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VICE CHAIR

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COMMISSIONER

ALLEN R. GILLESPIE, CFA
COMMISSIONER

EDWARD N. GIOBBE, MBA
COMMISSIONER

REYNOLDS WILLIAMS, J.D., CFP
COMMISSIONER



RETIREMENT SYSTEM INVESTMENT COMMISSION

1201 MAIN STREET, SUITE 1510, COLUMBIA, SC 29201

MICHAEL HITCHCOCK
CHIEF EXECUTIVE OFFICER

GEOFFREY BERG, CFA
CHIEF INVESTMENT OFFICER

AGENDA

THURSDAY, December 7, 2017

RSIC Presentation Center

9:30 AM

Commission Meeting

- I. Call to Order and Consent Agenda
 - A. Adoption of Proposed Agenda
 - B. Approval of August and September Minutes
- II. Meketa Asset Allocation Discussion
- LUNCH
- III. Chair's Report
 - A. Approve Proposed 2018 Meeting Schedule
- IV. Audit and Enterprise Risk Management Committee Report
- V. CEO's Report
- VI. CIO's Report
 - A. 3rd Quarter Investment Performance Update
- VII. Executive Session to discuss investment matters pursuant to S.C. Code Sections 9-16-80 and 9-16-320; to receive advice from legal counsel pursuant to S.C. Code Section 30-4-70(a)(2) related to litigation filed by American Timberlands Fund II, LP and to receive advice from legal counsel pursuant to S.C. Code Section 30-4-70(a)(2).
- VIII. Potential Action Resulting from Executive Session
- IX. Adjournment

NOTICE OF PUBLIC MEETING

This notice is given to meet the requirements of the S.C. Freedom of Information Act and the Americans with Disabilities Act. Furthermore, this facility is accessible to individuals with disabilities, and special accommodations will be provided if requested in advance.

**South Carolina Retirement System Investment Commission
Meeting Minutes**

**August 29, 2017 9:30 a.m.
Capitol Center
1201 Main Street, 15th Floor
Columbia, South Carolina 29201
Meeting Location: Presentation Center**

Commissioners Present:

Dr. Rebecca Gunnlaugsson, Chair
Dr. Ronald Wilder, Vice Chair
Ms. Peggy Boykin, PEBA Executive Director (Absent)
Mr. Allen Gillespie (Via Telephone)
Mr. Edward Giobbe
Mr. Reynolds Williams (Via Telephone)

I. CALL TO ORDER AND CONSENT AGENDA

Chair Rebecca Gunnlaugsson called the special meeting of the South Carolina Retirement System Investment Commission (“Commission”) to order at 9:32 a.m. Dr. Ronald Wilder made a motion to approve the proposed agenda as presented. Mr. Reynolds Williams seconded the motion, which was approved unanimously.

II. EXECUTIVE SESSION

Mr. Allen Gillespie made a motion that the Commission recede into Executive Session to receive advice from legal counsel pursuant to S.C. Code Section 30-4-70(a)(2) related to litigation filed by American Timberlands Fund II, LP. and to discuss investment matters pursuant to S.C. Code Sections 9-16-80 and 9-16-320, Mr. Edward Giobbe seconded the motion, which passed unanimously. Mr. Williams requested that the minutes reflect that he would not be participating in the discussion, or any deliberation, related to the American Timberlands Fund.

III. POTENTIAL ACTION RESULTING FROM EXECUTIVE SESSION

Upon a return to open session at 10:38 a.m., Mr. Michael Hitchcock, Chief Executive Officer, noted the Commission did not take any reportable action while in executive session. Any action that did occur while in executive session pursuant to S.C. Code Ann. § 9-16-80 and § 9-16-320 will be publicized when doing so would not jeopardize the Commission’s ability to achieve its investment objectives or implement a portion of the annual investment plan.

IV. INVESTMENT RECOMMENDATION

Mr. Geoff Berg, Chief Investment Officer, introduced Mr. W. Alexander Campbell, Investment Officer, who gave a presentation on a proposal to invest up to \$200 million in the Heitman

Core Real Estate Debt Income Trust, LP (“Heitman”), a new open-ended vehicle that will focus on originating loans on stable and transitional properties located in gateway and transitional gateway markets throughout the United States. Mr. Campbell noted that RSIC had negotiated a favorable fee structure and secured a seat on the advisory board for this investment, and indicated that RSIC Operations and Due Diligence had given Heitman a pass rating.

Mr. Campbell explained that 11% of the current real estate allocation is comprised of debt strategies, and with this new investment, it would increase to approximately 15%. He then noted that this investment offered attractive risk-adjusted expected returns and downside protection. Mr. Campbell said that he expected the strategy would generate net returns of between 7 ½ % to 9 ½ %. He also noted that while the product was a new open end fund, the managers overseeing the fund had extensive experience and the team was part of a much larger, well established real estate firm.

Dr. Wilder made a motion to (a) adopt the recommendation of the CIO and the Internal Investment Committee as set forth in the Summary Terms Chart on Page 1 of the Due Diligence Report dated August 11, 2017; (b) authorize an investment of up to \$200 million into Heitman Core Real Estate Debt Income Trust, LP; (c) authorize the CEO or the Chair to negotiate and execute any necessary documents to implement the Investment as approved by the Commission (1) upon documented approval for legal sufficiency by RSIC Legal, and (2) upon expiration of the three business day review period as approved by the Commission on May 1, 2014 (or as the review period may be amended or superseded by the Commission); and (d) authorize the CEO, Chair, and/or the CIO or their designee(s) to thereafter authorize the custodian of funds to transfer such funds as are necessary to meet the Retirement System trust funds’ obligations with respect to the Investment. Mr. Gillespie seconded the motion. After discussion by the Commissioners, the motion passed unanimously.

V. ADJOURNMENT

There being no further business, upon a motion made by Mr. Giobbe and seconded by Mr. Williams, the Commission voted unanimously to adjourn. The meeting adjourned at 10:55 a.m.

[Staff Note: In compliance with S.C. Code Ann. Section 30-4-80, public notice of and the agenda for this meeting were delivered to the press and to parties who requested notice and were posted at the entrance, in the lobbies, and near the 15th Floor Presentation Center at 1201 Main Street, Columbia, S.C., at 1:44 p.m. on August 25, 2017.]

**South Carolina Retirement System Investment Commission
Meeting Minutes**

**September 28, 2017 9:00 a.m.
Capitol Center
1201 Main Street, 15th Floor
Columbia, South Carolina 29201
Meeting Location: Presentation Center**

Commissioners Present:

Dr. Rebecca Gunnlaugsson, Chair
Dr. Ronald Wilder, Vice Chair
Ms. Peggy Boykin, PEBA Executive Director
Mr. Allen Gillespie (In Person & Via Telephone)
Mr. Edward Giobbe
Mr. Reynolds Williams

I. CALL TO ORDER AND CONSENT AGENDA

Chair Rebecca Gunnlaugsson called the meeting of the South Carolina Retirement System Investment Commission (“Commission”) to order at 9:00 a.m. Mr. Allen Gillespie made a motion to approve the proposed agenda as presented. Dr. Ronald Wilder seconded the motion, which was approved unanimously.

The Chair referred to the draft minutes from the June 22, 2017 Commission Meeting as presented and asked whether there was a motion to approve the minutes. Mr. Gillespie made a motion to approve the minutes as presented. Dr. Wilder seconded the motion, which passed unanimously.

II. CHAIR’S REPORT

The Chair reviewed the 2018 proposed Commission meeting dates and requested feedback on any conflicts from the Commissioners. Next, the Chair introduced Meketa Investment Group (“Meketa”), the Commission’s new general investment consultant. Meketa was selected by the Commission after a competitive request for proposal (“RFP”) procurement process. Meketa currently serves over 160 clients representing \$900 billion in aggregate assets and will assist the Commission by providing a variety of services, including asset allocation and asset liability modeling for the Plan, review and evaluation of Plan performance, policy reviews, and annual Portfolio reviews. The Chair introduced Mr. Frank Benham, Managing Director and Director of Research for Meketa, who will be one of the consultants working with the Commission. Mr. Benham has 18 years of investment consulting experience and is based out of Meketa’s headquarters in Boston. The Chair also introduced Mr. Aaron Lally, Vice President of Meketa. Mr. Lally has over eight years of investment experience and is based out of Meketa’s Florida office.

III. AUDIT AND ENTERPRISE RISK MANAGEMENT COMMITTEE REPORT

The Chair introduced Mr. Gillespie to provide the Audit and Enterprise Risk Management Committee Report. Mr. Gillespie noted that the Committee met on August 28, 2017 and Mr. Andrew Chernick, Chief Operations Officer, had provided a compliance update to the Committee and stated that no material exceptions were noted during the quarter ended March 31, 2017. Mr. Gillespie reported that all Annual Investment Manager Compliance Questionnaires had been completed and returned and an initial review of the responses had been completed by Staff. The Committee also discussed the planning for the fiduciary audit, which will be conducted by a firm selected by the State Auditor through an RFP procurement process. The final report will be due, by law, on or before January 15, 2019.

The Committee also discussed the Agreed Upon Procedures review by Experis of the internal and fixed income and trading functions, which resulted in 18 recommendations. Mr. Gillespie shared that 14 of the 18 recommendations had already been implemented by Staff. The Committee approved an expansion of the Agreed Upon Procedures review to be completed by CliftonLarsonAllen, focusing on valuation and due diligence guidelines. Additionally, Mr. Gillespie noted that the Committee discussed potentially seeking a review for Global Investment Performance Standards (“GIPS”) compliance for pension funds and requested that Staff explore the possibility of completing GIPS review in the future.

Lastly, Mr. Gillespie announced that a new Director of Audit and Enterprise Risk Management had recently been selected, and the new Director would be introduced at the December Commission meeting.

IV. HUMAN RESOURCES & COMPENSATION COMMITTEE REPORT

Dr. Wilder gave the Human Resources and Compensation Committee (“HRC Committee”) Report. He began by stating that the Committee met on September 15, 2017. He informed the Commission that, in his new position as Chief Operating Officer, Mr. Chernick will oversee the daily operations of RSIC’s Human Resources Department. Dr. Wilder then announced that Ms. Brittany Storey had been promoted to the position of Human Resources Manager, and she will report to Mr. Chernick.

Dr. Wilder went on to explain that the Committee reviewed its Charter at the meeting and stated that the HRC Committee is on track to fulfill its obligations under the Charter. Dr. Wilder added that the HRC Committee discussed personnel matters and the CEO’s evaluation during the executive session portion of the meeting.

V. CEO’S REPORT

The Chair introduced Mr. Michael Hitchcock, Chief Executive Officer. Mr. Hitchcock began by introducing several new employees. Ms. Kara Brurok, the new Director of External Policy who will be handling all governmental relations affairs. Mr. Hitchcock also introduced two new members of the IT team, Mr. Shane Dixon, IT Service Technician and Mr. Eric Baker, whose role will be IT Systems Administrator.

The next item for discussion was the FY 2019 annual budget request, which will need to be submitted to the Executive Budget Office. Mr. Hitchcock explained that RSIC was not asking for any changes from the FY 2018 budget. Mr. Hitchcock discussed the fact that RSIC operates solely on trust fund dollars, and does not receive any funds from the State's general fund. He noted that over the past two budget years RSIC has asked for reductions in authorization, explaining that fiscal year 2018 was a \$1.5 million reduction in authorization from the previous budget year. He stated that there was no request for additional funds and no additional FTEs in the FY 2019 proposed budget request. In response to a question from Dr. Wilder, Mr. Hitchcock explained that funds are only drawn from the trust as needed for expenses. In FY 2018 RSIC did not utilize all of its authorization, therefore the full budget request was not drawn from the trust and the surplus budget funds remain in the trust and continue to earn a return. After some additional discussion regarding open FTEs and other budget matters, Mr. Gillespie made a motion for the Commission to authorize the CEO to submit a proposed Fiscal Year 2019 detail budget substantially similar to the draft budget presented for inclusion in the Governor's annual budget, Mr. Edward Giobbe seconded the motion, which passed unanimously.

Mr. Hitchcock concluded his report by reviewing the annual Material Interest Form and asking the Commissioners to sign and return the form to Mr. Chernick.

VI. CIO's REPORT

Mr. Geoff Berg, Chief Investment Officer, introduced Mr. David King, Reporting Officer, to review the Plan's fiscal year 2016-2017 investment performance. Mr. King stated that the Plan ended the year with an 11.88 percent return, exceeding the policy benchmark's 11.82 percent return by six basis points and noted that the Plan ended the fiscal year with \$30.1 billion in assets. Mr. King indicated that the Plan achieved \$3.3 billion in investment gains during the fiscal year, and paid out net benefits of \$1.1 billion.

Mr. King offered a brief summary of the history of the Plan's value. He stated that at the Commission's inception in October 2005, the Plan had assets of \$25.6 billion, indicated that the Plan had grown to \$29.5 billion before the financial crisis, and indicated that the Plan's fiscal year ending value of \$30.1 billion represented a new high for the Plan. Mr. King noted that since the Commission's inception, the Plan had paid out \$11.2 billion in net benefits.

He noted that public equity, equity options, private equity, mixed credit and private debt all had double-digit returns for the fiscal year and the interest rate sensitive assets (most notably, core fixed income, public real estate and global infrastructure) had negative returns for the year.

After further discussion of the performance information, Ms. Peggy Boykin commended Mr. Berg and staff for improving the Plan's peer rankings, as well as the overall realignment of the portfolio.

Mr. King provided an investment performance update for the month of July 2017, noting that the Plan returned 1.93 percent for the month of July, versus the policy benchmark of 1.63 percent.

Mr. Berg introduced Mr. David Hutchings, a partner with Albourne Partners. Mr. Hutchings explained that RSIC had retained Albourne as a specialty consultant for the private markets portfolio, and provided a high-level overview of the firm and the services they would provide as an extension of the investment staff.

VII. INVESTMENT RECOMMENDATIONS

Mr. Berg then introduced Mr. Steve Marino, Director, to present a recommendation to implement a Global Tactical Asset Allocation Network for the GAA portfolio. Mr. Marino identified three goals of this recommendation: (1) develop a portfolio with a more consistent excess return profile; (2) create strong economic alignment through a low base management fee, and a performance fee that rewards managers for sustained performance, not just short term success, and (3) develop a more strategic relationship with managers for greater sharing of knowledge.

Mr. Marino explained that the proposed Global Tactical Asset Allocation Network would consist of three managers: Morgan Stanley, PineBridge and Standard Life. The recommended allocation would be up to four percent for each manager. Mr. Marino presented details on the fee structure, noting the blended fees across all three managers would be a management fee of 29 basis points, a hurdle rate of 88 basis points over the benchmark, a performance fee of 11.25 percent, with an all-in blended fee cap of 87 basis points. Mr. Marino reviewed the investment considerations, including key person risk, the potential for paying performance fees in negative return environments, and active drawdown risk, and discussed each manager individually, reviewing specific differentiating factors for Morgan Stanley, PineBridge and Standard Life.

Mr. Edward Giobbe noted that in accordance with S.C. Code Section 8-13-700(B), he would not be participating in the deliberations, voting or other actions on the matter before the South Carolina Retirement System Investment Commission regarding the Morgan Stanley GTAAN Fund. Mr. Giobbe retired, and receives a pension, from Morgan Stanley. Thus, to avoid a potential conflict of interest, or even the appearance of impropriety, Mr. Giobbe recused himself from the vote. (See Exhibit "A").

Mr. Reynolds Williams made a motion to dispense with the reading of the motion because the motion was posted in advance of meeting. Mr. Gillespie seconded the motion, which passed unanimously. Mr. Gillespie then moved that the Commission (a) adopt the recommendation of the CIO and the Internal Investment Committee as set forth in each Summary Terms Chart on Page 1 of the Due Diligence Reports dated September 28, 2017 for each of the three proposed investment managers [Morgan Stanley, Standard Life and PineBridge]; (b) authorize an investment of up to four (4) percent of Plan Assets for each proposed investment manager; (c) authorize the CEO or his designee to negotiate and execute any necessary documents to implement the Investments as approved by the Commission (1) upon documented approval for legal sufficiency by RSIC Legal, and (2) upon expiration of the three business day review period as approved by the Commission on May 1, 2014 (or as the review period may be amended or superseded by the Commission); and (d) authorize the CEO and/or the CIO or their designee(s) to thereafter authorize the custodian of funds to transfer such funds as are necessary to meet the Retirement System trust funds' obligations with respect to each proposed Investment. Mr. Williams seconded the motion, which passed unanimously.

Mr. Berg offered introductory comments regarding a proposed private equity investment with Francisco Partners, a buy out and growth equity firm focused on the technology sector. Mr. Berg noted that although RSIC would probably not get the full amount of its requested allocation from Francisco Partners because of very high investor demand for Fund V, the Investment team considered this a compelling investment opportunity. Mr. Berg then introduced Mr. Derek Connor, Senior Officer, who presented the recommendation to commit up to \$125 million to Francisco Partners V. Mr. Connor noted that Albourne had provided the Investment team with investment due diligence and operational due diligence reports on Francisco, and Francisco Partners had received a pass rating from RSIC's internal operational due diligence team. Mr. Connor then reviewed Francisco Partners' background, strategy and historical performance. He noted that Francisco Partners focuses on middle market technology companies, with typical investments between \$50 to \$250 million in companies with enterprise values between \$100 million and \$1 billion. After discussion of the investment strategy, investment considerations, and other issues, Mr. Williams moved to (a) adopt the recommendation of the CIO and the Internal Investment Committee as set forth in the Summary Terms Chart on Page 1 of the Due Diligence Report dated September 28, 2017; (b) authorize an investment of up to \$125 million; (c) approve a waiver of the three day review period; (d) authorize the CEO or his designee to negotiate and execute any necessary documents to implement the Investment as approved by the Commission upon documented approval for legal sufficiency by RSIC Legal; and (e) authorize the CEO and/or the CIO or their designee(s) to thereafter authorize the custodian of funds to transfer such funds as are necessary to meet the Retirement System trust funds' obligations with respect to the Investment. Mr. Gillespie seconded the motion, which passed unanimously.

A break was taken from 10:26 a.m. until 10:48 p.m.

Mr. Gillespie left the meeting and rejoined by telephone.

VIII. INVESTMENT DELEGATION POLICY

Mr. Hitchcock introduced the proposed Investment Delegation Policy (the "Policy"), which had been posted for the Commissioners to review prior to the meeting, along with proposed edits to the Policy submitted by Dr. Wilder. He explained that the proposed policy was based on amendments made to the Commission's governing statutes in the Pension Reform Act, which was enacted on July 1, 2017. The amendments granted the Commission authority to delegate certain investment decision making to the Staff within the limits outlined in the statute. He explained that the proposed policy reflects a shift in responsibilities for the Commission, from a focus on implementation of the Portfolio and manager selection to a greater emphasis on asset allocation and oversight. This shift would allow the Commission to focus on 'big picture' issues that directly impact the performance of the Portfolio, rather than the day-to-day management of the Portfolio. The proposed Investment Delegation Policy would delegate final authority to invest to the Staff, subject to specific limits and controls, as set forth in the proposed Policy. Mr. Hitchcock also noted that state law required that the Commission's investment consultant provide an analysis of the extent of investment authority delegation in other public pension funds. He explained that Meketa had performed such an analysis and thanked Meketa for all of their work in this area and noted that the report from Meketa would be made part of the public record.

Mr. Hitchcock then walked the Commission through the proposed Policy, noting that the public market staff would be allowed to commit up to 2 percent of the total value of Plan assets in public market investments (such as global public equity, mixed credit, core fixed income and other similar liquid strategies). For a private market investment, including private equity, private real estate, and private debt, Staff would be allowed to commit up to 75 basis points (.75 percent) of the total value of Plan assets in a single investment under the Policy. Publicly traded real estate investments would be limited to 1 percent of the total value of plan assets per investment. Mr. Hitchcock further explained that certain investments would still be presented to the Commission for approval, regardless of the size of the proposed investment, including investments in a new asset classes or new strategies. Dr. Wilder discussed his proposed edits, which included providing that proposed investments, other than in publicly traded assets, with direct connections to South Carolina, would also be submitted to the Commission for approval. The Commissioners discussed the types of investments that the Commission would need to approve under this section of the Policy.

Mr. Gillespie inquired about Section III of the Policy and the size of the limits on proposed investments. Ms. Boykin voiced concerns about the delegation for private markets versus publicly traded assets. She stated that if the Commission disagreed with staff, it would be harder to get capital back that has already been committed in an illiquid private market

investment. Mr. Hitchcock explained that the statute does authorize the Commission to give RSIC the ability to commit up to 1 percent for private market investments, but the proposed Policy is lower than that, at 75 basis points.

The Commissioners discussed the importance of this Policy and the substantial shift in direction the Policy represents for the Commission. A lengthy discussion ensued regarding the Policy, including a possible “phase in” period for the delegation and other options to implement the Policy.

Mr. Lally of Meketa reported that Meketa researched 45 other large public state retirement systems and sought out four questions (1) who is delegating, (2) what parameters do they put in place, (3) what reporting is required to the boards, and (4) has the decision to delegate had any impact on the performance of the retirement systems? He stated that they found that half of the surveyed systems delegated investment authority to their chief investment officer (“CIO”). This is trend in the pension industry. Their analysis indicated that governing boards want to focus more on asset allocation and other strategic decisions and less on operational aspects of approving individual asset managers. They also found that our large peers are moving to delegating authority to the CIO.

Mr. Lally continued, stating that most systems treat private and public managers differently, for private market investments plans have put limits on what size commitment the system can make, in either dollars or as a percentage of plan assets. Mr. Lally concluded that plans are increasingly moving towards investment delegation to the CIO and the boards retain control over asset allocation, rather than devoting a substantial amount of time to receiving manager recommendations. Mr. Lally noted that more boards are concentrating on long-term objectives of their plans by delegating investment authority to the CIO and staff.

The Chair noted that the Commission reviews the Statement of Investment Objectives and Policies (“SIOOP” yearly and the delegation policy will reside in the SIOOP. Discussion continued regarding the delegation limits and whether the Commission was comfortable with the proposed limits. The Chair suggested lowering the delegation for private markets investments to 50 basis points initially, and then the Commission could re-visit the issue in the Spring during its review of the SIOOP. Mr. Gillespie inquired about the ability to include a provision in proposed contracts permitting the Commission to rescind a private market investment made under the Policy at the next Commission meeting if the Commission had objections to the investment. To which Ms. Betsy Burn, Chief Legal Officer, explained that it would be highly unlikely that many investment managers would agree to such a right of rescission. Mr. Hitchcock reminded the Commissioners that they would have access to the investment pipeline, which would provide the Commissioners insight into proposed investments during the due diligence period. A lengthy discussion regarding delegation issues ensued. The Commissioners requested that all contracts and due diligence materials be provided to the Commissioners for a three day review period prior to closing any investment under the Policy.

After additional discussion, Mr. Williams made a motion to (a) approve and accept the Report on Delegation by Meketa Investment Group as sufficient for purposes of compliance with S.C. Code Ann. Section 9-16-330(E); (b) adopt the Investment Delegation Policy, as amended during the meeting and as modified below; add the Investment Delegation Policy to the Statement of Investment Objectives and Policies (“SIOP”) as amended and adopted on June 22, 2017; and reaffirm the SIOP, as amended; (c) approve the delegation of the final authority to invest to the Chief Investment Officer, subject to compliance with requirements of S.C. Code Ann. Section 9-16-330 and within the parameters established in the SIOP as amended; and (d) accept the amendments as discussed during the meeting and incorporate them into the final policy. The policy will go into effect after the inclusion of the agreed upon amendments and upon review and acceptance by the Chair. Mr. Giobbe seconded the motion, which passed unanimously.

IX. GENERAL INVESTMENT CONSULTANT REPORT

Mr. Benham, Managing Director and Director of Research for Meketa, presented Meketa’s Initial Fund Review of the Plan. He noted that the review was extensive and Meketa had not identified any red flags or serious concerns to be brought to the Commission for immediate action. Mr. Benham provided an overview of the areas covered by the review which had been assigned priority ratings for potential improvement opportunities and areas for which Meketa requested additional input from the Commission. He emphasized the importance of asset allocation, as the single most influential determinant of how the Plan performs. He stated that Meketa would be providing a comprehensive presentation on asset allocation during the December Commission meeting. Mr. Benham also discussed fund governance, benchmarking, portfolio structure, equity options, and emerging market debt as part of his presentation. Commissioners asked questions throughout the discussion and Meketa provided additional information as requested.

12:52 p.m. Mr. Gillespie left the meeting.

X. EXECUTIVE SESSION

Dr. Wilder made a motion that the Commission recede into Executive Session to receive advice from legal counsel pursuant to S.C. Code Section 40-4-70(a)(2) related to litigation filed by American Timberlands Fund II, LP; to discuss investment matters pursuant to S.C. Code Sections 9-16-80 and 9-16-320; and to discuss personnel matters related to CEO performance and compensation pursuant to S.C. Code Section 30-4-70(a)(1). Mr. Giobbe seconded the motion, which passed unanimously.

XI. POTENTIAL ACTION RESULTING FROM EXECUTIVE SESSION

Upon a return to open session at 3:52 p.m., Mr. Williams made a motion that the Commission adopt the recommendation of the CIO and the Internal Investment Committee as set forth in the memo dated September 14, 2017 regarding TimesSquare Capital Management, LLC (“TimesSquare”); authorize the renewal of the Commission’s contractual relationship with TimesSquare for another period of up to five years upon the terms outlined in the September 14, 2017 memo; and authorize the CEO or his designee to negotiate and execute any documents to implement the renewal of the investment approved by the Commission (1) upon documented approval for legal sufficiency by RSIC Legal, and (2) upon expiration of the three business day review period as approved by the Commission on May 1, 2014 (or as the review process may be amended or superseded by the Commission). Mr. Giobbe seconded the motion, which passed unanimously.

The Chair indicated that the Commission had a second motion based on the outcome of the CEO performance review that was conducted in Executive Session. Mr. Williams made a motion that the Commission authorize the compensation increase for Mr. Hitchcock as discussed in executive session and directs the human resources department and other necessary parties to take all action necessary to implement the decision as approved by the Commission and directs that the salary increase be disclosed to the public and in the official minutes of the Commission meeting after the increase has been communicated to Mr. Hitchcock. Mr. Giobbe seconded the motion. Mr. Williams noted for the record that the Commission found Mr. Hitchcock’s work to be exemplary. Mr. Hitchcock’s annual salary, effective as of October 2, 2017, is \$284,583.00.

XII. ADJOURNMENT

There being no further business, upon a motion made by Mr. Williams and seconded by Mr. Giobbe, the Commission voted unanimously to adjourn. The meeting adjourned at 3:54 p.m.

[Staff Note: In compliance with S.C. Code Ann. Section 30-4-80, public notice of and the agenda for this meeting were delivered to the press and to parties who requested notice and were posted at the entrance, in the lobbies, and near the 15th Floor Presentation Center at 1201 Main Street, Columbia, S.C., at 4:54 p.m. on September 25, 2017.]

Exhibit "A"

In accordance with S.C. Code Section 8-13-700(B), I will not be participating in the deliberations, voting, or other actions on the matter before the South Carolina Retirement System Investment Commission regarding the Morgan Stanley GTAAN Fund. I retired from and receive a pension from Morgan Stanley. Thus, to avoid a potential conflict or even the appearance of impropriety, I will recuse myself from the vote.

I understand that this statement will be attached to the minutes for the September 28, 2017 Commission meeting.



Edward N. Giobbe

28 Sept 17

Date



South Carolina Retirement System Investment Commission
Asset Allocation Review
and Risk Analysis

Presented
December 7, 2017

Table of Contents

Introduction	3
Asset Allocation Overview.....	5
Proposed Policy Options.....	14
Other Policies Considered	32
Recommendations	37
Appendices	39
Setting Capital Markets Expectations	40

Introduction

Introduction

- This document evaluates the current asset allocation policy and presents alternative asset allocation options for the Retirement System.
- We provide various approaches to assessing the risk in each policy option in order to provide a “mosaic” of the risks faced by the Retirement System.
- The goal of this review is not to declare one portfolio the “right” choice or the only prudent choice, but to highlight the risk and return tradeoffs of different policy portfolios.
- The asset allocation review process highlights the natural tension between long-term goals and short-term risks, and should allow the Retirement System to make more informed decisions regarding portfolio positioning.

Asset Allocation Overview

Asset Allocation

What is Asset Allocation?

Asset allocation refers to the distribution of assets across a number of asset classes that exhibit different correlations with each other. Each asset class exhibits a unique combination of risk and reward. The expected and realized long-term returns vary by asset class, as does the interim volatility of those returns. Some asset classes, like equities, exhibit high degrees of volatility, but also offer high returns over time. Other asset classes, like cash, experience very little volatility, but offer limited return potential.

Why is Asset Allocation important?

The distribution of assets across various asset classes exerts a major influence on the return behavior of the aggregate pool over short and long time periods.

How does Asset Allocation affect aggregate performance?

In addition to exhibiting unique characteristics, each asset class interacts differently with other asset classes. Because of low correlations, the likelihood that any two asset classes will move together in the same direction is limited, with the movement of one asset class often offsetting another's. Combining asset classes allows investors to control more fully the aggregate risk and return of their portfolios, and to benefit from the reduction in volatility that stems from diversification.

Developing Investment Objectives

What is the Retirement System's long-term return objective?

- Benefits stability and /or growth
- Meet or exceed actuarial assumed rate of return of 7.25%
- Improve funded status
- Maintain purchasing power

What are the Retirement System's risk objectives?

- Volatility
 - Endpoint uncertainty
 - Year-to-year fluctuations in asset values and contribution levels
- Risk of short-term loss
- Permanent capital impairment
 - Failure to meet objectives
- Probability of meeting your assumed rate of return

Developing Investment Constraints

What is the overall time horizon for the Retirement System?

- On-going concern, with long-term time horizon for majority of assets

What are the liquidity needs of the Retirement System?

- Net cash outflows of approximately \$800 million per fiscal year for the next five years¹

What are the legal and regulatory constraints under which the Retirement System operates?

- South Carolina Code Ann. Title 9, Chapter 16
 - This includes a 70% maximum limitation on equities

Are there any other considerations that must be evaluated?

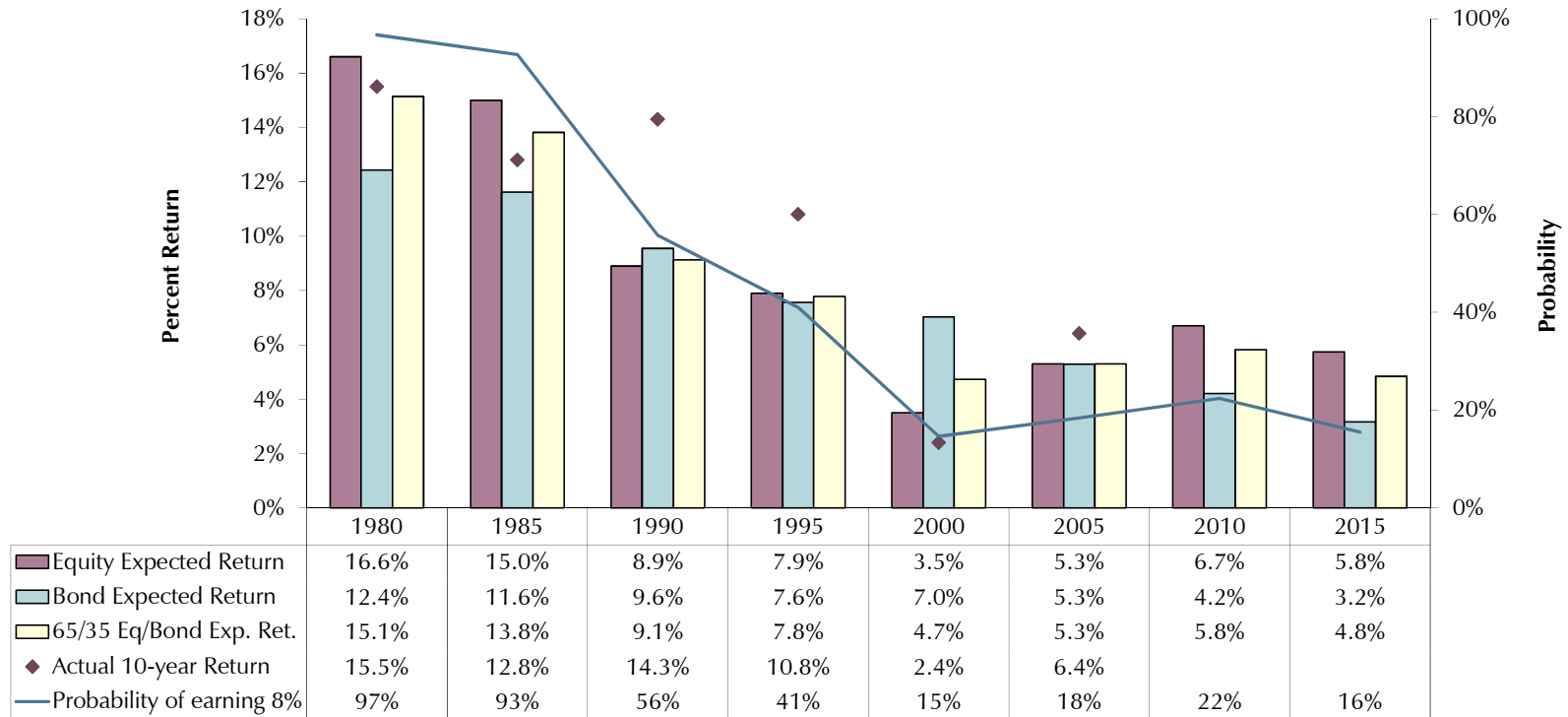
- Increasing contribution levels in the future
- Changing ratio of active to retired participants in the Retirement System?
- State fiscal and budget status?

¹ The net outflow is expected to decline over each of the next five years, averaging \$630 million from 2019 to 2022.

Asset Allocation Review Process

- Review the spectrum of asset allocation options, ranging from conservative to more aggressive.
- Choose a portfolio with expected returns and risk that are appropriate for the financial position of the Retirement System.
- Accept equity risk as means of achieving an acceptable long-term return, or consider lower returns and higher contributions that come with less equity risk.
- Understand the risks in a portfolio predominantly invested in equities and equity-like assets.

The Secular Decline in Investment Returns¹



- A portfolio comprised of 65% domestic stocks and 35% investment grade bonds has produced diminishing expected returns as well as actual returns over the past thirty years.

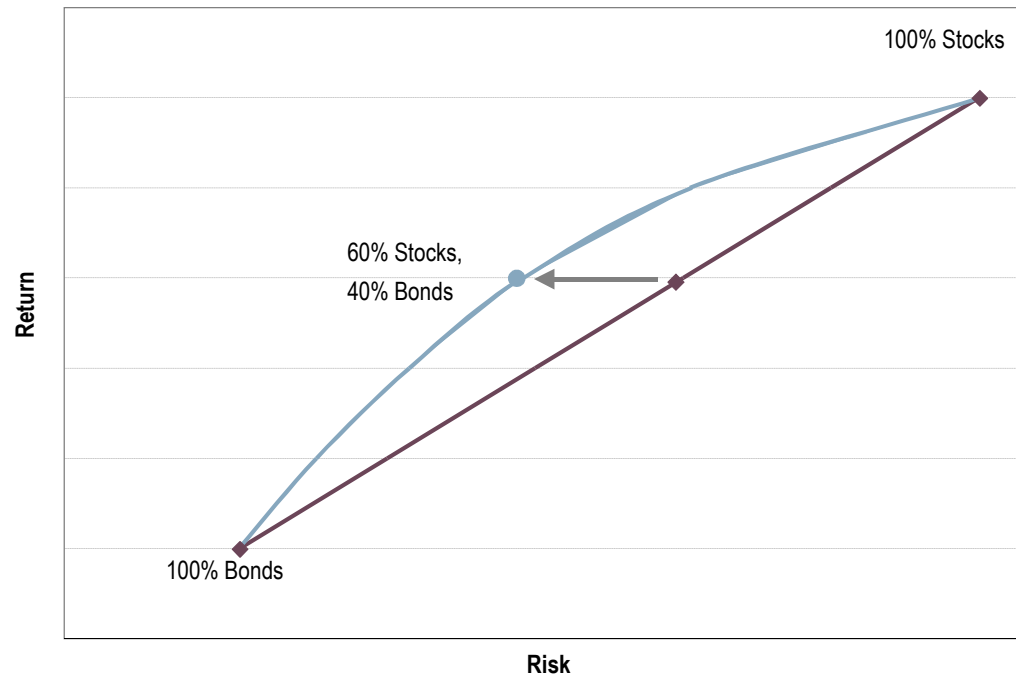
¹ Expected return assumptions for 1) Bonds equals the yield of the ten-year Treasury plus 100 basis points, and 2) Equities equals the dividend yield plus the earnings yield of the S&P 500 index (using the inflation-adjusted trailing 10-year earnings). Probability calculation is for the subsequent ten years.



Mean Variance Optimization

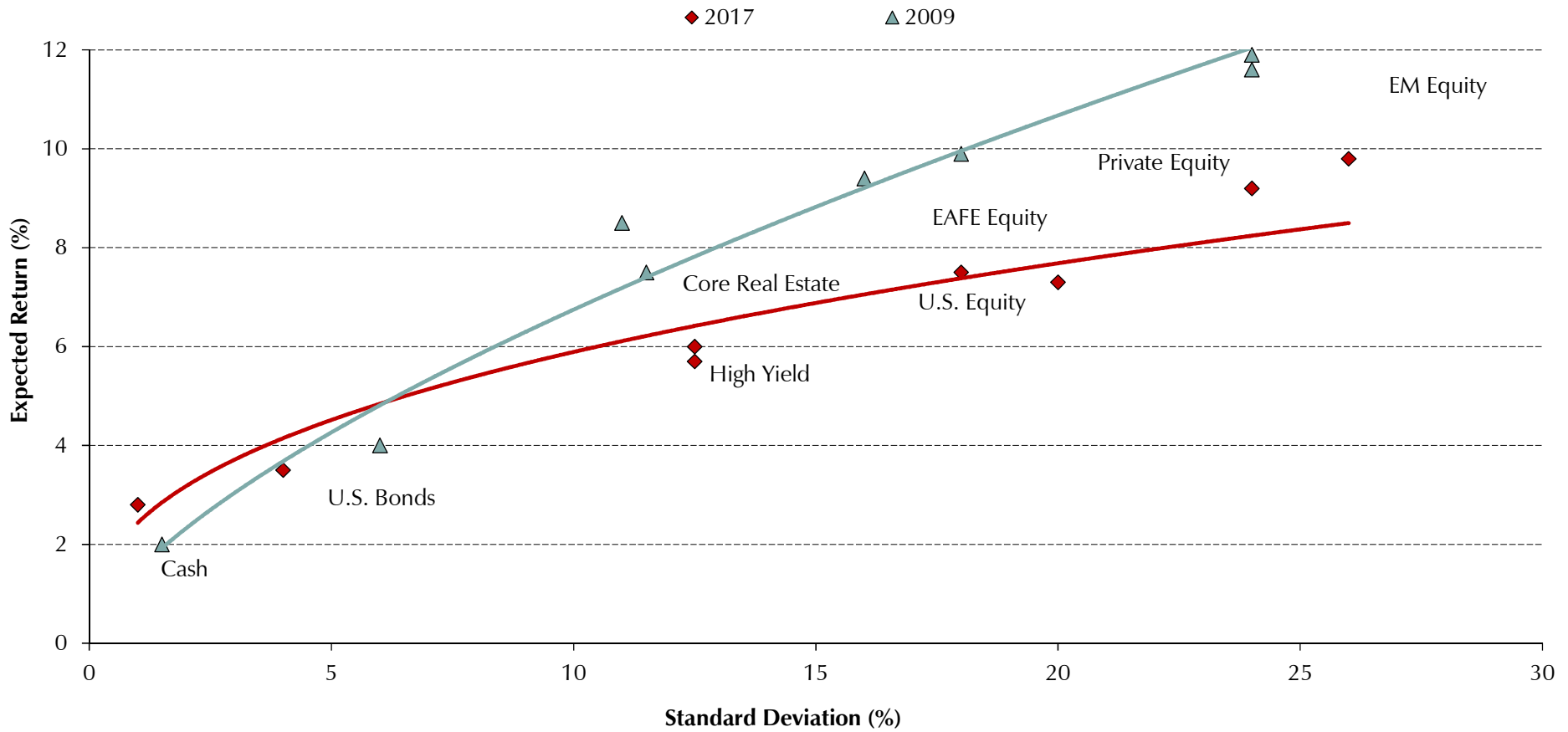
- MVO is the traditional starting point for determining asset allocation.
- MVO mathematically determines an “efficient frontier” of policy portfolios with the highest risk-adjusted returns.
- All asset classes exhibit only three characteristics, which serve as inputs to the model:
 - Expected return
 - Expected volatility
 - Expected covariance with all other assets
- The model assumes:
 - Normal return distribution
 - Stable volatility and co-variances over time
 - Returns are not serially correlated
- The MVO model tends to underestimate the risks of large negative events.

The Efficient Frontier



- Combining uncorrelated assets produces an “efficient frontier.” Different combinations of assets (e.g., 60% stocks & 40% bonds) will lie along this efficient frontier.
- By combining assets that are not highly correlated with each other, the Fund can produce a higher return for a given level of risk than it could by investing in perfectly correlated assets. Alternatively, it can experience lower risk for a given level of return.

Efficient Frontier Over Time: Less Return for the Same or More Risk¹



- A positive relationship exists between long-term return expectations and the level of risk accepted.
- However, this relationship is not static.

¹ Expected return and standard deviation are based upon Meketa Investment Group's Annual Asset Study.

Proposed Policy Options

Review of Proposed Asset Allocation Policies

- Staff and Meketa Investment Group discussed numerous policy options and went through multiple iterations for several of the options.
- The following page shows the current policy, the peer average, and three alternative policies.
 - Two of these policies (A and F) are considered “bookends”, as they represent the lowest and highest expected return portfolios considered by Meketa and Staff. They are shown to best illustrate the contrasts in risk options facing the Commission.
 - The third alternative shown (Policy H) consists solely of public market assets, and is shown for comparison purposes.
 - Most of the pages that follow focus on these alternatives, again to highlight the differences in the options being considered.
- The subsequent page shows the three policy options (B, C, and D) favored for consideration by Staff and Meketa.
 - It is immediately followed by two pages describing the thematic changes under consideration.
- At the end of presentation we show the other portfolio options discussed by Staff and Meketa.

Asset Allocation Policy Options: “Bookends”¹

	Current Policy (%)	Policy A (%)	Policy F (%)	Policy H (%)	Peer Average (%)
Rate Sensitive:	12	18	15	20	18
Cash & Short-term Bonds	2	1	1	1	1
Investment Grade Bonds	9	8	7	10	13
US Treasuries	1	6	5	6	1
TIPS	0	3	2	3	3
Credit:	18	14	11	14	7
High Yield Bonds & Bank Loans	6	4	2	10	3
Emerging Market Debt	5	4	3	4	3
Private Debt	7	6	6	0	1
Equities:	49	46	57	46	53
US Equity	18	16	21	23	31
Developed Foreign Equity	13	11	13	13	7
Emerging Markets Equity	4	5	8	5	6
Option-based Equity	5	5	5	5	0
Private Equity	9	9	10	0	9
Real Assets:	11	11	10	11	11
Real Estate	8	9	8	9	8
Infrastructure (and Commodities/NR)	3	2	2	2	3
Opportunistic	20	11	17	9	10
Hedge Funds ²	10	2	10	0	8
Tactical Asset Allocation	8	8	6	8	2
Other Opportunistic & Risk Parity	2	1	1	1	0
<i>Non-U.S. Dollar Exposure</i>	<i>26</i>	<i>24</i>	<i>29</i>	<i>25</i>	<i>18</i>
Expected Return	7.65	7.25	7.96	6.94	7.38
Standard Deviation	13.8	12.4	14.3	12.8	12.8
Probability of Achieving 7.25% over 20 Years	54.7	49.6	58.4	45.1	51.3

¹ Expected return and standard deviation are based upon Meketa Investment Group's 2017 Annual Asset Study. Throughout this document, returns for periods longer than one year are annualized.

² For the Current Policy (FY 18-19) and Policies B, D & F, the target allocation to “hedge funds” is via portable alpha. MIG modified its correlation assumptions for hedge funds to be more consistent with the expectations of the RSIC program.

Asset Allocation Policy Options: Recommended Options¹

	Policy B (%)	Policy C (%)	Policy D (%)	Proposed Target Ranges
Rate Sensitive:	20	14.5	16.5	+/- 5
Cash & Short-term Bonds	0.5	0.5	0.5	≤ 5
Investment Grade Bonds	10.5	6	8	+/- 4
US Treasuries	6	6	6	+/- 3
TIPS	3	2	2	+/- 2
Credit:	14	14.5	14.5	+/- 4
High Yield Bonds & Bank Loans	4	3.5	3.5	+/- 2
Emerging Market Debt	4	4	4	+/- 2
Private Debt	6	7	7	+/- 3
Equities:	46	50	50	+/- 5
US Equity	16	18	18	+/- 5
Developed Foreign Equity	11	11	11	+/- 4
Emerging Markets Equity	5	7	7	+/- 3
Option-based Equity	5	5	5	≤ 8
Private Equity	9	9	9	+/- 4
Real Assets:	11	11	11	+/- 4
Real Estate	9	9	9	+/- 3
Infrastructure (and Commodities/NR)	2	2	2	+/- 2
Opportunistic	19	10	18	+/- 6
Hedge Funds	10	2	10	≤ 10
Tactical Asset Allocation	8	7	7	+/- 3
Other Opportunistic & Risk Parity	1	1	1	≤ 3
<i>Non-U.S. Dollar Exposure</i>	24	26	26	
Expected Return	7.48	7.50	7.72	
Standard Deviation	12.7	13.2	13.5	
Probability of Achieving 7.25% over 20 Years	52.7	52.9	55.7	

¹ Expected return and standard deviation are based upon Meketa Investment Group's 2017 Annual Asset Study. Throughout this document, returns for periods longer than one year are annualized.

Proposed Changes

- **Reduce cash.**
 - Cash is the asset class with the lowest expected return. As such, any allocation to it acts as a drag on portfolio returns.
- **Add a dedicated allocation to Treasuries.**
 - Government bonds have historically been the most reliable hedge against bear markets in stocks. This is especially true for long-term Treasuries, which benefit from a “flight to quality” during such periods.
- **Add a dedicated allocation to TIPS.**
 - TIPS would further diversify the bond portfolio, while providing a modest hedge against any unexpected increase in inflation.
- **Increase emerging market equities.**
 - EM equities have the highest expected return among public market asset classes. Adding to EM equities would increase the return potential without sacrificing liquidity.
 - To mitigate currency risk, the allocation to EM debt (and developed non-US equity in several options) would be concurrently reduced.

Proposed Changes (continued)

- **Re-allocate within real assets.**
 - As private market infrastructure opportunities that meet Staff’s standards have been difficult to identify, a lower allocation to infrastructure would be easier to implement.
 - The allocation between core and non-core real estate would change. The mix would shift from its current mix of being predominantly non-core to being predominantly core (e.g., 50-65% core), consistent with the majority of peers.
- **Choose between a portfolio that does or does not use portable alpha.**
 - The System currently implements a portable alpha structure via the use of overlays and hedge funds. This approach increases the overall expected return while also increasing risk. Importantly, the hedge funds are intended to be low beta/market neutral. That is, they are designed not to be highly correlated with the rest of the System’s portfolio.
 - Importantly, however, there is a large amount of dispersion of returns among hedge funds, which creates a further degree of uncertainty, as our assumptions for the average hedge fund could bear out while the hedge funds in the System’s portfolio behave differently.
- **Include risk parity in the Other Opportunistic category and set an upper bound.**
 - Meketa and Staff envision this allocation as being truly opportunistic. That is, assets would not necessarily be allocated to the category unless/until the right opportunities are identified and vetted. Risk parity can serve as a “place holder” for such assets.

Comparison to Peers - Tracking Error

- The Retirement System's current target and proposed asset allocation policies are different than that of its peers.
- Each fund in the peer group is unique and differs in some way from the average of the peer group.
- Based on the peer average, the Retirement System can expect long-term tracking error (i.e., over a 20-year period) for each policy as follows:

Policy	Tracking Error per Annum (%)
Current Allocation	1.7
Policy A	1.6
Policy F	1.9
Policy H	2.7

- While we would expect higher tracking error over shorter periods of time, over the long-term, tracking error relative to peers would be between 1.6% and 2.7% based on the proposed options¹.
- For reference, a positive 2% tracking error would have moved a median plan up to the 16th percentile over the trailing ten years²; and a negative 2% tracking error would have moved the median plan down to the 77th percentile.

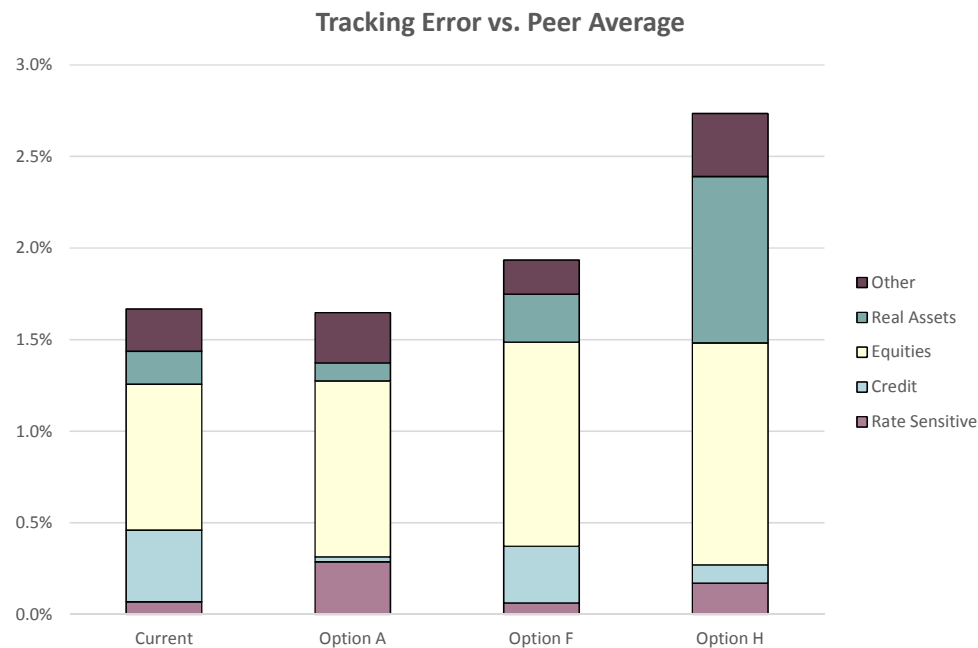
¹ Assuming a one standard deviation event.

² Based on Investor Force Public DB >\$1B Universe as of September 30, 2017.

Decomposition of Tracking Error

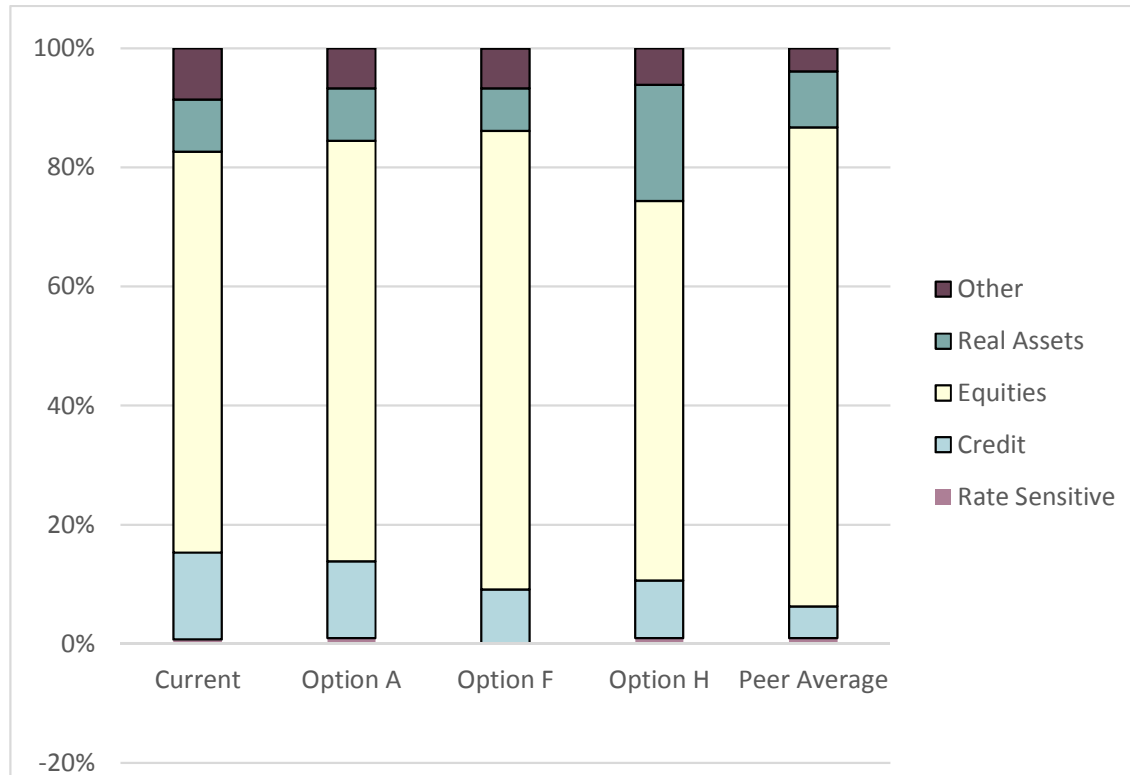
- Tracking error relative to the peer group can come from many different sources.
- The chart below examines the sources of tracking error due to differences in asset allocation.
 - Note that additional tracking error can be expected due to variances resulting from active management.

Sources of Tracking Error



- Option H has the highest amount of tracking error versus the peer average due to the lack of private market investments.

Risk Budgeting Analysis¹ (Risk Allocation)



- Assets with low relative volatility, such as rate sensitive fixed income, contribute much less to risk (as defined by standard deviation) than their asset weighting implies.

¹ Other includes Hedge Funds, TAA and risk parity. Risk allocation is calculated by multiplying the weight of the asset class by its standard deviation and its correlation with the total portfolio and then dividing this by the standard deviation of the total portfolio.



MVO-Based Risk Analysis

Scenario:	Current Policy (%)	Policy A (%)	Policy F (%)	Policy H (%)
“Worst Case” Returns¹:				
One Year	-22.4	-20.2	-23.0	-21.2
Three Years (<i>annualized</i>)	-10.9	-9.6	-11.2	-10.4
Five Years (<i>annualized</i>)	-7.0	-6.1	-7.2	-6.8
Ten Years (<i>annualized</i>)	-3.0	-2.4	-3.0	-2.9
Probability of Experiencing Negative Returns				
One Year	28.2	27.2	28.0	28.7
Three Years	15.8	14.6	15.7	16.5
Five Years	9.8	8.7	9.7	10.4
Ten Years	3.4	2.7	3.3	3.8
Probability of Achieving at least a 7.25% Return				
One Year	51.1	49.9	51.9	48.9
Three Years	51.8	49.8	53.3	48.1
Five Years	52.4	49.8	54.2	47.6
Ten Years	53.3	49.7	55.9	46.6
Twenty Years	54.7	49.6	58.4	45.1

- Policy F is structured to be the most aggressive portfolio. Accordingly, it has the highest likelihood of reaching the target return over the long term.

¹“Worst Case” Return Projections encompass 99th percentile of possible outcomes.

Value at Risk¹

Scenario	Current Policy	Policy A	Policy F	Policy H
VaR (%):				
One Month	-8.6	-7.7	-8.9	-8.0
Three Months	-14.0	-12.6	-14.5	-13.1
VaR (\$ mm):				
One Month	-2,674	-2,398	-2,767	-2,484
Three Months	-4,359	-3,898	-4,510	-4,057

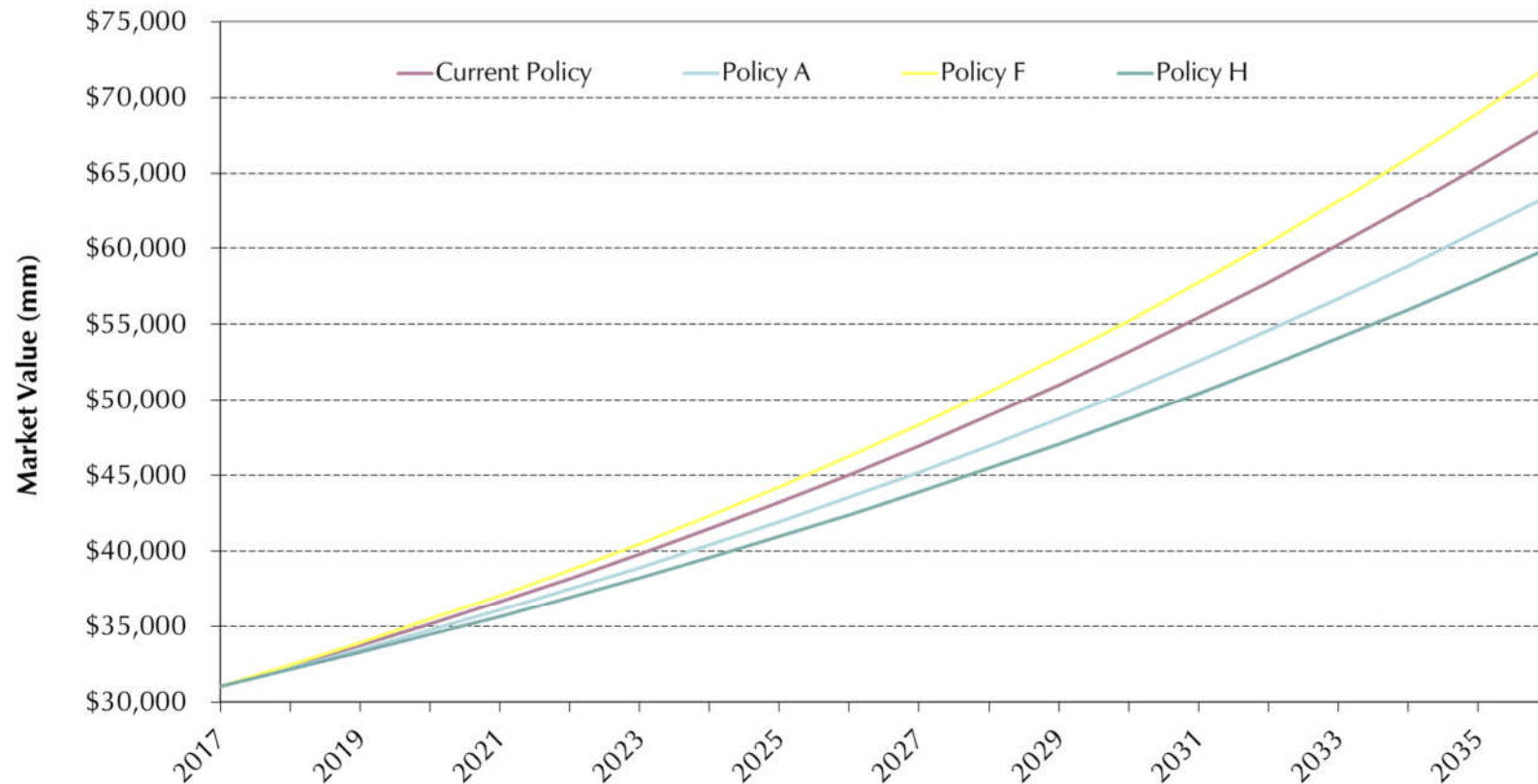
Conditional Value at Risk¹

Scenario	Current Policy	Policy A	Policy F	Policy H
cVaR (%):				
One Month	-9.9	-8.9	-10.3	-9.2
Three Months	-16.3	-14.6	-16.9	-15.2
cVaR (\$ mm):				
One Month	-3,081	-2,764	-3,188	-2,863
Three Months	-5,058	-4,527	-5,231	-4,707

- According to the VaR model, the Retirement System could lose up to \$2.7 billion in a single month.

¹ Calculated with a 99% confidence level and based upon Meketa Investment Group's Annual Asset Study. CVaR represents the average loss past the 99th percentile.

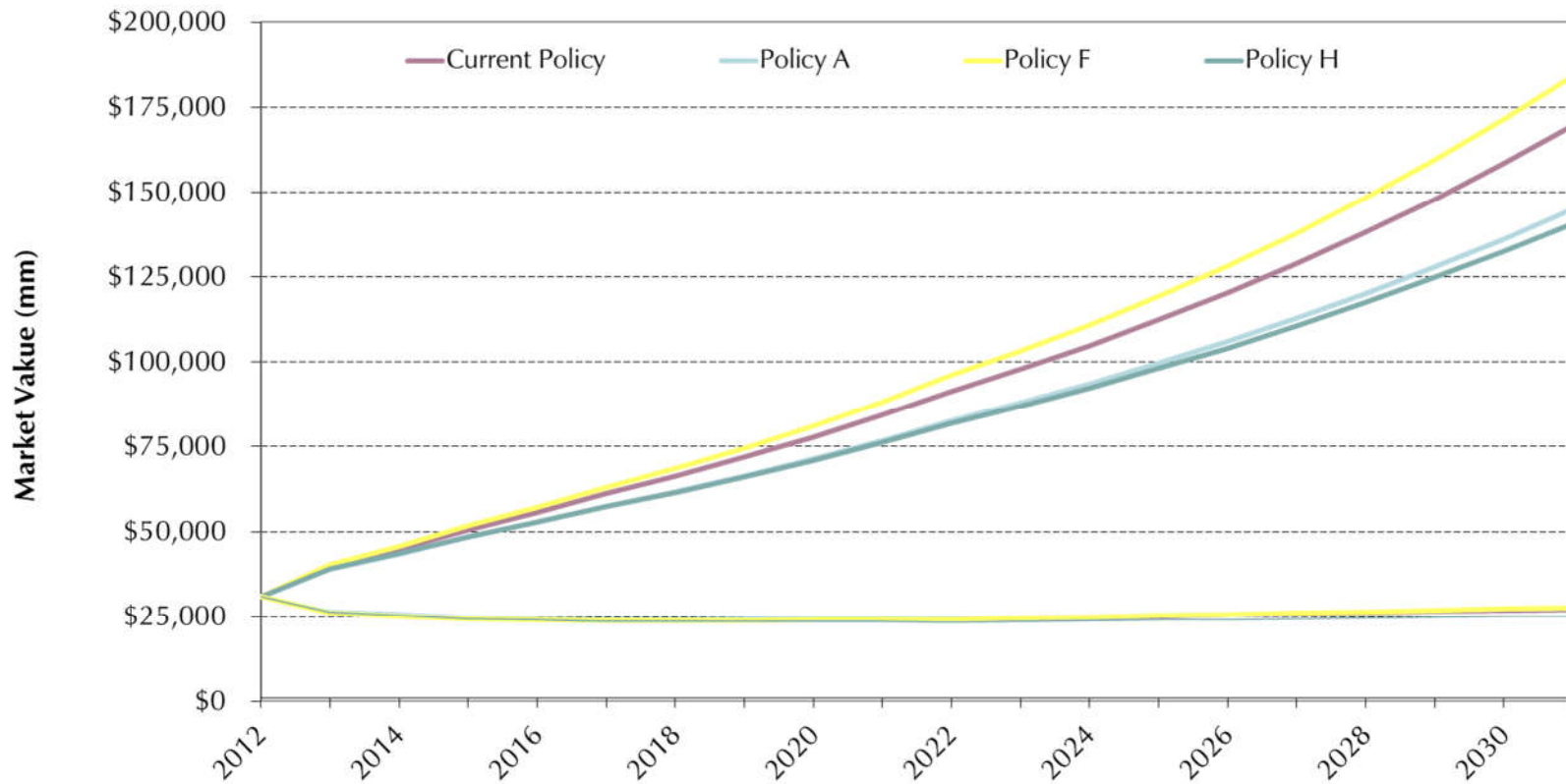
Growth of Assets¹



- Even apparently small differences in expected returns can result in dramatic differences over long time periods. The difference between Policy H and Policy F at the end of twenty years is \$12.1 billion.

¹ Assumes each policy option produces its expected return in each calendar year and net outflows of 3.3% per annum.

Growth of Assets - 5th and 95th Percentiles¹



- The difference for the negative case is small after twenty years (\$2.7 billion), but quite large for the positive case (\$48.6 billion).

¹ Assumes each policy option produces returns at the 5th percentile and 95th percentile of possible outcomes and net outflows of 3.3% per annum.



Historical Negative Scenario Analysis¹ (Cumulative Return)

Scenario:	Current Policy (%)	Policy A (%)	Policy F (%)	Policy H (%)	Peer Average (%)
Taper Tantrum (May-Aug 2013)	-0.9	-1.3	-1.2	-3.5	-0.6
Global Financial Crisis (4Q07 thru 1Q09)	-28.3	-23.2	-28.1	-29.8	-25.6
Popping of the TMT bubble (Apr 2000 – Sep 2002)	-10.6	-6.2	-12.4	-12.2	-11.7
LTCM (Jul – Aug 1998)	-10.0	-8.3	-10.3	-10.6	-9.5
Interest Rate Spike (1994)	1.8	1.4	1.0	-0.7	1.5
Crash of 1987 (September thru November 1987)	-11.8	-10.0	-12.8	-14.3	-12.7
Strong U.S. Dollar (1Q81 through 3Q82)	0.5	4.5	0.0	2.4	3.6
Stagflation (January thru March 1980)	-4.6	-4.4	-5.1	-5.6	-4.2
Stagflation (1Q73 thru 3Q74)	-24.8	-20.4	-26.3	-24.7	-20.4

- Policy A would have performed the best in environments of declining equity markets, due to its more conservative positioning.
- Policy H would have fared worst during periods of rising rates; however, the losses in these environments are dwarfed by the losses during an equity downturn.

¹See the Appendix for our scenario inputs. In periods where the ideal benchmark was not yet available we used the next closest benchmark(s) as a proxy.

Historical Positive Scenario Analysis¹ (Cumulative Return)

Scenario	Current Policy (%)	Policy A (%)	Policy F (%)	Policy H (%)	Peer Average (%)
Global Financial Crisis Recovery (Mar 2009 - Nov 2009)	36.9	32.5	37.8	46.5	34.5
Best of Great Moderation (Apr 2003 -Feb 2004)	32.6	29.0	34.8	33.3	29.4
Peak of the TMT Bubble (Oct 1998 - Mar 2000)	44.7	39.6	48.6	31.8	42.8
Plummeting Dollar (Jan 1986 - Aug 1987)	57.8	52.4	61.4	62.1	50.3
Volcker Recovery (Aug 1982 - Apr 1983)	32.1	30.3	34.1	38.0	34.0
Bretton Wood Recovery (Oct 1974 - Jun 1975)	29.1	26.6	31.0	33.0	29.9

- Policies F and H would have been the best option for capturing most of the upside in strongly positive markets.

¹ See the Appendix for our scenario inputs. In periods where the ideal benchmark was not yet available we used the next closest benchmark(s) as a proxy.

Stress Testing: Impact of Market Movements (Expected Return under Stressed Conditions)¹

What happens if (over a 12-month period):	Current Policy (%)	Policy A (%)	Policy F (%)	Policy H (%)	Peer Average (%)
10-Year T-Bond rates rise 100 bp	6.3	4.9	6.0	4.1	5.7
10-Year T-Bond rates rise 200 bp	4.4	2.5	3.6	1.6	3.4
10-Year T-Bond rates rise 300 bp	2.5	0.1	1.1	-0.7	1.6
BBB Spreads widen by 50 bp, HY by 200 bp	-1.0	-0.5	-1.1	-1.8	-0.6
BBB Spreads widen by 300 bp, HY by 1000 bp	-22.5	-19.2	-22.5	-22.9	-20.2
Trade-weighted U.S.\$ gains 10%	-0.9	0.0	-0.8	-0.5	0.4
Trade-weighted U.S.\$ gains 20%	-2.7	-1.9	-2.3	-3.1	-1.7
Equities decline 10%	-5.9	-4.8	-6.0	-5.8	-5.4
Equities decline 25%	-16.0	-13.7	-16.4	-16.4	-14.9
Equities decline 40%	-28.0	-24.4	-28.2	-30.0	-26.3

- Each policy portfolio has a different sensitivity to four major risk factors: interest rates, credit spreads, currency fluctuations, and equity values.
- The System's primary risk factors would continue to be an equity market decline and a widening of credit spreads, no matter the policy.

¹ Assumes that assets not directly exposed to the factor are affected nonetheless. See the Appendix for further details.

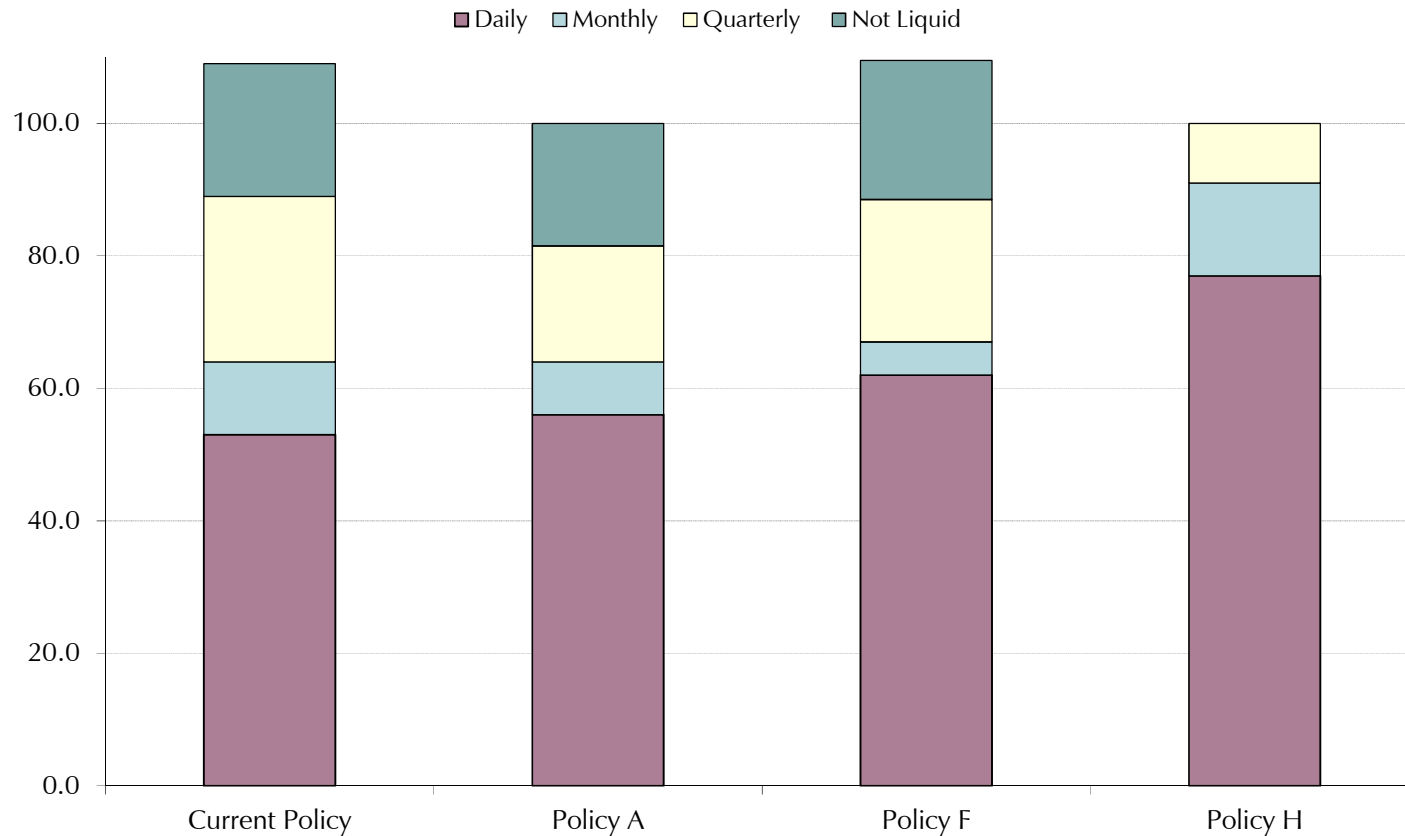
Stress Testing: Impact of Positive Market Movements (Expected Return under Stressed Conditions)¹

What happens if (over a 12-month period):	Current Policy (%)	Policy A (%)	Policy F (%)	Policy H (%)	Peer Average (%)
10-Year T-Bond rates decline 100 bp	7.8	7.5	8.4	7.8	7.6
10-Year T-Bond rates decline 200 bp	17.3	16.8	19.2	18.6	16.8
BBB Spreads narrow by 30 bp, HY by 100 bp	9.5	8.5	9.7	9.2	8.6
BBB Spreads narrow by 100 bp, HY by 300 bp	17.3	15.2	17.1	17.6	15.1
Trade-weighted U.S.\$ declines 10%	7.9	7.3	8.2	7.7	6.6
Trade-weighted U.S.\$ declines 20%	18.3	17.3	19.8	17.8	16.7
Equities appreciate 10%	7.7	6.9	8.0	7.6	7.3
Equities appreciate 30%	18.5	16.6	19.3	19.6	18.4

- The portfolios with the least downside risk are likewise the portfolios that participate least in upside scenarios.

¹ Assumes that assets not directly exposed to the factor are affected nonetheless. See the Appendix for further details.

Liquidity Profile¹



- The Current Policy and Policy F have more than 100% exposure due to the portable alpha program.
- Each mix has over 60% in daily liquid or monthly liquid asset classes.

¹ For the purpose of this analysis public equities and investment grade bond strategies were identified as daily liquid, public credit fixed income was identified as typically monthly liquid, core private real estate, core private infrastructure, hedge funds, and GAA were all identified as typically quarterly liquid. Private equity, private debt, private infrastructure and private real estate are all not liquid.

Other Policies Considered

Asset Allocation Policy Options: Other Policies Considered

	Policy E (%)	Policy G (%)	Policy I (%)	Policy J (%)
Rate Sensitive:	12	14	14	14
Cash & Short-term Bonds	0.5	0.5	2	2
Investment Grade Bonds	4.5	5.5	4	0
US Treasuries	5	6	4	6
TIPS	2	2	4	6
Credit:	11	13	13	13
High Yield Bonds & Bank Loans	2	8	2	2
Emerging Market Debt	3	5	4	4
Private Debt	6	0	7	7
Equities:	57	55	52	52
US Equity	21	28	19	18
Developed Foreign Equity	13	14	13	13
Emerging Markets Equity	8	8	5	4
Option-based Equity	5	5	6	8
Private Equity	10	0	9	9
Real Assets:	10	8	11	13
Real Estate	8	5	8	10
Infrastructure (and Commodities/NR)	2	3	3	3
Opportunistic	10	10	20	18
Hedge Funds	3	0	10	10
Tactical Asset Allocation	6	8	8	8
Other Opportunistic & Risk Parity	1	2	2	0
<i>Non-U.S. Dollar Exposure</i>	29	29	27	27
Expected Return	7.76	7.25	7.68	7.63
Standard Deviation	14.0	13.6	13.8	13.6
Probability of Achieving 7.25% over 20 Years	56.0	49.4	55.0	54.4

Asset Allocation Policy Options: Less Diversified Options

	Policy K (%)	Policy L (%)	Policy M (%)	Policy N (%)
Rate Sensitive:	23	4	35	24
Cash & Short-term Bonds	0	0	0	0
Investment Grade Bonds	23	4	35	24
US Treasuries	0	0	0	0
TIPS	0	0	0	0
Credit:	0	0	0	0
High Yield Bonds & Bank Loans	0	0	0	0
Emerging Market Debt	0	0	0	0
Private Debt	0	0	0	0
Equities:	77	96	65	76
US Equity	39	49	33	39
Non-US Foreign Equity	38	47	32	37
Private Equity	0	0	0	0
Real Assets:	0	0	0	0
Real Estate	0	0	0	0
Infrastructure (and Commodities/NR)	0	0	0	0
Opportunistic	0	0	0	0
Hedge Funds	0	0	0	0
Tactical Asset Allocation	0	0	0	0
Other Opportunistic & Risk Parity	0	0	0	0
<i>Non-U.S. Dollar Exposure</i>	<i>38</i>	<i>47</i>	<i>32</i>	<i>37</i>
Expected Return	7.26	7.93	6.80	7.23
Standard Deviation	14.6	18.1	12.4	14.4
Probability of Achieving 7.25% over 20 Years	49.6	56.1	43.0	49.2

Asset Allocation Policy Options: USD Denominated Assets Only

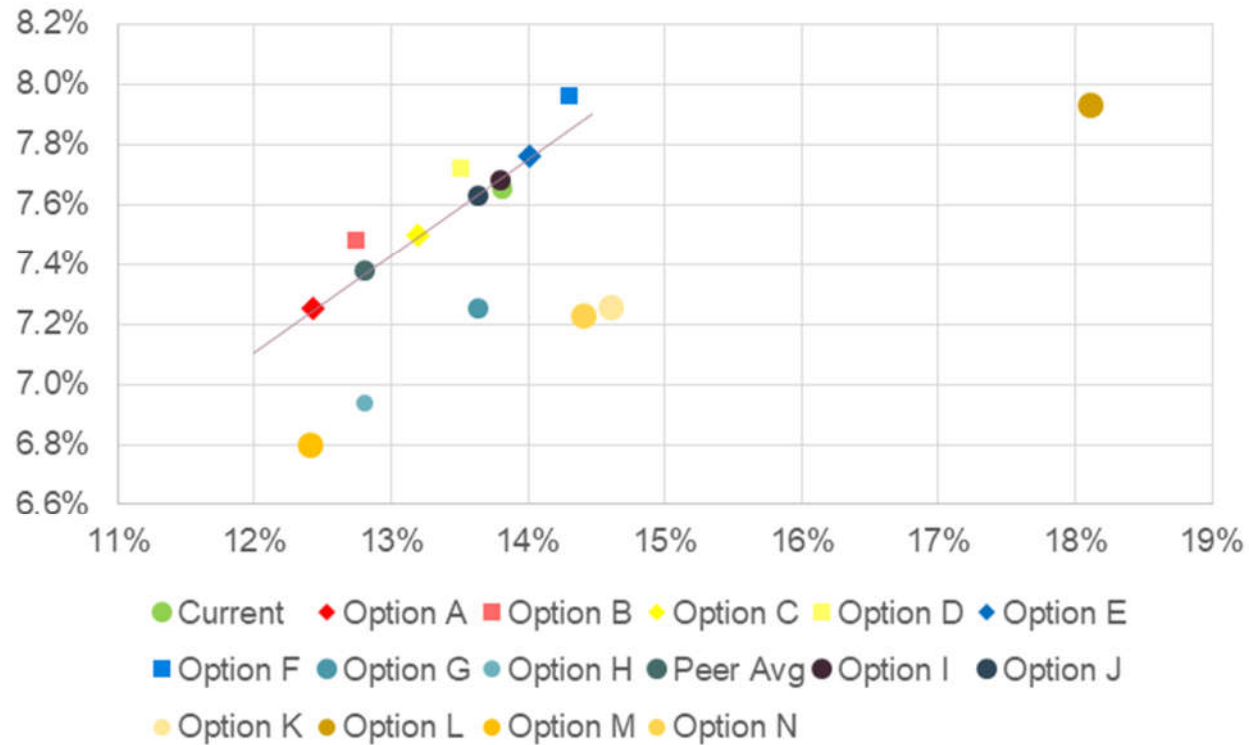
	Policy O ¹ (%)	Policy P ² (%)
Rate Sensitive:	12	20
Cash & Short-term Bonds	2	1
Investment Grade Bonds	9	10
US Treasuries	1	6
TIPS	0	3
Credit:	18	14
High Yield Bonds & Bank Loans	11	8
Emerging Market Debt	0	0
Private Debt	7	6
Equities:	49	46
US Equity	35	32
Non-US Foreign Equity	0	0
Private Equity	9	9
Real Assets:	11	11
Real Estate	8	9
Infrastructure	3	2
Opportunistic	20	19
Hedge Funds	10	10
Tactical Asset Allocation	8	8
Other Opportunistic & Risk Parity	2	1
<i>Non-U.S. Dollar Exposure³</i>	6	6
Expected Return	7.50	7.29
Standard Deviation	13.4	12.3
Probability of Achieving 7.25% over 20 Years	52.8	50.1

¹ Reflects current RSIC policy modified to include a public equity component consisting only of US equities; investment grade bonds consisting only of US investment grade bonds; and replacing EM debt with US high yield bonds and bank loans.

² Reflects Policy B modified to include a public equity component consisting only of US equities; investment grade bonds consisting only of US investment grade bonds; and replacing EM debt with US high yield bonds and bank loans.

³ Includes estimates for non-USD exposure in private equity, real estate, infrastructure, hedge funds, and tactical asset allocation.

Efficient Frontier for the Policy Options



- Policy options A, C, and E all fall along the “efficient frontier”.
- The policy options that use only public market investments all fall well below the efficient frontier.

Recommendations

Recommendations

- Meketa Investment Group recommends the Commissioners further review proposed Policies B, C and D at the February 2018 Commission meeting.
 - Meketa Investment Group will update its capital markets expectation in January. We anticipate having these available for the analysis presented to the Commission in February.

Appendices

Setting Capital Market Expectations

Overview of Annual Asset Study Methodology

- In order to construct an optimal portfolio from a risk-return standpoint, conventional financial wisdom dictates that one develop return, volatility, and correlation expectations over the relevant investing horizon.
- Given the uncertainty surrounding financial and economic forecasts, expectations development is challenging, and any of several methodological approaches may meaningfully contribute to this complex task.
- Meketa Investment Group's process relies on both quantitative and qualitative methodologies.
- First, we employ a large set of quantitative models to arrive at a set of baseline expected ten-year annualized returns for major asset classes.
- These models attempt to forecast a gross "beta" return for each *public market* asset class; that is, we specifically do not model "alpha," nor do we apply an estimate for management fees or other operational expenses¹.
- Our models are fundamentally based (based on some theoretically defined return relationship with current observable factors).
- Some of these models are more predictive than others. For this reason, we next overlay a qualitative analysis, which takes the form of a data-driven deliberation among the research team and our Investment Policy Committee.
- Return assumptions for hard-to-predict asset classes as well as those with limited data will be influenced more heavily by our qualitative analysis.
- As a result of this process, we form our ten-year annualized return expectations, which serve as the primary foundation of our longer-term, twenty-year expectations.

¹ Our expectations are net of fees where passive management is not available (e.g., private markets and hedge funds).

Overview of Annual Asset Study Methodology (continued)

- We form our twenty-year annualized return expectations by systematically considering historical returns on an asset class by asset class level. Specifically, we construct a weighted average of our ten-year expectations and average historical returns in each asset class.
- The weights are determined by a qualitative assessment of the value of the historical data. Generally, if we have little confidence that the historical average return is representative of what an investor can expect¹, we will weight our ten-year forecast more heavily. Therefore, the weight on our ten-year forecasts ranges from 0.5 to 0.9.
- We develop our twenty-year volatility and correlation expectations differently. We rely primarily on historical averages, with an emphasis given to the experience of the trailing ten years.
- Qualitative adjustments, when applied, usually serve to increase the correlations and volatility over and above the historical estimates (e.g., using the higher correlations usually observed during a volatile market).
- We also make adjustments to the volatility based on the historical skewness of each asset class (e.g., increasing the volatility for an asset class that has been negatively skewed).
- In the case of private markets and other illiquid asset classes where historical volatility and correlations have been artificially dampened, we seek public market equivalents on which to base our estimates before applying any qualitative adjustments.
- These volatility and correlation expectations are then combined with our twenty-year return expectations to assist us in subsequent asset allocation work, including mean-variance optimization and scenario analyses.

¹ For example, we have less confidence in historical data that do not capture many possible market scenarios or that are overly polluted by survivorship bias.

Each year, we revise our capital market expectations via our Asset Study.

- This involves setting long-term expectations for a variety of asset classes for:
 - Returns
 - Standard Deviation
 - Correlations
- Our process relies on both quantitative and qualitative methodologies.

Asset Class Definitions

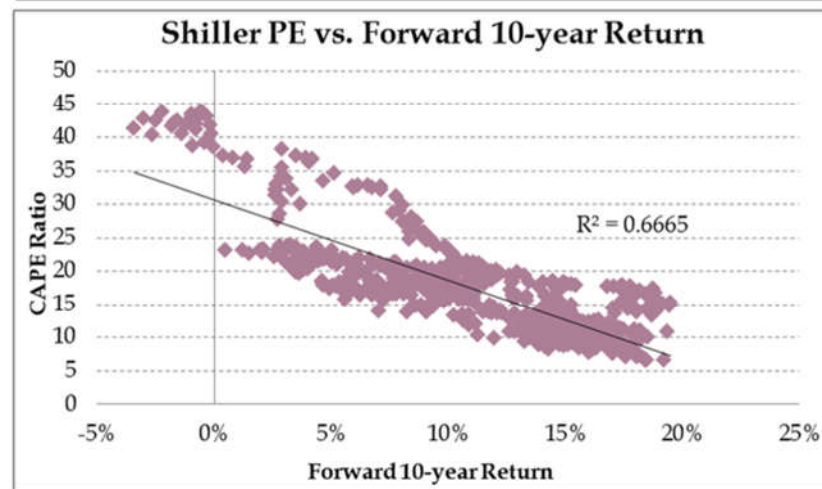
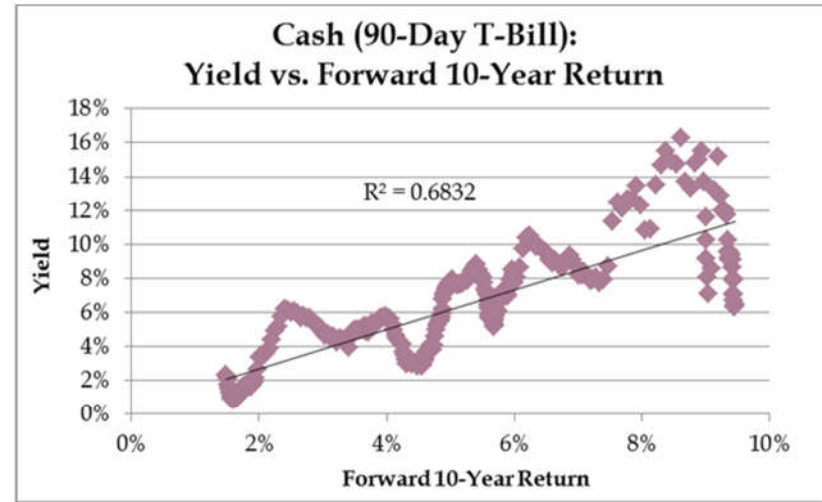
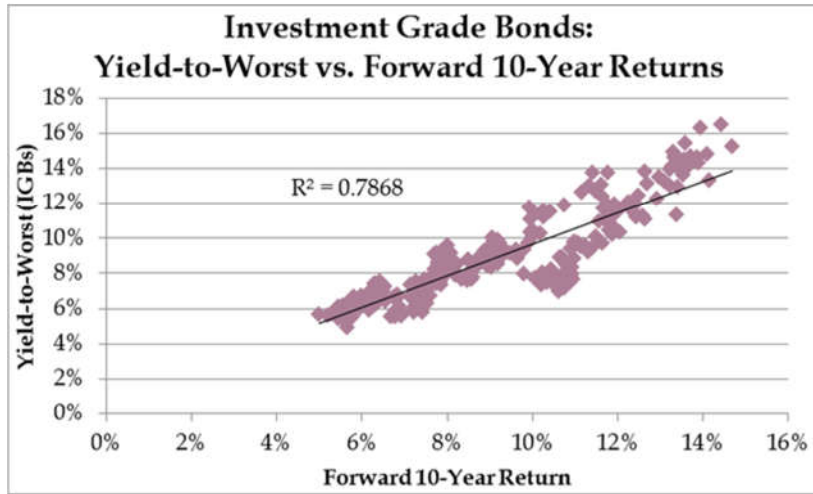
- Meketa Investment Group utilizes an approach that identifies asset classes that are appropriate for long-term allocation of funds, and that also are investable.
- Three considerations influence this process: unique return behavior, an observable historical track record, and a robust market.
- We then make forecasts for each unique asset class.

Our Process

- The first step is to build our 10-year forecasts.
 - Our fundamental models are primarily valuation based.
- Each model falls in one of eight groups, based on the most important factors that drive their returns:

Asset Class Category	Major Factors
Equities	Dividend Yield, GDP Growth, Valuation
Bonds	Yield to Worst, Default Rate, Recovery Rate
Commodities	Collateral Yield, Roll Yield, Inflation
Infrastructure	Public IS Valuation, Income, Growth
Natural Resources	Price per Acre, Income, Public Market Valuation
Real Estate	Cap Rate, Yield, Growth
Private Equity	EBITDA Multiple, Debt Multiple, Public VC Valuation
Hedge Funds and Other	Leverage, Alternative Betas

Some models are naturally more predictive than others



The next step is to move from 10-year to our 20-year forecasts.

- We do this by combining our 10-year forecasts with the historical returns for each asset class.
 - How much we apply to each depends on our confidence in them (both the model & the data).
- The 10-year model weighting varies between 50% and 100%.
- It only hits 100% when there is a lack of good historical data.
- We then infer a forecast of 10-year returns in ten years (i.e., years 11-20).
 - This allows us to test our assumptions with finance theory.
 - Essentially, we assume mean-reversion over the first ten years, then consistency with CAPM thereafter.

The final step is to make any qualitative adjustments.

- The Investment Committee reviews the output and may make adjustments due to:
 - Quality of the underlying data.
 - Confidence in the model.
 - External inputs (e.g., perceived risks).

Capital Market Assumption Development Example

Equities

- We use a fundamental model for equities that combines income and capital appreciation.

$$E(R) = \text{Dividend Yield} + \text{Expected Earnings Growth} + \text{Multiple Effect} + \text{Currency Effect}$$

- Meketa Investment Group evaluates historical data statistically to develop expectations for dividend yield, earnings growth, the multiple effect and currency effect.
- Our models assume that there is a reversion to the mean over long time periods.

Capital Market Assumption Development Example

Bonds

- The short version for investment grade bond models is:

$$E(R) = \text{Current YTW (yield to worst)}$$

- Our models assume that there is a reversion to the mean for spreads (though not yields).
- For TIPS, we add the real yield of the TIPS index to the breakeven inflation rate.
- As with equities, we make currency adjustments when necessary for foreign bonds.
- For bonds with credit risk, Meketa Investment Group estimates default rates and loss rates, in order to project an expected return:

$$E(R) = \text{YTW} - (\text{Annual Default Rate} * \text{Loss Rate})$$

Don't forget about the other inputs: standard deviation and correlation.

- Standard deviation:
 - We review the trailing ten-year standard deviation, as well as the trailing ten-year skewness.
 - Historical standard deviation serves as the base for our assumptions.
 - We increase or decrease the assumptions based on the size and sign of the historical skewness.

Asset Class	Standard Deviation	Skewness	Assumption
Bank Loans	7.9%	-2.1	10.0%

- We look at performance during the GFC to see if further changes were warranted (e.g., hedge funds).
- We also adjust for private market asset classes with “smoothed” return streams.
- Correlation:
 - We use trailing ten-year correlations as our guide.
 - Again, we make adjustments for performance during the GFC and “smoothed” return streams.
- Most of our adjustments are conservative in nature (i.e., they increase the standard deviation and correlation).

Horizon Study

- Annually, Horizon Actuarial Services, LLC publishes a survey of capital market assumptions that they collect from various investment advisors.
 - In the 2017¹ survey there were 35 respondents.
- The Horizon survey is a useful tool for Board members to determine whether their consultant's expectations for returns (and risk) are reasonable.

Asset Class	10-Year Average (%)	20-Year Average (%)	MIG 20-Year (%)
U.S. Equity (large cap)	6.5	7.8	7.8
Non-U.S. – Developed	7.0	7.6	8.1
Non-U.S. – Emerging	8.0	8.7	10.5
U.S. Corporate Bonds – Core	3.2	4.4	4.4
U.S Corporate Bonds – High Yield	5.1	6.2	6.8
Non-U.S. Debt – Developed	2.2	3.5	2.6
Non-U.S. Debt – Emerging	5.3	6.2	6.3
U.S. Treasuries (cash)	2.3	3.2	2.3
TIPS	2.8	4.0	3.3
Real Estate	6.2	6.7	5.9
Hedge Funds	4.9	6.0	5.6
Commodities	4.0	5.0	4.1
Infrastructure	6.7	7.1	6.7
Private Equity	9.0	10.1	9.4
Inflation	2.2	2.4	2.5

¹ The 10-year horizon includes all 35 respondents and the 20-year horizon includes 12 respondents.

Notes and Disclaimers

- ¹ The returns shown in the Policy Options and Risk Analysis sections rely on estimates of expected return, standard deviation, and correlation developed by Meketa Investment Group. To the extent that actual return patterns to the asset classes differ from our expectations, the results in the table will be incorrect. However, our inputs represent our best unbiased estimates of these simple parameters.
- ² The returns shown in the Policy Options and Risk Analysis sections use a lognormal distribution, which may or may not be an accurate representation of each asset classes' future return distribution. To the extent that it is not accurate in whole or in part, the probabilities listed in the table will be incorrect. As an example, if some asset classes' actual distributions are even more right-skewed than the lognormal distribution (i.e., more frequent low returns and less frequent high returns), then the probability of the portfolio hitting a given annual return will be lower than that stated in the table.
- ³ The standard deviation bars in the chart in the Risk Analysis section do not indicate the likelihood of a 1, 2, or 3 standard deviation event—they simply indicate the return we expect if such an event occurs. Since the likelihood of such an event is the same across allocations regardless of the underlying distribution, a relative comparison across policy choices remains valid.

Scenario Return Inputs

Asset Class	Benchmark Used
Investment Grade Bonds	Barclays Aggregate
TIPS	Barclays U.S. TIPS
Intermediate-term Government Bonds	Barclays Treasury Intermediate
Long-term Government Bonds	Barclays Long U.S. Treasury
EM Bonds (local)	JPM GBI-EM Global Diversified Composite
Bank Loans	CSFB Leveraged Loan
High Yield Bonds	Barclays High Yield
Direct Lending - First Lien	Cliffwater Direct Lending Index
Direct Lending - Second Lien	Cliffwater Direct Lending Index
Mezzanine Debt	Cambridge Associates Mezzanine
Distressed Debt	Cambridge Associates Distressed Debt Index
Core Real Estate	NCREIF Property
Value-Added RE	NCREIF Townsend Value Added
Opportunistic RE	NCREIF Townsend Opportunistic
REITs	NAREIT Equity
Infrastructure (private)	S&P Global Infrastructure
Natural Resources (private)	S&P Global Natural Resources
Timber	NCREIF Timberland
Commodities	Bloomberg Commodity Index
U.S. Equity	Russell 3000
Public Foreign Equity (Developed)	MSCI EAFE
Public Foreign Equity (Emerging)	MSCI Emerging Markets
Private Equity	Cambridge Associates Private Equity Composite
Long-short Equity	HFRI Equity Hedge
Global Macro	HFRI Macro
Hedge Funds	HFRI Fund Weighted Composite
Private Debt	Barclays High Yield and CSFB Leveraged Loan

Negative Historical Scenario Returns - Sample Inputs

	Taper Tantrum (May - Aug 2013)	Global Financial Crisis (Oct 2007 - Mar 2009)	2008 Calendar Year	Popping of the TMT Bubble (Apr 2000 - Sep 2002)	LTCM (Jul - Aug 1998)	Asian Financial Crisis (Aug 1997 - Jan 1998)	Rate spike (1994 Calendar Year)	Crash of 1987 (Sep - Nov 1987)	Strong dollar (Jan 1981 - Sep 1982)	Stagflation (Jan - Mar 1980)	Stagflation (Jan 1973 - Sep 1974)
Cash Equivalents	0.0	3.1	1.7	9.9	0.8	2.4	3.9	1.4	24.4	2.9	13.5
Short-term Investment Grade Bonds	-0.1	8.7	5.0	21.9	1.6	3.5	0.5	2.3	29.9	-2.6	4.3
Investment Grade Bonds	-3.7	9.3	5.2	28.6	1.8	4.9	-2.9	2.2	29.9	-8.7	7.9
Long-term Corporate Bonds	-9.3	-9.4	-5.2	26.9	-0.6	5.4	-5.8	1.5	29.6	-14.1	-12.0
Long-term Government Bonds	-11.6	24.5	24.0	35.5	4.1	8.6	-7.6	2.6	28.4	-13.6	-1.8
TIPS	-8.5	9.6	-2.4	37.4	0.7	2.0	-7.5	2.8	15.6	-7.8	4.3
Global ILBs	-7.4	-1.5	-7.7	39.7	0.7	2.2	-7.9	2.9	16.5	-8.3	4.5
High Yield Bonds	-2.0	-20.7	-26.2	-6.3	-5.0	5.6	-1.0	-3.6	6.9	-2.3	-15.5
Bank Loans	0.8	-22.5	-28.8	6.3	0.7	3.3	10.3	-1.7	3.3	-1.1	-7.5
Direct Lending - First Lien	3.4	-2.1	-5.8	-0.7	-0.7	1.7	0.7	-0.2	2.0	-0.6	-4.4
Direct Lending - Second Lien	4.6	-2.9	-7.8	-1.0	-0.9	2.3	1.0	-0.3	2.6	-0.8	-5.9
Foreign Bonds	-3.2	5.3	4.4	8.5	3.5	3.3	5.3	-0.3	34.8	-6.5	-1.4
Mezzanine Debt	4.6	-25.5	-25.9	-2.0	-2.6	10.3	7.6	0.4	3.2	-1.0	-7.2
Distressed Debt	4.6	-25.5	-25.9	-2.0	-2.6	10.3	7.6	0.4	3.2	-1.0	-7.2
Emerging Market Bonds (major)	-11.5	-2.7	-9.7	6.3	-28.2	-1.8	-18.9	-9.2	-1.6	-2.6	-20.2
Emerging Market Bonds (local)	-14.3	-2.3	-5.2	7.2	-34.1	-2.4	-22.8	-11.0	-2.0	-3.2	-23.9
US Equity	3.0	-43.8	-37.0	-43.8	-15.4	3.6	1.3	-29.5	-2.3	-4.1	-42.6
Developed Market Equity (non-US)	-2.2	-49.6	-43.4	-46.7	-11.5	-5.8	7.8	-14.5	-18.0	-7.0	-36.3
Emerging Market Equity	-9.4	-45.8	-53.3	-43.9	-26.7	-31.8	-7.3	-25.3	-12.1	-6.6	-44.2
Global Equity	-0.7	-46.6	-42.2	-46.7	-14.0	-3.2	5.0	-21.5	-11.2	-5.8	-39.3
Private Equity/Debt	5.7	-25.6	-27.2	-23.4	-3.2	15.7	13.2	0.6	-2.7	-2.5	-18.2
Private Equity	5.8	-25.8	-27.6	-26.0	-3.3	16.7	14.2	0.6	-3.9	-2.7	-20.1
Private Debt Composite	4.6	-21.3	-22.5	-1.7	-2.3	8.7	6.2	0.2	3.0	-1.0	-6.9
REITs	-13.3	-61.3	-37.7	45.4	-15.3	9.8	-3.5	-19.5	2.5	-3.6	-33.9
Core Private Real Estate	3.6	-7.3	-6.5	23.6	2.3	8.5	6.4	0.7	23.9	5.5	-4.4
Value-Added Real Estate	3.8	-18.0	-13.4	177.0	1.8	11.4	11.2	1.2	44.2	9.6	-7.6
Opportunistic Real Estate	4.0	-24.7	-21.8	21.4	1.5	20.0	18.8	0.9	30.7	7.0	-5.6
Natural Resources (Private)	2.5	-26.2	-34.1	-3.9	-16.9	-7.8	12.6	-10.8	-9.4	-9.2	19.3
Timberland	1.3	25.4	9.5	-1.5	0.5	12.0	15.4	3.8	23.6	-7.4	5.5
Farmland	3.3	30.2	15.8	11.4	0.8	3.9	9.4	2.2	13.3	-4.2	3.1
Commodities (naïve)	-2.4	-31.8	-35.6	18.5	-12.0	-6.2	16.6	1.8	-16.0	-9.6	139.5
Core Infrastructure	3.7	0.2	-0.6	24.8	-0.3	6.1	-11.5	0.0	-0.2	-0.1	-0.5
Hedge Funds	-0.4	-15.6	-19.0	-2.1	-9.4	1.7	4.1	-7.8	-3.8	-1.9	-15.7
Long-Short	1.0	-24.0	-26.6	-8.8	-8.3	7.9	2.6	-10.0	-4.9	-2.5	-19.8
Hedge Fund of Funds	-0.5	-17.8	-21.4	-0.4	-7.7	0.5	-3.5	-5.7	-2.7	-1.4	-11.5

Positive Historical Scenario Returns - Sample Inputs

	Global Financial Crisis Recovery (Mar 2009 - Nov 2009)	Best of Great Moderation (Apr 2003 - Feb 2004)	Peak of the TMT Bubble (Oct 1998 - Mar 2000)	Pre-Recession (Jun - Oct 1990)	Plummeting Dollar (Jan 1986 - Aug 1987)	Volcker Recovery (Aug 1982 - Apr 1983)	Bretton Wood Recovery (Oct 1974 - Jun 1975)
Cash Equivalents	0.1	0.9	6.7	3.3	10.0	6.0	4.5
Short-term Investment Grade Bonds	4.3	2.8	5.3	4.5	13.2	15.4	5.0
Investment Grade Bonds	9.0	4.6	1.7	3.8	14.4	26.4	9.2
Long-term Corporate Bonds	28.8	11.3	-3.1	1.5	15.9	42.1	17.5
Long-term Government Bonds	2.0	4.9	-2.3	2.4	15.4	33.6	11.8
TIPS	14.3	9.1	6.3	2.2	10.2	11.5	4.1
Global ILBs	24.7	9.6	6.6	2.3	10.8	12.1	4.3
High Yield Bonds	49.1	21.8	2.1	-12.9	24.9	23.3	19.3
Bank Loans	32.9	10.1	6.1	-6.1	11.1	10.4	8.7
Direct Lending - First Lien	10.6	5.7	1.1	-1.9	5.8	5.0	5.1
Direct Lending - Second Lien	14.3	7.7	1.4	-2.5	7.8	6.7	6.8
Foreign Bonds	23.4	15.2	-7.0	15.8	44.5	32.3	17.9
Mezzanine Debt	30.8	23.7	26.8	0.7	5.4	8.2	8.3
Distressed Debt	30.8	23.7	26.8	0.7	5.4	8.2	8.3
Emerging Market Bonds (major)	27.0	20.6	49.0	-8.7	38.9	21.6	21.0
Emerging Market Bonds (local)	37.5	25.2	61.0	-10.5	48.4	26.5	25.7
US Equity	51.6	37.2	50.2	-14.7	64.8	59.3	55.1
Developed Market Equity (non-US)	60.5	56.7	53.0	-9.7	140.0	29.6	34.6
Emerging Market Equity	94.6	79.4	101.3	-15.9	126.5	52.1	53.4
Global Equity	59.9	46.2	54.8	-11.1	108.4	43.0	44.6
Private Equity/Debt	15.4	23.3	84.6	4.6	19.1	13.7	18.4
Private Equity	13.0	23.7	92.1	5.5	21.7	14.8	20.2
Private Debt Composite	27.5	20.4	21.4	0.1	5.9	7.9	8.0
REITs	82.5	44.6	-5.2	-15.6	51.8	47.4	42.5
Core Private Real Estate	-16.4	9.0	18.1	1.9	13.1	6.8	4.5
Value-Added Real Estate	-32.7	11.4	19.6	3.2	23.6	11.9	7.8
Opportunistic Real Estate	-19.0	13.6	27.9	0.4	16.7	8.6	5.7
Natural Resources (Private)	57.8	36.1	22.2	6.0	78.3	30.2	14.8
Timberland	-3.3	8.5	20.5	5.7	28.6	20.0	8.7
Farmland	5.4	9.6	10.4	3.3	15.9	11.3	5.0
Commodities (naïve)	28.9	30.6	17.1	43.5	27.6	6.2	-20.2
Core Infrastructure	2.1	8.5	33.0	0.0	1.4	0.6	0.6
Hedge Funds	20.1	22.4	52.8	-1.9	30.6	13.8	14.5
Long-Short	25.9	25.3	81.4	5.1	40.8	18.0	18.9
Hedge Fund of Funds	10.3	13.3	36.8	11.9	21.3	9.7	10.3

Stress Test Return Assumptions - Sample Inputs¹

	10-year Treasury Bond rates drop 100 bps	10-year Treasury Bond rates drop 200 bps	Baa Spreads narrow by 30bps, High Yield by 100 bps	Baa Spreads narrow by 100bps, High Yield by 300 bps	Trade Weighted Dollar drops 10%	Trade Weighted Dollar drops 20%	U.S. Equities rise 10%	U.S. Equities rise 30%
Cash Equivalents	0.7	0.8	0.2	0.2	1.3	2.7	1.2	1.7
Short-term Investment Grade Bonds	3.4	5.3	1.1	2.6	2.5	3.6	1.7	3.1
Investment Grade Bonds	8.5	14.4	2.7	5.0	3.4	6.6	2.3	4.6
Long-term Corporate Bonds	18.4	32.3	7.1	16.5	6.2	10.6	3.8	8.2
Long-term Government Bonds	20.5	38.0	3.4	0.5	5.1	13.0	2.8	6.9
TIPS	7.1	12.0	3.3	7.0	4.6	4.1	2.2	4.3
Global ILBs	3.1	3.0	4.5	8.5	6.5	3.9	2.7	5.8
High Yield Bonds	9.2	13.1	8.9	27.5	4.7	5.1	6.0	13.7
Bank Loans	4.4	2.2	5.0	17.5	1.9	1.3	3.7	8.6
Direct Lending - First Lien	3.2	2.0	7.6	9.4	0.7	7.7	2.9	5.0
Direct Lending - Second Lien	3.6	2.4	10.2	12.7	0.8	11.0	4.1	7.1
Foreign Bonds	8.6	16.4	4.5	9.0	11.1	12.3	3.3	7.8
Mezzanine Debt	5.8	7.2	9.8	18.5	4.5	13.1	6.6	9.9
Distressed Debt	5.8	7.4	9.9	18.9	4.8	15.2	7.2	11.2
Emerging Market Bonds (major)	7.9	12.0	8.0	17.8	6.8	12.1	6.0	12.8
Emerging Market Bonds (local)	9.1	10.0	7.3	19.6	9.0	14.9	7.1	16.0
US Equity	8.9	22.7	11.2	16.8	5.4	21.5	10.0	30.0
Developed Market Equity (non-US)	3.9	21.4	12.5	19.9	15.9	28.2	8.3	20.2
Emerging Market Equity	5.8	21.1	13.2	37.8	16.6	33.5	13.0	27.8
Global Equity	6.5	21.9	12.0	22.1	11.3	26.3	10.0	26.1
Private Equity/Debt	7.3	12.3	10.7	13.2	6.6	19.5	9.0	19.0
Private Equity	7.7	14.1	10.9	13.1	6.9	20.7	9.5	21.5
Private Debt Composite	5.4	6.3	9.9	17.5	3.9	13.5	6.3	9.8
REITs	9.0	20.4	13.6	27.4	7.9	24.0	12.2	31.7
Core Private Real Estate	5.6	8.5	5.1	8.4	3.1	10.3	3.0	3.4
Value-Added Real Estate	8.0	15.0	5.0	10.3	4.6	16.4	4.3	6.5
Opportunistic Real Estate	8.0	15.0	3.6	8.7	2.7	18.2	4.0	5.5
Natural Resources (Private)	4.0	17.9	11.6	13.7	11.4	15.5	9.4	20.7
Timberland	6.0	15.5	3.8	5.5	4.6	15.4	4.8	5.8
Farmland	5.0	9.4	8.1	8.3	4.1	13.4	4.3	5.6
Commodities (naïve)	1.5	4.0	4.4	9.2	8.6	5.4	3.6	6.4
Core Infrastructure	5.0	6.0	6.9	4.0	4.8	11.2	2.6	4.3
Hedge Funds	8.2	11.8	5.7	11.9	4.6	7.8	6.0	11.9
Long-Short	8.3	13.0	6.2	12.8	5.8	12.4	7.1	15.0
Hedge Fund of Funds	6.6	10.0	4.3	10.1	3.2	6.2	4.5	10.2

¹ Assumptions are based on performance for each asset class during historical periods that resembled these situations.

“Positive” Stress Test Return Assumptions - Sample Inputs¹

	Taper Tantrum (May - Aug 2013)	Global Financial Crisis (Oct 2007 - Mar 2009)	2008 Calendar Year	Popping of the TMT Bubble (Apr 2000 - Sep 2002)	LTCM (Jul - Aug 1998)	Asian Financial Crisis (Aug 1997 - Jan 1998)	Rate spike (1994 Calendar Year)	Crash of 1987 (Sep - Nov 1987)	Strong dollar (Jan 1981 - Sep 1982)	Stagflation (Jan - Mar 1980)	Stagflation (Jan 1973 - Sep 1974)
Cash Equivalents	0.0	3.1	1.7	9.9	0.8	2.4	3.9	1.4	24.4	2.9	13.5
Short-term Investment Grade Bonds	-0.1	8.7	5.0	21.9	1.6	3.5	0.5	2.3	29.9	-2.6	4.3
Investment Grade Bonds	-3.7	9.3	5.2	28.6	1.8	4.9	-2.9	2.2	29.9	-8.7	7.9
Long-term Corporate Bonds	-9.3	-9.4	-5.2	26.9	-0.6	5.4	-5.8	1.5	29.6	-14.1	-12.0
Long-term Government Bonds	-11.6	24.5	24.0	35.5	4.1	8.6	-7.6	2.6	28.4	-13.6	-1.8
TIPS	-8.5	9.6	-2.4	37.4	0.7	2.0	-7.5	2.8	15.6	-7.8	4.3
Global ILBs	-7.4	-1.5	-7.7	39.7	0.7	2.2	-7.9	2.9	16.5	-8.3	4.5
High Yield Bonds	-2.0	-20.7	-26.2	-6.3	-5.0	5.6	-1.0	-3.6	6.9	-2.3	-15.5
Bank Loans	0.8	-22.5	-28.8	6.3	0.7	3.3	10.3	-1.7	3.3	-1.1	-7.5
Direct Lending - First Lien	3.4	-2.1	-5.8	-0.7	-0.7	1.7	0.7	-0.2	2.0	-0.6	-4.4
Direct Lending - Second Lien	4.6	-2.9	-7.8	-1.0	-0.9	2.3	1.0	-0.3	2.6	-0.8	-5.9
Foreign Bonds	-3.2	5.3	4.4	8.5	3.5	3.3	5.3	-0.3	34.8	-6.5	-1.4
Mezzanine Debt	4.6	-25.5	-25.9	-2.0	-2.6	10.3	7.6	0.4	3.2	-1.0	-7.2
Distressed Debt	4.6	-25.5	-25.9	-2.0	-2.6	10.3	7.6	0.4	3.2	-1.0	-7.2
Emerging Market Bonds (major)	-11.5	-2.7	-9.7	6.3	-28.2	-1.8	-18.9	-9.2	-1.6	-2.6	-20.2
Emerging Market Bonds (local)	-14.3	-2.3	-5.2	7.2	-34.1	-2.4	-22.8	-11.0	-2.0	-3.2	-23.9
US Equity	3.0	-43.8	-37.0	-43.8	-15.4	3.6	1.3	-29.5	-2.3	-4.1	-42.6
Developed Market Equity (non-US)	-2.2	-49.6	-43.4	-46.7	-11.5	-5.8	7.8	-14.5	-18.0	-7.0	-36.3
Emerging Market Equity	-9.4	-45.8	-53.3	-43.9	-26.7	-31.8	-7.3	-25.3	-12.1	-6.6	-44.2
Global Equity	-0.7	-46.6	-42.2	-46.7	-14.0	-3.2	5.0	-21.5	-11.2	-5.8	-39.3
Private Equity/Debt	5.7	-25.6	-27.2	-23.4	-3.2	15.7	13.2	0.6	-2.7	-2.5	-18.2
Private Equity	5.8	-25.8	-27.6	-26.0	-3.3	16.7	14.2	0.6	-3.9	-2.7	-20.1
Private Debt Composite	4.6	-21.3	-22.5	-1.7	-2.3	8.7	6.2	0.2	3.0	-1.0	-6.9
REITs	-13.3	-61.3	-37.7	45.4	-15.3	9.8	-3.5	-19.5	2.5	-3.6	-33.9
Core Private Real Estate	3.6	-7.3	-6.5	23.6	2.3	8.5	6.4	0.7	23.9	5.5	-4.4
Value-Added Real Estate	3.8	-18.0	-13.4	177.0	1.8	11.4	11.2	1.2	44.2	9.6	-7.6
Opportunistic Real Estate	4.0	-24.7	-21.8	21.4	1.5	20.0	18.8	0.9	30.7	7.0	-5.6
Natural Resources (Private)	2.5	-26.2	-34.1	-3.9	-16.9	-7.8	12.6	-10.8	-9.4	-9.2	19.3
Timberland	1.3	25.4	9.5	-1.5	0.5	12.0	15.4	3.8	23.6	-7.4	5.5
Farmland	3.3	30.2	15.8	11.4	0.8	3.9	9.4	2.2	13.3	-4.2	3.1
Commodities (naïve)	-2.4	-31.8	-35.6	18.5	-12.0	-6.2	16.6	1.8	-16.0	-9.6	139.5
Core Infrastructure	3.7	0.2	-0.6	24.8	-0.3	6.1	-11.5	0.0	-0.2	-0.1	-0.5
Hedge Funds	-0.4	-15.6	-19.0	-2.1	-9.4	1.7	4.1	-7.8	-3.8	-1.9	-15.7
Long-Short	1.0	-24.0	-26.6	-8.8	-8.3	7.9	2.6	-10.0	-4.9	-2.5	-19.8
Hedge Fund of Funds	-0.5	-17.8	-21.4	-0.4	-7.7	0.5	-3.5	-5.7	-2.7	-1.4	-11.5

¹ Assumptions are based on performance for each asset class during historical periods that resembled these situations.

Meketa Investment Group 2017 Annual Asset Study

Twenty-Year Annualized Return and Volatility Expectations for Major Asset Classes

Asset Class	Annualized Compounded Return (%)	Annualized Average Return (%)	Annualized Standard Deviation (%)
Rate Sensitive			
Cash Equivalents	2.8	2.8	1.0
Investment Grade Bonds	3.5	3.6	4.0
Long-term Government Bonds	3.8	4.6	12.5
TIPS	3.5	3.8	7.5
Credit			
High Yield Bonds	6.0	6.8	12.5
Bank Loans	5.5	6.0	10.0
Emerging Market Bonds (major; unhedged)	5.5	6.2	12.0
Emerging Market Bonds (local; unhedged)	5.9	7.0	14.5
Direct Lending - First Lien	5.7	6.4	11.0
Direct Lending - Second Lien	7.3	8.6	16.0
Mezzanine Debt	6.8	8.8	20.0
Distressed Debt	6.9	9.8	24.0
Equities			
Public U.S. Equity	7.5	9.1	18.0
Public Developed Market Equity	7.3	9.3	20.0
Public Emerging Market Equity	9.8	13.2	26.0
Private Equity	9.6	13.2	27.0
Real Assets			
REITs	6.5	10.7	29.0
Core Private Real Estate	5.7	6.5	12.5
Value Added Real Estate	7.2	9.0	19.0
Opportunistic Real Estate	8.9	12.0	25.0
High Yield Real Estate Debt	6.9	9.5	23.0
Natural Resources (Private)	8.4	11.1	23.0
Commodities	4.5	6.4	19.5
Infrastructure (Core)	6.8	8.1	16.0
Infrastructure (Non-Core)	8.8	11.4	23.0
Other			
Hedge Funds	5.3	5.8	9.5

Meketa Investment Group 2017 Annual Asset Study: Correlation Expectations

	TIPS	Investment Grade Bonds	High Yield Bonds	U.S. Equity	Developed Market Equity	Emerging Market Equity	Private Equity	Real Estate	Natural Resources (private)	Commodities	Core Infrastructure (private)	Hedge Funds
TIPS	1.00											
Investment Grade Bonds	0.80	1.00										
High Yield Bonds	0.30	0.20	1.00									
U.S. Equity	0.00	0.05	0.70	1.00								
Developed Market Equity	0.15	0.05	0.70	0.90	1.00							
Emerging Market Equity	0.15	0.05	0.70	0.80	0.90	1.00						
Private Equity	0.05	0.05	0.65	0.85	0.80	0.75	1.00					
Real Estate	0.10	0.20	0.50	0.50	0.45	0.40	0.45	1.00				
Natural Resources (private)	0.10	0.10	0.45	0.65	0.60	0.60	0.55	0.45	1.00			
Commodities	0.35	0.05	0.40	0.35	0.55	0.60	0.30	0.15	0.65	1.00		
Core Infrastructure (private)	0.30	0.30	0.60	0.55	0.55	0.50	0.45	0.60	0.60	0.40	1.00	
Hedge Funds	0.20	0.05	0.70	0.80	0.85	0.85	0.65	0.45	0.65	0.35	0.60	1.00

Commodities

Asset Class Description

- Commodities consist of raw materials that serve as inputs for many essential products
- The index consists of roughly three equal parts of energy, metals, and agriculture
- Futures are the preferred vehicle for investors as physical ownership and storage is costly

Pros

- Low correlation to traditional equity and fixed income markets
- Positive correlation with inflation
- Rising demand from emerging and developed markets

Cons

- High volatility
- Risk of declining prices from technological advances

Return History:

As of December 31, 2015	1-Year Return	3-Year Return	5-Year Return	10-Year Return	Since 2/1/91	Standard Deviation	Sharpe Ratio	Correlation
Bloomberg Commodity	-24.7	-17.3	-13.5	-6.4	2.1	15.4	0.1	1.00
S&P 500	1.4	15.1	12.6	7.3	9.7	15.9	0.6	0.30
Barclays Aggregate	0.5	1.4	3.2	4.5	6.1	3.8	1.6	0.04

Natural Resources

Asset Class Description

- Companies that harvest, produce, process, refine, transport and market commodities.
- Natural resources include a large array of opportunities in primarily in two categories:
 - Exploration and Production: Oil, natural gas, coal, industrial and precious metals.
 - Environment and Land: Farmland, timberland, water rights, and wetlands.
- Investors can access natural resources managers through public equities and private markets.

Pros

- Projected continuation of demand growth with a favorable supply/demand imbalance
- Return on capital invested to bring commodities to market

Cons

- Political risk is prevalent as some natural resource opportunities are located in unfriendly nations
- Environmental risks and sensitivity to geopolitical events can become issues

Return History:

As of December 31, 2015	1-Year Return	3-Year Return	5-Year Return	10-Year Return	Since 12/1/02	Standard Deviation	Sharpe Ratio	Correlation
S&P Global Natural Resources	-24.0	-11.3	-8.7	0.9	7.3%	22.9	0.3	1.00
S&P 500	1.4	15.6	12.6	7.3	8.3%	15.3	0.6	0.70

Private Equity

Asset Class Description

- Private equity represents investments in privately held companies.
- These investments are generally structured as partnerships that consist of ten to twenty equity investments in individual companies.
- Investments come in many forms, including: venture capital, buyouts, mezzanine debt, and special situations.
- Institutional investors can invest in direct funds or via a fund of funds.

Pros:

- Potential for returns in excess of those from public equities
- Greater potential for (more persistent) alpha

Cons:

- Often utilize leverage
- Limited liquidity
- High fees (management fee plus an incentive fee)

Return History:

As of September 30, 2015	1-Year Return	3-Year Return	5-Year Return	10-Year Return	Since 4/1/90	Standard Deviation	Sharpe Ratio	Correlation
Cambridge Associates FOF	11.7	13.3	12.7	10.5	13.5	12.3	1.1	1.00
S&P 500	-0.6	12.4	13.3	6.8	9.3	17.2	0.5	0.48

Real Estate

Asset Class Description

- Core real estate represents high-quality, income-producing properties with stable cash flows.
- The most common property types are: office, industrial (warehouse), retail (malls, shopping centers), and residential (apartments, condominiums).
- Institutional investors can invest via public markets (REITs) or private markets.

Pros:

- Core properties produce stable income
- Low correlation to traditional equity and bond markets

Cons:

- Historically, returns have been cyclical and linked to the performance of the broad economy
- During periods of large net redemptions, liquidity may dry up

Return History:

As of December 31, 2015	1-Year Return	3-Year Return	5-Year Return	10-Year Return	Since 4/1/94	Since 1/1/78	Standard Deviation	Sharpe Ratio	Correlation w/ NCREIF	Correlation w/ NAREIT
NCREIF Property	13.3	12.1	12.2	7.8	9.7	9.3	4.6	1.0	1.00	-0.25
NAREIT Equity	2.8	10.6	11.9	7.4	10.7	NA	22.1	0.4	-0.25	1.00
S&P 500	1.4	15.1	12.6	7.3	9.4	11.6	17.0	0.4	0.09	0.56
Barclays Aggregate	0.5	1.4	3.2	4.5	5.7	7.6	5.9	0.8	-0.12	0.16

Hedge Funds

Asset Class Description

- General term used to describe a broad array of strategies.
- Private investment vehicles that can invest in any asset class (i.e., no specific benchmark).
- Can utilize many investment tools including short selling, leverage, and derivatives to execute the chosen strategy.
- Institutional investors can invest in direct funds or via a fund of hedge funds.

Pros:

- Potential for equity like returns with bond like volatility
- Some strategies have historically exhibited low correlation to traditional equity and bond markets

Cons:

- Often utilize leverage
- Limited transparency and complex strategies require extensive oversight
- High fees (management fee plus an incentive fee)

Return History:

As of December 31, 2015	1-Year Return	3-Year Return	5-Year Return	10-Year Return	Since 1/1/90	Standard Deviation	Sharpe Ratio	Correlation
HFRI Fund-Weighted composite	-1.1	3.6	2.3	4.1	10.1	7.4	1.0	1.00
<i>S&P 500</i>	<i>1.4</i>	<i>15.1</i>	<i>12.6</i>	<i>7.3</i>	<i>9.3</i>	<i>14.6</i>	<i>0.6</i>	<i>0.74</i>
<i>Barclays Aggregate</i>	<i>0.5</i>	<i>1.4</i>	<i>3.2</i>	<i>4.5</i>	<i>6.3</i>	<i>3.9</i>	<i>1.6</i>	<i>0.09</i>

TIPS

Asset Class Description

- TIPS are inflation-linked bonds issued by the U.S. Treasury.
- They were first issued in 1997, and they are most often issued in maturities of 5, 10, and 30 years.
- The coupon is applied against the principal, which grows at the rate of inflation (i.e., the CPI-U).

Pros:

- Backed by the U.S. Treasury
- Negatively correlated with equities
- Prices rise when higher inflation is perceived

Cons:

- Less liquid than Treasuries, but much more liquid than corporate bonds
- Historically more volatile than Treasuries
- Will underperform during periods of perceived deflation

Return History:

As of December 31, 2015	1-Year Return	3-Year Return	5-Year Return	10-Year Return	Since 3/1/97	Standard Deviation	Sharpe Ratio	Correlation
Barclays US TIPS	-1.4	-2.3	2.5	3.9	5.6	6.1	0.9	1.00
S&P 500	1.4	15.1	12.6	7.3	7.1	16.8	0.4	0.02
Barclays Aggregate	0.5	1.4	3.2	4.5	5.4	3.6	1.5	0.76

Emerging Markets Debt

Asset Class Description

- Debt issued by governments of and corporations based in emerging markets.
- While originally dominated by U.S.-dollar issues, most (80%) are now issued in local currencies.

Pros:

- Higher yield than U.S. government bonds
- Only moderate correlation to U.S. equity and bond markets
- Significantly improved creditworthiness over the past decade

Cons:

- Potential for currency to move against U.S. investors
- High default risk historically and lower liquidity than U.S. government bonds
- Event and political risks

Return History:

As of December 31, 2014	1-Year Return	3-Year Return	5-Year Return	10-Year Return	Since 1/1/94	Standard Deviation	Sharpe Ratio	Correlation
JPM EM Bond Index - Global Diversified	1.2	1.0	5.4	6.9	9.3	13.3	0.7	1.00
S&P 500	1.4	15.1	12.6	7.3	9.0	16.4	0.6	0.53
Barclays Aggregate	0.5	1.4	3.2	4.5	5.5	3.8	1.5	0.38

High Yield Bonds

Asset Class Description

- Bonds that are rated as less than investment grade by the credit-rating agencies (e.g., S&P, Moody's).
- During the 1980's, original issue high yield debt started to gain respectability, but also developed reputation as "junk bonds."

Pros:

- Provide higher income than that available from traditional bonds
- High yield bonds have produced outsized gains during economic rebounds

Cons:

- The risk of default is the primary risk
- Liquidity risk, though muted, still exists
- Returns are highly tied to the economic (especially the credit) cycle

Return History:

As of December 31, 2015	1-Year Return	3-Year Return	5-Year Return	10-Year Return	Since 7/1/83	Standard Deviation	Sharpe Ratio	Correlation
Barclays US High Yield	-4.5	1.7	5.0	7.0	8.8	9.2	1.0	1.00
S&P 500	1.4	15.1	12.6	7.3	10.7	16.7	0.6	0.58
Barclays Aggregate	0.5	1.4	3.2	4.5	7.4	4.6	1.6	0.30

Bank Loans

Asset Class Description

- Bank loans are senior floating-rate loans made to corporations, usually made by a syndicate of banks.
- These loans are typically used by firms to fund everything from working capital needs to acquisitions.
- Companies have historically used leverage loans to access capital cheaper than by issuing high yield bonds.
- Though the loans were originated by banks, most trade freely in a secondary market.

Pros:

- Provide higher income than that available from traditional bonds
- More senior position in the capital structure implies less risk than for high yield bonds
- Floating-rate feature can provide a hedge against rising interest rates

Cons:

- The risk of default is the primary risk
- Liquidity risk is higher than for high yield bonds

Return History:

As of December 31, 2015	1-Year Return	3-Year Return	5-Year Return	10-Year Return	Since 1/1/92	Standard Deviation	Sharpe Ratio	Correlation
CSFB Leveraged Loan	-0.4	2.6	3.8	4.1	5.6	5.4	1.0	1.00
<i>S&P 500</i>	1.4	15.1	12.6	7.3	9.0	15.8	0.6	0.42
<i>Barclays Aggregate</i>	0.5	1.4	3.2	4.5	5.8	3.8	1.5	-0.02

Infrastructure

Asset Class Description

- The underlying foundation of basic services, facilities, and institutions upon which a community depends.
- Investable infrastructure includes the development and/or ownership of:
 - Transportation -- roads, bridges, airports
 - Environmental -- water, waste, sanitation
 - Energy -- pipelines, power generation and distribution
 - Communication -- cable, internet, phone networks
 - Social -- hospitals, schools, parks
- This is a relatively new asset class to U.S. investors, but it has a longer history in Europe, Canada, and Australia.
- Investors can access infrastructure through public and private markets.

Pros

- Equity-like returns.
- Provides a hedge against inflation.
- Low correlation to other asset classes.

Cons

- Public to private assets may be subject to political pressures in some areas.
- Private market structures are illiquid and can use leverage.

Emerging Markets

Asset Class Description

- Emerging markets are not easily defined, but typically encompass countries with low per capita income.
- Emerging markets comprise roughly 80% of the world's population and 37% of global economic output.
- The B.R.I.C. (Brazil, Russia, India, and China) countries are bellwethers of the emerging markets.

Pros

- Rationale behind investing in emerging markets is simple: growth.
 - Lower starting point, less debt burden, more favorable demographics.
- Expect higher returns than for developed markets.

Cons

- Greater volatility.
- Greater event and political risks.
- Despite improved liquidity, costs remain high.

Return History:

As of December 31, 2015	1-Year Return	3-Year Return	5-Year Return	10-Year Return	Since 1/1/88	Standard Deviation	Sharpe Ratio	Correlation
MSCI Emerging Markets	-14.9	-6.8	-4.8	3.6	10.3	26.4	0.4	1.00
S&P 500	1.4	15.1	12.6	7.3	10.3	16.0	0.6	0.66
Barclays Aggregate	0.5	1.4	3.2	4.5	6.6	4.0	1.7	0.02



South Carolina Retirement System Investment Commission
Infrastructure Investing

Infrastructure

Infrastructure funds invest in a wide range of physical assets and businesses that provide essential services to communities, including transportation (road, air, and sea), electricity, water, waste, telecommunications, and social infrastructure.

Utilities	Transportation	Communications	Social
Water Treatment	Roads	Broadcast Towers	Health Care (hospitals)
Water Distribution	Bridges	Cell Towers	Education (schools)
Waste Management	Tunnels	Copper Towers	Corrections (prisons)
Power Generation	Railways	Fiber Optic Cable	Judiciary (courthouse)
Electricity Transmission	Airports	Satellites	Emergency Response (police & fire)
Electricity Distribution	Waterports		Recreation (parks)
Oil and Gas Storage	Waterways		
Oil and Gas Transmission			
Oil and Gas Distribution			

Benefits	Risks
High barriers to entry	Political/Regulatory
Long-term contracts	Illiquidity
Stable revenue and income	Financial (interest rates)
Limited economic cyclicality	Business and Operational
Inflation linkage	Liability and Litigation

Strategic Objectives of an Infrastructure Allocation

Inflation Linkage

- Operating concessions with inflation adjustments
- Regulatory structures with inflation adjustments

Diversification

- Low correlation to equities and bonds
- Essential assets with minimal GDP sensitivity
- Contracts and regulation smooth returns

Cash Yield

- Stable returns with strong cash flow profile
- Contracted distributions
- Potential to represent a majority of the total return

Focus on Defensive Risk

- Mature, essential projects
- Limited construction or development risk
- Strong regulatory/legal frameworks
- Value-added growth opportunities

Investment Options

	Public Infrastructure	Core Private Infrastructure	Non-Core Private Infrastructure
Description	Investment in a portfolio of stocks of utility companies, rail-road companies, energy companies, etc. Either actively managed or index fund.	Investment in an open-end fund that owns existing toll roads, utility plants, airports, etc. Significant yield component.	Investment in a closed-end fund that purchases/develops/enhances "greenfield" assets seeking total return appreciation through value enhancement.
Typical Liquidity	Daily	Quarterly	None: 12-15 year life
Expected Return¹	7.4%	6.8%	8.8%
Expected Risk¹	19.0%	16.0%	23.0%
Expected Correlation to U.S. Equities¹	0.80	0.55	0.65

¹ Based on Meketa Investment Group 2017 Annual Asset Study, 20-year annual projections.



Investment Options

Public Markets Infrastructure

- Publicly-listed stocks of individual companies that own, operate, or service assets.
- Listed and traded on public exchanges
- Active and passive investment options
- Considerations
 - Diversification: higher correlations with the general market
 - Cash yield: little to no control over the management or strategy
 - Volatility: potential to capture a large amount of systemic risk
 - Inflation protection: lack of direct inflation protection
 - Non-US emphasis: benchmarks tend to have half or more in non-US exposure
 - Overlap: already receive some exposure from existing public equity managers

Investment Options (continued)

Core Private Markets

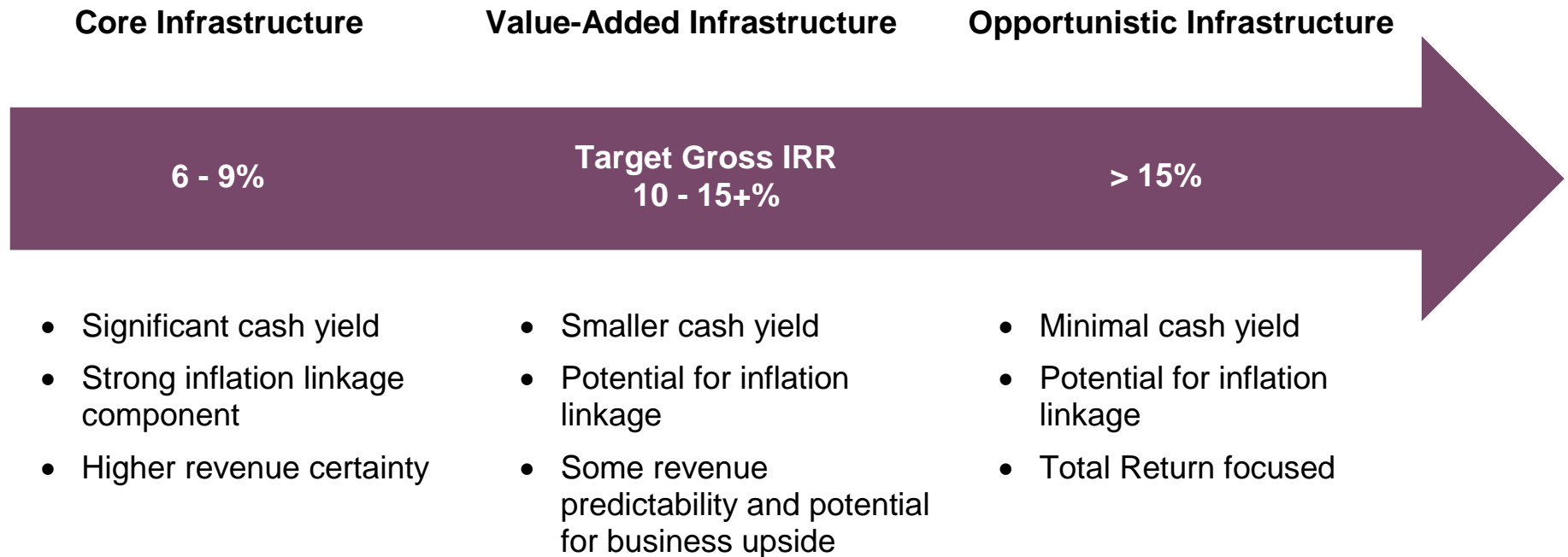
- A few open-end strategies and many closed-end funds
- Significant income component on stable assets
- Structural similarities to core open-end real estate
- Considerations
 - Limited opportunity set: very few core managers
 - Limited liquidity: typically quarterly liquidity but may have queues to enter or exit due to large lumpy asset exposure in the funds

Investment Options (continued)

Non-Core Private Markets

- Typically closed-ended private funds
- Defined term, investment period, and a fee structure that includes management and incentive fees
- Considerations
 - Limited investment universe: relatively fewer managers, not always in market
 - J-curve: returns may be low or negative during initial investment period
 - Illiquid: little to no liquidity over fund term, except for any cash yield and exit distributions
 - Blind pool risk: funds may not have made any investments at time of commitment
 - Strategy drift: fund manager may have significant discretion within broad mandate

Private Infrastructure - Risk/Reward Spectrum



Private Infrastructure - Risk/Reward Spectrum (continued)



	Core	Value-Add	Opportunistic
Definition	Essential, operational assets and businesses in developed markets, where the returns to investors come from highly predictable or recurring revenue sources, such as inflation-linked, long-term contracts or regulation.	Similar to core, yet provide opportunities for enhancing value through operational improvement, business expansion, new development, or other strategies.	Assets with risks related to investment in emerging markets, or significant exposure to marketing, GDP growth, business risk, greenfield development, or aggressive use of debt.
Opportunities	<ul style="list-style-type: none"> • Utilities • Transportation • Social infrastructure 	<ul style="list-style-type: none"> • U.S. power generation • Midstream Energy • Communications 	<ul style="list-style-type: none"> • Emerging Markets • Utilities
Trends	<ul style="list-style-type: none"> • Strong deal flow in Europe & Australia • Concerns: Pricing pressure on high quality assets 	<ul style="list-style-type: none"> • Generally attractive markets with active deal flow • Operationally-focused managers doing well 	<ul style="list-style-type: none"> • Greenfield and expansion projects; Growth in Renewables • Concerns: political and currency risks

Private Infrastructure - Open-End vs. Closed-End Comparison

	Open-End	Closed-End
Term of Commitment	<ul style="list-style-type: none"> • Perpetual 	<ul style="list-style-type: none"> • 10 – 15 years, extendable
Investment Period	<ul style="list-style-type: none"> • Ongoing for the Manager • Immediate subject to LP queue (up to 4Qs) 	<ul style="list-style-type: none"> • First 3-5 years for initial acquisitions
Distribution Period	<ul style="list-style-type: none"> • Immediate/ongoing from cash-yielding existing assets • LPs may elect to automatically reinvest cash distributions 	<ul style="list-style-type: none"> • Middle to end of term, depending on strategy • Return on capital with exits
Liquidity	<ul style="list-style-type: none"> • At LP's discretion, subject to redemption queue and rules 	<ul style="list-style-type: none"> • None
Redemptions	<ul style="list-style-type: none"> • LPs formally request to redeem some/all of capital • Some have hard and soft "locks" • Queue may/may not exist • Manager does not have to sell assets to meet requests 	<ul style="list-style-type: none"> • None

Private Infrastructure - Open-End vs. Closed-End Comparison (continued)

	Open-End	Closed-End
Risk/Return Profile	<ul style="list-style-type: none"> Core, possibly with some core+ 	<ul style="list-style-type: none"> Core, Value-Added, Opportunistic
Target Returns	<ul style="list-style-type: none"> 6-9% net, with 5-8% cash yield 	<ul style="list-style-type: none"> Core usually higher than open-end, other strategies mid-high range, w/decreasing cash yield
Geographies	<ul style="list-style-type: none"> All, usually OECD-focused 	<ul style="list-style-type: none"> All
Investment Focus	<ul style="list-style-type: none"> Brownfield assets with minimal financial or operational fixes needed May look at facility expansions and/or platform creation Contracted, concession, availability-based revenue streams 	<ul style="list-style-type: none"> Same as core open-end plus range of brownfield, khaki, greenfield per risk profile Value creation with financial and/or operational improvements Growth organically and/or acquisitions Revenues have variability
Management Fees	<ul style="list-style-type: none"> 1.0% to 1.5% 	<ul style="list-style-type: none"> 1.5% - 2.0%
Hurdle Rate	<ul style="list-style-type: none"> 6% - 7% 	<ul style="list-style-type: none"> 7% - 8%+
Carried Interest (Performance Fee)	<ul style="list-style-type: none"> 15% - 20% with no GP catch-up 	<ul style="list-style-type: none"> 20% with GP catch-up

Private Infrastructure - Open-End vs. Closed-End Comparison (continued)

	Open-End Infrastructure Funds	Closed-End Infrastructure Funds
Relative Strengths	<ul style="list-style-type: none"> • New investors acquire units of a portfolio of operational assets, which helps to mitigate blind pool risk and J-curve effect. • Commitments can be made any time, subject to queue. • Liquidity provided via higher cash yields and redemption rules. • Lower management fees and carry. • Often more transparent reporting and information. 	<ul style="list-style-type: none"> • Wide range of options available relative to strategy, geography, sector focus. • Higher returns via liquidity premium and wider strategy selection. • Well-defined GP-LP alignment via GP contribution and carry on healthy returns. • Key-man protections address staffing and succession. • Co-investment opportunities.
Considerations	<ul style="list-style-type: none"> • Limited universe: very few open-end funds versus closed-end options. • Only offer core/core+ strategies. • Drawdown of commitment can be delayed 1-2 years with long queues. • Fulfilling redemption requests can be delayed by queues, lack of available capital. • Possible recruitment, retention, and turnover issues due to lower compensation relative to closed-end funds. 	<ul style="list-style-type: none"> • Blind pool risk (could be mitigated by pre-seeded assets or later closing). • J-curve can be prominent, depending on strategy. • Managers only periodically in the market. • Illiquid: little to no liquidity over fund term, except for any cash yield and exit distributions. • Higher management fees and carry. • Term limitations force exits without fund extension or continuation vehicle.

Appendix – Case Studies

Open-End Fund Case Example A: Core	Open-End Fund Case Example B: Core/Core Plus
<p>Fund A invests in brownfield, core infrastructure assets in North America, the United Kingdom, and Europe. The Fund targets essential assets with defensive characteristics across a diverse range of asset-types, including: electricity generation, transmission, and distribution; gas transmission, distribution and storage; water and wastewater; transportation (toll roads, airports, sea ports); communications; and other infrastructure sub-sectors. Equity commitments per asset can range from \$300 million to \$900 million or more, although the average position in existing investments is \$400 million. The Fund invests in both majority and minority positions, yet requires a board seat for each investment.</p> <p>The Fund's target net IRR is 10%, calculated over a three-year rolling period, of which 6% to 8% is expected to come in the form of cash yield. The Fund's target geographic markets all have well-established infrastructure markets, regulatory regimes, and access to credit. While Fund A's open-ended structure reduces the need to exit investments at a specific point in time, the Fund maintains a target investment horizon of at least 15 years.</p>	<p>Fund B invests in a broad range of infrastructure and infrastructure-related assets located primarily in the U.S., Canada, Western Europe and Australia. The Fund focuses on core and core-plus infrastructure assets including: regulated utility assets (e.g., regulated electricity and gas transmission and distribution assets and regulated water and waste water distribution and collection assets); transportation assets (e.g., toll roads, bridges and tunnels, airports, seaports, railway lines, parking and transportation-related concessions); and contracted assets (e.g. power generation assets, and oil and gas pipelines). The Fund is expected to consist mainly of operating assets with little to no greenfield exposure. The team seeks to be a majority investor in deals and expects to make two to four investments per year requiring \$200 million to \$300 million in equity each.</p> <p>The Fund's target net IRR is 10% to 12%, with an annual yield of 5% to 7%. The Fund does not seek to invest in emerging markets as their political structures and regulations are less established and present political risks. In terms of exit, the team will pursue opportunistic exits on a case-by-case basis but are not compelled to exit due to the Fund's indefinite term.</p>

Closed-End Fund Case Example C: Core/Core Plus	Closed-End Fund Case Example D: Value-Added
<p>Fund C executes investments in core and core-plus infrastructure assets, or asset-backed companies operating essential energy, transportation and utilities infrastructure assets in North America, Western Europe, and the UK. The Manager will seek to make eight to 10 investments primarily in mature, operational, infrastructure businesses with no more than 25% of Fund commitments invested in pre-operational projects.</p> <p>The Manager intends to add value through “hands-on” operational expertise, carefully assessing and managing risk while focusing on the development of essential assets with downside protection underpinned by long term contracts. Manager C will seek to apply its value-enhancing strategy to build de-risked, core infrastructure assets that are attractive to a broad group of institutional investors.</p> <p>The Fund will target control investments of \$75 million to \$200 million in middle-market transactions with enterprise values of up to \$1 billion, seeking to avoid the larger and more heavily-contested transactions that the Manager believes typically attract large private equity funds and passive investors with lower return requirements. The Fund is targeting a gross IRR of 15% and a gross ROI of 2.0x with an annual average cash yield of 7%.</p>	<p>Fund D is a value-added strategy that will invest in transportation, renewable power, utilities, and energy. The Fund will seek to generate risk-adjusted returns by acquiring a diversified portfolio of core infrastructure assets on a value basis, with a focus on geographies where the Manager has a local operating presence, namely North America, Europe, South America, and Australasia. Manager D will seek to leverage its operating platforms and implement an operations-oriented approach to add value post-acquisition. The Fund will seek sufficient influence over its investments through control or co-control.</p> <p>Manager D has a well-established capability to source and execute investments that provide platforms to create multi-asset single-sector portfolios (e.g., wind, hydropower). Manager D also will invest in multi-sector assets (e.g., port-logistics-rail). Both strategies target value creation through operational synergies, shared management, and cost efficiencies. Under this strategy, Fund D could make 25-30 individual investments managed as 9 to 12 portfolio companies.</p> <p>The Fund's target gross IRR is 13%+ (equating to a net IRR of approximately 10%), with average annual cash yield of 5%. Manager D expects to begin exploring exits eight to ten years into the life span of an investment. The team will explore a variety of exit strategies, including, but not limited to, trade sales, partial monetization, and public offerings.</p>

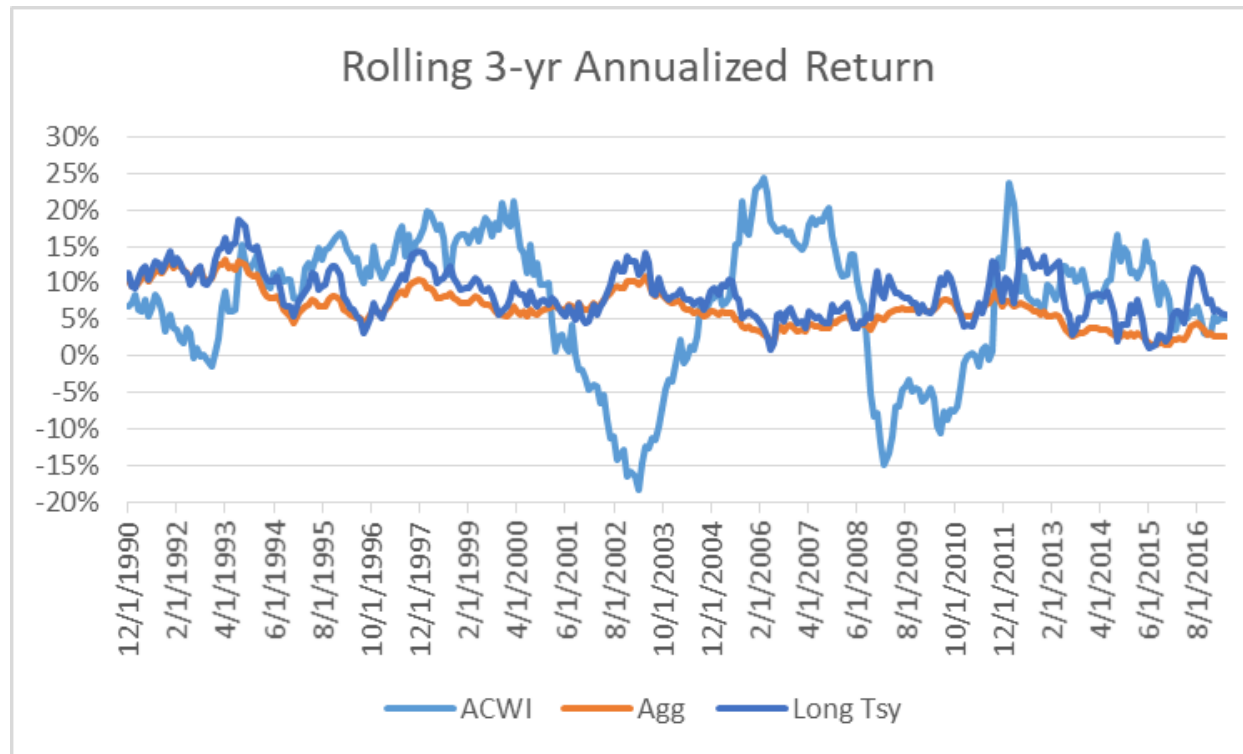


South Carolina Retirement System Investment Commission
Long-Term Treasuries

Benefits of Long-Term Treasuries

- Value retention during equity declines
- Portfolio volatility dampener
- Income
- Liquidity

Value Retention During Equity Declines



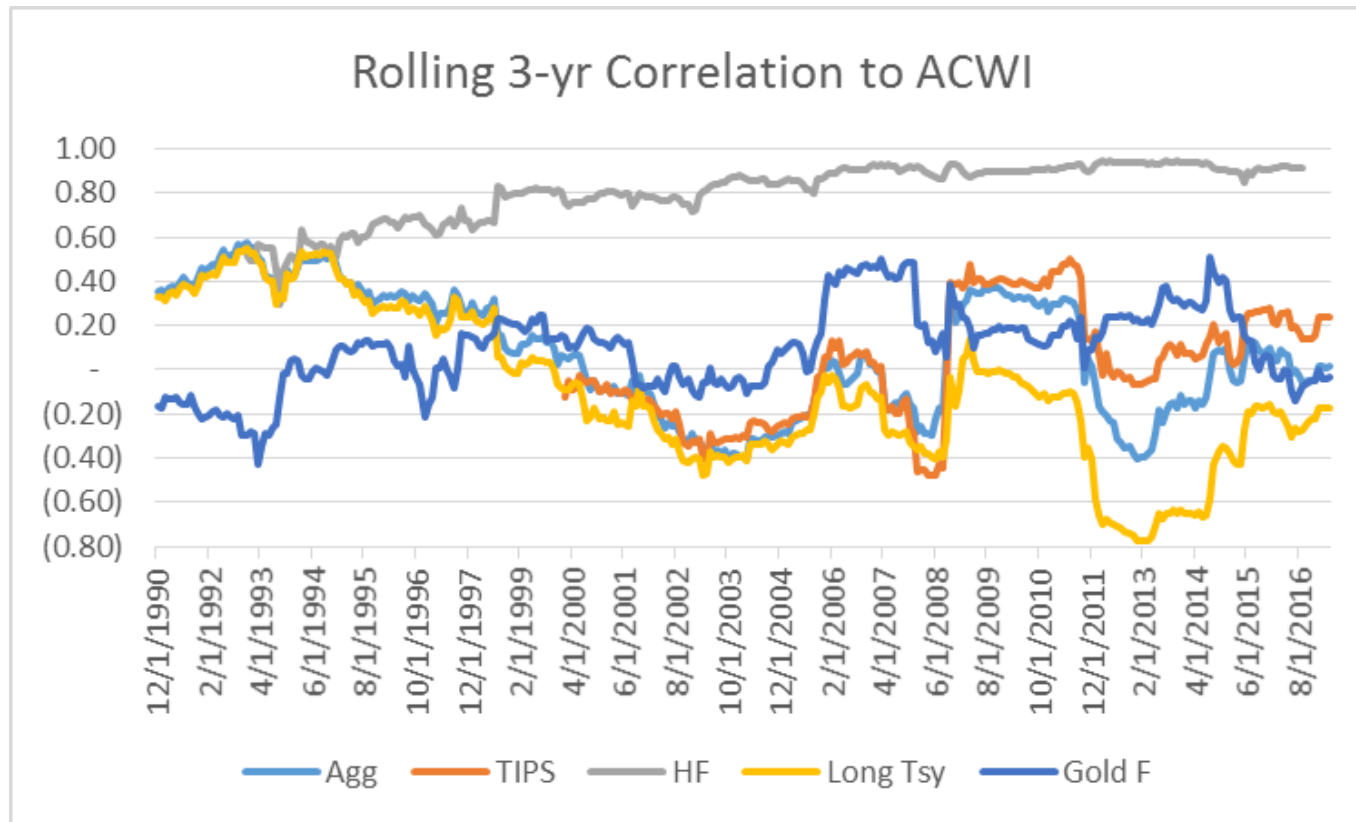
- Bonds have been far less volatile than equities historically.

Value Retention During Equity Declines

Cumulative Returns					
<u>Historical Scenario</u>	<u>Cash</u>	<u>Agg</u>	<u>Long Tsy</u>	<u>US Eq</u>	<u>HF</u>
Taper Tantrum (May-Aug 2013)	0.0%	-3.7%	-11.6%	3.0%	-0.4%
Global Financial Crisis (Oct 2007 - Mar 2009)	3.1%	9.3%	24.5%	-43.8%	-15.6%
2008 Calendar Year	1.7%	5.2%	24.0%	-37.0%	-19.0%
Popping of the TMT Bubble (Apr 2000 - Sep 2002)	9.9%	28.6%	35.5%	-43.8%	-2.1%
LTCM (Jul - Aug 1998)	0.8%	1.8%	4.1%	-15.4%	-9.4%
Asian Financial Crisis (Aug 1997 - Jan 1998)	2.4%	4.9%	8.6%	3.6%	1.7%
Rate spike (1994 Calendar Year)	3.9%	-2.9%	-7.6%	1.3%	4.1%
Crash of 1987 (Sep - Nov 1987)	1.4%	2.2%	2.6%	-29.5%	-7.8%
Strong dollar (Jan 1981-Sep 1982)	24.4%	29.9%	28.4%	-2.3%	-3.8%
Stagflation (Jan - Mar 1980)	2.9%	-8.7%	-13.6%	-4.1%	-1.9%
Stagflation (Jan 1973- Sep 1974)	13.5%	7.9%	-1.8%	-42.6%	-15.7%

- During the most severe bear markets for stocks, long Treasuries have been the most reliable hedge.

Portfolio Volatility Dampener



- Long Treasuries have exhibited the lowest (in fact, negative) correlation with equities over the past two decades.

More “Efficient” Portfolios

Portfolio Expected Returns, Volatility, and Sharpes							
	100% U.S. Bonds		70% U.S. Equity / 30% U.S. Bond				
	All IGB	All LT Tsy	30 IGB / 0 LT Tsy	25 IGB / 5 LT Tsy	20 IGB / 10 LT Tsy	15 IGB / 15 LT Tsy	0 IGB / 30 LT Tsy
Expected Return (20y)	3.5	3.9	6.7	6.8	6.9	6.9	7.1
Standard Deviation	4.0	12.5	12.7	12.6	12.4	12.3	12.0
Sharpe Ratio (20y)	0.18	0.09	0.31	0.32	0.3	0.34	0.36

- Long Treasuries are much more volatile than a portfolio of core bonds, and on a stand-alone risk-return basis they appear to be inferior.
- However, due to their negative correlation with most risky assets, they make a risky portfolio more efficient when substituted in the place of core bonds.

Income

- Most strategies that are designed to protect against a declining equity market have “negative carry”.
- This means they have a negative expected return in most environments.
- Example: buying insurance (e.g., buying put options) requires paying a premium.
- Long-Treasuries have a positive carry, as they provide a yield to their investors.

Liquidity

- US Treasuries are among the most liquid securities available.
- Can be implemented using Futures in addition to owning the actual bonds.
 - Treasury Futures are likewise highly liquid.

Considerations of Long-Term Treasuries

- Low yields
- Inflation risk
- Line-item volatility
- A low-rate environment
- Central Bank intervention

Low Yields



- For much of their history, Treasuries offered a higher yield than they do today.
- Asymmetry of possible outcomes is a concern: rates have a lot of room to rise, implying potential downside for bond values, but not as much room to fall.

The Impact of Rising Rates

Characteristics of the Major Bond Indices¹

	Yield	Duration	Convexity
B/B Aggregate	2.7%	6.0	0.2
B/B US Intermediate Treasury	1.9%	3.9	0.2
B/B US Long Treasury	2.7%	17.7	4.1

- Given their much longer duration, Long-Term Treasuries are much more sensitive to changes in interest rates than a typical core bond portfolio.
- The positive convexity means that they will not experience as sharp a loss in a rising rate environment as their duration alone implies.

¹ As of November 2017.

The Risk of Rising Rates

Long Treasuries' Performance During Periods of Rate Rises						
Start	End	Months	Initial Yield	Yield Change	Total Return (ann.)	Notes
Jul - 54	Oct - 57	39	2.47%	1.26%	-2.45%	Gradual
Apr - 58	Jan - 60	21	3.12%	1.25%	-5.82%	Sharp
May - 61	Aug - 66	63	3.73%	1.07%	1.40%	Very gradual
Jan - 67	Nov - 67	10	4.40%	1.04%	-14.50%	Very sharp
Aug - 68	Jun - 70	22	5.04%	1.95%	-7.07%	Sharp
Nov - 71	Aug - 74	33	5.44%	1.89%	-0.99%	Gradual
Dec - 76	Mar - 80	39	6.39%	5.48%	-5.62%	Big change
Jun - 80	Sep - 81	15	9.40%	4.74%	-16.20%	Sharp and big change

- During historical periods when yields increased by at least a full percent, the more gradual the increase, the less impact there was on total return.
- To the extent that a gradual rise in rates is already expected, current prices will reflect that, and investors should theoretically only see losses if the increase surprises with its suddenness or magnitude.

Implementation Issues

- Bonds vs. Futures
 - Treasury exposure can be implemented using Futures or the physical bonds
- Active vs. Passive
 - Minimal opportunity to add value via active management
- Term structure
 - Choice of benchmark(s) will affect sensitivity to rising rates and ability to hedge against bear markets

Summary

- Bonds serve as an anchor to windward in most equity-oriented portfolios.
- Long-Term Treasuries have been the most reliable hedge against severe equity declines.
- Their negative correlation with most risky assets improves the overall risk-reward profile of a portfolio.
- An investor should be conscious of the impact of rising rates given the low level of interest rates in secular terms.



South Carolina Retirement System Investment Commission
Treasury Inflation Protected Securities (TIPS)

M E K E T A I N V E S T M E N T G R O U P

100 LOWDER BROOK DRIVE SUITE 1100 WESTWOOD MA 02090

781 471 3500 fax 781 471 3411 www.meketagroup.com

Characteristics of Inflation Linked Bonds: Overview

- Offer a guaranteed return over inflation.
- Principal is adjusted at rate of inflation.
- Two components to yield:
 - Real yield
 - Market's expectation for future inflation
- Market value fluctuates.
- Prices rise when higher inflation is perceived.

History of Inflation Linked Bonds

- Generally issued by governments.
- Longer history in UK (1981).
- First issued in U.S. in 1997.
- **T**reasury **I**nflation **P**rotected **S**ecurities.
- 5-, 10-, and 30-year maturities issued.

Characteristics of TIPS: Expected Returns

- Add the “real” yield to the market’s expectation for inflation.
- No inflation risk premium.
- Inflation risk \approx liquidity risk.¹
- For the next twenty years, we expect a 3.5% annual return.²

¹ Academic work suggests that TIPS have a 50 bp liquidity risk premium versus a 60 bp inflation risk premium for nominal Treasuries. Though the two premia vary, we assume they offset each other over the long term.

² Based on Meketa Investment Group’s 2017 Annual Asset Study.

Components of Yield

Treasuries



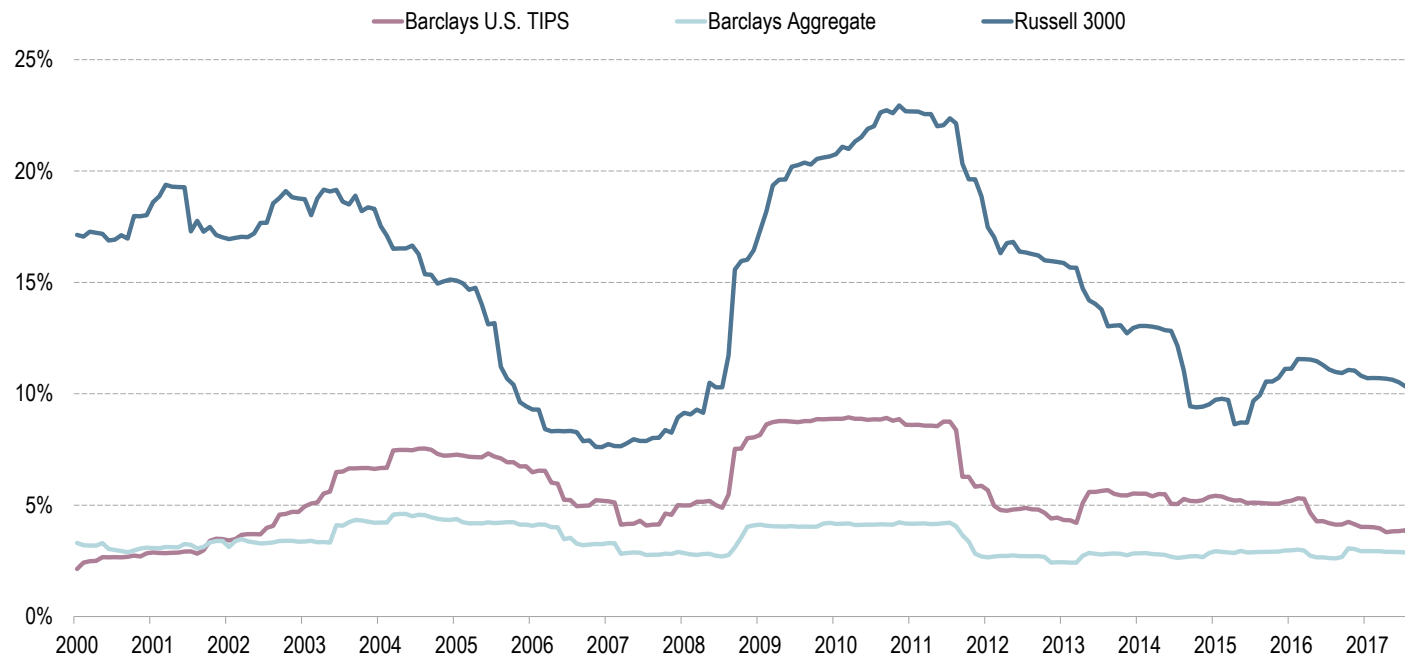
TIPS



Characteristics of TIPS: Volatility

- Will fluctuate daily with market sentiment.
- Also subject to the movement of real interest rates.
- More volatile than cash.
- Historically more volatile than Core Bonds.
- Less volatile than the broad equity market.

Rolling 36 Month Standard Deviation Monthly Returns: March 1997 – October 2017



Characteristics of TIPS: Correlations

- Very low correlation with equities.
- Positively correlated with nominal bonds.
- Low correlation with actual inflation (more sensitive to inflation *expectations*).

Correlation Matrix¹

Monthly Returns: March 1997 – September 2017

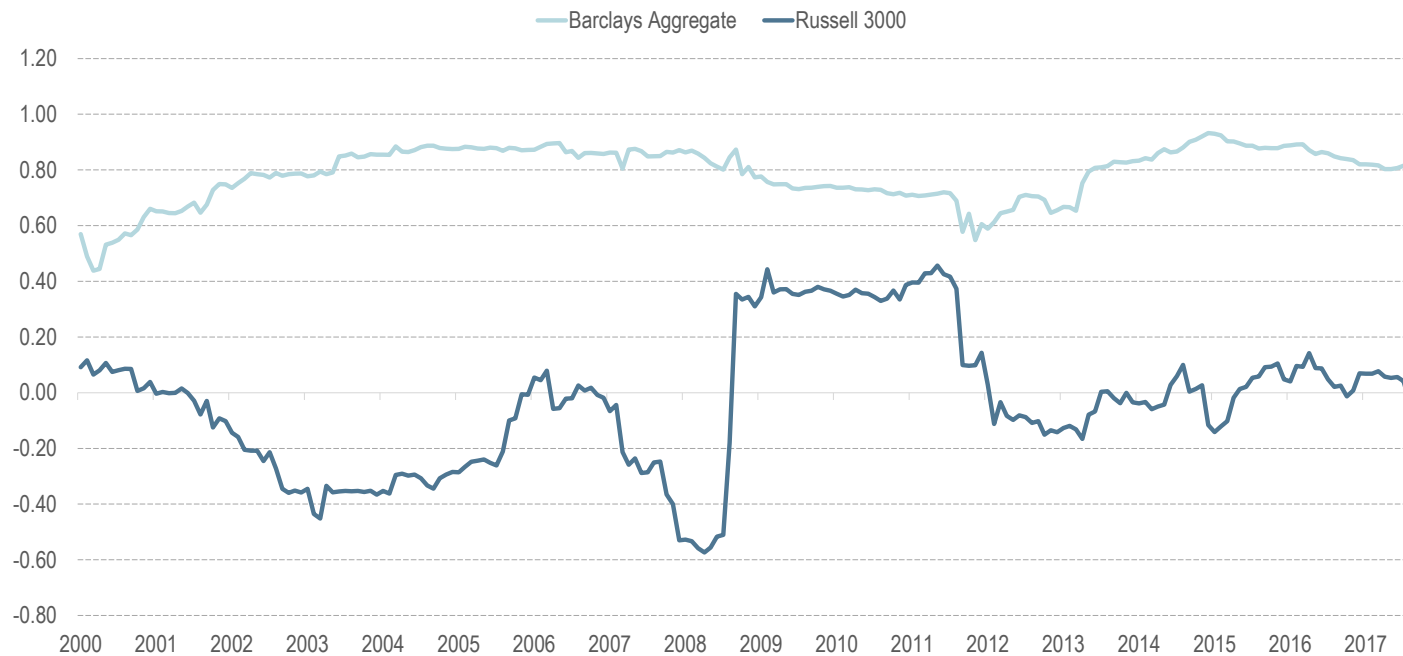
	TIPS	Bonds	Stocks	Inflation
TIPS	1.00			
Bonds	0.76	1.00		
Stocks	0.02	-0.05	1.00	
Inflation	0.09	-0.14	0.03	1.00

¹ TIPS represented by Barclays U.S. TIPS Index, Bonds by Barclays U.S. Aggregate Index, and Stocks by Russell 3000 Index.

Characteristics of TIPS: Correlations

- Correlations will vary through time, though within a predictable range.

Rolling 36 Month Correlations to Barclays U.S. TIPS Monthly Returns: March 1997 – October 2017

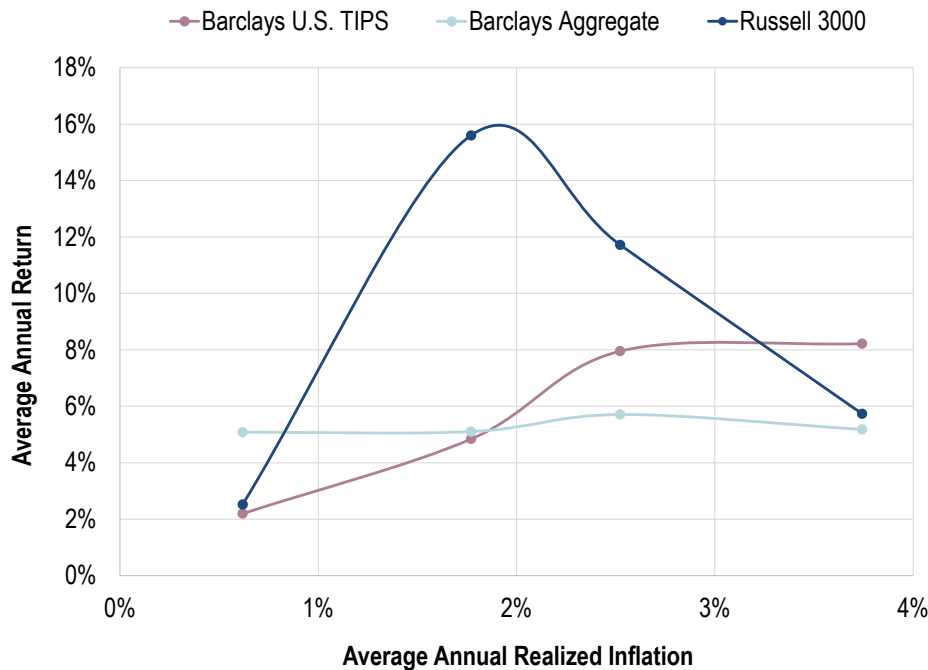


Role of TIPS: Need for an Inflation Hedge

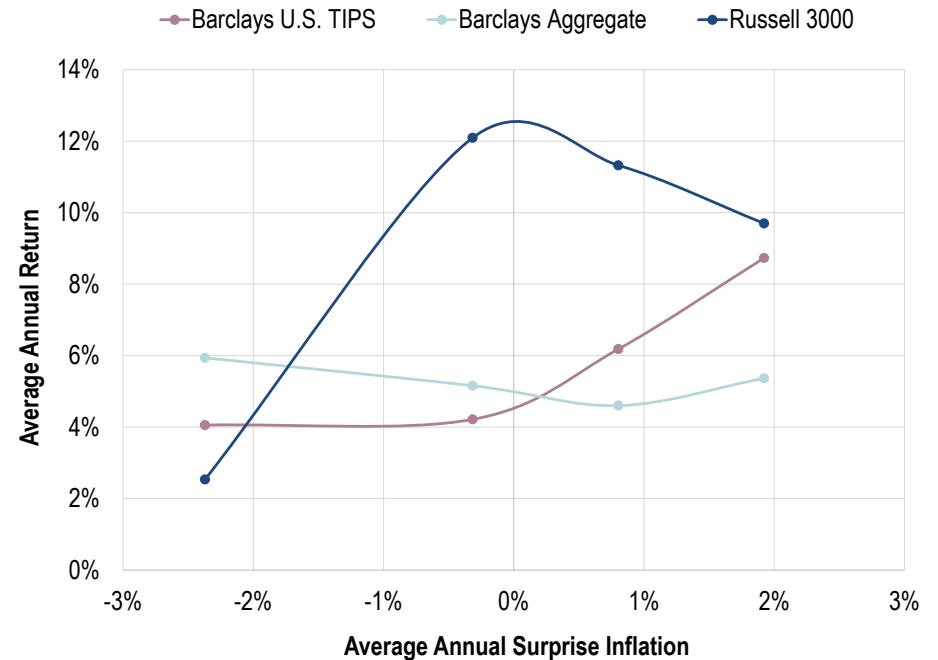
- Periods of high inflation are often accompanied by low stock and bond returns. These are the periods when TIPS fare relatively well.
- Markets factor inflation into asset prices. When inflation is much higher (or lower) than what is expected, asset prices react strongly to these “surprises.”

Returns Smoothed by Quartiles: March 1997 – September 2017

Annual Returns vs. Realized Inflation



Annual Returns vs. Surprise Inflation



Implementation Issues

- Market Liquidity
 - Less liquid than Treasuries, but much more liquid than corporate bonds
- Benchmark
 - Only 38 issues (Bloomberg Barclays and Merrill offer indices)
- Active vs. Passive
 - Minimal opportunity to add value with active management
- Term Structure
 - Accept the benchmark's structure or shorten duration for greater inflation sensitivity

Summary

- TIPS offer protection against unexpected inflation.
- TIPS have produced different return patterns from stocks and other bonds.
- TIPS can improve a retirement system's long-term risk-reward relationship.

Appendix I: How Have TIPS Performed?

As of October 31, 2017

	Barclays U.S. TIPS	Barclays Aggregate	Russell 3000
Trailing Period Returns (%)			
YTD 2017	1.9	3.2	16.4
1 Year	-0.1	0.9	24.0
3 Years	1.4	2.4	10.5
5 Years	-0.1	2.0	15.1
7 Years	2.3	2.9	14.0
10 Years	3.8	4.2	7.6
Since Inception¹ (3/1997)	5.4	5.2	8.1

- TIPS have underperformed the broad bond market, as measured by the Barclays U.S. Aggregate index, over one-, three-, five-, seven-, and ten-year trailing periods as of March 31, 2017. The underperformance of TIPS can be attributed in part to a general decline in inflation since the Global Financial Crisis.
- Since inception, TIPS have outperformed the broad bond market.

¹ Represents the period since the inception date of the Barclays U.S. TIPS index (March 1997).



Appendix I: How Have TIPS Performed?

As of October 31, 2017

	Barclays U.S. TIPS	Barclays Aggregate	Russell 3000
Return since March 1, 1997	5.4%	5.2%	8.1%
Standard Deviation	5.6	3.4	15.3
Calendar Year Returns:			
Partial 1997	1.9	9.0	24.7
1998	3.9	8.7	24.1
1999	2.4	-0.8	20.9
2000	14.3	11.6	-7.5
2001	8.2	8.4	-11.5
2002	16.6	10.3	-21.5
2003	8.4	4.1	31.1
2004	8.5	4.3	11.9
2005	2.8	2.4	6.1
2006	0.4	4.3	15.7
2007	11.6	7.0	5.1
2008	-2.4	5.2	-37.3
2009	11.4	5.9	28.3
2010	6.3	6.5	16.9
2011	13.6	7.8	1.0
2012	7.0	4.2	16.4
2013	-8.6	-2.0	33.6
2014	3.6	6.0	12.6
2015	-1.4	0.5	0.5
2016	4.7	2.6	12.7
YTD 2017	1.9	3.2	16.4

- TIPS have outperformed the broad bond market since inception, with more volatility.

Appendix II: How are TIPS Priced Currently?

- As of November 2017, ten-year nominal Treasuries yielded 2.3%, while ten-year TIPS yielded 0.4% plus inflation.
- Nominal Treasury yield minus the TIPS yield is a rough measure of the expected rate of inflation.
- Assuming no risk premium, this results in implied inflation of approximately 1.9%.
- Implied inflation is currently below the average historical rate of inflation.

Appendix III: Total Return Comparison of Barclays U.S. Aggregate Minus Barclays U.S. TIPS¹

		Changes In Rates (bps)				
		-100	-50	0	50	100
Inflation Rate Scenarios	4.0%	-5.77%	-4.06%	-2.59%	-1.35%	-0.35%
	3.0%	-4.77%	-3.06%	-1.59%	-0.35%	0.65%
	2.0%	-3.77%	-2.06%	-0.59%	0.65%	1.65%
	1.0%	-2.77%	-1.06%	0.41%	1.65%	2.65%
	0.0%	-1.77%	-0.06%	1.41%	2.65%	3.65%

Total Return Scenario: 100 bps Rate Increase and 2% Inflation

Total Return Over Longer Holding Periods	1 Year	3 Year	5 Year	7 Year	10 Year
Barclays U.S. Aggregate	-3.41%	0.86%	1.74%	2.11%	2.40%
Barclays U.S. Treasury U.S. TIPS	-5.05%	0.78%	1.99%	2.51%	2.90%

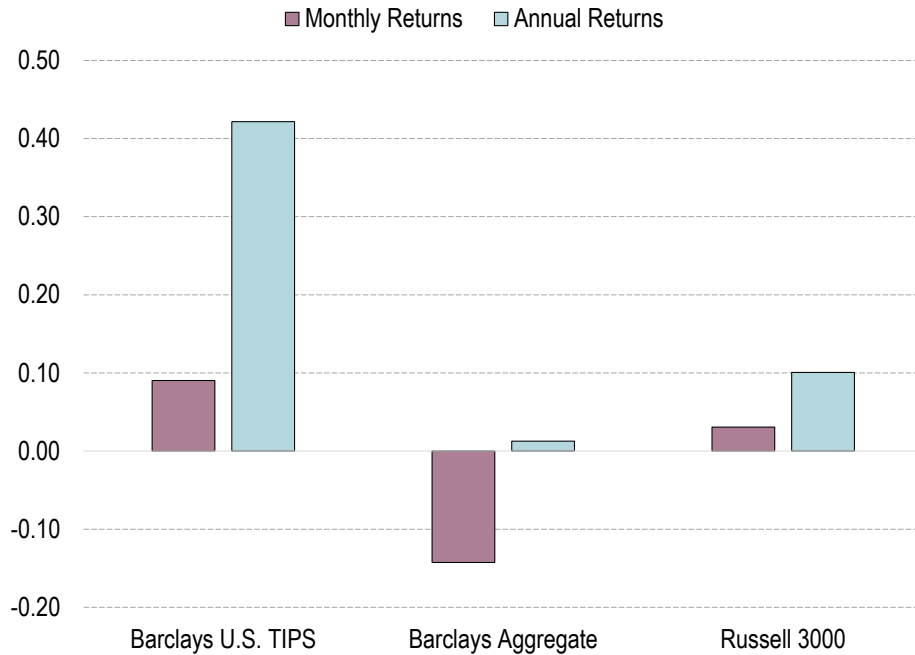
¹ Data is as of September 30, 2015 via Barclays, Bloomberg, and Thomson Reuters. Scenario assumes that the rate increase happens over one year.



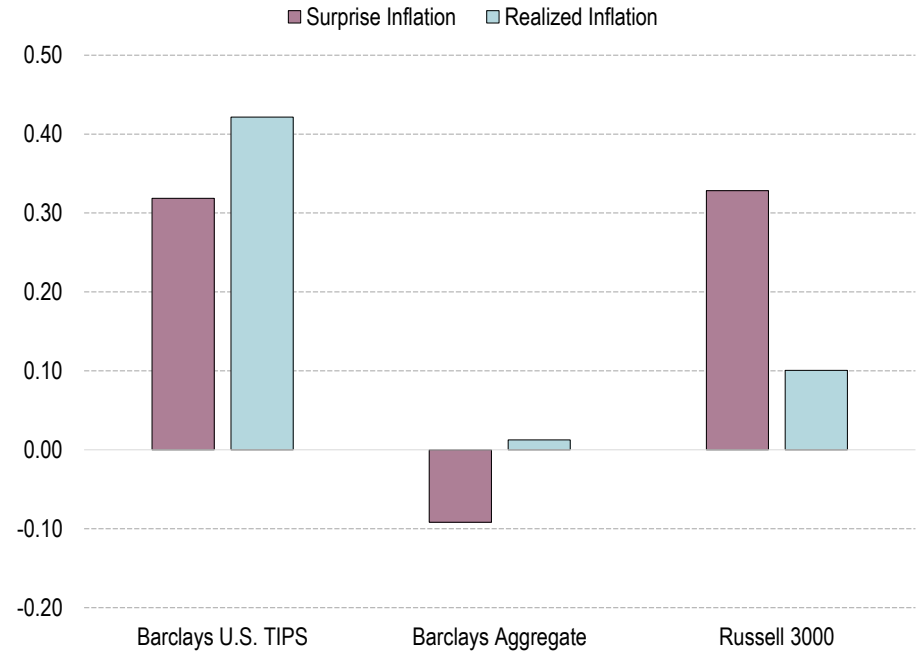
Appendix IV: Correlations to Inflation

March 1997 – September 2017

Correlations to CPI Inflation



Correlations to Inflation vs. Inflation Surprise





RETIREMENT SYSTEM INVESTMENT COMMISSION
1201 MAIN STREET, SUITE 1510, COLUMBIA, SC 29201

To: Commission Members
From: Michael Hitchcock, Chief Executive Officer
Date: September 28, 2017
Re: Meeting Schedule for 2018

2018 Proposed Commission Meeting Schedule

Thursday, February 8, 2018

Thursday, April 12, 2018

Thursday, June 14, 2018

Thursday, September 13, 2018

Thursday, November 8, 2018

FOR DISCUSSION PURPOSES ONLY

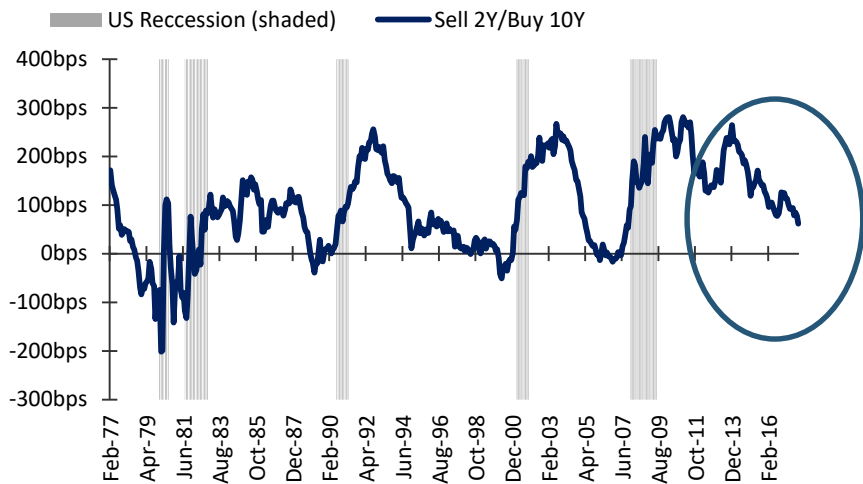
Macro and Capital Markets Update

Steve Marino, CFA
Geoffrey Berg, CFA

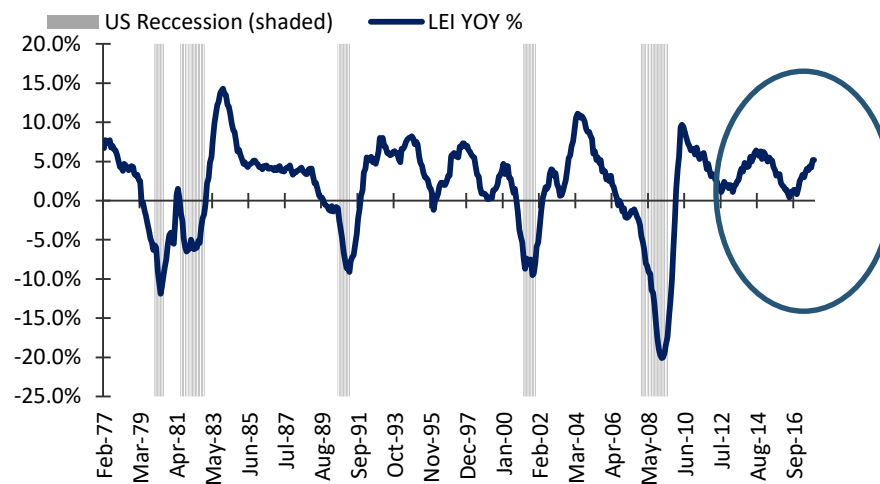
- US Economy is expanding and in later stage of the business cycle
- Growth is synchronized globally
- Near-term (6-12months) US recession risks are low
- Inflation is still MIA, but pressures are building
- Risk assets are expensive
- Optimism is high
- Forward looking return expectations should be managed lower
- Monetary policy is shifting course

US Economy intact and expanding, signs of inflationary pressures?

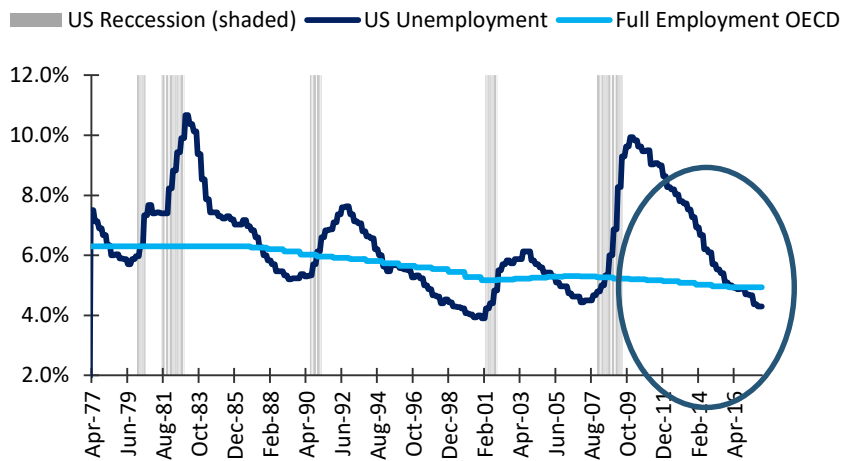
10-2 Spread



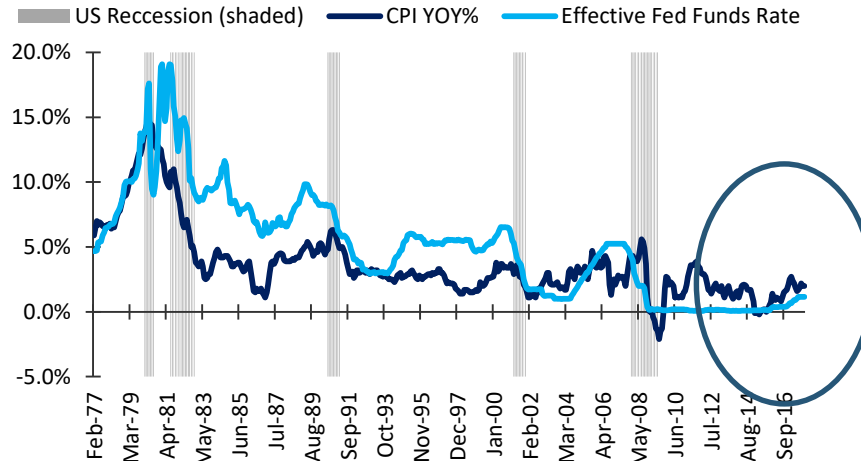
Leading Economic Indicators



Full Employment – Implies recession 2Q2019



Fed Funds – Inflation MIA

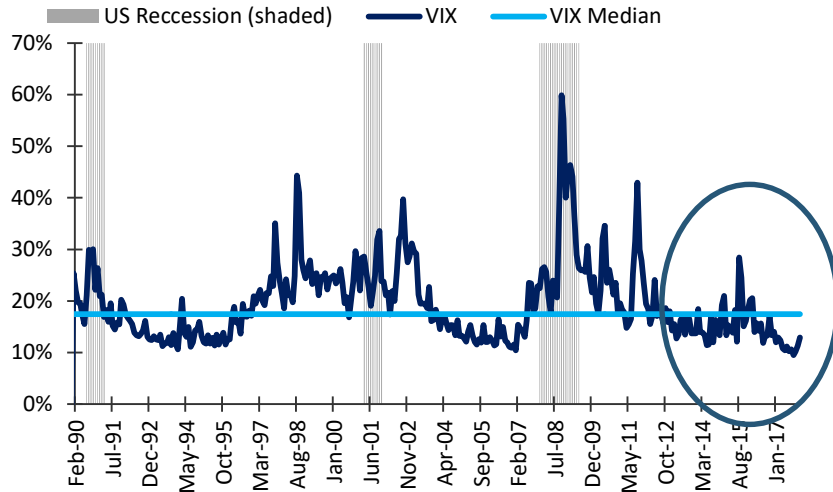


Source: Bloomberg

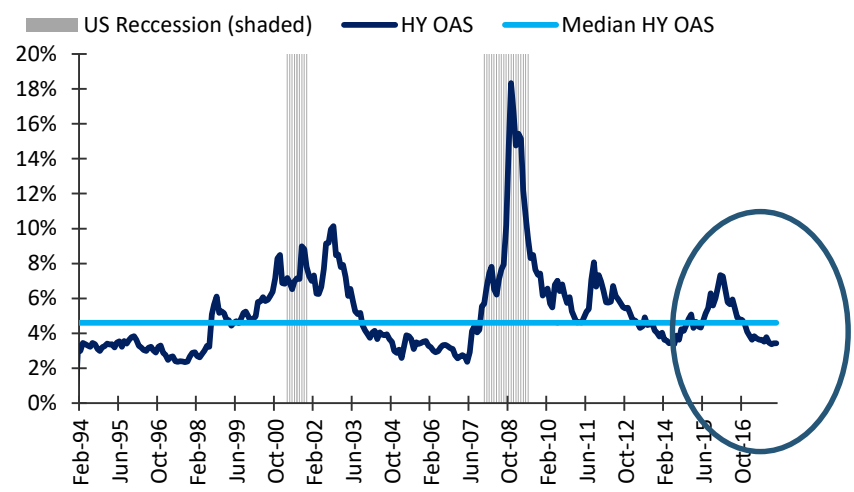
What's priced in?

Low volatility, tight spreads / earnings yield, high confidence

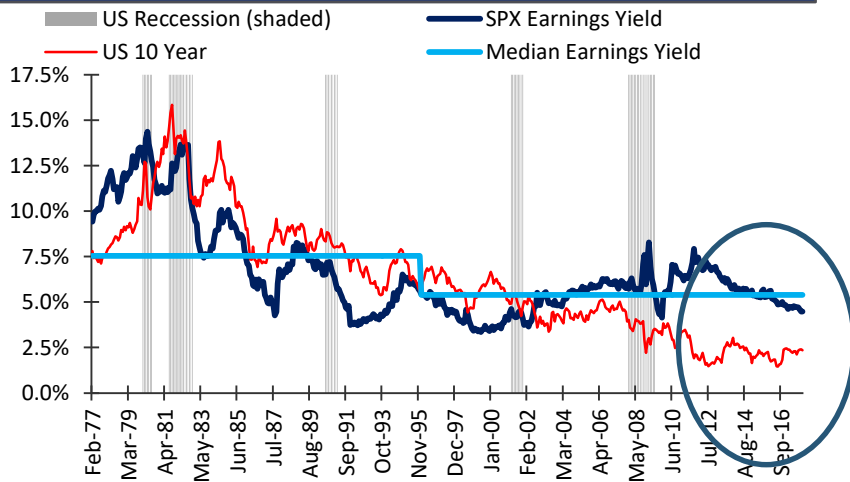
S&P 500 Implied Volatility - LOW



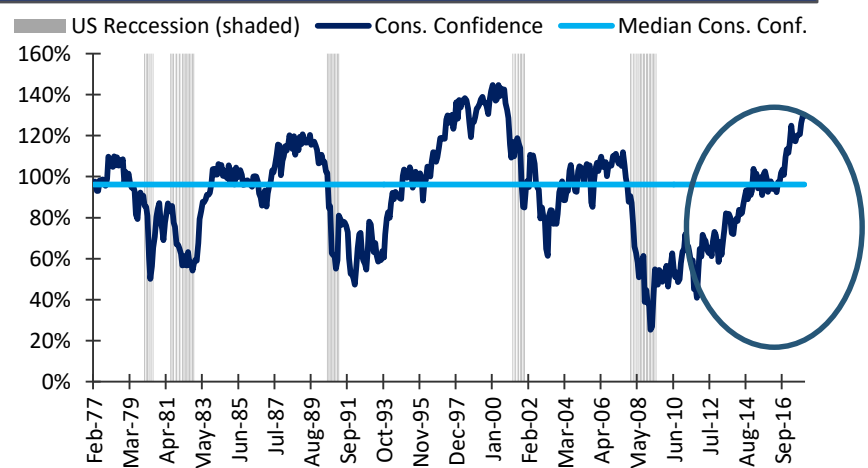
High Yield Option Adjusted Spread - TIGHT



S&P Earnings Yield - COMPRESSED



Consumer Confidence - ELEVATED



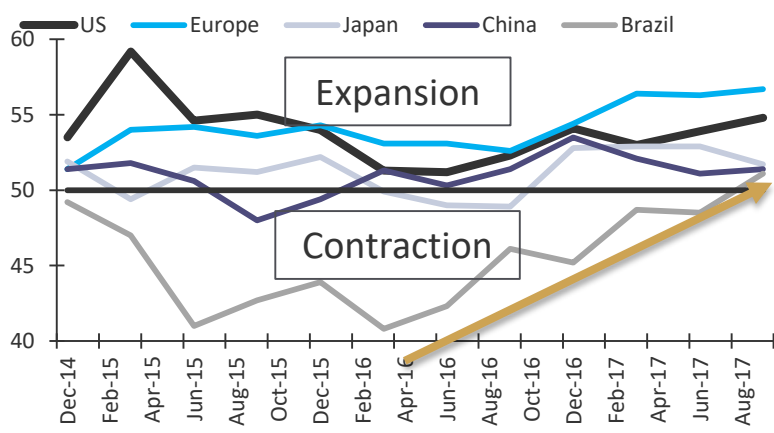
Source: Bloomberg

Growth accelerating with diverging monetary policy

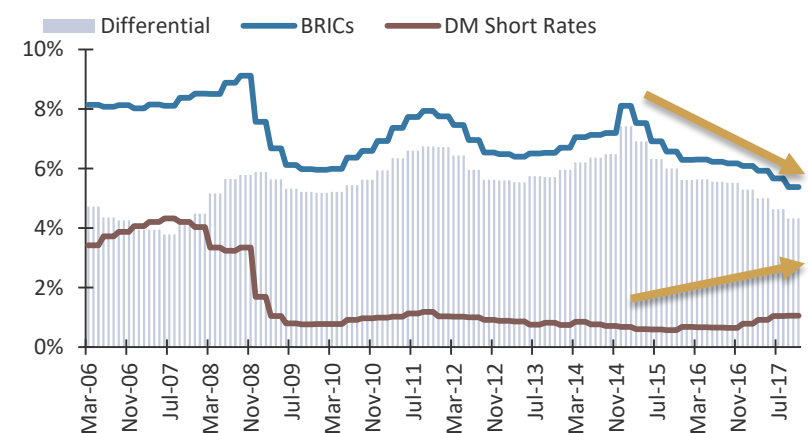
	CY 2016	Actual Growth	Expectations for Growth
		YoY Chg. 17Est. vs.16	Chg. In 2018 Estimates
Eastern Europe	2.16%	1.22%	0.38%
Eurozone	1.40%	0.80%	0.40%
EMEA	2.30%	0.78%	0.16%
US	1.50%	0.70%	0.18%
Western Europe	1.44%	0.66%	0.37%
Developed Economies	1.84%	0.40%	0.28%
G-8	1.70%	0.32%	0.28%
World	3.20%	0.30%	0.21%
Asia ex-Japan	5.80%	0.16%	0.15%
Asia Pacific	4.71%	0.10%	0.17%
BRICS	5.45%	-0.05%	0.12%
Emerging Economies	4.70%	-0.19%	0.00%
Latin America	1.54%	-0.51%	-0.12%

	Current		Chg. YoY	
	Cash Rate	10 Yr Yield	Cash Rate	10 Yr Yield
US	1.25%	2.39%	↑ 0.50%	-0.06%
European Union	0.11%	1.22%	0.00% ↑	0.14%
UK	0.50%	1.27%	↑ 0.25%	0.04%
Japan	-0.05%	0.05%	0.01%	0.00%
BRICS	5.38%	4.91%	↓ -0.70%	↑ 0.28%
Developed Economies	1.06%	1.95%	↑ 0.27%	0.01%

Markit Composite PMI's - Expanding



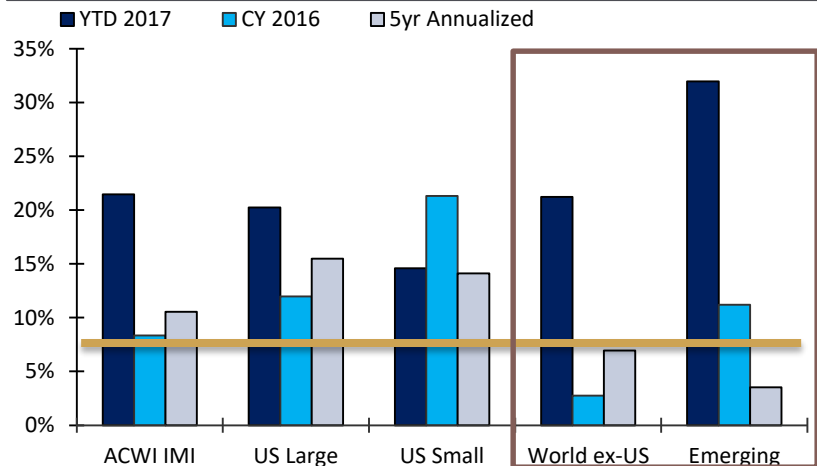
DM vs. EM Short Rates



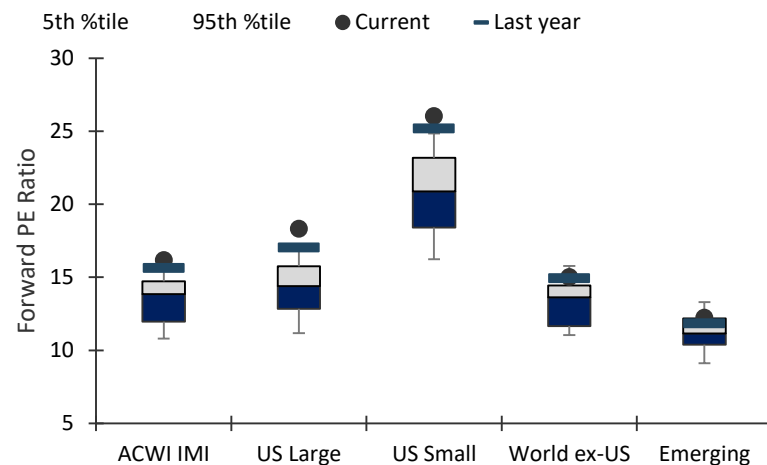
Source: Bloomberg, Markit PMI

Strong 2017 performance, high valuations but EPS growing

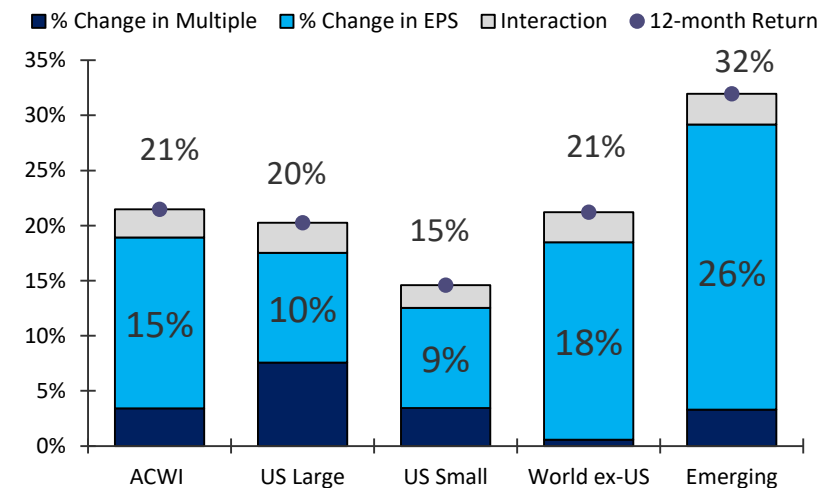
Global Equity Market Returns



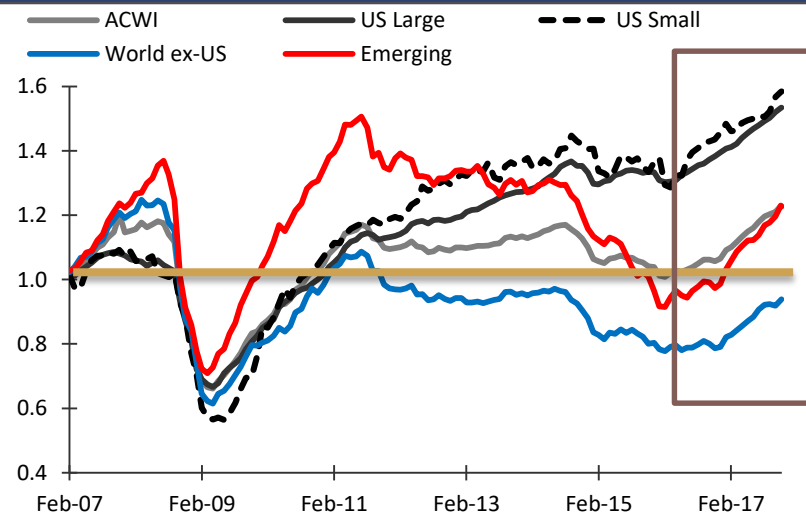
Forward PE Ratios (Prior 10-years)



Global Equity Performance Attribution - 2017



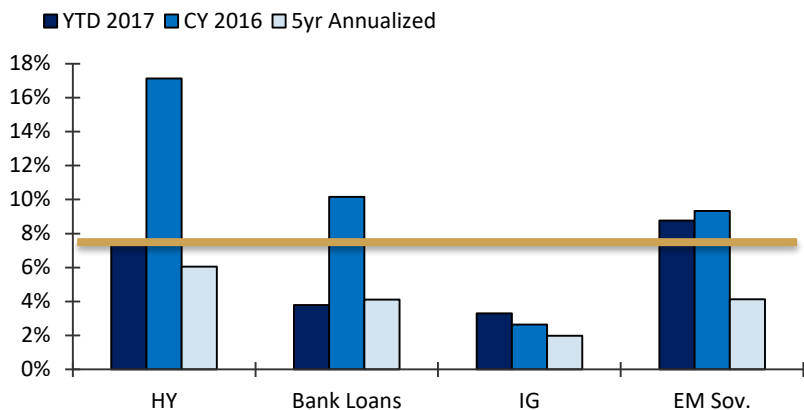
12m Forward EPS Indexed to 1



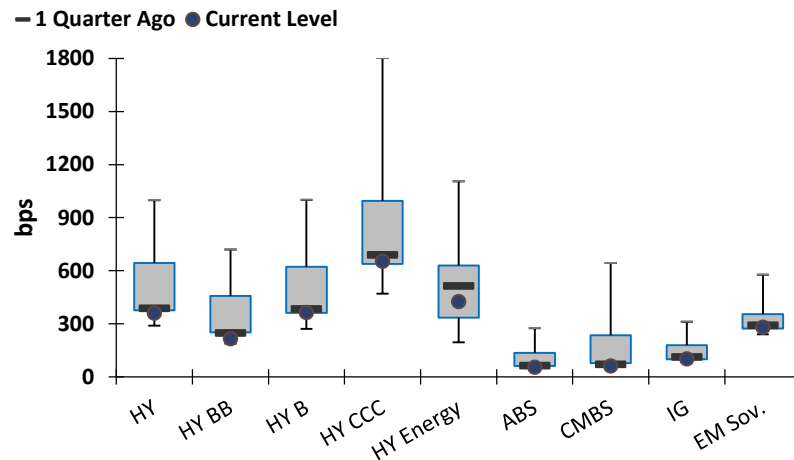
Source: Bloomberg

Tight spreads, falling forward returns, lower return/risk ratio

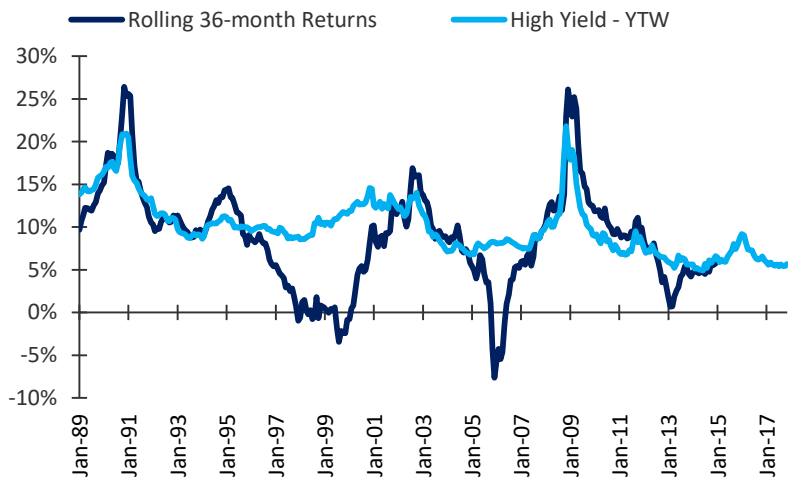
Returns by Credit Rating



TIGHT Spreads by Sector/Rating (Prior 15yrs)

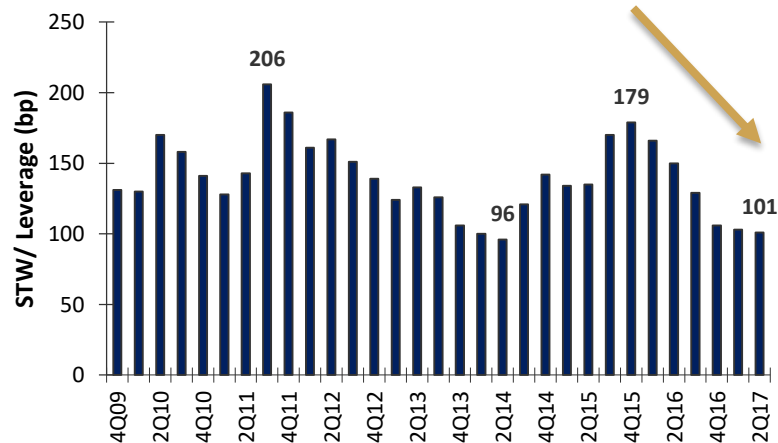


LOW FORWARD returns for Credit



High Yield Reward vs. Risk – LOWER ⁽¹⁾

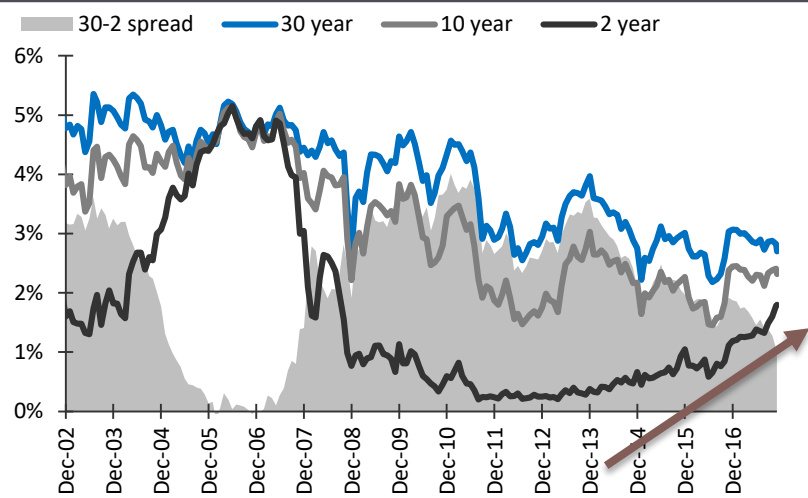
High Yield Spread to Worst (STW) / Leverage (Net Debt/EBITDA)



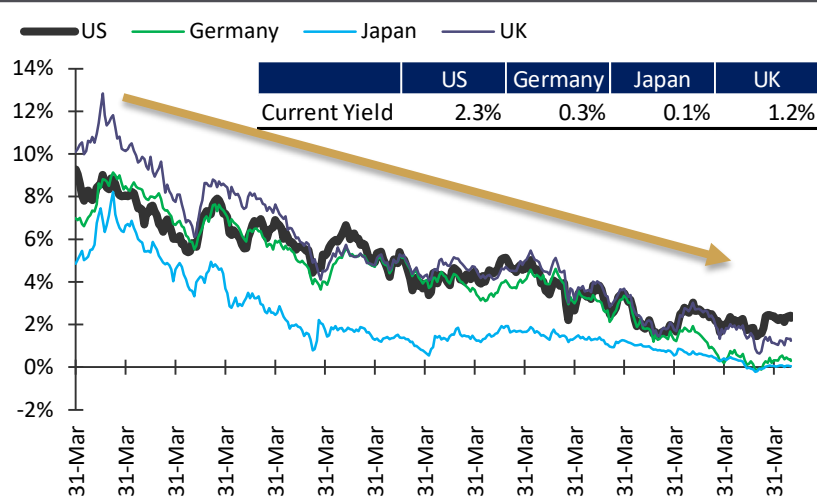
Source: (1) JPM Quarterly Credit Strategy, Bloomberg

Lower rates, flatter yield curve, higher sensitivity to rising rates

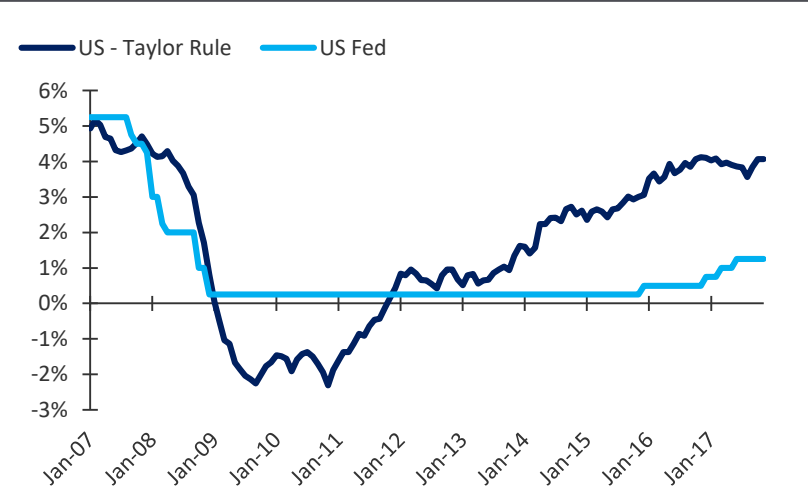
US Yield Curve - FLATTENING



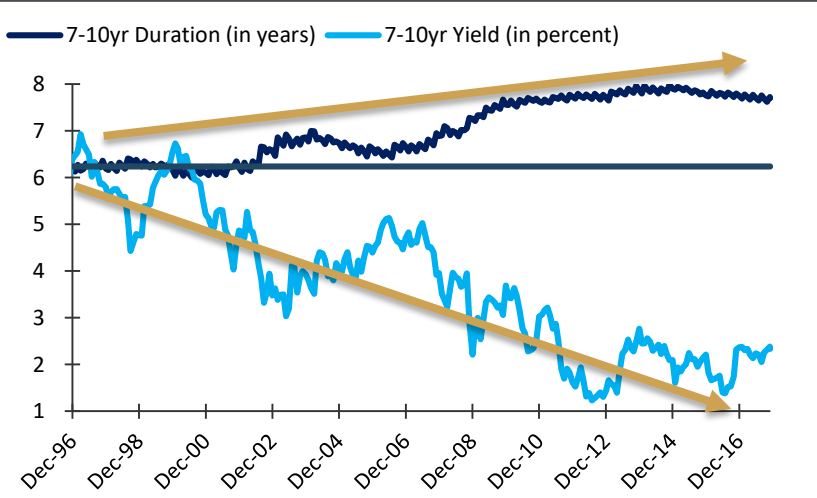
Global Rates - LOW



Fed Funds vs. Taylor Rule - SIGNALS HIKES



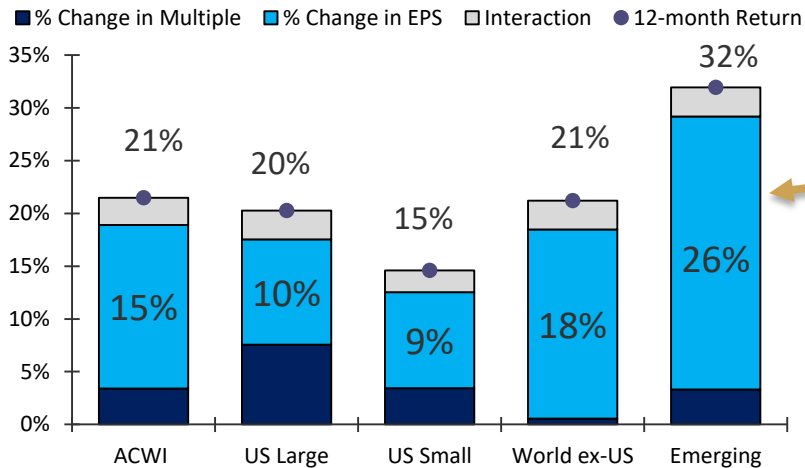
Duration Rises with Falling Yields



Source: Bloomberg

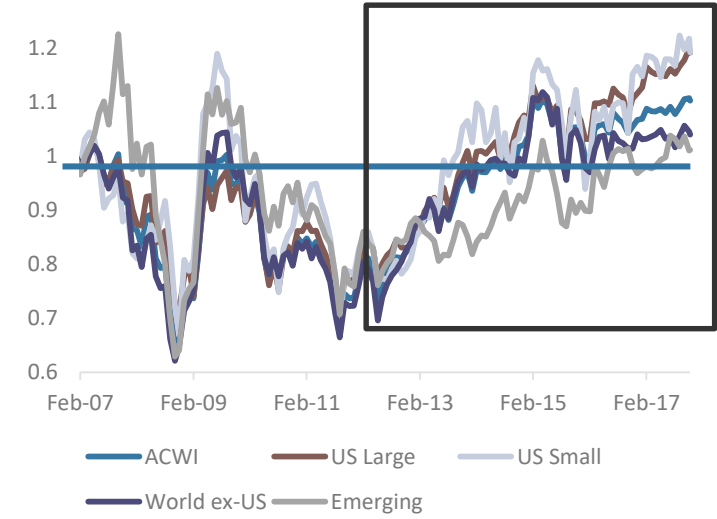
Appendix

Calendar Year to Date

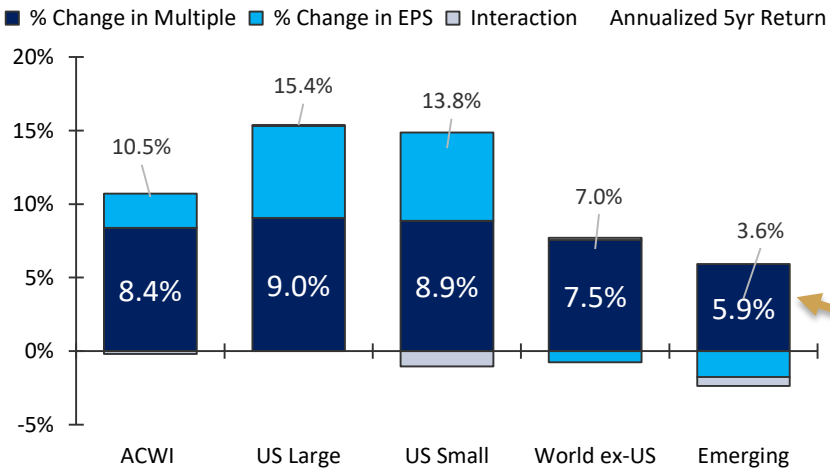


Earnings Growth

Multiple Expansion

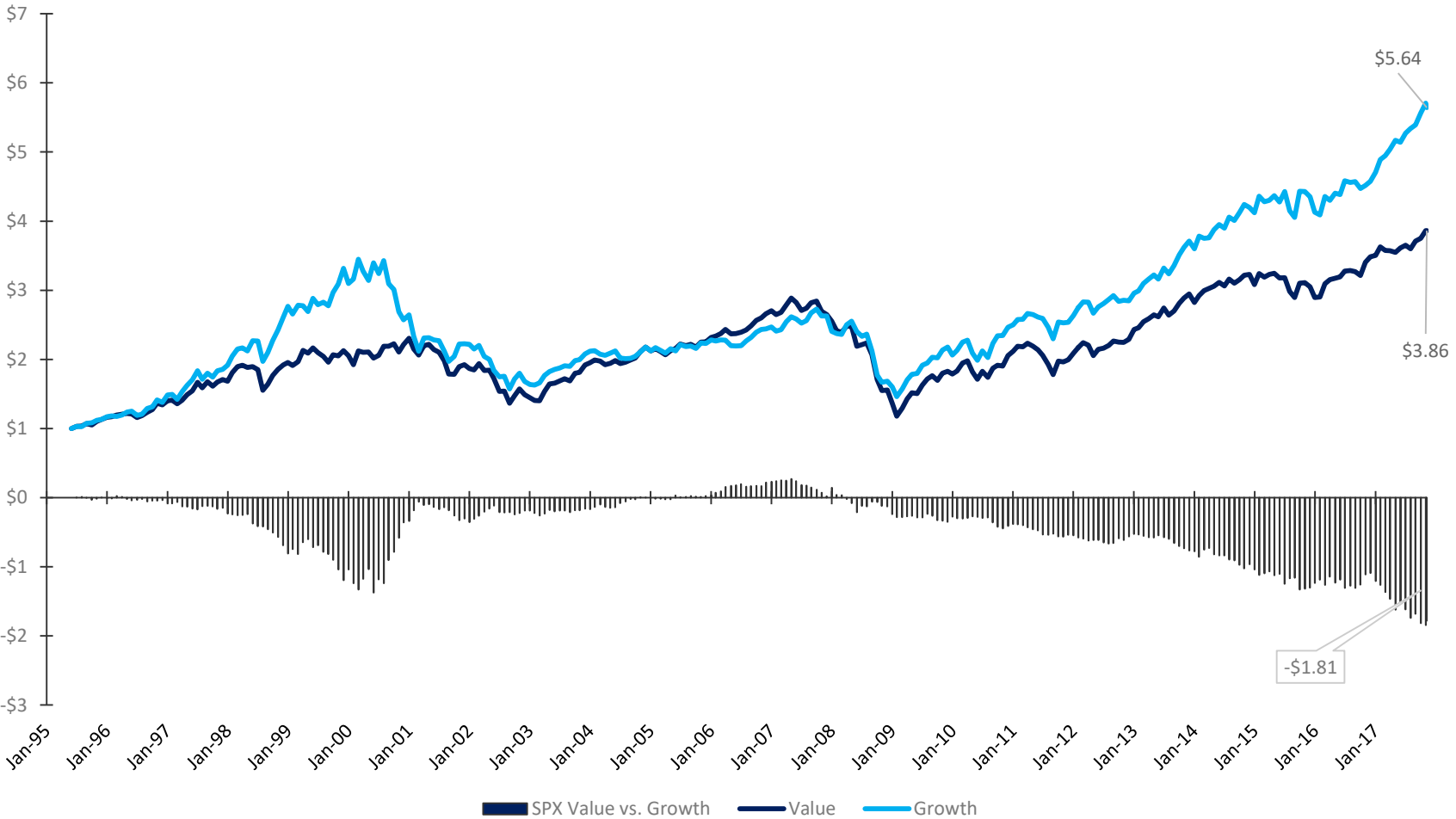


Trailing 5yr Annualized



Multiple Expansion

Growth vs. Value



Performance Update

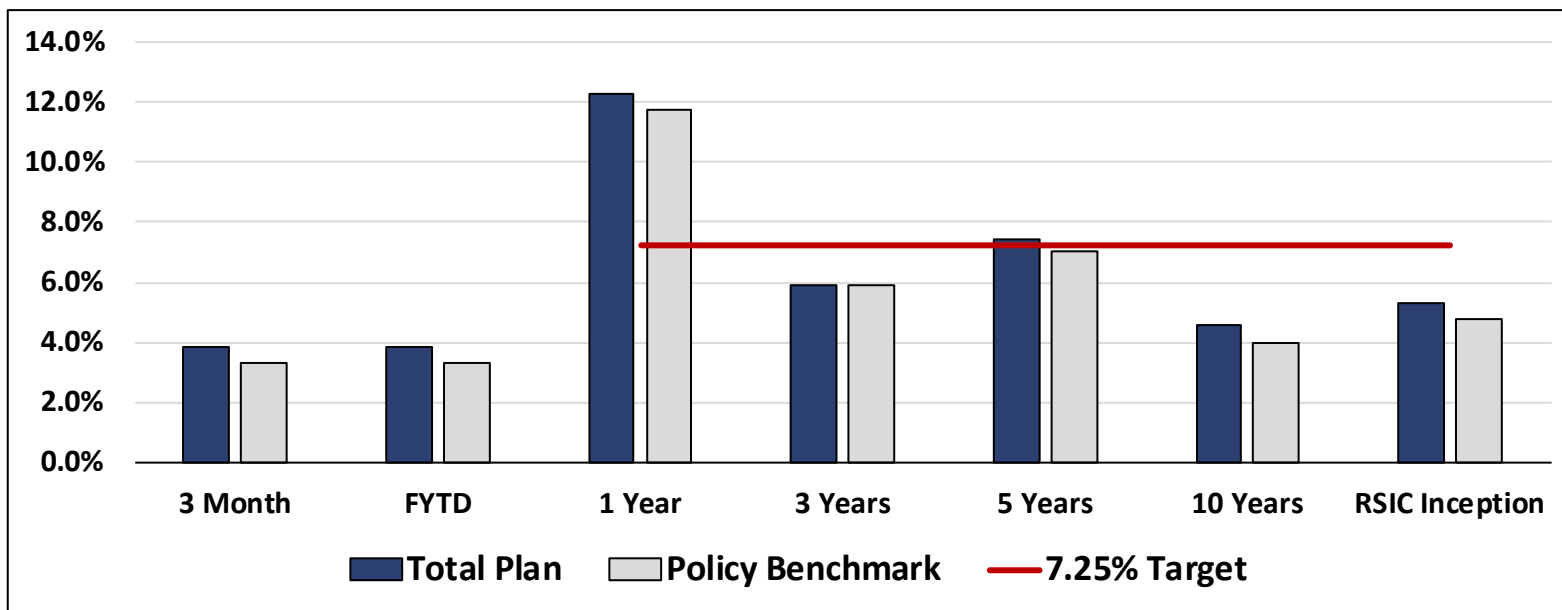
RSIC Commission Meeting

December 7, 2017

Data as of September 30, 2017

Performance– Plan & Policy Benchmark²

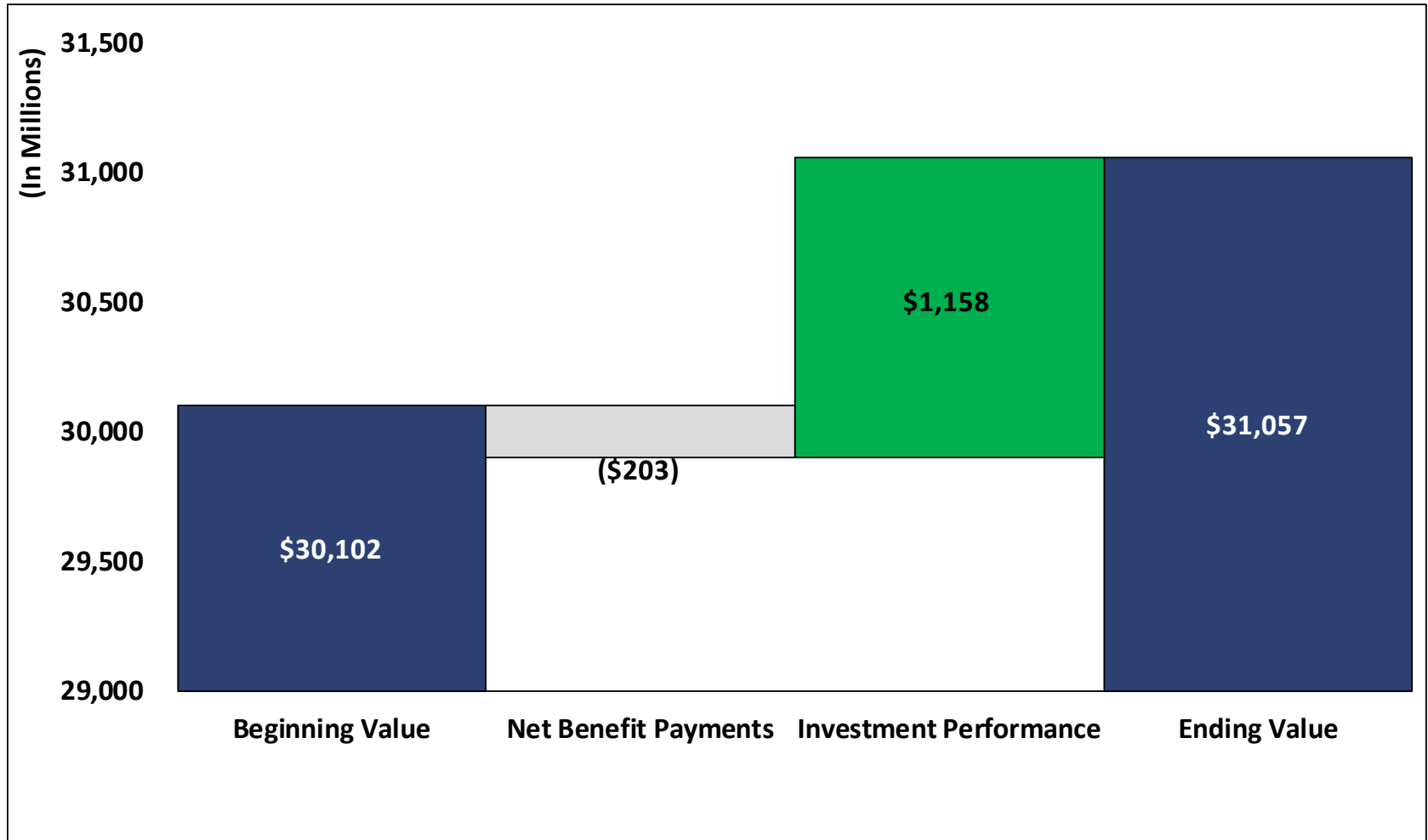
As of September 30, 2017



Historic Plan Performance As of 09/30/17	Market Value (In Millions)	Annualized						
		3 Month	FYTD	1 Year	3 Years	5 Years	10 Years	RSIC Inception
Total Plan	\$31,057	3.84%	3.84%	12.25%	5.90%	7.40%	4.55%	5.31%
Policy Benchmark		3.29%	3.29%	11.76%	5.91%	7.00%	3.95%	4.78%
Excess Return		0.55%	0.55%	0.49%	-0.01%	0.40%	0.60%	0.53%
Net Benefit Payments (In Millions)		(\$203)	(\$203)	(\$1,032)	(\$3,166)	(\$5,183)	(\$9,685)	(\$11,453)

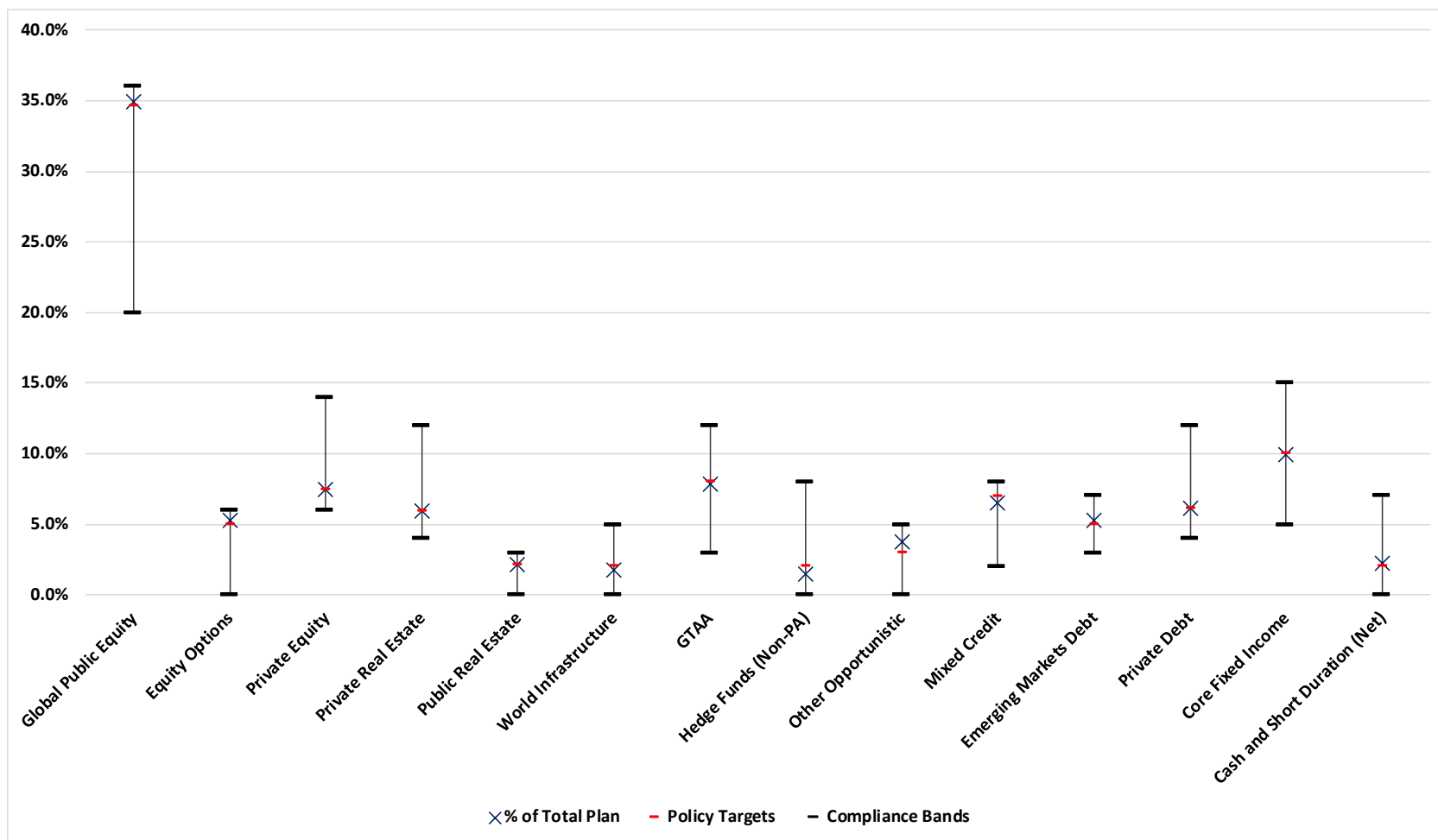
FYTD Benefits & Performance²

As of September 30, 2017



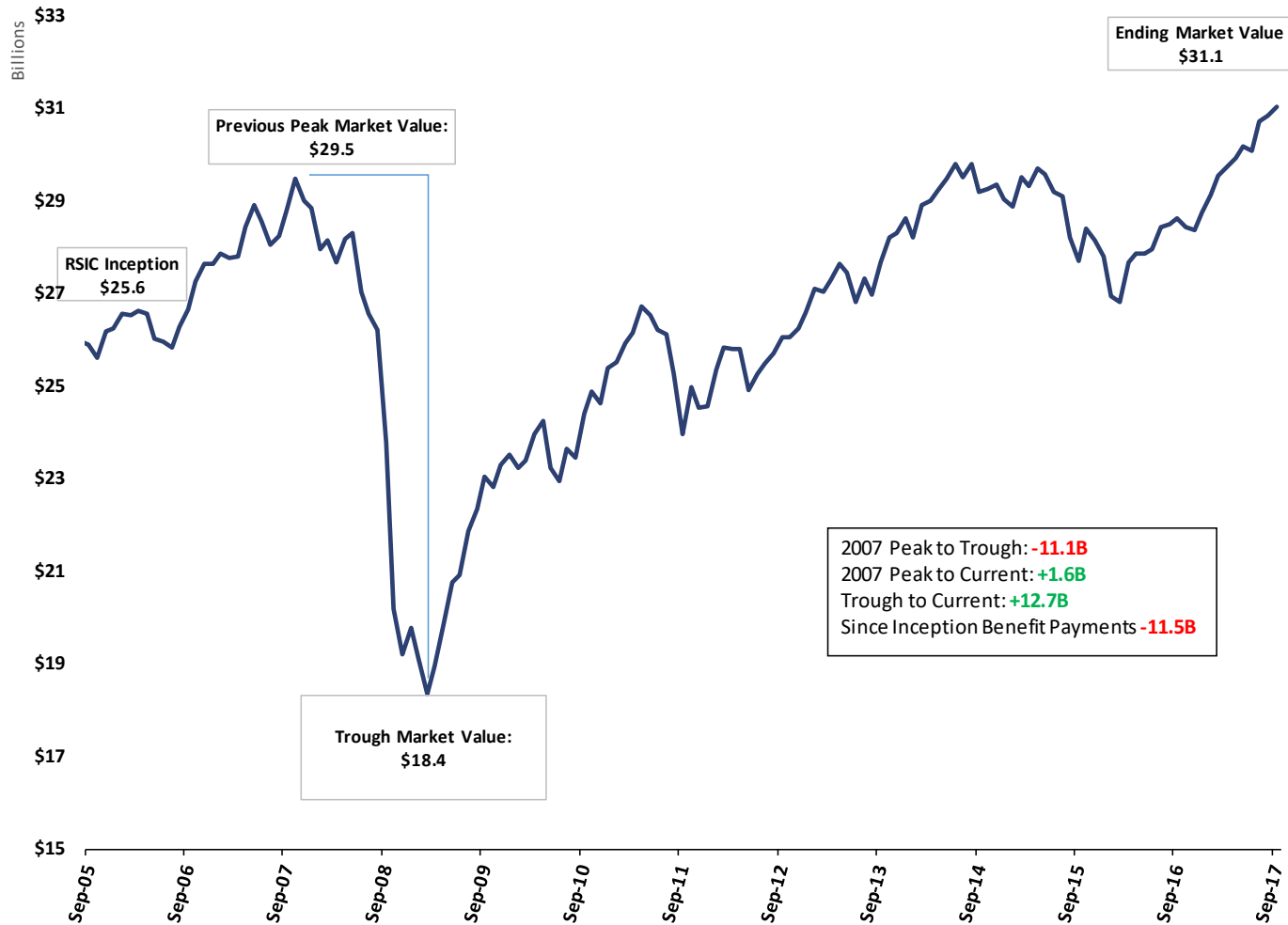
Portfolio Exposure & Policy Weights 4,8

As of September 30, 2017



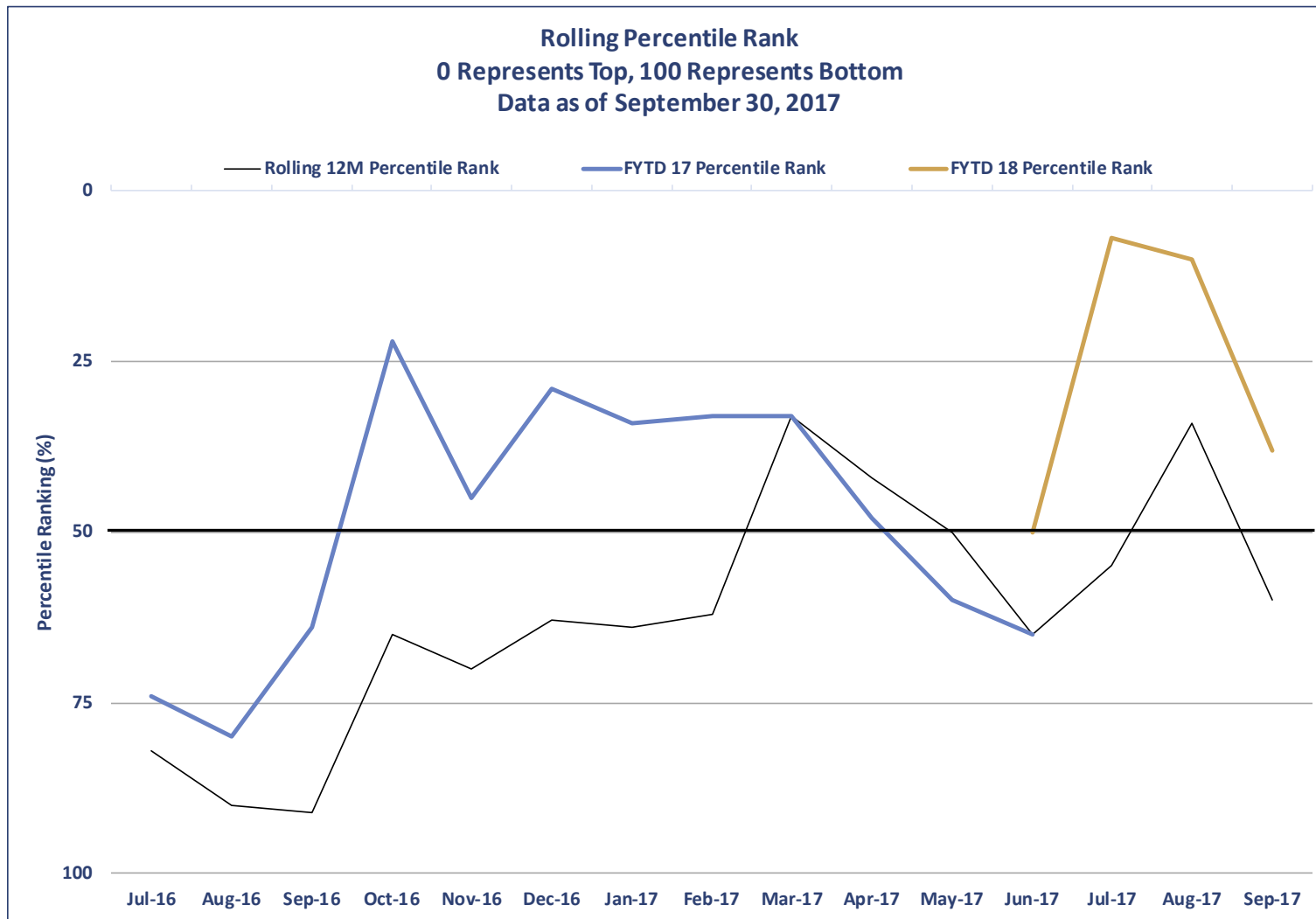
RSIC Market Value Through Time

As of September 30, 2017



STATE OF SOUTH CAROLINA

As of September 30, 2017



STATE OF SOUTH CAROLINA

Performance– Plan & Asset Classes^{1,3,4,10}

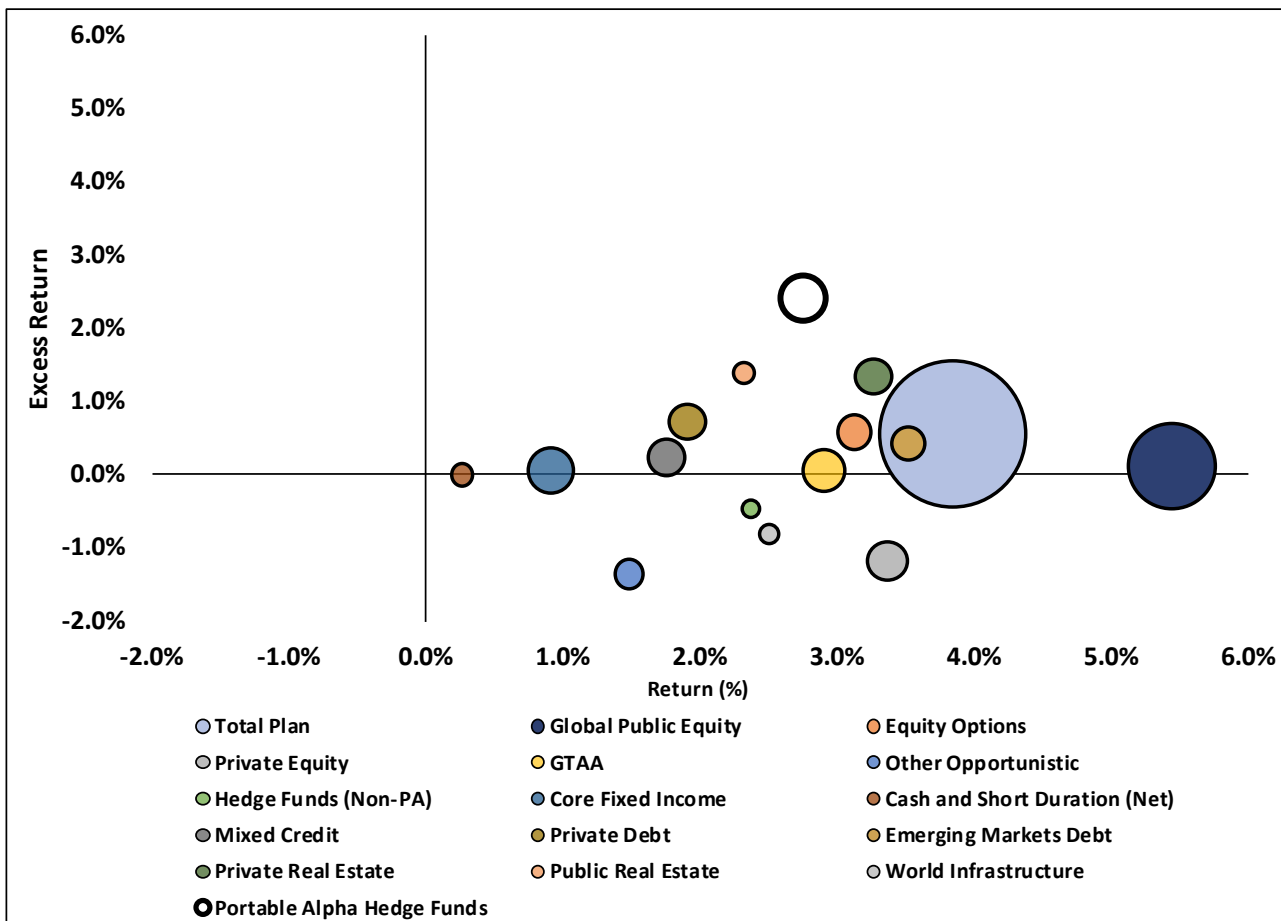
As of September 30, 2017

Asset Class / Benchmark returns as of 09/30/17	Plan Weight	Annualized				
		FYTD	YTD	1 Year	3 Years	5 Years
Total Plan	100.0%	3.84%	10.78%	12.25%	5.90%	7.40%
Policy Benchmark		3.29%	10.90%	11.76%	5.91%	7.00%
Global Public Equity	34.9%	5.44%	17.21%	18.95%	7.43%	10.63%
<i>Global Public Equity Blend</i>		5.32%	17.24%	18.73%	7.55%	10.27%
Equity Options	5.2%	3.12%	10.02%	12.40%	n/a	n/a
<i>CBOE S&P 500 BuyWrite Index (BXM)</i>		2.54%	9.93%	12.84%	n/a	n/a
Private Equity	7.4%	3.36%	10.82%	16.06%	9.61%	13.58%
<i>Private Equity Blend</i>		4.54%	15.58%	21.92%	10.53%	16.44%
GTAA	7.8%	2.90%	8.35%	7.66%	3.52%	4.42%
<i>GTAA Blend</i>		2.84%	9.42%	8.80%	4.91%	5.59%
Other Opportunistic	3.7%	1.48%	-1.77%	-0.07%	n/a	n/a
<i>50% MSCI World / 50% Barclays Aggregate</i>		2.84%	9.42%	8.80%	n/a	n/a
Hedge Funds (Non-PA)	1.5%	2.37%	4.54%	7.08%	n/a	n/a
<i>50% MSCI World / 50% Barclays Aggregate</i>		2.84%	9.42%	8.80%	n/a	n/a
Core Fixed Income	9.9%	0.91%	3.23%	0.28%	2.59%	2.02%
<i>Barclays US Aggregate Bond Index</i>		0.85%	3.14%	0.07%	2.71%	2.06%
Cash and Short Duration (Net)	2.1%	0.26%	0.57%	0.66%	0.32%	0.22%
<i>Merrill Lynch 3-Month T-Bill</i>		0.26%	0.57%	0.66%	0.32%	0.22%
Mixed Credit	6.5%	1.75%	5.36%	7.85%	2.98%	4.31%
<i>Mixed Credit Blend</i>		1.51%	4.97%	7.08%	5.25%	4.86%
Private Debt	6.1%	1.90%	2.78%	7.55%	4.28%	8.11%
<i>S&P/LSTA Leveraged Loan + 150 Bps on a 3-month lag</i>		1.18%	5.34%	8.92%	4.86%	6.08%
Emerging Markets Debt	5.2%	3.51%	13.10%	7.92%	4.92%	2.67%
<i>Emerging Markets Debt Blend</i>		3.09%	11.61%	5.98%	3.41%	2.02%
Private Real Estate	5.9%	3.26%	7.46%	9.68%	12.83%	15.33%
<i>NCREIF ODCE + 75 Bps</i>		1.92%	6.13%	8.62%	12.09%	12.54%
Public Real Estate	2.1%	2.32%	4.48%	0.85%	n/a	n/a
<i>FTSE NAREIT Equity REITs Index</i>		0.94%	3.67%	0.67%	n/a	n/a
World Infrastructure	1.7%	2.50%	13.05%	6.61%	n/a	n/a
<i>Dow Jones Brookfield Global Infrastructure Net Index</i>		3.30%	15.21%	9.16%	n/a	n/a
Ported Cash	3.8%	0.26%	0.57%	0.66%	n/a	n/a
<i>3 Month LIBOR</i>		0.33%	0.88%	1.11%	n/a	n/a
Ported Short Duration	4.2%	0.52%	1.59%	1.57%	n/a	n/a
<i>3 Month LIBOR</i>		0.33%	0.88%	1.11%	n/a	n/a
Portable Alpha Hedge Funds	9.5%	2.75%	3.22%	7.83%	n/a	n/a
<i>3 Month LIBOR</i>		0.33%	0.88%	1.11%	n/a	n/a

STATE OF SOUTH CAROLINA

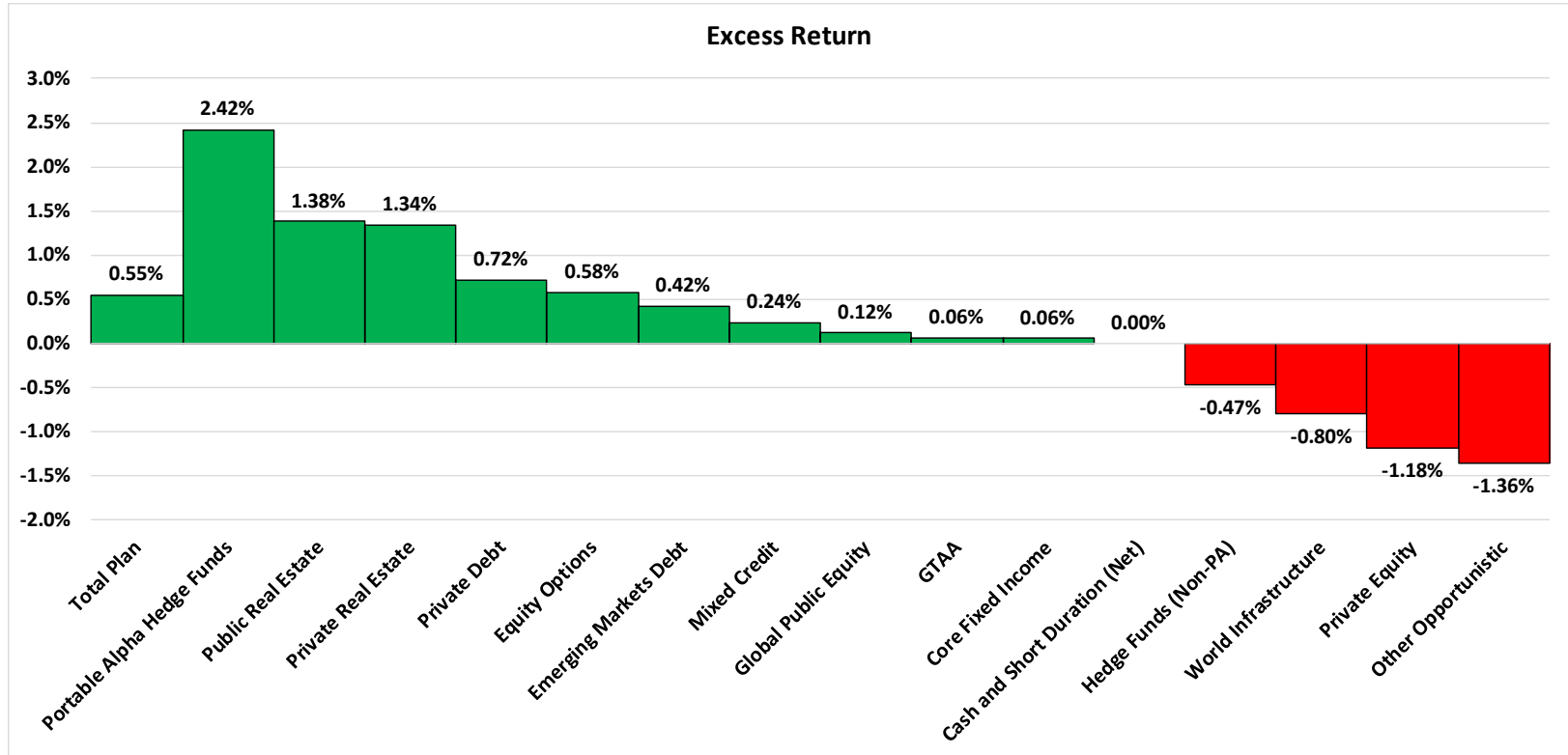
Asset Class Return & Excess^{3,4,10}

FYTD as of September 30, 2017



Relative Performance to Policy Benchmarks^{3,4,10}

FYTD as of September 30, 2017



Attribution of Excess Returns^{1,3,4,7,10}

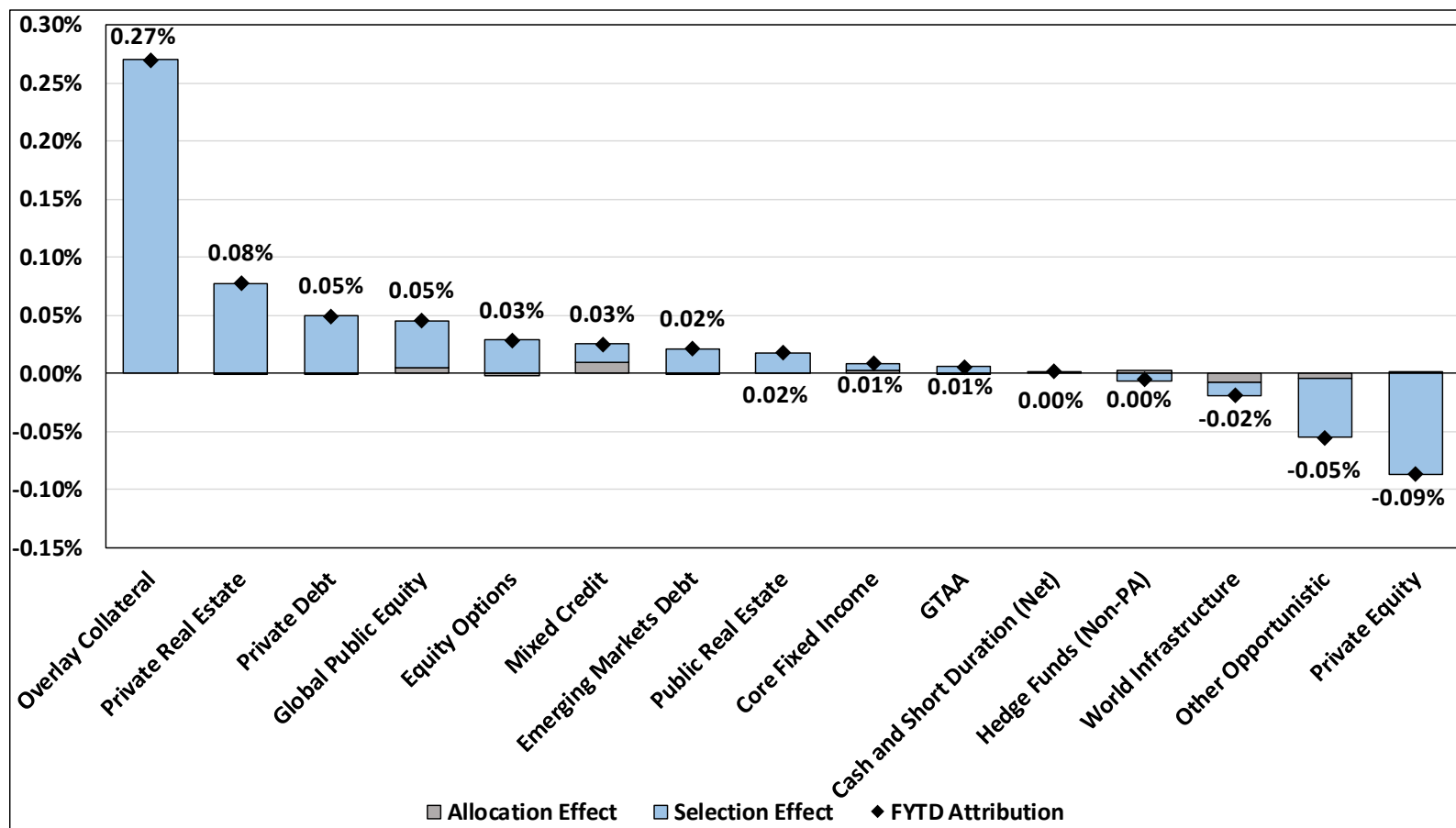
FYTD as of September 30, 2017

	Total Attribution	Allocation Effect	Selection Effect	Average O/U Weight	Asset Class FY Return	Asset Class BM Return
Fiscal Year Attribution						
Private Real Estate	0.08%	0.00%	0.08%	-0.02%	3.26%	1.92%
Private Debt	0.05%	0.00%	0.05%	0.25%	1.90%	1.18%
Global Public Equity	0.05%	0.01%	0.04%	0.18%	5.44%	5.32%
Equity Options	0.03%	0.00%	0.03%	0.22%	3.12%	2.54%
Mixed Credit	0.03%	0.01%	0.02%	-0.52%	1.75%	1.51%
Emerging Markets Debt	0.02%	0.00%	0.02%	0.22%	3.51%	3.09%
Public Real Estate	0.02%	0.00%	0.02%	0.00%	2.32%	0.94%
Core Fixed Income	0.01%	0.00%	0.01%	-0.12%	0.91%	0.85%
GTAA	0.01%	0.00%	0.01%	0.02%	2.90%	2.84%
Cash and Short Duration (Net)	0.00%	0.00%	0.00%	-0.12%	0.26%	0.26%
Hedge Funds (Non-PA)	0.00%	0.00%	-0.01%	-0.52%	2.37%	2.84%
World Infrastructure	-0.02%	-0.01%	-0.01%	-0.50%	2.50%	3.30%
Other Opportunistic	-0.05%	0.00%	-0.05%	0.96%	1.48%	2.84%
Private Equity	-0.09%	0.00%	-0.09%	-0.06%	3.36%	4.54%
Overlay Collateral	0.27%	0.00%	0.27%	n/a	1.62%	0.00%
Portable Alpha Hedge Funds	0.23%	0.00%	0.23%	n/a	2.75%	0.00%
Ported Short Duration	0.02%	0.00%	0.02%	n/a	0.52%	0.00%
Ported Cash	0.02%	0.00%	0.02%	n/a	0.26%	0.00%
	Total Plan Excess Return	Allocation Effect	Selection Effect	Interaction / Other	RSIC Return	RSIC Policy Benchmark Return
FYTD Total	0.55%	0.01%	0.38%	0.15%	3.84%	3.29%

STATE OF SOUTH CAROLINA

Attribution of Excess Returns^{1,3,4,7,10}

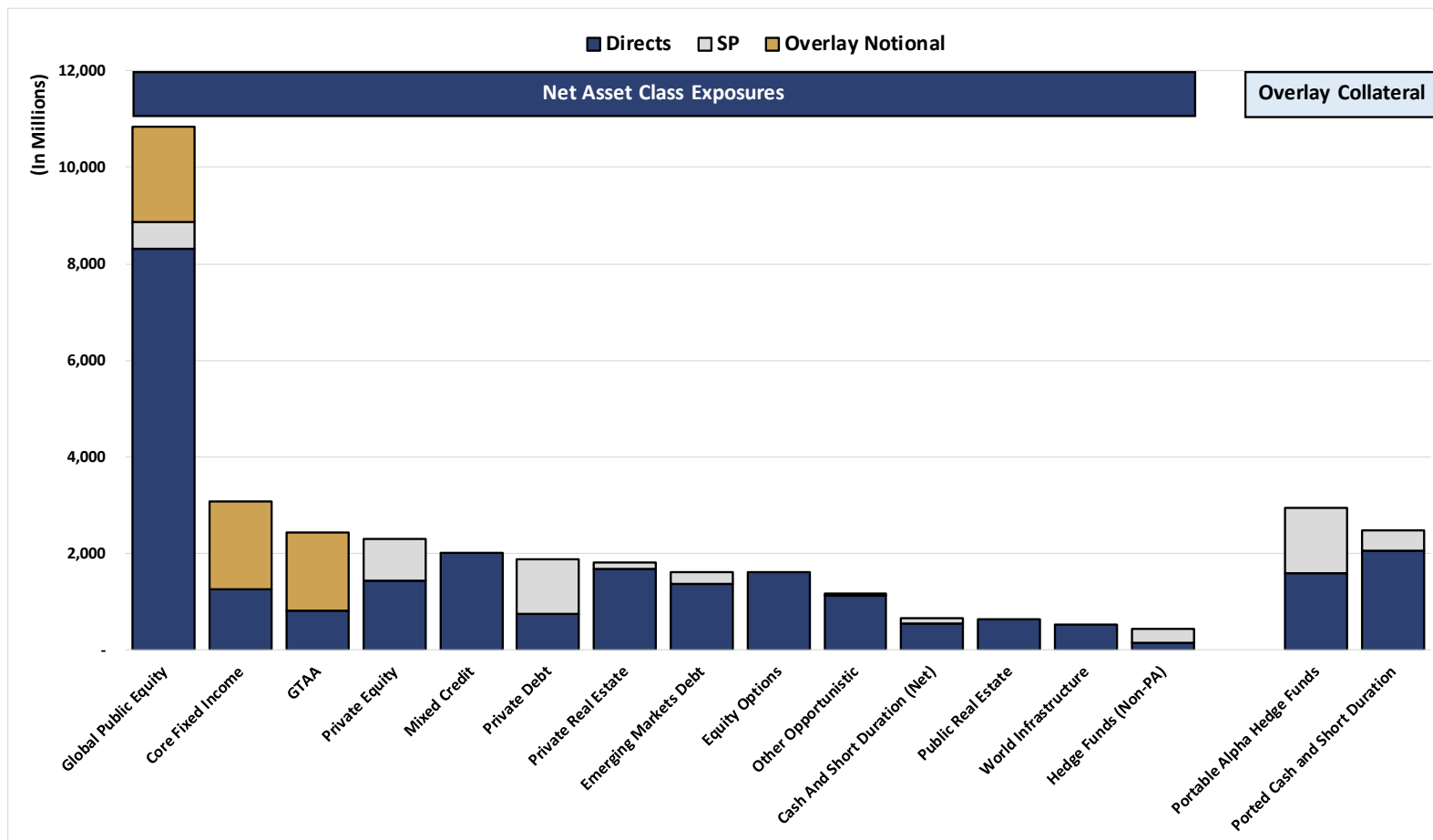
FYTD as of September 30, 2017



Appendix

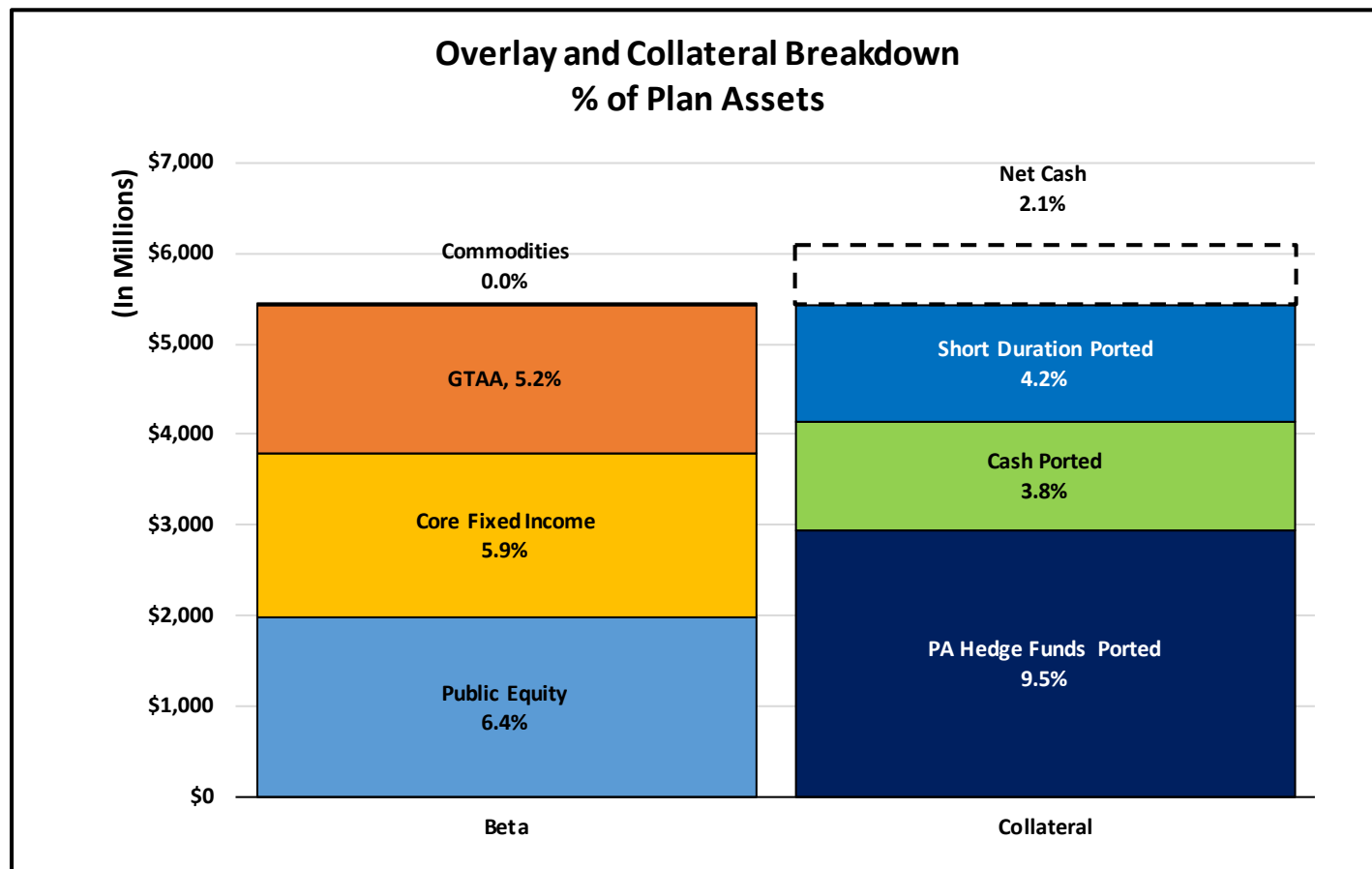
Asset Class Composition By Implementation⁴

As of September 30, 2017



Overlay Percentage by Asset Class⁶

As of September 30, 2017



Portfolio Exposures^{4,8}

As of September 30, 2017

Asset Allocation	Market Value as of 09/30/17	Overlay Exposures	Net Position	% of Total Plan	Policy Targets	Difference	Allowable Ranges	SIOP Compliance
Global Equity	12,778		14,757	47.5%	47.0%	0.5%	42% - 52%	YES
Global Public Equity	8,857	1,979	10,837	34.9%	34.6%	0.3%	20% - 36%	YES
Equity Options	1,626		1,626	5.2%	5.0%	0.2%	0% - 6%	YES
Private Equity	2,294	0	2,294	7.4%	7.4%	0.0%	6% - 14%	YES
Real Assets	2,994		2,994	9.6%	10.0%	-0.4%	8% - 14%	YES
Private Real Estate	1,827		1,827	5.9%	5.9%	0.0%	4% - 12%	YES
Public Real Estate	639		639	2.1%	2.1%	-0.1%	0% - 3%	YES
World Infrastructure	528		528	1.7%	2.0%	-0.3%	0% - 5%	YES
Opportunistic	2,411		4,039	13.0%	13.0%	0.0%	9% - 19%	YES
GTAA	808	1,623	2,431	7.8%	8.0%	-0.2%	3% - 12%	YES
Hedge Funds (Non-PA)	450		450	1.5%	2.0%	-0.5%	0% - 8%	YES
Other Opportunistic	1,152	6	1,157	3.7%	3.0%	0.7%	0% - 5%	YES
Diversified Credit	5,522		5,522	17.8%	18.0%	-0.2%	15% - 21%	YES
Mixed Credit	2,007		2,007	6.5%	6.9%	-0.5%	2% - 8%	YES
Emerging Markets Debt	1,626		1,626	5.2%	5.0%	0.2%	3% - 7%	YES
Private Debt	1,888		1,888	6.1%	6.1%	0.0%	4% - 12%	YES
Conservative Fixed Income	4,403		3,745	12.1%	12.0%	0.1%	10% - 16%	YES
Core Fixed Income	1,256	1,821	3,078	9.9%	10.0%	-0.1%	5% - 15%	YES
Cash and Short Duration (Net)	3,146	-2,479	668	2.1%	2.0%	0.1%	0% - 7%	YES
Portable Alpha Hedge Funds	2,950	-2,950	0	9.5%*	n/a	n/a	0% - 12%	YES
Total Plan	\$31,057	-	\$31,057	100.0%				
Total Hedge Funds	3,642	-	\$3,642	11.7%	n/a	n/a	0% - 20%	YES
Total Private Markets	6,010	-	\$6,010	19.4%	n/a	n/a	14% - 25%	YES

Total Hedge Fund exposure: 11.7% and consisted of: 9.5% Portable Alpha Hedge Funds, 0.8% to a hedge fund in Mixed Credit, and 1.5% Hedge Funds (Non-PA). *Portable Alpha Hedge Funds are expressed as gross exposure but employed in conjunction with the Overlay Program and are offset when looking at total plan market value.

STATE OF SOUTH CAROLINA

Performance Update

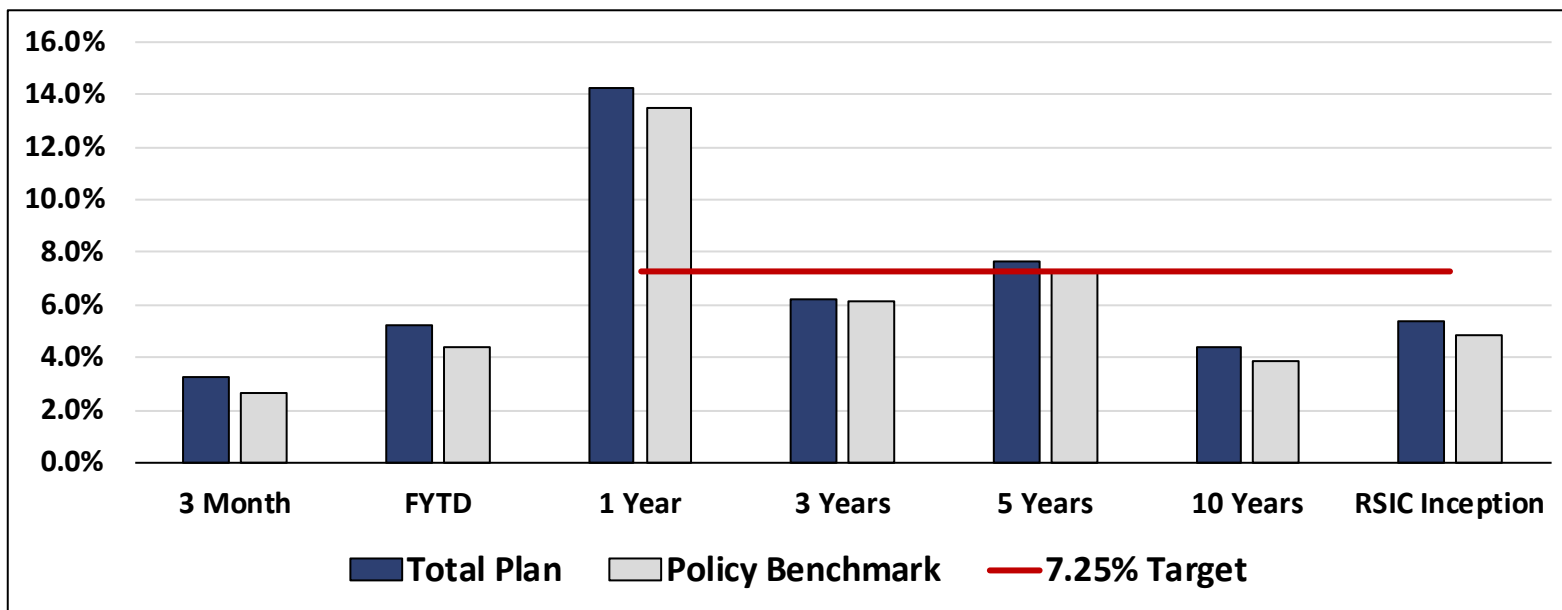
RSIC Commission Meeting

December 7, 2017

Data as of October 31, 2017

Performance– Plan & Policy Benchmark²

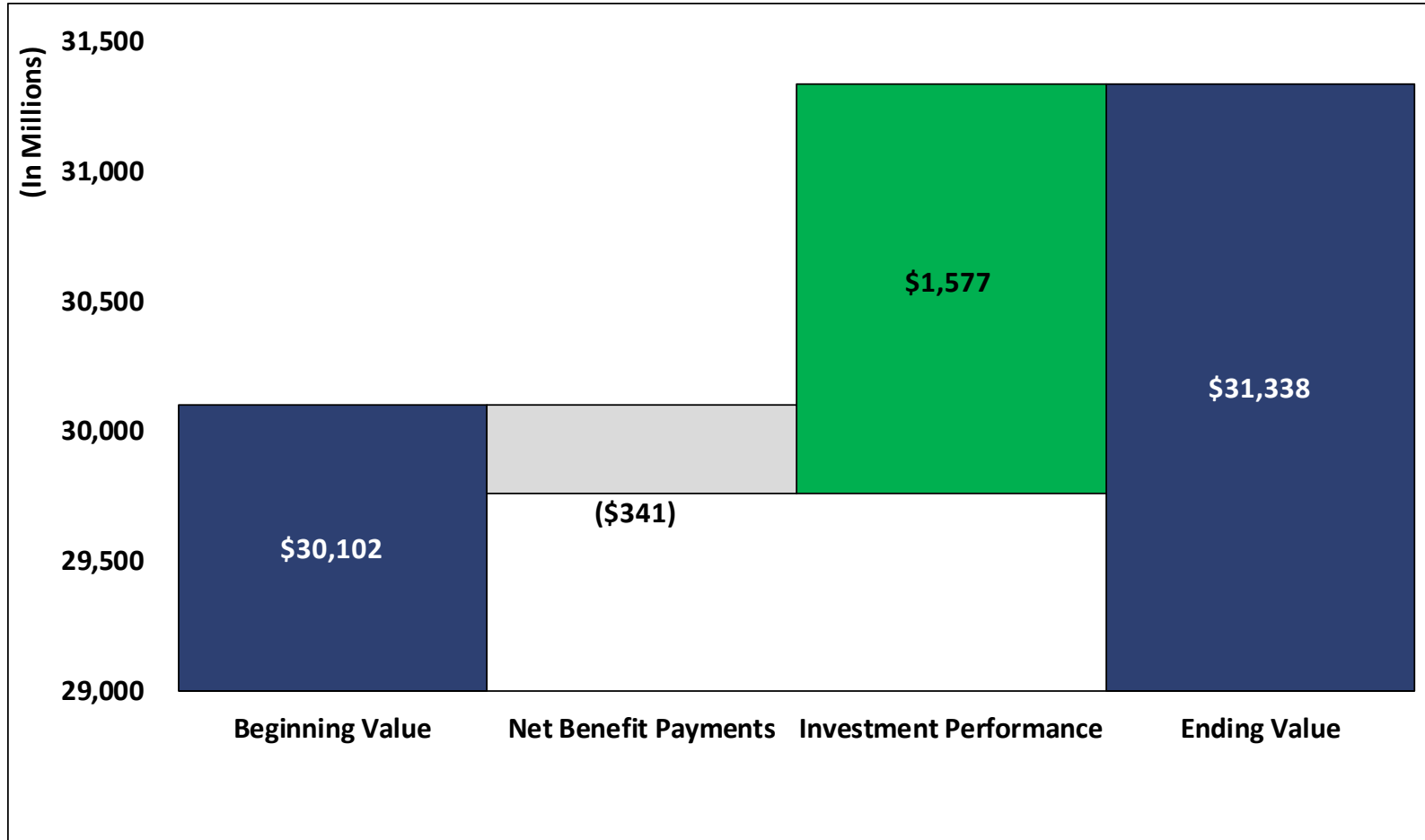
As of October 31, 2017



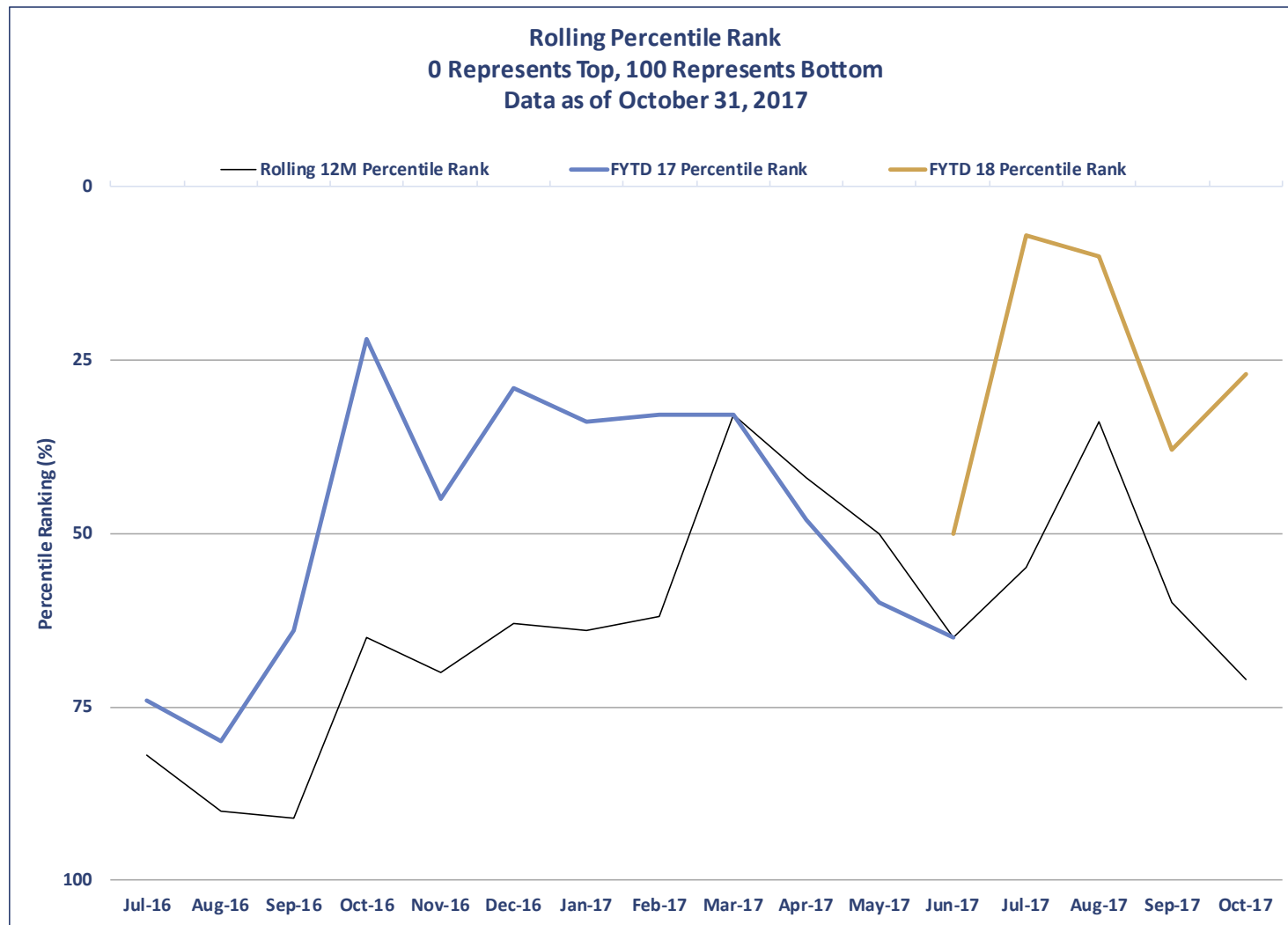
Historic Plan Performance As of 10/31/17	Market Value (In Millions)	Annualized						RSIC Inception
		3 Month	FYTD	1 Year	3 Years	5 Years	10 Years	
Total Plan	\$31,338	3.24%	5.23%	14.27%	6.21%	7.64%	4.43%	5.39%
Policy Benchmark		2.68%	4.36%	13.50%	6.17%	7.26%	3.84%	4.83%
Excess Return		0.56%	0.88%	0.77%	0.04%	0.38%	0.59%	0.55%
Net Benefit Payments (In Millions)		(\$363)	(\$341)	(\$1,090)	(\$3,231)	(\$5,269)	(\$9,772)	(\$11,590)

FYTD Benefits & Performance ²

As of October 31, 2017



As of October 31, 2017



STATE OF SOUTH CAROLINA

Footnotes

1. Represents asset class benchmarks as of reporting date. Benchmarks for asset classes may have changed over time.
2. Benefit payments are net of Plan contributions and disbursements.
3. "Cash" market value is the aggregate cash held at the custodian, Russell Investments, and strategic partnerships. Cash performance is estimated using the BofA Merrill Lynch 3-Month T-Bill rate.
4. Asset class exposures and returns include blended physical and synthetic returns and notional values (EM Debt, GTAA, Global Public Equity, Real Estate, Core Fixed Income, Private Equity, and Commodities).
5. Performance contribution methodology: Contribution is calculated by taking the sum of the [beginning weight] X [monthly return].
6. Source: Russell Investments; Net notional exposure.
7. Allocation Effect: $[\text{Asset Class Weight} - \text{Policy Weight}] * [\text{Benchmark Return} - \text{Plan Policy Benchmark}]$
Selection Effect: $[\text{Asset Class Return} - \text{Policy Benchmark Return}] * \text{Asset Class Weight in Plan}$
8. The target weights to Private Equity, Private Debt, and Private Real Estate will be equal to their actual weights, reported by the custodial bank, as of the prior month end. When flows have occurred in the asset classes, flow adjusted weights are used to more accurately reflect the impact of the asset class weights. In the case of Private Equity, the use of the flow adjusted weight will affect the target allocation to Public Equity, such that the combined target weight of both asset classes shall equal 42% of the Plan. For Private Debt, the use of the flow adjusted weight will affect the target allocation to Mixed Credit, such that the combined target weight of both asset classes shall equal 13% of the Plan. For Private Real Estate, the use of the flow adjusted weight will affect the target allocation to Public Real Estate, such that the combined target weight of both asset classes shall equal 8% of the Plan.
9. Policy Ending Value is an estimate of the Plan NAV had it earned the Policy Benchmark return.
10. Collateral held to support the overlay program represents opportunity cost associated with financing the overlay program. The Overlay collateral consists of Ported Cash, Ported Short Duration, and Portable Alpha Hedge Funds. The cost of holding these assets is proxied using 3 Month LIBOR. This benchmark is not a component of the Policy benchmark.
11. RSIC Peer Universe is Bank of New York Public Plans Greater than 5 Billion dollars. The universe includes fund returns that are gross of invoiced fees. The RSIC percentile rank represents the RSIC return gross of invoiced fees.

Disclosures

- Returns are provided by BNY Mellon and are time-weighted, total return calculations. Net of fee performance is calculated and presented after the deduction of fees and expenses. Periods greater than one year are annualized. Past performance is no guarantee of future results. Policy benchmark is the blend of asset class policy benchmarks using policy weights. Asset class benchmarks and policy weights are reviewed annually by the Commission's consultant and adopted by the Commission and have changed over time. The policy benchmark return history represents a blend of these past policies.
- Overlay allocation detail is provided by Russell Investments.
- This report was compiled by the staff of the South Carolina Retirement System Investment Commission and has not been reviewed, approved or verified by the external investment managers. No information contained herein should be used to calculate returns or compare multiple funds, including private equity funds.
- Effective October 1, 2005, the State Retirement System Preservation and Investment Reform Act ("Act 153") established the Commission and devolved fiduciary responsibility for investment and management of the assets of the South Carolina Retirement Systems upon RSIC.
- Allocation / exposure percentages might not add up to totals due to rounding.

Benchmarks

- **Global Public Equity Blend:**
7/2016 – Present: MSCI All-Country World Investable Markets Index (net of dividends)
Prior to 7/2016: MSCI All-Country World Index (net of dividends)
- **Equity Options Strategies:** CBOE S&P Buy Write Index (BXM)
- **Private Equity Blend:** 80% Russell 3000 Index on a 3-month lag / 20% MSCI EAFE (net of dividends) on a 3-month lag Plus 300 basis points
- **Core Fixed Income:** Bloomberg Barclays US Aggregate Bond Index
- **Emerging Market Debt:** 50% JP Morgan EMBI Global Diversified (US Dollar) / 50% JP Morgan GBIEM Global Diversified (Local)
- **Private Debt :** S&P/LSTA Leveraged Loan Index + 150 basis points on a 3-month lag
- **Mixed Credit Blend:**
7/2016 – Present: 1/2 Bloomberg Barclays US Corporate High Yield 2% Issuer Capped Bond Index
1/2 S&P/LSTA Leveraged Loan Index
Prior to 7/2016: 1/3 Bloomberg Barclays US Corporate High Yield 2% Issuer Capped Bond Index
1/3 S&P/LSTA Leveraged Loan Index
1/3 Bloomberg Barclays US Mortgage Backed Securities (MBS) Index
- **GTAA Blend:**
7/2016 – Present: 50% MSCI World Index (net of dividends)
50% Bloomberg Barclays US Aggregate Bond Index
Prior to 7/2016: 50% MSCI World Index (net of dividends)
50% Citi World Government Bond Index (WGBI)
- **Other Opportunistic:**
7/2016 – Present: 50% MSCI World Index (net of dividends)
50% Bloomberg Barclays US Aggregate Bond Index
- **Non PA Hedge Funds**
7/2016 – Present: 50% MSCI World Index (net of dividends)
50% Bloomberg Barclays US Aggregate Bond Index
- **Real Estate:** NCREIF Open-end Diversified Core (ODCE) Index + 75 basis points
- **Cash & Short Duration:** BofA Merrill Lynch 3-Month US Treasury Bill Index

FUND EVALUATION REPORT

South Carolina Retirement System

Performance Report
As of September 30, 2017



Confidentiality: This evaluation is prepared by Meketa Investment Group, Inc. for the exclusive use of the South Carolina Retirement System. This evaluation is not to be used for any other purpose or by any parties other than the System, their Board, employees, agents, attorneys, and/or consultants. No other parties are authorized to review or utilize the information contained herein without expressed written consent.

M E K E T A I N V E S T M E N T G R O U P

BOSTON
MASSACHUSETTS

CHICAGO
ILLINOIS

MIAMI
FLORIDA

PORTLAND
OREGON

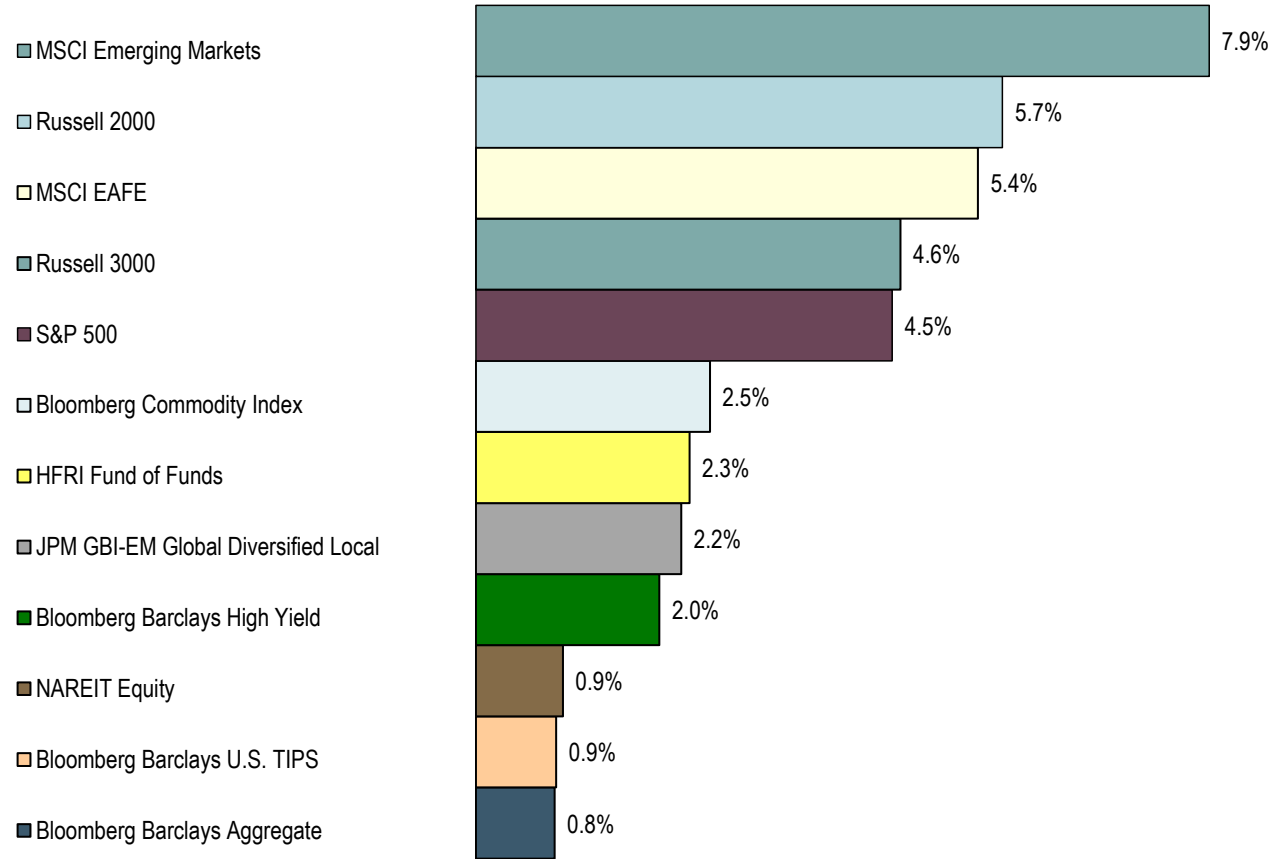
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Capital Markets Review

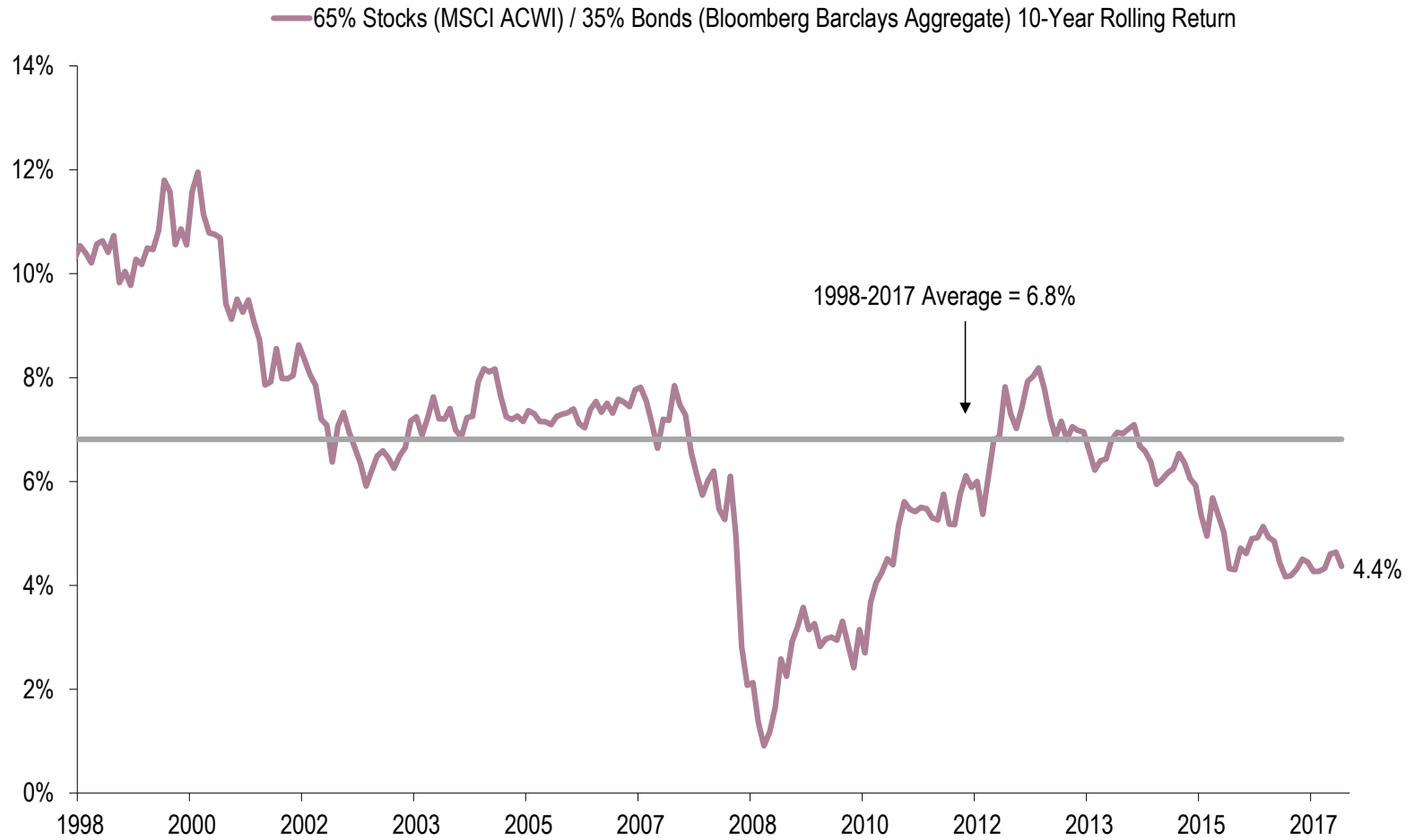
The World Markets¹ Third Quarter of 2017



¹ Source: InvestorForce.



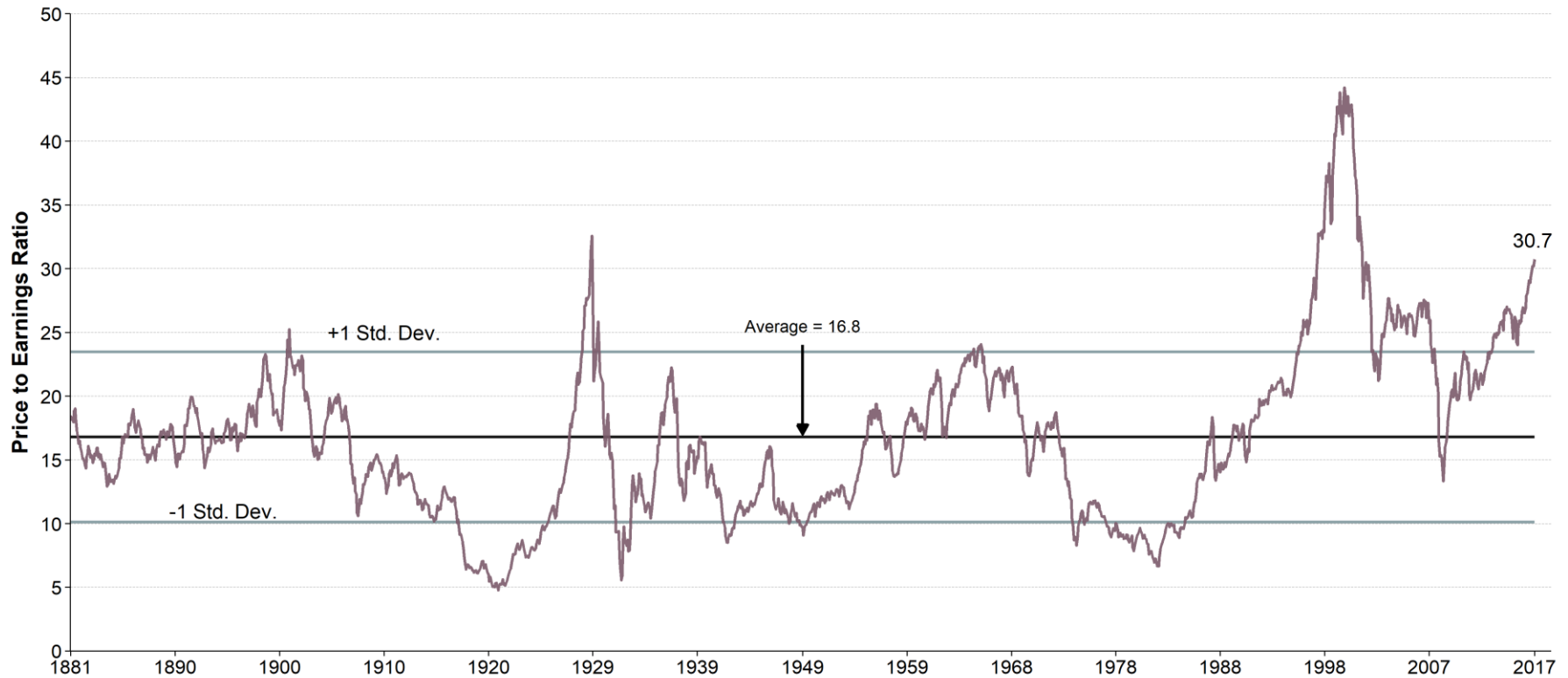
Rolling Ten-Year Returns: 65% Stocks and 35% Bonds¹



¹ Source: InvestorForce.



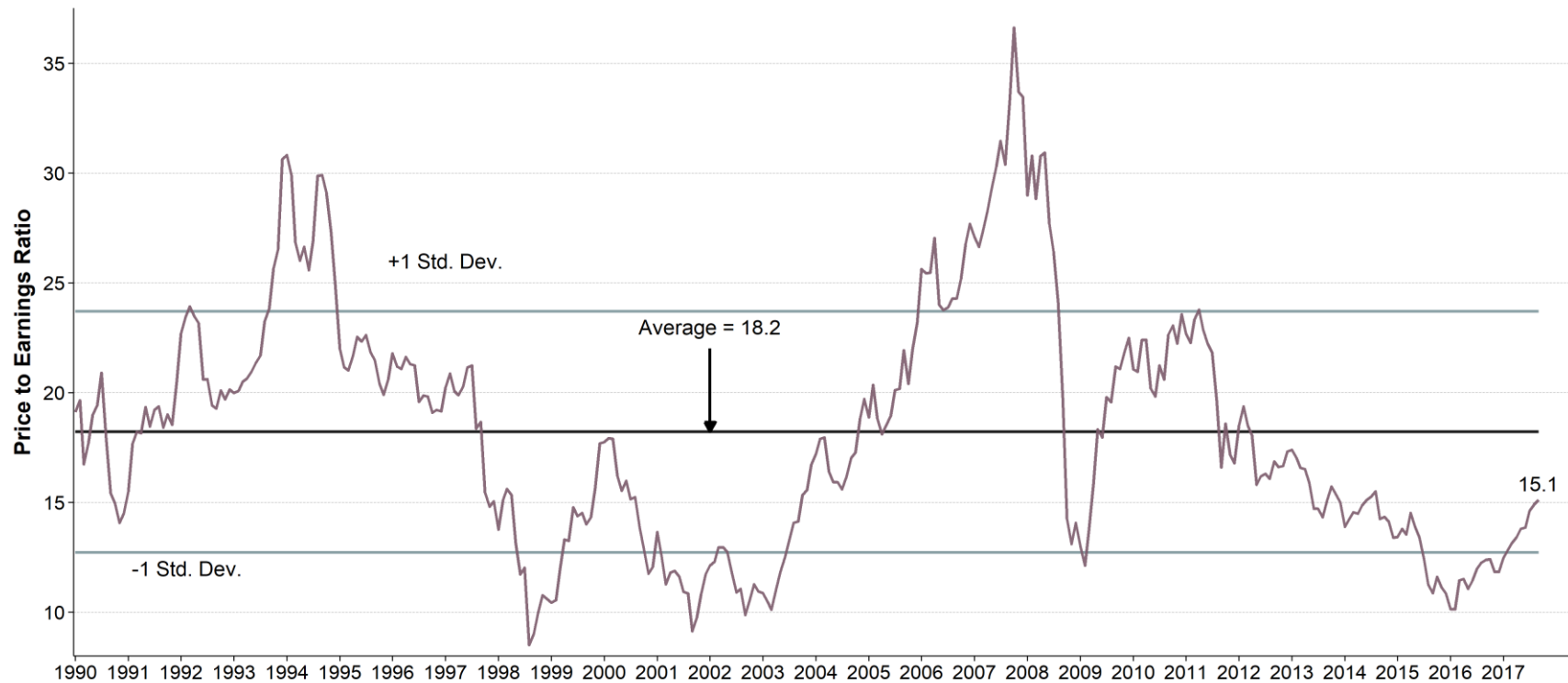
U.S. Equity Cyclically Adjusted P/E¹



- The cyclically adjusted P/E ratio for the S&P 500 was 30.7x which is above its average of 16.8x.
- Historically, a P/E ratio at this level has led to below average future returns over a 10 year horizon.

¹ Source: Robert Shiller and Yale University. Data is from January 31, 1881.

Emerging Market Equity Cyclically Adjusted P/E¹



- Emerging market equities (MSCI Emerging Markets) are priced slightly below their (brief) historical average.
- By this metric, emerging market equities are trading at a much lower valuation than U.S. equities, and at a slightly lower valuation than non-U.S. developed market equities.

¹ Source: MSCI and Bloomberg. Earnings figures represent the average of monthly "as reported" earnings over the previous ten years.

Ten-Year Treasury Yields¹



- The ten-year treasury yield was 2.3%, which is below the post-WWII average and above the 1.6% level of one year ago.
- The path of central bank interest rates remains at the center of market focus.
 - The Federal Reserve has announced it will begin to reduce the size of its balance sheet. This will ‘normalize’ the balance sheet.

¹ Source: U.S. Treasury.

Retirement System Performance Summary

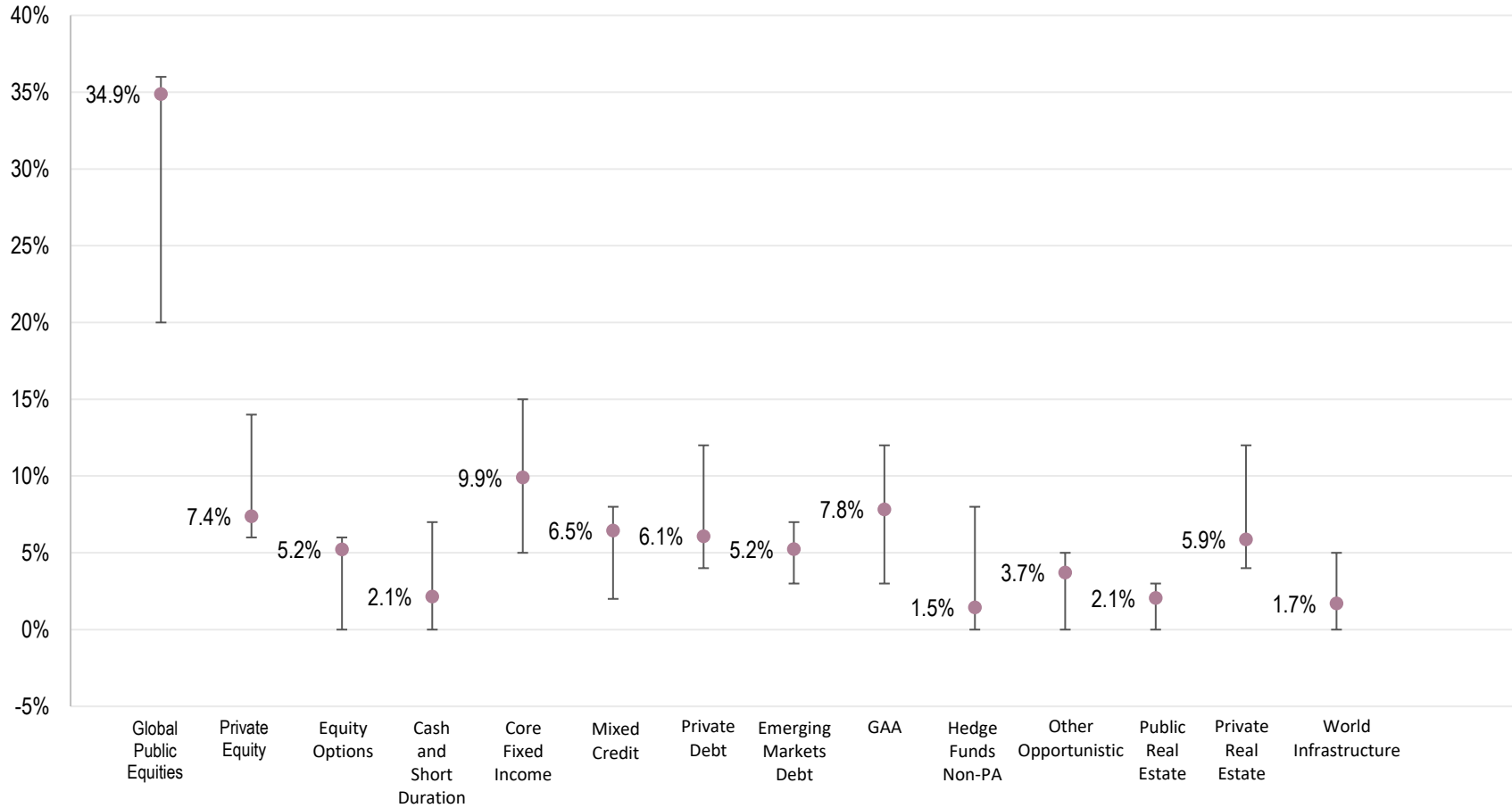
As of September 30, 2017

Allocation vs. Targets and Policy								
	MV at 9/30/17	Overlay Exposures	Net Position	% of Total System	% of Total System (Net)	FY 17-18 (a) Policy Targets	Allowable Ranges	SIOP Compliance?
Total System	31,057,035,714	-	31,057,035,714	100%	100%	100%	-	-
Equity	12,778,394,141	1,979,106,251	14,757,500,392	41%	48%	47%	42-52%	Yes
Global Equity	8,857,942,782	1,979,106,251	10,837,049,033	29%	35%	35%	20-36%	Yes
Private Equity	2,294,439,362	-	2,294,439,362	7%	7%	7%	6-14%	Yes
Equity Options	1,626,011,997	-	1,626,011,997	5%	5%	5%	0-6%	Yes
Conservative Fixed Income	4,402,096,627	(657,414,369)	3,744,682,258	14%	12%	12%	10-16%	Yes
Cash and Short Duration	3,145,740,975	(2,478,703,219)	667,037,755	10%	2%	2%	0-7%	Yes
Core Fixed Income	1,256,355,652	1,821,288,851	3,077,644,503	4%	10%	10%	5-15%	Yes
Diversified Credit	5,521,877,968	-	5,521,877,968	18%	18%	18%	15-21%	Yes
Mixed Credit	2,007,115,078	-	2,007,115,078	6%	6%	7%	2-8%	Yes
Private Debt	1,888,479,675	-	1,888,479,675	6%	6%	6%	4-12%	Yes
Emerging Markets Debt	1,626,283,215	-	1,626,283,215	5%	5%	5%	3-7%	Yes
Opportunistic	2,410,619,685	1,628,448,912	4,039,068,597	8%	13%	13%	9-19%	Yes
GAA	808,158,304	1,622,939,767	2,431,098,071	3%	8%	8%	3-12%	Yes
Hedge Funds Non-PA	450,481,695	-	450,481,695	1%	1%	2%	0-8%	Yes
Other Opportunistic	1,151,979,686	5,509,145	1,157,488,831	4%	4%	3%	0-5%	Yes
Real Assets	2,993,906,499	-	2,993,906,499	10%	10%	10%	8-14%	Yes
Public Real Estate	638,986,447	-	638,986,447	2%	2%	2%	0-3%	Yes
Private Real Estate	1,826,641,034	-	1,826,641,034	6%	6%	6%	4-12%	Yes
World Infrastructure	528,279,018	-	528,279,018	2%	2%	2%	0-5%	Yes
Hedge Funds PA	2,950,140,794	(2,950,140,794)	-	9%	0%	NA	0-12%	Yes

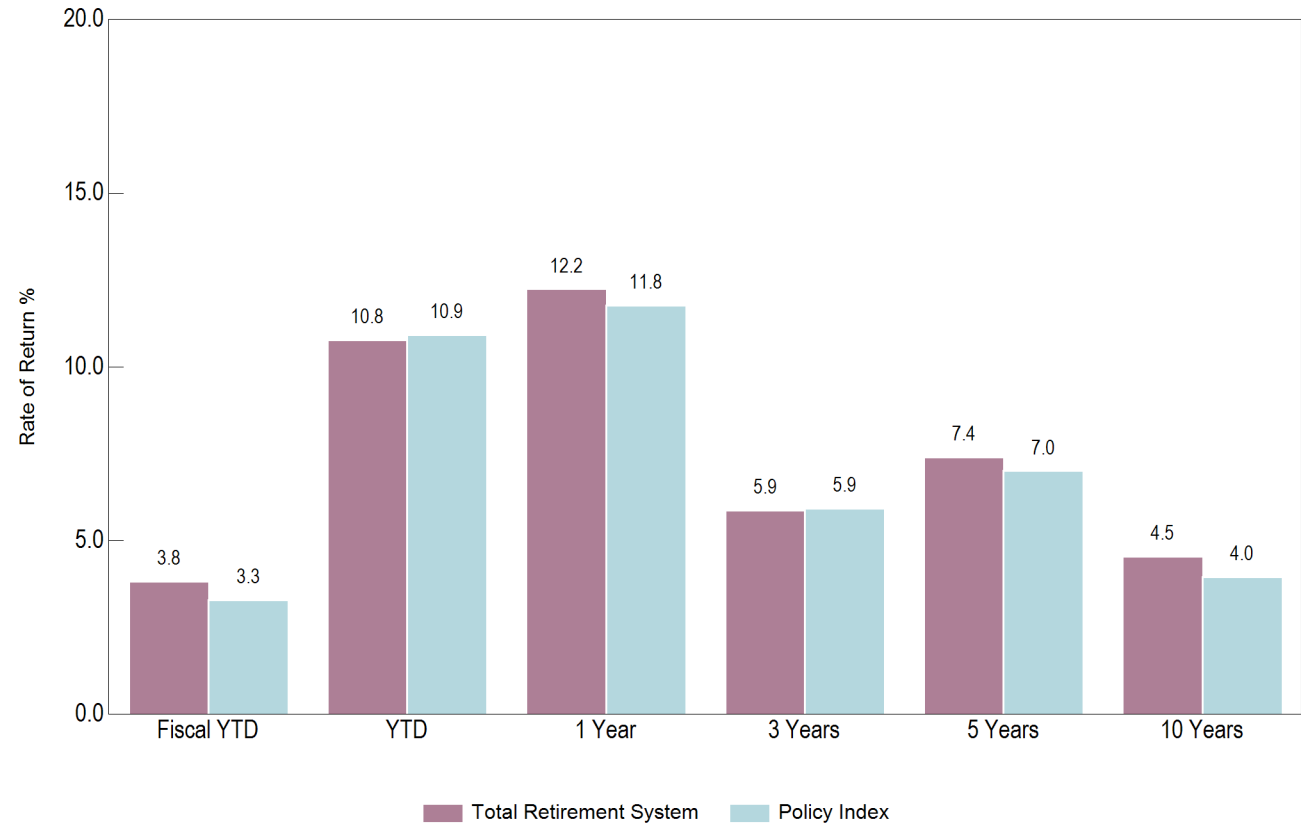
Includes cash in the Russell Overlay separate account.
Percentages may not sum to 100 due to rounding.



Actual vs. Policy Ranges: (Including Overlay)



Net Return Summary
Ending September 30, 2017



South Carolina Retirement System Investment Commission

Total Retirement System

As of September 30, 2017

Net Asset Class Performance Summary

	Market Value (\$)	% of Portfolio	Fiscal YTD (%)	YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Return (%)	Since
Total Retirement System	31,057,035,714	100.0	3.8	10.8	12.2	5.9	7.4	4.5	6.4	Jul-94
Policy Index			3.3	10.9	11.8	5.9	7.0	4.0	5.8	Jul-94
InvestorForce Public DB > \$5B Net Median			3.6	11.8	12.7	7.0	8.7	5.3	8.1	Jul-94
Global Public Equities	8,857,942,782	28.5	6.0	19.1	20.5	8.2	11.6	5.2	5.1	Jun-99
MSCI ACWI IMI Net USD			5.3	17.2	18.7	7.7	10.4	4.2	5.5	Jun-99
Private Equity	2,294,439,362	7.4	3.4	10.4	15.5	9.4	13.5	7.9	7.2	Apr-07
80% Russell 3000/20% MSCI EAFE + 300 basis points on a 3-month lag			4.5	15.6	21.9	10.5	16.4	14.0	14.7	Apr-07
Equity Options	1,626,011,997	5.2	3.1	10.0	12.4	--	--	--	11.8	Jul-16
CBOE S&P 500 BuyWrite USD			2.5	9.9	12.8	7.1	7.6	4.8	11.8	Jul-16
Short Duration	1,294,310,494	4.2	0.5	1.6	1.6	1.8	1.5	--	1.8	Mar-10
BBgBarc US Govt/Credit 1-3 Yr. TR			0.3	1.1	0.7	1.1	0.9	2.1	1.2	Mar-10
Cash and Overlay	1,851,430,481	6.0	0.1	0.1	0.1	-0.3	0.1	0.3	1.1	Oct-05
BofA Merrill Lynch 91-Day T-Bill			0.3	0.6	0.7	0.3	0.2	0.5	1.2	Oct-05
Core Fixed Income	1,256,355,652	4.0	1.5	4.5	2.2	3.5	2.6	4.6	6.2	Jul-94
BBgBarc US Aggregate TR			0.8	3.1	0.1	2.7	2.1	4.3	5.6	Jul-94
Mixed Credit	2,007,115,078	6.5	1.8	5.4	7.9	3.0	4.3	--	6.5	May-08
50% S&P LSTA Leveraged Loan Index/50% Barclays High Yield Index			1.5	5.0	7.1	5.2	4.9	6.0	6.3	May-08
Private Debt	1,888,479,675	6.1	1.9	2.8	7.5	4.3	8.1	--	7.3	Jun-08
S&P LSTA Leveraged Loan Index + 150 basis points on a 3-month lag			1.2	5.3	8.9	4.8	6.1	4.9	5.1	Jun-08
Emerging Market Debt	1,626,283,215	5.2	3.5	13.1	7.9	4.9	2.8	--	6.2	Jul-09
50% JP Morgan EMBI Global Diversified (USD)/50% JP Morgan EMBI Global Diversified			3.1	11.6	6.0	3.4	2.0	5.7	6.2	Jul-09
GAA	808,158,304	2.6	2.9	7.8	6.7	3.5	4.4	5.0	5.3	Aug-07
50% MSCI World Index/50% Barclays Aggregate Bond Index			2.8	9.4	8.8	5.3	6.6	4.6	4.9	Aug-07
Other Opportunistic	1,151,979,686	3.7	2.1	--	--	--	--	--	2.1	Jul-17
50% MSCI World Index/50% Barclays Aggregate Bond Index			2.8	9.4	8.8	5.3	6.6	4.6	2.8	Jul-17
Hedge Funds Non Portable Alpha	450,481,695	1.5	2.4	4.6	7.1	1.0	3.9	2.4	2.6	Aug-07
50% MSCI World Index/50% Barclays Aggregate Bond Index			2.8	9.4	8.8	5.3	6.6	4.6	4.9	Aug-07
Hedge Funds Portable Alpha	2,950,140,794	9.5	2.7	3.1	7.7	5.1	7.3	8.3	8.7	Jul-07
3-Month Libor Total Return USD			0.3	0.9	1.2	0.7	0.5	0.9	1.0	Jul-07
Public Real Estate	638,986,447	2.1	2.3	4.5	0.9	--	--	--	-3.3	Jun-16
FTSE NAREIT Equity REIT			0.9	3.7	0.7	9.9	9.7	5.8	4.6	Jun-16
Private Real Estate	1,826,641,034	5.9	3.3	7.5	9.7	12.8	15.3	--	6.9	Jul-08
NCREIF ODCE + 75 bps			1.9	6.1	8.6	12.1	12.5	--	--	Jul-08
World Infrastructure	528,279,018	1.7	2.5	13.1	6.6	--	--	--	6.5	Jun-16
DJ Brookfield Global Infrastructure			3.3	15.2	9.2	4.0	9.0	7.0	12.7	Jun-16

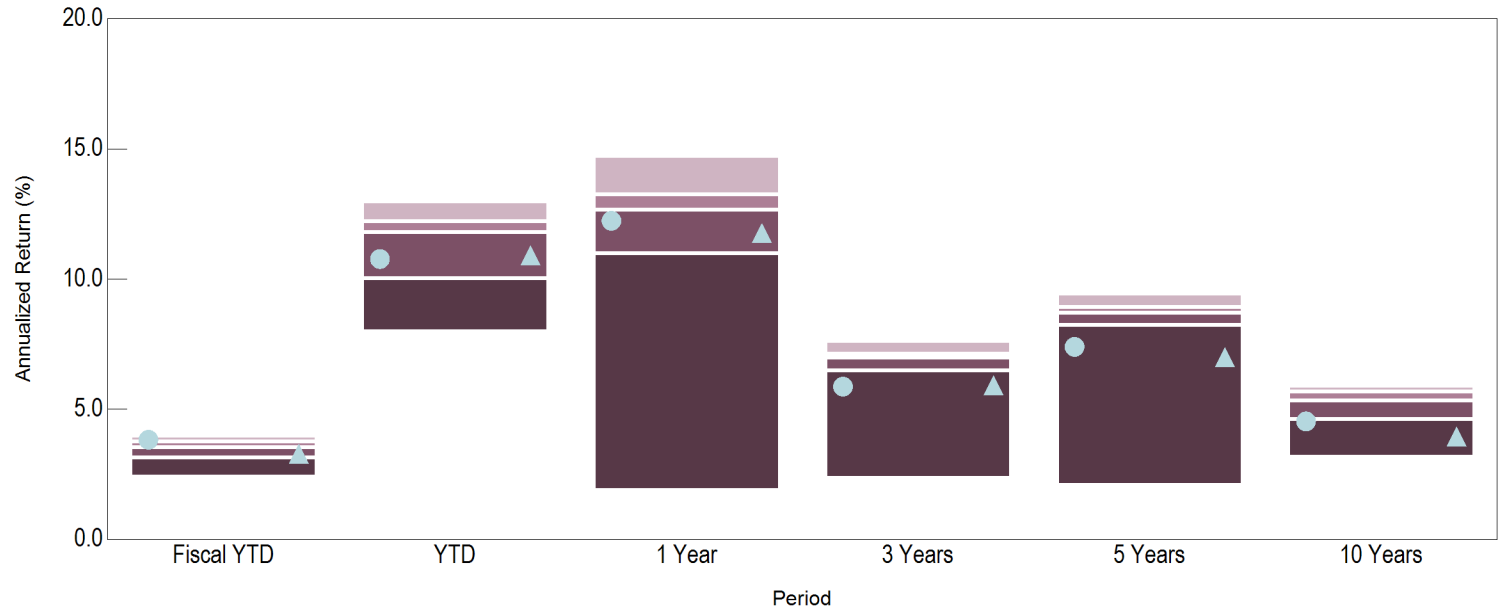
Returns are based on values obtained from BNYM.



South Carolina Retirement System
Total Retirement System

As of September 30, 2017

InvestorForce Public DB > \$5B Net Accounts
Ending September 30, 2017



	Fiscal YTD		YTD		1 Year		3 Years		5 Years		10 Years	
Return (Rank)	4.0		13.0		14.7		7.6		9.4		5.9	
5th Percentile	3.8		12.2		13.3		7.1		8.9		5.7	
25th Percentile	3.6		11.8		12.7		7.0		8.7		5.3	
Median	3.2		10.0		11.0		6.5		8.2		4.6	
75th Percentile	2.4		8.0		1.9		2.4		2.1		3.2	
95th Percentile	20		20		20		19		19		17	
# of Portfolios	3.8	(21)	10.8	(72)	12.2	(58)	5.9	(89)	7.4	(89)	4.5	(77)
Total Retirement System	3.3	(68)	10.9	(71)	11.8	(65)	5.9	(89)	7.0	(90)	4.0	(87)
Policy Index												



Statistics Summary
5 Years Ending September 30, 2017

	Anlzd Return	Anlzd Standard Deviation	Information Ratio	Beta	Sharpe Ratio	Tracking Error
Total Retirement System	7.4%	4.7%	0.4	1.0	1.5	1.1%
Policy Index	7.0%	4.7%	--	1.0	1.4	0.0%
Global Public Equities	11.6%	9.8%	0.3	0.9	1.2	3.4%
MSCI ACWI IMI Net USD	10.4%	10.0%	--	1.0	1.0	0.0%
Private Equity	13.5%	4.2%	-0.3	0.0	3.1	10.2%
80% Russell 3000/20% MSCI EAFE + 300 basis points on a 3-month lag	16.4%	9.5%	--	1.0	1.7	0.0%
Short Duration	1.5%	0.6%	1.6	0.8	2.2	0.4%
BBgBarc US Govt/Credit 1-3 Yr. TR	0.9%	0.6%	--	1.0	1.1	0.0%
Cash and Overlay	0.1%	0.9%	-0.2	-0.2	-0.2	0.9%
BofA Merrill Lynch 91-Day T-Bill	0.2%	0.1%	--	1.0	0.1	0.0%
Core Fixed Income	2.6%	2.9%	0.8	1.0	0.8	0.6%
BBgBarc US Aggregate TR	2.1%	2.8%	--	1.0	0.7	0.0%
Mixed Credit	4.3%	3.4%	-0.3	1.1	1.2	1.6%
50% S&P LSTA Leveraged Loan Index/50% Barclays High Yield Index	4.9%	2.8%	--	1.0	1.7	0.0%
Private Debt	8.1%	3.3%	0.6	0.4	2.4	3.4%
S&P LSTA Leveraged Loan Index + 150 basis points on a 3-month lag	6.1%	2.5%	--	1.0	2.4	0.0%
Emerging Market Debt	2.8%	8.7%	0.5	1.0	0.3	1.4%
50% JP Morgan EMBI Global Diversified (USD)/50% JP Morgan EMBI Global Diversified	2.0%	8.3%	--	1.0	0.2	0.0%

South Carolina Retirement System

Total Retirement System

As of September 30, 2017

	Anlzd Return	Anlzd Standard Deviation	Information Ratio	Beta	Sharpe Ratio	Tracking Error
GAA	4.4%	6.0%	-0.9	1.1	0.7	2.4%
50% MSCI World Index/50% Barclays Aggregate Bond Index	6.6%	5.2%	--	1.0	1.2	0.0%
Hedge Funds Non Portable Alpha	3.9%	3.4%	-0.6	0.4	1.1	4.3%
50% MSCI World Index/50% Barclays Aggregate Bond Index	6.6%	5.2%	--	1.0	1.2	0.0%
Hedge Funds Portable Alpha	7.3%	4.3%	1.6	-4.5	1.7	4.3%
3-Month Libor Total Return USD	0.5%	0.1%	--	1.0	2.9	0.0%
Private Real Estate	15.3%	3.4%	0.5	0.1	4.4	5.6%
NCREIF ODCE + 75 bps	12.5%	4.8%	--	1.0	2.6	0.0%

Disclosure Appendix

- Item 1. Fiscal year begins July 1.
- Item 2. All returns are presented net of management fees.
- Item 3. Policy index performance is calculated by multiplying each asset class target weight by the performance of its respective benchmark.
- Item 4. As stipulated in the Statement of Investment Objectives and Policies, the target weights to Private Equity, Private Debt and Real Estate will be equal to their actual weights, reported by the custodial bank, as of the prior month end. In the case of Private Equity, the use of the actual weight will affect the target allocation to Global Equity. For example, in FY 17-18, the combined target weight of both of these asset classes shall equal 42% of the Plan. For Private Debt, the use of the actual weight will affect the target allocation to Mixed Credit, such that the combined target weight of both asset classes in FY 17-18 shall equal 13% of the Plan. For private market Real Estate, the use of the actual weight will affect the target allocation to public market Real Estate (REITs), such that the combined target weight of both asset classes in FY 17-18 shall equal 8% of the Plan
- Item 5. Overlay exposure is reported from Russell. Market values and performance reported by BNYM are reconciled to manager reported data for public markets strategies.
- Item 6. Total retirement system performance is calculated inclusive of the overlay investments. Individual asset class performance is reported by BNYM excluding synthetic exposure from the overlay program.
- Item 7. Asset classes with less than five years of historical returns are excluded from the risk statistics summary.