfolio management could increase the demand for higher-beta investments.

Other researchers have attempted to explain the low-risk anomaly on the basis of behavioral elements. For example, Karceski (2002) pointed out that mutual fund investors tend to chase returns over time and across funds, possibly because of an extrapolation bias. These forces make fund managers care more about outperforming during bull markets than underperforming during bear markets, thus increasing their demand for high-beta stocks and reducing their required returns. In our study, we placed the irrationality elsewhere and focused on distortions introduced by benchmarking. Nevertheless, his model's predictions appear to complement our own, and the mechanisms could certainly work simultaneously.

Malcolm Baker is professor of finance at Harvard Business School, research associate at the National Bureau of Economic Research, and senior consultant at Acadian Asset Management, Boston. Brendan Bradley is director of managed volatility strategies at Acadian Asset Management, Boston. Jeffrey Wurgler is professor of finance at New York University Stern School of Business, research associate at the National Bureau of Economic Research, and senior consultant at Acadian Asset Management, Boston.

The Low-Risk Anomaly

In an efficient market, investors realize above-average returns only by taking above-average risks. Risky stocks have high returns, on average, and safe stocks do not. This simple empirical proposition has been hard to support on the basis of the history of U.S. stock returns. The most widely used measures of risk point rather strongly in the wrong direction.

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Why do low-beta and low-volatility stocks persistently outperform?*

- Higher-risk stocks tend to be overpriced because of irrational demand from naïve investors
- Most institutional investors are reluctant to hold low-volatility portfolios due to benchmarking concerns
- As a consequence, lower-risk stocks are persistently underpriced

The paper and its authors were awarded a Graham and Dodd Scroll Award by the CFA Institute in 2011

*Source: Baker, Bradley and Wurgler, "Benchmarks as Limits to Arbitrage: Understanding the Low-Volatility Anomaly." Copyright 2011, CFA Institute. Reproduced and republished from the Financial Analysts Journal with permission from CFA Institute. All rights reserved. The paper was published in the January/February 2011 issue of the FAJ. Bradley is an employee of Acadian Asset Management LLC. Baker and Wurgler are associated with the firm as consultants

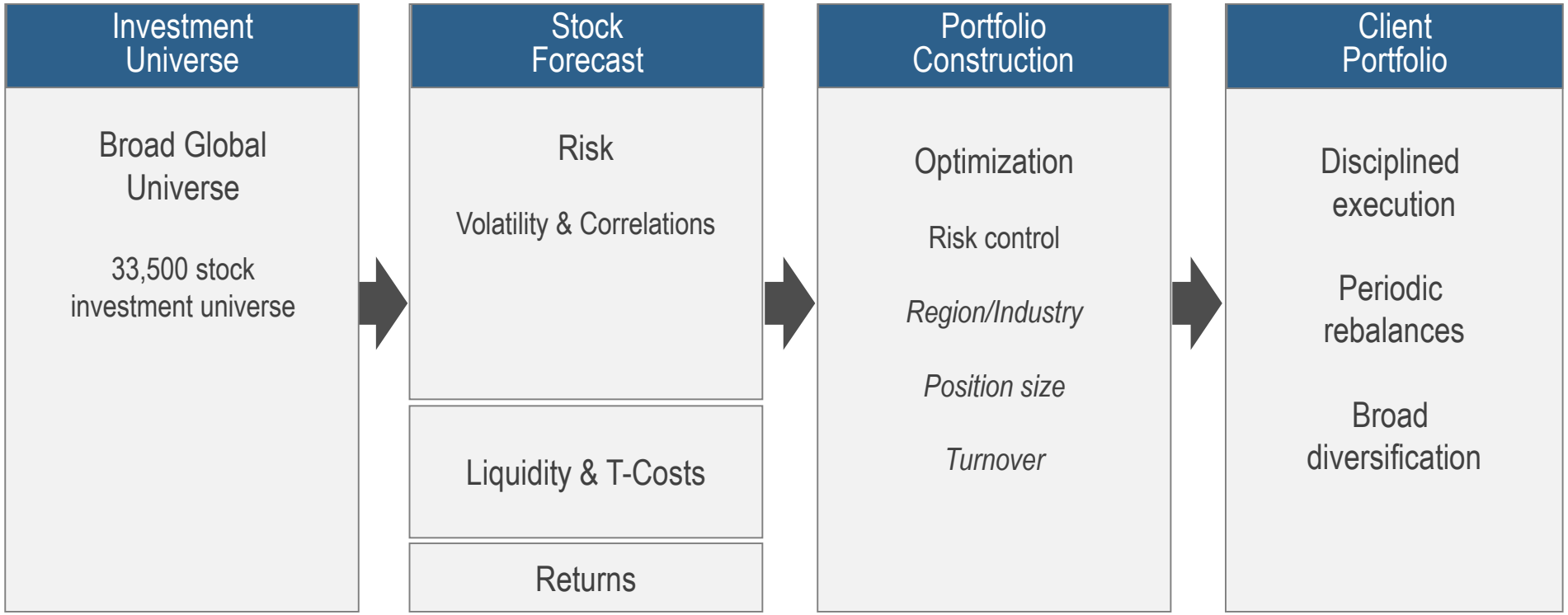
MANAGED VOLATILITY RESEARCH

- Baker, Malcolm. 2016. "Risk Neglect in Equity Markets." Journal of Portfolio Management 42, no. 3
  - Addresses implications of the risk anomaly for investing and corporate finance by examining asset allocation, high leverage in financial firms, low leverage in industrial firms, private equity, venture capital, and bank capital regulation.
- Baker, Malcolm, Brendan Bradley, and Ryan Taliaferro. 2014. “The Low-Risk Anomaly: A Decomposition into Micro and Macro Effects.” Financial Analysts Journal, vol. 70, no. 2 March/April
  - Analysis of the micro and macro components of the low-risk anomaly and the implications for the construction of managed volatility portfolios.
  - Winner of the Graham and Dodd Scroll Award, a CFA Institute program honoring the top Financial Analysts Journal articles.
- Baker, Malcolm, and Jeffrey Wurgler. 2013. “Would Stricter Capital Requirements Raise the Cost of Capital? Bank Capital Regulation and the Low Risk Anomaly.” New York University Working Paper, no. 2451/31748
  - Review of how the equity of lower risk banks have higher stock returns on a risk-adjusted or even a raw basis, a pattern consistent with the low-volatility mispricing documented in other samples.
- Baker, Malcolm, Brendan Bradley, and Jeffrey Wurgler. 2011. “Benchmarks as Limits to Arbitrage: Understanding the Low-Volatility Anomaly.” Financial Analysts Journal, vol. 67, no. 1 January/February
  - Highlights the structural limitations and behavioral influences that facilitate and preserve the mispricing of risk.
  - Winner of the Graham and Dodd Scroll Award, a CFA Institute program honoring the top Financial Analysts Journal articles.
- Baker, Malcolm, and Jeffrey Wurgler. 2007. “Investor Sentiment in the Stock Market.” Journal of Economic Perspectives, vol. 21, no. 2 Spring
  - Overview of how investor sentiment, a key factor of behavioral finance and asset mispricing, is measurable and disproportionately impacts certain subsets of stocks.
- Acadian Asset Management LLC White Paper. 2013. “Low-Volatility Equities and Interest-Rate Sensitivity.”
  - Study of how equity markets are impacted by varying interest rate sensitivities, and how a naive portfolio construction process may provide unintended exposures to various negative consequences.
- Acadian Asset Management LLC White Paper. 2012. “Low-Beta Stocks, High-Beta Stocks, and Relative Valuation.” (updated publication 2014)
  - Illustration and historical analysis of the wide array of equity valuations in both low- and high-risk stocks.

Bradley and Taliaferro are employees of Acadian. Baker and Wurgler are associated with the firm as consultants.

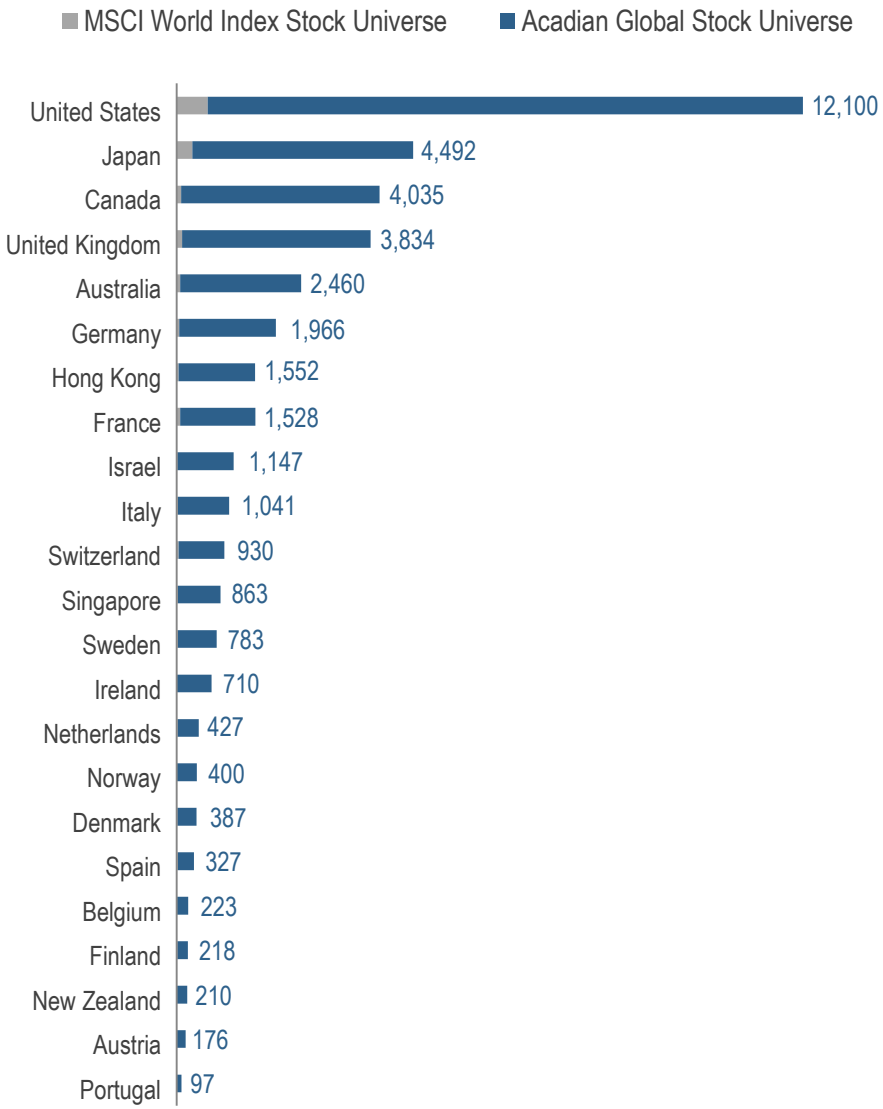
INVESTMENT PROCESS

Acadian's process is systematic, objective and consistent.



Source: Acadian Asset Management LLC.
The information provided is for illustrative purposes only based on proprietary models. There can be no assurance that the forecasts will be achieved.

SECURITY UNIVERSE



- Acadian utilizes a larger universe of securities than standard index constituents provide
- Non benchmark securities provide additional opportunities for diversification

As of 12/31/2015. Numbers displayed in graph reference that of the Acadian Stock Universe. For illustrative purposes only. Reference to the benchmark is for comparative purposes only and is not intended to indicate that the composite will contain the same investments as the benchmark. Investors have the opportunity for losses as well as profits. Past performance is no guarantee of future results.

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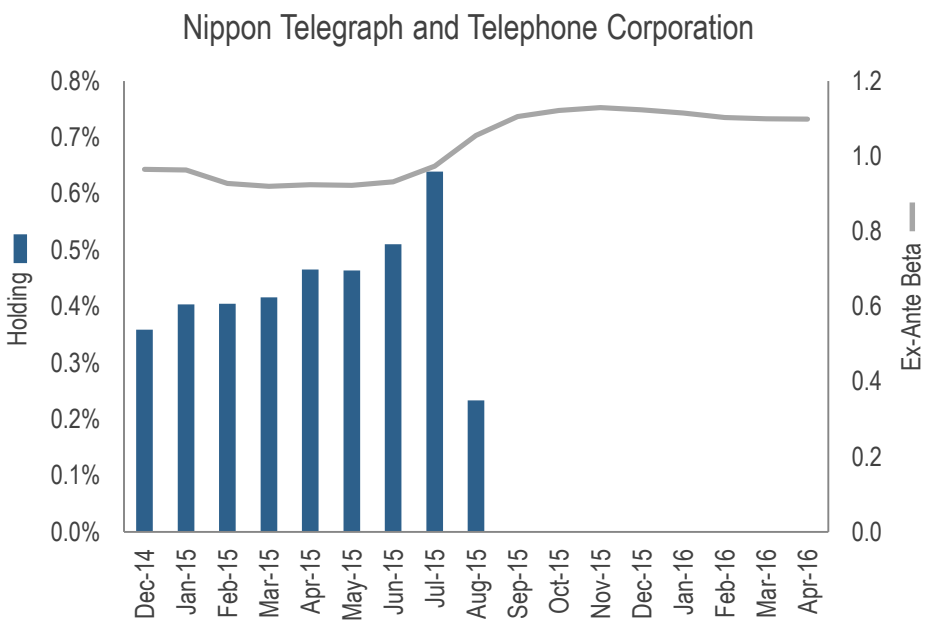
PROPRIETARY RISK MODELS

Long-Term

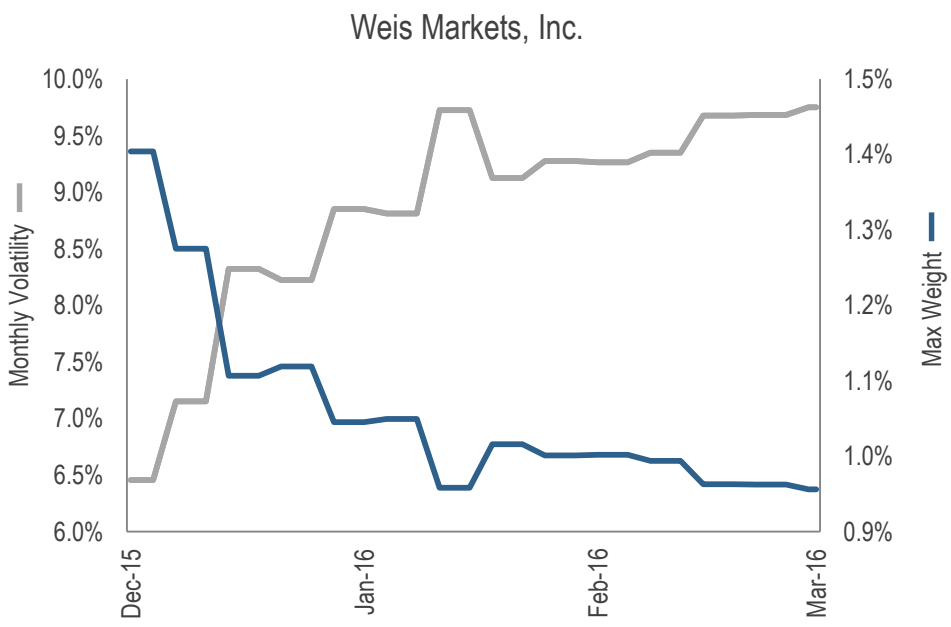
- Factor based model
- Slow moving, tailored to low risk strategies
- 1,000 trading day look back; 500 trading day half-life

Short-Term

- Statistically based model
- Fast moving, used to identify rapid changes in risk
- 60 trading day volatility look back



Longer horizon risk model establishes portfolio positioning



Shorter horizon risk model establishes maximum position size

Source: Acadian Asset Management LLC.
The information provided is for illustrative purposes only based on proprietary models. The selected stocks are intended to be an example of the process and are not a recommendation to buy or sell any specific security.
Nippon Telegraph and Telephone Corporation example covers 12/31/14 – 4/30/16 monthly time period. Weis Markets, Inc. example covers 12/15/15 – 3/15/16 daily time period.

STOCK FORECAST EXAMPLE

BOTTOM-UP ANALYSIS

Stock Forecasts:
Biomerieux vs.
Healthcare in Europe

VALUE	**+0.14**
Price to Intrinsic Income Value	0.03
Price to Intrinsic Asset Value	0.13
Discounted Cash Flow Value	0.00
Cash Flow Efficiency	-0.02
GROWTH	**+0.16**
Media Effect	0.12
Earnings Surpise	0.00
Recommendation Change	0.04
QUALITY	**+0.01**
Asset Quality	-0.03
Cash Flow Quality	0.09
Management Behavior	-0.05
TECHNICAL	**-0.07**
Momentum	0.06
Smart Reversal	-0.15
Industry Leadership	0.02

Stock Forecast Relative to Healthcare in Europe:
+0.24%

Healthcare in Europe Relative to World Equity:
+0.07%

Total Forecast for Biomerieux:
+0.31%

Beta for Biomerieux:
0.68

TOP-DOWN ANALYSIS

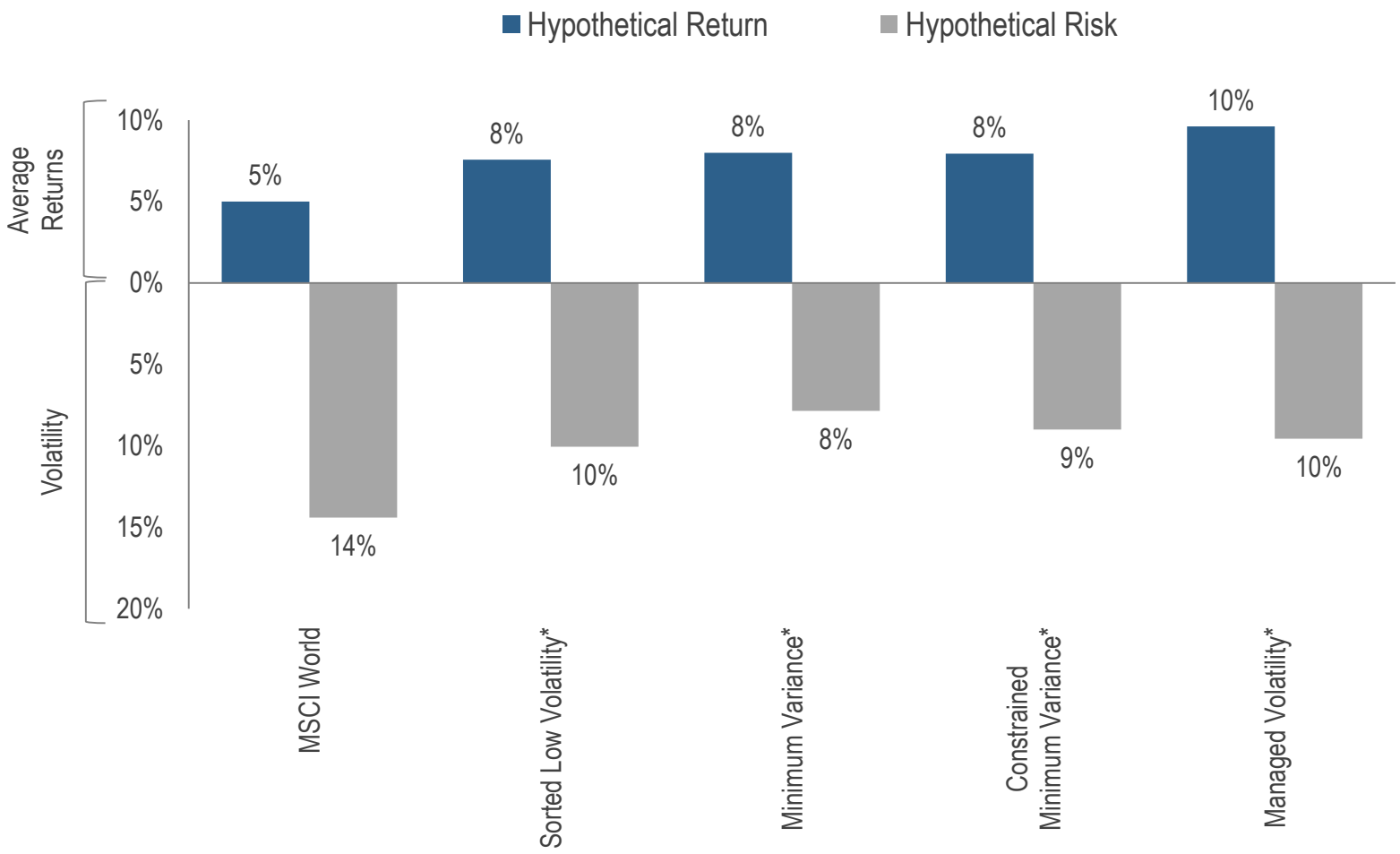
Peer Group Forecasts:
Healthcare in Europe vs.
World Equity

VALUE	**-0.10**
Price to Earnings	-0.10
GROWTH	**+0.01**
Recommendation Change	0.01
TECHNICAL	**+0.11**
Momentum	0.11
RISK	**-0.02**
Volatility	-0.02
MACRO	**+0.07**
Commodity Impact	0.07

Source: Acadian Asset Management LLC.
The information provided is for illustrative purposes only based on proprietary models. There can be no assurance that the forecasts will be achieved.
The selected stock is intended to be an example of the process and is not a recommendation to buy or sell this specific security.

ACTIVE MANAGEMENT

IMPORTANT FOR RETURNS IN MANAGED VOLATILITY



Source: Acadian Asset Management LLC, AAM Universe of Securities. Methodology: Hypothetical returns cover the period October 1998 – December 2015.
*Hypothetical Portfolios. For illustrative purposes only. This is meant to be an educational illustrative example and is not intended to represent investment returns generated by an actual portfolio. The Hypothetical Minimum Variance Portfolio we have created for educational illustrations does not include constraints on exposures to industries or, where relevant, countries and regions, nor does it manage toward a target for total portfolio risk. The Hypothetical portfolio with t-cost aversion & constraints does not manage toward a target for total portfolio risk either. The hypothetical results do not represent actual trading or an actual account, but were achieved by means of retroactive application of a model designed with the benefit of hindsight for the period specified above. Results are gross and would be reduced by advisory fees. Results reflect transaction costs and other implementation costs. Reference to the benchmark is for comparative purposes only. Hypothetical results are not indicative of actual future results. Every investment program has the opportunity for loss as well as profit.
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STABLE AND INTUITIVE PORTFOLIO POSITIONING

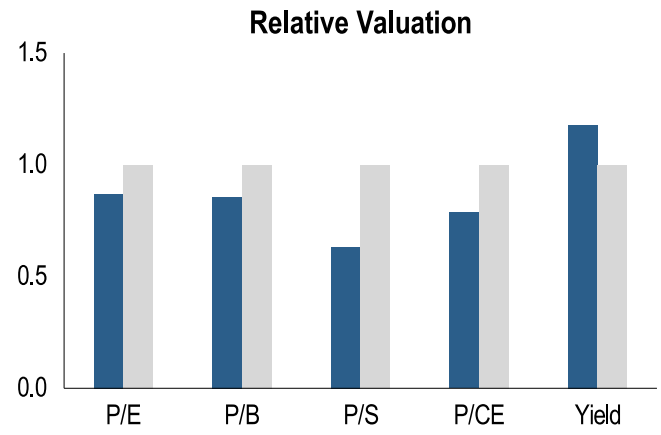
- Typically value and quality-oriented, dividend paying
- Highly diversified portfolio, typical maximum position size of 1.5%
- Conservative sector positioning

Managed volatility portfolios will vary depending on strategy and client directed mandate requirements. Portfolio holdings and investment performance will vary including for accounts within the same investment composite.

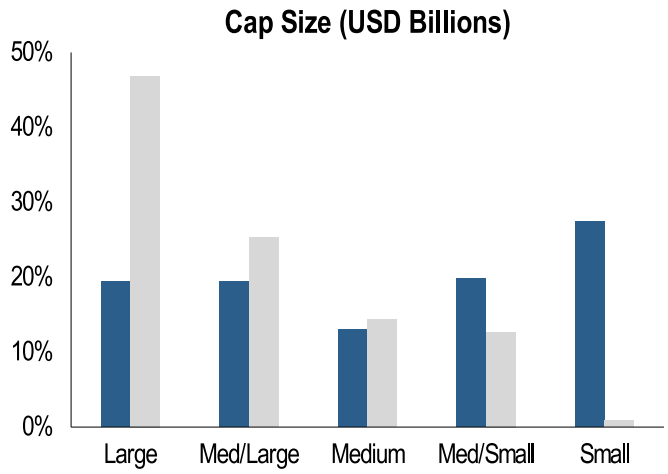
ALL-COUNTRY MANAGED VOLATILITY EQUITY PORTFOLIO

KEY CHARACTERISTICS – SEPTEMBER 30, 2016*

Valuation	Portfolio	Benchmark
Price/Earnings	17.8	20.5
Price/Book	1.8	2.1
Price/Sales	0.9	1.4
Price/Cash Earnings	8.6	11.0
Yield	3.0%	2.6%
Total Securities	403	2470



Cap Size (USD Billions)	Portfolio	Benchmark
Large > $50B	19.5%	46.9%
Med/Large $20-$50	19.5%	25.3%
Medium $10-$20	13.0%	14.3%
Med/Small $3-$10	19.9%	12.7%
Small <$3	27.4%	0.9%
Median	1.3	9.1
Weighted Average	41.2	99.7



Portfolio: All-Country Managed Volatility Equity. **Benchmark**: MSCI All-Country World (net).

*Preliminary. The data presented here is for a representative portfolio and is supplemental to the composite performance disclosure page attached. Reference to the benchmark is for comparative purposes only and is not intended to indicate that the composite will contain the same investments as the benchmark. Investors have the opportunity for losses as well as profits. Past performance is no guarantee of future results.

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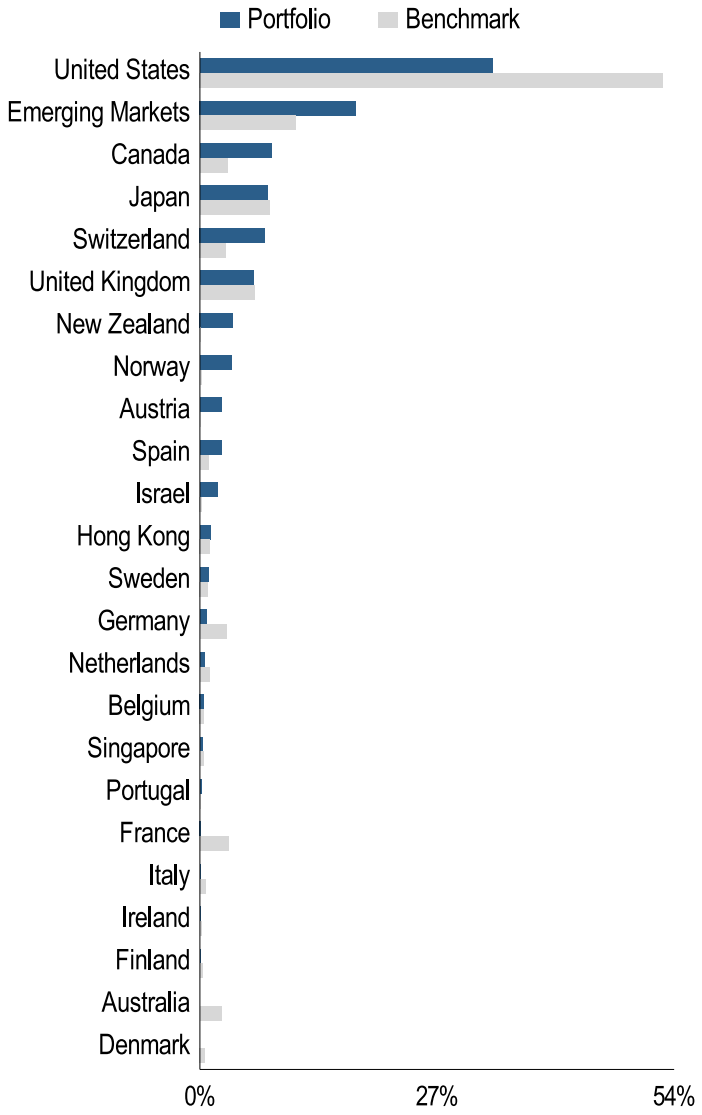
ALL-COUNTRY MANAGED VOLATILITY EQUITY PORTFOLIO

REGIONAL ALLOCATIONS – SEPTEMBER 30, 2016*

	Portfolio	Benchmark	Difference
Continental Europe	**19.1%**	**14.7%**	**4.4%**
Austria	2.5	0.1	2.4
Belgium	0.5	0.5	0.0
Denmark	0.0	0.6	-0.6
Finland	0.0	0.3	-0.3
France	0.1	3.2	-3.1
Germany	0.8	3.0	-2.2
Ireland	0.0	0.2	-0.1
Italy	0.1	0.6	-0.5
Netherlands	0.5	1.1	-0.6
Norway	3.6	0.2	3.3
Portugal	0.2	0.0	0.2
Spain	2.5	1.0	1.4
Sweden	1.0	0.9	0.0
Switzerland	7.4	3.0	4.4
United Kingdom	**6.1%**	**6.3%**	**-0.1%**
Australia/New Zealand	**3.8%**	**2.5%**	**1.3%**
Australia	0.0	2.4	-2.4
New Zealand	3.8	0.1	3.7
Hong Kong/Singapore	**1.4%**	**1.6%**	**-0.1%**
Hong Kong	1.2	1.2	0.0
Singapore	0.3	0.4	-0.2
Japan	**7.7%**	**7.9%**	**-0.2%**
North America	**41.5%**	**55.9%**	**-14.4%**
Canada	8.1	3.2	4.9
United States	33.3	52.7	-19.4
Middle East	**2.0%**	**0.2%**	**1.7%**
Israel	2.0	0.2	1.7
Emerging Markets	**17.8%**	**10.9%**	**6.8%**
Cash	**0.7**		



Portfolio: All-Country Managed Volatility Equity. **Benchmark**: MSCI All-Country World (net).

*Preliminary. The data presented here is for a representative portfolio and is supplemental to the composite performance disclosure page attached. Reference to the benchmark is for comparative purposes only and is not intended to indicate that the composite will contain the same investments as the benchmark. Investors have the opportunity for losses as well as profits. Past performance is no guarantee of future results.

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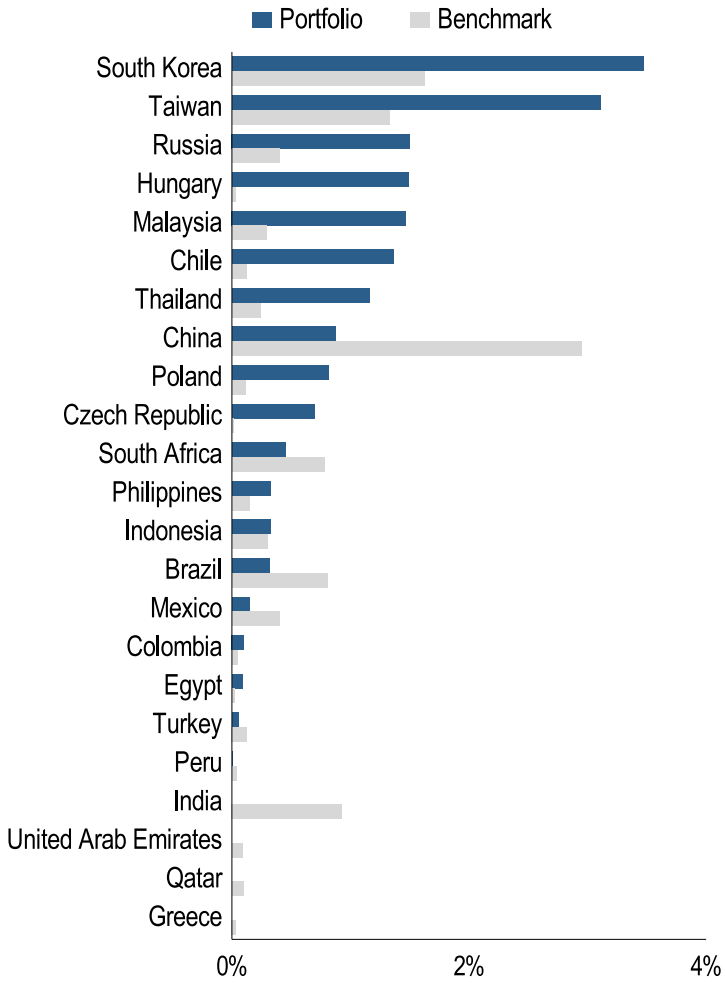
ALL-COUNTRY MANAGED VOLATILITY EQUITY PORTFOLIO

EMERGING MARKETS ALLOCATIONS – SEPTEMBER 30, 2016*

	Portfolio	Benchmark	Difference
Europe/Mid East/Africa	**5.1%**	**1.7%**	**3.4%**
Czech Republic	0.7	0.0	0.7
Egypt	0.1	0.0	0.1
Greece	0.0	0.0	0.0
Hungary	1.5	0.0	1.5
Poland	0.8	0.1	0.7
Qatar	0.0	0.1	-0.1
Russia	1.5	0.4	1.1
South Africa	0.5	0.8	-0.3
Turkey	0.1	0.1	-0.1
United Arab Emirates	0.0	0.1	-0.1
Latin America	**1.9%**	**1.4%**	**0.5%**
Brazil	0.3	0.8	-0.5
Chile	1.4	0.1	1.2
Colombia	0.1	0.0	0.1
Mexico	0.1	0.4	-0.3
Peru	0.0	0.0	0.0
Asia	**10.7%**	**7.8%**	**2.9%**
China	0.9	3.0	-2.1
India	0.0	0.9	-0.9
Indonesia	0.3	0.3	0.0
Malaysia	1.5	0.3	1.2
Philippines	0.3	0.1	0.2
South Korea	3.5	1.6	1.8
Taiwan	3.1	1.3	1.8
Thailand	1.2	0.2	0.9



Portfolio: All-Country Managed Volatility Equity. **Benchmark**: MSCI All-Country World (net).

*Preliminary. The data presented here is for a representative portfolio and is supplemental to the composite performance disclosure page attached. Reference to the benchmark is for comparative purposes only and is not intended to indicate that the composite will contain the same investments as the benchmark. Investors have the opportunity for losses as well as profits. Past performance is no guarantee of future results.

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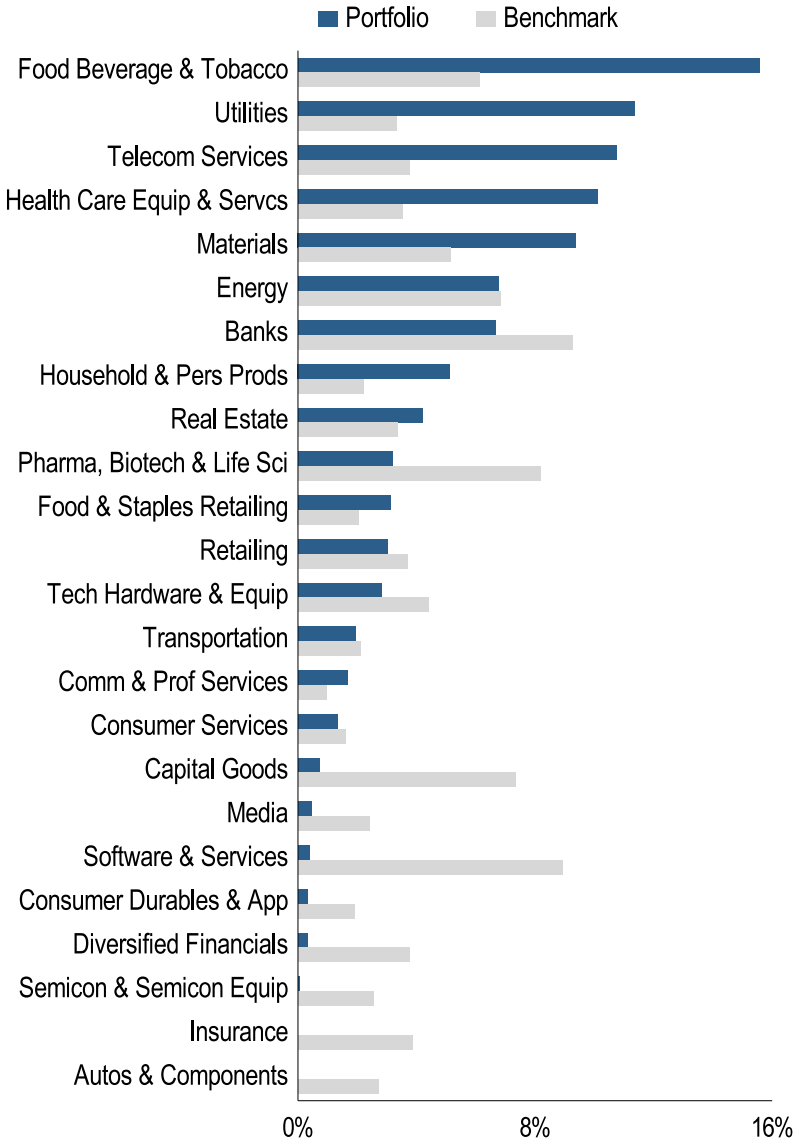
ALL-COUNTRY MANAGED VOLATILITY EQUITY PORTFOLIO

INDUSTRY ALLOCATIONS – SEPTEMBER 30, 2016*

	Portfolio	Benchmark	Difference
Consumer Discretionary	**5.1%**	**12.3%**	**-7.2%**
Automobiles & Components	0.0	2.7	-2.7
Consumer Durables & Apparel	0.3	1.9	-1.6
Consumer Services	1.3	1.6	-0.3
Media	0.5	2.4	-2.0
Retailing	3.0	3.7	-0.7
Consumer Staples	**23.8%**	**10.4%**	**13.4%**
Food & Staples Retailing	3.1	2.1	1.1
Food, Beverage & Tobacco	15.6	6.1	9.4
Household & Personal Products	5.1	2.2	2.9
Energy	**6.8%**	**6.8%**	**-0.1%**
Financials	**7.0%**	**16.9%**	**-9.9%**
Banks	6.7	9.3	-2.6
Diversified Financials	0.3	3.8	-3.4
Insurance	0.0	3.9	-3.9
Health Care	**13.3%**	**11.7%**	**1.6%**
Health Care Equipment & Services	10.1	3.5	6.6
Pharmaceuticals, Biotechnology & Life Sciences	3.2	8.2	-5.0
Industrials	**4.4%**	**10.4%**	**-6.0%**
Capital Goods	0.7	7.3	-6.6
Commercial & Professional Services	1.7	1.0	0.7
Transportation	1.9	2.1	-0.2
Information Technology	**3.3%**	**15.9%**	**-12.6%**
Semiconductors & Semiconductor Equipment	0.0	2.6	-2.5
Software & Services	0.4	8.9	-8.5
Technology Hardware & Equipment	2.8	4.4	-1.6
Materials	**9.4%**	**5.1%**	**4.2%**
Real Estate	**4.2%**	**3.3%**	**0.8%**
Telecommunication Services	**10.7%**	**3.8%**	**7.0%**
Utilities	**11.3%**	**3.3%**	**8.0%**
Cash	**0.7**		



Portfolio: All-Country Managed Volatility Equity. **Benchmark**: MSCI All-Country World (net).

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ALL-COUNTRY MANAGED VOLATILITY EQUITY PORTFOLIO

TOP TEN PORTFOLIO HOLDINGS – SEPTEMBER 30, 2016*

Name	Country	Industry	Portfolio (%)
Altria Group	United States	Food, Beverage & Tobacco	1.4
Samsung Electronics	South Korea	Technology Hardware & Equipment	1.2
PepsiCo	United States	Food, Beverage & Tobacco	1.2
Orkla ASA	Norway	Food, Beverage & Tobacco	1.2
Procter & Gamble	United States	Household & Personal Products	1.1
CLP Holdings Limited	Hong Kong	Utilities	1.1
AT&T Incorporated	United States	Telecommunication Services	1.1
KT Corporation	South Korea	Telecommunication Services	1.1
BCE Incorporated	Canada	Telecommunication Services	1.1
Rogers Communications	Canada	Telecommunication Services	1.1

Summary	Portfolio	Benchmark	Active Weight
% of Portfolio for Top 10 Active Weights	11.0	0.6	10.4
% of Portfolio for Top 20 Current Holdings	21.8	4.6	17.2
% of Non-Benchmark Portfolio Holdings	34.3		
Active Share of Portfolio	88.9		

Portfolio: All-Country Managed Volatility Equity. **Benchmark**: MSCI All-Country World (net).

*Preliminary. Portfolio holdings are subject to change and should not be considered a recommendation to buy or sell individual securities. The data presented here is for a representative portfolio and is supplemental to the composite performance disclosure page attached. Reference to the benchmark is for comparative purposes only and is not intended to indicate that the composite will contain the same investments as the benchmark. Investors have the opportunity for losses as well as profits. Past performance is no guarantee of future results. Index Source: MSCI Copyright MSCI 2016. All Rights Reserved. Unpublished. PROPRIETARY TO MSCI.

ALL-COUNTRY MANAGED VOLATILITY EQUITY COMPOSITE

PERFORMANCE (RETURNS IN USD – BEFORE MANAGEMENT FEES)

Time Period	Composite*	Benchmark	Value-Added vs. Benchmark
2011 (inception: Jun 1, 2011)	(2.6)%	(12.9)%	10.3%
2012	13.9	16.1	(2.2)
2013	16.1	22.8	(6.7)
2014	8.3	4.2	4.1
2015	1.0	(2.4)	3.4
2016 through September	10.8	6.6	4.2
One Year Annualized Return	15.0	12.0	3.0
Three Year Annualized Return	8.5	5.2	3.3
Five Year Annualized Return	11.1	10.6	0.5
Since-Inception Annualized Return	8.7	5.7	3.0
Since-Inception Annualized Standard Deviation	8.9	13.1	
Since-Inception Active Risk			7.1
Since-Inception Sharpe Ratio	1.0	0.4	

* Returns that include the most recent month are preliminary.

Composite: All-Country Managed Volatility Equity. **Benchmark**: MSCI All-Country World (net).
Acadian Asset Management LLC has prepared and presented this report in compliance with the Global Investment Performance Standards (GIPS®). Reference to the benchmark is for comparative purposes only and is not intended to indicate that the composite will contain the same investments as the benchmark. Investors have the opportunity for losses as well as profits. Past performance is no guarantee of future returns. The complete performance disclosure can be found in the composite performance disclosure page attached. The Three Month U.S. T-Bill is the risk-free rate in the Sharpe Ratio calculation.
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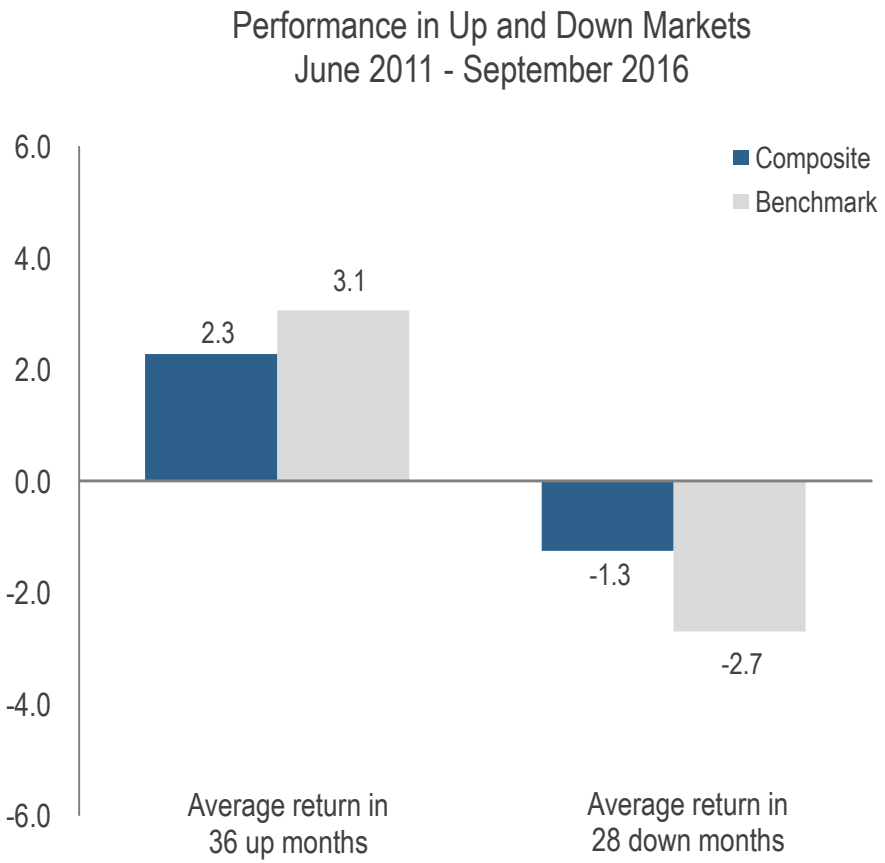
ALL-COUNTRY MANAGED VOLATILITY EQUITY COMPOSITE

PERFORMANCE (RETURNS IN USD – BEFORE MANAGEMENT FEES)



Performance History (%)

	2011	2012	2013	2014	2015	2016
January		1.4	3.1	-2.6	-0.2	-2.7
February		2.6	1.8	4.5	3.5	1.6
March		1.4	3.6	1.3	-1.2	7.4
April		1.5	3.4	1.2	2.6	1.3
May		-3.4	-4.9	1.8	0.1	-0.8
June	-0.5	4.4	-1.2	2.1	-1.5	2.5
July	-0.1	2.4	3.8	-0.5	1.3	2.6
August	-2.2	0.4	-2.8	2.4	-5.1	-1.6
September*	-5.2	2.0	3.3	-3.8	-1.9	0.3
October	4.4	-0.6	3.8	2.2	5.8	
November	-0.8	0.3	0.7	1.1	-1.5	
December	2.1	0.9	0.9	-1.5	-0.4	
Year	-2.6	13.9	16.1	8.3	1.0	10.8

*September 2016 return is preliminary

	Composite	Benchmark
Sharpe Ratio	1.0	0.4
Sortino Ratio	1.6	0.7

Composite: All-Country Managed Volatility Equity. **Benchmark**: MSCI All-Country World (net).
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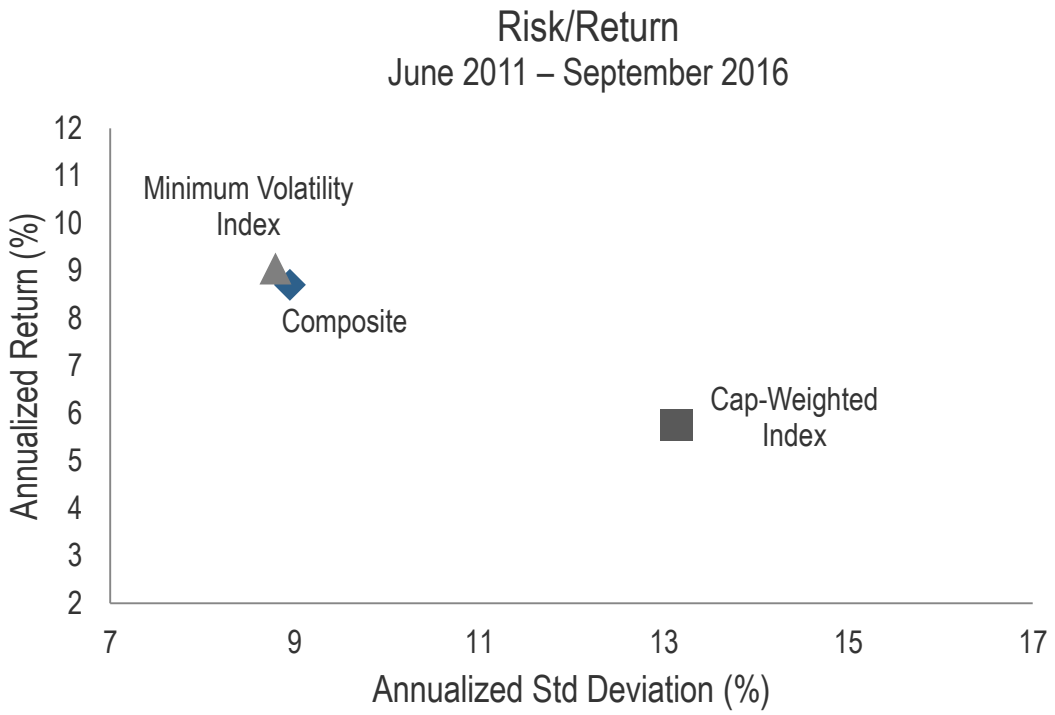
ALL-COUNTRY MANAGED VOLATILITY EQUITY COMPOSITE

PERFORMANCE (RETURNS IN USD – BEFORE MANAGEMENT FEES)*



	Composite	Minimum Volatility Index	Cap-Weighted Index
Return	8.70	9.04	5.74
Risk	8.95	8.79	13.14

Composite: All-Country Managed Volatility Equity. **Minimum Volatility Index**: MSCI All-Country World Minimum Volatility (net). **Cap-Weighted Index**: MSCI All-Country World (net).
*Preliminary. Source: Acadian Asset Management LLC, MSCI Reference to the benchmark is for comparative purposes only and is not intended to indicate that the composite will contain the same investments as the benchmark. Investors have the opportunity for losses as well as profits. Past performance is no guarantee of future returns. Returns are gross and would be reduced by advisory fees. The complete performance disclosure can be found in the composite performance disclosure page attached. Index Source: MSCI Copyright MSCI 2016. All Rights Reserved. Unpublished. PROPRIETARY TO MSCI.

CONCLUSION

SEPTEMBER 30, 2016

Deep and experienced investment organization

- Over 90 investment team members

Dedicated Managed Volatility team

- 5 investment team members exclusively focused on Managed Volatility

Pioneer in Managed Volatility strategies

- 10 year live track record; over USD 15 billion in assets under management

The AUM total includes $386 million in model advisory contracts, where Acadian does not have trading authority.

ACADIAN

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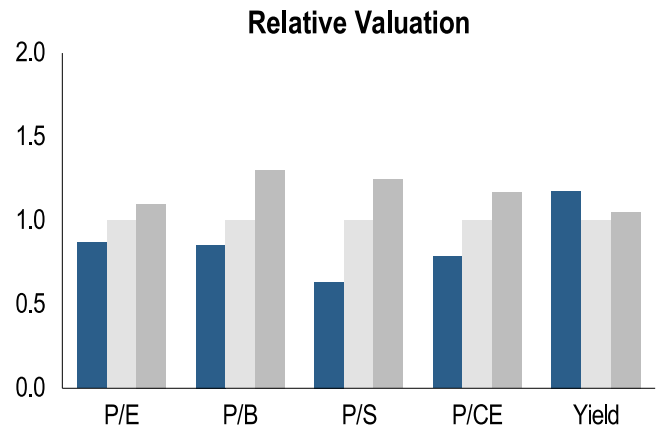
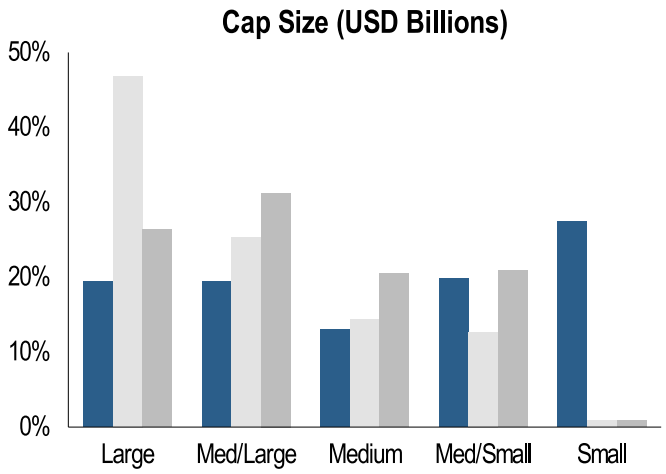
ALL-COUNTRY MANAGED VOLATILITY EQUITY PORTFOLIO

SUPPLEMENTAL CHARACTERISTICS – SEPTEMBER 30, 2016*

Valuation	Portfolio	Cap-Weighted Benchmark	Min-Volatility Benchmark
Price/Earnings	17.8	20.5	22.5
Price/Book	1.8	2.1	2.7
Price/Sales	0.9	1.4	1.8
Price/Cash Earnings	8.6	11.0	12.8
Yield	3.0%	2.6%	2.7%
Total Securities	403	2470	356



Cap Size (USD Billions)	Portfolio	Cap-Weighted Benchmark	Min-Volatility Benchmark
Large > $50B	19.5%	46.9%	26.4%
Med/Large $20-$50	19.5%	25.3%	31.2%
Medium $10-$20	13.0%	14.3%	20.5%
Med/Small $3-$10	19.9%	12.7%	20.9%
Small <$3	27.4%	0.9%	0.9%
Median	1.3	9.1	13.8
Weighted Average	41.2	99.7	59.4



Portfolio: All-Country Managed Volatility Equity. **Cap-Weighted Benchmark**: MSCI All-Country World (net). **Minimum Volatility Benchmark**: MSCI All-Country World Minimum Volatility (net).
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ALL-COUNTRY MANAGED VOLATILITY EQUITY COMPOSITE

PERFORMANCE (RETURNS IN USD – BEFORE MANAGEMENT FEES)

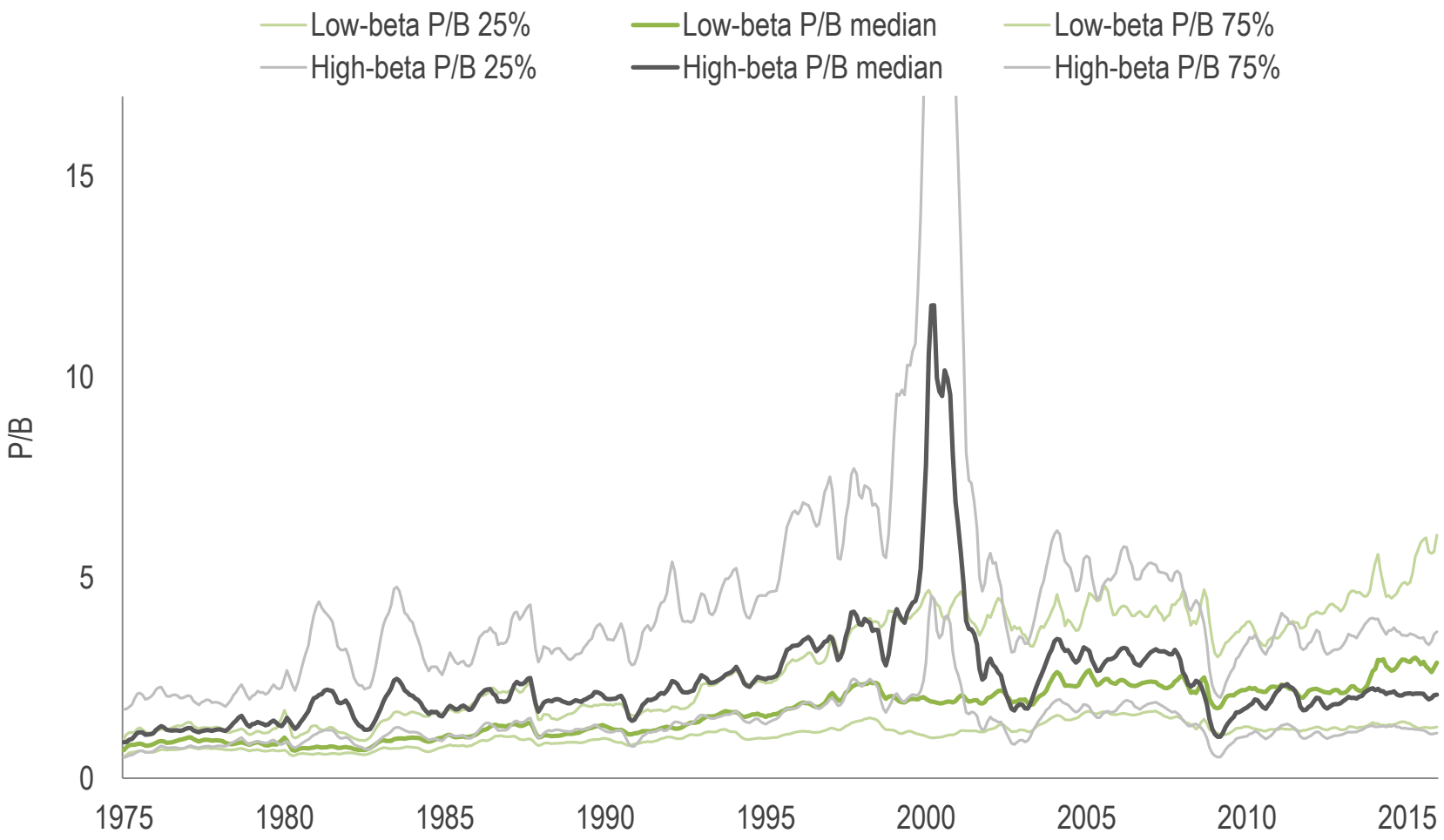
Time Period	Composite*	Benchmark	Value-Added vs. Benchmark
2011 (inception: Jun 1, 2011)	(2.6)%	(2.2)%	(0.4)%
2012	13.9	10.1	3.8
2013	16.1	16.9	(0.8)
2014	8.3	11.0	(2.7)
2015	1.0	2.8	(1.8)
2016 through September	10.8	10.6	0.2
One Year Annualized Return	15.0	16.3	(1.3)
Three Year Annualized Return	8.5	9.3	(0.8)
Five Year Annualized Return	11.1	11.4	(0.3)
Since-Inception Annualized Return	8.7	9.0	(0.3)
Since-Inception Annualized Standard Deviation	8.9	8.8	
Since-Inception Active Risk			2.6
Since-Inception Sharpe Ratio	1.0	1.0	

* Returns that include the most recent month are preliminary.

Composite: All-Country Managed Volatility Equity. **Benchmark**: MSCI All-Country World Minimum Volatility (net).
Acadian Asset Management LLC has prepared and presented this report in compliance with the Global Investment Performance Standards (GIPS®). Reference to the benchmark is for comparative purposes only and is not intended to indicate that the composite will contain the same investments as the benchmark. Investors have the opportunity for losses as well as profits. Past performance is no guarantee of future returns. The complete performance disclosure can be found in the composite performance disclosure page attached. The Three Month U.S. T-Bill is the risk-free rate in the Sharpe Ratio calculation.
Index Source: MSCI Copyright MSCI 2016. All Rights Reserved. Unpublished. PROPRIETARY TO MSCI.

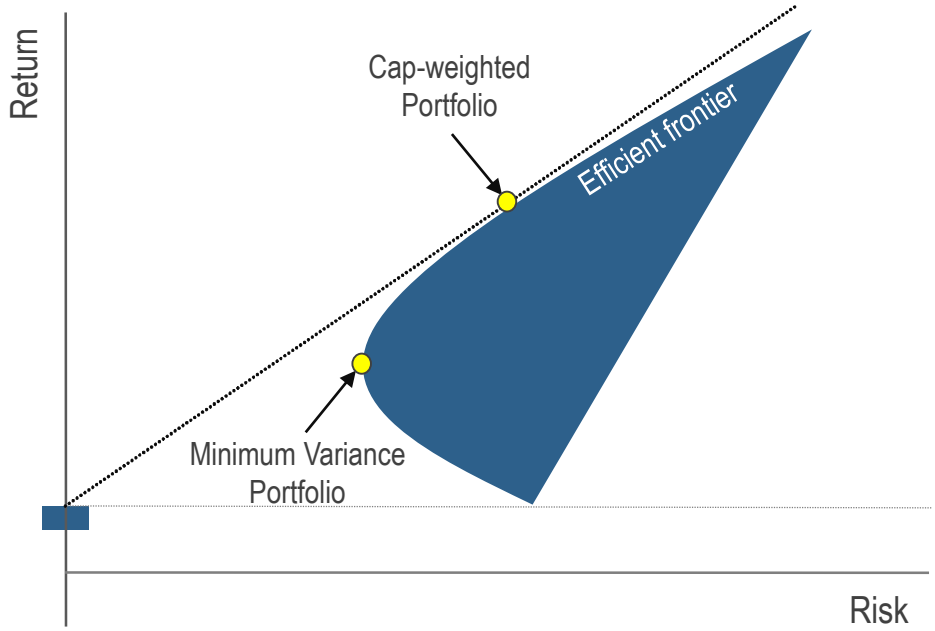
PRICE-TO-BOOK

U.S. 1975 – 2015

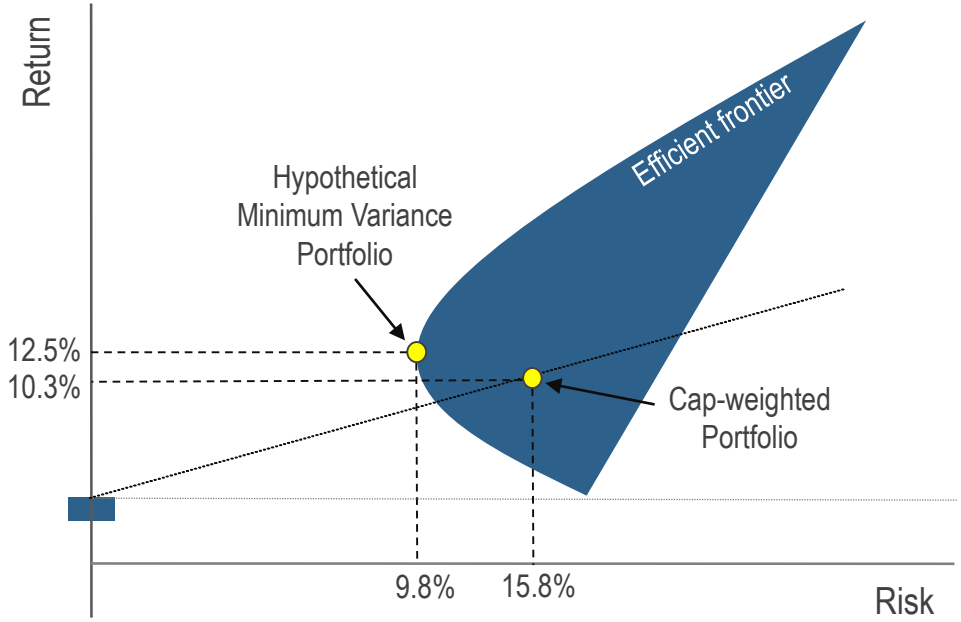


Source: Acadian Asset Management LLC, CRSP®, Center for Research in Security Prices. Graduate School of Business, The University of Chicago. Used with permission. All rights reserved. crsp.uchicago.edu
Thick lines depict cross-sectional medians of P/B, while thin lines depict the 25% and 75% cross-sectional breakpoints, i.e., the inter-quartile range, of P/B. For illustrative purposes only. This is meant to be an educational illustrative example and is not intended to represent investment returns generated by an actual portfolio. They do not represent actual trading or an actual account, but were achieved by means of using the CRSP universe of securities as a whole. Results do not reflect transaction costs, other implementation costs and do not reflect advisory fees or their potential impact. Hypothetical results are not indicative of actual future results. Every investment program has the opportunity for loss as well as profit.

WHAT ARE MANAGED VOLATILITY STRATEGIES?



Annualized Volatility, Return for U.S. Stocks
1968 – 2015



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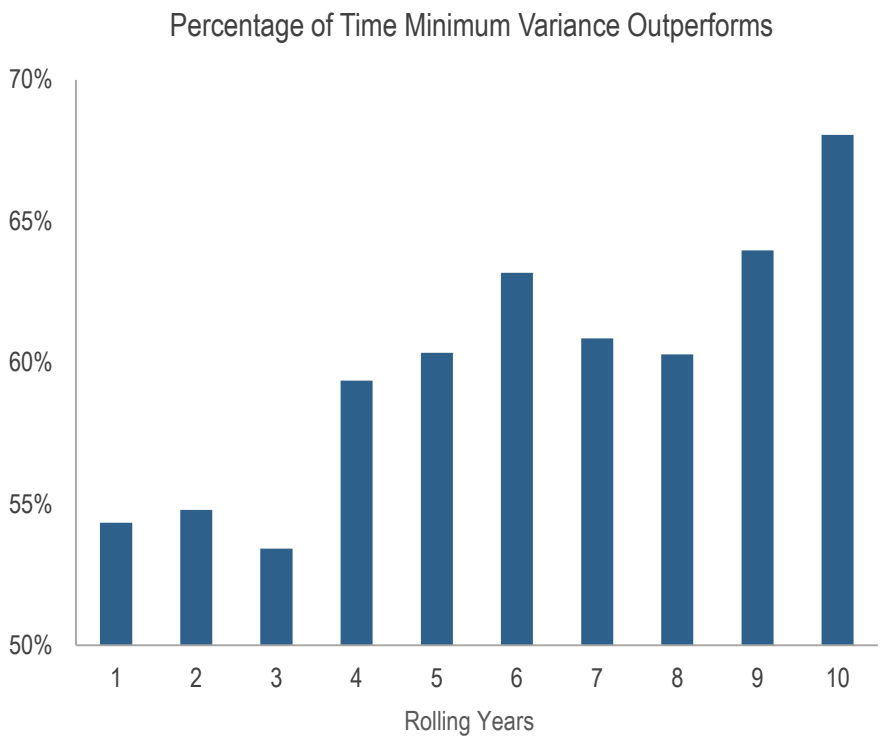
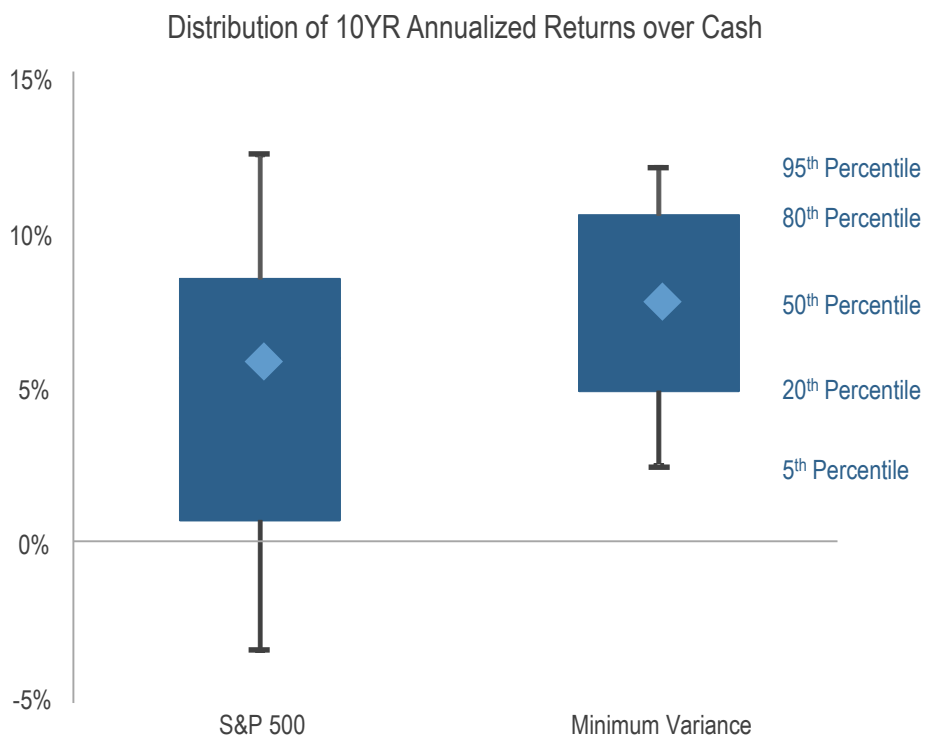
LONG-RUN PERFORMANCE PATTERNS

S&P 500 VERSUS HYPOTHETICAL MINIMUM VARIANCE PORTFOLIO





Source: Acadian Asset Management LLC, CRSP®, Center for Research in Security Prices. Graduate School of Business, The University of Chicago. Used with permission. All rights reserved. crsp.uchicago.edu , S&P Universe of Securities. January 1968 – December 2015. For illustrative purposes only. This is meant to be an educational illustrative example and is not intended to represent investment returns generated by an actual portfolio. The Hypothetical Minimum Variance Portfolio we have created for educational illustrations does not include constraints on exposures to industries or, where relevant, countries and regions, nor does it manage toward a target for total portfolio risk. The hypothetical results do not represent actual trading or an actual account, but were achieved by means of retroactive application of a model designed with the benefit of hindsight for the period specified above. Results are gross and would be reduced by advisory fees. Results reflect transaction costs and other implementation costs. Reference to the benchmark is for comparative purposes only. Hypothetical results are not indicative of actual future results. Every investment program has the opportunity for loss as well as profit. Index Source: Copyright © 2016, Standard & Poor's Financial Services LLC. All rights reserved.

RECOVERING FROM DRAWDOWNS

- Offsetting a large loss requires an even bigger gain
- Investors often fail to appreciate the impact that large drawdowns may have on investment outcomes

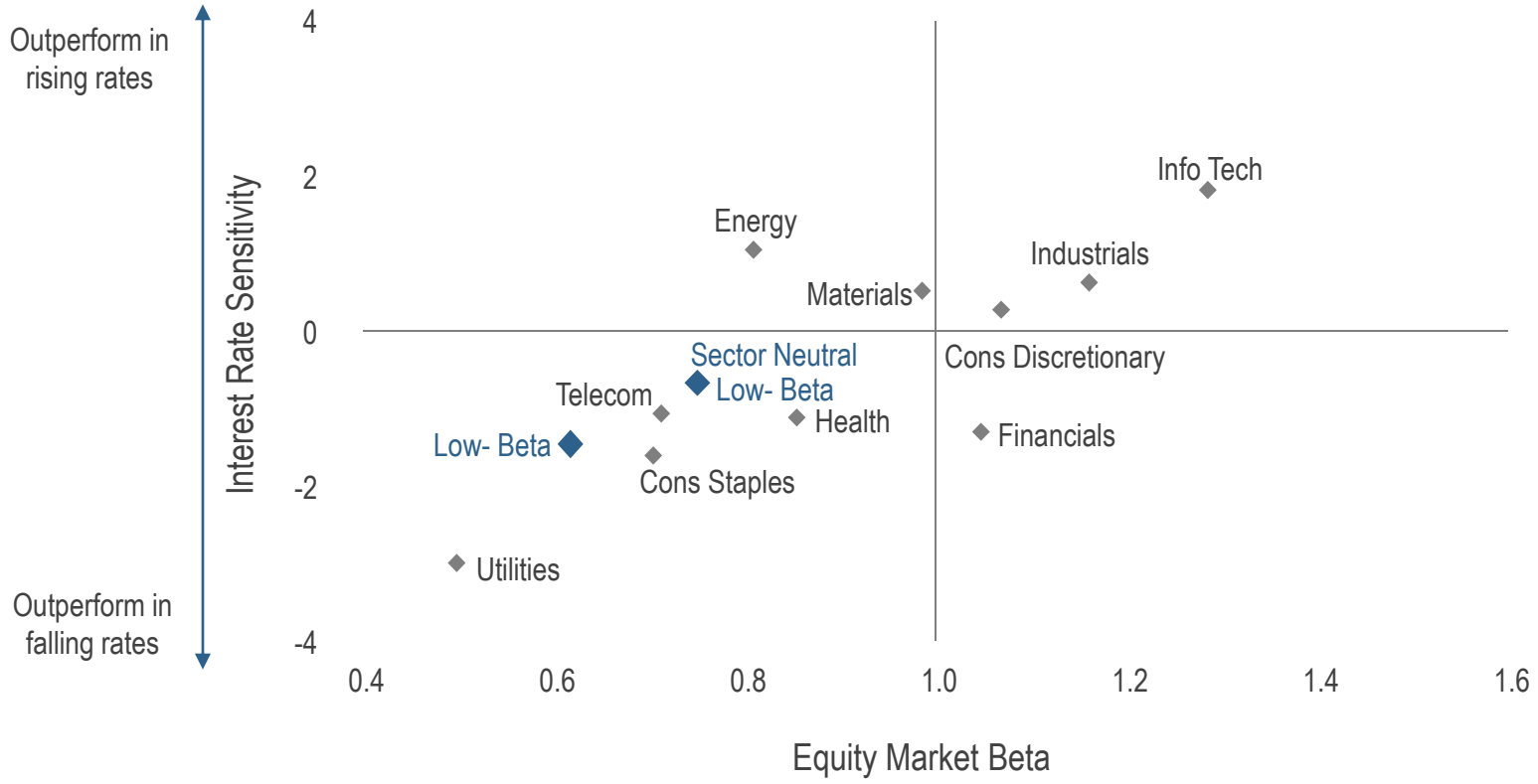
Markets Losses	Required % Return to Get Back Even
10%	11%
20%	25%
30%	43%
40%	67%
50%	100%
60%	150%
70%	233%
80%	400%
90%	900%

This is meant to be an educational illustrative example and is not intended to represent investment returns generated by an actual portfolio. They do not represent actual trading or an actual account, but were achieved by means of using the following formula: 1/(1-"market losses")-1.

EQUITY MARKET AND INTEREST RATE SENSITIVITIES

1966 – 2012

Equity market and interest-rate sensitivities of sectors and two hypothetical low-beta portfolios



Source: Acadian Asset Management LLC, CRSP®, Center for Research in Security Prices. Graduate School of Business, The University of Chicago. Used with permission. All rights reserved. crsp.uchicago.edu, S&P Universe of Securities. Methodology: measures the sensitivity to changes in the 10-yr treasure yield. The low beta portfolio is a hypothetical portfolio of stocks in the lowest quintile of (CAPM) beta, weighted according to their market capitalizations. The sector-neutral low beta portfolio is a hypothetical portfolio of stocks in the lowest quintile of beta, weighted according to their market capitalizations within each sector, where sector weights are those of the broad market index. For illustrative purposes only. This is meant to be an educational illustrative example and is not intended to represent investment returns generated by an actual portfolio. They do not represent actual trading or an actual account, but were achieved by means of using the CRSP universe of securities as a whole. Results do not reflect transaction costs, other implementation costs and do not reflect advisory fees or their potential impact. Hypothetical results are not indicative of actual future results. Every investment program has the opportunity for loss as well as profit.

ACADIAN

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HYPOTHETICAL PERFORMANCE DISCLOSURE

Hypothetical performance results have many inherent limitations, some of which are described below. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. In fact, there are frequently sharp differences between hypothetical performance results and the actual performance results subsequently achieved by any particular trading program.

One of the limitations of hypothetical performance results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. For example, the ability to withstand losses or to adhere to a particular trading program in spite of trading losses are material points which can also adversely affect actual trading results. There are numerous other factors related to the markets in general or to the implementation of any specific trading program which cannot be fully accounted for in the preparation of hypothetical performance results and all of which can adversely affect actual trading results.

PERFORMANCE DISCLOSURE

ALL-COUNTRY MANAGED VOLATILITY EQUITY COMPOSITE

	Composite Return (%) Gross-of-Fees	Composite Return (%) Net-of-Fees	MSCI All-Country World Return (%)	MSCI All-Country World Minimum Volatility Return (%)	Dispersion of Returns Within Composite (%)	Three-Year ex-Post Standard Deviation of Absolute Returns			Number of Portfolios in Composite	Assets in Composite ($MMs)	Total Firm Assets under Management ($MMs)
						Composite	MSCI ACW	MSCI ACW Min Vol			
2011*	-2.6	-2.8	-12.9	-2.2	n/a	n/a	n/a	n/a	1	111	42,200
2012	13.9	13.4	16.1	10.1	n/a	n/a	n/a	n/a	1	195	51,903
2013	16.1	15.6	22.8	16.9	n/a	n/a	n/a	n/a	3	363	65,153
2014	8.3	7.8	4.2	11.0	2.2	8.1	10.5	8.0	3	370	70,339
2015	1.0	0.6	-2.4	2.8	1.8	9.1	10.8	8.9	10	900	66,834
2016 to Q2	9.3	9.1	1.2	11.0	n/a	9.2	11.7	8.6	11	1,097	69,688

*Performance Inception: June 1, 2011. This composite was created on July 1, 2011. All figures stated in USD.

Acadian Asset Management claims compliance with the Global Investment Performance Standards (GIPS®) and has prepared and presented this report in compliance with the GIPS standards. Acadian Asset Management has been independently verified for the periods January 1, 1994 through June 30, 2016 by Ashland Partners & Company LLP. A copy of the verification report is available upon request. Verification assesses whether (1) the firm has complied with all the composite construction requirements of the GIPS standards on a firm-wide basis and (2) the firm's policies and procedures are designed to calculate and present performance in compliance with the GIPS standards. Verification does not ensure the accuracy of any specific composite presentation. Reference to the benchmark is for comparative purposes only and is not intended to indicate that the composite will contain the same investments as the benchmark. Investors have the opportunity for losses as well as profits. Past performance is no guarantee of future results. Acadian Asset Management is an investment adviser specializing in global equity management. Acadian Asset Management is defined to include assets managed by Acadian Asset Management LLC, an investment adviser registered with and regulated by the United States Securities and Exchange Commission, as well as assets managed by its four wholly-owned affiliates, Acadian Asset Management (Australia) Limited (ABN 41 114 200 127), Acadian Asset Management (Japan), registered with the Kanto Local Financial Bureau, Acadian Asset Management Singapore Pte Ltd, (Registration Number: 199902125D) is licensed by the Monetary Authority of Singapore, and Acadian Asset Management (UK) Limited, authorized and regulated by the Financial Conduct Authority of the United Kingdom. On June 30, 2015, Acadian acquired the assets of Acadian's Australian office.

Methodology: Returns are net of estimated foreign withholding taxes on dividends, interest, and capital gains. As of January 1, 2010 Acadian's methodology was augmented to produce a more accurate gross return figure by eliminating modest cash flows such as securities lending income and custodial fees which are regarded as independent of the investment management process; the reinvestment of all income and trading expenses continue to be included. Gross returns will be reduced by investment advisory fees and other expenses. Monthly composite results are asset-weighted by beginning-of-month asset values of member portfolios which are geometrically linked to arrive at the annual composite return. Net-of-fee performance is accrued on a monthly basis and is calculated using the highest management fee as described in section 2A of the firm's Form ADV for the investment process utilized to manage this strategy; such form is available upon request. Net-net-of-fees additionally include incentive fees which, when applicable, are also accrued on a monthly basis. The standard fee schedule for accounts managed with this product is 0.40% on assets managed. Management fees may vary according to the range of services provided, investment performance, and the amount of assets under management. Constituent portfolios are included from the first full month after inception to the present or the last full month prior to cessation of the client relationship with the firm. For example, an account that opened January 15, 2010 will be included beginning February 1, 2010. An account that terminated February 12, 2010 will be included through January 31, 2010. Policies for valuing portfolios, calculating performance, and preparing compliant presentations are available upon request.

Dispersion: Acadian's broad definitions are mainly the product of a highly customized process that may result in modest differences with regards to portfolio characteristics among constituents. All accounts managed with directly comparable investment objectives are included, though it's possible for members to utilize slightly different benchmarks in optimization and reporting. Although at times dispersion among constituents may be high, the long-term forecast for each portfolio is consistent with the overall composite. The 'Dispersion' statistic presented above is an annual, asset-weighted standard deviation calculation performed only on those portfolios who have been members for the entire calendar year. Thirty-six months are required to calculate the 'Three Year ex-Post Standard Deviation' statistic. These figures are not shown if the requirements necessary to perform the calculations are unavailable.

Composite Description: This composite focuses on broad exposure to developed and emerging equity markets. The strategy aspires to provide market-like returns with less-than-market volatility. A complete list of the firm's composites and their descriptions is available upon request.

Benchmark Description: The primary benchmark for the composite is MSCI All-Country World (net of dividend withholding taxes). The MSCI ACWI (All Country World Index) Index is a free float-adjusted market capitalization weighted index that is designed to measure the equity market performance of developed and emerging markets. The secondary benchmark for the composite is MSCI All-Country World Minimum Volatility (net). The MSCI ACW Minimum Volatility Index is calculated by optimizing the MSCI ACW index to produce an index with the least volatility for a given set of constraints and to ensure index replicability and investability.

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ARROWSTREET CAPITAL

LIMITED PARTNERSHIP

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Global Minimum Volatility Equity

Oregon Investment Council
October 26, 2016

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TAB 2
STRATEGY

EXHIBITS
SUPPORTING MATERIALS

The information set forth herein has been prepared by Arrowstreet Capital, Limited Partnership ("we," us," "our," or "Arrowstreet") solely for the benefit of select, qualified persons for informational and discussion purposes only. All information contained herein is proprietary and confidential. Any reproduction or distribution of these materials, in whole or in part, or the disclosure of its contents, without Arrowstreet's prior written consent, is prohibited. Please see Additional Disclosures at the end of this presentation.

This information has been prepared for a one-on-one presentation and is not intended for mass distribution.

Firm
Overview

SPECIALIST GLOBAL EQUITIES MANAGER

- Strategy built from sound investment intuition
- Multi-dimensional forecasting approach
- Work exclusively with institutional investors

COMMITMENT TO ONGOING RESEARCH PROGRAM

- Strong ties to academic community

OWNED AND CONTROLLED BY SENIOR MANAGEMENT

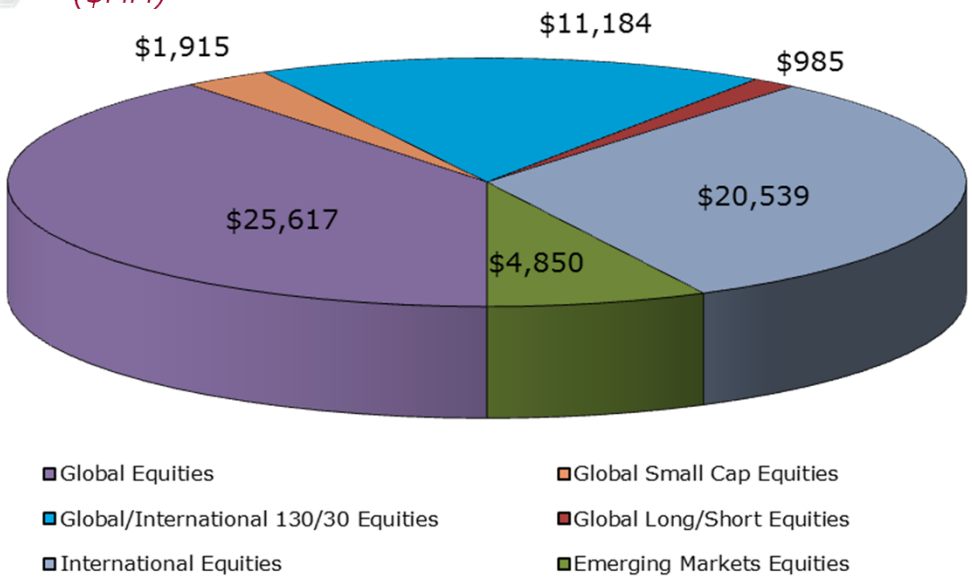
Assets Under Management (AUM) as of June 30, 2016: $65 billion

REPRESENTATIVE CLIENTS

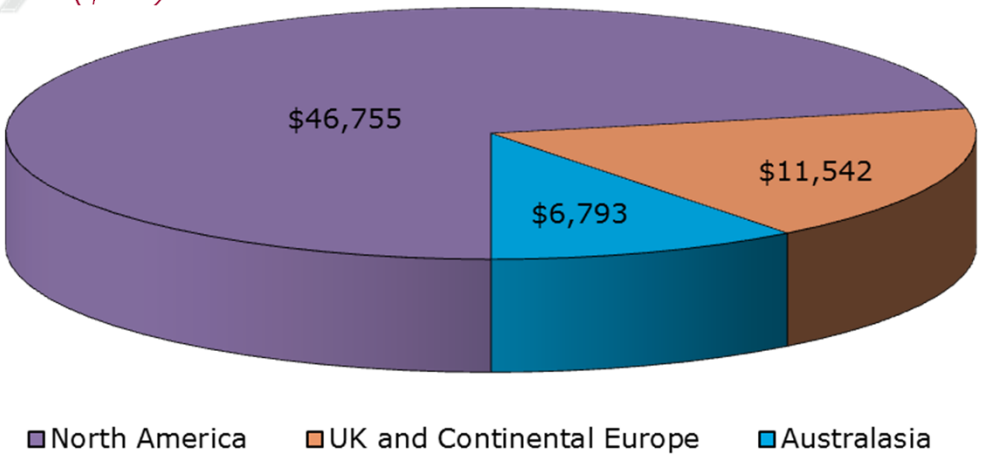
Air Canada Pension
Annuitas Management
ANZ OnePath
Blue Sky Group
Boeing Company
CalPERS
Casey Family Programs
Caterpillar
Church of England
Eastman Kodak
Hewlett-Packard Company
Illinois Municipal Retirement Fund
Indiana Public Retirement System
Iowa University Board of Regents
Kaiser Permanente
Kinder Morgan
Macquarie Bank
Missouri Education Pension Trust
National Grid
Ohio Public Employees Retirement System
Oregon State Treasury
Public Employees Retirement System of Mississippi
Raytheon
School Employees Retirement System of Ohio
State Teachers Retirement System of Ohio
Sonoma County Employees' Retirement Association
Union Pacific
United Technologies
University of Washington
Victorian Funds Management
Virginia Retirement System
YMCA

Selection Criteria: Representative clients are chosen due to their recognition in the marketplace and their willingness to allow us to use their name. It is not known whether the listed clients approve or disapprove of Arrowstreet Capital, Limited Partnership or the advisory services provided by Arrowstreet Capital, Limited Partnership.

AUM BY STRATEGY
($MM)



AUM BY CLIENT DOMICILE
($MM)



Senior Investment Resources

Peter Rathjens, Ph.D.
Partner, CIO

PORTFOLIO MANAGEMENT

Name	Year Joined ASC	Industry Exp.
John Capeci, Ph.D. *Partner*	1999	22
Manolis Liodakis, Ph.D. *Partner*	2012	18
Michelle Morphew, CFA *Manager*	2010	16
Alex Ogan *Partner*	2005	11
George Pararas, CFA *Partner*	2002	20
Michael Zervas, CFA *Partner*	2004	15

INVESTMENT PROCESSES

Name	Year Joined ASC	Industry Exp.
Sam Thompson, Ph.D. *Partner*	2005	11
Marta Campillo, Ph.D. *Partner*	1999	20

RESEARCH

Name	Year Joined ASC	Industry Exp.
John Campbell, Ph.D. *Partner*	1999	24
Tuomo Vuolteenaho, Ph.D. *Partner*	2004	13
Alex Merlis, CFA *Partner*	2006	15
Derek Vance, CFA *Partner*	2008	9
Yijie Zhang, Ph.D. *Partner*	2006	10

- Manage all portfolios and strategies using a team-based approach
- Average industry experience of 17 years; average of 11 years with Arrowstreet
- Supported by 21 associate level investment professionals

This organizational chart is provided as of June 30, 2016.

Performance Summary as of September 30, 2016 [1,2]

Portfolio	Oregon State Treasury EMK	Oregon Common School Fund	Oregon Common School Fund *Arrowstreet Emerging Market Fund III*	Oregon Public Employees Retirement Fund *Arrowstreet International Equity - Alpha Extension Fund*
Portfolio Inception Date	September 1, 2006	May 1, 2008	October 1, 2011	June 15, 2015
Benchmark	MSCI Emerging Markets IMI (Gross)	MSCI World ex USA IMI (Net)	MSCI Emerging Markets IMI (Net)	MSCI All Country World ex USA IMI (Net)
YTD Portfolio Gross Return	14.98%	5.91%	14.05%	6.34%
YTD Benchmark Return	15.34%	3.68%	15.02%	6.08%
YTD Value Added/Lost (Gross of Fees)	**-0.36%**	**2.23%**	**-0.96%**	**0.26%**
1 Year Portfolio Gross Return	15.71%	12.21%	16.80%	12.02%
1 Year Benchmark Return	16.60%	8.00%	16.19%	9.81%
1 Year Value Added/Lost (Gross of Fees)	**-0.89%**	**4.20%**	**0.61%**	**2.21%**
3 Year Annualized Portfolio Gross Return	0.20%	6.15%	0.22%	*
3 Year Annualized Benchmark Return	0.02%	0.83%	-0.33%	*
3 Year Annualized Value Added/Lost (Gross of Fees)	**0.18%**	**5.32%**	**0.55%**	*
5 Year Annualized Portfolio Gross Return	5.28%	13.01%	4.70%	*
5 Year Annualized Benchmark Return	3.59%	7.26%	3.24%	*
5 Year Annualized Value Added/Lost (Gross of Fees)	**1.69%**	**5.75%**	**1.46%**	*
Since Inception Annualized Portfolio Gross Return	9.35%	6.04%	4.70%	-1.67%
Since Inception Annualized Benchmark Return	4.65%	0.53%	3.24%	-3.99%
Since Inception Annualized Value Added/Lost (Gross of Fees)	**4.70%**	**5.51%**	**1.46%**	**2.32%**

Disclosures

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[2]Performance results presented herein are shown gross of investment advisory fees and include the reinvestment of income. Actual performance results of the clients of the Firm are reduced by investment advisory fees. For example, if a portfolio appreciated by 10% each year for ten years with no fees deducted, the average annualized return would be 10%. If the portfolio was charged investment advisory fees of 0.75% for each of the ten years, then the average annualized return would have been 9.18%. Investment advisory fees applicable to the strategy are described in the Form ADV Part 2 Brochure. The return information presented represents past performance and is not a guarantee of future results. Returns for periods over one year are annualized. Results presented above are in USD. The benchmark name presented reflects the account's current benchmark. The benchmark may have changed over time and as such all presented benchmark performance figures were calculated with respect to the benchmark applicable at each point in time.

** Not applicable as portfolio inception date is June 15, 2015.*

Global Minimum Volatility Equity

Strategy Objectives

CONSISTENTLY OUTPERFORM SELECTED LOW-BETA BENCHMARK

Target Outperformance: 3% per year over a market cycle

Target Tracking Error: 3% – 7% per year

BENCHMARK AWARE INVESTMENT STYLE

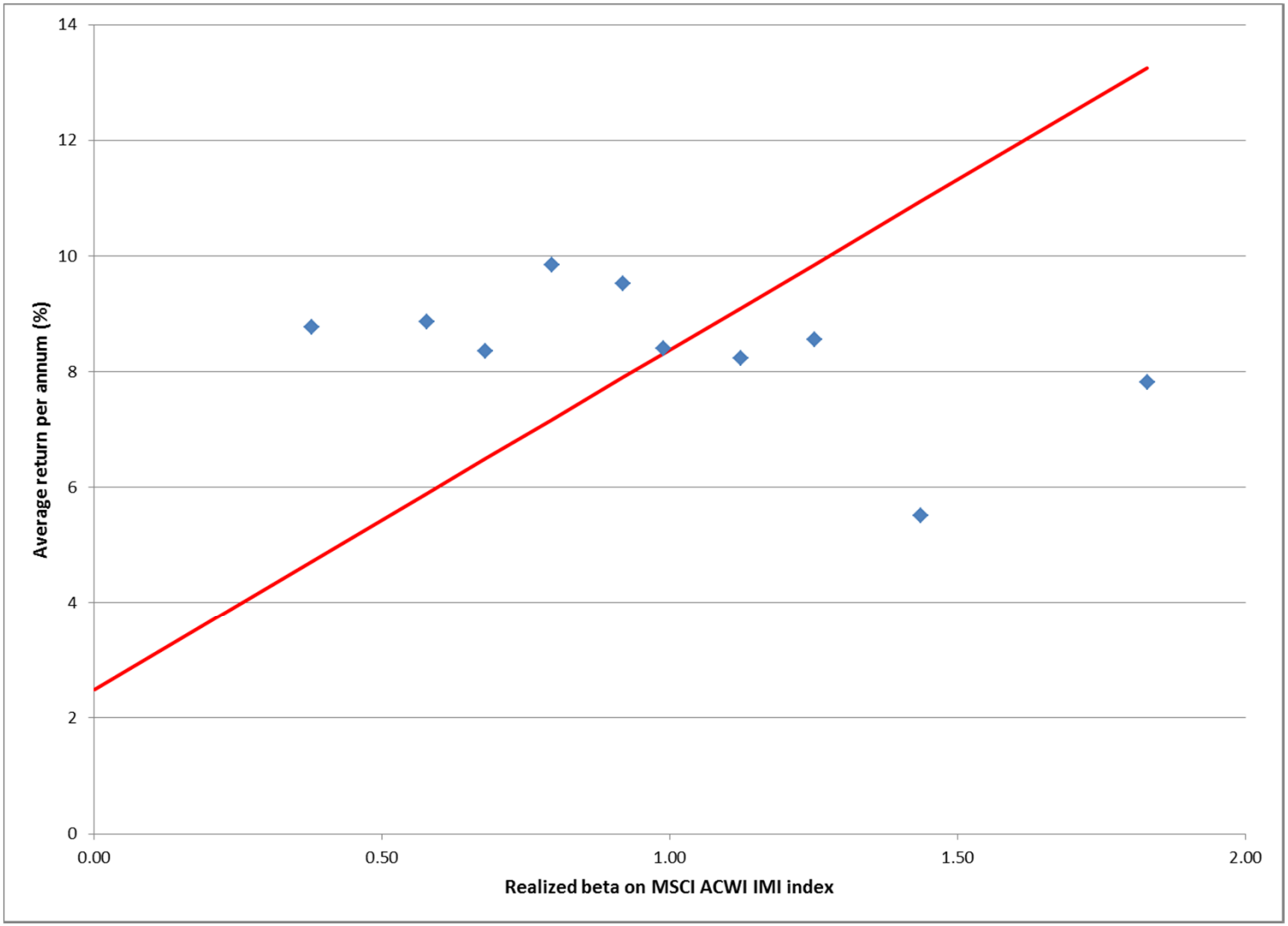
Style neutral on an active basis over long periods

Risk controlled

Outperform the selected benchmark in a broad range of market environments

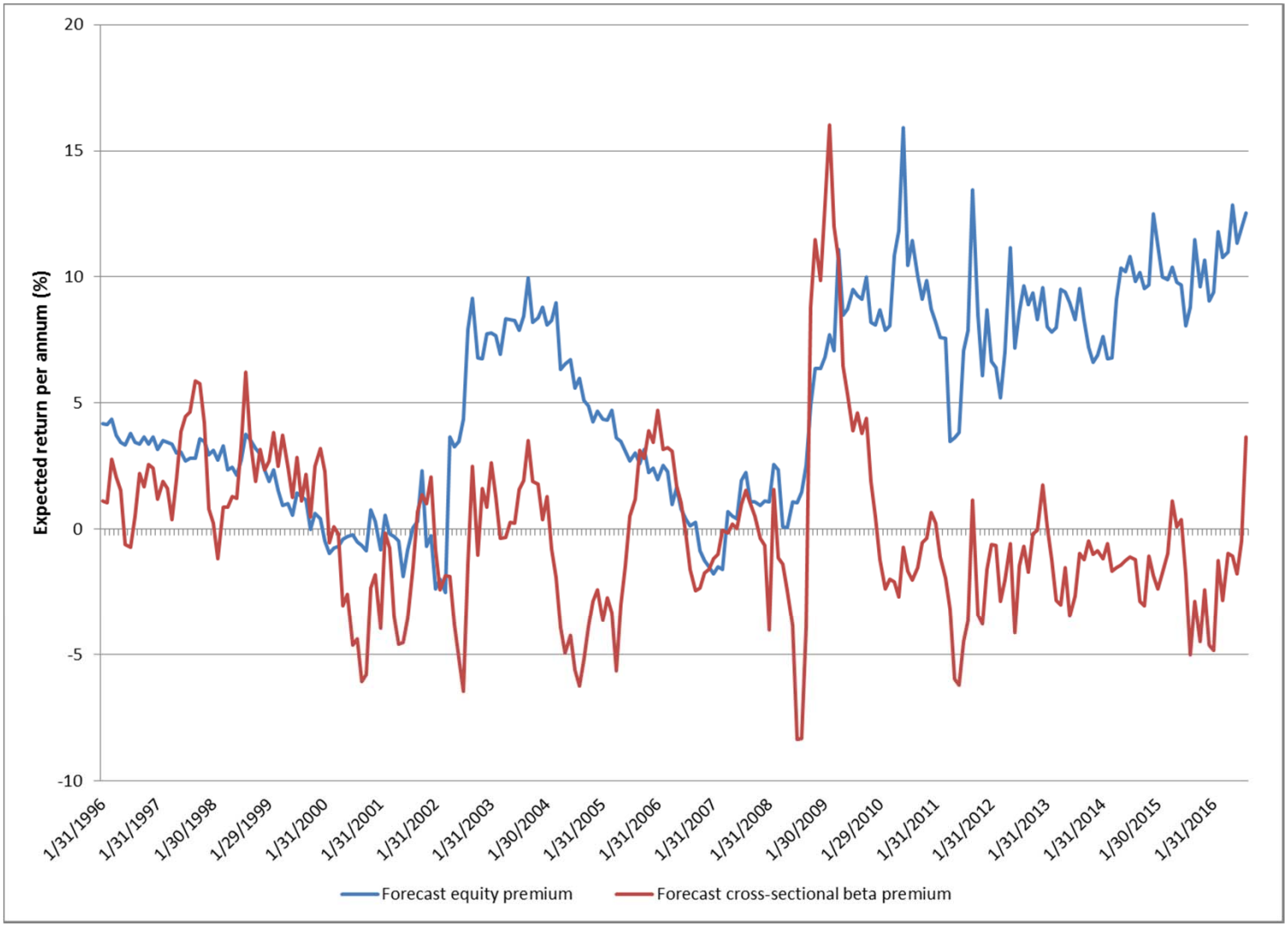
DIVERSIFICATION FROM OTHER MANAGERS

RETURNS TO BETA-SORTED PORTFOLIOS
AUGUST 1993 – AUGUST 2016



Source: Arrowstreet Internal Databases.
The figure plots the average USD returns on beta-sorted decile portfolios against the realized betas of those portfolios for the 8/1993-8/2016 period. The portfolios are rebalanced monthly without trading costs based on Arrowstreet's beta forecasts for individual stocks. The universe consists of MSCI ACWI IMI constituents and realized betas are measured relative to the MSCI ACWI IMI index. The red line is drawn from the average 1-month Treasury bill return through the average return and realized beta of the MSCI ACWI IMI index.

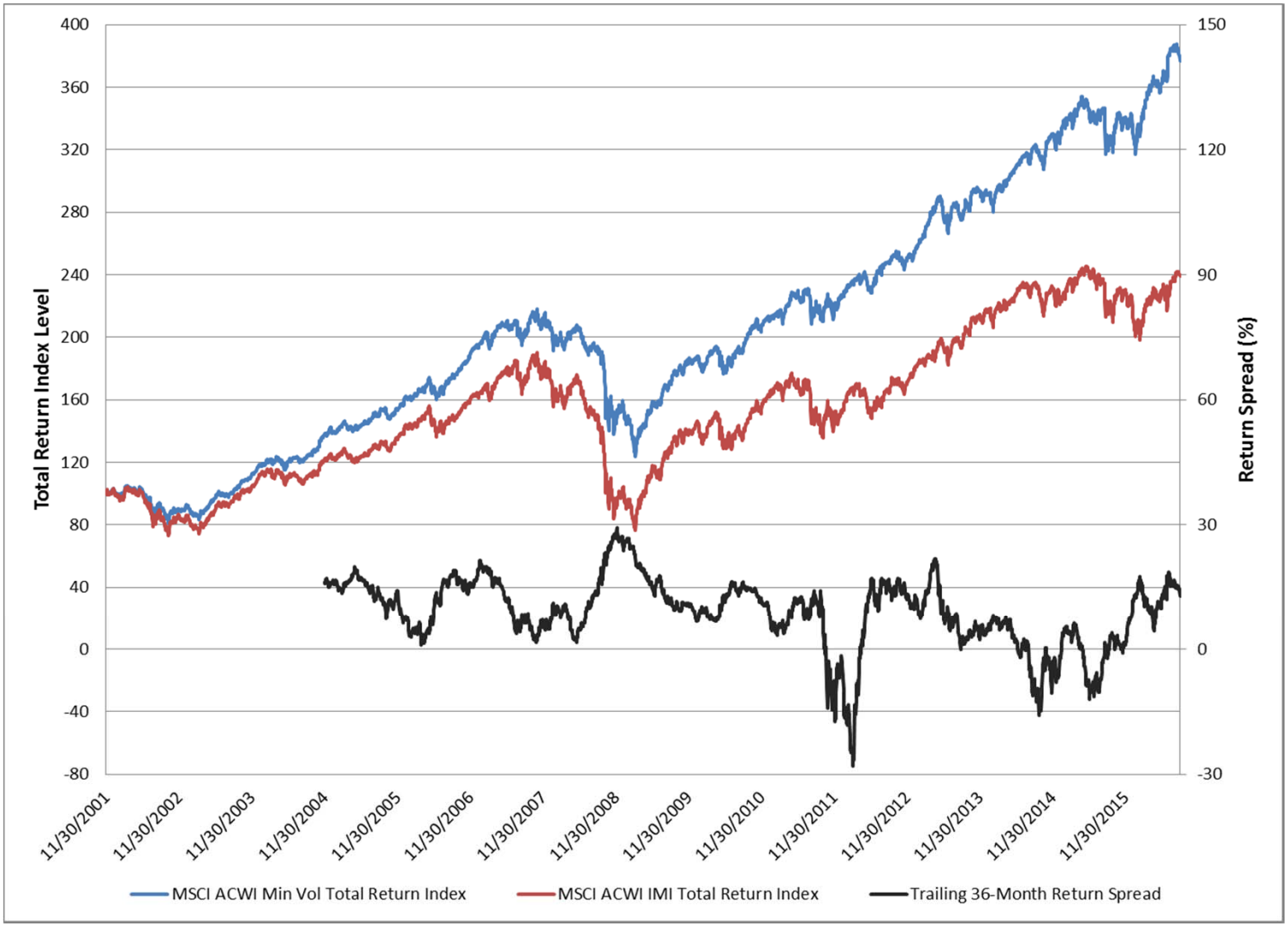
FORECAST CROSS-SECTIONAL BETA PREMIUM AND EQUITY PREMIUM



Source: Arrowstreet Internal Databases.

The figure plots our equity premium forecast with the blue line and our cross-sectional beta premium forecast with the red line. The cross-sectional beta premium forecast is the cross-sectional regression coefficient of Arrowstreet's stock return forecasts on Arrowstreet's market beta forecasts. The regression is run among MSCI ACWI IMI constituents and observations are weighted proportional to the stocks' market capitalizations.

CUMULATIVE INDEX PERFORMANCE



Source: Arrowstreet Internal Databases.

KEY ISSUES TO CONSIDER FOR LOW VOLATILITY

INVESTMENT RATIONALE FOR LOW VOLATILITY:

- Belief that high-risk stocks tend to underperform low-risk stocks on a risk-adjusted basis.

ALTERNATIVES FOR EXPLOITING THIS PHENOMENON:

- Low volatility index products: Replicate a published low-volatility index with index-fund fees and no alpha.

- Products that actively minimize risk subject to transaction costs: Require estimating risk characteristics for individual securities. No alpha and fees only slightly higher than index-fund fees.

- Fully active alpha products: Seek to add alpha over a published low-volatility index while controlling risk and trading costs. Deserve full active management fees.

ADDITIONAL CONSIDERATIONS:

- We believe low-volatility products should not be benchmarked to a 100% capitalization-weighted index. Investors should not confuse benchmark mismatch with alpha. A defensive equity benchmark or a blended 70%/30% cap weighted and cash benchmark are more appropriate benchmarks for a low volatility strategy.

- In fully active alpha products, a strict short-sales restriction often limits underweight opportunities to only a small number of low beta, mega-cap stocks. However, a 70%/30% blended benchmark strategy will allow at least some underweighting of all stocks in the capitalization weighted index.

PORTFOLIO CONSTRUCTION

Client portfolios built considering forecasts, risks and transaction costs

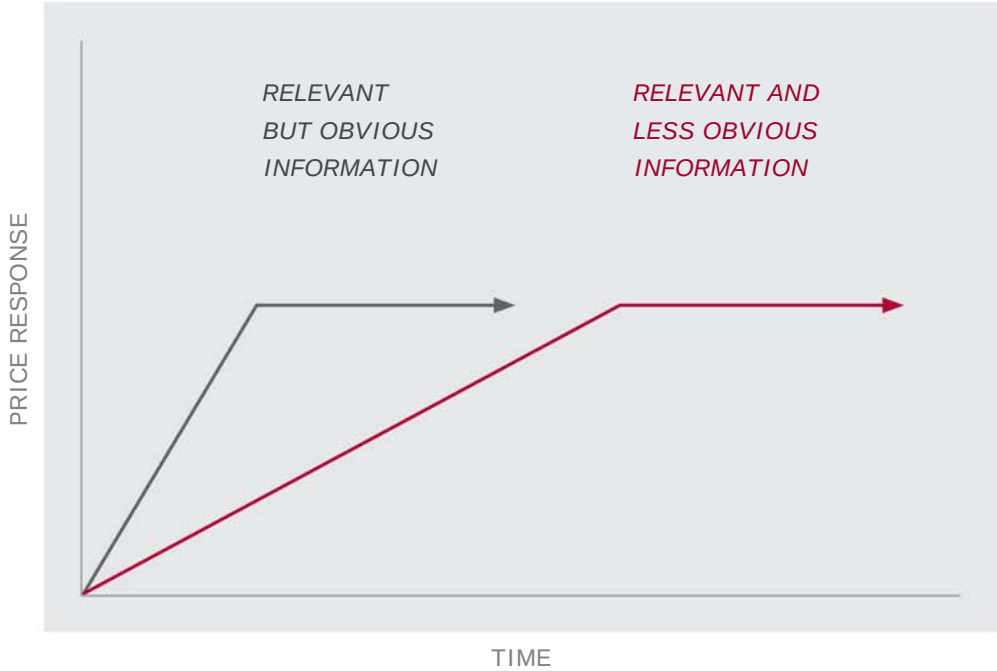
ALPHA FORECASTS FOR PORTFOLIO CANDIDATES

- TRANSACTION COSTS
- RISK ESTIMATES
- STYLE CONSTRAINTS
- TARGET POSITION LIMITS

PORTFOLIO

INVESTMENT PHILOSOPHY

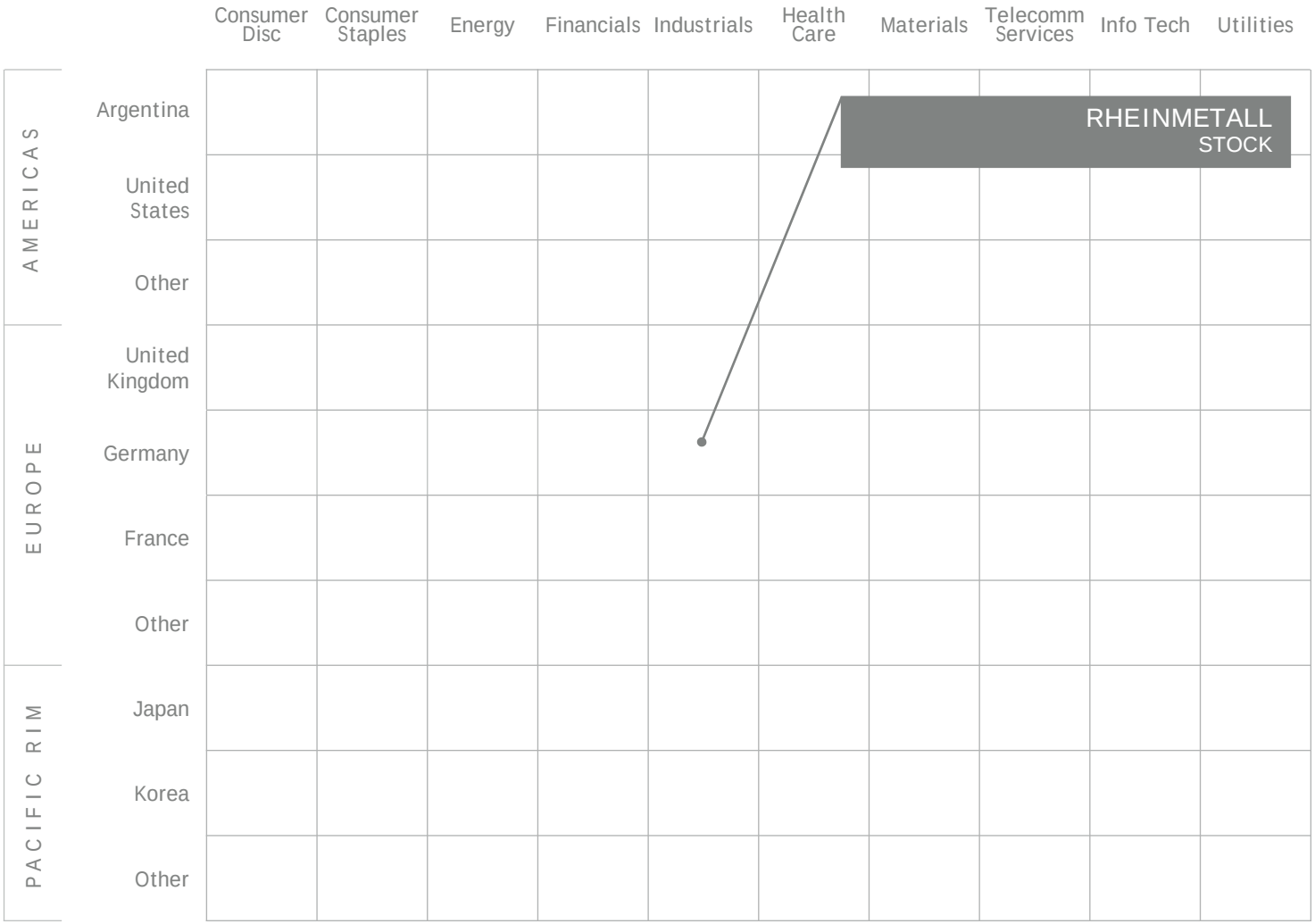
Adding value by identifying investment signals that are relevant to prices and less obvious to investors



DEFINING DIRECT EFFECTS

INFLUENCE OF STOCK INFORMATION

- VALUATION
- MOMENTUM
- QUALITY
- HIGH FREQUENCY
- CATALYSTS
- EXTREME SENTIMENT



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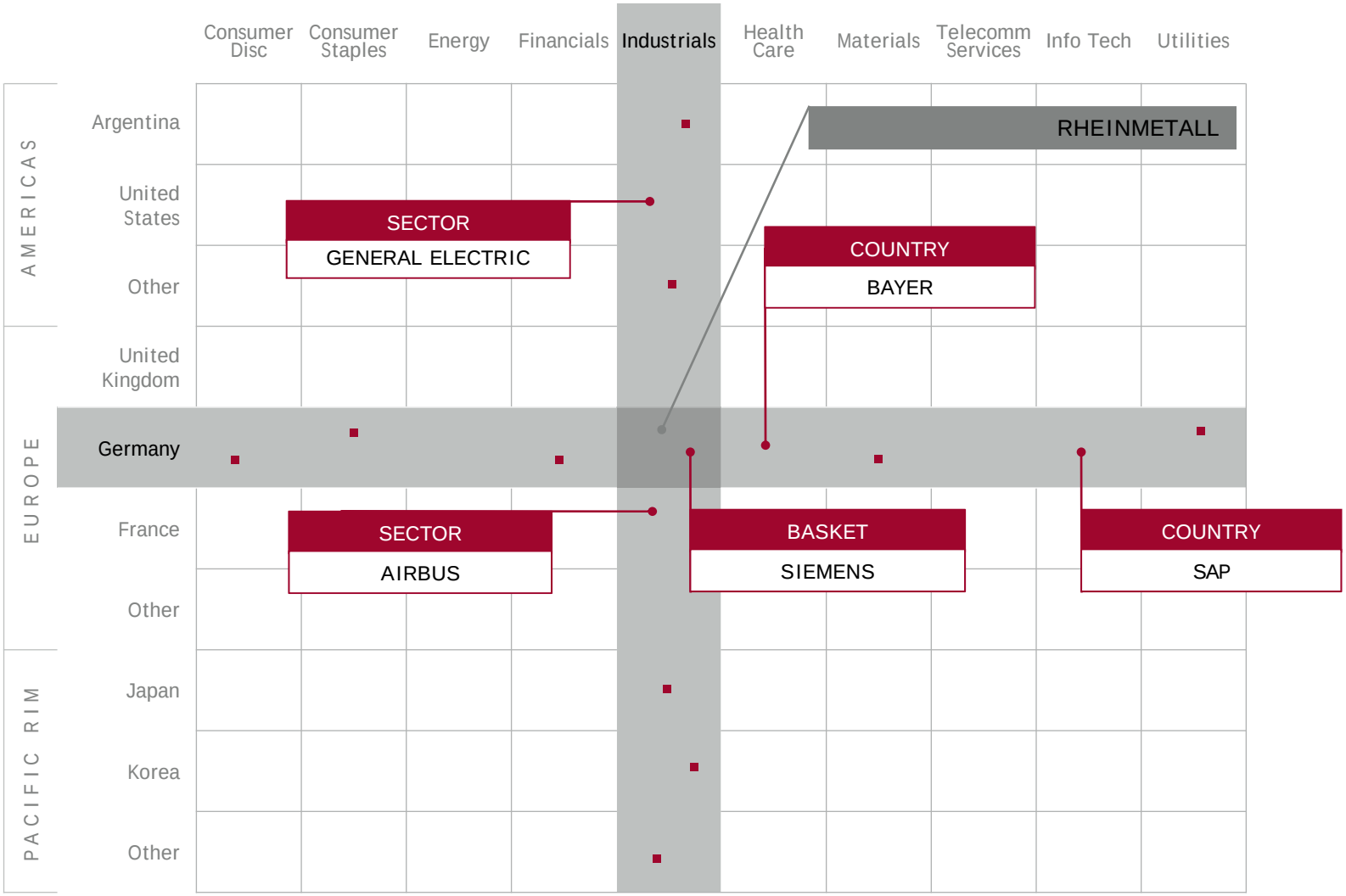
DEFINING INDIRECT EFFECTS

INFLUENCE OF SECTOR, COUNTRY & BASKET INFORMATION

- VALUATION
- MOMENTUM
- QUALITY
- CATALYSTS
- EXTREME SENTIMENT



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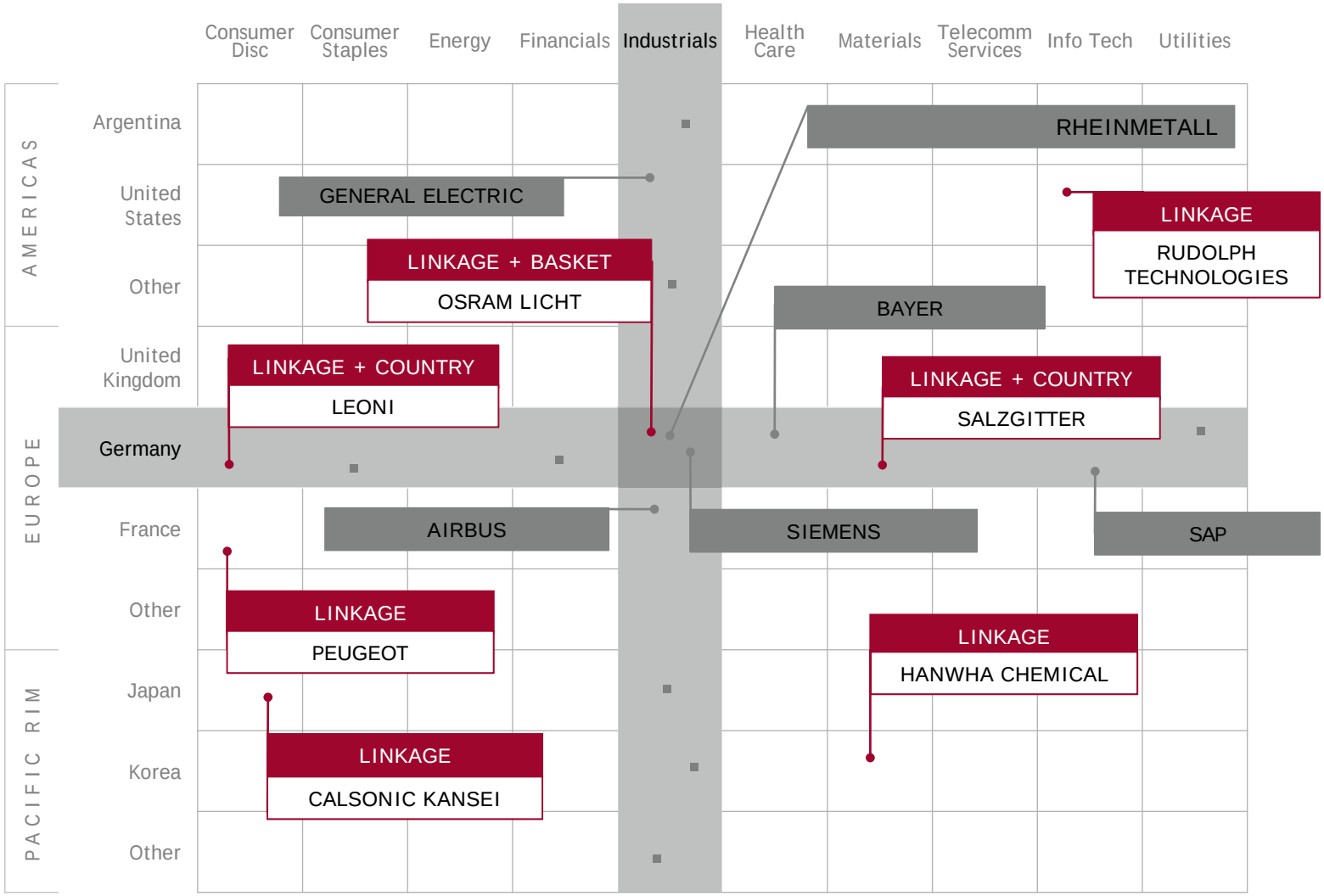
DEFINING INDIRECT EFFECTS

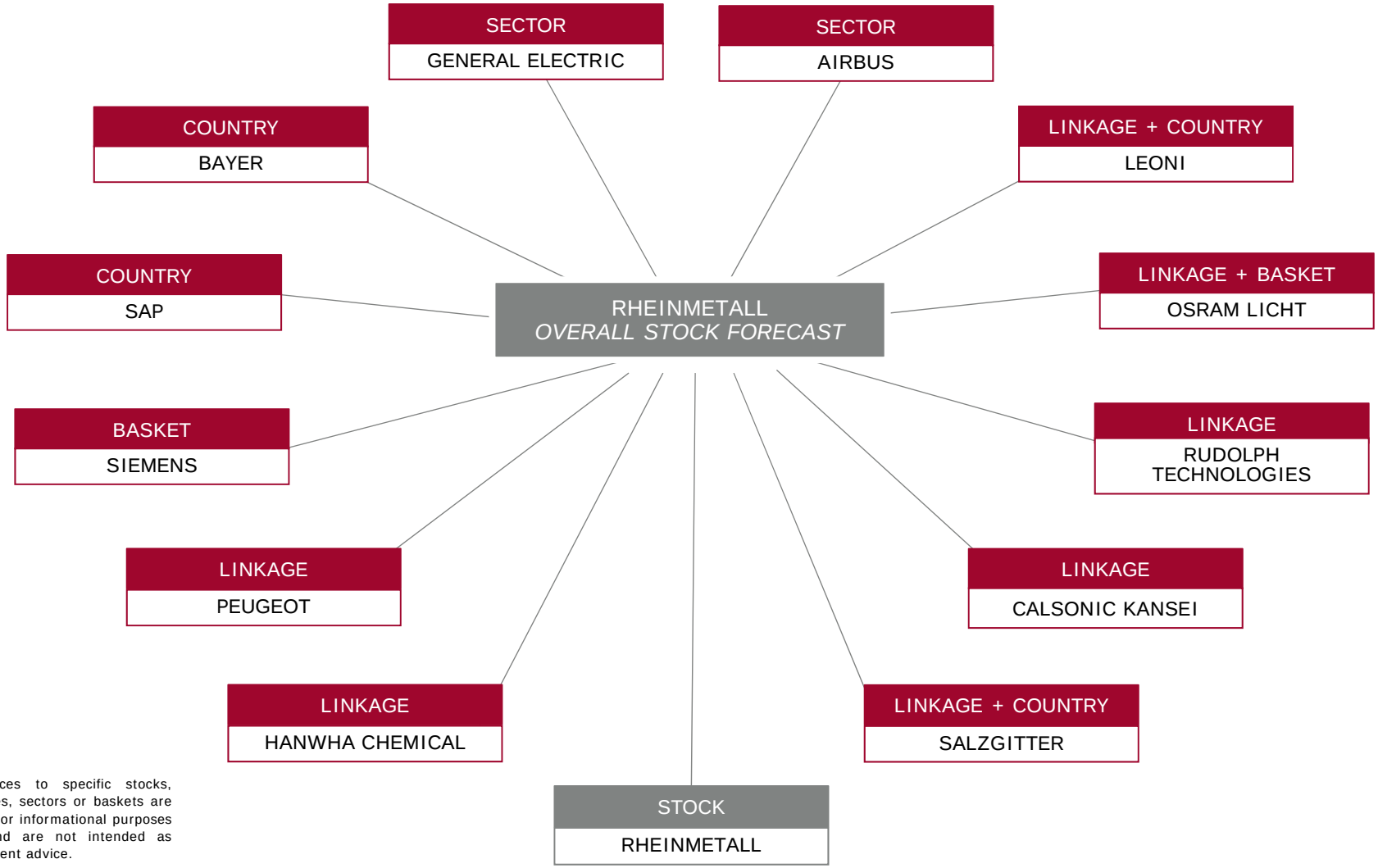
INFLUENCE OF EXPANDED LINKAGES

- VALUATION
- MOMENTUM



References to specific stocks, countries, sectors or baskets are shown for informational purposes only and are not intended as investment advice.

INVESTMENT PROCESS



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PORTFOLIO CONSTRUCTION

Client portfolios built considering forecasts, risks and transaction costs

ALPHA FORECASTS FOR PORTFOLIO CANDIDATES

10,000+ STOCKS

TRANSACTION COSTS

Reflecting trade size and expected holding period

RISK ESTIMATES

Proprietary risk model

STYLE CONSTRAINTS

Control portfolio tilts

TARGET POSITION LIMITS

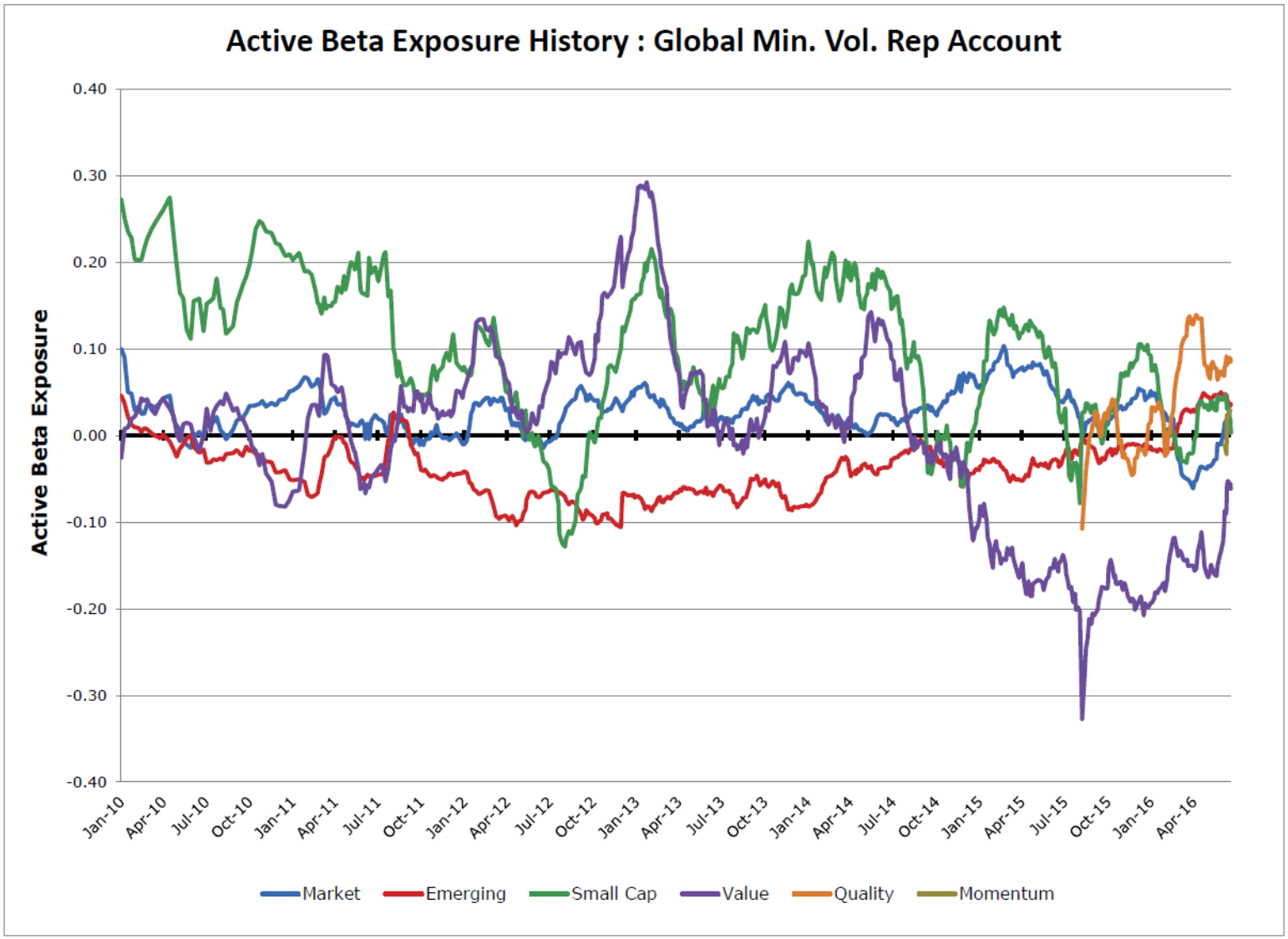
(relative to the benchmark)

Country:	+/- 10%
Sector:	+/- 15%
Basket:	+/- 5%
Stock:	+/- 3%

PORTFOLIO

GENERALLY
150–500 STOCKS
BROADLY DIVERSIFIED
STYLE NEUTRAL
RISK CONTROLLED

ACTIVE BETA EXPOSURE



Represents Arrowstreet's proprietary measures of **ex ante** style betas.

June 2016 Active (Benchmark Relative) Portfolio Weights

REPRESENTATIVE GLOBAL MINIMUM VOLATILITY EQUITY PORTFOLIO

Country	Total	Consumer Discretionary	Consumer Staples	Energy	Financials	Health Care	Industrials	Information Technology	Materials	Telecommunication Services	Utilities
Total		**-4.13**	**8.56**	**-1.95**	**-8.81**	**-3.60**	**-2.87**	**2.50**	**3.07**	**-0.58**	**6.30**
DEV Austria	**-0.19**	--	--	-0.13	--	--	--	--	-0.06	--	--
DEV Belgium	**-0.67**	--	-0.53	--	--	-0.15	--	--	--	0.00	--
DEV Canada	**-0.32**	-0.43	0.24	-0.56	-1.92	--	0.17	-0.11	3.28	-0.99	--
DEV Denmark	**-0.67**	--	--	--	-0.12	-0.41	-0.14	--	--	--	--
DEV Finland	**-0.07**	--	--	-0.07	--	--	--	--	--	--	--
DEV France	**-0.50**	--	-0.20	-0.11	-0.05	--	-0.04	-0.10	--	--	--
DEV Germany	**-0.20**	--	--	--	--	--	-0.20	--	--	--	--
DEV Hong Kong	**-2.16**	-0.16	--	--	-1.80	--	-0.49	--	--	0.46	-0.18
DEV Ireland	**0.03**	--	0.03	--	--	--	--	--	--	--	--
DEV Israel	**-0.57**	--	--	--	-0.60	-0.09	--	-0.10	--	0.22	--
DEV Italy	**0.52**	-0.13	--	0.20	--	--	--	--	--	--	0.45
DEV Japan	**-3.86**	-1.06	1.12	-0.49	-2.07	0.01	-1.33	-1.61	-0.73	2.30	0.00
DEV Netherlands	**-0.05**	--	-0.05	--	--	--	--	--	--	--	--
DEV New Zealand	**0.64**	--	--	--	--	0.03	0.07	--	--	-0.01	0.55
DEV Norway	**-0.31**	--	0.04	0.07	--	--	--	--	-0.33	-0.09	--
DEV Portugal	**-0.01**	--	--	0.05	--	--	--	--	--	--	-0.07
DEV Singapore	**-1.50**	-0.25	-0.05	--	-0.69	--	--	--	--	-0.50	--
DEV Spain	**-1.07**	-0.27	--	--	--	--	-0.35	-0.39	--	-0.18	0.11
DEV Sweden	**-0.25**	-0.23	0.03	0.19	-0.04	0.12	0.02	-0.11	-0.08	-0.14	--
DEV Switzerland	**-0.15**	-0.10	1.05	--	-0.58	-0.18	0.63	0.05	-0.76	-0.24	--
DEV United Kingdom	**3.29**	0.18	0.72	0.83	-0.14	-0.26	-0.06	1.05	0.40	-0.06	0.63
DEV United States	**2.05**	-1.77	4.76	-3.63	-0.95	-2.94	-1.29	3.72	0.97	-1.59	4.77
EMK Brazil	**0.34**	--	0.16	0.11	0.01	0.03	--	--	--	--	0.02
EMK Indonesia	**0.16**	--	--	--	--	--	--	--	--	0.16	--
EMK Mexico	**0.77**	--	0.64	--	0.07	--	--	--	0.06	--	--
EMK Russia	**1.65**	--	--	1.53	--	--	--	--	0.12	--	--
EMK South Korea	**0.52**	0.02	0.27	0.07	--	--	--	0.04	0.04	0.09	--
EMK Taiwan	**0.44**	--	0.20	--	--	--	0.14	0.06	0.03	--	--
EMK Thailand	**0.30**	0.06	--	--	--	0.24	--	--	--	--	--
EMK Turkey	**0.37**	--	0.13	--	0.08	--	0.02	--	0.14	--	--

Range		
Max	Min	Color Code
>.15	0.15	
0.15	0.00	
0.00	-0.15	
-0.15	<-0.15	

Top 5 Active Weights

Stock	Basket	Active Weight
Facebook, Inc. Class A	**United States Information Technology**	**2.41**
Public Storage	**United States Financials**	**1.83**
Nippon Telegraph And Telephone Corporation	**Japan Telecommunication Services**	**1.28**
Colgate-Palmolive Company	**United States Consumer Staples**	**1.23**
Exelon Corporation	**United States Utilities**	**1.013**

Note: Information presented above is based on the longest standing account in the Global Minimum Volatility Equity Composite as of June 30, 2016. The information presented above is not an endorsement of any particular region, sector, or stock.

Portfolio weights are measured at the end of the calendar period indicated. Weights may temporarily drift beyond position limits in between trading sessions because of price movements.

EXPANDED LINKAGES EXAMPLE

STOCK: RHEINMETALL | COUNTRY: GERMANY | SECTOR: INDUSTRIALS

Largest Basket Constituents

	Stock	Country	Sector	MktCap ($US mil)
1	SIEMENS AG	Germany	Industrials	90,416
2	DEUTSCHE POST AG	Germany	Industrials	35,358
3	MAN SE	Germany	Industrials	14,442
4	BRENNTAG AG	Germany	Industrials	8,853
5	GEA GROUP AG	Germany	Industrials	7,796

Largest Country Constituents (Different Basket)

	Stock	Country	Sector	MktCap ($US mil)
1	BAYER AG	Germany	Health Care	110,431
2	SAP AG	Germany	Information Technology	97,113
3	DAIMLER AG	Germany	Consumer Discretionary	93,452
4	DEUTSCHE TELEKOM AG	Germany	Telecommunications	85,312
5	ALLIANZ SE	Germany	Financials	81,001

Largest Sector Constituents (Different Country)

	Stock	Country	Sector	MktCap ($US mil)
1	GENERAL ELECTRIC	U.S.	Industrials	286,534
2	BOEING CO	U.S.	Industrials	98,454
3	3M COMPANY	U.S.	Industrials	97,277
4...	UNITED TECHNOLOGIES	U.S.	Industrials	85,864
10	AIRBUS GROUP SE	France	Industrials	56,732

Most Linked Securities (Ranked)

	Stock	Country	Sector	MktCap ($US mil)
1	**PEUGEOT SA**	**France**	**Consumer Discretionary**	**14,094**
2	**MAN SE**	**Germany**	**Industrials**	**14,442**
3	LEONI AG	Germany	Consumer Discretionary	1,282
4	**RENAULT**	**France**	**Consumer Discretionary**	**29,838**
5	OSRAM LICHT AG	Germany	Industrials	6,119
6	**SALZGITTER AG**	**Germany**	**Materials**	**1,696**
7	USG PEOPLE N.V.	Netherlands	Industrials	1,260
8	**FAURECIA SA**	**France**	**Consumer Discretionary**	**4,842**
9	**RUDOLPH TECHNOLOGIES**	**U.S.**	**Information Technology**	**447**
10	NORMA GROUP SE	Germany	Industrials	1,660
11	VALEO SA	France	Consumer Discretionary	12,137
12	DMG MORI AG	Germany	Industrials	3,196
13	JENOPTIK AG	Germany	Information Technology	920
14	**APERAM**	**France**	**Materials**	**2,366**
15	ELRINGKLINGER AG	Germany	Consumer Discretionary	1,442
16	**MCDERMOTT INT'L INC**	**U.S.**	**Energy**	**1,278**
17	**CALSONIC KANSEI CORP**	**Japan**	**Consumer Discretionary**	**2,216**
18	KUKA AG	Germany	Industrials	3,093
19	SGL CARBON SE	Germany	Industrials	1,379
20	**FFP S.A.**	**France**	**Financials**	**1,831**
21	**DAIMLER AG**	**Germany**	**Consumer Discretionary**	**90,758**
22	**HANWHA CHEMICAL CORP**	**Korea**	**Materials**	**3,285**
23	KION GROUP AG	Germany	Industrials	4,797
24	BUZZI UNICEM SPA	Italy	Materials	407
25	**SUPERIOR INDUSTRIES**	**U.S.**	**Consumer Discretionary**	**502**

References to stocks are for illustrative purposes only and are not intended as investment advice to any person. Arrowstreet Capital, Limited Partnership may have already bought or sold or may in the future buy and sell these securities on behalf of its clients. A complete list of buys and sells is available upon request. These securities do not represent all of the securities that Arrowstreet Capital, Limited Partnership may trade in on behalf of its clients. There can be no assurance that an investment in the securities of these issuers, or in any investment recommendation, has been or will be profitable to the clients of Arrowstreet Capital, Limited Partnership.

Data as of November 30, 2015.

EXAMPLE TRADE

Stock:	**Rheinmetall AG**
Region:	**Europe**
Country:	**Germany**
Sector:	**Industrials**

30-Nov-15

Buy 0.10

Direct Effects			
	Level	**Change Since**	
Stock Factors	**30-Nov**	**29-Nov**	**24-Nov**
Catalyst Signals	0.17	-0.01	-0.16
Extreme Sentiment Signals	0.20	0.03	0.03
High Frequency Signals	0.08	0.13	0.18
Momentum Signals	0.25	0.00	0.03
Quality Signals	0.06	0.00	-0.01
Value Signals	-0.01	0.00	-0.01

Indirect Effects			
	Level	**Change Since**	
Country / Sector Basket Factors	**30-Nov**	**29-Nov**	**24-Nov**
Catalyst Signals	-0.12	0.04	0.06
Extreme Sentiment Signals	-0.01	-0.01	-0.01
Momentum Signals	0.27	0.03	0.10
Quality Signals	0.04	0.00	0.00
Value Signals	0.07	-0.01	-0.02
Country Factors			
Momentum Signals	0.08	0.02	0.04
Sector Factors			
Momentum Signals	0.15	0.01	0.05
Expanded Linkages			
Valuation Signals	-0.21	-0.01	-0.02
Momentum Signals	0.22	0.07	0.08

Return Forecasts			
	Level	**Change Since**	
	30-Nov	**29-Nov**	**24-Nov**
Monthly Excess Return Forecast	2.46	0.39	0.41
Annualized Excess Return Forecast	29.48		

Portfolio Construction (Optimization)			
	New Position	**Initial Position**	**Change**
Portfolio Weight	0.10	0.00	**0.10**
Benchmark Weight	0.01	0.01	
Active Weight	0.09	-0.01	
Transaction Cost Estimate	0.21 (average)		
Risk Contribution	Increase Risk (Small Cap Beta)		

References to stocks are not intended as investment advice to any person. Arrowstreet Capital, Limited Partnership may have already bought or sold or may in the future buy and sell these securities on behalf of its clients. A complete list of buys and sells is available upon request. These securities do not represent all of the securities that Arrowstreet Capital, Limited Partnership may trade in on behalf of its clients. There can be no assurance that an investment in the securities of these issuers, or in any investment recommendation, has been or will be profitable to the clients of Arrowstreet Capital, Limited Partnership.

BIOGRAPHIES

NAME/TITLE	RESPONSIBILITIES	BEGAN AT FIRM	YRS. EXP.	EDUCATION	PRIOR EXPERIENCE
SENIOR MANAGEMENT					
Peter Rathjens, Ph.D. PARTNER, CHIEF INVESTMENT OFFICER	Responsible for the firm's investment products; Chairs the firm's Investment Committee	1999	35	Princeton University, Ph.D. in Economics: 1990 Oberlin College, B.A. in Economics and Mathematics: 1981	1998–1999: CIO, PanAgora 1995–1999: Director of Global Investments, PanAgora 1991–1995: Director of Research, PanAgora 1990–1991: Equity Analyst, Colonial Management 1988–1990: Assistant Professor of Economics, Brandeis University 1986–1988: Instructor of Economics, Princeton University 1983–1984: Quantitative Analyst, Lehman Brothers 1981–1983: Analyst, Data Resources
Anthony Ryan, CFA PARTNER, CHIEF EXECUTIVE OFFICER	Develops and implements the firm's strategic business plan	2011	29	London School of Economics, M.Sc.: 1986 University of Rochester, B.A.: 1985	2009-2011: Chief Administrative Officer, Fidelity Investments 2006–2009: U.S. Treasury Department 2000–2006: Partner, Head of Global Business Development & Client Relations, Grantham, Mayo, van Otterloo & Co. LLC 1994–2000: State Street Global Advisors, Principal, State Street Corporation 1988-1994: Manager, Global Investments, PanAgora Asset Management 1987-1988: Manager, Equity Investments, The Boston Company
John Campbell, Ph.D. PARTNER	Develops and implements the firm's research agenda	1999	24	Yale University, Ph.D. in Economics: 1984 Oxford University, B.A. in Economics: 1979	1994–Present: Professor of Applied Economics, Harvard University 1998–1999: Director of External Research, PanAgora 1992–1998: Academic Advisory Committee, PanAgora 1984–1994: Professor of Economics, Princeton University

BIOGRAPHIES

NAME/TITLE	RESPONSIBILITIES	BEGAN AT FIRM	YRS. EXP.	EDUCATION	PRIOR EXPERIENCE
INVESTMENT PROFESSIONALS					
John Capeci, Ph.D. PARTNER	Implements the firm's investment strategies	1999	22	Princeton University, Ph.D. in Economics: 1990 Harvard University, A.B. in Economics: 1984	1998–1999: Director of Research, PanAgora 1994–1998: Senior Investment Manager, PanAgora 1990-1995: Assistant Professor, Brandeis University
Manolis Liodakis, Ph.D. PARTNER	Implements the firm's investment strategies	2012	18	City University, London, Ph.D. in Finance: 1999 University of Birmingham, MBA in Finance: 1996 Athens University of Economics & Business, B.S. in Economics & Business: 1994	2008-2011: Managing Director of Global Equities Hybrid Strategies, Citadel Asset Management 2001-2008: Managing Director-Head of European Quantitative Equity Research, Citigroup Global Markets 2000-2001: Strategist, Morgan Stanley 1998-2000: Associate, Salomon Brothers
Michelle Morphew, CFA MANAGER	Implements the firm's investment strategies	2010	16	University of Pennsylvania, MBA in International Financial Analysis and MA in International Studies: 2001 Harvard University, AB in Social Studies: 1994	2005–2010: Product Specialist, Wellington Management 1997–2004: European Equity Analyst, Putnam Investments
Alex Ogan PARTNER	Implements the firm's investment strategies	2005	11	Harvard College, A.B. in Economics: 2005	2003-2004: Project Engineer, Aaxis Technologies
George Pararas, CFA PARTNER	Implements the firm's investment strategies	2002	20	Babson College, MBA in Finance: 2011 Georgetown University, B.S. in Business Administration: 1996	2000–2002: Analyst, Putnam Investments 1998–2000: Senior Investment Associate, PanAgora 1996–1998: Registered Representative, Fidelity Investments
Michael Zervas, CFA PARTNER	Implements the firm's investment strategies	2004	15	Stonehill College, B.S. in Business Administration: 2001	2001–2004: Consultant, FactSet Research Systems

BIOGRAPHIES

NAME/TITLE	RESPONSIBILITIES	BEGAN AT FIRM	YRS. EXP	EDUCATION	PRIOR EXPERIENCE
INVESTMENT PROFESSIONALS					
Sam Thompson, Ph.D. PARTNER	Designs, develops, and maintains the investment systems used to support the management of client portfolios	2005	11	University of California at Berkeley, Ph.D. in Economics and M.A. in Statistics: 2000 Yale University, B.A. in Economics: 1995	2005-2006: Consultant, Arrowstreet Capital 2004-2005: Associate Professor of Economics, Harvard University 2000-2004: Assistant Professor of Economics, Harvard University
Marta Campillo, Ph.D. PARTNER	Designs, develops, and maintains the investment systems used to support the management of client portfolios	1999	20	Boston University, Ph.D. in Economics: 2000 Universidad Complutense, M.A.: 1992 Institute of Fiscal Studies, M.A.: 1990 Universidad de Autonoma, B.S.: 1989	1997-1999: Teaching Assistant – Dept. of Economics, Boston University 1995-1997: Research Assistant – Prof. Jeffrey Miron, Boston University 1990-1993: Research Associate-Foundation of Applied Economics Studies, FEDEA
Tuomo Vuolteenaho, Ph.D. PARTNER	Develops and implements the firm's research agenda	2004	13	University of Chicago, Ph.D. in Finance: 2000 Helsinki School of Economics and Business Administration, M.S. in Economics: 1995	2004: Consultant, Arrowstreet Capital 2000–2004: Assistant Professor of Economics, Harvard University 1995–2000: Teaching Assistant, University of Chicago
Alex Merlis, CFA PARTNER	Develops and enhances the firm's forecasting and risk models	2006	15	Boston University, M.A. in Mathematical Finance: 2006 Harvard University, A.B. in Physics and S.M. in Engineering Sciences: 1996	2003-2005: Quantitative Long/Short Analyst, Citadel Investment Group 2002-2003: Quantitative Analyst, StarMine Corp.
Derek Vance, CFA PARTNER	Develops and enhances the firm's forecasting and risk models	2008	9	Harvard College, A.B. in Economics: 2007	2007-2008: Analyst, Goldman Sachs
Yijie Zhang, Ph.D. PARTNER	Develops and enhances the firm's forecasting and risk models	2006	10	Yale University, Ph.D. in Finance: 2006 Rutgers University, M.S. in Economics: 2000 Tsignhua (Qinghua) University, B.A. in Finance: 1997	2003-2006: Teaching Assistant, Yale University

BIOGRAPHIES

NAME/TITLE	RESPONSIBILITIES	BEGAN AT FIRM	YRS. EXP.	EDUCATION	PRIOR EXPERIENCE
BUSINESS DEVELOPMENT					
Michael Stanton, CFA PARTNER	Responsible for the firm's sales and marketing efforts	2006	22	Colby College, B.A. in Government: 1992	2000–2006: Managing Director of Consultant Relations, Babson Capital Management 1994–2000: Consultant Relations Associate, Putnam Investments 1993–1994: Investor Services, Putnam Investments
Matthew B. Coll, CFA MANAGER	Responsible for the firm's sales and marketing efforts	2015	23	The Wharton School of the University of Pennsylvania, M.B.A.: 1994 Georgetown University, B.S.B.A. in Finance: 1987	2009 – 2014: Partner, Business Development, Consultant Relations, and Relationship Management, Westfield Capital Management 1996 – 2008: Associate Partner, Marketing & Relationship Management, Wellington Management 1994 – 1996: Associate, CSC Index 1988 – 1992: Finance Manager, MCIC
Neil Garceau MANAGER	Responsible for the firm's sales and marketing efforts	2010	20	Bentley University, M.S. in Finance: 1999 University of Rhode Island, B.S. in Accounting: 1992	2002-2009: Institutional Relationship Manager, The Boston Company Asset Management 1998-2002: Senior Financial Analyst, The Boston Company Asset Management 1995-1998: Senior Legal and Compliance Analyst, The Boston Company Asset Management 1993-1995: Senior Financial Auditor, Mellon Financial Corporation
Peter May MANAGER	Responsible for the firm's sales and marketing efforts	2015	17	Tuck School of Business at Dartmouth College, MBA: 2003 Amherst College, B.A. in Psychology: 1996	2010-2013: Director, Institutional Client Service, Artio Global Investors 2004-2010: Account Manager, Wellington Management Company 2003-2004: Consultant, Monitor Group 2000-2001: Research Associate, Forrester Research 1996-2000: Communications Manager, Pioneer Investments
Anne Luisi MANAGER	Investment Specialist	2014	11	Darden School of Business, MBA in Business Administration: 2012 Dartmouth College, B.S. in Economics: 2002	2011-2014: Associate – Investment Specialist, J.P. Morgan Private Bank 2002-2008: Associate - High Yield Credit Sales, J.P. Morgan Securities

BIOGRAPHIES

NAME/TITLE	RESPONSIBILITIES	BEGAN FIRM	YRS. EXP.	EDUCATION	PRIOR EXPERIENCE
CLIENT RELATIONSHIP MANAGEMENT					
Jon Simon, CFA MANAGER	Responsible for the firm's client service efforts	2014	24	Boston College, M.S. In Finance: 2004 and B.S. in Finance: 1991	2004-2014: Director, Client Service, Batterymarch Financial Management 2001-2002: Institutional Client Service, Barclays Global Investors 1994-2001: Defined Contribution Specialist, MFS Investment Management 1992-1994: Associate, Aetna Investment Services

ADDITIONAL DISCLOSURES: GLOBAL MINIMUM VOLATILITY EQUITY

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[1] Target Value Added are our ex-ante objective for outperformance per year relative to benchmarks over full market cycles (4-5 years), based upon our assessment of the available investment opportunities when portfolios are run at the respective tracking error ranges indicated above. The Tracking Error is the range of ex-ante annualized standard deviation of the difference between the composite and composite benchmark returns we expect given our investment style. Target "Info" (Information) Ratio equals Target Value Added divided by the internal ex-ante expectations of full market cycle average tracking error.

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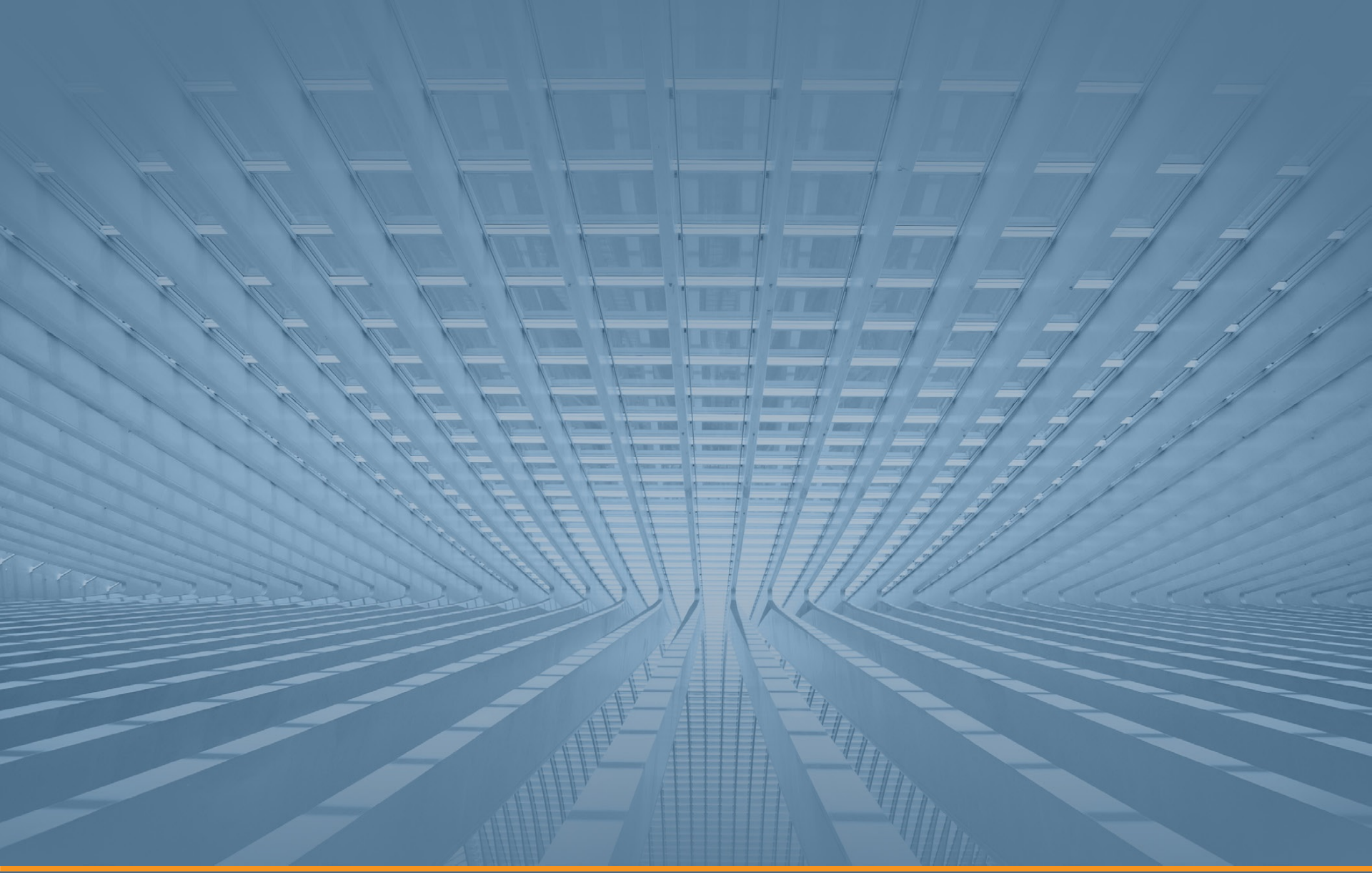

LOS ANGELES CAPITAL

OREGON INVESTMENT COUNCIL
GLOBAL MANAGED VOLATILITY EQUITY

OCTOBER 26, 2016

LOS ANGELES

C A P I T A L

LEGAL DISCLOSURES

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Unless otherwise indicated, the information in this presentation is as of the date listed on the cover page.

LOS ANGELES CAPITAL

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V. APPENDIX

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LOS ANGELES

CAPITAL

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LOS ANGELES CAPITAL

PEOPLE

- Senior investment team averages 30+ years of experience
- Team-based approach promotes cross-training and diversity of thought
- 28 employees own 100% of the Firm
- Recognized by P&I as one of the "Best Places to Work in Money Management" in 2014 and 2015

INSIGHTS

- Investment process dynamically adapts to changing market conditions
- Valuation, earnings, financial, market and management factors drive stock selection
- Research blends fundamental and quantitative methods

RESULTS

- Consistent excess returns across market environments
- Alphas uncorrelated with the majority of both fundamental and quantitative equity managers
- 19 out of 21 composites with track records longer than one year have outperformed on a gross basis since inception

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ASSETS UNDER MANAGEMENT

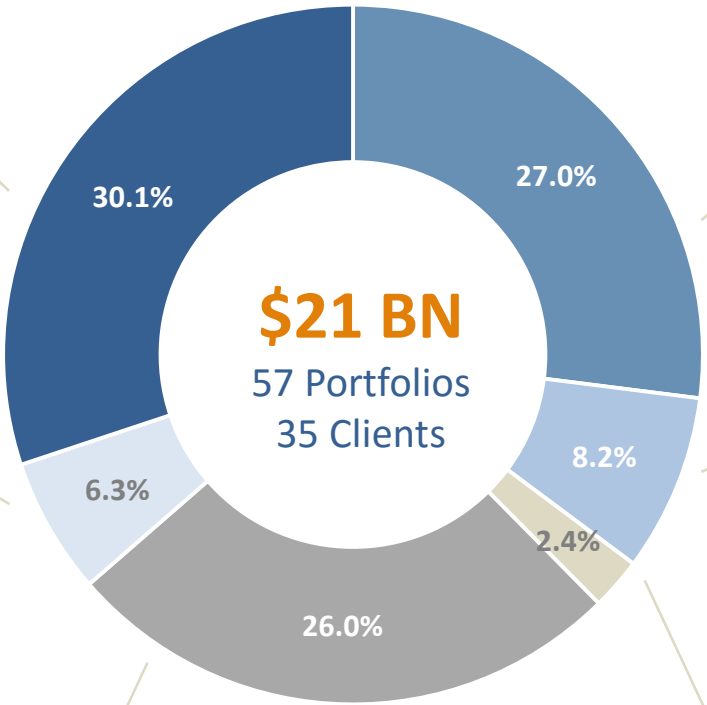
September 30, 2016

Global
$6.3 BN
World, ACWI, ACWI ex U.S., EAFE, Europe
Managed Volatility

Emerging Markets
$5.7 BN

Long/Short Active Extension
$1.4 BN
U.S., U.S. Value, EAFE

U.S. All Cap
$1.7 BN
Core
Deep Value, Managed Volatility



U.S. Small/Mid Cap
$508 M
Core, Growth, Value

U.S. Large Cap
$5.4 BN
Core, Growth, Value

Total Managed Vol
$1.2 BN

DIVERSIFIED BUSINESS
- 74% Institutional Plan Sponsors*
- 26% Sub Advised Funds

DIVERSIFIED CLIENTS
- 62% U.S.
- 38% Non-U.S.

As of 9/30/2016; Global Assets include ACWI and Global Developed strategies. Active Extension includes U.S. & EAFE applications; Institutional Plan Sponsors include: government and corporate pension plans, foundations, religious organizations, endowments, advised private funds, Taft-Hartley plans, proprietary accounts, and related private funds. Sub-advised funds includes sub-advised U.S. and non-U.S. mutual funds, UCITS and CITs. Diversified business and clients based on AUM.

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THE FIRM

Investment Committee

BOARD OF DIRECTORS

Thomas D. Stevens, CFA
President, CEO, Chairman
Portfolio Management
MBA, Univ. of Wisconsin
40 Years Experience/14 With Firm

Hal W. Reynolds, CFA
Chief Investment Officer
Portfolio Management
MBA, Univ. of Pittsburgh
34 Years Experience/14 With Firm
• Investment Committee Chair

Daniel E. Allen, CFA
Director of Global Equities
Portfolio Management
MBA, Univ. of Chicago
33 Years Experience/7 With Firm

Stuart K. Matsuda
Director of Trading
Trading
MBA, Cal State University Northridge
29 Years Experience/14 With Firm

RESEARCH

Edward Rackham, Ph.D.
Co-Director of Research
PhD, Oxford University
11 Years Experience/5 With Firm

Bradford J. Rowe, CFA
Co-Director of Research
MBA, Univ. of Wisconsin
15 Years Experience/9 With Firm

Fanesca Young, Ph.D., CFA
Director of Quant Research & Managing Director
PhD, Columbia University
11 Years Experience/8 With Firm

Charles Fann, CFA
Director of Investment Technology
BA, Univ. of California at Los Angeles
13 Years Experience/12 With Firm

74 Employees

100% Employee Owned

Investment Committee – 20 Years Average Experience

TRADING

Christine M. Kugler
Director of Implementation
BA, Univ. of California at Santa Barbara
23 Years Experience/14 With Firm

PORTFOLIO MANAGEMENT

Laina Draeger, CFA
Portfolio Manager
MBA, Univ. of San Francisco
9 Years Experience/9 With Firm

Kristin Ceglar, CFA
Portfolio Manager
BA, Harvard University
11 Years Experience/11 With Firm

Daniel Arche, CFA
Portfolio Manager
BA, Univ. of Southern California
10 Years Experience/9 With Firm

Stable & Experienced

As of 09/30/2016. All Investment Committee members listed above are principals of Los Angeles Capital.

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BENEFITS OF LOW VOLATILITY PORTFOLIOS

- Downside Protection
- Higher Active Share
- Improved Sharpe Ratios
- Superior Liability Match

KEYS TO SUCCESSFUL IMPLEMENTATION

- Valuation/ Factor Crowding
- Forward Looking Risk Process
- Portfolio Diversification
- Cost Management

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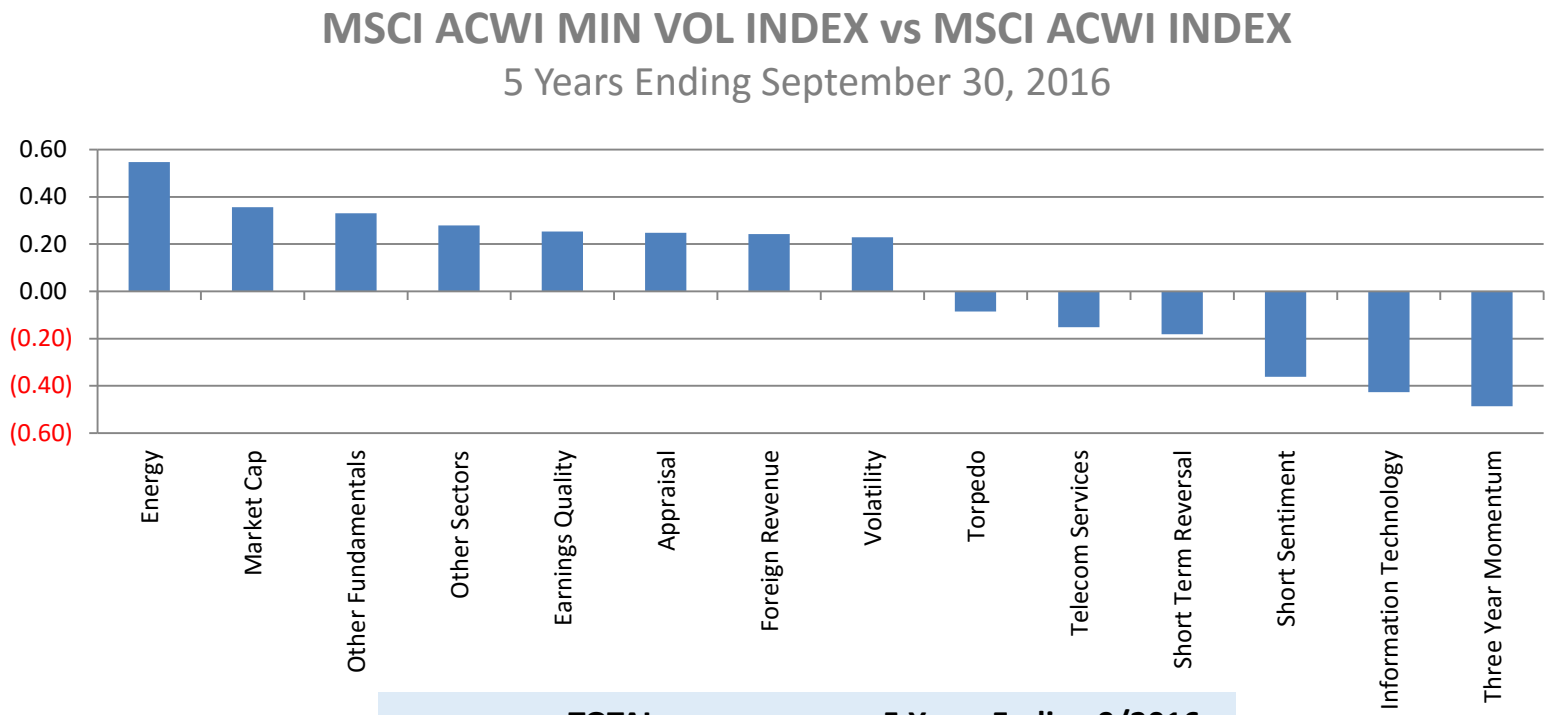
DRIVERS OF LOW VOLATILITY PERFORMANCE



TOTAL	5 Years Ending 9/2016
MSCI ACWI Min Vol	12.29
MSCI ACWI	11.27
Benefit to Min Vol	1.02

Recent Low Vol portfolios returns driven by more than Low Vol

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INVESTOR PREFERENCE THEORY®

We believe a stock's expected return is a function of its risk exposures and their expected payoff in the current market environment.

Dividend Discount Model
Stock's expected return is the discount rate which equates tomorrow's dividends with today's stock price

Fama French Model
Investors price multiple risks: Beta, Size, and Style

Investor Preference Theory®

Capital Asset Pricing Model
Market prices are based on level of risk

In contrast to peers, we believe that investor preferences are shaped by current market conditions, not past performance.

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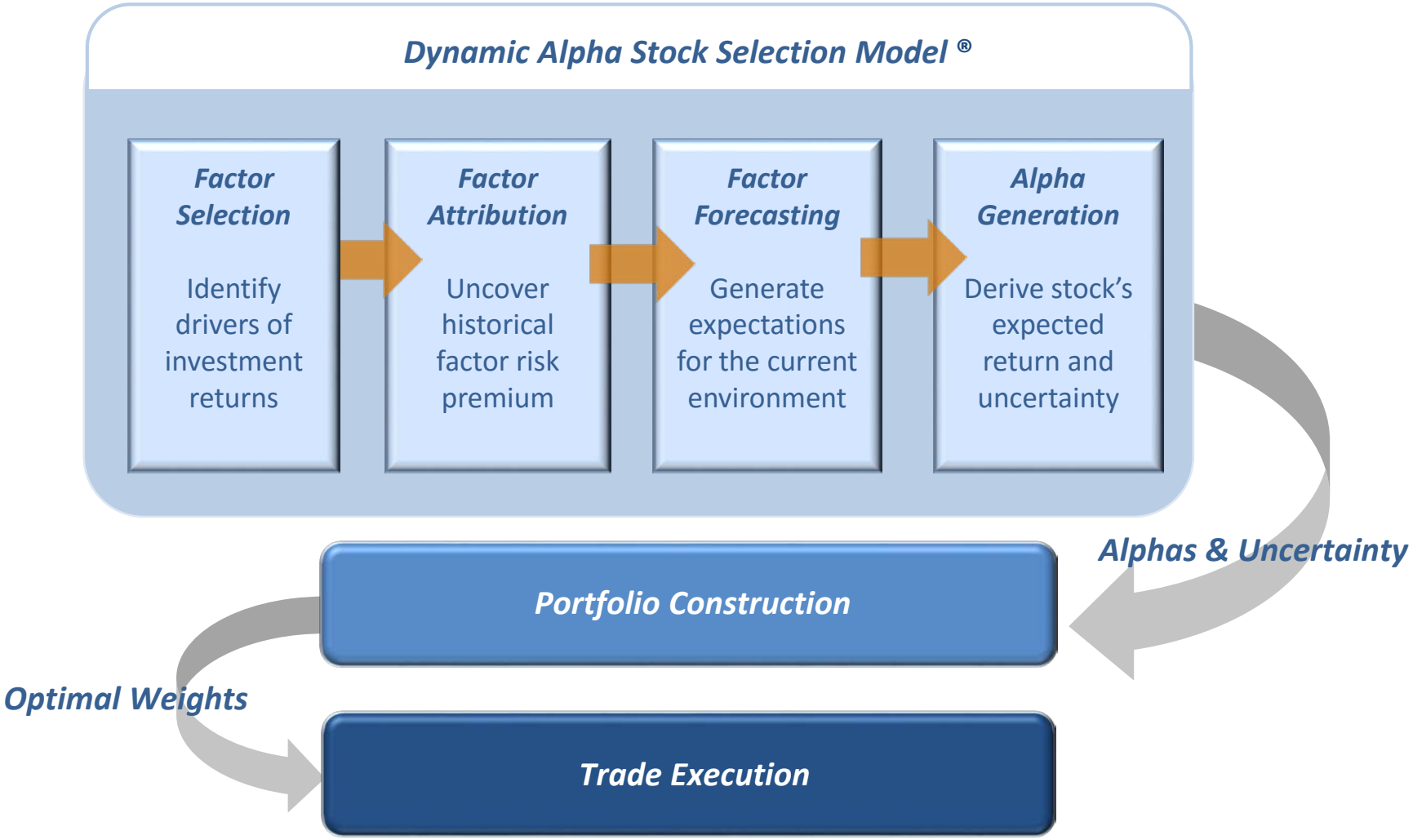
INVESTMENT PROCESS OVERVIEW



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GLOBAL FACTOR INPUTS*

Los Angeles Capital's Dynamic Alpha Stock Selection Model®

Company Fundamentals

Valuation	Earnings	Market	Financial	Management
Earnings Yield	Analyst Insight	Market Cap	Distress	Earnings Quality
Book to Price	Profitability	Short Term Reversal	Leverage	Change in Shares
Yield	Torpedo	One Year Momentum	Foreign Revenue	Short Sentiment
Appraisal		Three Year Momentum	Pension Risk	
		Volatility		

Market Sectors

Basic Materials
Consumer Discretionary
Consumer Staples
Energy
Finance
Health Care
Industrials
Real Estate
Technology
Telecom
Utilities

Regions/Countries

North America
Pac ex Japan
Japan
Europe
Emerging Markets

*This is representative of the Global Factor Inputs as of 08/31/2016; Factor lists may vary slightly by region and by market segment.

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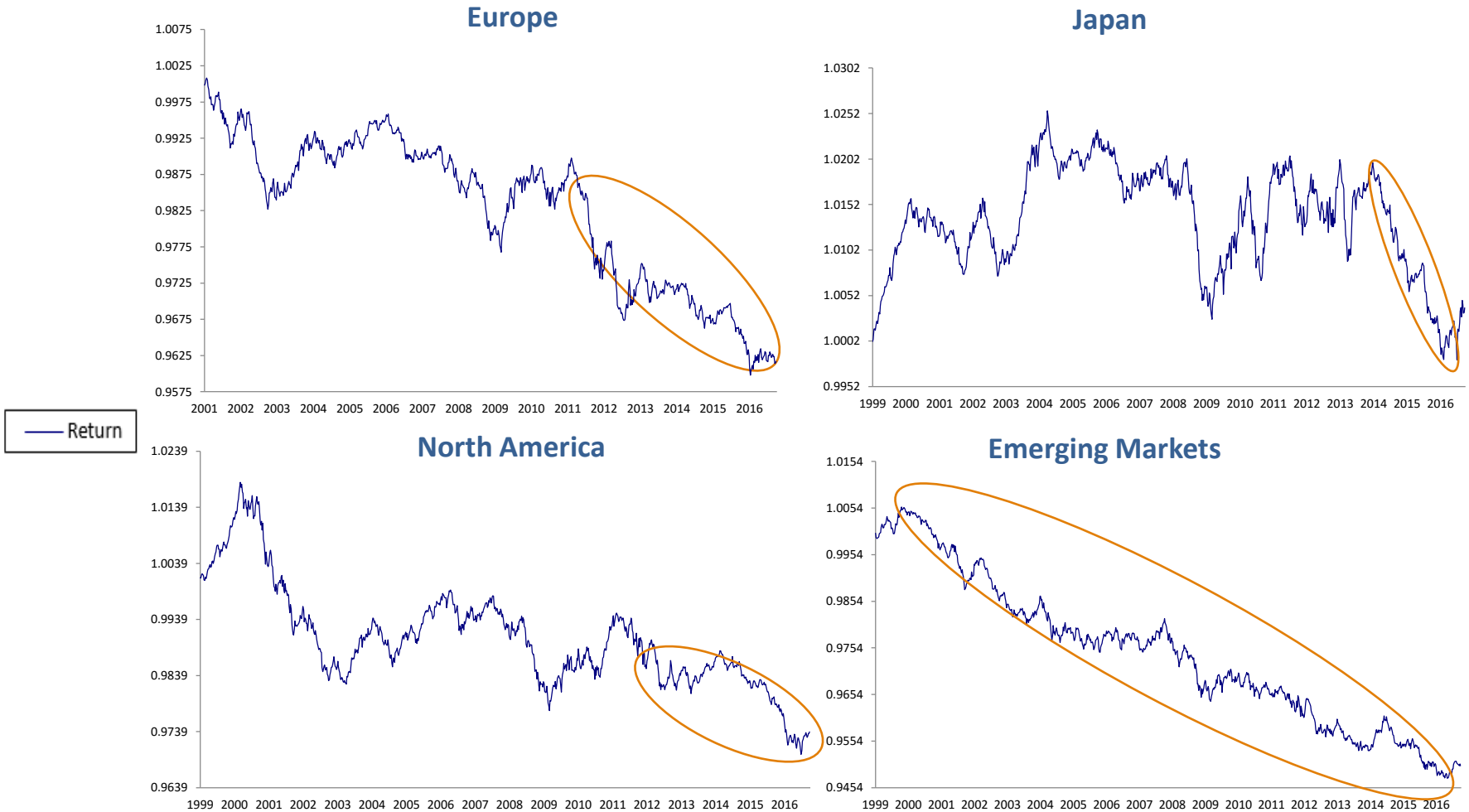
INVESTOR PREFERENCES

Applying Volatility Globally



The return plots the normalized return for the factor as determined by a proprietary regression based analysis of stock data and overall market performance.
This factor analysis should be read in connection with important disclosures set forth at the end of this presentation under the heading "Factor Analyses".

As of 9/30/2016

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FORECAST ALPHA

Los Angeles Capital's Dynamic Alpha Stock Selection Model®

GLOBAL ALPHA EXAMPLE

SELECT FACTORS

	Europe Factor Forecast	Swedish Match Factor Exposure	Swedish Match Alpha Component	Accor Factor Exposure	Accor Alpha Component
Volatility	-0.14	-1.13	0.15	-0.03	0.00
Analyst Insight	0.22	0.64	0.14	-1.63	-0.37
Earnings Quality	0.16	1.67	0.27	-1.67	-0.27
Market Capitalization	-0.35	-0.81	0.28	-0.24	0.08
Momentum	0.36	1.37	0.49	-1.23	-0.44
Country					
Sweden	0.30	Sweden	0.30		
France	-0.06			France	-0.06
Sector					
Staples	0.06	Staples	0.06		
Discretionary	-0.16			Discretionary	-0.16
			⋮		⋮
Alpha Forecast			**0.98**		**-1.17**

Swedish Match develops, manufactures, markets, and sells tobacco products worldwide. Accor operates a chain of hotels worldwide.

As of 9/30/2016 Holdings should be considered "Supplemental Information." The issuers or securities noted above or elsewhere in this document are provided as illustrations or examples only, for the limited purpose of analyzing general market or economic conditions, and may not form the basis for an investment decision. Los Angeles Capital makes no representation as to whether any security (or the security of any issuer) mentioned is now or was ever held in any Los Angeles Capital portfolio. Los Angeles Capital is not recommending the purchase, sale or holding of any security and is making no representation or indication of its own holdings of any securities. Los Angeles Capital may in fact be currently recommending the purchase of a security or the sale of a security regardless of any statement made about that security or whether Los Angeles Capital owns it or not. Discussions of securities are strictly for educational use only and are not intended to serve as investment advice. Any statement made herein, including any statement or implication drawn from any discussion of individual securities, is subject to change at any time, without notice.

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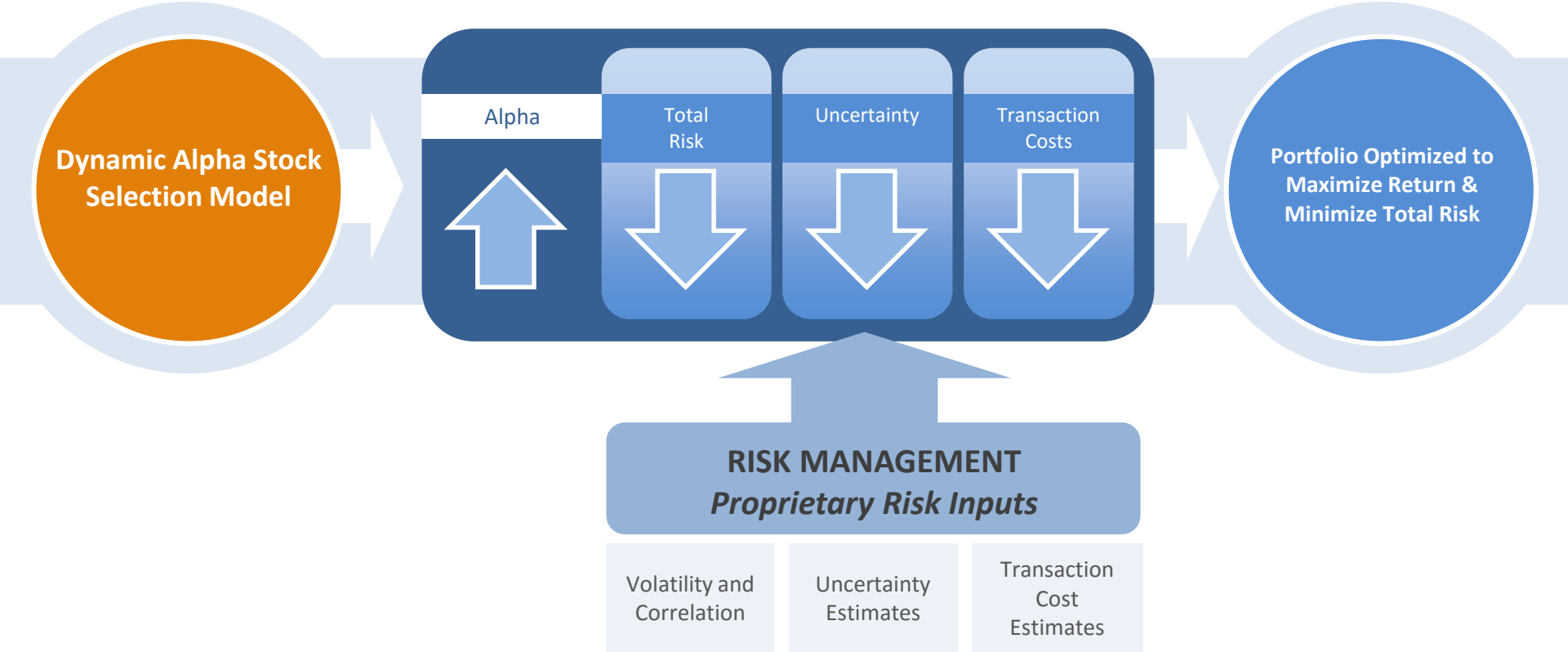
MANAGED VOL PORTFOLIO CONSTRUCTION

DYNAMIC RISK BUDGETING



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GLOBAL MANAGED VOLATILITY EQUITY

Portfolio Objectives and Constraints

Objective: *Maximize total return subject to a penalty to total risk, alpha uncertainty and trading costs to generate superior Sharpe ratios*

Constraints vs. capitalization weighted market index

- Universe: MSCI ACWI
- Max Tracking error of 5%
- Countries +/-5%
- Sectors +/- 6%
- Securities +/-1.5% or 20x weight
- Turnover ~ 80% annual
- Minimum beta .7

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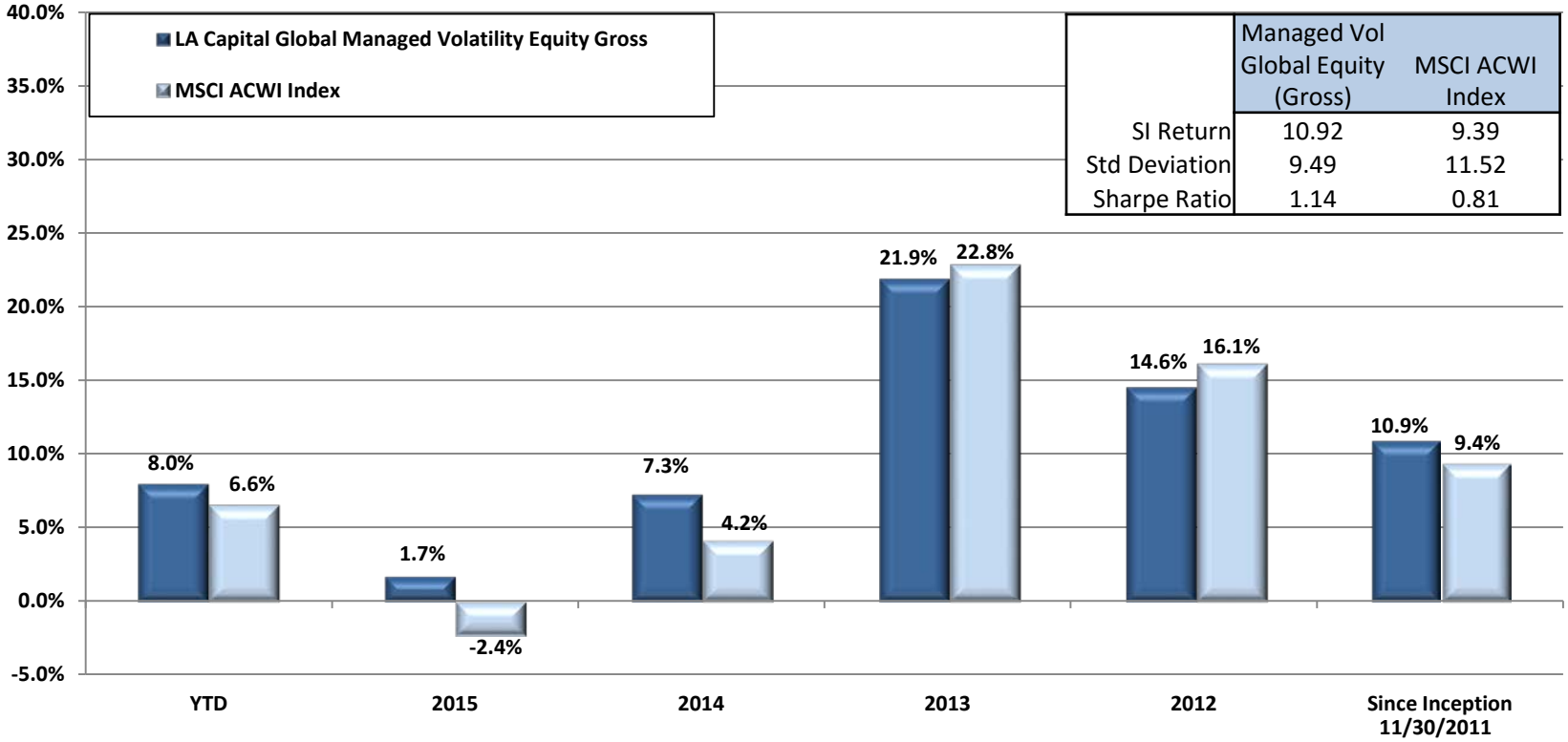
LA CAPITAL GLOBAL MANAGED VOLATILITY

*September 31, 2016**



	Managed Vol Global Equity (Gross)	MSCI ACWI Index
SI Return	10.92	9.39
Std Deviation	9.49	11.52
Sharpe Ratio	1.14	0.81

SAMPLE PORTFOLIO PARAMETERS

Investment Objective	MSCI ACWI Index +3%	**Risk Budget**	5% tracking error
Number of Stocks	300 - 500	**Turnover**	average 60 - 80%
Sector Bets	+-6%	**Security Bets**	+-2%
Country Bets	+-5%	**Fee Schedule**	See Appendix

*preliminary returns as of 10/11/16

Composite returns are presented both gross and net of fees. Gross returns are net of non-reclaimable withholding taxes and trading expenses. Net returns are reduced by the highest applicable management fee for this product (0.60%). All returns reflect the reinvestment of dividends and other earnings. Returns are impacted by economic conditions which may or may not persist into the future and the potential for profit is accompanied by the possibility of loss. All valuations are computed and performance is reported in USD. Please see the "LA Capital Global Managed Volatility Equity Composite" as provided at the end of this book for further disclosures. The portfolio parameters suggested above represent Los Angeles Capital's suggested parameters for the strategy and are not indicative of each of the portfolios comprised in the composite.

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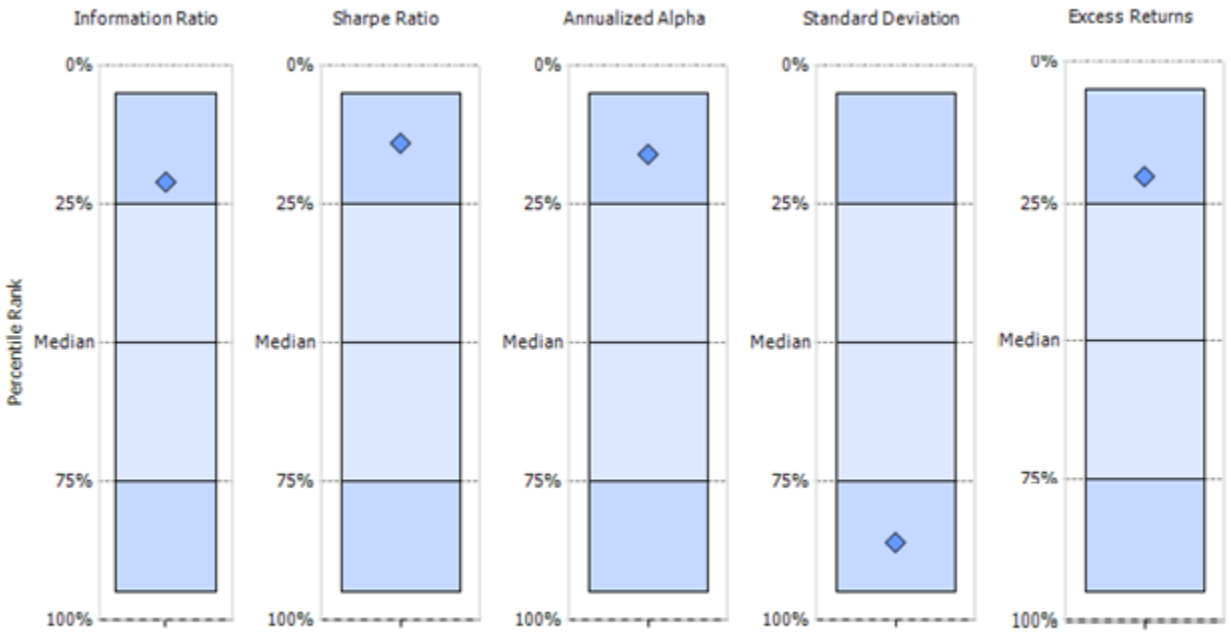
UNIVERSE RANKINGS

June 30, 2016

Three Year Statistics vs. eVestment Global Large Cap Core Equity vs. MSCI ACWI-ND Displayed In US Dollar (USD)



	Information Ratio	Sharpe Ratio	Annualized Alpha	Standard Deviation	Excess Returns
Median	0.51	0.65	1.89	11.81	1.56
Product	**0.90**	**0.94**	**4.49**	**10.14**	**3.58**
Rank	**21**	**14**	**16**	**86**	**20**

eVestment Alliance, LLC and its affiliated entities (collectively, "eVestment") collect information directly from investment management firms and other sources believed to be reliable, however, eVestment does not guarantee or warrant the accuracy, timeliness, or completeness of the information provided and is not responsible for any errors or omissions. Performance results may be provided with additional disclosures available on eVestment's systems and other important considerations such as fees that may be applicable. Not for general distribution and limited distribution may only be made pursuant to client's agreement terms. * All categories not necessarily included, Totals may not equal 100%. Copyright 2012-2016 eVestment Alliance, LLC. All Rights Reserved.

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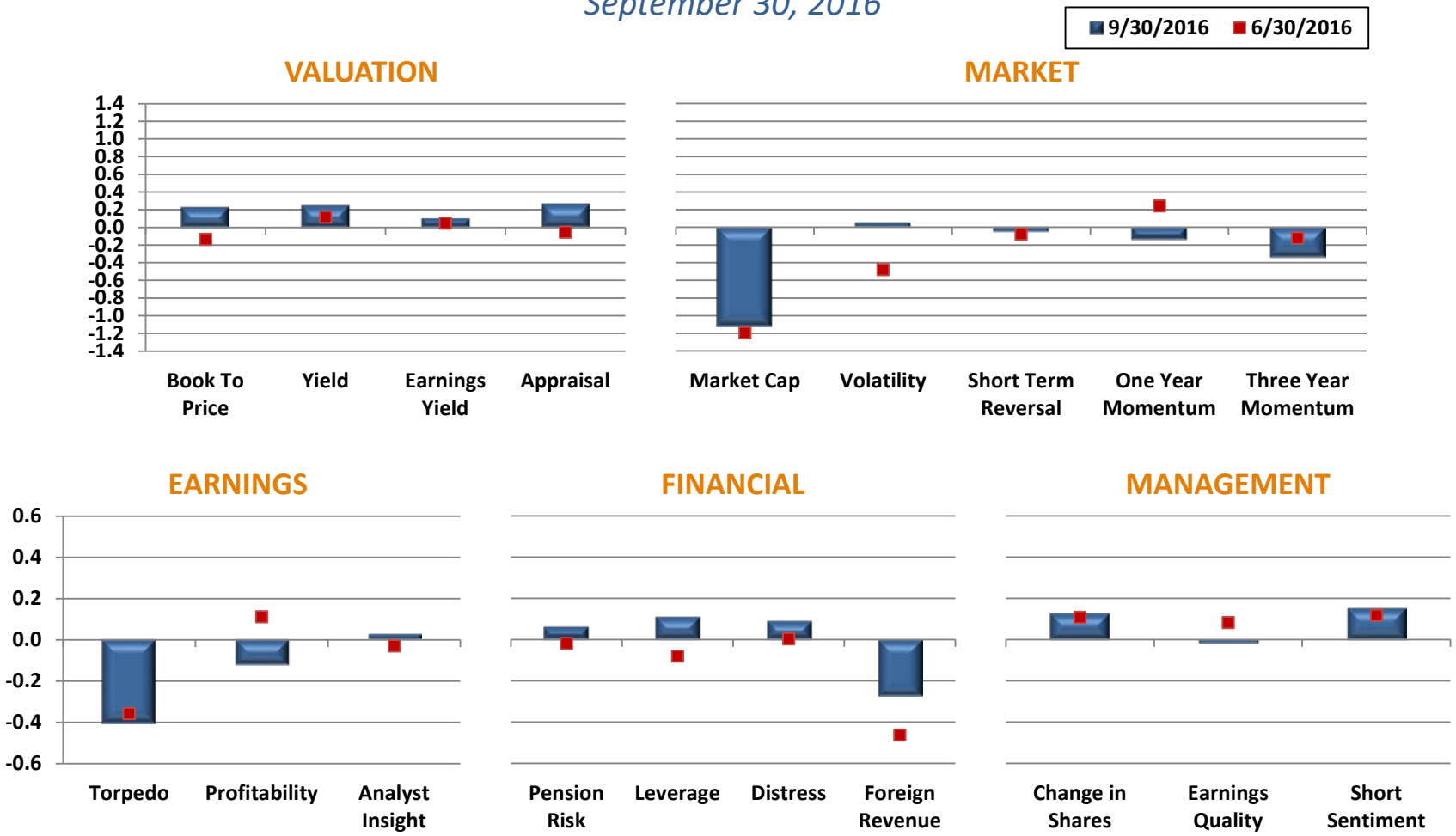
ACTIVE FACTOR EXPOSURES*

September 30, 2016



* Selected fundamental factors normalized, relative to MSCI All Country World Index

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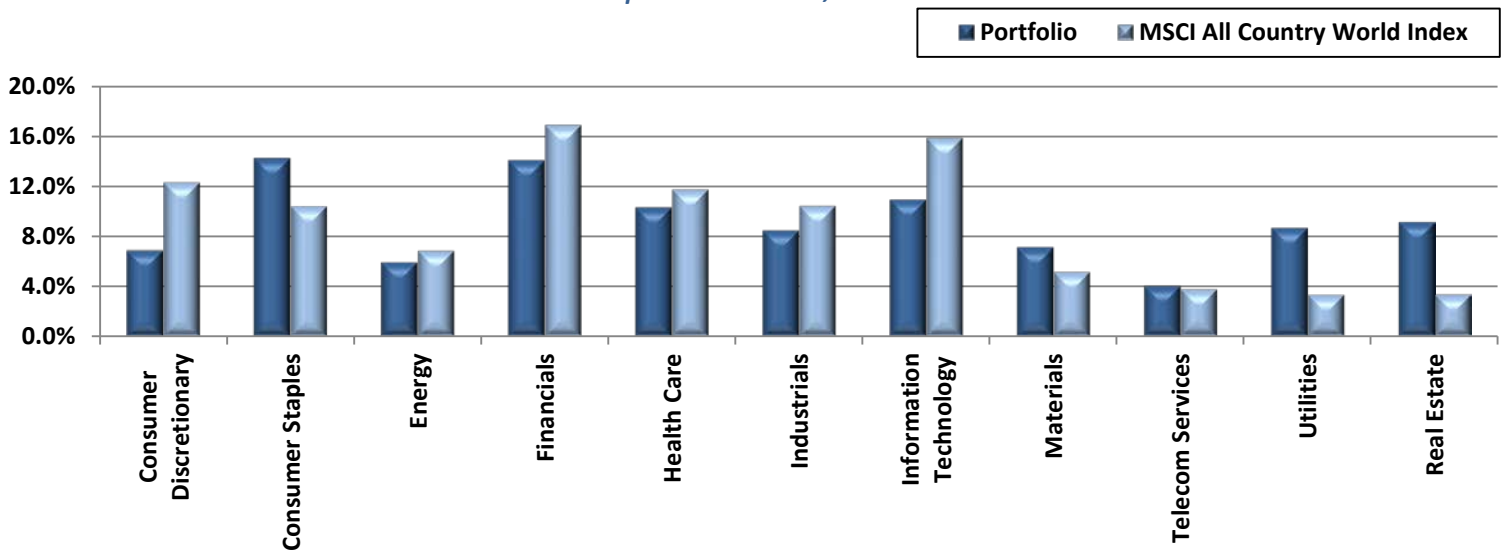
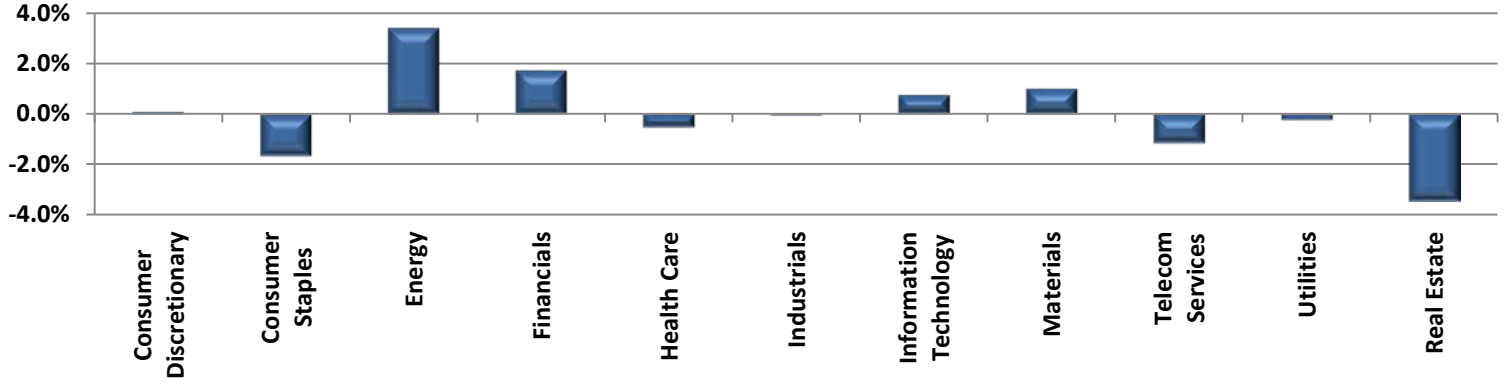
SECTOR WEIGHTS

September 30, 2016



Portfolio Change in Sector Exposures June 30, 2016 - September 30, 2016



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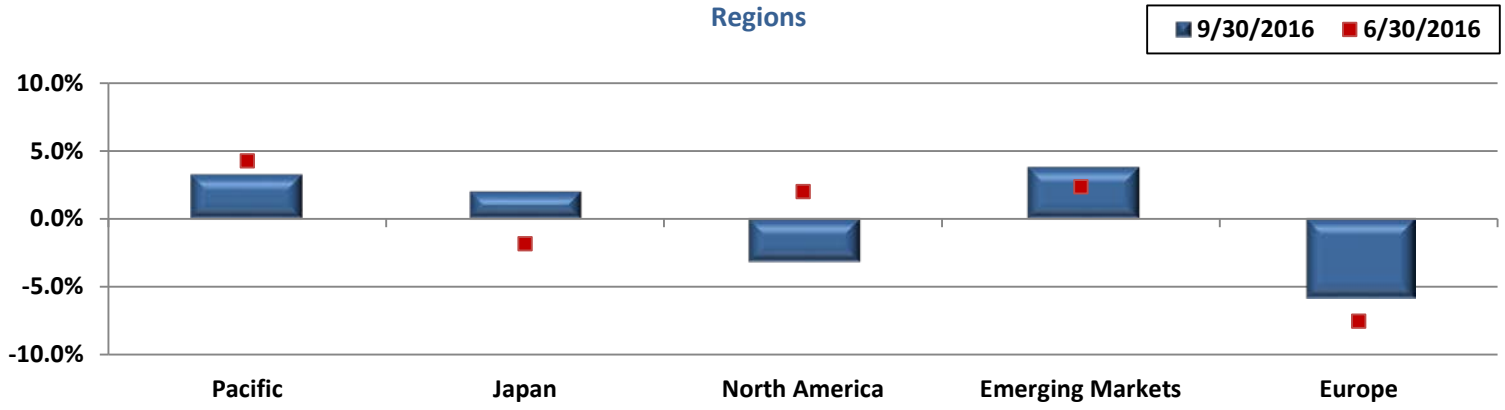
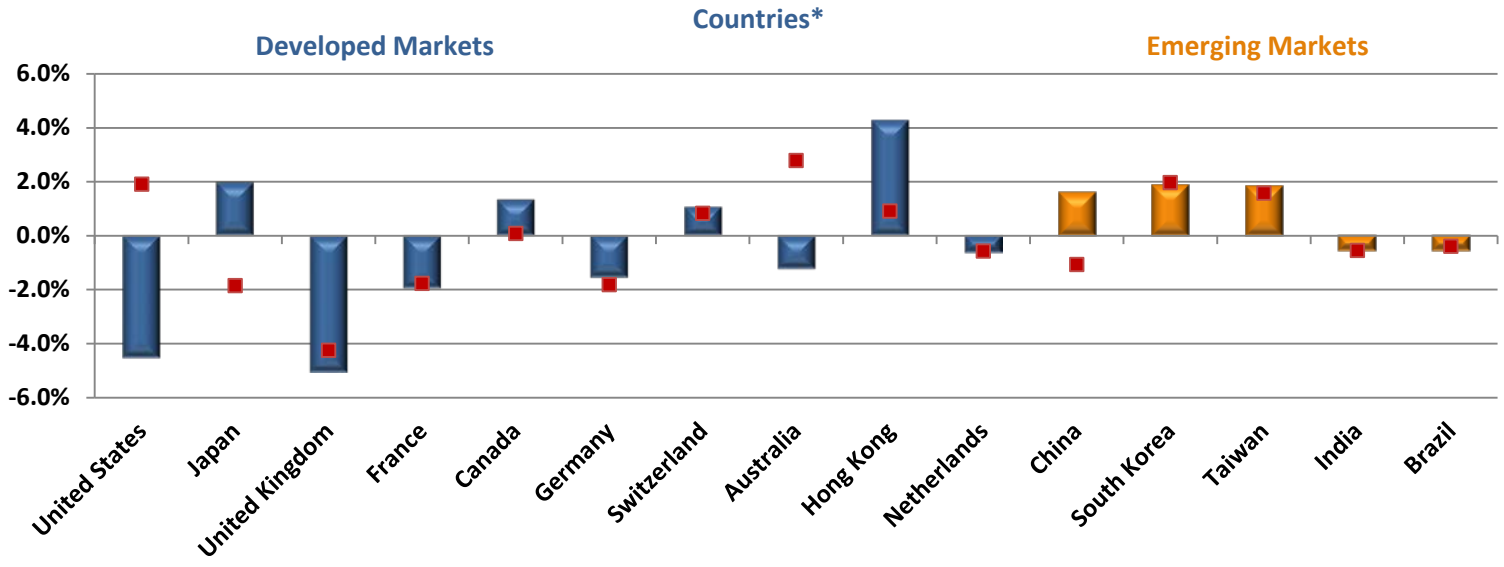
ACTIVE COUNTRY WEIGHTS

Portfolio vs. MSCI All Country World Index





* Top 10 Developed Markets countries and top 5 Emerging Markets countries determined by market capitalization

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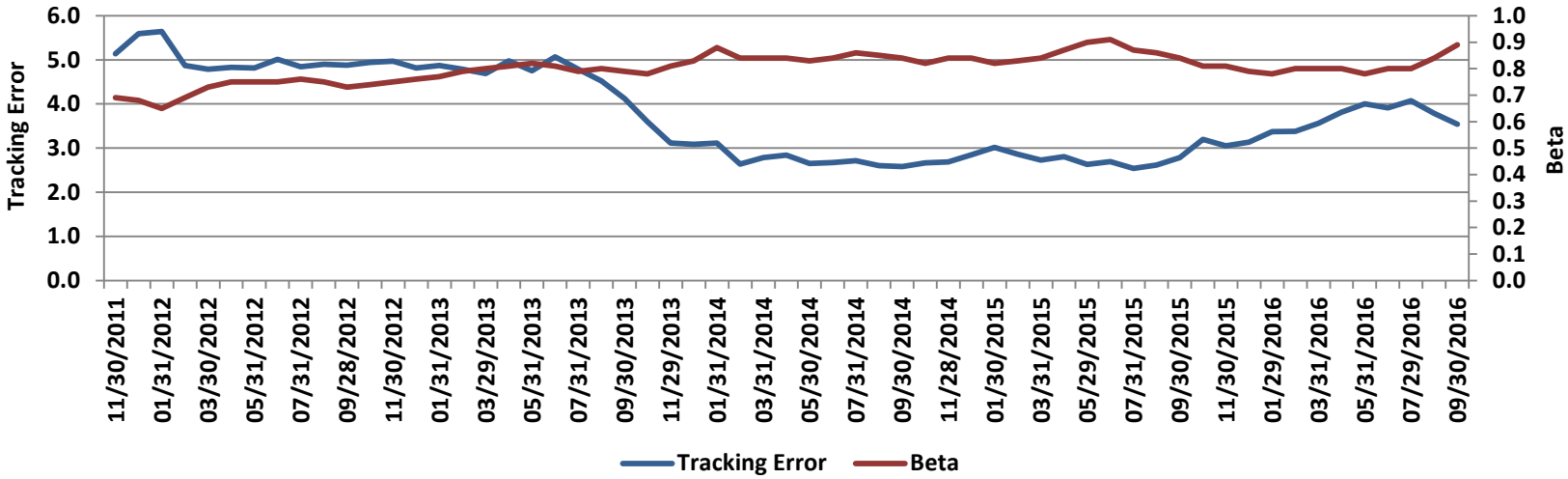
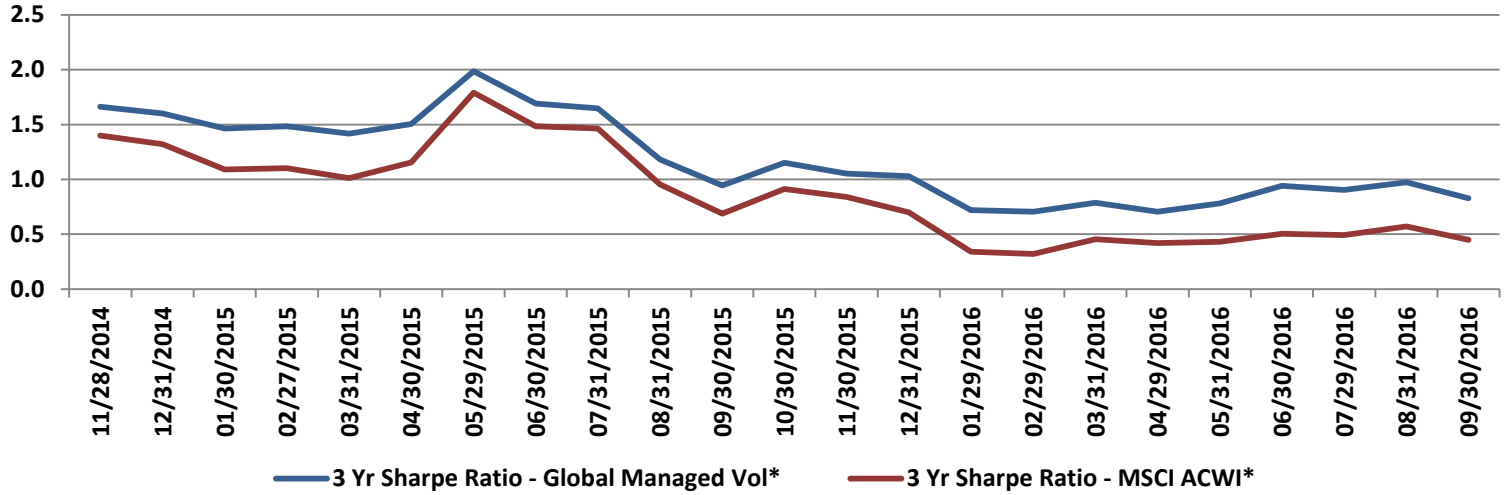
RISK PROFILE THROUGH TIME





Tracking Error and Beta from Wilshire GR6 risk model against MSCI All Country World Index
*Source: eVestment Analytics

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UNIQUE ASPECTS OF LOS ANGELES CAPITAL'S APPROACH

- **Los Angeles Capital's approach captures the benefits of low volatility investing while controlling key investment risks**
  - Return estimation linked directly to low volatility return drivers
  - Dynamic process adapts to changing market conditions
  - Proprietary risk management blends benefits of fundamental, statistical and alpha uncertainty models
  - Proprietary trading algorithms tailored to stock selection minimize implementation costs
  - Forward looking investment approach generates consistent Sharpe ratios
- **Low correlation with other managers**
- **Senior team members an average of 30 years of experience building risk models and managing risk controlled portfolios**

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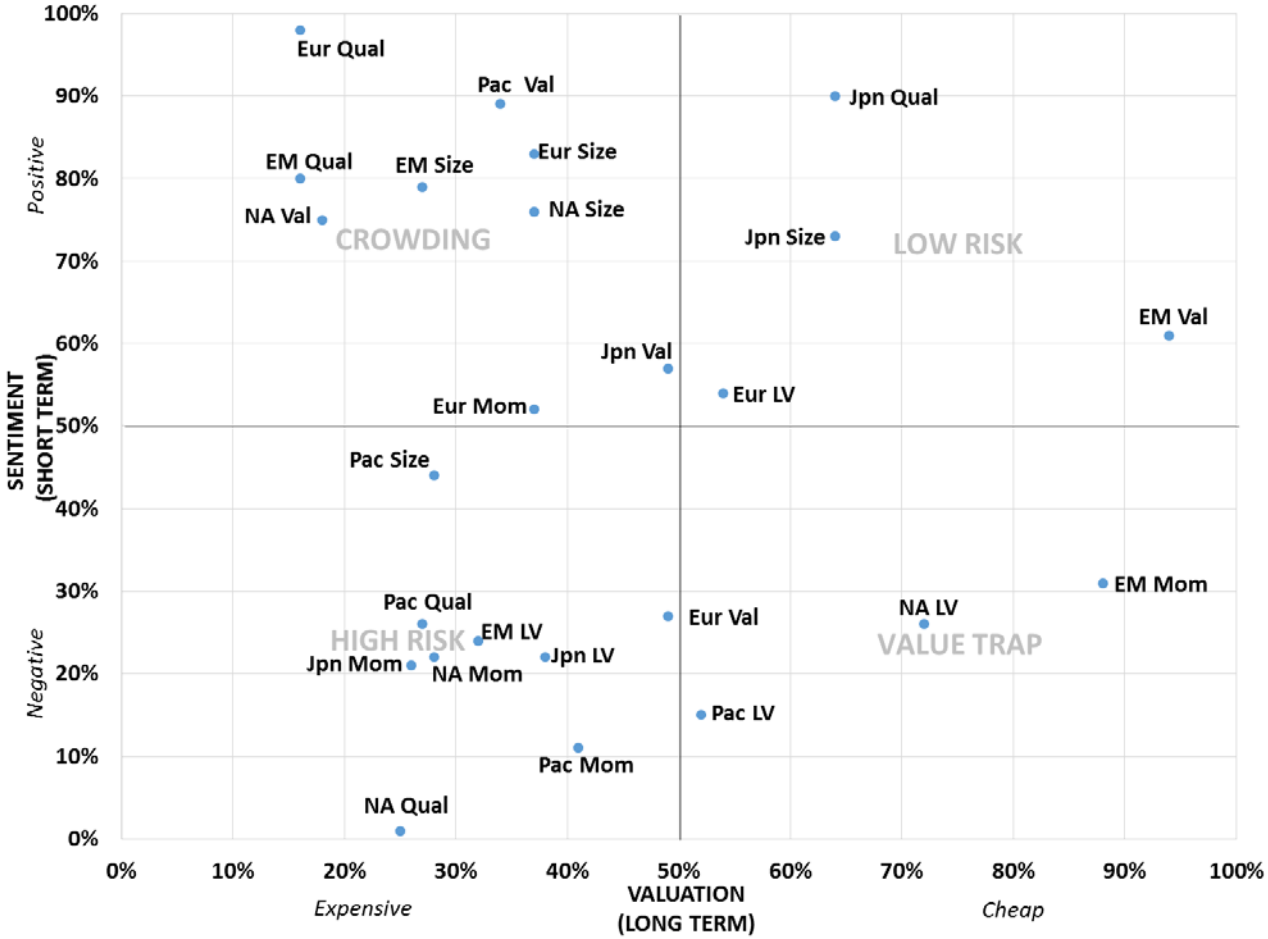
GLOBAL FACTOR OUTLOOK MAP

September 30, 2016



As of September 30, 2016, the position relative to the historical distribution starting April 1, 2002
Long Term represents Los Angeles Capital Dynamic Alpha Model long term forecasts
Short Term represents Los Angeles Capital Dynamic Alpha Model forecasts

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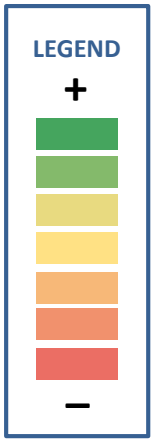
GLOBAL FACTOR ANALYSIS – ALPHA DRIVERS

*Correlation Between Factors and Expected Returns**
September 30, 2016

		U.S.	Europe	Japan	Pacific ex Japan	Emerging Markets
Earnings	Analyst Insight	-0.09	0.21	-0.34	0.21	0.66
	Profitability	-0.23	-0.06	-0.18	-0.17	0.08
	Torpedo	-0.15	-0.04	0.06	0.37	0.18
Market	Market Cap	-0.29	-0.49	-0.50	-0.13	-0.09
	Short Term Reversal	-0.03	-0.28	-0.20	-0.11	
	One Year Momentum	-0.36	0.32	-0.51	-0.35	0.14
	Three Year Momentum	-0.69	-0.18	-0.41	-0.44	-0.26
	Volatility	0.55	-0.25	0.32	0.59	0.10
Financial	Distress	0.33	-0.18	0.18	0.26	0.30
	Leverage	0.53	-0.23	0.25	0.30	0.30
	Foreign Revenue	0.18	0.27			
	Pension Risk	0.14	-0.02			
Valuation	Earnings Yield	-0.12	-0.12	0.38	-0.18	0.36
	Book to Price	0.32	-0.20	0.47	0.47	0.45
	Yield	0.37	-0.17	0.40	-0.16	0.11
	Appraisal	0.40	-0.05	0.53	0.03	0.15
Mgmt	Change in Shares	0.06	-0.10	0.03	-0.09	
	Earnings Quality	-0.23	0.23	-0.02	0.01	0.19
	Insider Buying	-0.07				
	Short Sentiment	0.12	0.12	-0.05	0.14	
ESG	ESG**	-0.01	0.07	-0.01	-0.22	-0.01



*Factors shown are common across developed market models; U.S. regions represented by the US Large Cap Model and others by MSCI standard regional indices. The rows and columns represent the correlation between each factor and region.
**Not a current Dynamic Alpha Model factor.

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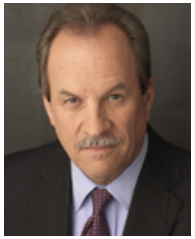
THOMAS D. STEVENS, CFA

Los Angeles Capital - Chairman, CEO, Senior Portfolio Manager and Principal
LACM Global, Ltd.- Chairman, CEO and Director



BBA University of Wisconsin, 1974
MBA University of Wisconsin, 1976

1986 - 2002 Wilshire Asset Management
1980 - 1986 Wilshire Associates
1976 - 1980 National Bank of Detroit

Thomas Stevens is the Chairman, CEO and Director of LACM Global and Chairman and CEO of Los Angeles Capital. Mr. Stevens is one of the Firm's co-founders and plays a key role in setting the Firm's strategic goals and overseeing all departments at Los Angeles Capital with particular focus on Portfolio Management, Finance and Client Servicing. He is a voting member of the Firm's Investment Committee and also serves on the Firm's Risk Committee.

Prior to the founding of Los Angeles Capital in 2002, Mr. Stevens was a Senior Managing Director and Principal at Wilshire Associates. Early in his 22 year career at Wilshire, he oversaw the Equity Services Division providing quantitative tools and services to over 120 investment management firms. For 16 years he ran Wilshire Asset Management, a division of the firm, delivering custom asset management solutions to large institutional investment organizations. Before joining Wilshire, Mr. Stevens worked for the National Bank of Detroit as a research analyst and later as a portfolio manager responsible for select major pension fund client relationships.

Mr. Stevens serves on the Board of Directors for the Los Angeles Capital Global Funds plc, a UCITS fund registered in Ireland, and is also on the Board for Special Olympics Southern California. He also serves on the Board for Proxy Parent Foundation providing financial services and personal support assistance to people with mental illness.

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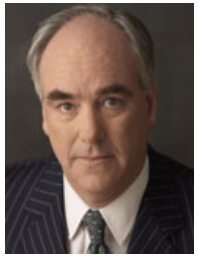
HAL W. REYNOLDS, CFA

Los Angeles Capital - Chief Investment Officer, Senior Portfolio Manager and Principal
LACM Global, Ltd.- Chief Investment Officer



BA University of Virginia, 1980
MBA University of Pittsburgh, 1982

1998 - 2002 Wilshire Asset Management
1989 - 1998 Wilshire Associates
1982 - 1989 Mellon Bank

Hal Reynolds is the Chief Investment Officer of LACM Global. As Chief Investment Officer and Chairman of Los Angeles Capital's Investment Committee, Mr. Reynolds oversees the firm's investment process. Since co-founding Los Angeles Capital in 2002, Mr. Reynolds has worked closely with the Research team to develop Investor Preference Theory®, the Dynamic Alpha Stock Selection Model®, and the Forward Attribution® process for developing forwarding looking expected factor returns. Working with the Research Directors, he develops the firm's research goals and provides guidance on key projects to enhance the stock selection, portfolio construction, and trading processes. As a member of the Portfolio Review Committee, he works with senior members of the portfolio management team to establish key portfolio parameters for portfolio construction and rebalancing and developing procedures for monitoring and controlling portfolio risk.

Prior to Los Angeles Capital, Mr. Reynolds was a managing director and principal at Wilshire Associates. Mr. Reynolds joined the consulting division of Wilshire Associates in 1989 where he served as a senior consultant to large ERISA plans. He also designed Wilshire Compass, Wilshire's asset allocation and manager optimization technology for plan sponsors. In 1996, Mr. Reynolds began consulting for Wilshire Asset Management where he helped develop the Dynamic Alpha Model, which developed into Los Angeles Capital's Dynamic Alpha Stock Selection Model®, and other quantitative long/short applications for Wilshire Asset Management. In 1998, he joined Wilshire Asset Management as Chief Investment Officer.

Prior to joining Wilshire, Mr. Reynolds was a vice president at Mellon Bank where he was responsible for the design and management of Mellon's portfolio analysis product for plan sponsors.

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STUART MATSUDA

Los Angeles Capital - Director of Trading and Principal

BBA University of Hawaii, 1986
MBA California State University Northridge, 1990

1992 - 2002 Wilshire Asset Management
1987 - 1991 Wilshire Associates

As Director of Trading, Mr. Matsuda manages global equity trading activity and is a member of the firm's Investment Committee. He is responsible for the design and implementation of efficient, low cost program trading strategies and rigorous post trade evaluation analyses. Mr. Matsuda oversees the firm's trading strategy, including wave optimization, and overall execution of the firm's global trading platform. Prior to co-founding Los Angeles Capital, Mr. Matsuda was a vice president and principal at Wilshire Associates where he also served as Wilshire Asset Management's Director of Trading.

Before joining the Asset Management division at Wilshire, Mr. Matsuda spent four years as a consultant in the Equity Management Services division assisting institutional and corporate clientele in the development of customized solutions for equity portfolio management problems.

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DANIEL E. ALLEN, CFA

Los Angeles Capital - Director of Global Equities, Senior Portfolio Manager and Principal
LACM Global, Ltd.- Director of Global Equities and Director

BBA Pacific Lutheran University, 1982
MBA University of Chicago Booth School of Business, 1991

1993 - 2009 Wilshire Associates
1991 - 1993 Asset Strategy Consulting
1983 - 1989 Wilshire Associates

Daniel Allen is the Director of Global Equities of LACM Global. As Director of Global Equities, Mr. Allen is responsible for developing global equity applications for clients and is a senior member of the Portfolio Management team and a member of Los Angeles Capital's Investment Committee. Mr. Allen works with clients on managing their portfolios and assisting in setting the strategic direction for the firm. He also serves on the Board of Directors of Los Angeles Capital Global Funds plc.

Prior to joining Los Angeles Capital, Mr. Allen was a senior managing director and board member of Wilshire Associates. For more than twenty years, Mr. Allen held senior positions at Wilshire. Mr. Allen began in the Equity Management division and worked with several members of the Los Angeles Capital team. Mr. Allen assisted 100+ institutional money managers in applying risk models, performance attribution, and portfolio optimization techniques to their equity portfolios. Mr. Allen returned to Wilshire's Consulting division to advise international investors and to head the firm's international manager research. In 1998, Mr. Allen moved to Europe and spent the next decade leading Wilshire's Private Markets group's asset management activities in the region. In this capacity, he was responsible for sourcing and evaluating private equity opportunities while serving on the Global Investment Committee. Mr. Allen returned to Los Angeles in 2008 as a Management Committee member of the Private Markets group. Mr. Allen joined Los Angeles Capital in 2009.

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EDWARD RACKHAM, Ph.D.

Co-Director of Research and Principal

Mchem University of Oxford, 2000
PhD University of Oxford, 2004

2005 - 2011 Wilshire Associates

As Co-Director of Research, Dr. Rackham is responsible for overseeing all functions of the Research department which includes: model development, risk management and factor research. Alongside these broad responsibilities, Dr. Rackham specializes in the development of Investment Risk Management tools and he and the Risk Management group focus on the research and development of portfolio construction techniques that are designed to forecast and control the investment risk of the firm's portfolios. In addition, Dr. Rackham and the Risk Management group look at ways to embed the firm's stock selection views into investment portfolios in a cost-controlled fashion while simultaneously controlling for forecast uncertainty in both portfolio's expected performance and the portfolio's forward-looking risk.

Prior to joining Los Angeles Capital, Dr. Rackham spent six years at Wilshire Associates researching and developing risk and portfolio analytics tools, most recently as the Head of Research and Development of their Equity Analytics group. Previously, Dr. Rackham was an instructor in mathematics and physical chemistry at the University of Oxford, where he also earned his doctorate.

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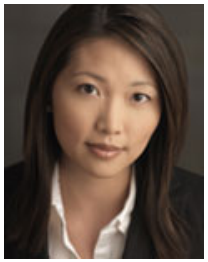

FANESCA C. YOUNG, Ph.D., CFA

Director of Quantitative Research and Managing Director, Principal

BA University of Virginia, 2001
MA Columbia University, 2003
MPhil Columbia University, 2005
PhD Columbia University, 2005

Dr. Young is a Managing Director and the Director of Quantitative Research, and a member of the firm's Management Committee and Investment Committee.

Dr. Young has primary responsibility for the development of the methodology behind Los Angeles Capital's proprietary Dynamic Alpha Stock Selection Model for forecasting emerging and developed market equity returns. Furthermore, Dr. Young and the quantitative research team continually look at novel and sophisticated analytics and unstructured datasets to improve the firm's quantitative process. In addition to her research responsibilities, she is responsible for communicating with and cultivating key relationships with institutional investors in Asia. In these capacities, Dr. Young works closely with the Research, Portfolio Management, and Marketing departments.

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LARA L. CLARKE

Managing Director and Principal

BS Pennsylvania State University, 1999
MBA UCLA Anderson School of Management, 2012

2006 - 2008 StarMine Corporation
2005 - 2006 Tiburon Research Group
1999 - 2004 Thomson Financial

Ms. Clarke oversees the firm's business development efforts in the Western and Midwest regions of the U.S. In addition, Ms. Clarke has played an integral role in expanding existing relationships with institutional investors including public and corporate pension plans, foundations, endowments, and investment consultants.

Ms. Clarke brings to Los Angeles Capital a diverse industry background, having worked in sales and relationship management roles for StarMine Corporation, a quantitative equity analytics company, and Thomson Financial (Baseline), where her client servicing and business development efforts focused on equity analytics and portfolio analysis.

Ms. Clarke is the Co-President of Women in Institutional Investments Network (WIIIN), a 501(c)(3) non-profit she co-founded in order to strengthen relationships and facilitate a dialogue to advance and empower women in the Southern California institutional investment community.

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THE INVESTMENT TEAM

NAME	TITLE/RESPONSIBILITY	INDUSTRY EXP	FIRM EXP	HIGHEST LEVEL EDUCATION
PORTFOLIO MANAGEMENT				
Thomas Stevens, CFA *	CEO and Senior Portfolio Manager	40	14	MBA University of Wisconsin, 1976
Hal Reynolds, CFA *	CIO and Senior Portfolio Manager	34	14	MBA University of Pittsburgh, 1982
Daniel Allen, CFA *	Director of Global Equities and Senior Portfolio Manager	33	7	MBA University of Chicago, 1991
Laina Draeger, CFA *	Portfolio Manager	9	9	MBA University of San Francisco, 2007
Kristin Ceglar, CFA *	Portfolio Manager	11	11	BA Harvard University, 2005
Daniel Arche, CFA *	Portfolio Manager	10	9	BA University of Southern California, 2006
Matthew Stevens	Portfolio Management Associate	12	4	BA University of Wisconsin, 2004
Steven Chew, CFA	Portfolio Management Associate	6	6	BA University of California, Los Angeles, 2010
Tanvi Kacheria, CFA	Portfolio Management Associate	5	5	BA University of Southern California, 2010
RESEARCH				
David Borger, CFA	Director Emeritus of Research	39	14	MA MBA University of Michigan, 1975, 1977
Edward Rackham, Ph.D. *	Co-Director of Research	11	5	Ph.D. Oxford University, 2004
Bradford Rowe, CFA *	Co-Director of Research	15	9	MBA University of Wisconsin, 2007
Fanesca Young, Ph.D., CFA *	Director of Quantitative Research and Managing Director	11	8	Ph.D. Columbia University, 2005
Charles Fann, CFA *	Director of Investment Technology	13	12	BA University of California, Los Angeles, 2002
Dinah Chowayou *	Associate Director	17	10	MS Cornell, 2005
Anthony Arefian, CFA *	Associate Director	13	8	MBA UCLA Anderson School of Management, 2010
Justin Ceglar, CAIA, CFA *	Associate Director	12	8	MSFE Claremont Graduate University, 2009
Yuan Ding *	Associate Director	7	7	MS University of Wisconsin, 2009
Cien Shang, Ph.D.	Research Associate	5	2	Ph.D. Columbia University, 2010
Susana Salazar	Research Associate	4	4	BS University of California, Los Angeles, 2012
TRADING				
Stuart Matsuda *	Director of Trading	29	14	MBA California State University, Northridge 1990
Christine Kugler *	Director of Implementation	23	14	BA University of California, Santa Barbara, 1993
Richard Dixon *	Director of Global Trading Strategy	33	2	BA University of California, Los Angeles, 1980
Bradley P. Barker, CFA *	Director	11	11	BA University of California, Los Angeles, 2003
Joseph Garcia *	Global Trading Associate	8	8	BA San Diego State University, 2008

*Principal
Roster as of 07/31/2016. Positions below Associate not reflected.

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PERFORMANCE DISCLOSURES

•Los Angeles Capital Management and Equity Research, Inc. ("Los Angeles Capital") is an independent, employee owned investment advisory firm founded in 2002, and registered under the Investment Advisers Act of 1940. Los Angeles Capital is an institutional adviser that offers global equity active management in both developed and emerging markets.

•EARLY TRACK RECORD - Prior to the establishment of the firm, all investment decision makers were employed by Wilshire Associates, Incorporated, in the Wilshire Asset Management division. Therefore, all performance results prior to April 2002 are from Wilshire Asset Management and have been linked to the current performance record of Los Angeles Capital. Additional information regarding the firm's policies and procedures for valuing portfolios, calculating and reporting performance results is available upon request.

•Total firm assets as of 6/30/16: $20.1 billion. A complete list and description of all the firm's composites is available upon request.

•PRICING AND RETURNS-Portfolios are priced daily based on trade date positions, accrued dividends, cash, and cash equivalents. Returns are calculated daily and linked to avoid distortion from cash flows. Returns reflect the reinvestment of dividends and other earnings. Returns are impacted by economic conditions which may or may not persist into the future. The potential for profit is accompanied by the possibility of loss. Each account is managed against an index but the extent to which each account's risk profile differs from those indexes will vary.

•Valuations are computed and performance is reported in US Dollars unless indicated otherwise.

•PERFORMANCE-Performance may be presented both gross and net of fees. Gross returns are gross of investment management and custodial fees but net of non-reclaimable withholding taxes and trading expenses. Except as otherwise noted, net returns are net of the highest applicable investment management fee (based on the fee schedules listed below), non-reclaimable withholding taxes and trading expenses, but gross of custodial fees. Commencing January 1, 2011, the gross and net returns for Limited Partnerships managed by the Firm and CITs sub-advised by the Firm, are net of custodial expenses in addition to the withholding taxes and trading expenses. For UCITS funds managed by the Firm, net returns are net of the total expense ratio which includes management and custodial expenses ("TER"). The gross returns on UCITS funds are calculated using daily net asset values and adding back the UCITS TER. Trading expenses are the actual costs of buying or selling investments. A client's return will be reduced by advisory fees and other expenses the client may incur.

•The management fee schedule for separate accounts is as follows: Global ACWI Assignments – 60 bps on the first $25 million, 45 bps on the next $175 million, and 35 bps thereafter. For all long only developed market portfolios with an alpha target of 3% or greater, there will be an incremental charge of 20 bps per tier. This applies to all global portfolios with at least 80% invested in developed markets. Fees will reduce account/composite performance over time. For example, for the three years ending 12/31/2012, the L.A. Capital US Large Cap Equity Composite is reduced from 10.56% to 10.12% on an annualized basis. Actual advisory fees may vary among clients with the same investment strategy.

•FACTOR ANALYSIS-Factor Analyses are for illustrative purposes only and should not form the basis for any investment decision. These Analyses contain both historical and forecasted factor returns adjusted for the average and volatility of actual results. The Firm researches many different factors that change as the Firm implements enhancements to the Los Angeles Dynamic Alpha Stock Selection Model® (the "Model").A full set of factor graphs for major economic regions is available upon request. Individual factor graphs may show that the Model was not as predictive as it appears to be in another factor graph in the same region. Factor graphs are derived from retroactive application of the Model in effect at the time this factor graph was developed with the benefit of hindsight. The items that might have influenced the Model in prior periods and their impact on the above graph cannot be predicted. The Firm was founded in March 2002 and first started managing European strategies in 2007, Emerging Markets strategies in 2009, and Long/Short strategies in 2006. Factor graph analyses may pre-date those events. Limitations are inherent in simulated results as simulations do not represent actual results and do not reflect material changes to the Model that may have occurred over time. Predictability of factor returns as well as actual factors returns may or may not persist into the future. See also the Firm's actual performance presentation and accompanying footnotes.

AQR Defensive Equity Strategy

Prepared Exclusively for Oregon Investment Council

CONFIDENTIAL

October 26, 2016

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AQR Overview

Our Firm

AQR is a global investment management firm built at the intersection of financial theory and practical application. We strive to deliver superior, long-term results for our clients by looking past market noise to identify and isolate what matters most, and by developing ideas that stand up to rigorous testing. Our focus on practical insights and analysis has made us leaders in alternative and traditional strategies since 1998.

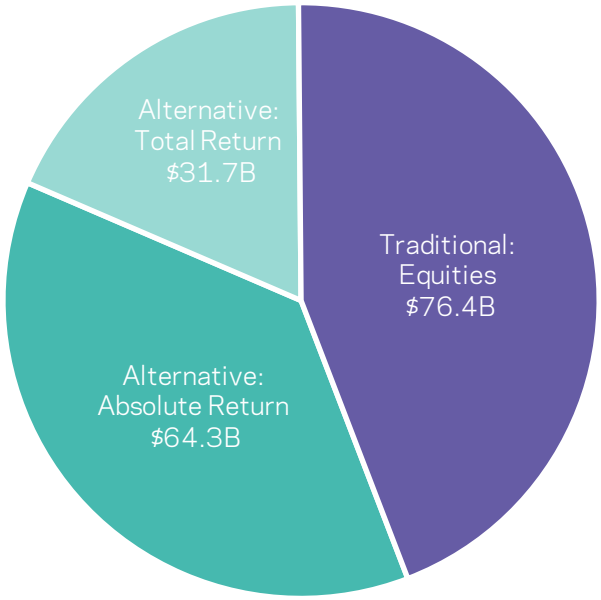
At a Glance

- AQR takes a systematic, research-driven approach to managing alternative and traditional strategies
- We apply quantitative tools to process fundamental information and manage risk
- Our clients include institutional investors, such as pension funds, defined contribution plans, insurance companies, endowments, foundations, family offices and sovereign wealth funds, as well as RIAs, private banks and financial advisors
- The firm has 26 principals and 744 employees; nearly half of employees hold advanced degrees
- AQR is based in Greenwich, Connecticut, with offices in Boston, Chicago, Hong Kong, London, Los Angeles, and Sydney
- Approximately $172.4 billion in assets under management as of September 30, 2016*

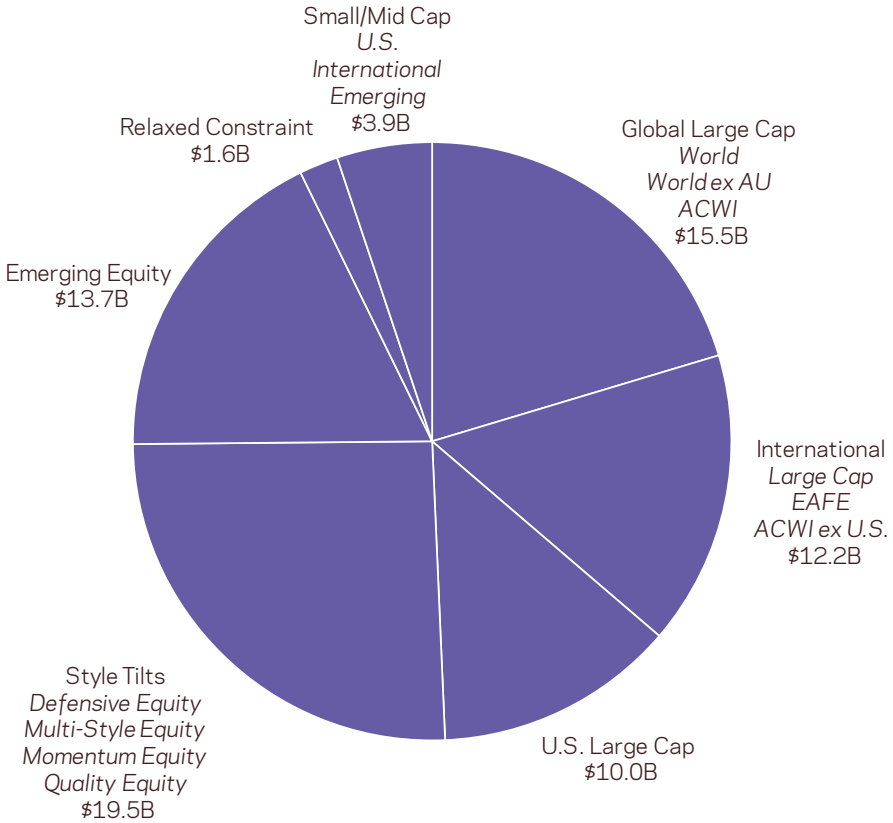
* Approximate as of 9/30/2016, includes assets managed by CNH Partners, an affiliate of AQR.

Assets Under Management

Total Assets
$172.4B*



Traditional Equity Strategies
$76.4B*



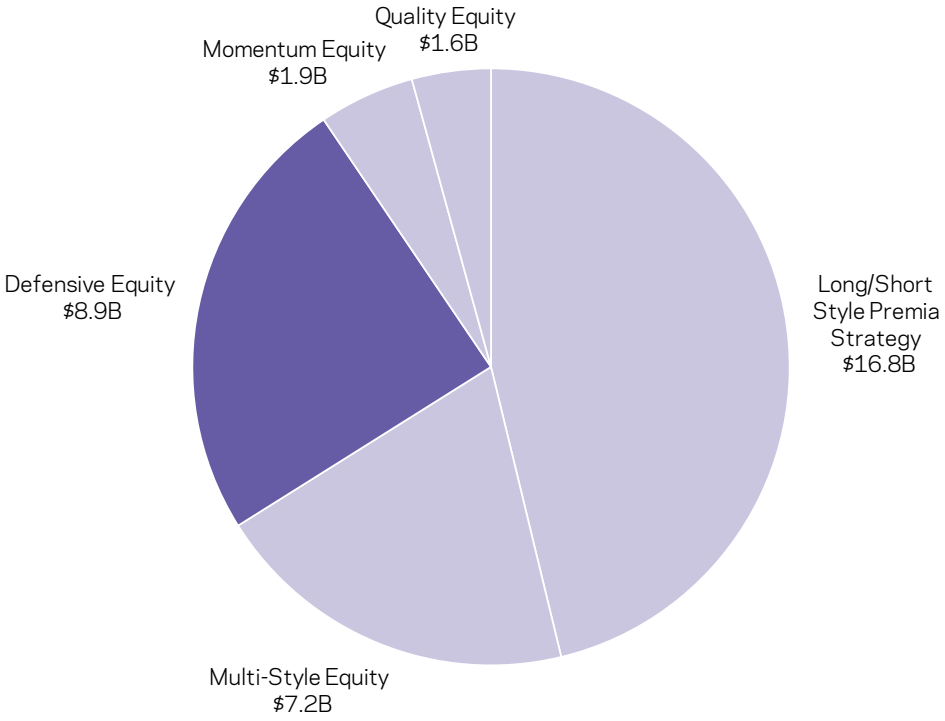
* Approximate as of 9/30/2016, includes assets managed by CNH Partners, an affiliate of AQR.

Assets Under Management

AQR Style Premia Strategies

Strategy	Inception Date
Momentum Equity	July 2009
Defensive Equity	February 2011
Long/Short Style Premia Strategy	September 2012
Multi-Style Equity	March 2013
Quality Equity	December 2013

Style Premia Assets
$36.3B*



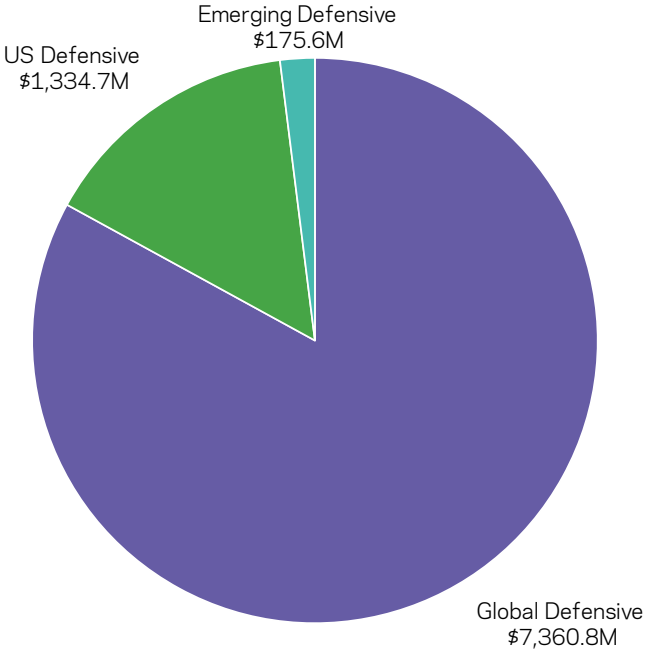
* Approximate as of 9/30/2016, includes assets managed by CNH Partners, an affiliate of AQR.

Assets Under Management

AQR Defensive Strategies Across Various Universes

Strategy	Inception Date
Global Defensive Equity	February 2011
U.S. Defensive Equity	February 2011
Emerging Defensive Equity	August 2012

Defensive Equity Strategies
$8.9B*



* Approximate as of 9/30/2016

Who We Are

Cliff Asness, Ph.D.*
Managing and Founding Principal

Portfolio Management, Research, Risk Management and Trading
(Total Team: 221)

John Liew, Ph.D.*
Founding Principal

Portfolio Management and Research

Michele Aghassi, Ph.D.
Principal

Andrea Frazzini, Ph.D.
Principal

Jacques Friedman*
Principal

Brian Hurst*
Principal

Ronen Israel*
Principal

Michael Katz, Ph.D.
Principal

Hoon Kim, Ph.D., CFA
Principal

Oktay Kurbanov
Principal

Michael Mendelson*
Principal

Tobias Moskowitz, Ph.D.
Principal

Yao Hua Ooi
Principal

Lasse Pedersen, Ph.D.
Principal

Mark Mitchell, Ph.D.
Principal (CNH)

Todd Pulvino, Ph.D.
Principal (CNH)

Rocky Bryant
Principal (CNH)

Risk Management

Lars Nielsen*
Principal
Chief Risk Officer

Trading

Isaac Chang
Managing Director

Brian Hurst*
Principal

Business Development
(Total Team: 142)

David Kabiller, CFA*
Founding Principal

Client Solutions

Gregor Andrade, Ph.D.*
Principal

Jeff Dunn
Principal

Jeremy Getson, CFA*
Principal

Marco Hanig, Ph.D.
Principal

Chris Palazzolo, CFA
Principal

Portfolio Solutions

Antti Ilmanen, Ph.D.
Principal

Strategy

Ted Pyne, Ph.D.
Managing Director
Chief Strategy Officer

Marketing

Suzanne Escousse
Managing Director
Chief Marketing Officer

Corporate Infrastructure
(Total Team: 327)

Finance

John Howard*
Principal
Chief Finance Officer and Chief Operating Officer

Accounting, Operations and Client Administration

Steve Mellas
Principal

Systems Development and IT

Neal Pawar
Principal
Chief Technology Officer

Human Resources

Jen Frost
Managing Director
Chief Human Resources Officer

Compliance And Legal
(Total Team: 54)

Compliance

H.J. Willcox
Managing Director
Chief Compliance Officer

Legal

Bradley Asness
Principal
Chief Legal Officer

Personnel as of 9/30/2016 = 744
*Member of Strategic Planning Committee (SPC)

Global Stock Selection Team

Portfolio Management and Research
(Total Team: 29)

Jacques Friedman Principal	**Andrea Frazzini, Ph.D.** Principal	**Michele Aghassi, Ph.D., CFA** Principal	**Hoon Kim, Ph.D., CFA** Principal
Ronen Israel Principal	**Tobias Moskowitz, Ph.D.** Principal	**Scott Richardson, Ph.D.** Managing Director	**Reha Tutuncu, Ph.D.** Managing Director
Shaun Fitzgibbons Vice President	**Tarun Gupta, Ph.D.** Vice President	**Lukasz Pomorski, Ph.D.** Vice President	**Adrienne Ross** Vice President
	Laura Serban, Ph.D. Vice President	**Nathan Sosner, Ph.D.** Vice President	

Portfolio Implementation
(Total Team: 14)

Oktay Kurbanov Principal	**Hoon Kim, Ph.D., CFA** Principal	**Alla Markova** Vice President	**Jessica Yeh** Vice President

Total Global Stock Selection Team: 43

Risk Management (Total Team: 11)		**Trading** (Total Team: 47)		**Front Office Technology** (Total Team: 51)
Lars Nielsen Principal	**Lauralyn Pestritto** Managing Director	**Brian Hurst** Principal	**Isaac Chang** Managing Director	**Neal Pawar** Principal

Personnel as of 9/30/2016

Why AQR Defensive Equity?

Building a Truly Defensive Equity Portfolio

A combined approach that seeks to reduce risk without sacrificing returns

Low Beta	• Targets a low exposure to market risk via tilt toward low-beta stocks • Dampens cyclicality and benefits from higher risk-adjusted return
Quality	• Active stock selection targets highly profitable, stable, low-leverage companies • May provide additional protection in flight-to-quality scenarios
Risk-Balanced	• Balanced risk exposure to industry and country • Constrained exposure to value, growth, momentum and other styles

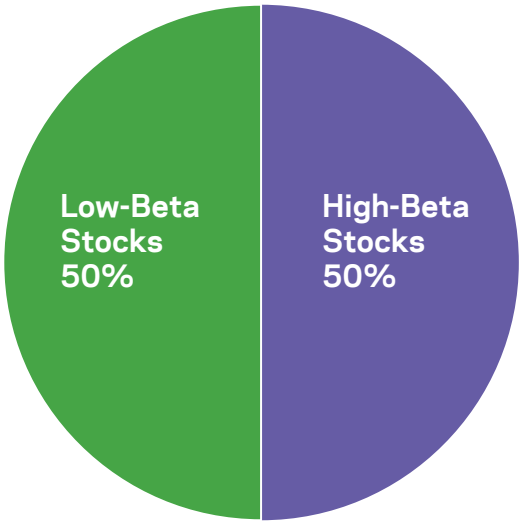
Strategies are subject to change at any time.

Betting Against Beta: Motivation

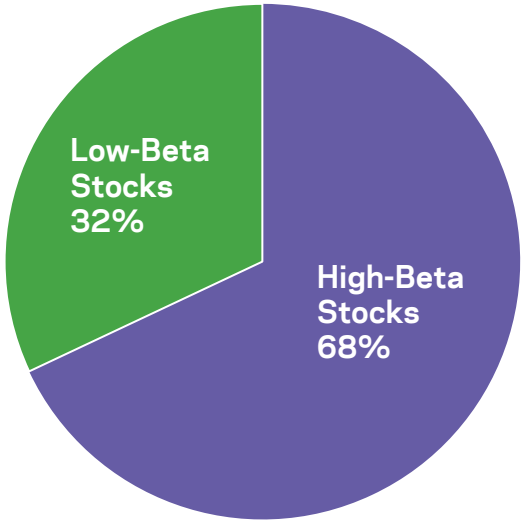
High-beta stocks are often responsible for the majority of equity portfolio risk, but have not delivered commensurate returns to investors

- The average return of high-beta stocks has been about the same as the average return of low-beta stocks*
- This "low-risk anomaly" was discovered by Black, Jensen and Scholes (1972)

Fraction of Market Capitalization



Fraction of Market Risk

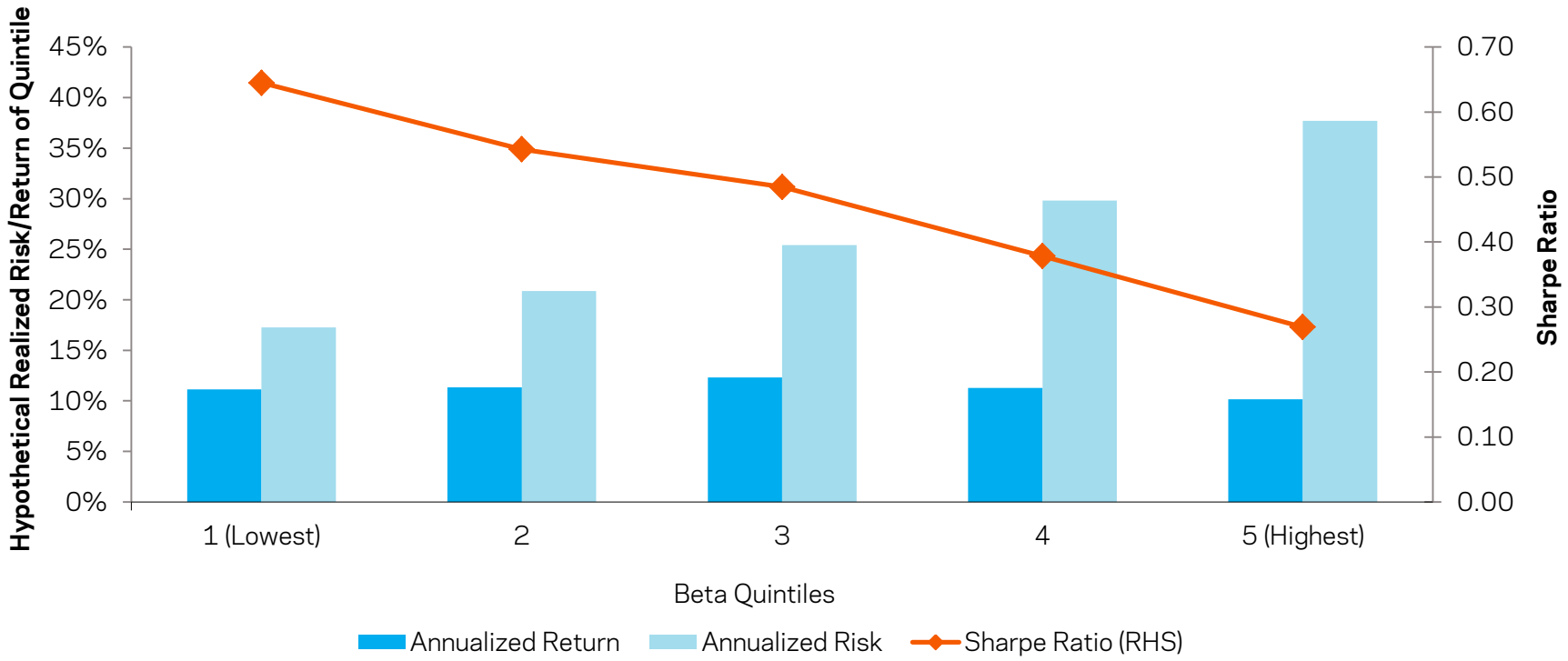


Source: AQR. The above example is for illustrative purposes only and is not based on an actual portfolio.
* Please see page 14 for the annualized return of U.S. equities split by beta quintiles.

Betting Against Beta: The Low-Risk Anomaly

There is significant empirical evidence that higher risk leads to lower risk-adjusted returns

U.S. Equities
January 1926–December 2015



Source: AQR. U.S. Equities is the Russell 3000. Prior to 1980, U.S. Equities is represented by the CRSP U.S. index. Past performance is not a guarantee of future performance. Return and Risk characteristics are provided excess of cash. Portfolios are formed by sorting stocks on realized market beta and dividing the stocks into quintile portfolios; returns are excess of cash. Quintile portfolio returns are equal-weighted returns of the stocks in that portfolio. These are not the returns of an actual portfolio AQR manages and are for illustrative purposes only. Hypothetical data has certain inherent limitations, some of which are disclosed in the Appendix. Please read important disclosures in the Appendix.

Portfolio Construction: Defensive

Combined Approach Seeks to Reduce Risk Without Sacrificing Returns

Stocks are compared to one another on an industry-neutral basis. Examples of Our Low Fundamental Risk Metrics:

Profitability	• High Margins • High Asset Turnover
Sustainable Earnings	• Cash flow vs. accruals
Low Earnings Risk	• Low earnings variability • Low cash flow variability
Low Credit Risk	• Distance to Default

Source: AQR. For illustrative purposes only, not representative of an actual portfolio currently managed by AQR. Portfolio construction is subject to change at any time.

Fundamentally Grounded Security Selection

Low Fundamental Risk Can Give Downside Protection and Alpha

Companies with low fundamental risk have historically provided strong downside protection

Hypothetical Sharpe Ratios of Low Fundamental Risk Factor

	Universe		
	Global	**U.S.**	**Emerging**
All Markets	1.0	1.1	0.7
Up Markets	0.5	0.9	0.0
Down Markets	1.8	1.5	1.7
Down-Up Markets	**1.3**	**0.6**	**1.7**

Source: AQR. Analysis is based on AQR models of hypothetical long/short, beta and dollar-neutral portfolios; Global January 1990–December 2015, U.S. January 1984–December 2015 and Emerging January 1995–December 2015. Up and Down market determinations are based on the performance of the MSCI World (for global) and Russell 1000 (for U.S.) and MSCI Emerging (for emerging). Please read Appendix for important disclosures and additional details on the backtest methodology. Hypothetical performance results have certain inherent limitations, some of which are disclosed in the Appendix. These are not the Sharpe ratios of an actual portfolio and are for illustrative purposes only.

Fundamentally Grounded Security Selection

Fundamental Low-Risk Stocks Display Tail Hedging Characteristics

Source: AQR. Performance results based on AQR models of hypothetical long/short, beta and dollar-neutral portfolios, and are gross of fees and transaction costs. These are not the returns of an actual portfolio and are for illustrative purposes only. Statistics above are calculated using a simplified sort on a low fundamental risk factor, using a liquid universe of global stocks (from January 1990-December 2015), with the universe approximately representing the MSCI World Index, rebalanced monthly. Security weights are based on their ranking, and is controlled for beta, country and global industry exposures. Hypothetical performance results have certain inherent limitations, some of which are disclosed in the Appendix. Past performance is not a guarantee of future performance.

Risk-Balanced

Portfolio Construction Settings

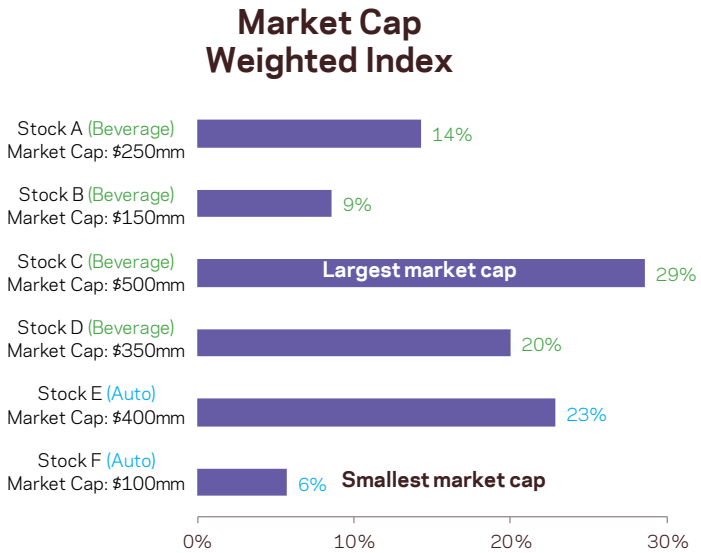
To seek better diversification, portfolio industry and country allocations are anchored versus a reference portfolio that spreads risk equally across all stocks in the universe.

	Global Defensive	U.S. Defensive	Emerging Defensive
Number of Holdings	> 150	> 150	> 100
Position	1.5% max. position	1.5% max. position	1.5% max. position
Industry*	+/-5% vs. equal volatility index	+/-4% vs. equal volatility index	+/-5% vs. equal volatility index
Country**	+/-2% vs. equal volatility index	N/A	+/-2% vs. equal volatility index
Risk Factor Exposures	+/-0.25 STD except for volatility and leverage	+/-0.25 STD except for volatility, earnings variability and leverage	+/-0.25 STD except for volatility and leverage

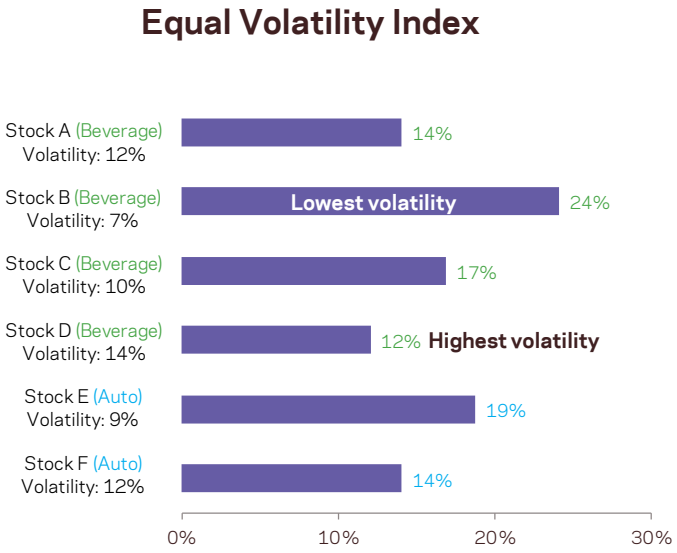
Source: AQR. Portfolio construction is subject to change at any time. Diversification does not eliminate the risk of experiencing investment losses.
* The portfolio is anchored around a benchmark with equal volatility weight to every stock, grouped by industry.
** The portfolio is also anchored around a benchmark with equal volatility weight to every stock, grouped by country.

Hypothetical Example of Industry Constraints

- A traditional market cap weighted index allocates weights to stocks based on market cap
- An equal volatility index allocates weights so that each stock has a proportional level of risk



Beverage Industry Weight: 71%
Auto Industry Weight: 29%
Total: 100%



Beverage Industry Weight: 67%
Auto Industry Weight: 33%
Total: 100%

Industry Weight Constraints:
(based on equal volatility index)

Beverage: 67% +/- 5%

62% - 72%

Auto: 33% +/- 5%

28% - 38%

- Industry weight constraints are anchored around a portfolio that spreads risk equally across all stocks

Source: AQR. For illustrative purposes only. Please read important disclosures in the Appendix.

Portfolio Construction

Stock Views (Low Fundamental Risk Characteristics)	Risk Model (Volatilities and Correlations)	Investment Constraints & T-Costs
• **Low fundamental characteristics may provide** – Asymmetric payoff profile – Less reliance on risk and correlation estimates in the optimization	• **Combines responsiveness and estimation accuracy** – Responsive to recent shocks – Cognizant of longer history	• **Country and industry risk allocations based on equal asset risk benchmark anchoring points** • **Turnover constraints and t-cost penalties**

Optimizer

Robust Optimization

- Solutions are insensitive to small changes in expected returns

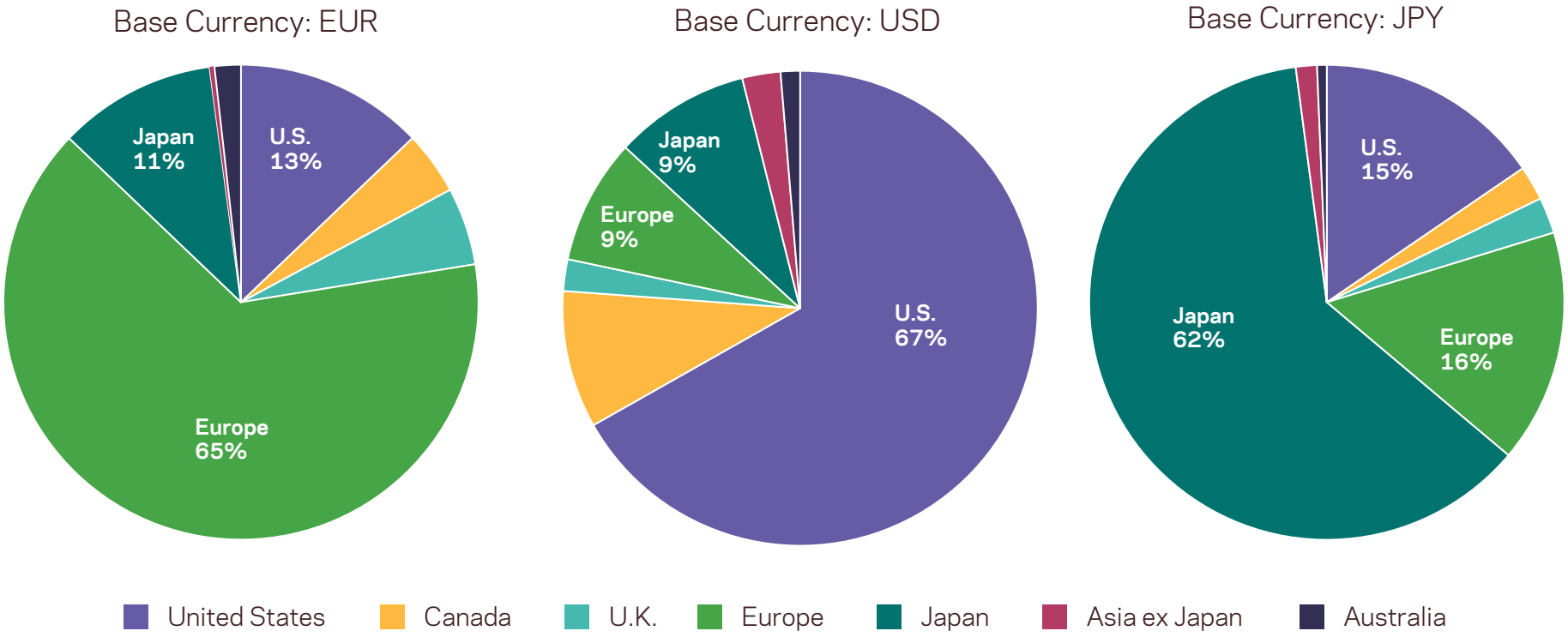
Optimal Portfolio

Source: AQR. AQR's optimization process illustrated above may not always lead to successful investing and is subject to change. Portfolio construction is subject to change.

Removal of Currency Sensitivity

Minimum-variance portfolios are highly sensitive to the choice of base currency

Minimum-Variance Portfolios Constructed Using Different Base Currencies

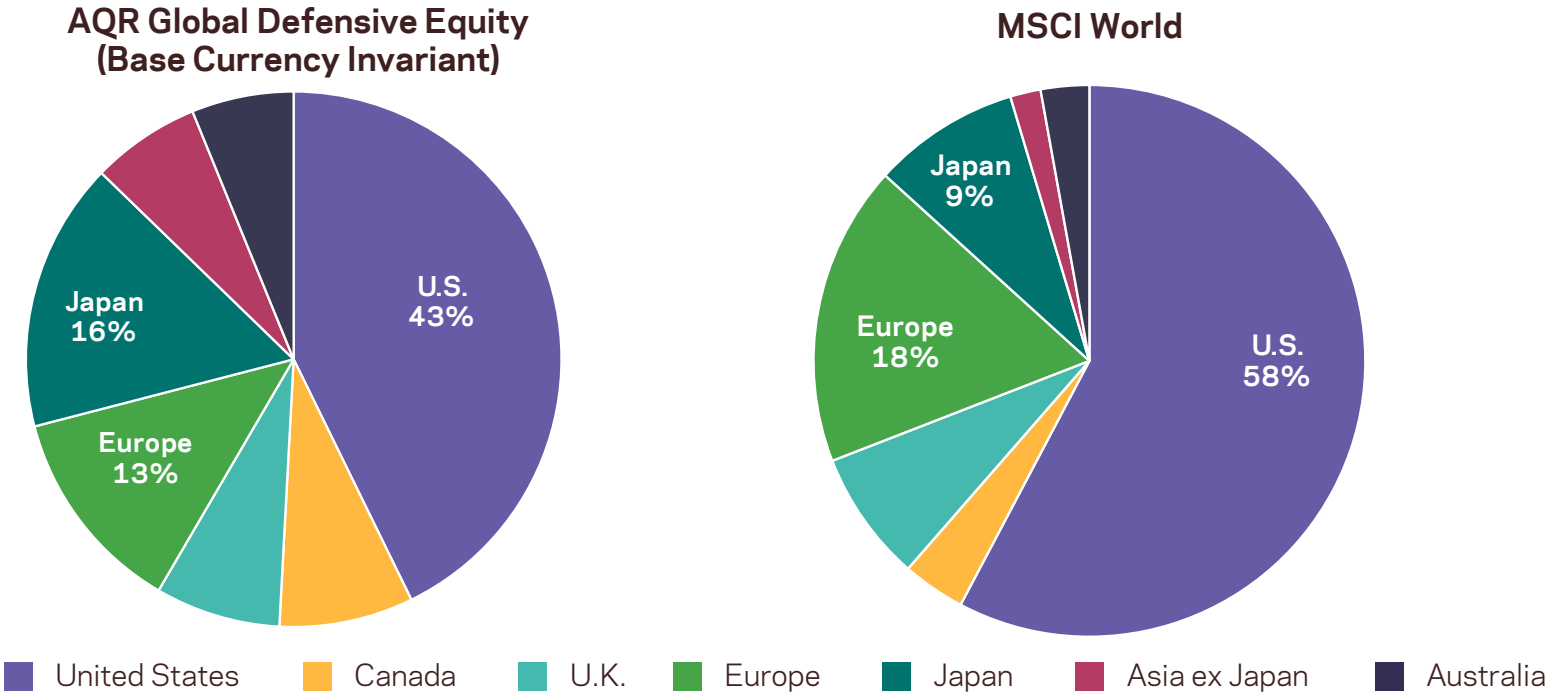


Source: AQR. Data is estimated as of 2011. Figures above are not based on an actual portfolio and are for illustrative purposes only. Please read important disclosures in Appendix.

Removal of Currency Sensitivity

AQR global defensive equity portfolios are constructed to be invariant to choice of base currency

- The AQR Global Defensive Equity portfolio, with equal risk constraints and base currency invariance in place, can lead to less extreme country allocation relative to market-cap weighting or minimum variance approaches.



Source: AQR and MSCI World Index. Data is estimated as of April 2015. Portfolio construction and exposures are subject to change. The Global Defensive Equity Portfolio figures above are hypothetical, are not based on an actual portfolio and are for illustrative purposes only. Please read important disclosures in Appendix.

AQR's Long History of Style Premia Research

AQR Style Premia Research Includes Key Studies of Defensive Styles

2015		Asness, Frazzini, Israel, Moskowitz and Pedersen resurrect the **size** premium in "Size Matters, if You Control Your Junk"
2014		Asness, Frazzini, Israel and Moskowitz summarize what we know and dispel myths about **value** and **momentum** in "Fact, Fiction, and Value Investing" and "Fact, Fiction, and Momentum Investing"
		Ilmanen, Maloney and Ross explore the **macro sensitivities of styles** in "Exploring Macroeconomic Sensitivities"
2013		Asness, Frazzini and Pedersen examine the **quality** factor in "Quality Minus Junk"
		Frazzini, Israel and Moskowitz evaluate **trading costs** in "Trading Costs of Asset Pricing Anomalies"
2012		Koijen, Moskowitz, Pedersen and Vrugt document pervasiveness of **carry** strategies in "Carry"
		Frazzini and Pedersen demonstrate pervasiveness of **low-risk** style in "Betting Against Beta"
		Frazzini and Asness challenge the traditional construction of the **value** premium in "The Devil in HML's Details"
		Israel and Moskowitz show robustness of **equity styles** in "How Tax Efficient Are Equity Styles" and "The Role of Shorting, Firm Size and Time on Market Anomalies"
		Israel, Ilmanen and Moskowitz combine **four styles in multiple contexts** in "Investing with Style"
2010		Asness, Frazzini and Pedersen examine applications of the **low-risk** style in "Leverage Aversion and Risk Parity"
		Ilmanen presents long-term evidence for **major strategy styles** in his book, *Expected Returns*
		Berger, Israel and Moskowitz describe potential role for **momentum** in "The Case for Momentum Investing"
2008		Asness, Moskowitz and Pedersen demonstrate the pervasiveness of **value** and **momentum** in "Value and Momentum Everywhere"
		Brunnermeier, Nagel and Pedersen analyze risks to **carry** strategies in "Carry Trades and Currency Crashes"
2006		Frazzini investigates behavioral explanations for **momentum** in "The Disposition Effect and Under-Reaction to News"
1998	**AQR Founding Principals began managing investments**	Moskowitz and Grinblatt document the **momentum effect in industries** in "Do Industries Explain Momentum?"
		Asness, Liew and Stevens study **styles across countries** in "Parallels Between the Cross-Sectional Predictability of Stock and Country Returns"
		Asness documents case for **two major styles** in "The Interaction of Value and Momentum Strategies"
1994		Asness shows the implications for a combined **value/momentum** approach in his Ph.D. dissertation

AQR

MSCI ACWI Defensive Equity

MSCI ACWI Defensive Equity Performance

Since Inception (August 2012- August 2016)

	Gross Returns	MSCI ACWI Index**	Gross Excess Return
3Q 2012*	4.2%	5.4%	-1.2%
4Q 2012	-0.4%	2.9%	-3.3%
1Q 2013	8.6%	6.5%	2.1%
2Q 2013	-4.3%	-0.4%	-3.9%
3Q 2013	6.1%	7.9%	-1.8%
4Q 2013	3.1%	7.3%	-4.2%
1Q 2014	2.5%	1.1%	1.4%
2Q 2014	5.8%	5.0%	0.7%
3Q 2014	-2.4%	-2.3%	-0.1%
4Q 2014	0.3%	0.4%	-0.1%
1Q 2015	1.6%	2.3%	-0.7%
2Q 2015	-1.4%	0.3%	-1.8%
3Q 2015	-5.8%	-9.5%	3.7%
4Q 2015	4.2%	5.0%	-0.9%
1Q 2016	5.9%	0.2%	5.6%
2Q 2016	3.4%	1.0%	2.4%
3Q 2016***	0.8%	4.7%	-3.9%
Summary (As of August 31, 2016)			
2012	3.8%	8.4%	-4.6%
2013	13.7%	22.8%	-9.1%
2014	6.1%	4.2%	1.9%
2015	-1.7%	-2.4%	0.6%
2016 YTD	10.3%	5.9%	4.4%
Since Inception (Ann.)	**7.8%**	**9.2%**	**-1.5%**
Annualized Volatility	**9.5%**	**10.8%**	**5.2%**
Sharpe Ratio	**0.8**	**0.8**	
Beta vs. MSCI ACWI	**0.8**	**1.0**	

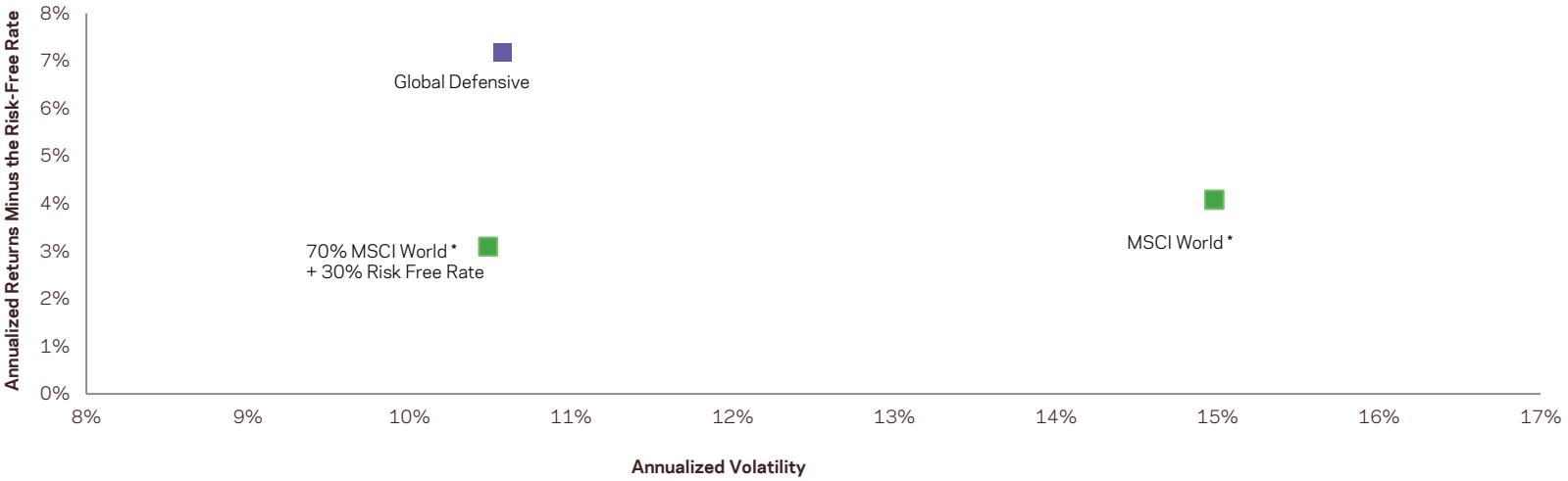
Source: AQR. Performance for the month ending in August 31, 2016 is an estimate and subject to change. Inception Date: August 1, 2012. *3Q 2012 consists of only August and September returns. **MSCI ACWI Net Returns. Excess Returns are in excess to the listed index. ***3Q 2016 consists of only July and August returns. Please see the Appendix for important risk and performance disclosures.

Developed Defensive Equity: Backtest Performance

Seeking Market-Like Returns With Lower Risk

Hypothetical Risk/Return Trade-Off

April 1993–March 2016



Hypothetical Gross Returns

April 1993-March 2016

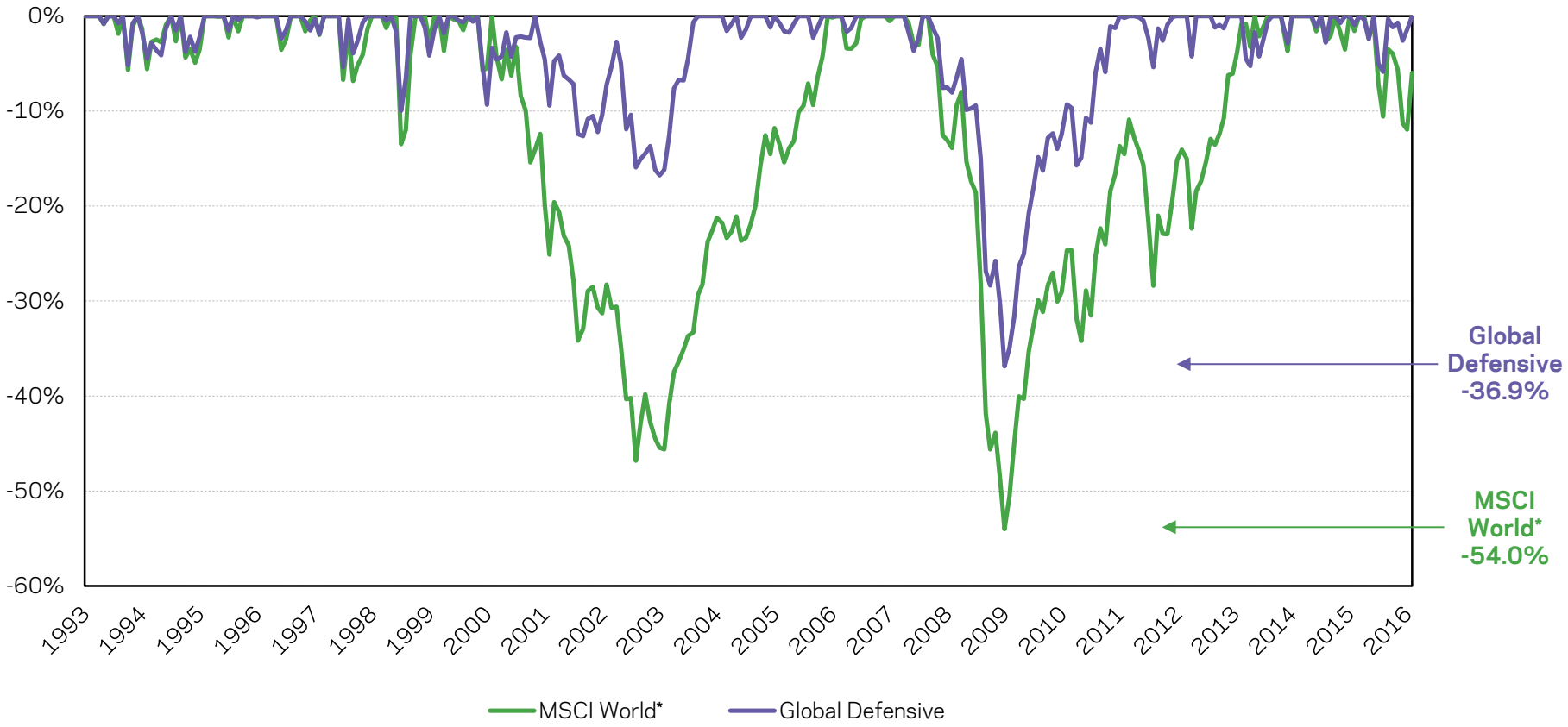
	MSCI World*	Global Defensive	70% MSCI World* 30% Risk Free Rate
Annualized Return	6.8%	9.9%	5.9%
Annualized Volatility	15.0%	10.6%	10.5%
Sharpe Ratio	0.3	0.7	0.3
Beta vs. MSCI World*	1.0	0.6	0.7
Max Drawdown	-54.0%	-36.9%	-40.8%

Source: AQR. Global Defensive is a backtest of AQR's Global Defensive Equity Strategy net of transaction and financing costs but gross of advisory fees shown in USD. Additional details on backtest methodology in Appendix. These are not the returns to an actual portfolio AQR manages and are for illustrative purposes only. Hypothetical performance results have certain inherent limitations, some of which are disclosed in the Appendix. This information is supplemental to the GIPS® compliant presentation for the Global Defensive Equity Composite included in the Appendix. *MSCI World (Net). Net total return indices reinvest dividends after the deduction of withholding taxes. Past performance is not a guarantee of future performance. Please read important disclosures in Appendix.

Developed Defensive Equity: Drawdown

Hypothetical Global Defensive Equity vs. MSCI World*

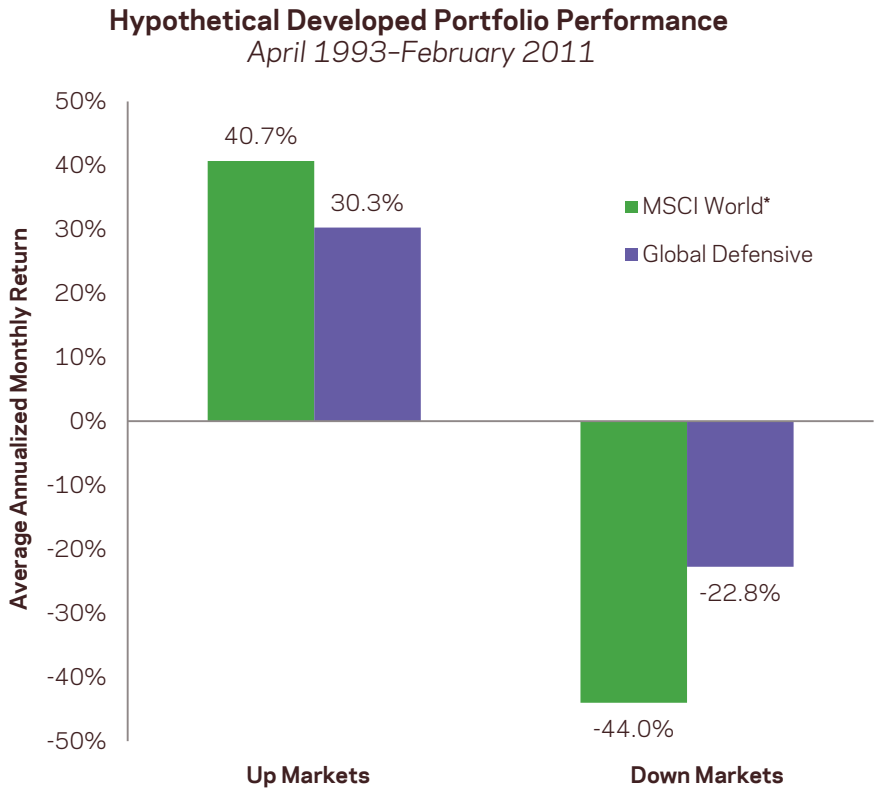
Hypothetical Drawdown Analysis
April 1993–March 2015

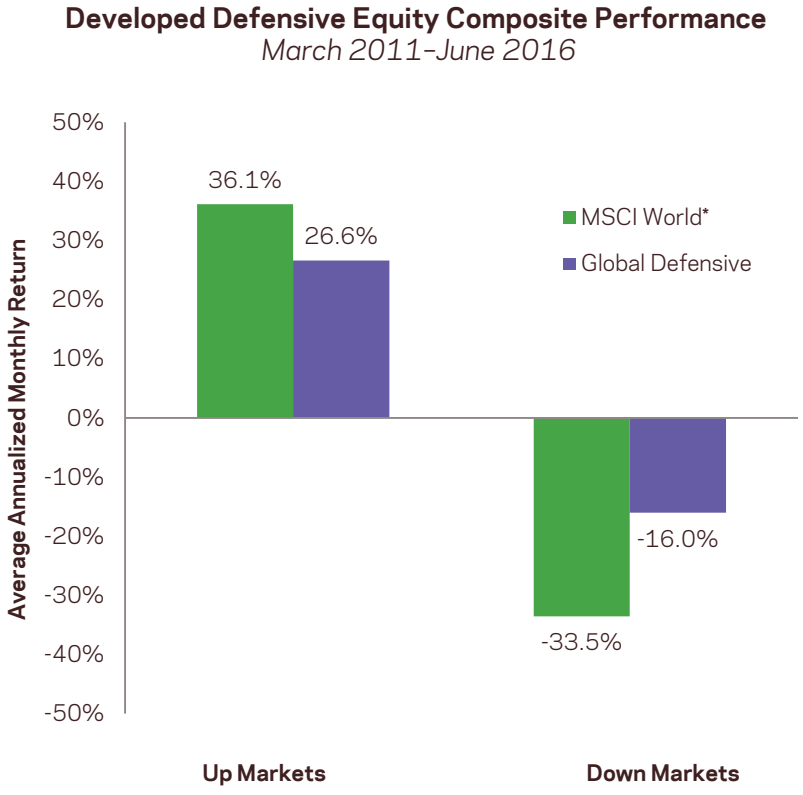


Source: AQR. Global Defensive is a backtest of AQR's Global Defensive Equity Strategy net of transaction and financing costs but gross of advisory fees. Additional details on backtest methodology in Appendix. Hypothetical performance results have certain inherent limitations, some of which are disclosed in the Appendix. *MSCI World (Net). Net total return indices reinvest dividends after the deduction of withholding taxes. Please read important disclosures in Appendix.

Developed Defensive Equity: Performance

A Low-Beta Strategy That Seeks to Reduce Drawdowns During Stress Periods





Source: AQR. The Hypothetical Global Portfolio is a backtest of AQR's Global Defensive Equity Strategy net of transaction and financing costs but gross of advisory fees. Additional details on backtest methodology in Appendix. Global Defensive Equity Composite performance is gross of advisory fee. All performance is shown in USD. Up and Down market determinations are based on the performance of the MSCI World Index (net of dividends). These are not the returns to an actual portfolio AQR manages and are for illustrative purposes only. Hypothetical performance results have certain inherent limitations, some of which are disclosed in the Appendix. The actual returns shown above are gross of fees. This information is supplemental to the GIPS® compliant presentation for the Global Defensive Equity Composite included in the Appendix. *MSCI World (Net). Net total return indices reinvest dividends after the deduction of withholding taxes. Past performance is not a guarantee of future performance. Please read important disclosures in Appendix.

Developed Defensive Equity: Performance

Composite Performance

March 2011–September 2016

	Global Defensive Equity Composite - Gross of Fees	Global Defensive Equity Composite - Net of Fees	MSCI World *	Gross Excess Return
1Q 2011	-0.5%	-0.5%	-1.0%	0.5%
2Q 2011	4.4%	4.3%	0.5%	4.0%
3Q 2011	-5.8%	-5.9%	-16.6%	10.8%
4Q 2011	3.6%	3.5%	7.6%	-4.0%
1Q 2012	5.7%	5.6%	11.6%	-5.9%
2Q 2012	0.3%	0.2%	-5.1%	5.4%
3Q 2012	6.8%	6.6%	6.7%	0.1%
4Q 2012	-1.2%	-1.3%	2.5%	-3.7%
1Q 2013	10.1%	10.0%	7.7%	2.4%
2Q 2013	-4.2%	-4.3%	0.6%	-4.9%
3Q 2013	6.6%	6.5%	8.2%	-1.6%
4Q 2013	3.5%	3.4%	8.0%	-4.5%
1Q 2014	2.7%	2.6%	1.3%	1.4%
2Q 2014	5.7%	5.6%	4.9%	0.8%
3Q 2014	-2.4%	-2.5%	-2.2%	-0.2%
4Q 2014	0.9%	0.8%	1.0%	-0.1%
1Q 2015	2.0%	1.8%	2.3%	-0.4%
2Q 2015	-1.4%	-1.5%	0.3%	-1.7%
3Q 2015	-4.8%	-4.9%	-8.4%	3.6%
4Q 2015	4.7%	4.6%	5.5%	-0.8%
1Q 2016	5.4%	5.2%	-0.3%	5.7%
2Q 2016	3.7%	3.6%	1.0%	2.7%
3Q 2016	1.3%	1.2%	4.9%	-3.6%
Summary (As of September 30, 2016)				
2011	1.4%	1.0%	-10.8%	12.2%
2012	11.9%	11.4%	15.8%	-4.0%
2013	16.4%	15.9%	26.7%	-10.3%
2014	6.9%	6.4%	4.9%	2.0%
2015	0.2%	-0.2%	-0.9%	1.1%
2016 YTD	10.7%	10.3%	5.6%	5.2%
Since Inception (Ann.)	**8.4%**	**7.9%**	**6.7%**	**1.7%**
Annualized Volatility	**9.4%**	**9.4%**	**12.7%**	**6.7%**
Sharpe Ratio	**0.9**	**0.8**	**0.5**	
Beta vs. MSCI World*	**0.6**	**0.6**	**1.0**	

Source: AQR. Performance for March 1, 2011, through September 30, 2016, of the Global Defensive Equity Composite in USD. Estimated return data for the month ending September 30, 2016. Gross performance does not reflect the deduction of investment advisory fees. Net composite returns of the AQR Global Defensive Equity Composite are net of a standard management fee per annum for this composite of 0.45%. Please note, as we have varying fee arrangements, the net performance numbers above are not representative of all investors or achievable by all investors. Please see the Appendix for important risk and performance disclosures. Excess Returns are in excess to the listed index. The Composite strategy is benchmark-agnostic and therefore this composite has no benchmark. The data presented herein is supplemental to the GIPS® compliant presentation for the Global Defensive Equity Composite included in the Appendix. *MSCI World (Net). Net total return indices reinvest dividends after the deduction of withholding taxes. Past performance is not a guarantee of future performance. Please read important disclosures in Appendix.

Developed Defensive Equity: Characteristics and Exposures

Risk exposures are constrained

- Except those associated with volatility and leverage

Portfolio Characteristics
As of June 30, 2016

	AQR Global Defensive Equity	MSCI World*
Number of Stocks	420	1,644
P/B	2.7	2.1
P/E (Forward)	18.4	15.9
P/E (Trailing)	20.4	18.1
P/CF	12.8	11.6
Sales/EV	0.5	0.5
ROE	21.3	18.6
Earnings Growth 5 Yr (Trailing)	4.0	4.5
Debt/Equity	0.7	1.0
Ex Ante Beta	0.7	1.0
Median Market Cap ($M)	17,847	10,677

Barra GEM2L Risk Exposures
As of June 30, 2016

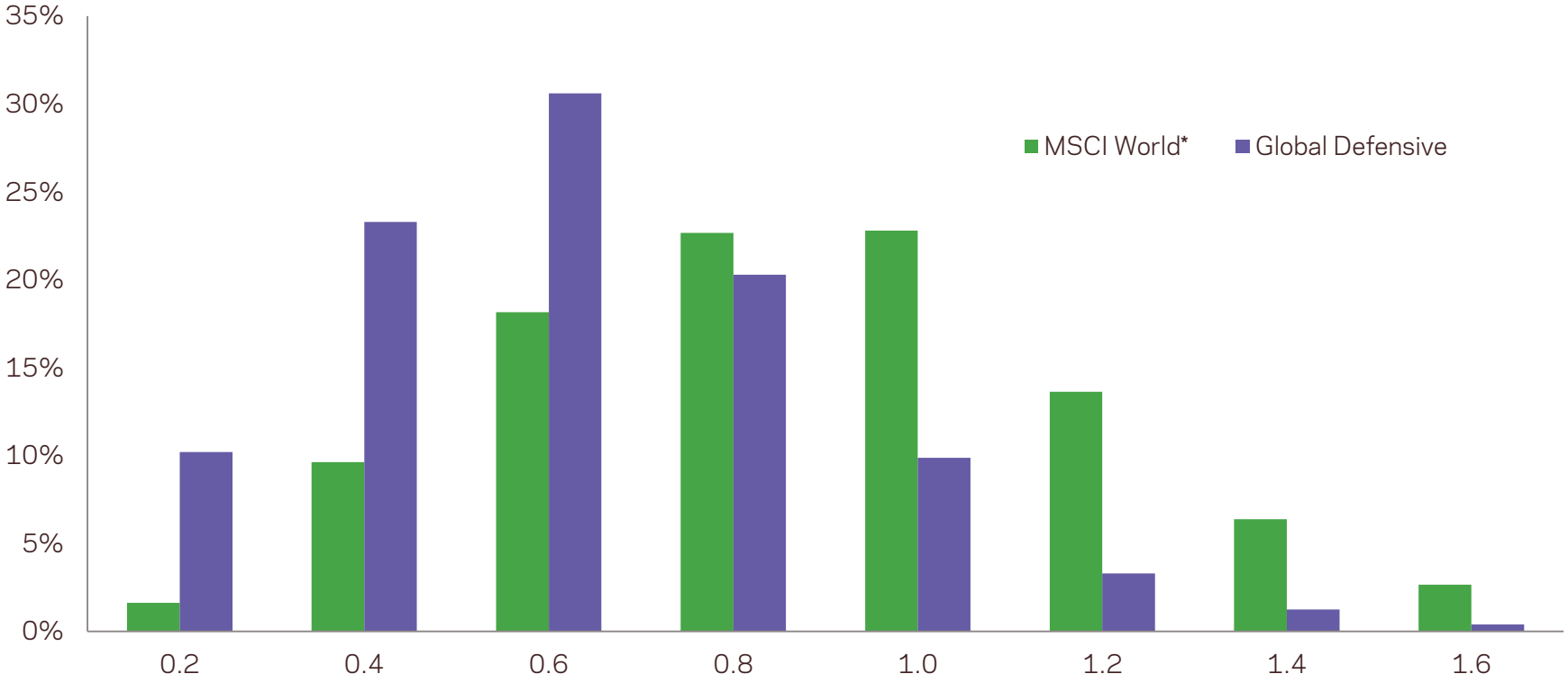
	AQR Global Defensive Equity	MSCI World*
Growth	-0.21	-0.03
Leverage	-0.32	0.00
Liquidity	-0.03	-0.01
Momentum	0.24	0.05
Size	0.05	0.31
Size Nonlinearity	0.11	-0.09
Value	-0.22	0.02
Volatility	-0.61	-0.09
World	1.00	1.00

Data sources: Compustat, Datastream, Bloomberg, XpressFeed, and IBES. Portfolio construction, holdings and exposures are subject to change. Average P/E ratios (both trailing and forecast) of the stocks in the portfolios exclude individual stock price-to-earnings ratios that are negative. Average P/B ratios of the stocks in the portfolios exclude individual stock price-to-book ratios that are negative. Average Sales/EV ratios of the portfolios exclude individual stocks that have sales-to-enterprise values that are negative. Characteristics are from the representative account with unique tracking error and account guidelines and may not be fully representative of other Global Equity portfolios AQR may manage. This information is supplemental to the GIPS® compliant presentation for the Global Defensive Equity Composite included in the Appendix. Please read important disclosures in the Appendix. *MSCI World (Net).

Developed Defensive Equity: Low-Beta Portfolio

More Exposed to Low-Beta Stocks than the Cap-Weighted Benchmark

Distribution of Beta in Developed Equity Portfolios
As of June 30, 2016



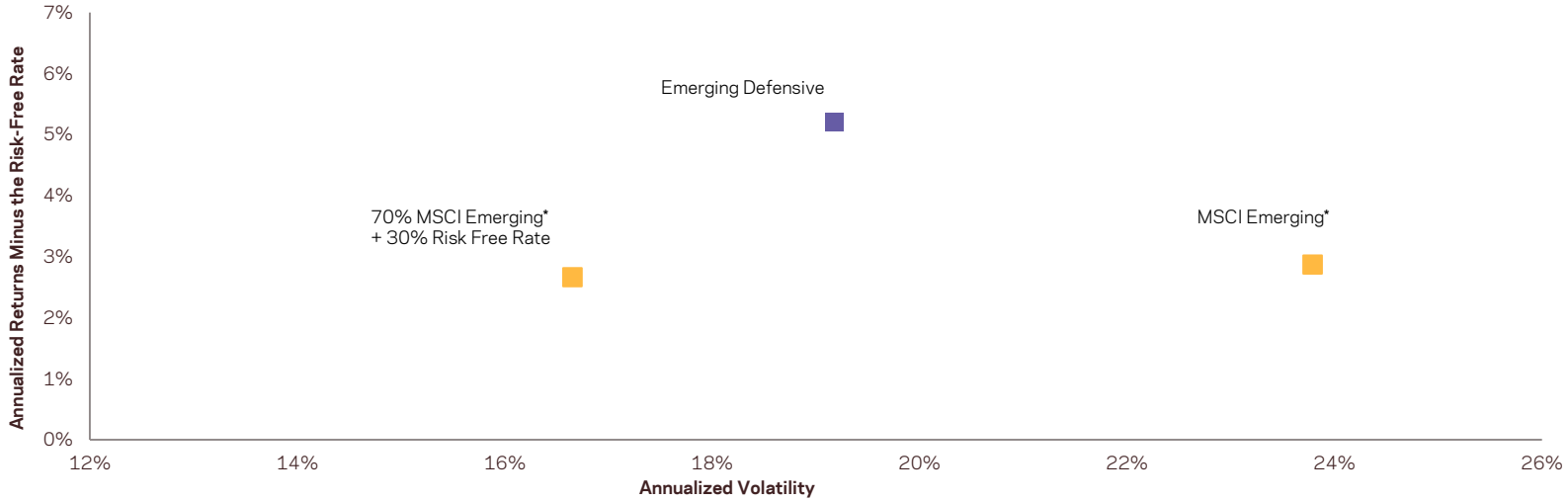
Source: AQR. The Global Defensive Equity Strategy beta distribution is based on estimates and are subject to change. Portfolio construction is subject to change. Characteristics are from the representative account with unique tracking error and account guidelines and may not be fully representative of other Global Equity portfolios AQR may manage. This information is supplemental to the GIPS compliant presentation for the Global Defensive Equity Composite included in the Appendix. Please read important disclosures in the Appendix. *MSCI World (Net).

Emerging Defensive Equity: Performance

Seeking Market-Like Returns With Lower Risk

Hypothetical Risk/Return Trade-Off

January 1996–March 2016



Hypothetical Gross Returns

January 1996–March 2016

	MSCI Emerging*	Emerging Defensive	70% MSCI Emerging* 30% Risk Free Rate
Annualized Return	5.4%	7.7%	5.2%
Annualized Volatility	23.8%	19.2%	16.7%
Sharpe Ratio	0.1	0.3	0.2
Beta vs. MSCI Emerging*	1.0	0.8	0.7
Max Drawdown	-61.6%	-54.1 %	-47.1%

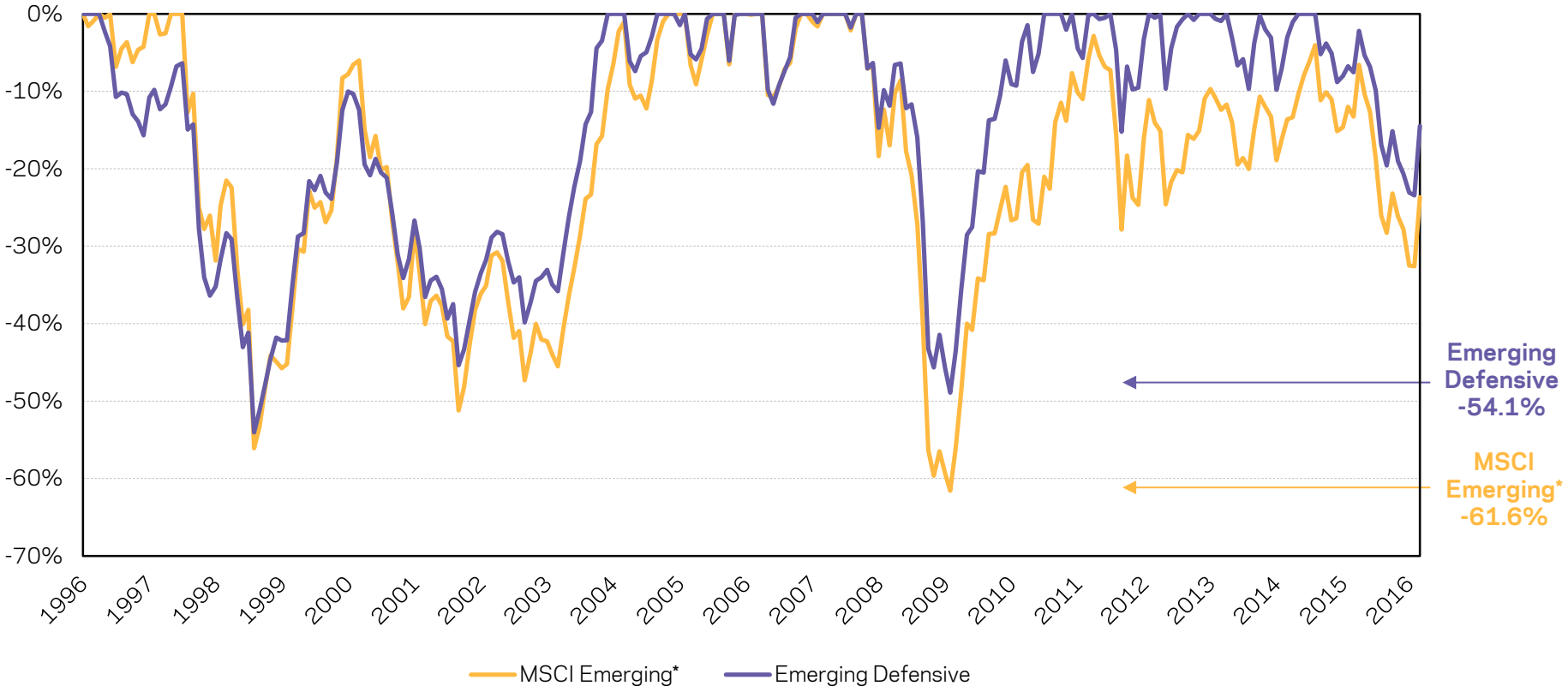
Source: AQR and MSCI Emerging Markets Index. Emerging Defensive is a backtest of AQR's Emerging Defensive Equity Strategy net of transaction and financing costs but gross of advisory fees shown in USD. Please read performance disclosures in the Appendix for a description of the backtest methodology. These are not the returns to an actual portfolio AQR manages and are for illustrative purposes only. Hypothetical performance results have certain inherent limitations, some of which are disclosed in the Appendix. This information is supplemental to the Global Investment Performance Standards (GIPS®) compliant presentation for the Emerging Markets Composite included in the Appendix. *MSCI Emerging (Net). Net total return indices reinvest dividends after the deduction of withholding taxes. Past performance is not a guarantee of future performance. Please read important disclosures in the Appendix.

Emerging Defensive Equity: Drawdown

Hypothetical Emerging Defensive Equity vs. MSCI Emerging*

Drawdown Analysis
January 1996–March 2016

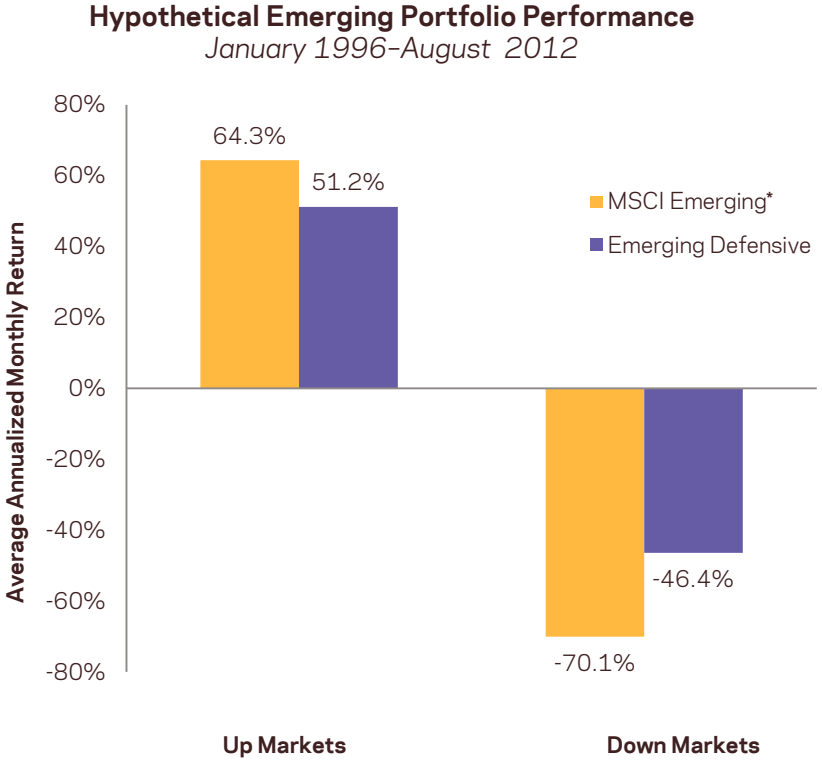
Maximum Drawdown from October 2007

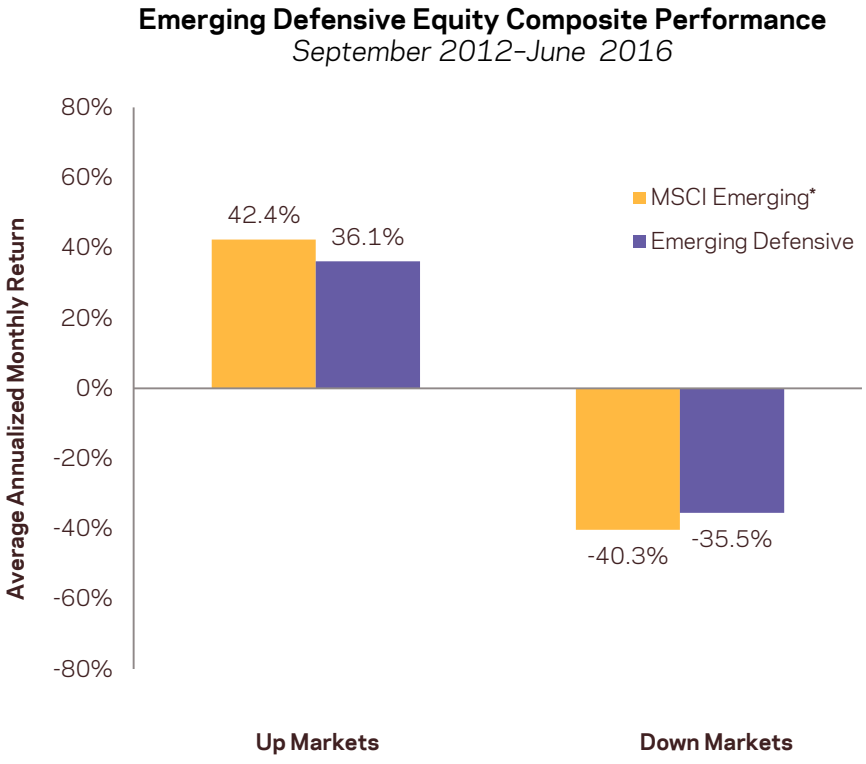


Source: AQR and MSCI Emerging Markets Index. Emerging Defensive is a backtest of AQR's Emerging Defensive Equity Strategy net of transaction and financing costs but gross of advisory fees. Please read performance disclosures in the Appendix for a description of the backtest methodology. This information is supplemental to the GIPS® compliant presentation for the Emerging Markets Composite included in the Appendix. Past performance is not a guarantee of future performance. *MSCI Emerging (Net). Net total return indices reinvest dividends after the deduction of withholding taxes. Please read important disclosures in the Appendix.

Emerging Defensive Equity: Performance

A Low-Beta Strategy That Seeks to Reduce Drawdowns During Stress Periods





Source: AQR and MSCI Emerging Markets Index. Emerging Defensive is a backtest of AQR's Emerging Defensive Equity Strategy net of transaction and financing costs but gross of advisory fees. Please read performance disclosures in the Appendix for a description of the backtest methodology. Emerging Defensive Equity Composite performance is gross of advisory fee. Up and Down market determinations are based on the performance of MSCI Emerging. All performance is shown in USD. These are not the returns to an actual portfolio AQR manages and are for illustrative purposes only. Hypothetical performance results have certain inherent limitations, some of which are disclosed in the Appendix. This information is supplemental to the GIPS® compliant presentation for the Emerging Markets Composite included in the Appendix. Past performance is not a guarantee of future performance. *MSCI Emerging (Net). Net total return indices reinvest dividends after the deduction of withholding taxes. Please read important disclosures in the Appendix.

Emerging Defensive Equity: Performance

Composite Performance

August 2012 - September 2016

	AQR Emerging Defensive Equity Composite - Gross of Fees	AQR Emerging Defensive Equity Composite - Net of Fees	MSCI Emerging*	Gross Excess Return
3Q 2012	4.5%	4.4%	5.7%	-1.2%
4Q 2012	5.3%	5.1%	5.6%	-0.3%
1Q 2013	-1.6%	-1.8%	-1.6%	0.0%
2Q 2013	-5.0%	-5.1%	-8.1%	3.1%
3Q 2013	2.3%	2.2%	5.8%	-3.4%
4Q 2013	0.0%	-0.1%	1.8%	-1.8%
1Q 2014	0.5%	0.3%	-0.4%	0.9%
2Q 2014	6.4%	6.3%	6.6%	-0.2%
3Q 2014	-2.4%	-2.5%	-3.5%	1.1%
4Q 2014	-5.1%	-5.2%	-4.5%	-0.6%
1Q 2015	-1.7%	-1.9%	2.2%	-3.9%
2Q 2015	-1.8%	-1.9%	0.7%	-2.5%
3Q 2015	-13.8%	-13.9%	-17.9%	4.1%
4Q 2015	-1.3%	-1.5%	0.7%	-2.0%
1Q 2016	10.4%	10.2%	5.7%	4.7%
2Q 2016	0.4%	0.2%	0.7%	-0.3%
3Q 2016	1.7%	1.6%	9.0%	-7.3%
Summary (As of September 30, 2016)				
2012	10.0%	9.7%	11.6%	-1.6%
2013	-4.3%	-4.9%	-2.6%	-1.7%
2014	-0.9%	-1.5%	-2.2%	1.3%
2015	-17.9%	-18.4%	-14.9%	-2.9%
2016 YTD	12.7%	12.2%	16.0%	-3.3%
Since Inception (Ann.)	**-0.8%**	**-1.4%**	**1.2%**	**-2.0%**
Annualized Volatility	**13.5%**	**13.5%**	**15.2%**	**5.7%**
Sharpe Ratio	**-0.1**	**-0.1**	**0.1**	
Beta vs. MSCI Emerging*	**0.8**	**0.8**	**1.0**	

Source: AQR Performance for August 1, 2012, through September 30, 2016, of the Emerging Defensive Equity Composite in USD. Estimated return data for the month ending September 30, 2016. Gross performance does not reflect the deduction of investment advisory fees. Net composite returns of the AQR Emerging Defensive Equity Composite are net of a standard management fee per annum for this composite of 0.60%. Please note, as we have varying fee arrangements, the net performance numbers above are not representative of all investors or achievable by all investors. Please see the Appendix for important risk and performance disclosures. Excess Returns are in excess to the listed index. The data presented herein is supplemental to the GIPS® compliant presentation for the Emerging Defensive Equity Composite included in the Appendix. The Composite strategy is benchmark-agnostic and therefore this composite has no benchmark. Past performance is not a guarantee of future performance. *MSCI Emerging (Net). Net total return indices reinvest dividends after the deduction of withholding taxes. Please read important disclosures in the Appendix.

Emerging Defensive Equity: Characteristics and Exposures

Risk exposures are constrained

- Except those associated with volatility and leverage

Portfolio Characteristics
As of June 30, 2016

	AQR Emerging Defensive Equity	MSCI Emerging*
Number of Stocks	212	835
P/B	2.1	1.5
P/E (Forward)	15.2	11.8
P/E (Trailing)	16.7	13.0
P/CF	10.1	8.3
Sales/EV	0.6	0.6
ROE	20.1	17.0
Earnings Growth 5 Yr (Trailing)	7.7	9.5
Debt/Equity	0.4	0.6
Ex Ante Beta	0.8	1.0
Median Market Cap ($M)	6,302	5,502

Barra GEM2L Risk Exposures
As of June 30, 2016

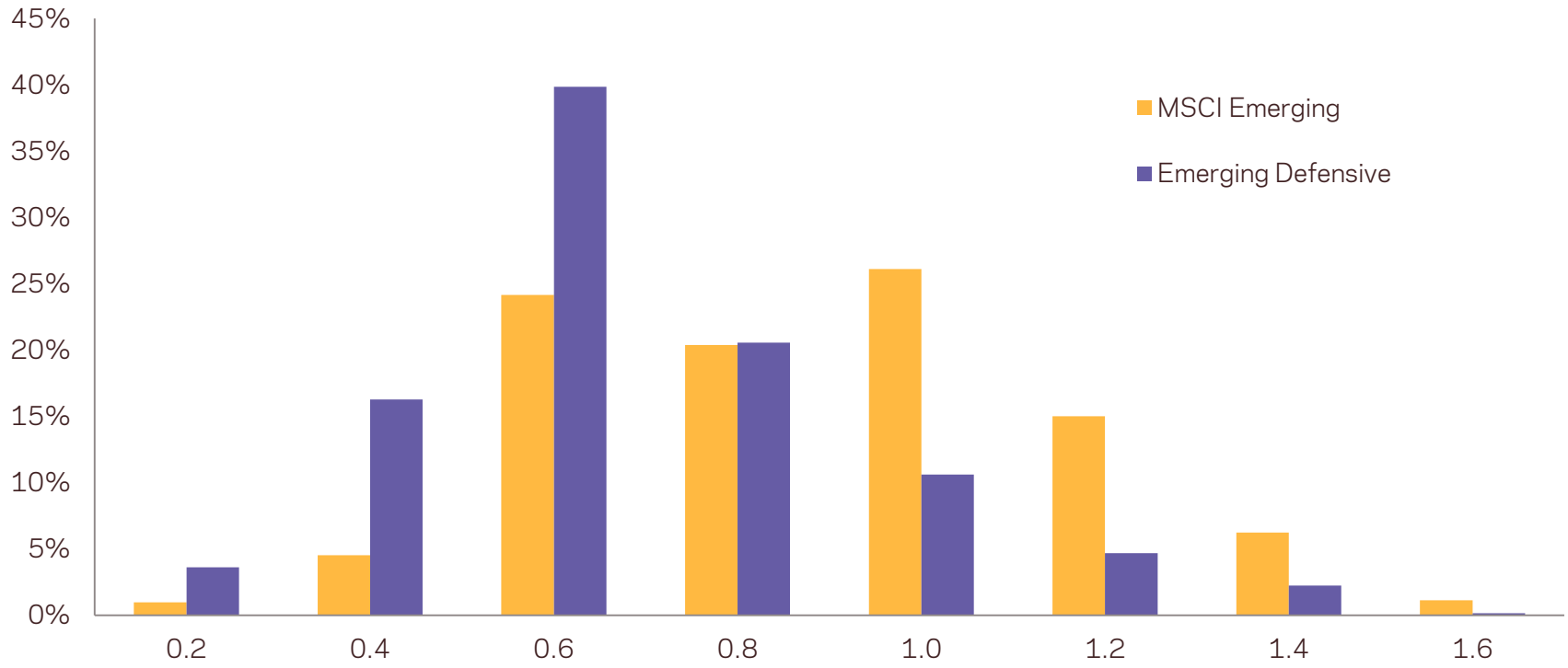
	AQR Emerging Defensive Equity	MSCI Emerging*
Growth	-0.09	0.04
Leverage	-0.32	0.01
Liquidity	0.01	0.15
Momentum	0.08	-0.14
Size	0.05	0.32
Size Nonlinearity	0.08	-0.10
Value	-0.18	0.04
Volatility	-0.60	0.09

Data sources: Compustat, Datastream, Bloomberg, XpressFeed, and IBES. Portfolio construction, holdings and exposures are subject to change. Average P/E ratios (both trailing and forecast) of the stocks in the portfolios exclude individual stock price-to-earnings ratios that are negative. Average P/B ratios of the stocks in the portfolios exclude individual stock price-to-book ratios that are negative. Average Sales/EV ratios of the portfolios exclude individual stocks that have sales-to-enterprise values that are negative. This information is supplemental to the GIPS® compliant presentation for the Emerging Defensive Equity Composite included in the Appendix. Characteristics are from the representative account with unique tracking error and account guidelines and may not be fully representative of other Emerging Defensive Equity portfolios AQR may manage. Please read important disclosures in the Appendix. *MSCI World (Net).

Emerging Defensive Equity: Low-Beta Portfolio

Exploits the "Low-Risk Anomaly" by Overweighting Low-Beta Stocks

Distribution of Beta in Emerging Equity Portfolios
As of June 30, 2016



Source: AQR. The Emerging Defensive Equity Strategy beta distribution is based on estimates and are subject to change. Portfolio construction is subject to change. *MSCI Emerging (Net). Please read important disclosures in Appendix. Characteristics are from the representative account with unique tracking error and account guidelines and may not be fully representative of other Emerging Equity portfolios AQR may manage. Please read important risk disclosures in the Appendix.

Conclusion

AQR Defensive Equity

Defensive Equity strategy aims to deliver downside protection with upside potential

- Through active stock selection, risk management and diversification
- Without buying insurance through derivatives

AQR's Advantage

- Extensive experience in quantitative research and risk management since the mid-1990s
- In-depth knowledge of portfolio construction and optimization
- Advanced trading and transaction cost modeling technology
- Continuous research and innovation

Appendices

Defensive Equity: Backtest

Backtesting Methodology

Universe

- Liquid tradable universes for Developed (roughly equivalent to the MSCI World Index) and Emerging (roughly equivalent to the MSCI Emerging Index)

Quarterly rebalancing frequency with the following backtesting period

- Developed Defensive Equity: February 1993 to March 2016
- Emerging Defensive Equity: January 1995 to March 2016

Risk model

- For our Developed Defensive Equity strategy
  - Barra Global Equity Model (GEM) from 1993 to 2004
  - Barra Global Equity Model 2 Long-term (GEM2L) from 2005 to 2014
- For our Emerging Defensive Equity strategy
  - Barra Global Equity Model (GEM) from 1995 to 1996
  - Barra Global Equity Model 2 Long-term (GEM2L) from 1997 to 2014

Performance is measured after AQR's proprietary t-cost estimates

Disclosures

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There is no guarantee, express or implied, that long-term return and/or volatility targets will be achieved. Realized returns and/or volatility may come in higher or lower than expected. Diversification does not eliminate the risk of experiencing investment losses. ***Past performance is not a guarantee of future performance.***

Hypothetical performance results (e.g., quantitative backtests) have many inherent limitations, some of which, but not all, are described herein. No representation is being made that any fund or account will or is likely to achieve profits or losses similar to those shown herein. In fact, there are frequently sharp differences between hypothetical performance results and the actual results subsequently realized by any particular trading program. One of the limitations of hypothetical performance results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. For example, the ability to withstand losses or adhere to a particular trading program in spite of trading losses are material points which can adversely affect actual trading results. The hypothetical performance results contained herein represent the application of the quantitative models as currently in effect on the date first written above and there can be no assurance that the models will remain the same in the future or that an application of the current models in the future will produce similar results because the relevant market and economic conditions that prevailed during the hypothetical performance period will not necessarily recur. There are numerous other factors related to the markets in general or to the implementation of any specific trading program which cannot be fully accounted for in the preparation of hypothetical performance results, all of which can adversely affect actual trading results. Discounting factors may be applied to reduce suspected anomalies. This backtest's return, for this period, may vary depending on the date it is run. Hypothetical performance results are presented for illustrative purposes only. In addition, our transaction cost assumptions utilized in backtests, where noted, are based on AQR's historical realized transaction costs and market data. Certain of the assumptions have been made for modeling purposes and are unlikely to be realized. No representation or warranty is made as to the reasonableness of the assumptions made or that all assumptions used in achieving the returns have been stated or fully considered. Changes in the assumptions may have a material impact on the hypothetical returns presented. Hypothetical performance is gross of advisory fees, net of transaction costs, and includes the reinvestment of dividends. If the expenses were reflected, the performance shown would be lower.

There is a risk of substantial loss associated with trading commodities, futures, options, derivatives and other financial instruments. Before trading, investors should carefully consider their financial position and risk tolerance to determine if the proposed trading style is appropriate. Investors should realize that when trading futures, commodities, options, derivatives and other financial instruments one could lose the full balance of their account. It is also possible to lose more than the initial deposit when trading derivatives or using leverage. All funds committed to such a trading strategy should be purely risk capital.

Broad-based securities indices are unmanaged and are not subject to fees and expenses typically associated with managed accounts or investment funds. Investments cannot be made directly in an index.

The MSCI World Index is a free float-adjusted market capitalization weighted index that is designed to measure the equity market performance of developed markets.

The MSCI Global Minimum Volatility Indexes are designed to serve as transparent and relevant benchmarks for managed volatility equity strategies. The indexes aim to reflect the performance characteristics of a minimum-variance strategy, focused on providing absolute return and volatility with the lowest absolute risk. Please note used in this presentation is an AQR proxy MSCI Minimum Volatility Index.

The Russell 1000 Index is an index of approximately 1,000 of the largest companies in the U.S. equity markets. It comprises over 90% of the total market capitalization of all listed U.S. stocks, and is considered a bellwether index for large cap investing.

The MSCI Emerging Markets Index is a free float-adjusted market capitalization index that is designed to measure equity market performance in the global emerging markets.

Performance Disclosures

AQR Capital Management, LLC
Global Defensive Equity Composite
2/28/11 - 12/31/15

Year	Gross Return %	Number of Portfolios	Composite 3-Yr StDev %	Composite Assets ($M)	Total Firm Assets ($M)	% Non-Fee Paying Portfolios
2011	1.40	1	N/A	3.47	43,540.99	100
2012	11.87	1	N/A	3.89	71,122.42	100
2013	16.42	3	N/A	812.67	98,302.69	0
2014	6.91	3	9.01	1,236.00	122,655.99	0
2015	0.25	4	9.69	1,064.06	142,173.39	0

*** No Benchmark**

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AQR claims compliance with the Global Investment Performance Standards (GIPS®) and has prepared and presented this report in compliance with the GIPS standards. AQR has been independently verified for the period August 1998 through December 2015. The verification reports are available upon request. Verification assesses whether (1) the firm has complied with all the composite construction requirements of the GIPS standards on a firm-wide basis and (2) the firm's policies and procedures are designed to calculate and present performance in compliance with the GIPS standards. Verification does not ensure the accuracy of any specific composite presentation.

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For purposes of firm-wide compliance and firm-wide total assets, AQR defines the "Firm" as entities controlled by or under common control with AQR (including voting right). The Firm is comprised of AQR and its advisory affiliates, including CNH Partners, LLC ("CNH").

Upon request AQR will make available a complete list and description of all of Firm composites, as well as additional information regarding the policies for valuing portfolios, calculating performance, and preparing compliant presentations.

Past performance is not an indication of future performance.

Performance Disclosures

AQR Capital Management, LLC
Global Defensive Equity Composite
2/28/11 – 12/31/15

Composite Characteristics: The Global Defensive Equity Composite (the "Composite") was created in March 2011. Accounts included seek to provide capital protection when global equity markets decline while capturing a significant portion of the upside in rising global equity markets. *The Composite strategy is benchmark agnostic and therefore the Composite has no benchmark. The Composite is denominated in USD.

New accounts that fit the composite definition are added at the start of the first full calendar month after the assets come under management, or after it is deemed that the investment decisions made by the investment advisor fully reflect the intended investment strategy of the portfolio. Composites will exclude terminated portfolios after the last full calendar month performance measurement period that the assets were under management. The Composite will continue to include the performance results for all periods prior to termination. Effective for periods beginning July 1, 2010 through February 28, 2015, the composite defined a significant cash flow as an external cash flow within a portfolio of 50%. Additional information is available upon request.

Calculation Methodology: All portfolios except mutual funds and UCITS are valued monthly and intra-month for large cash flows as defined by firm policy. The Modified Dietz calculation methodology is used when calculating monthly and intra-month returns. Mutual funds and UCITS are valued daily and performance is calculated on a daily basis. Gross of fees returns are calculated gross of management and performance fees, administrative and custodial costs and net of transaction costs beginning January 1, 2010. Prior to January 1, 2010, gross of fees returns are gross of management and performance fees, and net of administrative, custodial, and transaction costs. Additional information regarding fees and the calculation of gross and net performance is available upon request.

The dispersion measure is the equal-weighted standard deviation of accounts in the composite for the entire year. Dispersion is not considered meaningful for periods shorter than one year or for periods during which the composite contains five or fewer accounts for the full period. The three-year annualized ex-post standard deviation measure is inapplicable when 36 monthly returns are not available.

Fees: Returns are calculated net of all withholding taxes on foreign dividends. Accruals for fixed income and equity securities are included in calculations. AQR's management or advisory fees are described in Part 2A of its Form ADV. In addition, AQR funds may have a redemption charge of 2.00% based on gross redemption proceeds that may be charged upon early withdrawals. Consultants supplied with gross results are to use this data in accordance with SEC, CFTC and NFA guidelines.

AQR's asset based fees for portfolios within the Composite may range up to 0.45% of assets under management and are generally billed monthly or quarterly at the commencement of the calendar month or quarter during which AQR will perform the services to which the fees relate.

Other Disclosures: AQR may engage in leveraged, derivative, and short positions in order to meet its performance objectives. The use of these positions may have a material impact on performance results. Additionally, there may be subjective unobservable inputs used in the valuation of certain financial instruments utilized by certain AQR managed investment vehicles. The risks inherent to the strategies employed by accounts included are set forth in the applicable offering documents and other information provided to potential subscribers, from where more detailed information regarding the extent to which leverage, derivatives, and short positions can be obtained. These are available on request, if not provided along with this presentation itself.

Performance Disclosures

AQR Capital Management, LLC
Emerging Defensive Equity Composite
7/31/12 - 12/31/15

Year	Gross Return %	Net Return %	Number of Portfolios	Dispersion %	Composite 3-Yr StDev %	Composite Assets ($M)	Total Firm Assets ($M)
2012	9.95	9.68	2	N/A	N/A	234.62	71,122.42
2013	-4.34	-4.92	2	N/A	N/A	320.43	98,302.69
2014	-0.87	-1.46	2	N/A	N/A	225.88	122,655.99
2015	-17.85	-18.35	2	N/A	12.76	129.10	142,173.39

*** No Benchmark**

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AQR claims compliance with the Global Investment Performance Standards (GIPS®) and has prepared and presented this report in compliance with the GIPS standards. AQR has been independently verified for the period August 1998 through December 2015. The verification reports are available upon request. Verification assesses whether (1) the firm has complied with all the composite construction requirements of the GIPS standards on a firm-wide basis and (2) the firm's policies and procedures are designed to calculate and present performance in compliance with the GIPS standards. Verification does not ensure the accuracy of any specific composite presentation.

Firm Information: AQR Capital Management, LLC ("AQR") is a Connecticut based investment advisor registered with the Securities and Exchange Commission under the Investment Advisors Act of 1940. AQR conducts trading and investment activities involving a broad range of instruments, including, but not limited to, individual equity and debt securities, currencies, futures, commodities, fixed income products and other derivative securities.

For purposes of firm-wide compliance and firm-wide total assets, AQR defines the "Firm" as entities controlled by or under common control with AQR (including voting right). The Firm is comprised of AQR and its advisory affiliates, including CNH Partners, LLC ("CNH").

Upon request AQR will make available a complete list and description of all of Firm composites, as well as additional information regarding the policies for valuing portfolios, calculating performance, and preparing compliant presentations.

Past performance is not an indication of future performance.

Performance Disclosures

AQR Capital Management, LLC
Emerging Defensive Equity Composite
7/31/12 - 12/31/15

Composite Characteristics: The Emerging Defensive Equity Composite (the "Composite") was created in September 2012. Accounts included seek to provide capital protection when Emerging equity markets decline while capturing a significant portion of the upside in rising Emerging equity markets. Beginning May 2016, the composite characteristics are updated to the standardized style description. The investment objective is unchanged. Prior to May 2016 the composite inception date was August 31, 2012. The Composite is denominated in USD. *The composite strategy is benchmark agnostic and therefore the composite has no benchmark.

New accounts that fit the composite definition are added at the start of the first full calendar month after the assets come under management, or after it is deemed that the investment decisions made by the investment advisor fully reflect the intended investment strategy of the portfolio. Composites will exclude terminated portfolios after the last full calendar month performance measurement period that the assets were under management. The Composite will continue to include the performance results for all periods prior to termination. Effective for periods beginning July 1, 2010 through February 28, 2015, the composite defined a significant cash flow as an external cash flow within a portfolio of 50%. Additional information is available upon request.

Calculation Methodology: All portfolios except mutual funds and UCITS are valued monthly and intra-month for large cash flows as defined by firm policy. The Modified Dietz calculation methodology is used when calculating monthly and intra-month returns. Mutual funds and UCITS are valued daily and performance is calculated on a daily basis. Gross of fees returns are calculated gross of management and performance fees, administrative and custodial costs and net of transaction costs beginning January 1, 2010. Prior to January 1, 2010, gross of fees returns are gross of management and performance fees, and net of administrative, custodial, and transaction costs. Additional information regarding fees and the calculation of gross and net performance is available upon request.

Composite net of fees returns are calculated by deducting the maximum management or advisory fee charged by AQR from the gross composite monthly returns to all portfolios in the composite. The standard model management fee per annum for this Composite is specified below. Composite assets may have been exposed to the impact of performance fees.

The dispersion measure is the equal-weighted standard deviation of accounts in the composite for the entire year. Dispersion is not considered meaningful for periods shorter than one year or for periods during which the composite contains five or fewer accounts for the full period. The three-year annualized ex-post standard deviation measure is inapplicable when 36 monthly returns are not available.

Fees: Returns are calculated net of all withholding taxes on foreign dividends. Accruals for fixed income and equity securities are included in calculations. AQR's management or advisory fees are described in Part 2A of its Form ADV. In addition, AQR funds may have a redemption charge of 2.00% based on gross redemption proceeds that may be charged upon early withdrawals. Consultants supplied with gross results are to use this data in accordance with SEC, CFTC and NFA guidelines.

AQR's asset based fees for portfolios within the Composite may range up to 0.60% of assets under management and are generally billed monthly or quarterly at the commencement of the calendar month or quarter during which AQR will perform the services to which the fees relate.

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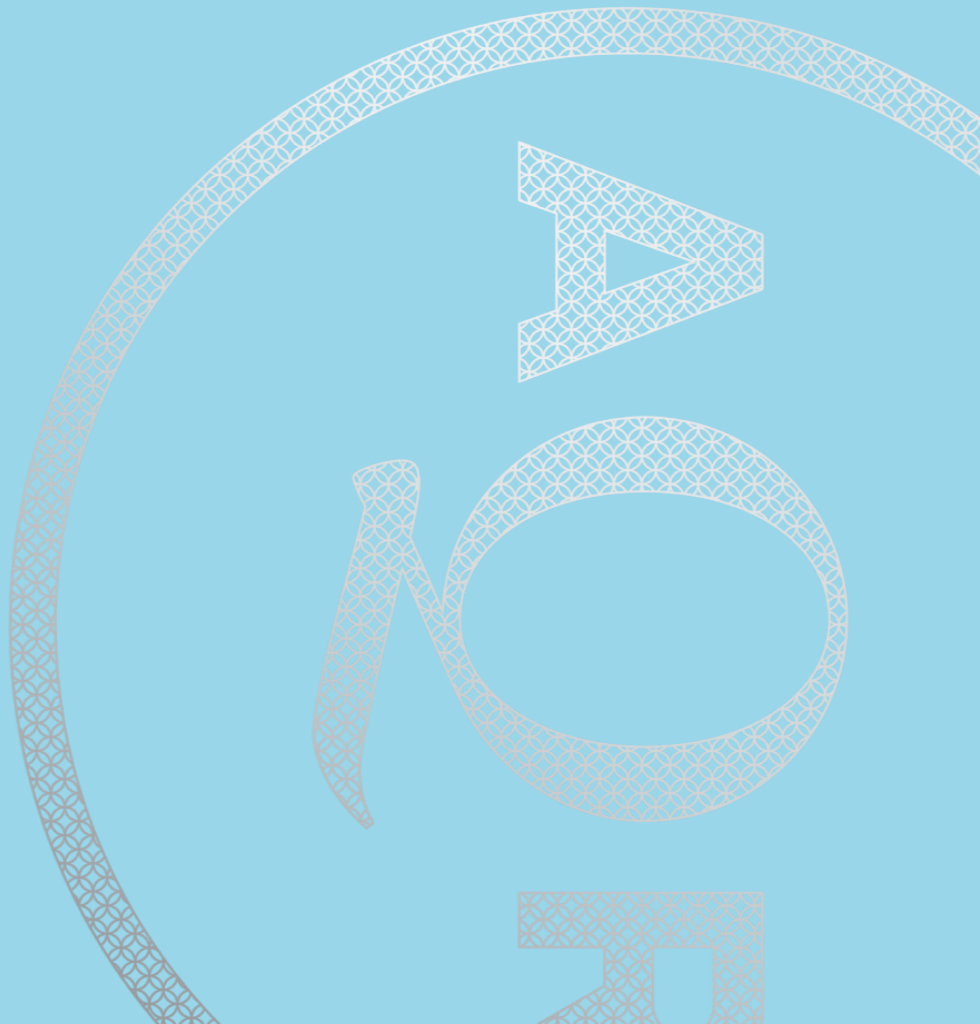


TAB 7 – International Risk Premia Strategy

OPERF Public Equity Portfolio

Oregon Investment Council
OPERF Public Equity Portfolio – World X-U.S. Risk Premia Strategy
STAFF RECOMMENDATION
October 26, 2016

Purpose

Recommend funding a $1.2 billion internally-managed World X-U.S. Risk Premia strategy within the OPERF Public Equity Portfolio.

Background - Internal Management

Staff has successfully managed select public equity strategies since 2009. As of September 30, 2016, internally-managed public equity AUM totaled approximately $5.2 billion, representing 19 percent of OPERF's $26.1 billion global public equity portfolio. Since inception, all internally-managed public equity mandates have outperformed their assigned benchmarks.

Exhibit 1
Internally Managed Equity Performance (Period Ending 9/30/16, unless otherwise noted)

Period Ending 9/30/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
OST 400 Portfolio	$ 532,520,632	12.70%	15.69%	8.40%	9.63%	13.96%	16.77%	14.26%
S&P 400 Index		12.40%	15.33%	8.14%	9.35%	13.66%	16.51%	13.96%
Excess		0.29%	0.37%	0.27%	0.27%	0.30%	0.26%	0.30%
Inception Date of Oct. 1, 2009	Tracking Error = 30 bps	Target Excess Return: 10 bps						

Period Ending 9/30/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
OST 500 Portfolio	$ 1,953,966,495	7.83%	15.47%	7.16%	11.21%	13.20%	16.41%	13.23%
S&P 500 Index		7.84%	15.43%	7.11%	11.16%	13.15%	16.37%	13.17%
Excess		0.00%	0.04%	0.05%	0.04%	0.04%	0.04%	0.056%
Inception Date of Oct 1, 2009	Tracking Error = 10 bps	Target Excess Return: 5 bps						

Period Ending 9/30/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
Russell 2000 Synthetic	$ 384,147,678	12.74%	17.06%	9.31%	7.73%	13.12%	16.92%	12.39%
Russell 2000 Index		11.46%	15.47%	8.12%	6.71%	12.12%	15.82%	11.39%
Excess		1.28%	1.59%	1.19%	1.02%	1.00%	1.10%	1.00%
Inception Date of April 1, 2010	Tracking Error = 50 bps	Target Excess Return: 30 bps						

Period Ending 9/30/15	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
TEMS	$ 180,449,700	-16.55%	-22.43%	-9.25%	-6.42%	-0.92%	-4.08%	9.01%
MSCI EM Index		-15.48%	-19.28%	-8.25%	-5.27%	-0.15%	-3.24%	8.87%
Excess		-1.07%	-3.15%	-1.01%	-1.15%	-0.77%	-0.85%	0.14%
Inception Date of Feb 1, 2009	Tracking Error = 400 bps	Target Excess Return: 200 bps	TERMINATED SEPTEMBER 30, 2015					

Period Ending 8/31/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
RUSSELL RAFI LC	$ 1,371,571,346	10.27%	13.81%	4.97%	11.23%	14.23%	N/A	14.65%
RAFI LC Index		*10.06%*	*13.54%*	*4.90%*	*11.21%*	*14.21%*	*N/A*	*14.62%*
RUSSELL 1000		7.83%	11.69%	5.89%	12.02%	13.93%	N/A	14.46%
Excess		2.43%	2.11%	-0.93%	-0.79%	0.31%	N/A	0.19%
Inception Date of Nov 1, 2011	Tracking Error = 300 bps	Target Excess Return: 150 bps	TERMINATED AUGUST 31, 2016					

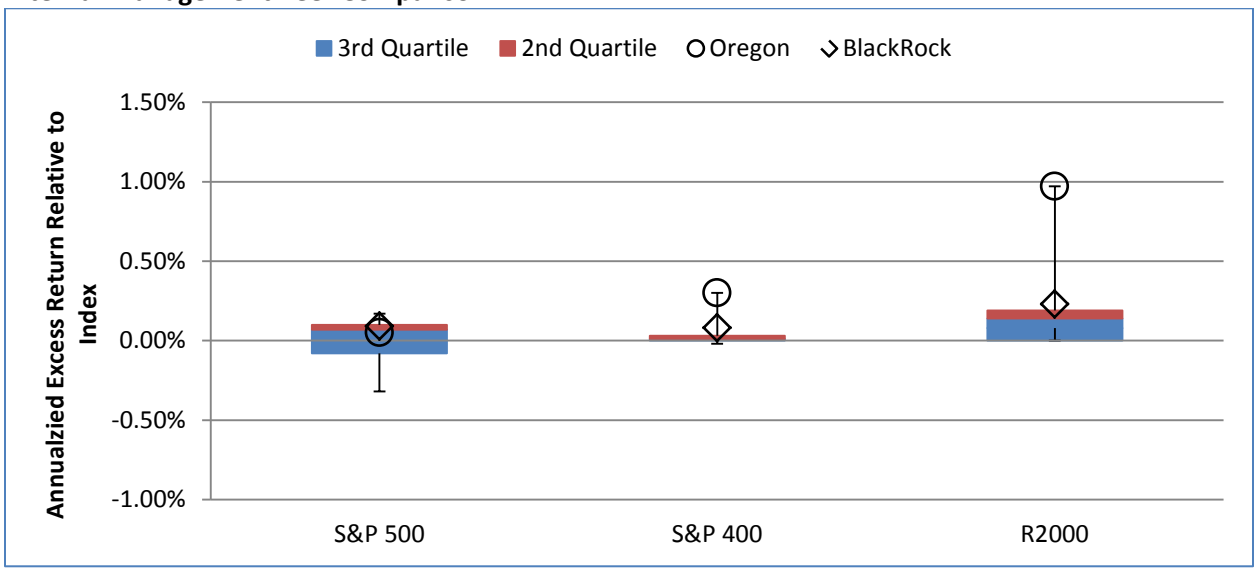
Period Ending 9/30/16	Market Value	YTD	1 year	2 years	3 years	4 years	5 years	Inception
RISK PREMIA	$ 2,145,793,982	7.06%	14.65%	8.27%	N/A	N/A	N/A	8.90%
MSCI Risk Premia Index		*7.02%*	*14.76%*	*8.35%*	*N/A*	*N/A*	*N/A*	*8.93%*
MSCI USA		7.78%	14.97%	6.93%	N/A	N/A	N/A	8.04%
Excess		-0.719%	-0.327%	1.337%	N/A	N/A	N/A	0.87%
Inception Date of Jan 1, 2014	Tracking Error = 300 bps	Target Excess Return: 150 bps						

Source: State Street

In addition, and as seen in the following chart created from the ***eVestment*** consulting database (Exhibit 2), OPERF's internally-managed, passive public equity strategies (S&P 500, S&P 400 and Russell 2000) have performed well in peer group rankings that include other institutional asset managers. Specifically,

each of OPERF's internally-managed, passive public equity strategies ranks in the top quartile of its respective peer group universe. While past performance does not guarantee future results, with the experience reflected by the above-listed results as well as the processes established to produce those results, staff expects internally-managed strategies to continue to deliver cost-effective, value-accreting performance.

Exhibit 2
Internal Management Peer Comparison



Source: eVestment, gross of fees, through June 30, 2016. Inception dates correspond to internally-managed mandate launches.

Aladdin User Site Visits

Staff conducted half day on-site visits with various BlackRock Solutions Aladdin ("Aladdin") users managing international equity assets:

1) Virginia Retirement System has been managing international developed and emerging market equity strategies internally for several years, and recently acquired and converted to the Aladdin platform;
2) California State Teachers Retirement System (CalSTRS) has been managing an international developed equity strategy for two months. CalSTRS on-boarded this strategy in Aladdin with no issues;
3) Microsoft Corporation's treasury department has been managing U.S. and international developed equity strategies for four and two years, respectively; and
4) BlackRock Asset Management recently implemented Aladdin for its index management group.

Aladdin is an operationally robust portfolio management tool. With the exception of foreign exchange considerations, the portfolio management work flows between U.S. and international equity strategies are identical.

Currently, staff time devoted to internal management activities is modest (roughly 15 – 20 percent of total public equity staff time). This efficient use of staff time reflects in part the trading and internal management infrastructure developed for and in support of these efforts:

1) Implemented Aladdin for equity portfolio and risk management efforts (2015);
2) Initiated Aladdin-based workflows to support mid- and back-office functionality in connection with equity and futures trading activities (2015); and
3) Activated Aladdin pre- and post-trade compliance protocols (2014).

In staff's opinion, given the systems, personnel and processes already in place and as described above, the addition of an internally-managed World X-U.S. Risk Premia portfolio would require little incremental resources. Additionally, the BlackRock team that services OST has been directly involved in the recent launch of a similar international equity mandate at CalSTRS. Staff is highly confident in the BlackRock team's ability to assist OST with the successful launch of the proposed World X-U.S. Risk Premia portfolio.

MSCI Risk Premia Indices

Risk factor indices are relatively new offerings by multiple index providers. Staff reviewed and compared various suites of indices currently available. Although there are small nuances between different index providers (e.g., types of fundamental data, constituent weightings, etc.), these indices generally deliver similar risk factor exposures. Staff found MSCI's focus on the balance between factor efficacy and practical "investability" particularly attractive. In addition, the depth of MSCI's research resources, the integration between its index and Barra Risk platform divisions, and the fact that MSCI currently provides benchmarks for a number of existing OPERF strategies made MSCI staff's preferred choice.

Staff proposes to construct an international risk premia strategy which will have a blending of four specific risk factor exposures: 1) MSCI's World X-U.S. Momentum; 2) MSCI World X-U.S. Enhanced Value; 3) MSCI World X-U.S. Quality; and MSCI World X-U.S. Low Vol.

Issues to Consider

Pros

- This approach will provide direct exposures to risk factor premia that enjoy abundant and robust empirical support as persistent sources of excess return.
- The proposed blended index is aimed at a very liquid segment of the public equity market (developed X-U.S.) and should have little or no market impact in the reallocation of existing mandates.
- This strategy's portfolio management costs will be consistent with the management fees associated with the mandates it replaces (i.e., a low single digit basis point license fee).
- Staff has high regard for MSCI, a leading provider of indices and risk management systems.
- Staff has been managing a U.S.-based MSCI Risk Premia portfolio since January 2014 and is very familiar with the operational aspects of MSCI index rebalancings.

Cons

- Risk factor premia have historically produced **long-term outperformance**, but have also experienced significant, multi-year periods of underperformance. [**Mitigant**: Strong empirical evidence supports both the efficacy of these risk factor premia (i.e., these factors produce a higher mean return relative to market averages) as well as reversions to this higher mean following periods of underperformance.]

- Tilting toward risk premia implies that the OST Public Equity Portfolio may no longer be neutral relative to Value and Growth dimensions. [**Mitigant**: Portfolio exposures in the OPERF Public Equity continue to be managed relative to the MSCI ACWI IMI benchmark and consistent with the OIC's 200 basis point annual tracking error allowance.]
- This blended index may not deliver the desired levels of exposure to the underlying risk factors. [**Mitigant**: MSCI will provide a customizable index, so staff will regularly evaluate index construction to ensure it delivers the appropriate blend of both risk factor exposure and investability.]
- Managing Non-U.S. portfolios might be more operationally complex than managing U.S.-based equity portfolios. [**Mitigant**: Staff has visited various public, corporate, and asset management firms that use Aladdin for their Non-U.S. portfolio management mandates.]

The recommendation of the MSCI World X-US Risk Premia strategy is consistent with **OIC INV 1201** - *Statement of OIC Investment and Management Beliefs:*

> *Section 6.A. - All fees, expenses, commissions and transaction costs should be diligently monitored and managed in order to maximize net investment returns*.
>
> 1. *Active management should therefore be a deliberate choice and applied only to those public market strategies/managers in which the OIC enjoys a high degree of confidence that such strategies/managers will be sufficiently rewarded on a risk-adjusted basis and net of all fees and related transactions costs.*

<u>Recommendation</u>

1. Staff recommends funding an internally-managed, international developed risk premia public equity strategy in the amount of $1.2 billion.
2. Amend OIC policy VIN 603 (Internal Equity – Portfolio Objectives & Strategies) accordingly.

TAB 8 – CEM Benchmarking Report

OPERF

CEM Benchmarking Inc.
2015 OPERF Cost Study

Purpose
To present the OPERF investment cost analysis performed by CEM Benchmarking Inc. ("CEM") for both the calendar and five-year period ended December 31, 2015.

Background
Beginning in 2003, Treasury staff provided the OIC an independent assessment of the various costs incurred for OPERF management (e.g., asset management, custody and consulting fees), and how those costs and resultant net OPERF performance compare with other institutional investors.

CEM is recognized as the foremost, independent, third-party provider of cost analysis to defined benefit and defined contribution plans. Using the firm's unique database, CEM has provided defined benefit fund sponsors with net return and cost insights since 1990. That database includes 162 pension funds (including 55 U.S. public funds), valued at approximately $3.2 trillion.

Similar to previous years' analyses, staff provided CEM with updated OPERF cost and operating data. For the calendar year ended December 31, 2015, OPERF's total investment costs (including asset management, custody, consulting and other fees) were approximately 74 basis points, consistent with the 76 bps reported for calendar year 2014.

OPERF's custom peer group for benchmarking purposes is comprised of 17 U.S. funds ranging in asset size from $24 billion to $89 billion. In terms of asset size, the peer group's median fund was $46 billion, and within the peer group, OPERF was the 6th largest fund. Based on CEM's analysis, OPERF's total costs given its implementation style and asset mix were higher than "expected" by approximately $10.8 million or 1.6 basis points.

Staff Recommendation
None, information only. Report findings will be presented by CEM.

Oregon Public Employees Retirement Fund
Investment Benchmarking Results

For the 5 year period ending December 2015

Bruce Hopkins
CEM Benchmarking Inc
October 26, 2016

CEM Benchmarking Inc.
What gets measured gets managed

Key takeaways

Returns

- Your 5-year net total return was 8.1%. This was above the U.S. Public median of 7.2% and above the peer median of 7.5%.
- Your 5-year policy return was 8.4%. This was above the U.S. Public median of 7.2% and above the peer median of 7.3%.

Value added

- Your 5-year net value added was -0.2%. This was slightly below the U.S. Public median of 0.0% and slightly below the peer median of 0.0%.

Cost

- Your investment cost of 73.5 bps was above the peer median cost of 50.5 bps. You were higher cost because your investments were more heavily weighted in higher cost private asset classes. However, your cost was close to your benchmark cost of 71.8 bps. This suggests that your fund was normal cost compared to your peers, given your assets.
- Your fund was normal cost because you had a higher cost implementation style. This added cost was partly offset because you paid less than peers for similar services.

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This benchmarking report compares your cost and return performance to CEM's extensive pension database.

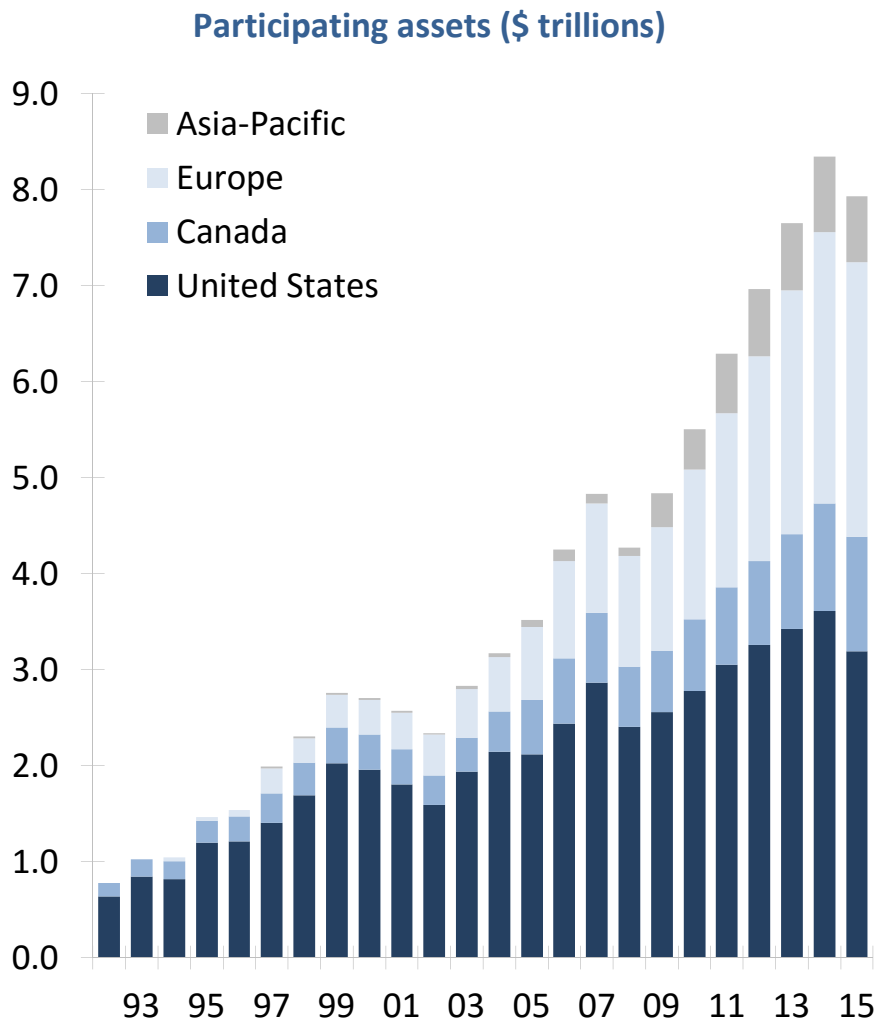
• 162 U.S. pension funds participate with total participating assets of $3.2 trillion.

• 70 Canadian funds participate with assets totaling $1,189 billion.

• 51 European funds participate with aggregate assets of $2.7 trillion. Included are funds from the Netherlands, Norway, Sweden, Finland, Ireland, Denmark and the U.K.

• 6 Asia-Pacific funds participate with aggregate assets of $685 billion. Included are funds from Australia, New Zealand, China and South Korea.

The most meaningful comparisons for your returns and value added are to the U.S. Public universe which consists of 55 funds.



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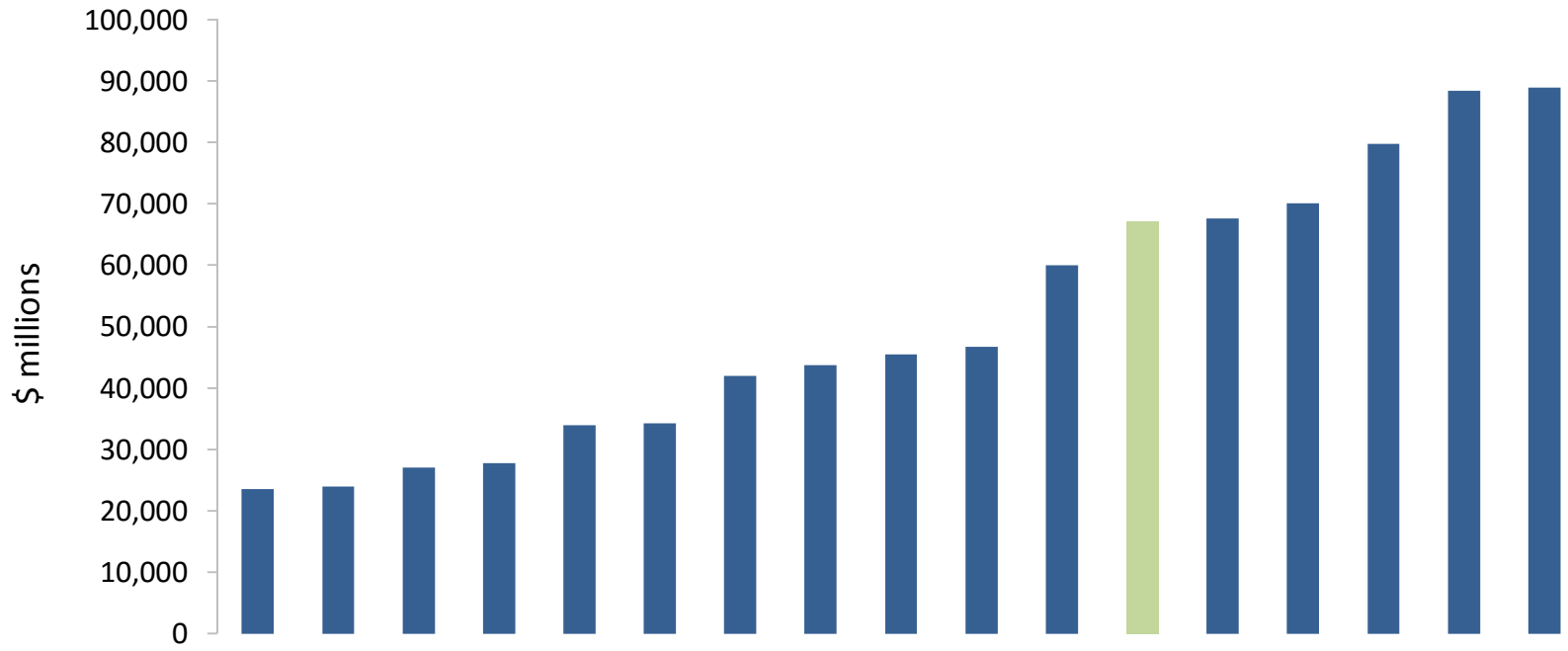
The most valuable comparisons for cost performance are to your custom peer group because size impacts costs.

Peer group for Oregon Public Employees Retirement Fund

- 17 U.S. public sponsors from $24 billion to $89 billion
- Median size of $46 billion versus your $67 billion



To preserve client confidentiality, given potential access to documents as permitted by the Freedom of Information Act, we do not disclose your peers' names in this document.

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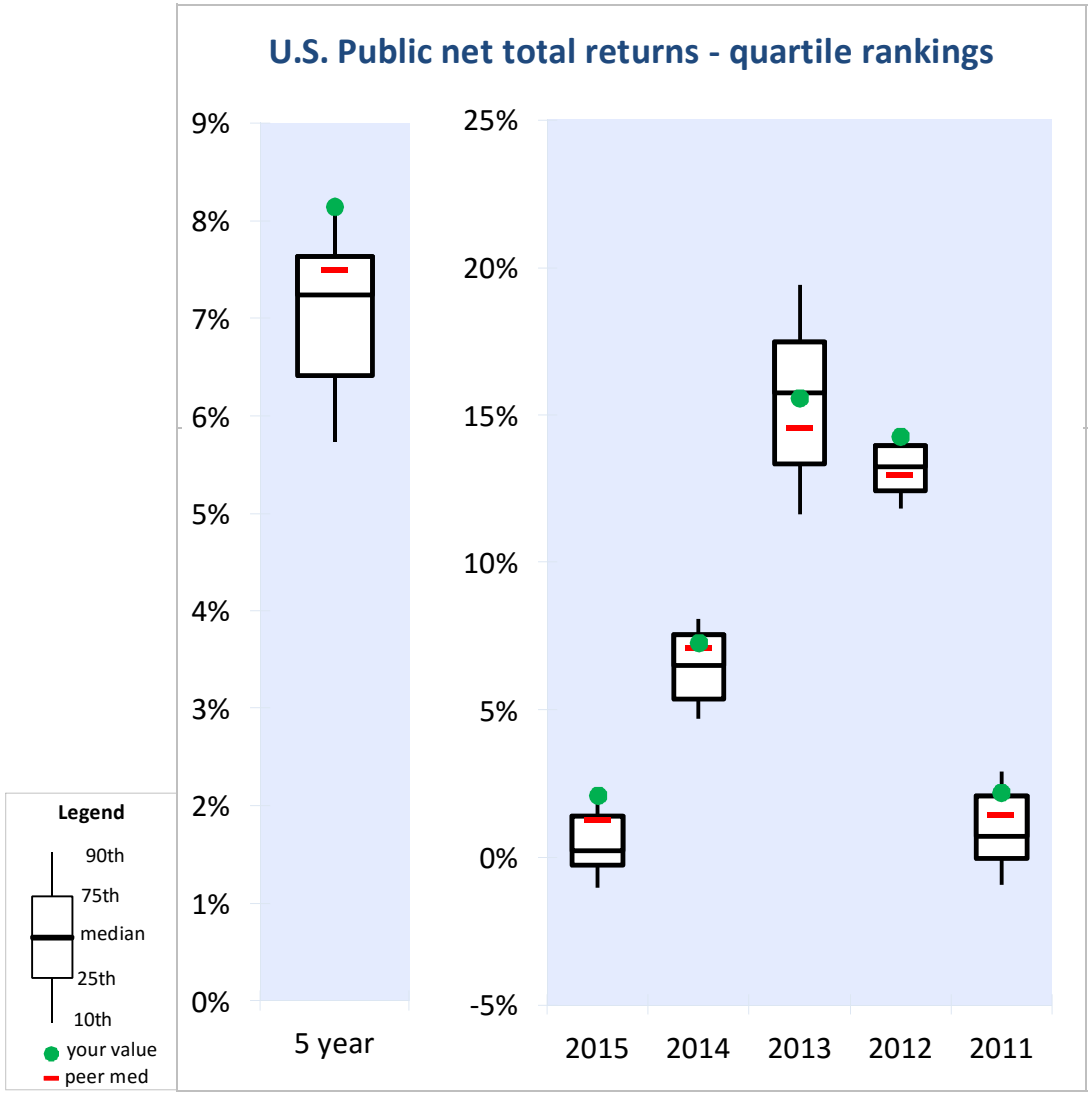
Your 5-year net total return of 8.1% was above both the U.S. Public median of 7.2% and the peer median of 7.5%.

	Your 5-year
Net total fund return	8.1%
- Policy return	8.4%
= Net value added	-0.2%



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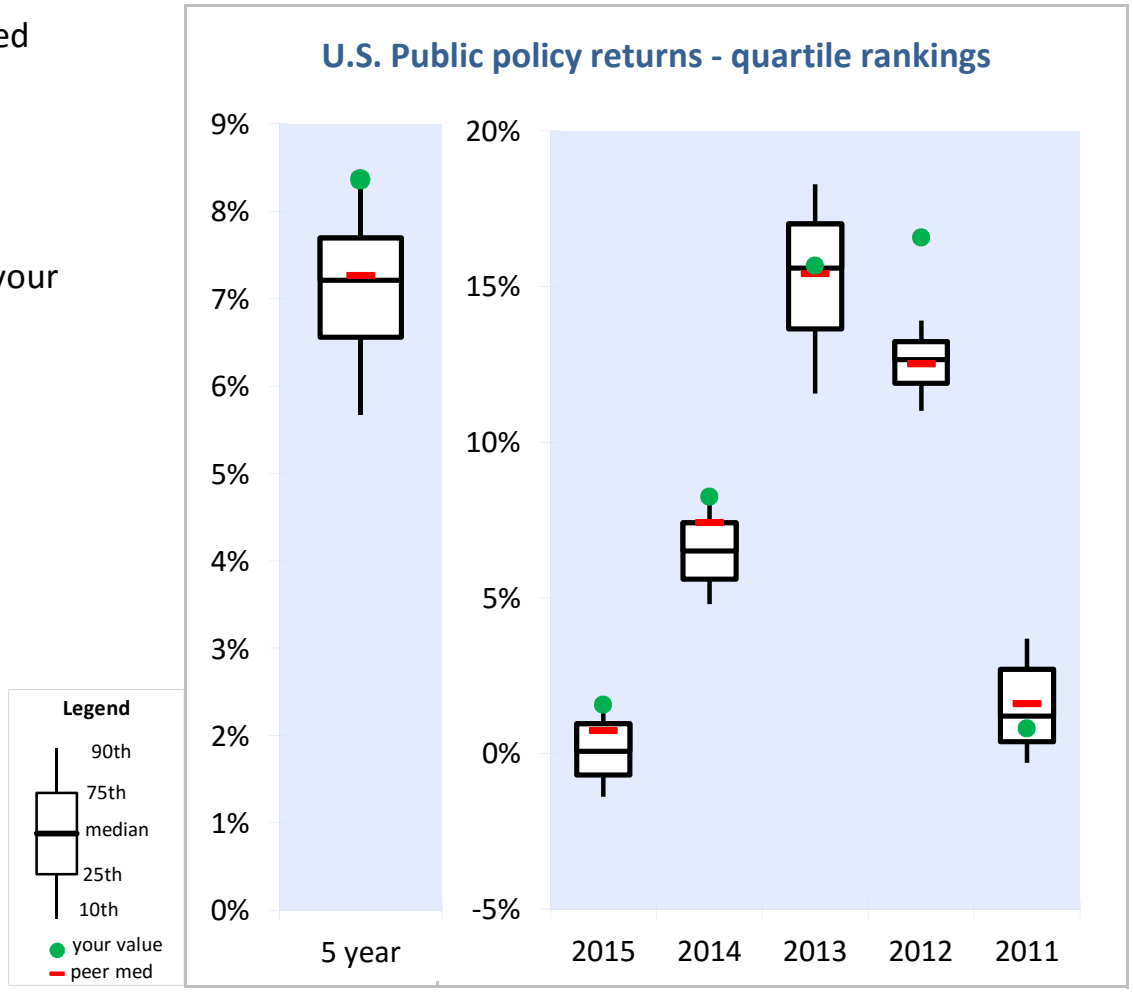
Your 5-year policy return of 8.4% was above both the U.S. Public median of 7.2% and the peer median of 7.3%.

Your policy return is the return you could have earned passively by indexing your investments according to your policy mix.

Having a higher or lower relative policy return is not necessarily good or bad. Your policy return reflects your investment policy, which should reflect your:

- Long term capital market expectations
- Liabilities
- Appetite for risk

Each of these three factors is different across funds. Therefore, it is not surprising that policy returns often vary widely between funds.



To enable fairer comparisons, the policy returns of all participants except your fund were adjusted to reflect private equity benchmarks based on lagged, investable, public-market indices. If CEM used this same adjustment for your fund, your 5-year policy return would be 8.2%, 0.2% lower than your actual 5-year policy return of 8.4%. Mirroring this, your 5-year total fund net value added would be 0.2% higher. Refer to the Research section pages 6-7 for details.

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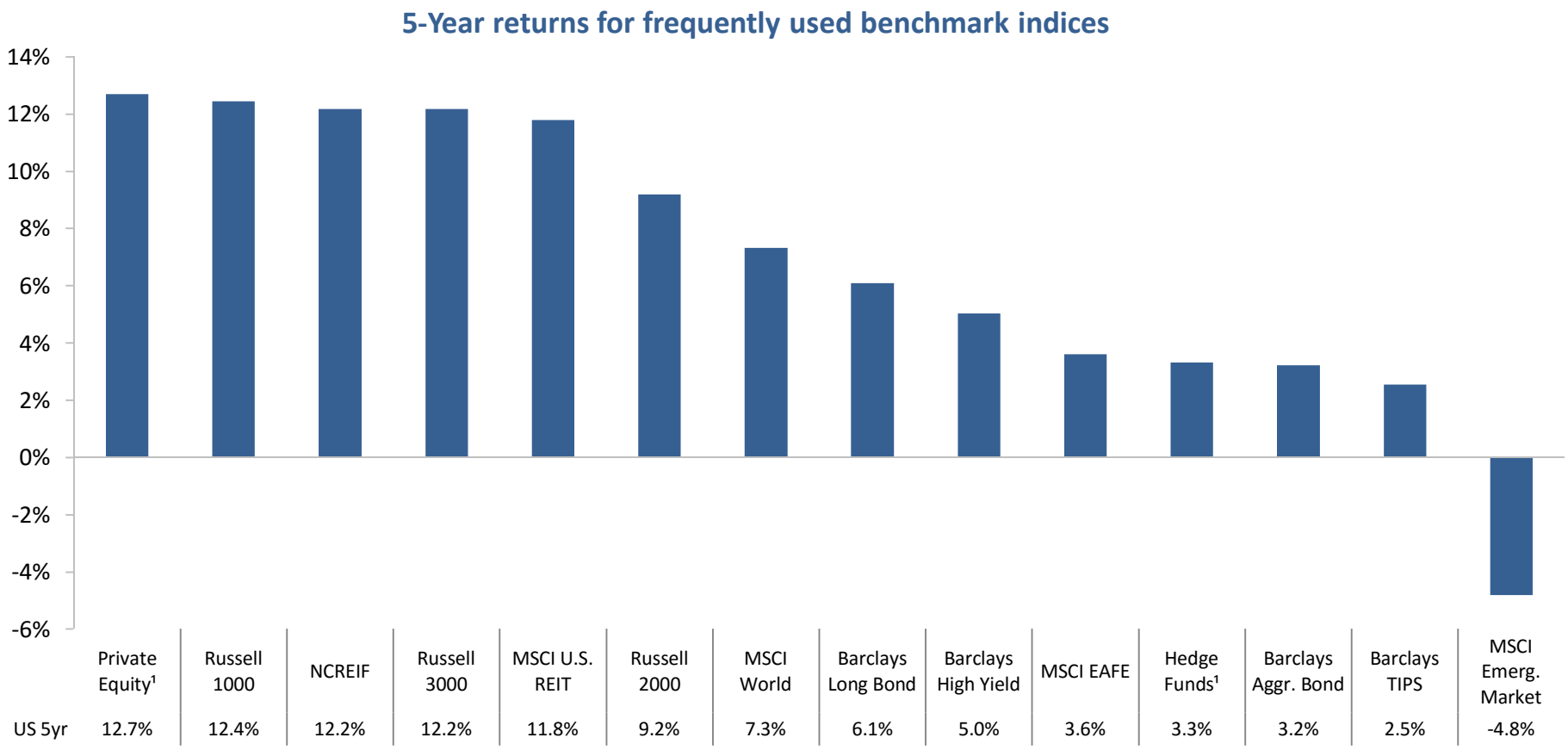
Differences in policy returns are caused by differences in benchmarks and policy mix. The two best performing asset classes for the 5 years ending 2015 were private equity[1] and large cap stock (Russell 1000).



1. The private equity benchmark is the average of the default private equity benchmark returns applied to U.S. participants. The hedge fund benchmark is the average benchmark return reported by U.S. participants.

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Your 5-year policy return was above the U.S. Public median primarily because of:

- The positive impact of your higher weight in two of the better performing asset classes of the past 5 years: Private Equity and Real Estate.

5-year average policy mix

	Your Fund	Peer Avg.	U.S. Public Avg.
U.S. Stock	0%	22%	24%
EAFE Stock	0%	7%	6%
ACWIxUS Stock	0%	8%	9%
Global Stock	42%	9%	8%
Other Stock	0%	2%	4%
Total Stock	42%	48%	51%
U.S. Bonds	20%	19%	18%
High Yield Bonds	0%	2%	2%
Other Fixed Income[1]	4%	7%	7%
Total Fixed Income	24%	28%	27%
Hedge Funds	0%	3%	4%
Real Estate incl. REITS	12%	9%	7%
Other Real Assets[1]	3%	1%	3%
Private Equity	19%	10%	8%
Total	100%	100%	100%

1. Other fixed income includes Inflation Indexed, Emerging and Global bonds. Other real assets includes commodities, natural resources and infrastructure.

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Your policy asset mix has changed over the past 5 years. At the end of 2015 your policy mix compared to your peers and the U.S. universe as follows:

Policy asset mix

Asset class	Your fund 2011	2012	2013	2014	2015	Peer avg. 2015	U.S. Public avg. 2015
U.S. Stock	0%	0%	0%	0%	0%	21%	23%
EAFE Stock	0%	0%	0%	0%	0%	6%	5%
ACWIxUS Stock	0%	0%	0%	0%	0%	7%	10%
Global Stock	43%	43%	42%	42%	42%	11%	9%
Other Stock	0%	0%	0%	0%	0%	2%	4%
Total Stock	43%	43%	42%	42%	42%	48%	50%
U.S. Bonds	19%	19%	17%	24%	24%	19%	18%
Cash	0%	0%	0%	0%	0%	0%	-1%
Other Fixed Income[1]	6%	6%	7%	0%	0%	7%	9%
Total Fixed Income	25%	25%	24%	24%	24%	27%	26%
Hedge Funds	0%	0%	0%	0%	0%	4%	5%
Real Estate incl. REITS	11%	11%	13%	13%	13%	9%	8%
Other Real Assets[1]	0%	5%	3%	3%	3%	2%	3%
Private Equity	21%	16%	20%	20%	20%	10%	9%
Total	100%	100%	100%	100%	100%	100%	100%

1. Other fixed income includes Inflation Indexed, Emerging and Global bonds. Other real assets includes commodities, natural resources and infrastructure.

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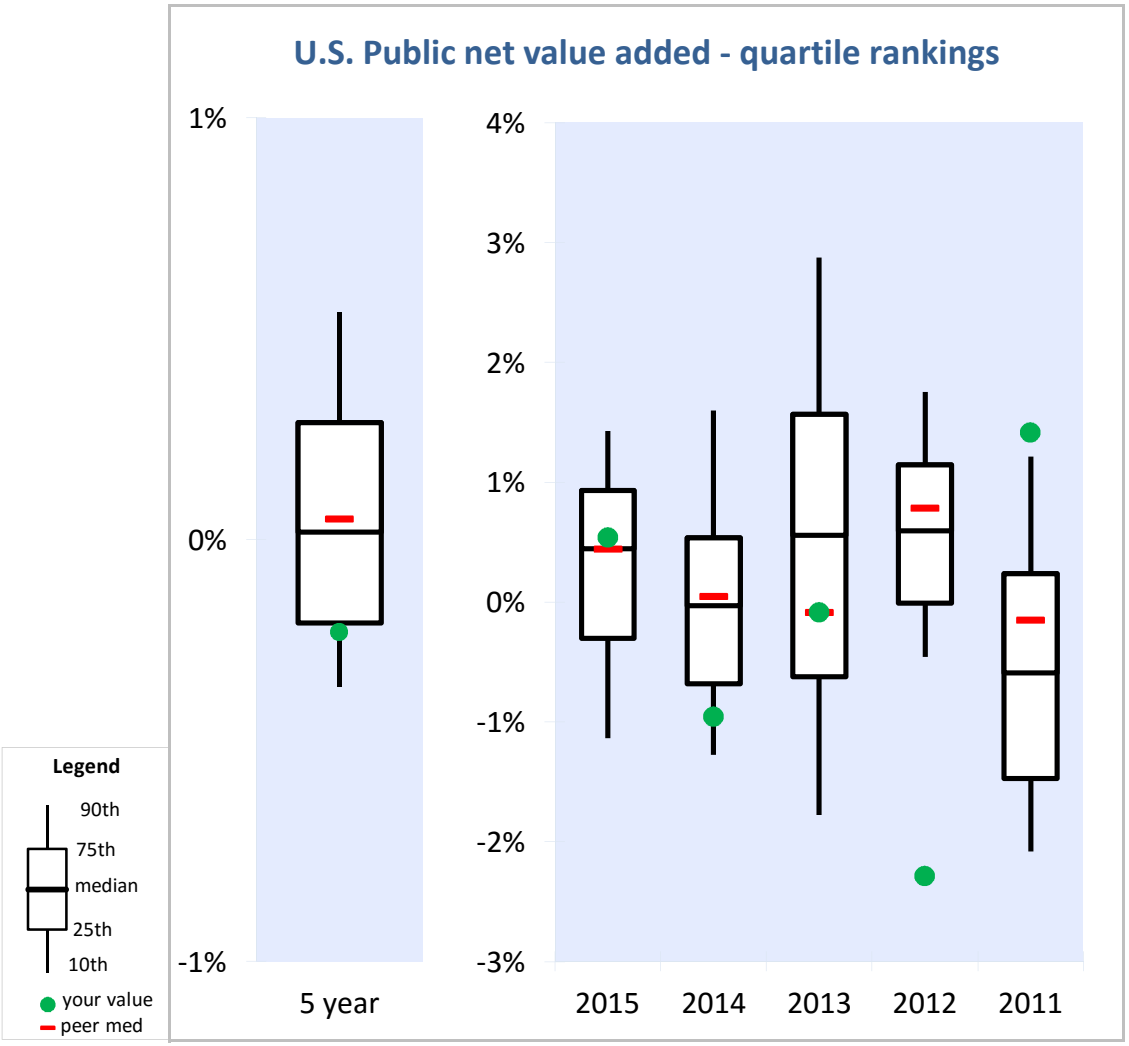
Net value added is the component of total return from active management. Your 5-year net value added was -0.2%.

Net value added equals total net return minus policy return.

Value added for Oregon Public Employees Retirement Fund

Year	Net Return	Policy Return	Net value Added
2015	2.1%	1.6%	0.5%
2014	7.3%	8.2%	(1.0%)
2013	15.6%	15.7%	(0.1%)
2012	14.3%	16.6%	(2.3%)
2011	2.2%	0.8%	1.4%
5-year	8.1%	8.4%	(0.2%)

Your 5-year net value added of -0.2% compares to a median of 0.0% for your peers and 0.0% for the U.S. Public universe.



Your value added was impacted by your choice of benchmarks for private equity. CEM suggests using lagged, investable benchmarks for private equity (see Research section, pages 6-7, for reasons why). If your fund used the private equity benchmark suggested by CEM, your 5-year total fund value added would have been 0.2% higher.

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Your investment costs were $493.2 million or 73.5 basis points in 2015.

Asset management costs by asset class and style ($000s)	Internal Management			External Management				
	Passive	Active	Overseeing of external	Passive fees	Active base fees	Perform. fees [3]	Total	
U.S. Stock - Broad/All			264		4,471	819	5,553	
U.S. Stock - Large Cap	93		340	170	6,872		7,475	
U.S. Stock - Small Cap	99		154		8,911		9,164	
Stock - Emerging		187	424		11,154		11,765	
Stock - ACWIxU.S.			701	522	40,901		42,124	
Stock - Global			286	363	3,699		4,348	
Fixed Income - U.S.			1,072		5,309		6,381	
Fixed Income - U.S. Gov't			186		4,515		4,701	
Fixed Income - Other			486		22,795		23,281	
Cash		284					284	
REITs			50		6,117		6,168	
Real Estate			480		18,005		18,484	
Real Estate - LPs			1,056		49,990		51,046	
Other Real Assets			1,491		23,249		24,740	
Diversified Private Equity			2,414		208,309 [1]		210,723	
Diversified Priv.Eq. - Fund of Funds			240		42,424 [2]		42,664	
Other Private Equity			198		20,959 [1]		21,157	
Overlay Programs			944		579		1,523	
Total excluding private asset performance fees							491,582	73.2bp
Oversight, custodial and other costs [4]								
Oversight & consulting							1,304	
Trustee & custodial								
Audit							47	
Other							277	
Total oversight, custodial & other costs							1,628	0.2bp
Total investment costs (excl. transaction costs & private asset performance fees)							493,210	73.5bp

Footnotes

[1] Cost derived from the partnership level detail you provided. Costs are based on partnership contract terms.

[2] Default underlying costs were added to fund of funds. The defaults added were: Diversified Priv.Eq. 157 bps base fees refer to Appendix A for full details.

[3] Total cost excludes carry/performance fees for real estate, infrastructure, natural resources and private equity. Performance fees are included for the public market asset classes and hedge funds.

[4] Excludes non-investment costs, such as PBGC premiums and preparing checks for retirees.

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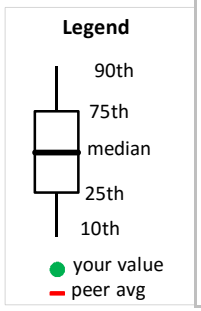
Your total investment cost of 73.5 bps was above the peer median of 50.5 bps.

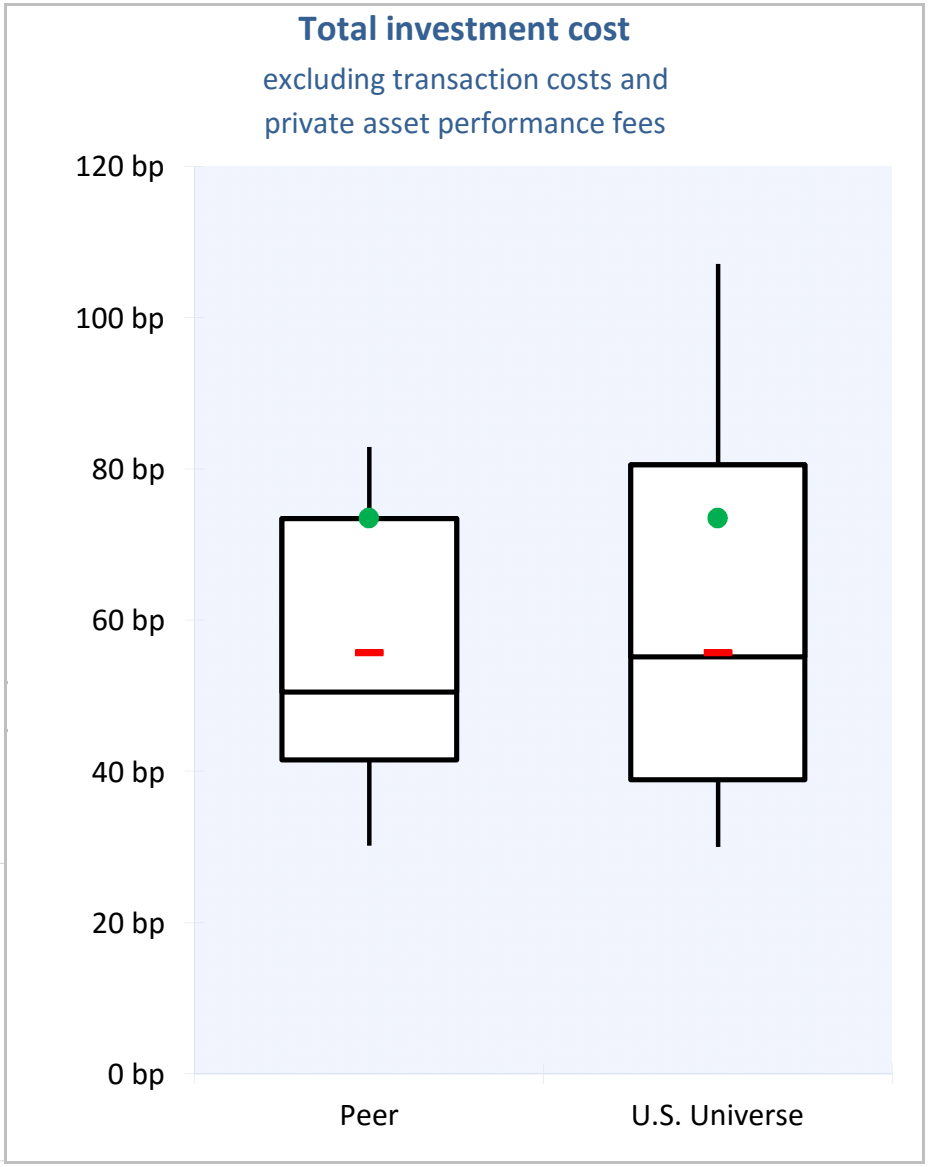
Differences in total investment cost are often caused by two factors that are often outside of management's control:

- Asset mix, particularly holdings of the highest cost asset classes: real estate (excl REITS), infrastructure, hedge funds and private equity. These high cost assets equaled 33% of your fund's assets at the end of 2015 versus a peer average of 25%.

- Fund size. Bigger funds have advantages of scale.

Therefore, to assess whether your costs are high or low given your unique asset mix and size, CEM calculates a benchmark cost for your fund. This analysis is shown on the following page.





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Benchmark cost analysis suggests that, after adjusting for fund size and asset mix, your fund was normal cost in 2015.

Your benchmark cost is an estimate of what your cost would be given your actual asset mix and the median costs that your peers pay for similar services. It represents the cost your peers would incur if they had your actual asset mix.

Your total cost of 73.5 bp was close to your benchmark cost of 71.8 bp. Thus, your excess cost was 1.6 bp.

Your cost versus benchmark

	$000s	basis points
Your total investment cost	493,210	73.5 bp
Your benchmark cost	482,391	71.8 bp
Your excess cost	10,819	1.6 bp

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Your fund was normal cost because you had a higher cost implementation style that was mostly offset by paying less than peers for similar services.

Explanation of your cost status

	Excess Cost/ (Savings) $000s	bps
1. Higher cost implementation style		
• More fund of funds	4,268	0.6
• More external active management (less lower cost passive and internal)	29,626	4.4
• More overlays	283	0.0
• Other style differences	(1,165)	(0.2)
	33,012	4.9
2. Paying less than peers for similar services		
• External investment management costs	(15,926)	(2.4)
• Internal investment management costs	45	0.0
• Oversight, custodial & other costs	(6,313)	(0.9)
	(22,194)	(3.3)
Total excess cost	10,819	1.6

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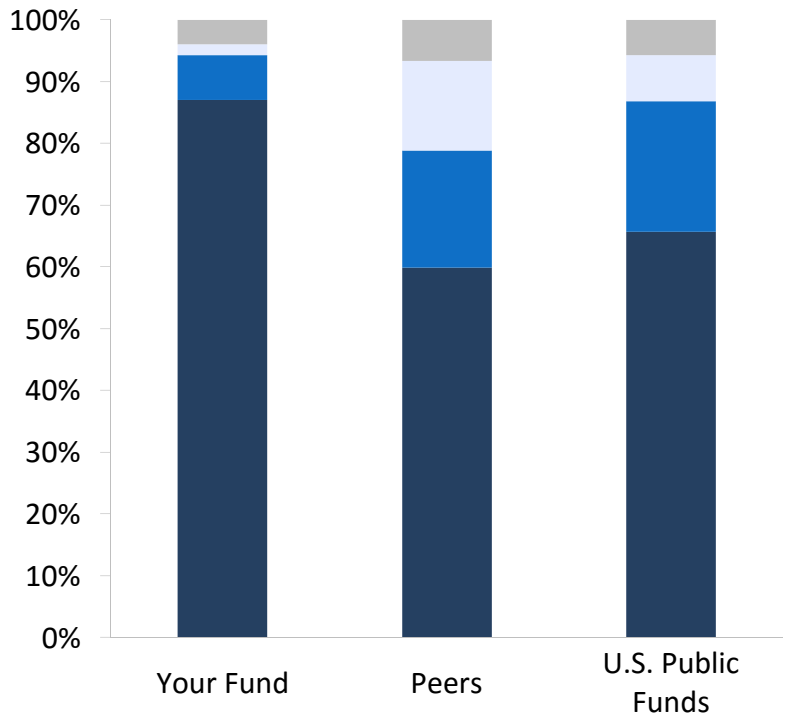
Differences in cost performance are often caused by differences in implementation style.

The greatest cost impact of differences in implementation style is usually caused by:

- External active management because it tends to be much more expensive than internal or passive management.
- Within external active holdings, fund of funds usage because it is more expensive than direct fund investment.

Implementation style[1]



	Your Fund	Peers	U.S. Public Funds
Internal passive	4%	7%	6%
Internal active	2%	15%	7%
External passive	7%	19%	21%
External active	87%	60%	66%

1. The graph above does not take into consideration the impact of derivatives.

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Differences in implementation style cost you 4.9 bps relative to your peers.

Calculation of the cost impact of differences in implementation style

Asset class	Your avg holdings in $mils	% External active: You	Peer average	More/ (less)	Premium vs passive & internal[1]	Cost/ (savings) $000s	bps
	(A)			(B)	(C)	(A X B X C)	
U.S. Stock - Broad/All	1,450	100.0%	19.0%	81.0%	39.4 bp	4,631	
U.S. Stock - Large Cap	6,825	41.7%	23.4%	18.3%	21.4 bp	2,676	
U.S. Stock - Small Cap	2,835	70.2%	74.8%	(4.5%)	59.6 bp	(764)	
Stock - Emerging	1,740	90.6%	67.3%	23.3%	47.1 bp	1,906	
Stock - ACWIxU.S.	10,942	84.0%	63.1%	20.9%	43.8 bp	10,018	
Stock - Global	1,711	58.1%	62.6%	(4.5%)	34.5 bp	(268)	
Fixed Income - U.S.	5,509	100.0%	57.5%	42.5%	12.4 bp	2,905	
Fixed Income - U.S. Gov't	4,966	100.0%	20.1%	79.9%	Insufficient[2]	0	
Fixed Income - Other	4,500	100.0%	93.3%	6.7%	14.5 bp	434	
REITs	1,918	100.0%	70.3%	29.7%	34.1 bp	1,940	
Real Estate ex-REITs	6,575	100.0%	94.8%	5.2%	62.7 bp	2,158	
Partnerships, as a proportion of external:	6,575	54.7%	41.1%	13.5%	44.8 bp	3,989	
Other Real Assets	1,433	100.0%	100.0%	0.0%		0	
Diversified Private Equity	17,356	100.0%	99.8%	0.2%	Insufficient[2]	0	
Other private equity	1,129	100.0%	93.9%	6.1%	Insufficient[2]	0	
Impact of less/more external active vs. lower cost styles						29,626	4.4 bp
		Fund of funds % of LPs			vs. direct LP[1]		
Real Estate ex-REITs - LPs	3,596	0.0%	0.0%	0.0%		0	
Diversified Private Equity - LPs	17,356	11.0%	7.6%	3.4%	72.9 bp	4,268	
Impact of less/more fund of funds vs. direct LPs						4,268	0.6 bp
			Overlays and other				
Impact of higher use of portfolio level overlays						283	0.0 bp
Impact of mix of internal passive, internal active, and external passive[3]						(1,165)	(0.2) bp
Total impact of differences in implementation style						33,012	4.9 bp

Footnotes

1. The cost premium is the additional cost of external active management relative to the average of other lower cost implementation styles - internal passive, internal active and external passive.
2. A cost premium listed as 'Insufficient' indicates that there was not enough peer data to calculate the premium.
3. The 'Impact of mix of internal passive, internal active and external passive' quantifies the net cost impact of differences in cost between, and your relative use of, these 'low-cost' styles.

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The net impact of paying more/(less) for external asset management costs saved 2.4 bps.

Cost impact of paying more/(less) for external asset management

	Your avg holdings in $mils	Cost in bps			Cost/ (savings) in $000s
		Your Fund	Peer median	More/ (less)	
	(A)			(B)	(A X B)
U.S. Stock - Broad/All - Active	1,450	38.3[1]	40.6	(2.3)	(328)
U.S. Stock - Large Cap - Passive	2,179	1.2	1.0	0.2	45
U.S. Stock - Large Cap - Active	2,847	25.0	24.4	0.6	180
U.S. Stock - Small Cap - Active	1,991	45.5	64.3	(18.8)	(3,745)
Stock - Emerging - Active	1,576	73.5	56.0	17.5	2,751
Stock - ACWIxU.S. - Passive	1,750	3.4	3.4	0.0	0
Stock - ACWIxU.S. - Active	9,192	45.2	47.2	(2.0)	(1,864)
Stock - Global - Passive	717	6.7	5.3	1.3	96
Stock - Global - Active	994	38.9	39.8	(0.9)	(90)
Fixed Income - U.S. - Active	5,509	11.6	14.7	(3.1)	(1,718)
Fixed Income - U.S. Gov't - Active	4,966	9.5	9.5*	0.0	0
Fixed Income - Other - Active	4,500	51.7	43.1	8.6	3,871
REITs - Active	1,918	32.2	38.5	(6.3)	(1,211)
Real Estate ex-REITs - Active	2,979	62.0	62.0	0.0	0
Real Estate ex-REITs - Limited Partnership	3,596	142.0	106.8	35.1	12,631
Other Real Assets - Active	1,433	172.7	154.3	18.4	2,634
Diversified Private Equity - Active	15,453	136.4	156.5	(20.2)	(31,169)
Diversified Private Equity - Fund of Fund	1,903	224.2	229.4	(5.3)	(1,001)
Other Private Equity - Active	1,129	187.3	165.0	22.3	2,522
	Notional				
Derivatives/Overlays - Passive Beta	1,370	11.1	7.7*	3.4	470
Total impact of paying more/less for external management					(15,926)
Total in bps					(2.4) bp

*Universe median used as peer data was insufficient.

[1] You paid performance fees in this asset class.

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The net impact of paying more/(less) for internal asset management costs rounds to 0.0 bps.

Cost impact of paying more/(less) for internal asset management

	Your avg holdings in $mils	Cost in bps			Cost/ (savings) in $000s
		Your Fund	Peer median	More/ (less)	
	(A)			(B)	(A X B)
U.S. Stock - Large Cap - Passive	1,798	0.5	0.3	0.3	45
U.S. Stock - Small Cap - Passive	844	1.2	1.2	0.0	0
Stock - Emerging - Active	164	11.4	11.4	0.0	0
Total impact of paying more/less for internal management					45
Total in bps					0.0 bp

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The net impact of differences in oversight, custodial & other costs saved 0.9 bps.

Cost impact of differences in oversight, custodial & other costs

	Your avg holdings in $mils	Cost in bps			Cost/ (savings) in $000s
		Your fund	Peer median	More/ (less)	
	(A)			(B)	(A X B)
Oversight & consulting	67,147	0.2	0.8	(0.6)	(4,249)
Custodial	67,147	0.0	0.2	(0.2)	(1,363)
Audit	67,147	0.0	0.0	(0.0)	(182)
Other	67,147	0.0	0.1	(0.1)	(520)
Total					(6,313)
Total in bps					(0.9) bp

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Summary of the benchmark cost analysis which suggests that, after adjusting for fund size and asset mix, your fund was normal cost in 2015.

Why are you high/(low) cost by asset class?

Asset class/category	Due to impl. style $000s	Due to paying more/ (less)	Total $000s	Total bps
U.S. Stock - Broad/All	4,631	(328)	4,303	
U.S. Stock - Large Cap	1,770	270	2,040	
U.S. Stock - Small Cap	(1,064)	(3,745)	(4,809)	
Stock - Emerging	1,946	2,751	4,697	
Stock - ACWIxU.S.	10,018	(1,864)	8,154	
Stock - Global	(268)	6	(262)	
Fixed Income - U.S.	2,905	(1,718)	1,187	
Fixed Income - U.S. Gov't	0	0	0	
Fixed Income - Other	434	3,871	4,306	
REITs	1,940	(1,211)	729	
Real Estate ex-REITs	6,148	12,631	18,778	
Other Real Assets	0	2,634	2,634	
Diversified Private Equity	4,268	(32,171)	(27,902)	
Other private equity	0	2,522	2,522	
Overlays	283	470	753	
Oversight, Custodial & Other		(6,313)	(6,313)	
Total	33,012	(22,194)	10,819	1.6 bp

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Summary of key takeaways

Returns

- Your 5-year net total return was 8.1%. This was above the U.S. Public median of 7.2% and above the peer median of 7.5%.
- Your 5-year policy return was 8.4%. This was above the U.S. Public median of 7.2% and above the peer median of 7.3%.

Value added

- Your 5-year net value added was -0.2%. This was slightly below the U.S. Public median of 0.0% and slightly below the peer median of 0.0%.

Cost and cost effectiveness

- Your investment cost of 73.5 bps was above the peer median cost of 50.5 bps. You were higher cost because your investments were more heavily weighted in higher cost private asset classes. However, your cost was close to your benchmark cost of 71.8 bps. This suggests that your fund was normal cost compared to your peers, given your assets.
- Your fund was normal cost because you had a higher cost implementation style. This added cost was partly offset because you paid less than peers for similar services.

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TAB 9 – Asset Allocations & NAV Updates

Asset Allocations at September 30, 2016

OPERF	Policy	Target[1]	Regular Account $ Thousands	Pre-Overlay	Overlay	Net Position	Actual	Variable Fund $ Thousands	Total Fund $ Thousands
Public Equity	32.5-42.5%	37.5%	26,404,675	38.1%	437,468	26,842,143	38.7%	608,648	27,450,791
Private Equity	13.5-21.5%	17.5%	13,731,084	19.8%		13,731,084	19.8%		13,731,084
Total Equity	**50.0-60.0%**	**55.0%**	**40,135,759**	**57.9%**	**437,468**	**40,573,227**	**58.5%**		**41,181,875**
Opportunity Portfolio	0-3%	0.0%	1,455,524	2.1%		1,455,524	2.1%		1,455,524
Fixed Income	**15-25%**	**20.0%**	**14,574,448**	**21.0%**	**534,787**	**15,109,234**	21.8%		**15,109,234**
Real Estate	**9.5-15.5%**	**12.5%**	**8,754,050**	**12.6%**	**(43,700)**	**8,710,350**	12.6%		**8,710,350**
Alternative Investments	**0-12.5%**	**12.5%**	**3,496,307**	**5.0%**		**3,496,307**	5.0%		**3,496,307**
Cash[2]	**0-3%**	**0.0%**	**936,314**	**1.4%**	**(928,555)**	**7,759**	0.0%	6,402	**14,161**
TOTAL OPERF		**100%**	**$ 69,352,402**	**100.0%**	**$ -**	**$ 69,352,402**	**100.0%**	**$ 615,050**	**$ 69,967,451**

[1]Targets established in June 2015. Interim policy benchmark consists of: 40% MSCI ACWI IMI Net, 22.5% Custom FI Benchmark, 20% Russell 3000+300bps (1 quarter lagged), 12.5% NCREIF ODCE (1 quarter lagged), & 5% CPI+400bps.

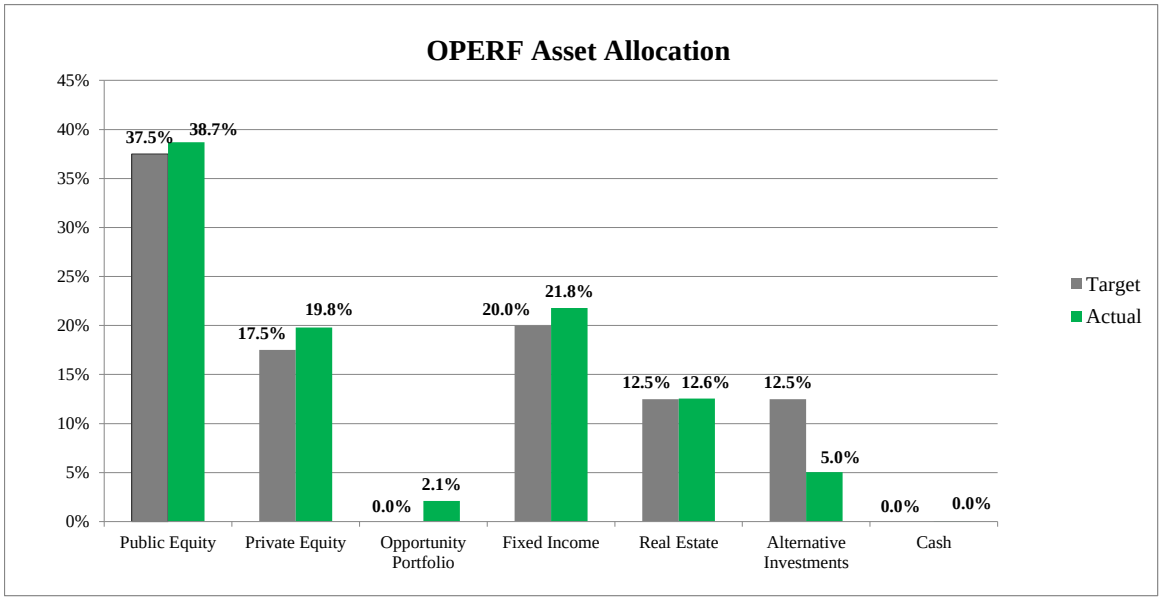
[2]Includes cash held in the policy implementation overlay program.

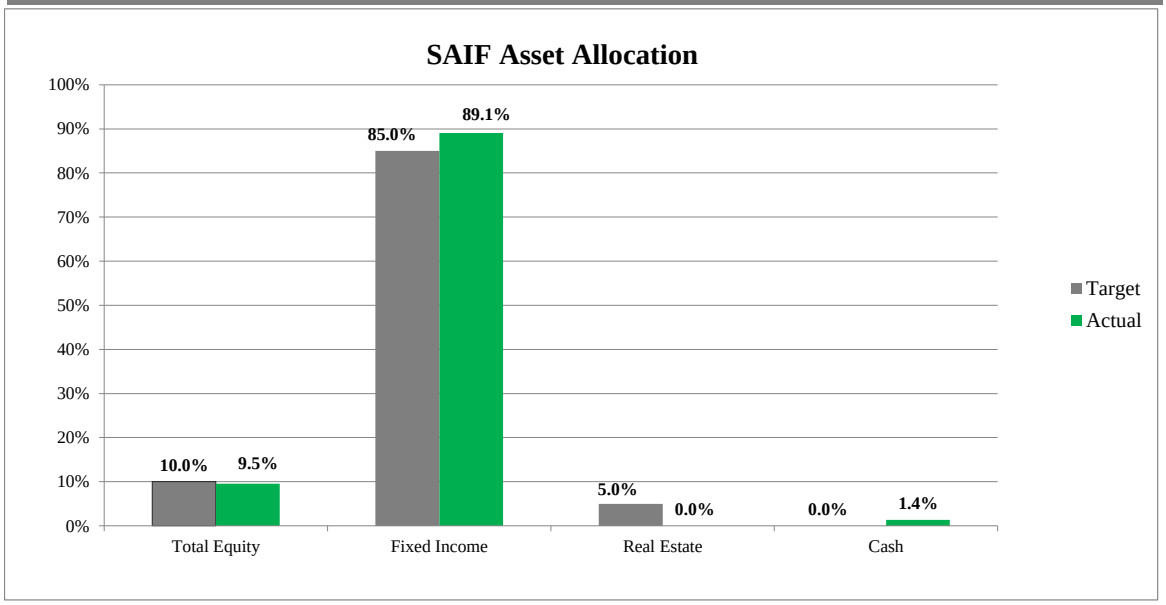
SAIF	Policy	Target	$ Thousands	Actual
Total Equity	**7-13%**	**10.0%**	**467,648**	**9.5%**
Fixed Income	**80-90%**	**85.0%**	**4,364,444**	**89.1%**
Real Estate	**0-7%**	**5.0%**	**0**	**0.0%**
Cash	**0-3%**	**0%**	**67,208**	**1.4%**
TOTAL SAIF			**$ 4,899,300**	**100.0%**

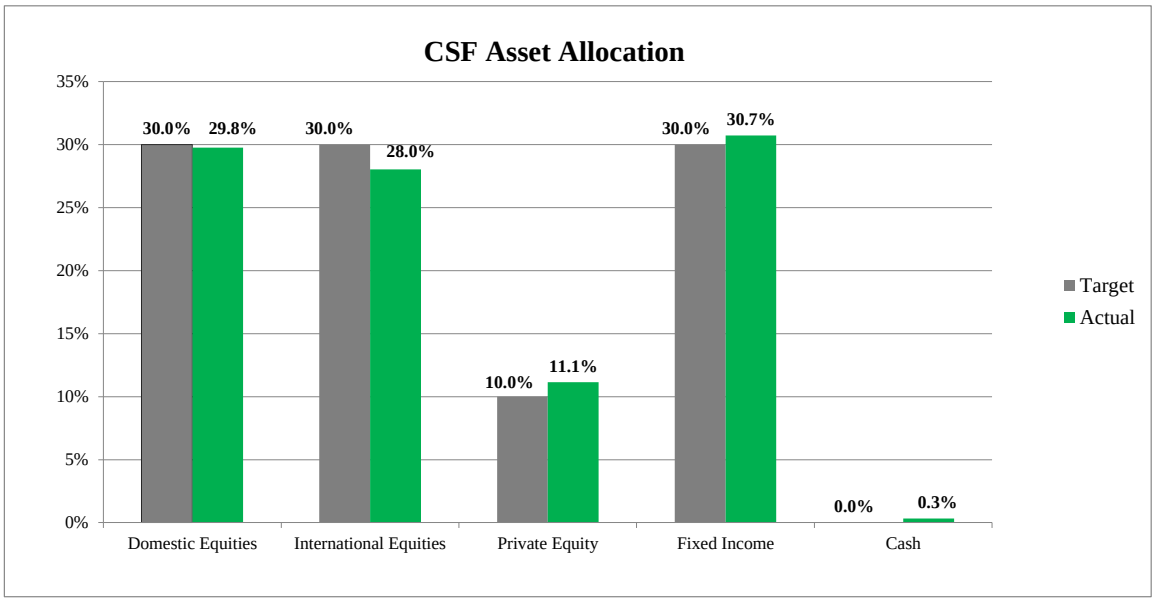
CSF	Policy	Target	$ Thousands	Actual
Domestic Equities	25-35%	30%	432,538	29.8%
International Equities	25-35%	30%	407,581	28.0%
Private Equity	0-12%	10%	161,913	11.1%
Total Equity	**65-75%**	**70%**	**1,002,032**	**68.9%**
Fixed Income	**25-35%**	**30%**	**446,714**	**30.7%**
Cash	**0-3%**	**0%**	**4,606**	**0.3%**
TOTAL CSF			**$ 1,453,353**	**100.0%**

SOUE	Policy	Target[3]	$ Thousands	Actual
Global Equities	65-75%	70%	**1,513**	70.4%
Growth Assets	**65-75%**	**70%**	**1,513**	**70.4%**
Fixed Income	25-35%	30%	636	29.6%
Cash	0-3%	0%	1	0.1%
Diversifying Assets	**25-35%**	**30%**	**637**	**29.6%**
TOTAL SOUE			**$ 2,151**	**100.0%**

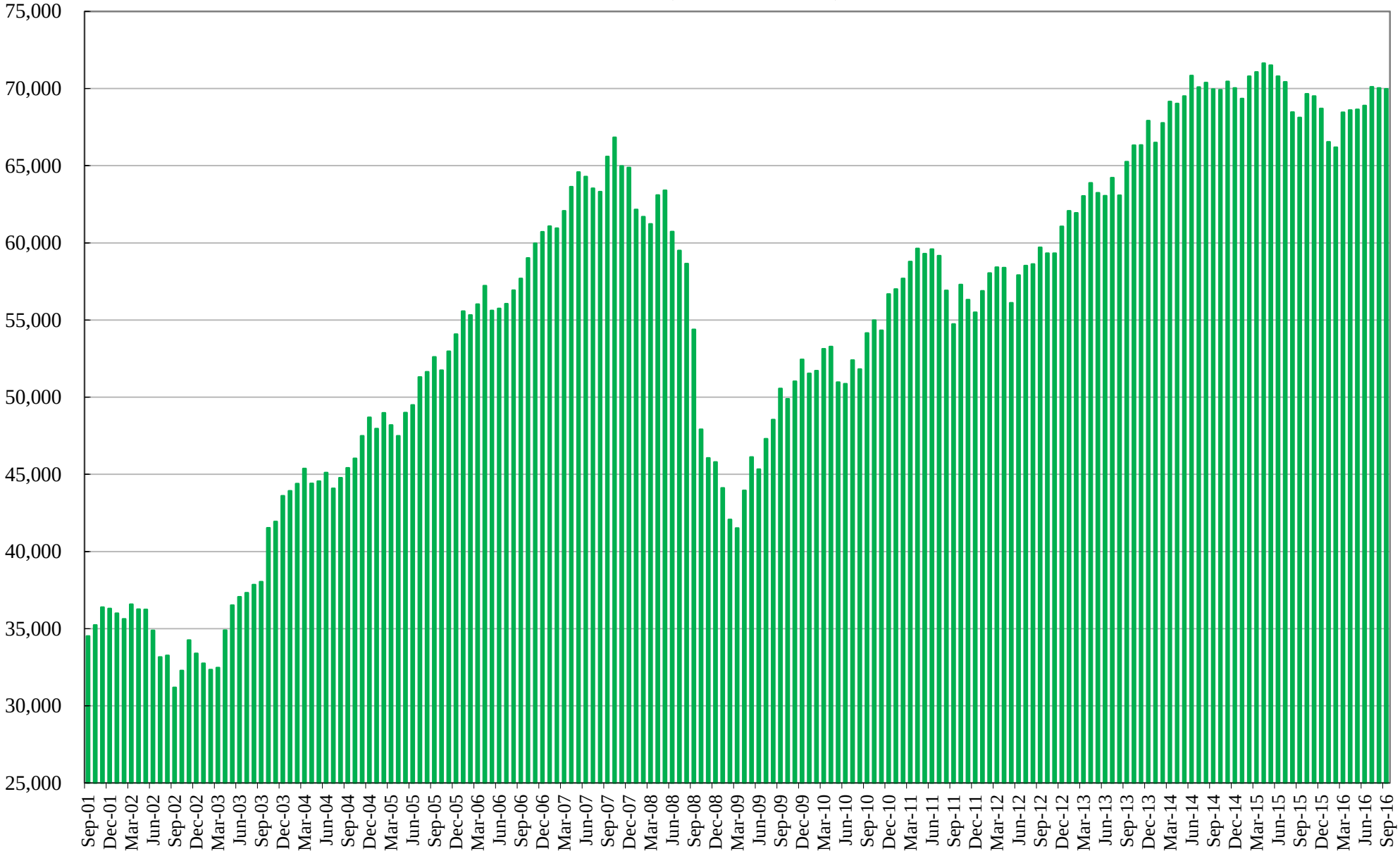
[3]Revised asset allocation adopted by OIC, March 2015.


OPERF Asset Allocation
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
37.5%
38.7%
17.5%
19.8%
0.0%
2.1%
20.0%
21.8%
12.5%
12.6%
12.5%
5.0%
0.0%
0.0%
Public Equity
Private Equity
Opportunity Portfolio
Fixed Income
Real Estate
Alternative Investments
Cash
Target
Actual

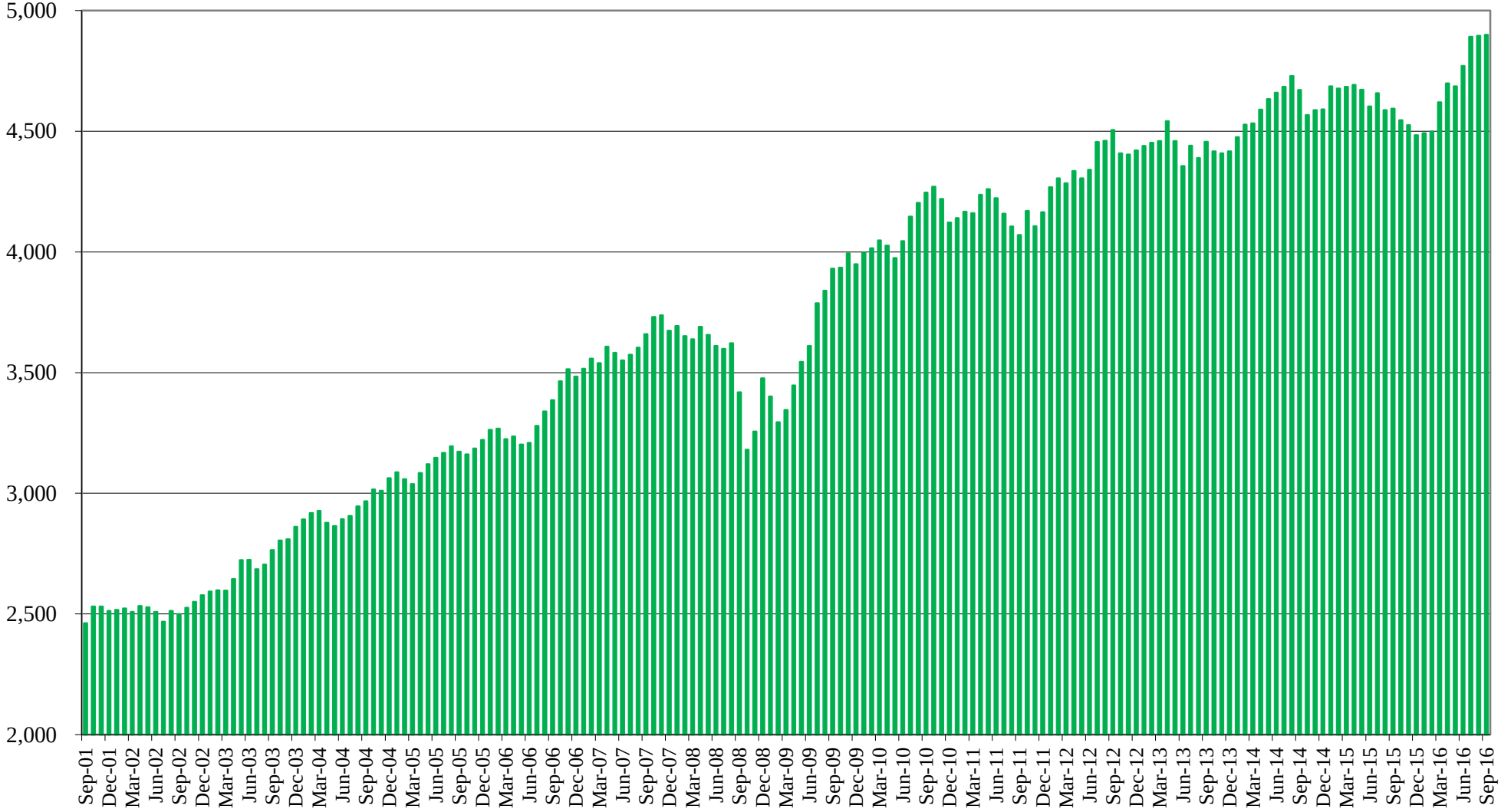

SAIF Asset Allocation
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
10.0%
9.5%
85.0%
89.1%
5.0%
0.0%
0.0%
1.4%
Total Equity
Fixed Income
Real Estate
Cash
Target
Actual


CSF Asset Allocation
35%
30%
25%
20%
15%
10%
5%
0%
30.0%
29.8%
30.0%
28.0%
10.0%
11.1%
30.0%
30.7%
0.0%
0.3%
Domestic Equities
International Equities
Private Equity
Fixed Income
Cash
Target
Actual

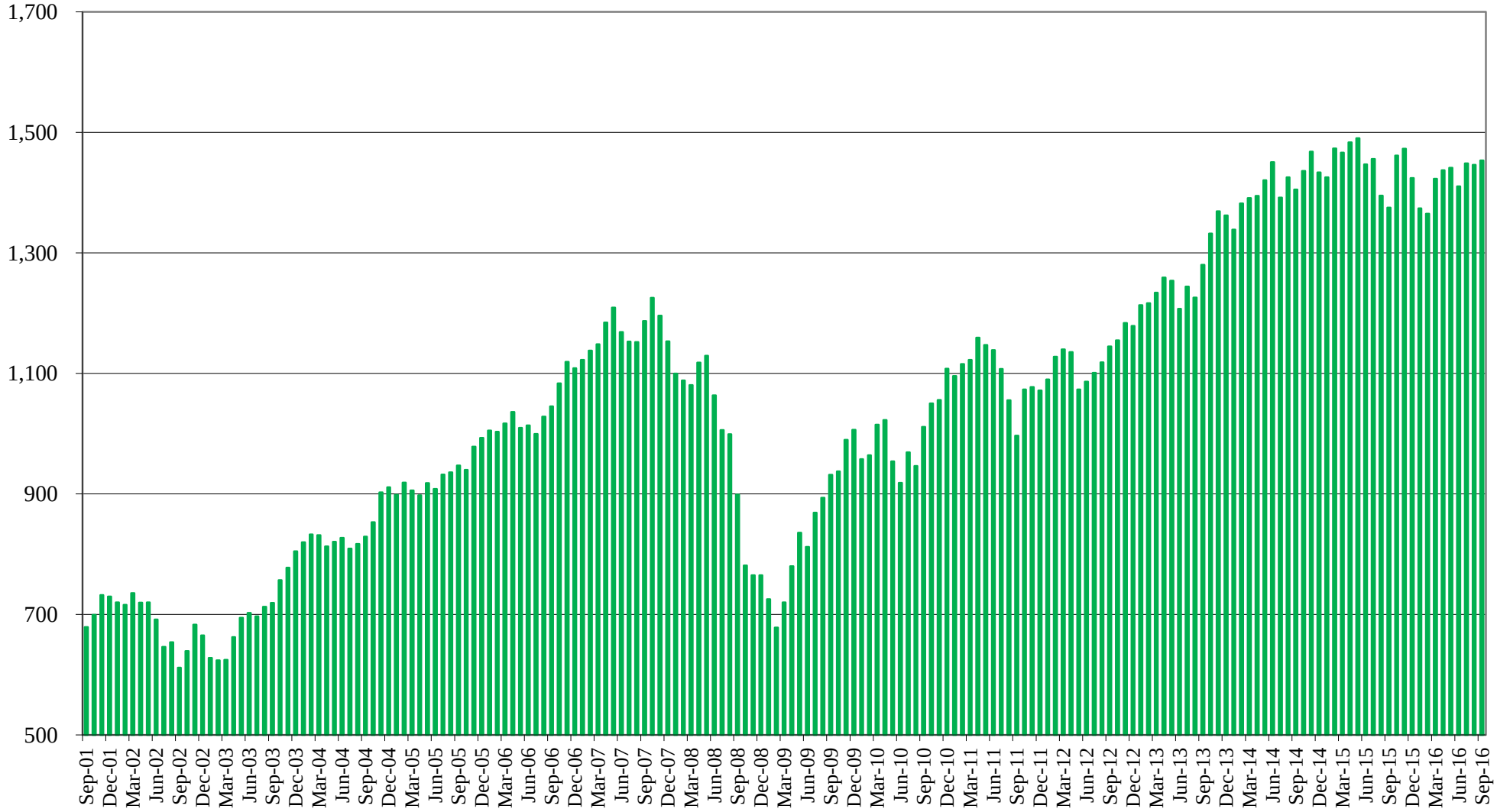
OPERF NAV
15 years ending September 2016
($ in Millions)



SAIF NAV
15 years ending September 2016
($ in Millions)



CSF NAV
15 years ending September 2016
($ in Millions)



TAB 10 – Forward Calendar

2016/17 OIC Forward Calendar and Planned Agenda Topics

December 7:	OPERF Real Estate Manager Recommendation OPERF Alternatives Manager Recommendation Private Equity Manager Recommendation OPERF Q3 2016 Performance & Risk Report OSTF Review Fixed Income Program Review OPERF Currency Project Introduction IAP Update and Discussion
February 1, 2017:	Private Equity Manager Recommendation Private Equity Program Review Real Estate Program Review Placement Agent Report 2018 OIC Calendar Approval IAP Recommendation
March 15, 2017:	OPERF Opportunity Portfolio Review SAIF Annual Review Q4 2016 OPERF Performance & Risk Report OPERF Overlay Review Securities Lending Update OPERF Currency Project Recommendation
April 26, 2017:	OPERF Alternatives Portfolio Review OPERF Asset Allocation & Capital Market Assumptions Update CSF Annual Review OIC Policy Updates
June 7, 2017:	OITP Review Q1 2017 OPERF Performance & Risk Report
August 9, 2017:	Corporate Governance Update
September 20, 2017:	Q2 2017 OPERF Performance & Risk Report