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Investment Management

Arizona State Retirement System

2017

Introduction

- ASRS is responsible for the administration of \$36 billion in assets in connection with the retirement plan and other related activities
- The Investment Management Division (“IMD”) manages these assets through numerous programs described in this document
- In this document, we will describe the investment program and the processes to implement and govern the program

IMD Tasks and Responsibilities

- Operate the investment program
 - Manage internal portfolios of stocks and bonds
 - Search for and diligize external asset managers
 - Monitor external managers
- Evaluate performance using returns and holdings based techniques
- Monitor markets and portfolio composition for re-balance and tactical positioning opportunities
- Research and strategy formulation on both macro and micro dimensions
- Prepare various reports for internal use, the board and the public
- Follows compliance processes to ensure all legal and policy requirements are met

Investment Goals

- We describe our investment program in terms of assets, strategy and process
 - We make market returns by owning assets
 - We enhance those returns by strategies and processes designed to add value
- Our goal is to invest in a well diversified portfolio designed to earn attractive returns considering the risks taken
- By following this strategy, the portfolio is structured to earn above market returns and to earn the actuarially assumed rate of return over a long horizon

Strategic Asset Allocation

- ASRS invests in accordance with a strategic asset allocation (“SAA”) policy
- The SAA is updated not less frequently than once every four years
- The current SAA provides the following target allocations:
 - Equities 58%, including
 - Domestic equities 26%
 - Developed and Emerging Market International Equities 24%
 - Private Equity 8%
 - Credit and lending strategies 14%, including
 - Private Debt 12%
 - High Yield 2%
 - Interest Rate Sensitive Fixed Income 11%
 - Real Estate 10%
 - Multi-asset class strategies 5%
 - Commodities 2%
- The complete SAA can be found at
<https://www.azasrs.gov/content/asset-allocation>

Risk and Return

- The SAA is designed to provide a well diversified portfolio across multiple return generation sources
 - When we use the word “risk”, we are focused primarily on processes, activities or exposures that generate returns
 - We avoid using the word “risk” when we mean “volatility” even though that usage is common
 - Although much early research in what has become known as modern portfolio theory treated volatility as a proxy for risk, more recent research has cast doubt on whether volatility is positively correlated with returns, especially within asset classes
- Therefore, in order to make money you have to take risk
- We find it useful to think of risk primarily in terms of business risk, i.e.
 - The ability of companies to successfully sell products and manage their operations
 - The ability of properties to attract tenants
 - The ability of borrowers to repay their loans when we extend them credit
- The economy, business cycle and capital markets dynamics also are a source of risk
 - The economy has ups and downs creating risks and opportunities
 - Economic retractions are a source of risk, particularly for enterprises lacking resources to ride out a recession
 - Unanticipated inflation is a risk for fixed rate investments and for businesses which may need time to adjust to changing prices
 - When investors seek safety during a recession this causes the prices of risky assets to decline, particularly if stressed or illiquid parties become compelled sellers
 - This is a source of opportunity for investors who are long term oriented and have the resources and fortitude to take advantage of these opportunities

Market Returns

- ASRS engages in the strategic asset allocation process in order to define and place constraints on the broad categories of assets we will own
 - We invest in businesses through stocks and private equity
 - This is a globally diversified portfolio across market capitalization and including both developed and emerging economies
 - We invest in government and investment grade bonds where the source of return is primarily related to interest rates
 - We invest in “credit”, i.e. loans to companies where the return derives primarily from the ability to collect spreads relative to risk free interest rates
 - We invest in properties, primarily commercial real estate but also agriculture and infrastructure
 - We invest in commodities, currencies and other liquid assets where the source of return is driven by underlying price trends and may be driven by “alternative risk premia”
- We benchmark returns from these assets against market indices of comparable type and risk
- Sometimes, market returns from assets are called “beta”

Trading in Efficient Markets

- Generally, listed markets are quite efficient and very hard to beat
- Nevertheless, even the most liquid markets offer trading opportunities which we systematically explore and exploit in our internal portfolios. For example,
 - There is some predictability in price patterns around index name changes
 - There may be opportunity for larger investors to profit by providing liquidity for block trades
 - Futures may at times be “cheap” providing enhanced return opportunities
 - Capital market dynamics may influence the pricing of risk and create investment opportunity across fixed income sectors

Idiosyncratic Risk and Information Advantage in Private Markets

- While listed markets generally are liquid and efficient enough to arbitrage away any diversifiable idiosyncratic risk, private markets operate differently because
 - Information is widely and cheaply available in liquid markets, while information is expensive and often proprietary in private markets
 - It generally is illegal to trade on “inside” information in liquid markets, while no such restriction applies to private markets
- Diligence and information advantages
 - We diligize asset managers to assess their skill, process discipline and organizational depth
 - We diligize markets, companies and properties when investing directly
 - This method is most applicable in less liquid markets
 - Stock and bond markets are regulated so that investors (and non-investors) have access to the same information; so, it is generally not possible to gain an information edge in these markets
 - Business planning and strategy
 - We invest in companies or properties with a plan in mind and generate value by executing that plan
 - Requires long term orientation and control over management
 - Often requires specialized expertise in markets or processes
- Alignment of interest and avoidance of agency costs
 - Invest in structures where management has the same economic interest as investors
- Collectively, these strategies allow us to pursue idiosyncratic business risk and profit potential in private markets

Alternate Risk Premia in Equity and Other Markets

- Alternate Risk Premia
 - In liquid markets, there is strong evidence of risk factors driving performance
 - Fama and French demonstrate the influence of size and value on stock performance in their research from the early 1990's
 - Additional research demonstrates additional factors such as carry (yield) and momentum
 - These can be implemented in long only market portfolios such as the ASRS risk factor portfolio
 - Or they can be implemented in long/short portfolios across multiple markets with low correlation to those markets
 - Investable directly or as an overlay to traditional beta

Gaining Performance Advantage as a Long Term Investor

- Any investor with a large pool of capital in relation to their near term needs is in a position to manage their assets to a longer horizon
 - ASRS assets of \$36 billion are roughly 36 times the net annual outflow for benefit payments
- A long term investor can afford to be relatively indifferent to short term ups and downs in its portfolio
 - While ASRS measures and monitors volatility, we maintain focus on the long term in order to gain advantage by a willingness to tolerate short term market fluctuations
- We ride out tough markets and do not sell risky assets in times of stress
- We re-balance in favor of risky assets when they fall below target weights due to market action
- We seek out opportunity to buy assets cheaply when they are impacted by distress and market dislocations across a business cycle and due to regulatory change

Gaining Performance Advantage as a Tactical Investor

- We monitor markets considering
 - valuations relative to historic norms
 - relative valuation across asset classes
 - relative valuation of currency and global interest rates
 - trends and momentum
- We document this analytical work in “house views” which are the basis for tactical decisions to overweight or underweight certain asset classes
- A tactical positioning committee meets monthly (or more frequently if necessary) to review and implement tactical decisions

Strategy Formation and Idea Generation

- The portfolio managers are experts in the markets they cover
- They are responsible to monitor market conditions and identify opportunities for attractive investment based capital markets dynamics, regulatory dislocations and other factors leading to mispricing of risk
- When a strategy for potential investment is identified, the portfolio managers and CIO concur on a plan for research and diligence which may culminate in the deployment of capital

Research

- We remain current in financial markets research as a source of ideas for portfolio implementation
- We conduct ongoing event studies and simulations as a source of ideas for trading implementation in our internal portfolios

Diligence

- We engage in diligence in an effort to find the best partners and business opportunities
- In private markets we seek an information advantage through diligence
- When our portfolio managers identify an opportunity
 - we engage in an outbound process to find the best counterparties to pursue the opportunity
 - we analyze their track record with state of the art statistical methods
 - we perform diligence on operational, organizational and legal matters to confirm integrity in the implementation and conduct of their business strategy

Managing Liquidity

- The annual net outflow for benefit payments is approximately \$1 billion per year, compared to approximately \$36 billion in fund assets
 - We have recurring cash flow from dividends, interest and rents which can cover the preponderance of this negative cash flow without requirement of asset sales
- IMD manages liquidity to deliver cash to operating accounts when needed for these payments
- The bigger challenge is to ensure we have resources available to purchase assets in times of stress and when they are cheap
 - We maintain exposure to treasuries and investment grade bonds which retain their value in such times
 - We have flexibility to alter the “beta” allowing certain “multi-asset” strategies to operate as an overlay to other liquid assets, creating an opportunity to increase exposure to stocks when warranted
 - We have structured our investments in less liquid sectors in separate accounts that give us favorable liquidity terms and ability to control investment pace if needed

Performance Measurement and Feedback

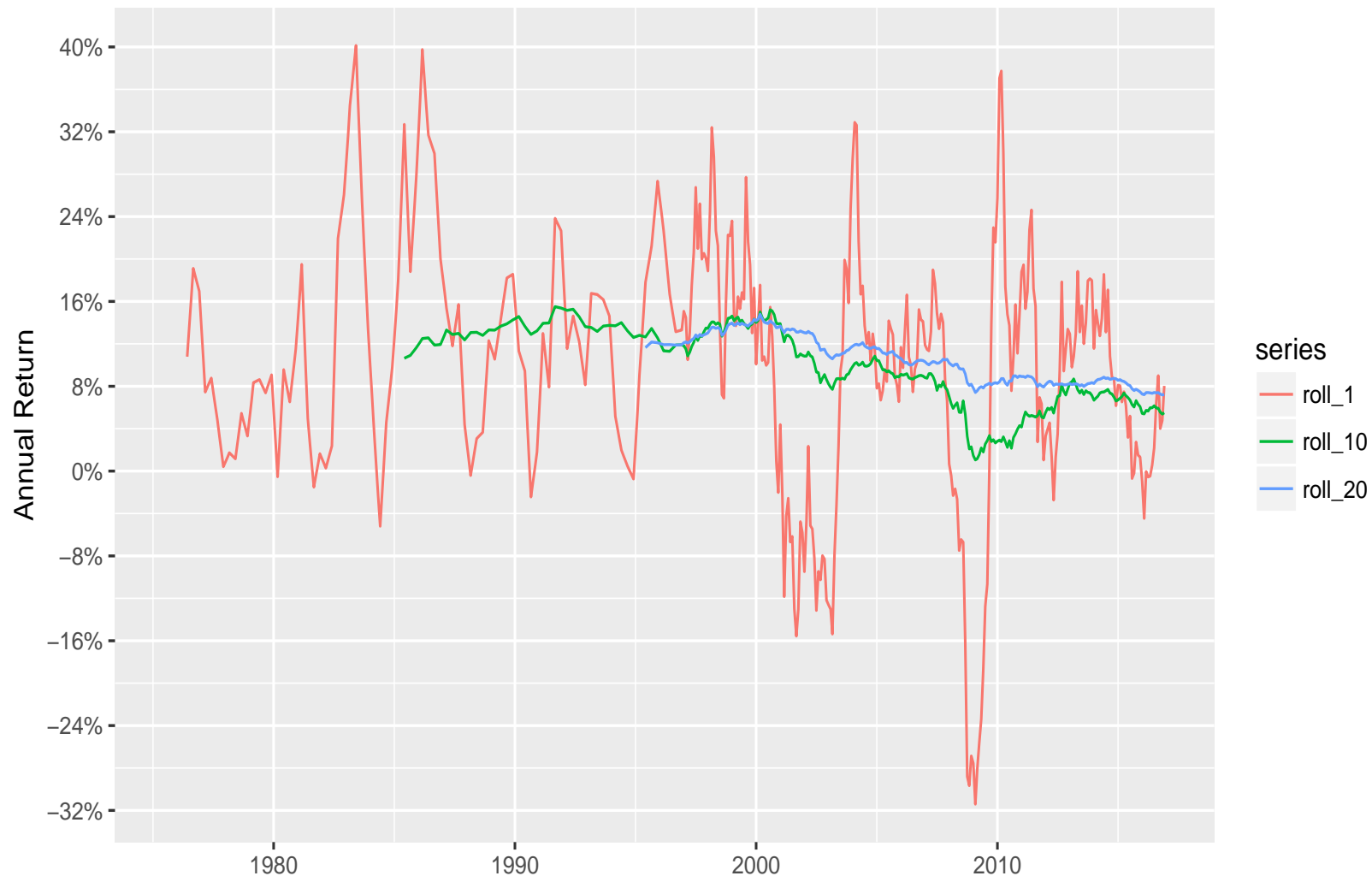
- We view performance measurement and feedback as an active part of our investment process and not a mere administrative activity
- Performance measurement adds value because you can only improve if you are candid with yourself about what you are good at and where you need to improve
- In order to create the highest value from performance measurement, the most advanced statistical methods are needed
 - We implement both returns and holdings based analysis
 - and we are able to present that over varying time frames and rolling periods in order to understand trends

Cost Management

- Costs matter and we are highly cognizant of costs in managing the investment program
 - We manage approximately one third of our assets internally at effectively zero cost
 - The remainder of public market assets are managed with custom negotiated vehicle and fee structures
- Private market investments are generally implemented in strategies involving highly specialized expertise
 - We need to acquire talent to pursue these strategies and cost minimization is not the objective
 - We pursue high return on investment on any fees we pay
 - by first diligizing managers and only negotiating with the most highly qualified among them, and
 - by structuring competitive negotiations among these managers
 - By implementing our private markets investment program largely through separate accounts, we implement in much larger account sizes which facilitates favorable negotiation of fees

Total Fund Returns

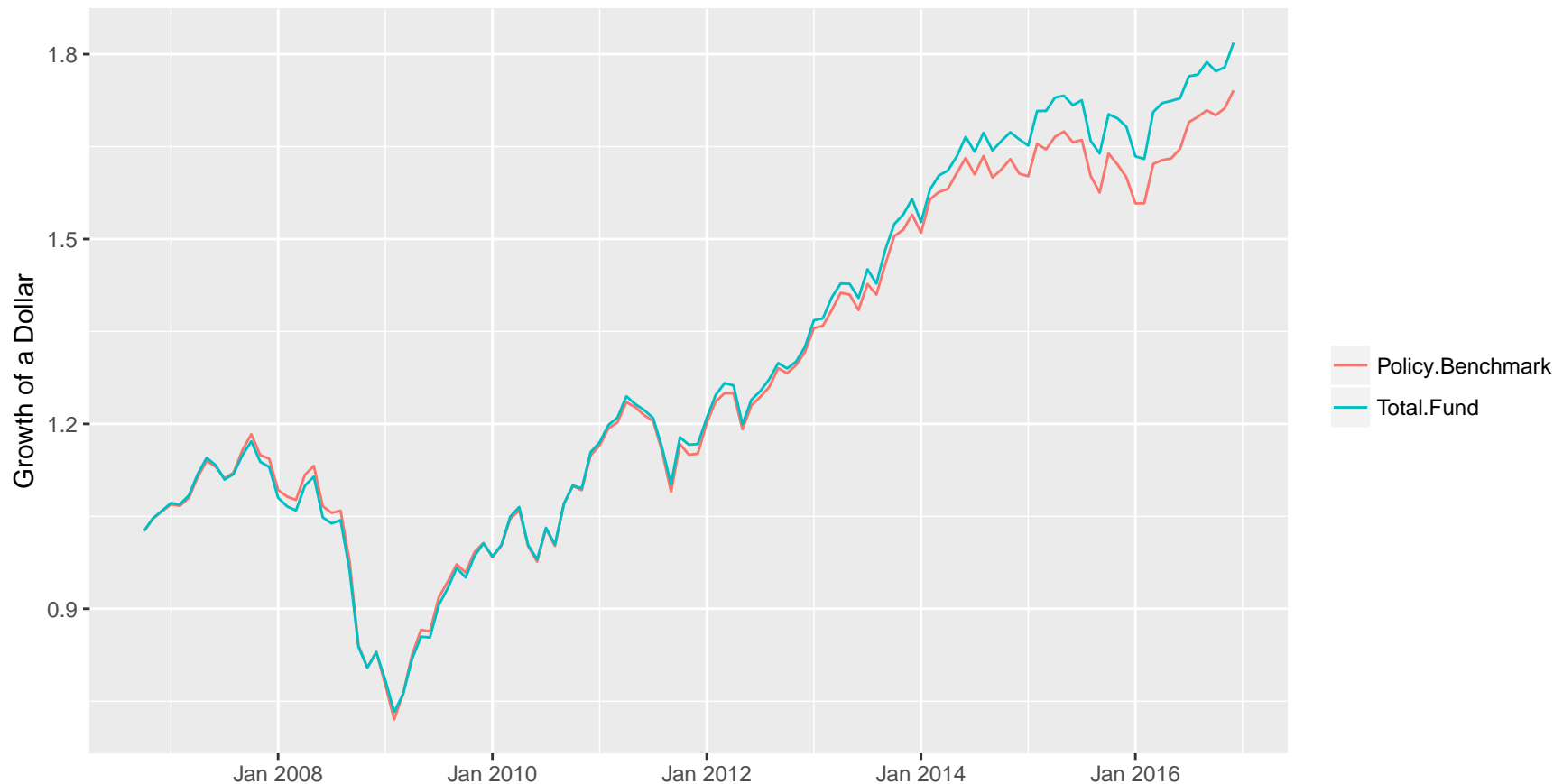
ASRS Total Fund One Ten and Twenty Year Rolling Returns



10 Year Total Fund Return

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Total Fund & Interim Policy Benchmark Performance



Total Fund Excess Return Decomposition

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Allocation & Selection Effect Only

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Historical Strategic Asset Allocation

The Strategic Asset Allocation is designed to produce steady returns over a long period of time and is typically completed once every 3 years

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Allocation and Active Weights

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array extent  
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Public Equity Performance Summary

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Public Equity Brinson Attribution

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non-conformable arrays  
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Allocation & Selection Effect Only

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Private & Opportunistic Equity

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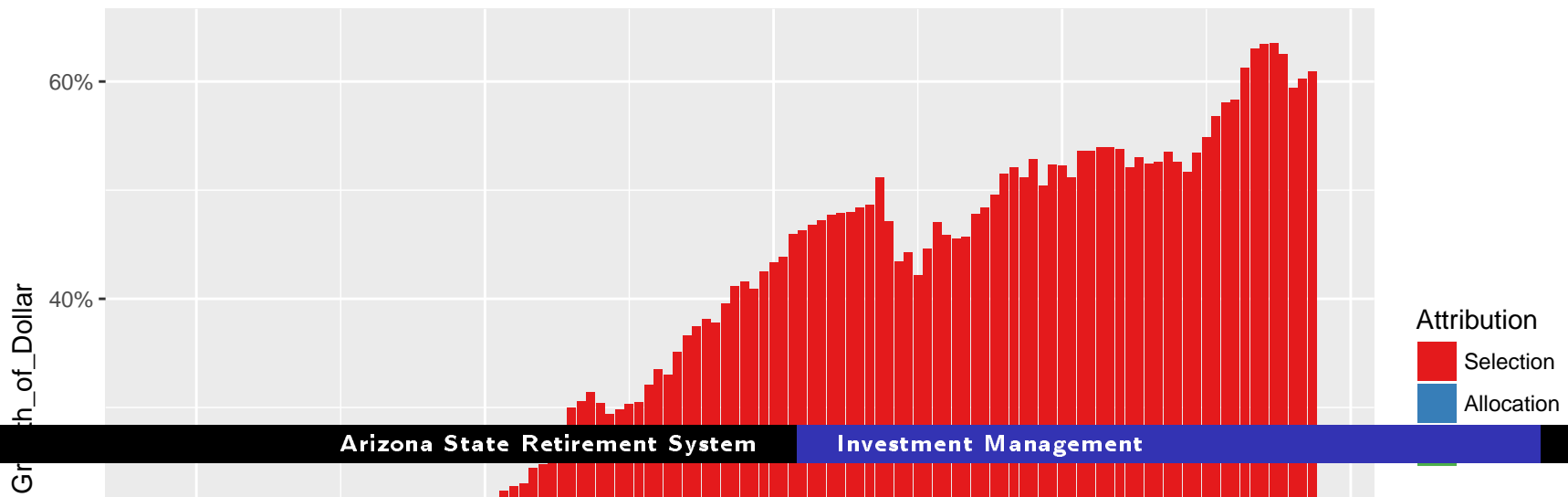
Public Fixed Income Performance Summary

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Public Fixed Income Brinson Attribution

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Brinson Return Attribution



Allocation & Selection Effect Only

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Private & Opportunistic Debt Summary

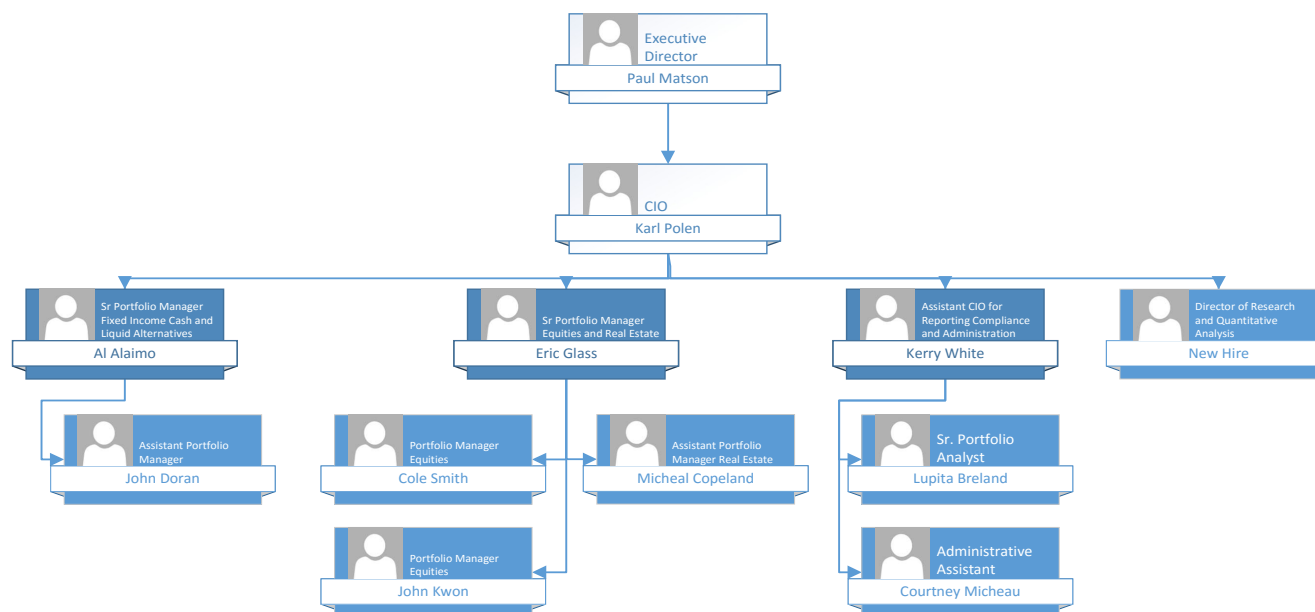
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Real Estate Summary

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Organization Chart

Investment Management Organization

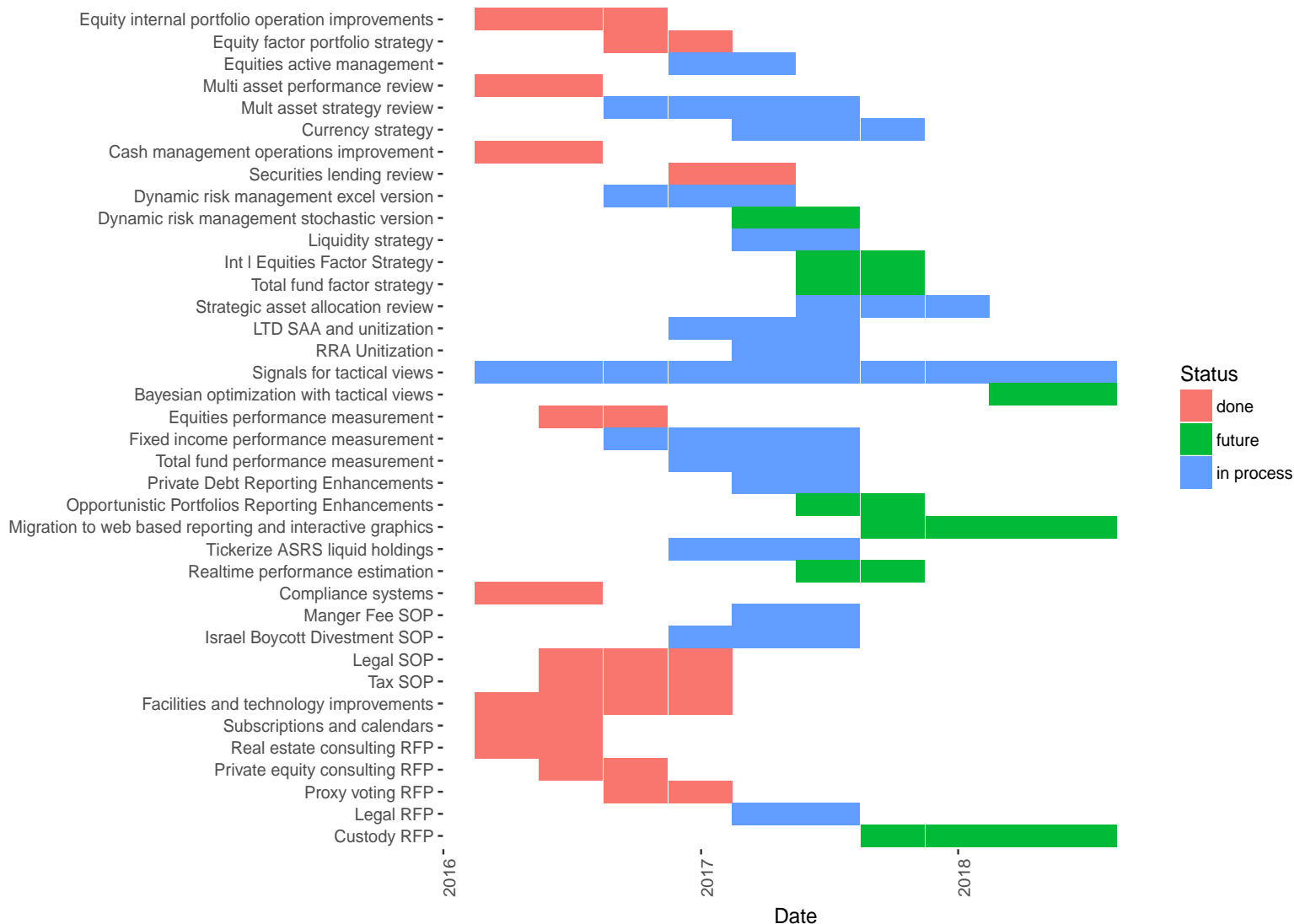


Notes:

1. The Investment Strategy Committee is a committee of the whole co-chaired by the Exec. Director and CIO. It decides policy matters and refers investments for decision to asset class committees for review pursuant to SIP006.
2. The Tactical Positioning Committee makes tactical and rebalance decisions. Its members are the Exec. Director, CIO, Asst. CIO and each of the Sr. Portfolio Managers.
3. Asset Class Committees include the Exec. Director, CIO, Asst. CIO and relevant portfolio managers. They are established pursuant to SIP006 and make investment decisions in accordance with the requirements of SIP006.
4. Various working groups are established for projects and continuing processes. Working groups report to the Investment Strategy Committee. The Exec. Director and CIO are active participants on various working groups.

Project Management

ASRS Investment Management Division Projects



Karl Polen, CIO

- Associated with ASRS since 1994
 - Board member 1994 to 2007 including multiple terms as chairman of the board and chair of investments
 - Head of Private Markets Investing 2010 to 2016
 - CIO since 2016
- Experience prior to ASRS
 - 33 years private sector experience
 - Bulk of experience in CFO and COO roles for two major real estate operators based in Phoenix
 - Extensive deal experience negotiating a wide range of transactions involving billions of value
 - Operational experience supervising teams of over 1,000 people in diverse business activities
 - Board and other Memberships
 - Central Arizona Project – board member 1996 to 2000
 - Boys and Girls Clubs of Metropolitan Phoenix – board member 2005 to 2010
 - National Academy of Recording Arts and Sciences – voting member since 1977
- Education
 - Vanderbilt University, Master of Business Administration (graduated tied for first in class)
 - Certified Public Accountant (highest score in state on CPA exam, license currently inactive)
 - University of Tennessee, studies in mathematics and computer science
 - University of Illinois, Bachelor of Music

Al Alaimo, Sr Portfolio Manager (fixed income, cash, liquid alternatives)

- Senior Fixed Income Portfolio Manager
- Joined ASRS in 2009
- Previously, Portfolio Manager and Director of Research for Seneca Capital Management LLC in San Francisco and a Managing Director in high yield bond research for Banc of America Securities LLC in New York.
- MBA in Finance from the University of Rochester and a BS in accounting and finance from Syracuse University
- From 2010-2013, taught an undergraduate course on Fixed Income which he created for the Finance Department at the W.P. Carey School of Business at Arizona State University.
- Chartered Financial Analyst (CFA)
- Certified Public Accountant (CPA)

Eric Glass, Sr Portfolio Manager (equities and real estate)

- Joined ASRS in 2008
 - Analyst across multiple asset classes 2008 to 2013
 - Private Markets investing 2013 to 2016
 - Head of Private Markets & Equities since 2016
- Experience prior to ASRS
 - 7 years private sector experience
 - Majority of experience as equity analyst; fundamental analysis and forensic accounting
 - Experience in tax and advisory for HNW clients in public accounting
 - Board and other Memberships
 - Junior Achievement volunteer
 - Habitat for Humanity volunteer
 - Feed My Starving Children volunteer
- Education
 - University of Minnesota, Master of Business Administration
 - Finance & Entrepreneurship
 - Iowa State University, Bachelor of Science with Honors & Distinction
 - Finance & Accounting; Economics
 - Chartered Financial Analyst (CFA)
 - Certified Public Accountant (CPA) (license currently inactive)
 - Chartered Alternative Investment Analyst (CAIA)

Kerry White, Assistant CIO (operations, compliance and reporting)

- Joined ASRS since 2011
 - Private Markets Asset Manager 2011 to 2016
 - Assistant CIO since 2016
- Experience prior to ASRS
 - 24 years of private sector experience
 - 20 years of experience in public accounting, practice areas include auditing, management consulting, training and tax
 - COO and CFO experience for non-profit and manufacturing industries
 - Operational expertise, internal control, network and system administration for variety of clients and employers
 - Board and other Memberships
 - Arizona Bicycle Club – president 2015 to current, board member 2013 to 2015, 300+ member organization
 - Maricopa County Parks Community Park Volunteer, Usury Park 2010 - 2015
 - AICPA – member 1997 to current, AZCPA – member 2010 to current
- Education
 - Grand Canyon University, MBA with an Emphasis in Finance (3.97 GPA)
 - Certified Public Accountant (Active license in both Arizona and Washington State)
 - Specialty Certifications in Governmental and Non-Profit Accounting & Auditing, and Technology
 - St. Martins University, Bachelor of Arts in Accounting, Cum Laude

IMD is Committed to State of the Art Technology

- IMD invests effort and resources to technology in part because
 - Automation of repetitive tasks improves quality and saves money
 - Implementation of graphical reporting methods improves communication and makes it more impactful
- More importantly, technology helps us make money
 - by implementing state of the art performance measurement techniques which provide feedback and identify areas for improvement
 - by allowing us to implement the most sophisticated statistical and modeling methods not practical any other way
 - these methods help identify and test trading and investment methodologies and strategies
- ASRS has been a leader in the adoption of these sophisticated methods
 - Several members of the team have expertise as “coders” enabling us to efficiently implement new methods
 - By way of example, ASRS implemented “PME” methods for performance evaluation as they were identified in academic literature and years before they were commercially available

Investment Policy Statement - Purpose

- The Investment Policy Statement ([Link to IPS](#)) is designed to communicate and establish the following:
 - investment beliefs,
 - goals & objectives,
 - constraints, and
 - guidelines for development and implementation of the ASRS strategic and tactical asset allocation policy.
- The investment policy statement is important to the long term success of the ASRS investment objectives.
- The investment policy statement was developed with the following goals:
 - Clearly and explicitly establish the parameters governing ASRS assets
 - Establish a target asset allocation that is both long-term and dynamic to take advantage of market opportunities and expected to achieve its investment rate of return objectives
 - Protect the financial health of the ASRS
 - Establish a framework for monitoring investment activity and facilitate communication between Board, Staff and other involved parties.

Investment Policy Statement - Goals

- These are macro-level expected outcomes that the ASRS wants to achieve through its investment program.
- Goals:
 - Maximizes fund rates of return for acceptable levels of fund risk.
 - Achieves 75th percentile rates of return compared to peers.
 - Achieves long-term fund rates of return equal to or greater than the actuarial assumed interest rate.
 - Achieves long-term economic and actuarial funded states of 100 percent
 - Mitigates contribution rate volatility
- Collectively, the above goals incorporate the following elements that are important for a fund's comprehensive investment structure:
 - Complementary use of absolute and relative rates-of-return perspectives.
 - Complementary use of asset-only and asset-liability perspectives.
 - Complementary use of economic and actuarial perspectives.

Investment Policy Statement - Objectives

- Objectives:
 - Achieve a 20-year rolling annual total fund net rate of return equal to or greater than the actuarial assumed interest rate of 8%.
 - Achieve 1-year and 3-year rolling actual total fund net rates of return equal to or greater than the return of the ASRS asset allocation policy (SAAP) benchmark.
 - Achieve 1-year and 3-year rolling annual net rates of return for ASRS strategic asset classes that are equal to or greater than their respective strategic asset class benchmarks.
 - Ensure sufficient monies are available to meet pension benefits, health insurance, member refunds, administrative payments, and other cash-flow requirements.

Investment Policy Statement - Investment Beliefs

- The investment belief are to ensure the development of congruent and synergistic investment strategies, and to ensure the effective and efficient allocation of resources. They determine the general paradigm within which investment strategies are developed, investment ideas are reviewed, and investment decisions are implemented. Modifications to these beliefs will occur if experiential, academic, conceptual and/or practical perspectives suggest that a superior belief system exists.
- Asset class decisions are key:
 - Decisions with respect to which asset classes and sub-asset classes to invest in and allocations to these have a greater impact on total fund investment returns than decisions in which specific securities to invest.
- Theories and concepts must be sound:
 - Over longer periods of time, investment outcomes conform to logical theories and concepts. Significant deviations from theoretically and conceptually sound investment constructs are usually not sustainable and typically self-reverting.
- House capital market views are imperative:
 - Development and articulation of sound House Views will ensure consistency amount investment decisions, clarity of investment direction, baselines for debates, and conformity of understanding.

Investment Policy Statement - Investment Beliefs (Continued)

- Investment strategies must be forward looking:
 - Use forward looking insights, rather than simply relying on past strategies.
 - Public Markets are generally informationally efficient.
- Market frictions are highly relevant:
 - And can be significantly detrimental to investment performance. As a result transactions will initiated only to the extent there is a strong level of conviction that they will result in increases investment returns or decreased risks net of all market frictions.
- Internal investment professionals are the foundation of a successful investment program.
- External investment management is beneficial.
- Investment consultants:
 - Utilized when there is a need in one of the four areas: independence, perspective, special skills, and resource allocation.
- Trustee expertise:
 - Trustees often have experience in various areas of investment management and this expertise should be utilized while ensuring a separation between Board oversight and staff man

Investment Policy Statement - Investment Considerations

- Arizona State Statutes
 - ASRS investments may be limited by Arizona Revised Statutes.
- ASRS is managed on a going-concern basis and uses the following time frames for construction decisions and contribution rate determinations.
 - Portfolio construction decisions: Strategic asset allocations focus on medium term (3 - 5 years) capital market expectations, subject to the constraint of meeting the long-term assumed actuarial rate based on long-term (30 year) capital market assumptions. Tactical deviation decisions are based on shorter-term (less than 3-5 year) capital market expectations.
 - Contribution rate determination: Liabilities are discounted based upon long-term capital market expectations. Contribution rates are set based upon longer (10 year) investment valuation smoothing periods, and longer-term (30 years 'closed') deficit/surplus amortization periods.
- Liquidity and Cash-Flow
 - Planning for and effectively managing cash to meet anticipated needs and ensure adequate liquidity.

Investment Policy Statement - Risk Management, Monitoring and Reporting

- A risk management framework is applied for identifying, managing and reporting on ASRS investments.
- Provide assurance to Executive Management and Board that investment management programs are designed, implemented and maintained to achieve investment goals and objectives.
- Reporting periodicity and detail vary depending on target audience.
- Use of leverage is determined at the manager level and monitored by Investment Management and ASRS consultants.
- Use of derivatives is determined at the manager level and monitored by Investment Management and ASRS consultants.
- Management of currency exposure is determined at manager level and monitored by Investment Management and ASRS consultants.

Investment Policy Statement - Asset Allocation

- The ASRS asset mix will reflect investments in strategic and tactical asset classes and strategies whose collective risk/return profile are anticipated to achieve its long-term investment rate of return goals and objectives.
- Dynamic approach where initiation and periodicity will primarily be a function of market dynamics.
- Study will be used to determine the long-term policy asset weights.
- Asset reviews in addition to periodic studies are conducted as warranted or triennially, whichever is shorter.
- The study may include, but not be limited to the following:
 - Discussion and analysis of existing and evolving asset classes and investment strategies.
 - Evaluation of expected sources of investment returns, risk and diversification (quantitatively/ qualitatively).
 - Reviewing investment industry developments (academic and pragmatic).
 - Utilization of quantitative tools (e.g., efficient frontier mean-variance optimization, risk budgeting) and evaluation of multiple scenarios.
 - Reviewing and engaging discussions regarding capital market assumptions.
 - Reviewing asset allocation policies from other public and non-public entities.

Investment Policy Statement - Other Topics

- The investment policy statement addresses the other following items:
 - Re-balancing
 - Voting of portfolio proxies
 - Securities litigation
 - Securities lending
 - Management of investment fees
 - Roles and responsibilities

Strategic Investment Policies

- Strategic Investment Policies (SIPs) are overall guidance for major functions within the fund. The Strategic Investment Policies cover such topics as:
 - Asset Allocation
 - Tactical Positioning and Re-balancing
 - Securities Litigation
 - Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Funding Policy

SIP006 Investment Manager, Partner and Co-Investment Selection and Oversight

- This SIP covers the selection process and diligence and of public and private market investment managers and partners. The process is as follows:
- Sourcing investments
 - Sourcing is the primary responsibility of the Investment Management Department (IMD).
- Screening investments
 - Based on the investments merits further diligence may be recommended.
- Analysis and Due Diligence
 - IMD staff will provide expertise and project management for the analysis and due diligence of the potential investment.
 - The process will produce a due diligence packet with specified contents as outlined in the SIP.

SIP006 Investment Manager, Partner and Co-Investment Selection and Oversight(Continued)

- Decision Making through the Asset Class Committee
 - Decisions will be documented through committee minutes
- Governance and Oversight
 - The ASRS general consultant conducts an annual review of the process to determine compliance with this SIP, consistency with applicable policies, House Views and if applicable, the investment program's pacing and implementation plans.
 - The ASRS external auditors also review compliance with the policy on a sampling basis.
- Monitoring
 - Monitoring of the investments is performed by the CIO, IMD staff, custody bank, consultants and other service providers and reported to the Asset Class Committee, Investment Committee and Board of Trustees.

Standard Operating Policies

- The Standard Operating Policies (SOP's) govern activities for public equity and fixed income activities and include such things as:
 - Approved Dealers
 - Trade Dispute Resolution
 - Delegation of Authority for Pre and Post Trade
 - Trade Processes and Verification
 - Cash Assetization and Trade Management Program
- SOP's are written as needed to codify processes or to fulfill best practices.
- They are reviewed by the CIO with final approval provided by the Director.

Other Policies

- IMD has formally adopted a number of other policies governing its operations
- These policies include:
 - Continuity of Operations
 - Commission Recapture
 - Proxy Voting
 - Securities Lending Compliance
 - Placement Agent Disclosure
 - Fee Negotiations
 - Legal Process for Investments
 - Tax and Other Compliance Filings
 - Israel Divestment Policy
 - Signature Authority
 - Audit and Appraisals

Compliance Overview

- Compliance functions are composed of middle and back office functions that utilize both internal and external resources to ASRS.
- External Resources in the process include:
 - General Investment Consultant - perform independent monitoring of the investment program and report directly to the Board of Trustees.
 - Asset Class Consultants - perform diligence and monitoring of potential and existing investments. Report results to the Asset Class Committee and Investment Committee.
 - Custodian Bank - processes transactions, record activity and calculate performance on daily basis. The custodian works with ASRS accounting and IMD to resolve issues.
 - External Auditors - annually audit activities in IMD as part of the agency wide financial audit.
- The ASRS investment observes the following standards:
 - GASB - ASRS reports in accordance to Generally Accepted Accounting Standards as promulgated by the Government Accounting Standards Board.
 - GFOA - ASRS voluntarily adheres to the reporting standards of the Government Finance Officer's Association for financial, investment and actuarial reporting for the Comprehensive Annual Financial Report (CAFR).

Middle and Back Office Compliance

- Middle office compliance functions include:
 - Pre and post trade compliance on public and fixed income trading to ensure that every trade meets the individual portfolio restrictions.
 - Performance and attribution
 - Corporate actions processing
 - Proxy voting
 - Performance reporting
 - Cash management
- Back office compliance functions include:
 - Custody
 - Investment compliance
 - Portfolio/fund accounting
 - Fund administration
 - Legal
 - Tax
 - Reporting
- These functions are designed to ensure that ASRS is in compliance with its policies and procedures, state and federal rules and laws in regards to its investment holdings.

Compliance Practices - Public Markets

- The ASRS engages in several compliance practices to ensure we are in compliance with policies, procedures, rules and laws.
- Use of Bloomberg AIM/OMS for pre and post trade compliance for all public trading, ensures every trade complies with its portfolio requirements.
- State Street provides post trade daily compliance to ensure compliance with Letters of Direction and Strategy Papers in effect.
- Daily & monthly compliance monitoring at the individual portfolio and external investment level on a post-trade basis.
- Total fund level compliance & monthly statute test for Arizona Revised Statute investment limits and Arizona Restricted Country Test.
 - Concentration limits
 - Issuer and debt exposure
 - Restricted countries

Compliance Initiatives - Private Markets

Private Markets compliance practices include:

- Our custodian bank monitors capital calls, financial reporting, performance measurement and reconciliation of all private markets investments.
- Private Equity and Real Estate Consultants review each and every capital call for appropriateness, authenticity and compliance with governing documents prior to approving payment.
- Review of Private Markets investments on a rotational basis to:
 - confirm fees are correctly calculated and reported,
 - valuation policies are observed, and
 - the partnership is being administered in accordance with the partnership agreement.

Reporting Overview

- ASRS has implemented a comprehensive and transparent system of reports to keep ASRS management, the Board and public on the ASRS investments.
- Utilizes statistical analysis to report on performance for public and private investments.
- Report frequency and detail is dependent on audience.
- Utilizing the R programming language and Lyx document processor with investment data able to do reproducible analysis efficiently and effectively.
- Investments continues to expand the reporting through the use of R and Lyx to develop additional analysis on investments for review, modeling, and diligence.

Internally Generated Reports

- IMD internally generates portfolio analytics through R and Lyx for each portfolio.
- Public Equities, Fixed Income and Commodities:
 - Returns Based Performance Analysis on total asset class and sub-asset classes with detailed performance at the manager level.
 - Custom generated Brinson Return Attribution
 - Holdings based attribution utilizing MSCI Barra data
- Private Markets
 - a monthly reporting package
 - a quarterly performance chart pack
 - an internal website with cash flow and performance metrics on each partnership

Externally Generated Reports

- State Street as our custodian is the investment book or record.
- NEPC is the performance book of record and are responsible for monitoring all IMD activity to ensure it complies with policies and reports directly to the Board of Trustees.
- Various reporting is performed by our external consultants for diligence, compliance and performance reporting.
- NEPC - our general investment consultant produces the following reports:
 - Board Report - consist of total fund performance, measurement of performance to goals, objectives and benchmarks on quarterly basis
 - Investment Performance Report - detailed report on performance of asset classes and to asset level on quarterly basis
- State Street - our custodial bank produces the following reports
 - Risk report - reviews risk on public investments and scenario analysis each quarter
 - Monthly Statute Test - compliance with Arizona Revised Statutes and Restricted Countries test on fund level
- Private Equity and Real Estate Consultants
- Compliance review reports on private investment funds
- Due diligence reporting on potential investments
 - Annual real estate asset reviews

Strategy

- Domestic Equity
 - Passive: managed internally for beta exposure
 - Factors: managed internally and through ETFs (transitioning away from ETFs)
 - Active: transitioned away from
- International Equity
 - Passive: managed externally in SMAs for beta exposure
 - Factors: under review
 - Active: transitioning away from

Allocation: Domestic Equity

Sub-asset class	Benchmark	Allocation	Passive	Factors	Active
US Large Cap	S&P 500	20%	69%	22%	9%
US Mid Cap	S&P 400	3%	75%	0%	25%
US Small Cap	S&P 600	3%	38%	0%	62%

Allocation: International Equity

Sub-asset class	Benchmark	Allocation	Passive	Factors	Active
Developed Large Cap	MSCI EAFE	17%	70%	0%	30%
Developed Small Cap	MSCI EAFE SC	2%	29%	0%	71%
Emerging Markets	MSCI Emerging Markets	5%	30%	0%	70%

Passive Portfolios

- Internally managed domestic 'E' portfolios: E2 (US LC), E10 (US MC), and E6 (US SC)
 - Index replication of respective benchmark for core beta exposure
 - Collectively aim to outperform by 10 bps through tactical positioning/trading opportunities
 - Improvements discussed in subsequent section
- Externally managed international portfolios: Blackrock EAFE, Blackrock EAFE SC, Blackrock Emerging Markets
 - Index replication of respective benchmark for core beta exposure
 - Highly liquid and cost competitive

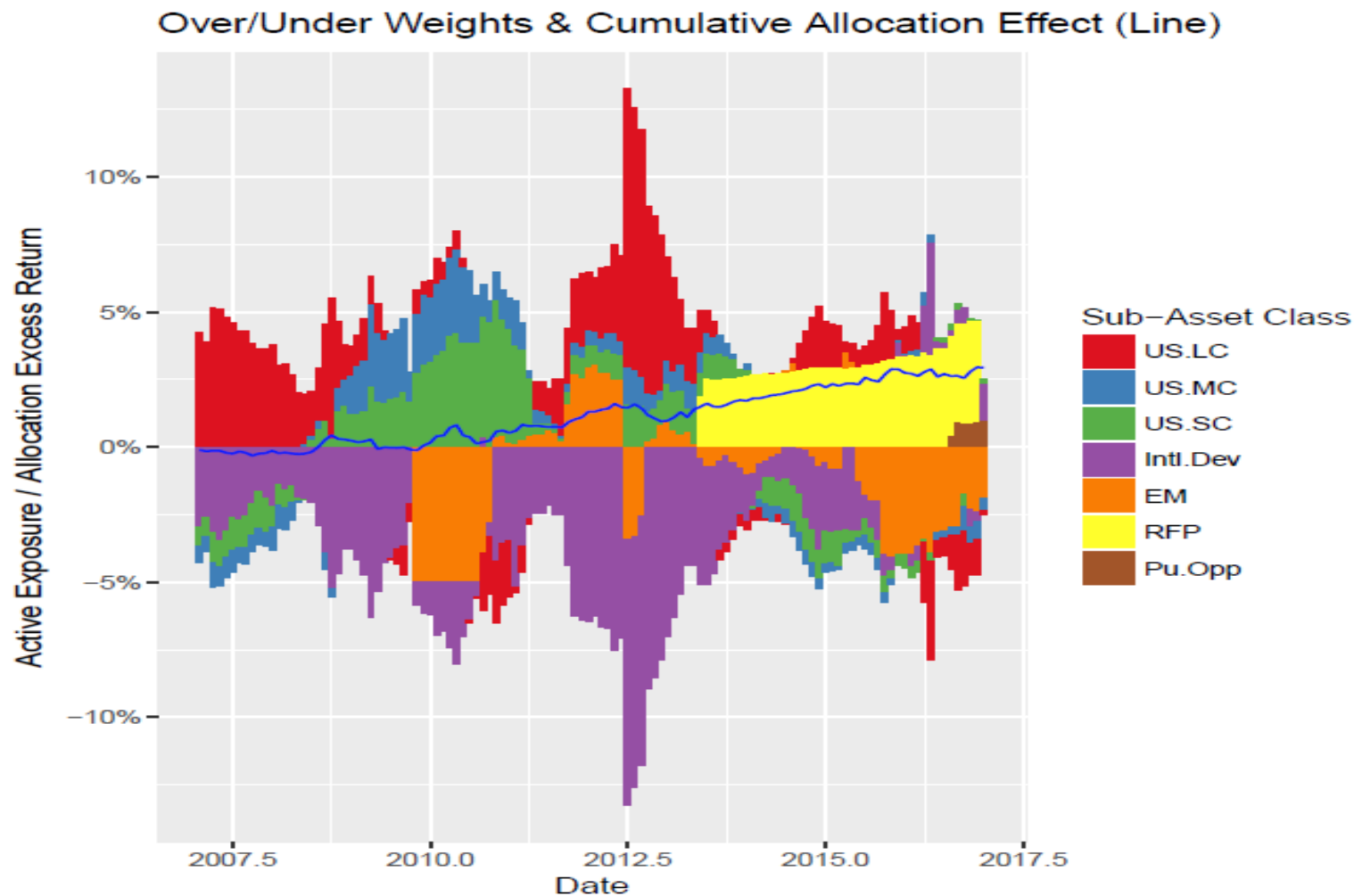
Factor Portfolios

- Current structure:
 - Internally managed: high dividend yield (E7) and minimum volatility (E8)
 - Designed return premium seeking portfolios
 - Externally managed Blackrock ETFs: MSCI USA Momentum (MTUM), MSCI USA Value (VLUE), MSCI USA Size (SIZE), and MSCI USA Quality (QUAL)
 - Combined into multi-factor E9 portfolio which ASRS controls the weighting scheme
 - Designed as a risk-mitigation overlay strategy to dampen portfolio-wide exposures
- Reconfiguration approved at February 2017 Combined Asset Class Committee; implementation underway
 - Discussed in subsequent section

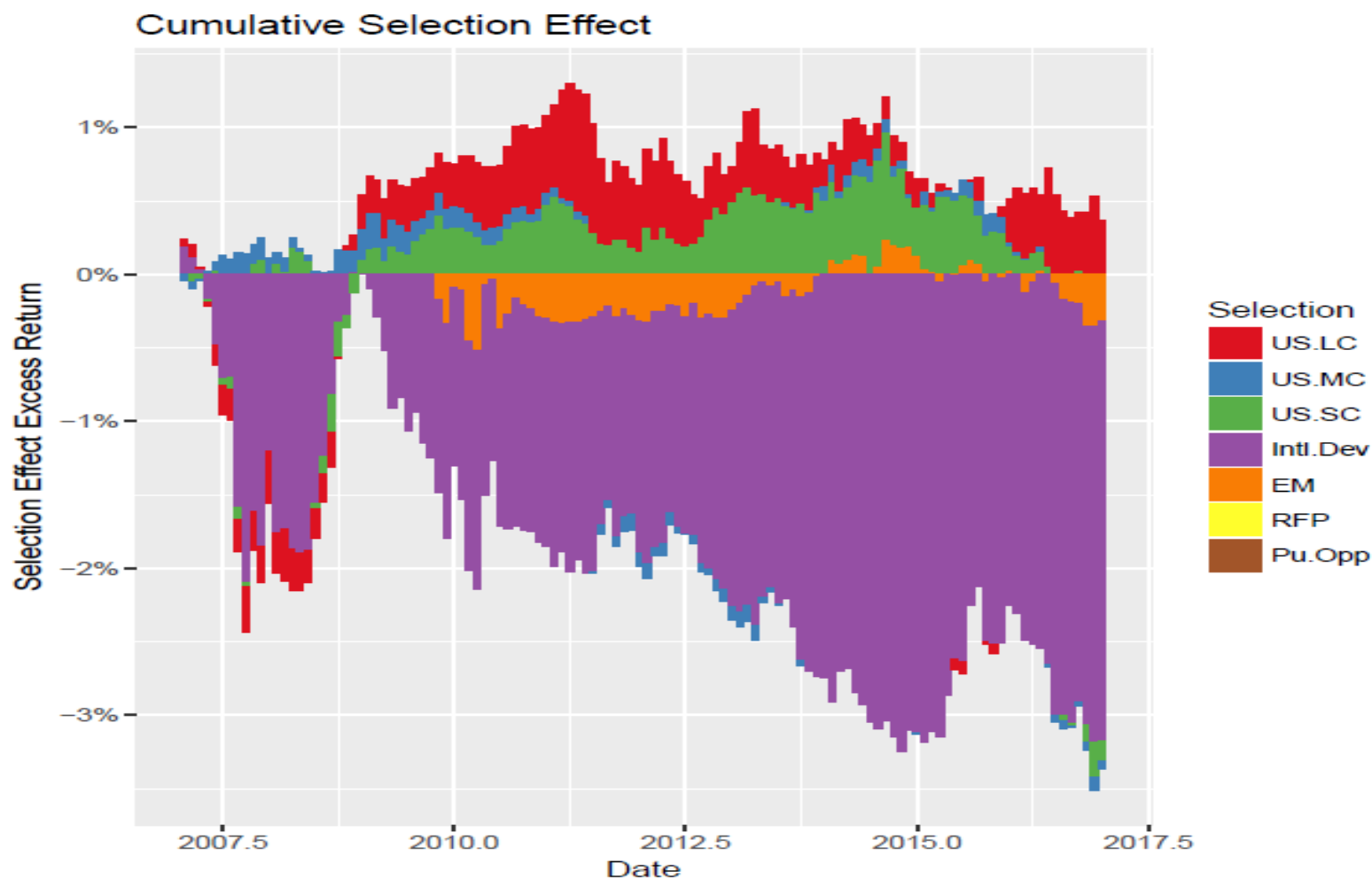
Active Portfolios

- ASRS recently completed a comprehensive study active management and decided to end its active management program
 - Discussed further in subsequent section

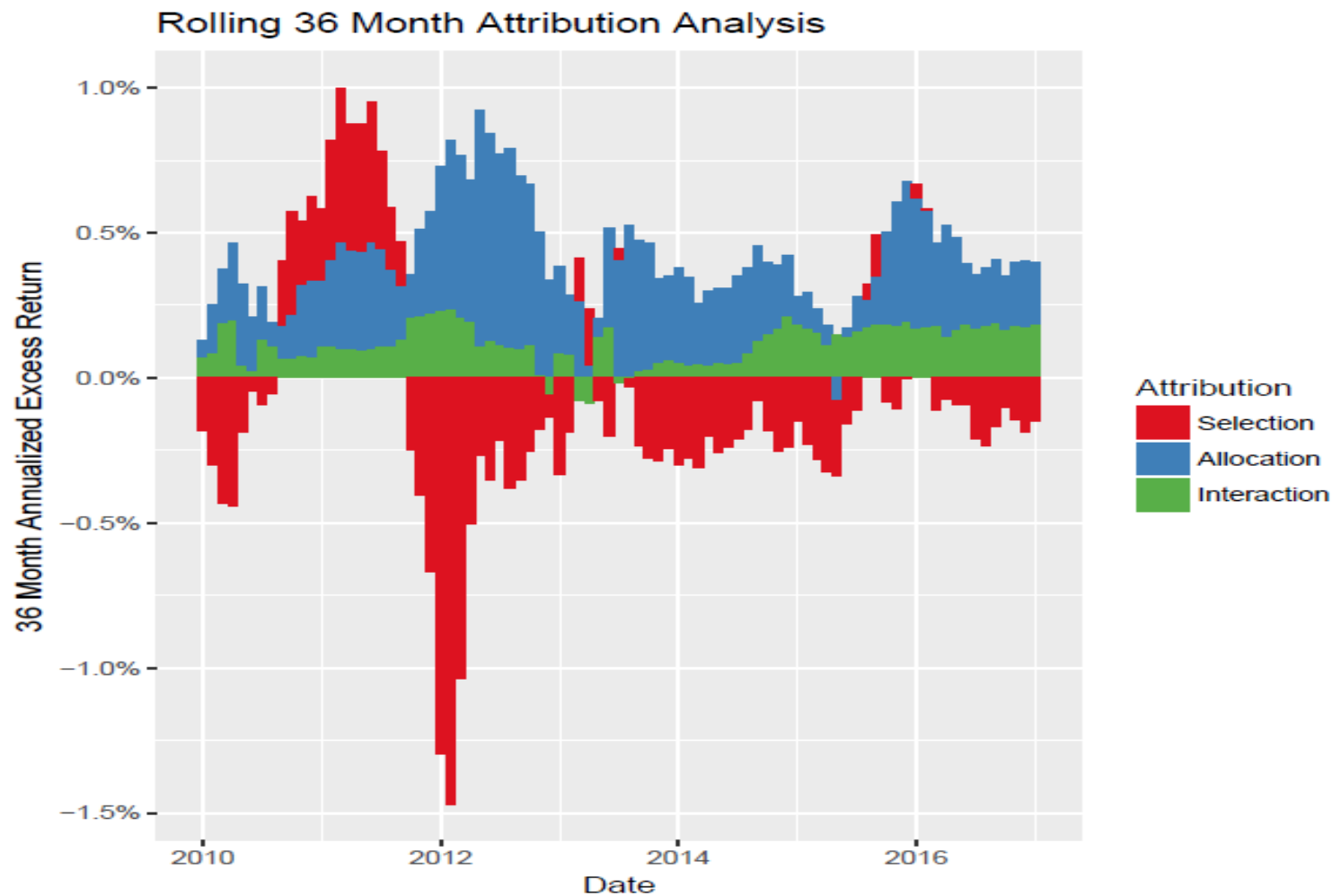
Cumulative Performance Attribution



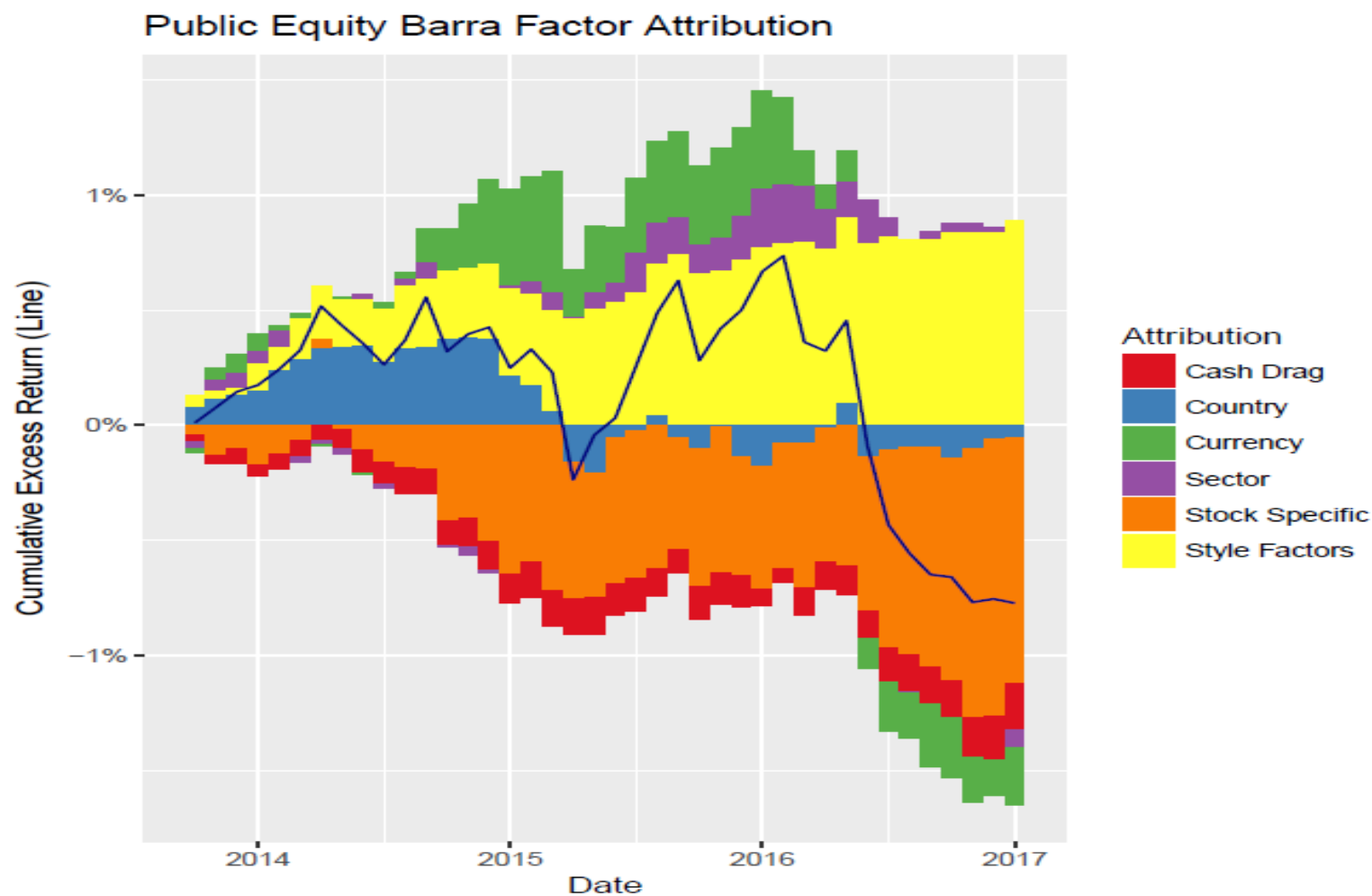
Cumulative Performance Attribution



Rolling Performance Attribution



Holdings Based Performance Attribution



Historical Takeaways

- Selection
 - Selection effect is poor due to active managers, particularly in international
- Allocation:
 - Allocation effect is good due to systematic international underweight and risk factor exposure
- Other notables:
 - E-Portfolios progress
 - Risk Factor program reconfiguration to further enhance returns
 - Active manager study has concluded

Passive Portfolios: Progress to Date

- ASRS identified opportunities to improve the operations and returns of the E portfolios, results presented at February Combined Asset Class Committee
- Improvements:
 - Equitization model – Optimized to better match cash flows
 - Elevated cash levels – Reduced from ~100bps to ~20bps
 - Cash flows – Moved to active monitoring of flows
 - Futures Mismatch – Reduced exposure to futures
 - Trading – Reduction of trading volume
 - Passively traded the index changes – Moved to active decision trading based on our matrix
- Other studies & actions completed:
 - Futures roll
 - ETF utilization
 - Tracking Error Optimization (Barra Portfolio Manager)
 - Potential Index Changes
 - Value/Growth overlap in mid cap

Passive Portfolios: Current & Future Initiatives

- Current initiatives:
 - Trading operations review - implement best practices for selection process of brokers, utilization of transition managers, and trade execution
- Future potential portfolio management enhancements:
 - Event studies:
 - Biggest movers
 - News sentiment
 - Intraday index momentum
 - Spin-offs
 - Matrix utilization:
 - Statistical studies for trade optimization

Factor Portfolios: Study

- ASRS conducted a study to determine the best implementation methodology for factor portfolios
- Presented February 2017 Combined Asset Class Committee
 - Phases:
 - 1 Review of factor offerings as long-only index products
 - 2 Comparison of factor index providers
 - 3 Multi-factor portfolio construction
 - 4 ASRS portfolio optimization & implementation

Factor Portfolios: Study

After careful study ASRS concluded:

- Factors represent risk premia that are a source of out-performance vs market value weighted indices
 - Value, momentum, size, min vol
 - Quality is a largely debated factor
 - definitions include: ROE, Debt/Equity, earnings variability, Total debt/BV, ROA, accruals, asset turnover, gross profitability, and asset growth
 - established in 2014, subsequent academic challenges to robustness¹²³:
- Timing of factors is not a source of excess returns and therefore should be equal weighted

¹ <http://www.cfapubs.org/doi/pdf/10.2469/faj.v72.n5.6>

² https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2520929

³ https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2601662

Factor Portfolios: Implementation Plan

- Merge E9 with E7 & E8 into new multi-factor portfolio E11
 - License multi-factor index from EDHEC (Scientific Beta)
 - 4 factors, equal weight
 - Rebalanced quarterly
 - Benchmarked against S&P 500
- Rationale:
 - Intuitive, simple structure
 - Excess return seeking factor expressions
 - 'Enhanced' passive opportunities do not exist in E7 & E8
 - Cost savings & improved liquidity vs ETFs
 - Time savings for staff

Active Management: Study

- ASRS conducted a study to determine the role of active management in the portfolio
- Presented April & June 2017 Combined Asset Class Committees
- ASRS initiative:
 - Do active managers that persistently outperform exist
 - If so, can be outperforming active managers consistently be identified by particular method(s)
 - If active managers can be identified ex post, do the method(s) work ex ante
 - Does alpha exist after optimal benchmark assignment
 - Separate skill from luck
- Phases:
 - 1 Reviewed ASRS history of active management
 - 2 Reviewed academic literature
 - 3 Conducted tests using in and out of sample data on >5,000 funds over 45 years
 - 1 Year Return Sorted Portfolios (Hendricks and Carhart)
 - Bootstrap (Kosowski and Fama & French)
 - False Discovery Rate (Storey & Wermers)
 - Factor Based Replication

Active Management: Study

- Key takeaways:
 - ASRS has not had consistent success in identifying alpha generating managers
 - Few managers have a long history
 - Alpha generating managers are rare and lack persistence
 - A consistent method for identifying alpha generating managers hasn't been found
 - Methods that identify alpha generating managers don't work ex ante with regularity

Active Management: Implementation Plan

- ASRS resources would be more efficiently utilized in other areas managing the total equity portfolio
- Transition to be implemented in 2 phases: domestic first, followed by international
 - US LC split 75% | 25% between E2 & E11 consistent with factor implementation
- Working to populate transition manager roster & best practices before implementation
- Study of factors in international equity will determine if factors will be added to the international transition plan

Opportunistic Public Equity

- Allows for investments outside of the SAA that are opportunistic in nature
 - Liquid exposure
 - Intended to outperform the respective US or International Equity composite benchmark
- Tortoise MLP strategy implemented in August 2016 to capitalize on energy dislocation and spread expansion

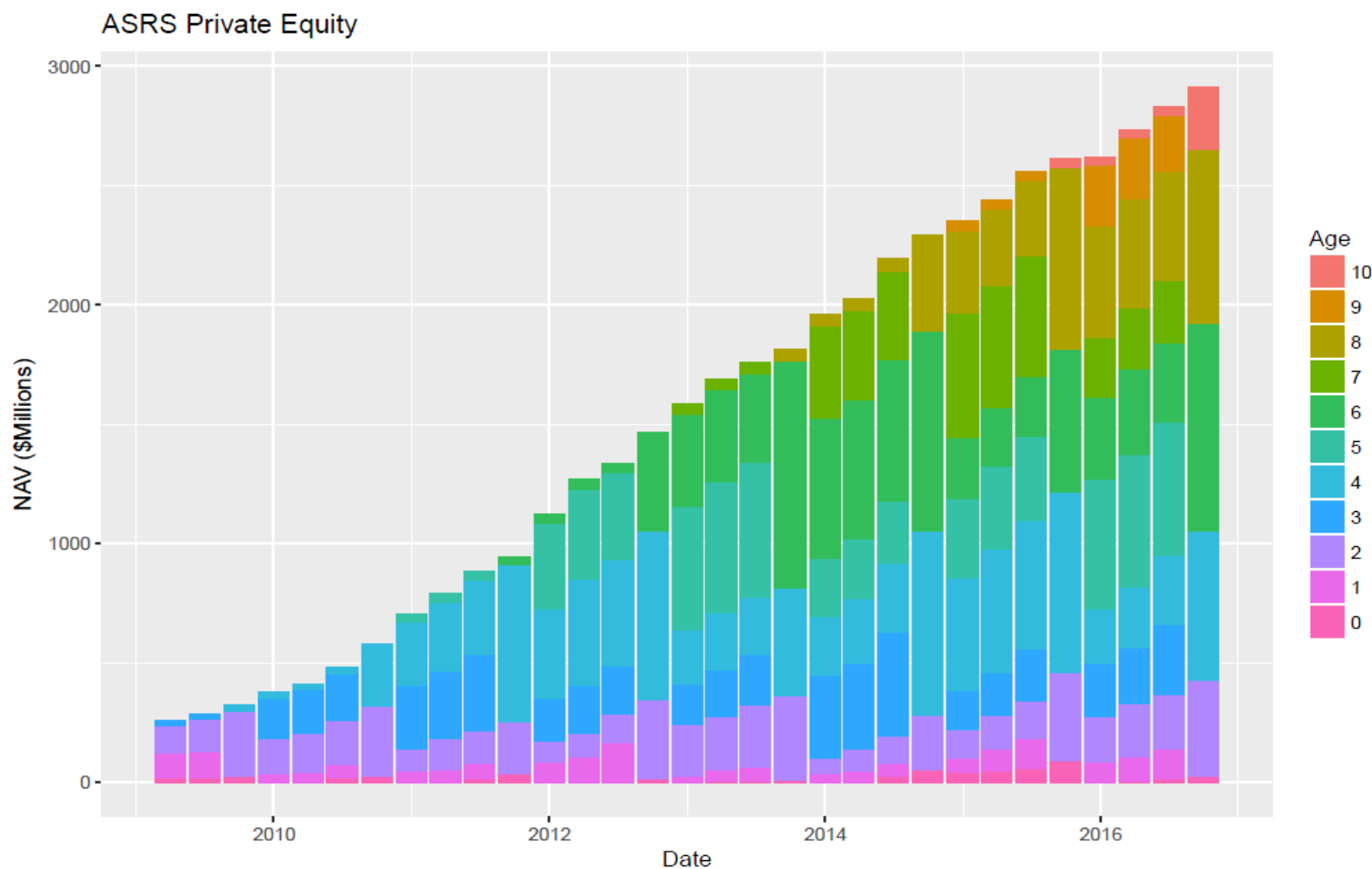
Private Equity

- ASRS has allocated 8% of total assets (+/- 2%) to private equity as part of its strategic asset allocation
- ASRS began investing in private equity in 2007
- The NAV of PE assets was \$ 3009 million on December 31, 2016
 - This is 8.64% of total fund and the NAV is \$ 222 million above target funding
- We update pacing plans annually to adjust investment levels to achieve and maintain target funding
- Investment pace for 2017 is \$725 million in new commitments

ASRS Portfolio Commitments by Vintage

	Commitment Amount	# of Funds	Commitment per Fund
2006	50	1	50
2007	483	15	32
2008	688	15	46
2009	386	8	48
2010	370	8	46
2011	659	12	55
2012	325	5	65
2013	550	10	55
2014	620	11	56
2015	690	12	58
2016	700	13	54
	5,521	110	50

ASRS Portfolio NAV by Age



ASRS Commitments by Size

	Commitments	Percentage
Mega	631	22%
Large	1263	44%
Medium	469	16%
Small	533	18%
Total Buyout	2,896	

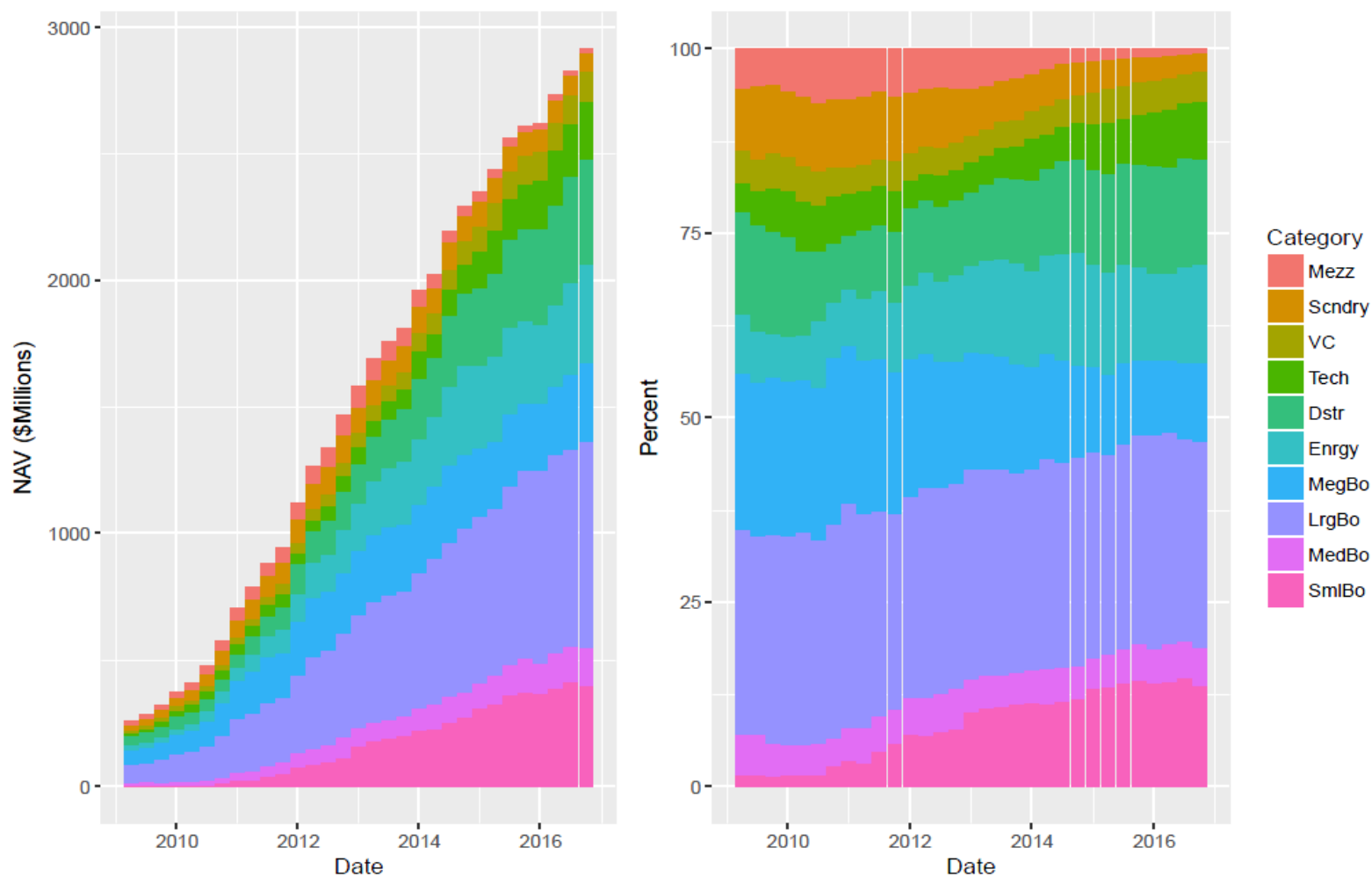
Note: reflects funds that have called capital

ASRS Commitments by Style

	Commitments	Percent of Commitments
Energy	828	16%
Info Tech	405	8%
Health Care	80	2%
Finance	103	2%
Consumer	80	2%
Defense	220	4%
Secondaries	174	3%
Mezzanine	100	2%
VC	115	2%
Generalist	2,351	46%

Note: reflects funds that have called capital

ASRS NAV by Style



Investment Philosophy

We believe successful private equity investing hinges on three considerations

- Strategy
- Track Record
- Organizational Dynamics

Strategy

- Academic research provides evidence on the performance of private equity⁴
 - Private Equity buyout funds outperform public markets by about 20% in total value over the life of a fund
 - Venture Capital has underperformed
- A review of the ASRS portfolio leads to conclusions about comparative performance
 - Mid sized buyout funds deliver the best and most consistent returns
 - Firms with specialized expertise in restructuring or an industry sector often do well

⁴Harris, Jenkinson and Kaplan. Private Equity Performance: What Do We Know? The Journal of Finance, October 2014.

Strategy

- ASRS favors
 - Buyout strategies that emphasize organizational transformation instead of mere financial engineering
 - Investments in growing sectors with high revenue growth potential (technology, healthcare)
 - Investments in sectors impacted by regulatory change (financial services)
 - Investments with sponsors having specialized expertise in restructuring, bankruptcy and turnaround situations
- ASRS is underweight
 - Venture Capital
 - Europe
 - Emerging Markets

Track Record

- Private equity performance has a fairly high level of dispersion
 - “Top quartile” funds outperform median funds by 5% to 10% depending on vintage
 - It is exceedingly rare for managers to perform persistently in the top quartile, but we do find managers persistently above median
 - ASRS implements private equity to provide diversification by manager, strategy and vintage year
- ASRS utilizes “PME” methods for performance assessment
 - PME (public market equivalent) measurements compare private equity returns to returns in public markets as if you invested in the public markets on the same days and in the same amounts as were invested in the PE fund
 - ASRS has been a leader in this realm, implementing software for PME methods nearly two years before it was commercially available through Bloomberg and other services⁵

⁵For a detailed explanation of PME methods, see this conference presentation
<http://www.rinfinance.com/agenda/2014/talk/KarlPolen.pdf>

Performance Tracking

- In connection with creation of the software for the PME calculations, ASRS has built a performance tracking and reporting system for private assets
- State Street is the official book of the record and the ASRS system works from information downloaded from the State Street system
- The ASRS system generates
 - a monthly reporting package
 - a quarterly performance chart pack
 - an internal website with cash flow and performance metrics on each partnership

Comparison to Russell 2000 (December 31, 2016)

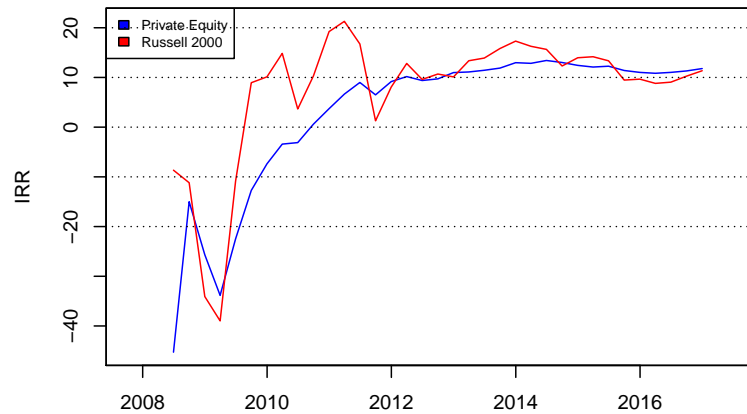
IRR Compared to Russell 2000

	One Quarter	One Year	Three Years	Five Years	Inception
Private Equity IRR	5.35%	15.59%	10.57%	12.60%	11.79%
Russell 2000 IRR	8.58%	19.90%	5.60%	12.37%	11.35%

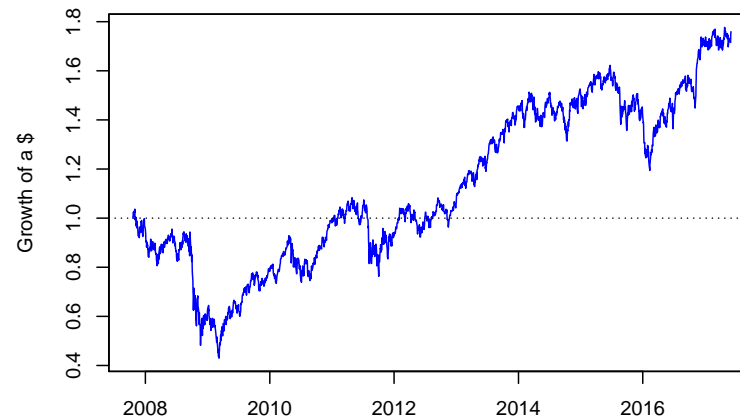
Current and Legacy Portfolios

Fund	R2K PME	Fund IRR	R2K \$Mtch IRR	Fund TVPI
Total PE	1.01	11.79%	11.35%	1.45
Total PE Legacy Portfolio	1.03	12.27%	11.59%	1.62
Total PE Current Portfolio	1.00	10.51%	10.72%	1.23

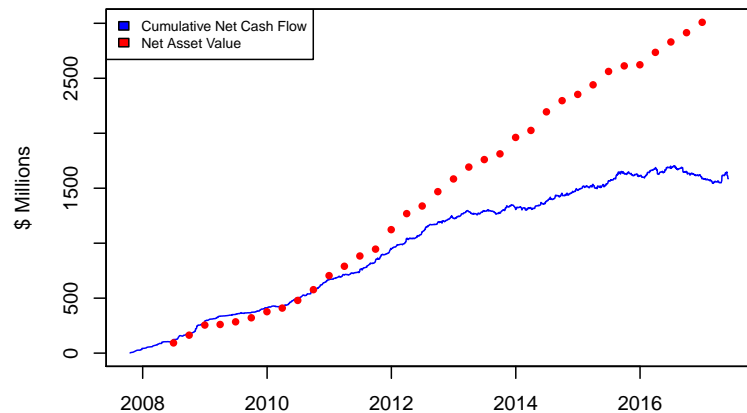
Private Equity IRRs compared to Russell 2000
 Inception through indicated date



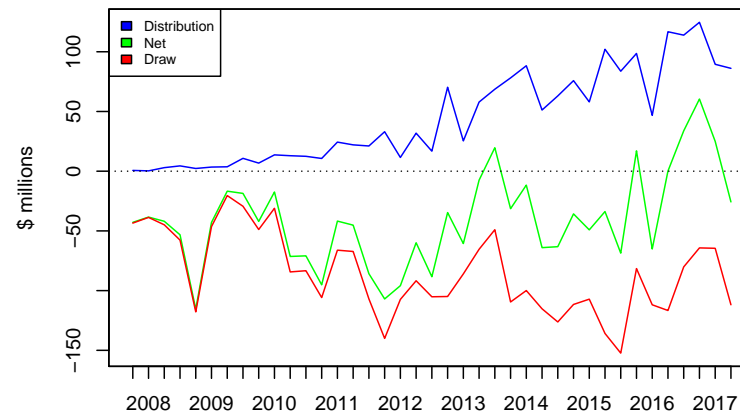
Russell 2000



Private Equity Cumulative Net Capital Contributed
 Compared to Value



Private Equity
 Quarterly Draws and Distributions



Performance Compared to Other PE (December 31, 2016)

Private Equity Comparative Performance

	One Quarter	One Year	Three Years	Five Years	Inception
Private Equity IRR	5.35%	15.59%	10.57%	12.60%	11.79%
Russell 2000 IRR	8.58%	19.90%	5.60%	12.37%	11.35%
Burgiss IRR	2.03%	9.03%	9.35%	11.55%	10.44%

Private Opportunistic Equity (December 31, 2016)

Private Opportunistic Performance

	One Quarter	One Year	Three Years	Five Years	Inception
Private Opportunistic IRR	12.89%	26.70%	17.91%	NA%	23.81%
Absolute 8 IRR	1.96%	8.00%	7.99%	NA%	8.00%

- The NAV in private opportunistic equity assets was \$305 million as of December 31, 2016
- While we customarily compare opportunistic investments to an absolute return benchmark
 - The inception to date dollar matched IRR for an investment in Russell 2000 would have been 8.89%

“Hunter, not hunted”

- ASRS uses quantitative screens from the Preqin database and PME methods to discern private equity sponsors with persistent excellent results
- ASRS has established an outbound program to pursue investments with the most highly qualified sponsors
 - Continue to refine criteria, particularly to identify firms built to last & possessing specialized skills to complement our portfolio

Organizational Dynamics

- Although we place much emphasis on quantitative analysis to discern performance
 - this analysis is not securities analysis
 - the new investor does not participate in the track record deals
 - private equity investing is best thought of as a team hiring decision
- Traditional private equity diligence places emphasis on stability
 - But common sense suggests that the best firms will be dynamic, evolving with changing conditions, weeding out weak performers and promoting high performers
 - Research has found that stability is a negative indicator of performance⁶

⁶Cornelli, Simintzi and Vig. Team Stability and Performance in Private Equity. 2014 Working Paper.
<http://www.collierinstitute.com/Research/Paper/264>

Fixed Income

- We have an overweight allocation to Fixed Income with a weighting as of December 31, 2016 of 27.6% vs. the interim SAA target of 25.3%. Following the US presidential election, we lowered our allocation to Fixed Income by cutting back our holdings of Interest Rate Sensitive Fixed Income assets.
- The overweight in Fixed Income reflects an overweight in Opportunistic Debt (3.7% vs. a 0.0% target) offset by underweights in Interest Rate Sensitive Fixed Income (11.5% vs. a 11.9% target) and High Yield Fixed Income (3.3% vs. a 4.2% target).
- We continue to believe that the Private Debt asset class offers the most attractive opportunity in fixed income with double-digit yields and relatively stable investment performance available for investors willing to accept illiquidity.
- Effective April 1, 2017, the SAAP target for Private Debt was raised to 12% from 10% with a range of 8-16%. Investments in Private Debt represented approximately 9.1% of the total fund as of 12/31/16 while our current partnership commitments represent approximately 14.3% of the total fund. While the SAAP target for Private Debt was raised, it was lowered for High Yield Fixed Income to 2% of the total fund from 4%.

Fixed Income Positioning vs. SAAP

- As a December 31, 2016, ASRS was positioned in fixed income as follows based on the SAAP adopted in 2015 and the Interim Adjusted SAAP Policy targets:

	<u>Actual</u>	<u>SAAP Target</u>	Interim <u>Adjust. SAAP</u>	<u>Over/ (Under)¹</u>
Total Fixed Income	27.6%	25.0%	25.3%	2.3%
Interest Rate Sensitive	11.5%	11.0%	11.9%	(0.5%)
High Yield	3.3%	4.0%	4.2%	(0.9%)
Private Debt	9.1%	10.0%	9.1%	0.0%
Opportunistic Debt	3.7%	0.0%	0.0%	3.7%

¹ Versus Interim SAA adjusted policy with unfunded private debt and real estate prorated to Interest Rate Sensitive and High Yield.

Revised SAAP Schematic Effective 4/1/17

Adopted in 2015				Effective 4/1/17			
ASRS Strategic Asset Allocation Policy Schematic				ASRS Strategic Asset Allocation Policy Schematic			
Asset Class	Policy	Range	Benchmark	Asset Class	Policy	Range	Benchmark
Tactical Cash (Unassetized)	0%	(0-3%)		Tactical Cash (Unassetized)	0%	(0-3%)	
Operating Cash (Unassetized)	0%			Operating Cash (Unassetized)	0%		
Operating Cash (Assetized)	0%			Operating Cash (Assetized)	0%		
Total Cash	0%			Total Cash	0%		
Treasuries (Long Duration)	0%	(0-10%)	Barclays LT Treasuries	Treasuries (Long Duration)	0%	(0-10%)	Barclays LT Treasuries
Core Bonds	11%		Barclays Aggregate	Core Bonds	11%		Barclays Aggregate
Interest Rate Sensitive	11%			Interest Rate Sensitive	11%		
US High Yield	4%		Barclays High Yield	US High Yield	2%	(0-6%)	Barclays High Yield
Private Debt	10%	(8-12%)	S&P/LSTA Leveraged Loan Index + 2.5%	Private Debt	12%	(8-16%)	S&P/LSTA Leveraged Loan Index + 2.5%
Opportunistic Debt	0%		Investment Specific	Opportunistic Debt	0%		Investment Specific
Total Fixed Income	25%	(18-35%)		Total Fixed Income	25%	(18-35%)	
Large Cap	20%		S&P 500	Large Cap	20%		S&P 500
Mid Cap	3%		S&P 400	Mid Cap	3%		S&P 400
Small Cap	3%		S&P 600	Small Cap	3%		S&P 600
U.S. Equity	26%	(16-36%)		U.S. Equity	26%	(16-36%)	
Developed Large Cap	17%		MSCI EAFE	Developed Large Cap	17%		MSCI EAFE
Developed Small Cap	2%		MSCI EAFE Small Cap	Developed Small Cap	2%		MSCI EAFE Small Cap
Emerging Markets	5%		MSCI EM	Emerging Markets	5%		MSCI EM
Non-U.S. Equity	24%	(14-34%)		Non-U.S. Equity	24%	(14-34%)	
Private Equity	8%	(6-10%)	Russell 2000	Private Equity	8%	(6-10%)	Russell 2000
Opportunistic Equity	0%		Investment Specific	Opportunistic Equity	0%		Investment Specific
Total Equity	58%	(48-65%)		Total Equity	58%	(48-65%)	
Commodities	2%	(0-4%)	Bloomberg Total Return	Commodities	2%	(0-4%)	Bloomberg Total Return
Real Estate	10%	(8-12%)	NCREIF ODCE	Real Estate	10%	(8-12%)	NCREIF ODCE
Infrastructure	0%	(0-3%)	Investment Specific	Infrastructure	0%	(0-3%)	Investment Specific
Farmland & Timber	0%	(0-3%)	Investment Specific	Farmland & Timber	0%	(0-3%)	Investment Specific
Opportunistic Inflation Linked	0%		Investment Specific	Opportunistic Inflation Linked	0%		Investment Specific
Total Inflation Linked	12%	(10-16%)		Total Inflation Linked	12%	(10-16%)	
Multi-Asset Class Strategies	5%	(0-12%)	Investment Specific	Multi-Asset Class Strategies	5%	(0-12%)	Investment Specific
Total	100%			Total	100%		

Approved by ASRS Board on 3/27/2015

Proforma Positioning vs. Revised SAAP Effective 4/1/17

- Proforma for the revised SAAP effective 4/1/17, ASRS was positioned in fixed income as follows as of 12/31/16:

	<u>Actual</u>	<u>SAAP Target</u>	Interim Adjust. <u>SAAP</u>	Over/ <u>(Under)</u> ¹
Total Fixed Income	27.6%	25.0%	25.3%	2.3%
Interest Rate Sensitive	11.5%	11.0%	13.7%	(2.2%)
High Yield	3.3%	2.0%	2.5%	0.8%
Private Debt	9.1%	12.0%	9.1%	0.0%
Opportunistic Debt	3.7%	0.0%	0.0%	3.7%

¹ Versus Interim SAA adjusted policy with unfunded private debt and real estate prorated to Interest Rate Sensitive and High Yield.

Interest Rate Sensitive Fixed Income

Interest Rate Sensitive Fixed Income is comprised of the Core Fixed Income and Treasuries (Long Duration) asset classes. Core fixed income represents the US investment-grade market which includes US Treasuries and Agencies, Agency Mortgage-Backed Securities, Corporate Bonds, Commercial Mortgage-Backed Securities (CMBS) and Asset-Backed Securities (ABS). Its benchmark is the Barclays U.S. Aggregate Bond Index, which encompasses the market for U.S. dollar denominated, fixed-rate, taxable, investment-grade bonds that are SEC-registered. Treasuries (Long Duration) is comprised of US Treasuries with maturities of 10 years or longer; its benchmark is the Barclays U.S. Treasury Long Index. The performance of Interest Rate Sensitive Fixed Income is heavily tied to the direction of US Treasury rates. In addition, Interest Rate Sensitive Fixed Income tends to perform well when equity markets decline (ex. 2008) or when inflation expectations materially decline. As a result, it is an important part of the overall ASRS portfolio because it provides a source of balance and diversification from riskier assets such as equities.

Interest Rate Sensitive Fixed Income (Continued)

IMD House View: Interest Rate Sensitive Fixed Income is likely to generate low returns due to low overall yields as Treasury rates remain at low levels. That being said, it remains a safe haven in times of market turbulence and tends to perform well when risky assets such as equities sell off. We are underweight Interest Rate Sensitive Fixed Income vs. the interim SAA adjusted policy target. We see a heightened risk that rates may rise over the intermediate term.

Weighting vs. Revised Interim SAAP Policy Effective 4/1/17:		Underweight
ASRS Actual Weighting (December 31, 2016)		11.5%
Pro Forma Interest Rate Sensitive Interim Adj. Policy		13.7%

Core Fixed Income Managers

Portfolio	Market Value (\$MM) 12/31/16	%	IMD Commentary
Blackrock US Debt Index Fund	\$1,976	51	Passive strategy with history of modest outperformance.
F2 Internally Managed Account	\$1,868	49	Enhanced passive strategy with an objective to slightly outperform the Barclays U.S. Aggregate Bond Index (the "Index") through a stratified sampling strategy. History of outperformance particularly over the past 10-year period.
Total	\$3,844	100	

Treasuries (Long Duration) Manager

Portfolio	Market Value (\$MM) 12/31/16	%	IMD Commentary
BlackRock Long Term Government Bond Index Fund	\$ 0	100	Passive strategy. We currently do not have an allocation to the Treasuries (Long Duration) asset class.
Total	\$0	100	

Barclays U.S. Long Treasury Index Yield 2016-2017

Barclays U.S. Long Treasury Index Yield 2016 – 2017



High Yield Fixed Income

High Yield Fixed Income is the below investment-grade corporate bond market in the US. Unlike Interest Rate Sensitive Fixed Income which has a high correlation with Treasury rates, High Yield Fixed Income has historically had a negative correlation with Treasury rates and a positive correlation with the equity markets. Returns are heavily influenced by credit developments at highly leveraged companies whose performance is tied to factors that affect equity markets (economic outlook, earnings, cash flow, valuations, etc.)

IMD House View: Pro forma for the revised Interim SAAP effective 4/1/17, we have an overweight in High Yield Fixed Income. We have had an unusually long credit cycle, which began with an upturn in 2009. With an improved business outlook and strong global demand for yield buoying the high yield market, we believe that defaults will likely remain low for the foreseeable future and the credit cycle will be elongated. High Yield Fixed Income will likely outperform Interest rate Sensitive Fixed Income in the near-term. That being said, we will likely reduce our weighting in the high yield asset class over time to fund the expansion of our investments in Private Debt, an asset class which offers significantly higher expected returns with lower volatility.

High Yield Fixed Income (Continued)

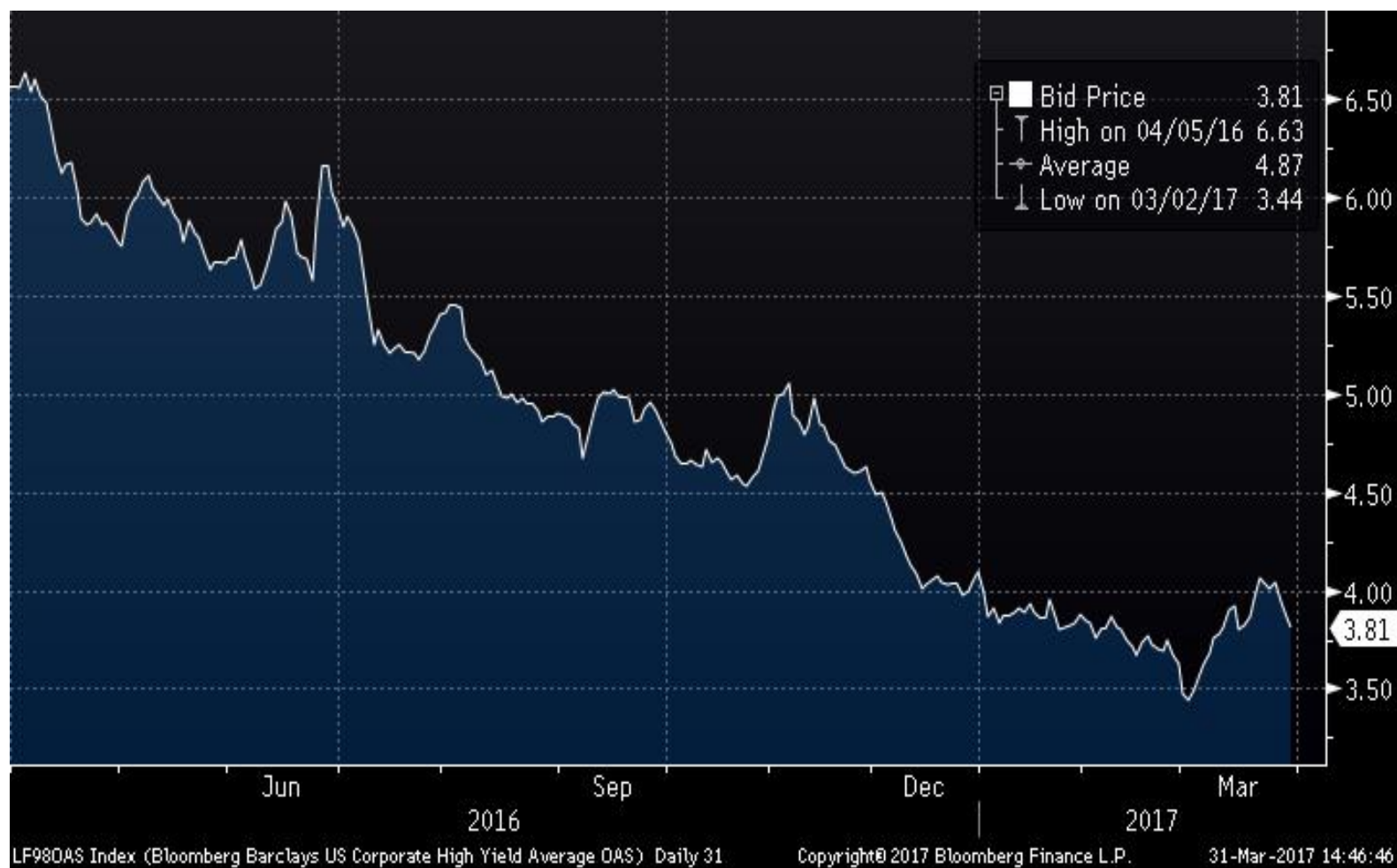
Weighting vs. Revised Interim SAAP Effective 4/1/17:	Overweight
ASRS Actual Weighting (December 31, 2016)	3.3%
Pro Forma High Yield Fixed Income Interim Adj. Policy	2.5% (0-6% range)

High Yield Fixed Income Managers

Portfolio	Market Value (\$MM) 12/31/16	%	IMD Commentary
Columbia Separate Account	\$752	66	Active manager with flexible investment style that adjusts portfolio risk based on the investment outlook. While Columbia has meaningfully underperformed the high yield benchmark for the one-year period, it has significantly outperformed over the most recent three-year period and has a longer term track record well above its peers.
JP Morgan High Yield	\$391	34	Active manager with a flexible investment style that is agnostic to credit quality. Since the inception of the mandate in 2013, JP Morgan has slightly underperformed the high yield benchmark. Its track record for the one- and three-year periods compares favorably with its peers.
Total	\$1,143	100	

Barclays US Corporate High Yield Index

Option Adjusted Spread (OAS) 2016 - 2017



Barclays US Corporate High Yield Index

Yield-to-Worst 2016 - 2017



Private Debt

Private Debt is comprised of illiquid loans and bonds that typically fund highly leveraged companies and real estate properties that are typically too small in size to meet the requirements of the tradable leveraged loan, high yield bond, or commercial mortgage-backed securities markets.

For example, Private Debt may consist of secured loans funding leveraged buyouts of small to mid-size companies or mezzanine financing for real estate properties. Returns in the asset class are determined by: 1) the expected returns of individual investments (based on the cash coupon rate or spread over LIBOR and other sources of return including underwriting fees, original issuance discounts and premium call features) and 2) the actual level of credit losses experienced in the underlying portfolios.

Private Debt (Continued)

IMD House View: Private Debt offers the most attractive opportunity in the fixed income markets with double-digit yields readily available for investors willing to accept illiquidity. The market opportunity is principally driven by regulatory constraints that make it unattractive for banks to hold illiquid loans or other debt of below investment-grade credit quality.

Actual Weighting vs. Revised SAAP Policy Effective 4/1/17:	Underweight ⁷
Actual Weighting (December 31, 2016)	9.1%
Private Debt Policy	12.0% (8-16% range)

⁷ ASRS is tactically overweight based on commitments made of approximately 14.3% of the total fund.

Private Debt Characteristics

Pros:

- High Expected Net Returns (10-11% on average)
 - Substantially higher gross returns (a combination of yield, fees, OID, and call premiums) than comparable public market securities (high yield bonds, tradable bank loans, asset-backed securities, CMBS)
 - Low loss history in underlying portfolios
- Primarily Floating Rate
 - Approximately 80% of ASRS's ongoing private debt commitments are expected to be floating rate investments
- Full Due Diligence by Managers
- Customized Covenants and Credit Monitoring

Private Debt Characteristics (Continued)

Cons:

- Illiquid
- Delayed Deployment of Capital

Private Debt Market Environment

- Demand for corporate loans are driven by: 1) middle market buyout and acquisition activities which need financing, and 2) middle market borrowers which need to refinance existing loans from banks.
- Regulatory constraints limit banks ability to make below investment-grade, illiquid loans (typically to middle market companies)
 - Basel III
 - Dodd-Frank
 - “Leveraged Lending Guidelines” of OCC/Fed/FDIC

ASRS Private Debt Program

Lending Strategies Diversified Across 10 Managers

- US Corporate
 - Five managers targeting unique areas of the middle market
 - One manager targeting larger companies
- European Corporate
 - One manager targeting middle market lending
- Real Estate Finance
 - Two managers targeting three market segments
- Asset Backed
 - One manager targeting unique market opportunity

ASRS Private Debt Program

- Focus on Fund-of-One Partnerships With Leading Managers
- Customized Terms:
 - Scalable Evergreen
 - Termination Rights
 - Superior Fees
 - Investment Restrictions
 - Leverage Constraints (if applicable)

Private Debt Managers

Private Debt Managers

Portfolio	ASRS Commitment (\$MM)	Market Value (\$MM) 3/24/17	Target Net Return	%	IMD Commentary
Sonoran Private Credit Opportunities Fund, LLC (Managed by Cerberus)	\$1,100	882	13%	27	Separate account that invests in floating-rate secured loans primarily to fund private-equity sponsored middle market leveraged transactions . The LLC can leverage ASRS's investment by up to 1.5x to boost returns.
Monroe Private Credit Fund A	\$650	327	11%	10	Fund-of-one partnership that invests in floating-rate secured loans primarily to fund smaller middle market leveraged transactions . The partnership can leverage ASRS's equity investment by up to 1.25x to boost returns.
RFM Cactus Holding Company, LLC (Partnership with Related)	\$625	520	10%	16	Fund-of-one partnership that invests in: 1) "Freddie B" securities (first loss tranches of multi-family property securitizations that have been pooled and sponsored by Freddie Mac;) and 2) mezzanine debt to finance real estate properties.
Cactus Direct Lending Fund, LP (Partnership with HPS)	\$600	278	12%	9	Fund-of-one partnership that invests in floating-rate secured loans primarily to fund middle market leveraged transactions (ex. buyouts, recapitalizations) often without a private equity sponsor. The partnership can leverage ASRS's equity investment by up to 1.25x to boost returns.
AP Mezzanine Partners III , LP (Partnership with HPS)	\$500	53	11%	2	Fund-of-one partnership that invests primarily in mezzanine debt to fund highly leveraged transactions for larger capitalization companies.
ICG Arizona Senior Direct Lending Credit Fund	\$401	242	11%	8	Fund-of-one partnership that invests in floating-rate secured loans primarily to fund private-equity sponsored middle market leveraged transactions in Europe. The partnership can leverage ASRS's equity investment by up to 1.0x.
H/2 Core Real Estate Debt Fund	\$400	318	6%	10	Open-ended fund that invests in floating-rate senior mortgage loans and other conservatively underwritten real estate finance investments. The fund will utilize leverage of up to 60%.
Sonoran Cactus Private Asset Backed Fund, LLC (Managed by Ares)	\$500	162	10%	5	Separate account that invests in loans backed by consumer and commercial receivables.
Arizona – White Oak Investor LLC	\$210	214	12%	7	Separate account that invests in floating-rate secured loans for small- to mid-size companies typically lacking a deal sponsor.
AP Mezzanine Partners II, LP (Partnership with HPS, in liquidation)	\$170	170	11%	5	Fund-of-one partnership that invests primarily in mezzanine debt to fund highly leveraged transactions for larger capitalization companies. Investment period expired 6/30/16.
Blackstone/GSO Capital Solutions Fund (in liquidation)	\$44	44	13%	1	Commingled fund which provided rescue financing to companies seeking to avoid a bankruptcy or restructuring. Investment period ended in 2013 and portfolio is now running off.
Total	\$5,200	\$3,210		100	22

Opportunistic Debt

Opportunistic Debt is tactical in nature and represents asset classes or strategies not encompassed in the SAAP and offer the potential to meet the fund's targeted return. Since its inclusion in ASRS's portfolio beginning in 2008, Opportunistic Debt, including both existing and defunded mandates, has generated an aggregate net IRR of 9.3% through 09/30/16. However, performance over the past three years was not as strong with a 4.6% net IRR primarily due to weak performance in 2015 when the credit markets sold off.

IMD House View: Opportunities exist in select fixed income markets (primarily distressed debt) to generate expected returns that exceed other fixed income asset classes in the SAAP. ASRS has \$1.3 billion of commitments (representing approximately 3.6% of the total fund) to ongoing Opportunistic Debt partnerships and \$0.5 billion of investments (representing approximately 1.4% of the total fund) in partnerships that are in liquidation.

Opportunistic Debt (Continued)

Actual Weighting vs. Revised SAAP Policy Target Effective 4/1/17:	
ASRS Actual Weighting (December 31, 2016)	3.7%
Opportunistic Debt Policy	0.0% (0-10% ⁸ range)

⁸Range of 0-10% includes all opportunistic asset classes (debt, equity and inflation-linked) which totaled 4.9% at 12/31/16.

Opportunistic Debt Managers funds Making New Investments

Portfolio	ASRS Commitment (\$MM)	Market Value (\$MM) 3/24/17	Target Net Return	%	IMD Commentary
Avenue-ASRS Europe Opportunities Fund & Avenue Europe Capital Partners III	\$350	\$216	12%	25	\$250 million fund-of-one partnership with Avenue and \$100 million co-mingled fund commitment to invest in distressed debt of European companies.
LCM Partners CO IV LP	\$350	\$71	10%	8	Fund-of-one partnership with LCM Capital that invest in pools of small European loans, both non-performing and performing, sold by European banks and other financial institutions.
OZ Credit Opportunities Domestic Partners L.P.	\$300	\$360	12%	41	Co-mingled fund managed by Och-Ziff utilizes a multi-strategy approach to allocate to both distressed structured and corporate credit as it sees fit based on the opportunity.
Ares Saguaro Income Opportunity Fund	\$300	\$222	8%	26	Fund-of-one partnership with Ares that invests in publicly-traded, high-yielding business development companies ("BDCs") and commercial mortgage REITs
Total	\$1,300	\$869		100	

Opportunistic Debt Managers Funds in Liquidation

Portfolio	ASRS Commitment (\$MM)	Market Value (\$MM) 3/24/17	Target Net Return	%	IMD Commentary
GSO Cactus Credit Opportunities Fund	\$261	\$261	12%	53	Fund-of-one partnership with GSO to exploit the highest conviction, risk-adjusted corporate credit opportunities across the GSO platform including distressed debt in the US and Europe. Investment period terminated in October 2016.
Avenue Europe Capital Partners II	\$93	\$93	15%	19	Fund invests in distressed debt of European companies. Investment period ended in 2014.
Oaktree Opportunities Fund VIIIb	\$94	\$94	15%	19	Funds invests in distressed debt primarily corporate such as leveraged loans. Investment period ended in 2014.
Fortress MSR Opportunities Fund II	\$26	\$26	12%	5	Fund invests in excess mortgage-servicing rights. Investment period ended in 2015.
Oaktree Opportunities Fund VIII	\$14	\$14	15%	3	Funds invests in distressed debt primarily corporate such as leveraged loans. Investment period ended in 2012.
TCW Capital Trust	\$6	\$6	10%	1	Fund invests in four asset classes: leveraged loans, high yield bonds, private debt and mezzanine debt. Investment period ended in 2013.
Total	\$494	\$494		100	

Real Estate Strategy

- ASRS Implements its real estate program pursuant to a strategic plan
- ASRS updated this plan in September, 2015
- The ASRS Real Estate Strategic Plan can be found at the following link
www.azasrs.gov/content/key-investment-documents

Real Estate Objectives

- Generate attractive risk adjusted returns at or above the actuarial target return of 8%
- Enhance the overall diversification of the ASRS investment program
- Generate regular cash flow from stabilized properties
- The program is bench-marked against the NCREIF ODCE index. The real estate strategic plan provides the following guidance regarding the target return and selection of the benchmark:

“By selecting the NFI-ODCE as benchmark, the ASRS considers this benchmark as an opportunity cost, not a model portfolio. The ASRS expects that its portfolio will vary significantly from the ODCE index. The ASRS will manage its investments actively and dynamically in the real estate asset class in order to target a net return expectation of 8%. The 8% net objective represents a significant premium over the 6.5% net long term expectation for passive, stable, equity real estate positions.”

Real Estate Portfolio Structure

- 75% of the portfolio is planned for implementation in separate account structures
 - In these structures, ASRS will be a majority owner with significant control rights including control over liquidity events and the right to utilize a consultant to validate each property meets the investment criteria and return hurdles applicable to the investment
 - ASRS favors separate account structures because of the ability to negotiate custom investment criteria, enhanced controls and enhanced liquidity
- 25% of the portfolio is planned for implementation in commingled structures
 - Commingled structures will be used for differentiated strategies that are only available in a commingled structure or not feasible to implement in a separate account
- ASRS commenced building the separate account portfolio in 2013 and this portfolio now constitutes approximately one half of the real estate portfolio. We anticipate the target portfolio structure will be achieved within three years as we continue to build out the separate accounts and the legacy commingled funds run off.

Property Markets

- Real estate performance is strongly influenced by observable and durable demographic and economic trends
- Rental increases occur in situations with high demand and constraints on supply
- Some important trends are:
 - The demographics of baby boomers and their children profoundly affect real estate demand
 - E-commerce affects utilization of industrial and retail space
 - The structure of employment away from goods producing to service occupations affects the geographic dispersion of economic activity
 - Urbanization is a continuing trend with a pattern of globally significant cities emerging
 - Office utilization is becoming much more efficient with a strong downward trend of space utilization per employee

Demand Driven Investing

- In order to capitalize on these trends, we are creating a customized investment strategy that we like to call “demand driven investing”.
 - We believe the risk of real estate is not having tenants
 - We search for opportunities with strong demand fundamentals driven by age and income demographics, education levels, concentrations of high quality jobs and other relevant location criteria
- We identify sectors that have favorable demand dynamics with demographic or other economic tail wind and search for markets with supply barriers
 - Apartments, industrial, self-storage, medical office, senior housing, student housing are overweight sectors for us
- We have implemented a robust search and recruitment process to find the most qualified parties to be our partners in this program
 - Identify first tier operators in each of these sectors to implement through custom separate account arrangement

Property Level Underwriting

- All of our separate account agreements require consultant confirmation that each property acquired meets investment criteria and meets applicable return hurdles
 - While there are national real estate statistics, property markets are inherently local
 - We underwrite every property in the context of its competitiveness in the supply/demand dynamic of its neighborhood
- We are supported in this process by a consultant with deep expertise in this type of property level underwriting and with extensive contacts in the real estate industry

Diversification and Leverage

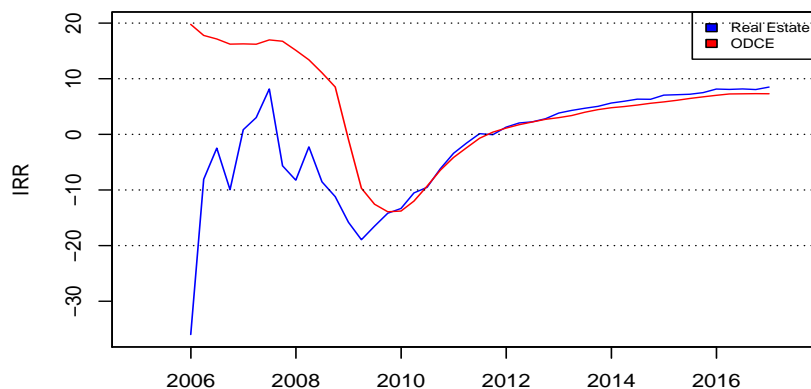
- As required by the strategic plan, the portfolio will be well diversified across
 - Property types
 - Geography
 - Life Cycle Stage
 - Vintage Year
- The portfolio will levered at 50% to 60% loan to value
 - Leverage is measured at the portfolio level, allowing latitude at the property level
 - Higher leverage is permitted on stable properties with access to fixed rate financing but offset by lower leverage on properties in the process of implementing a value creation business plan
 - Given the uncertainty on future interest rates, leverage of up to 65% may be utilized on an asset level basis for fixed interest rate debt

Capital Markets

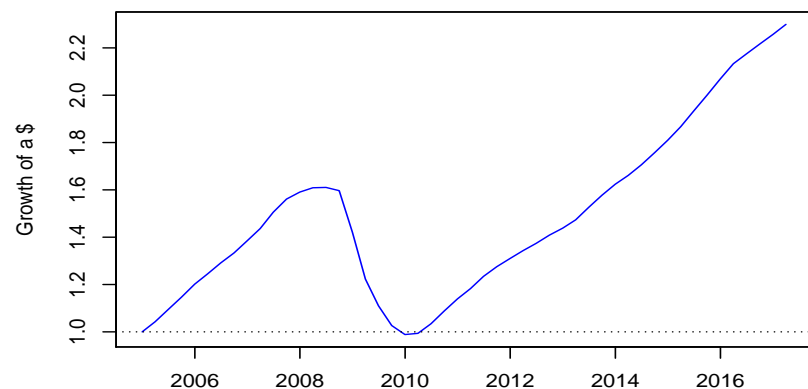
- Like other asset classes, real estate faces challenges as we approach what may be the end of an extended period of very low interest rates
 - While real estate cap rates are low, spreads to treasuries are higher than historic norms indicating some degree of interest rate increase is already priced into values
- Our strategy in this context is:
 - Focus on diversification, especially by vintage year
 - Highly disciplined underwriting at the property level anticipating future increases in interest rates and cap rates
 - Avoid the most expensive core properties which in the current market are “priced to perfection”
 - Focus on niche property types such as medical office priced wide of traditional property categories
 - Focus on properties with value creation potential through operational improvement investing directly with expert operators

Performance Overview

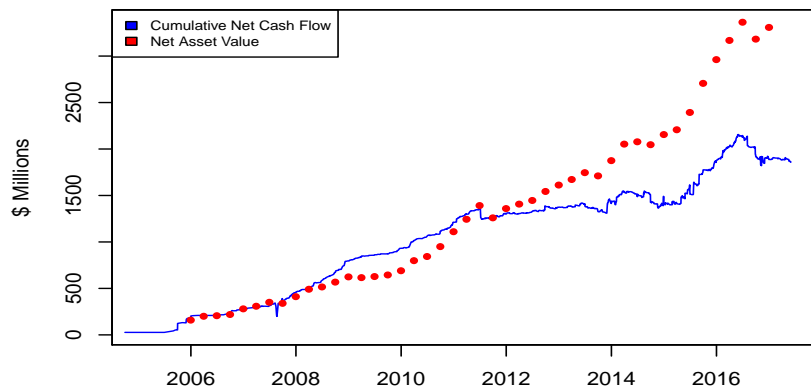
**Real Estate IRRs compared to ODCE
 Inception through indicated date**



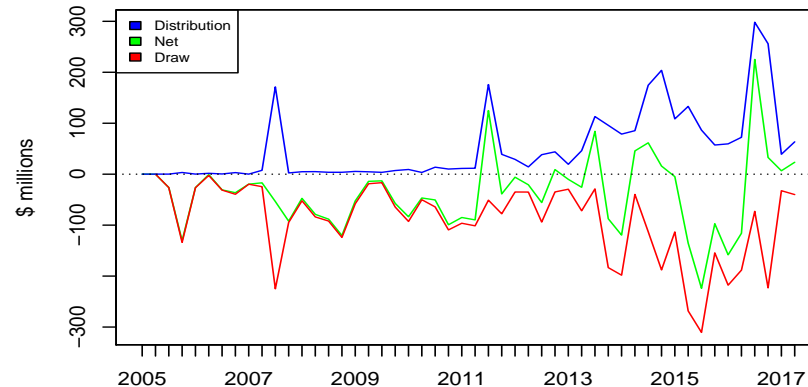
ODCE



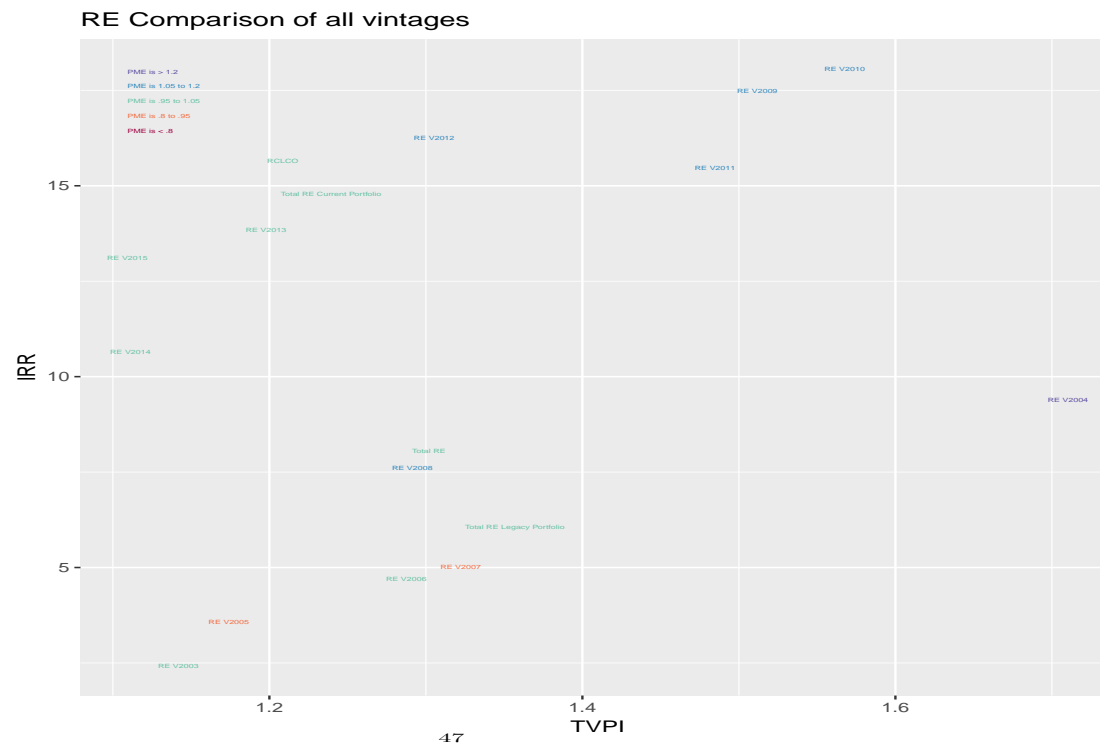
**Real Estate Cumulative Net Capital Contributed
 Compared to Value**



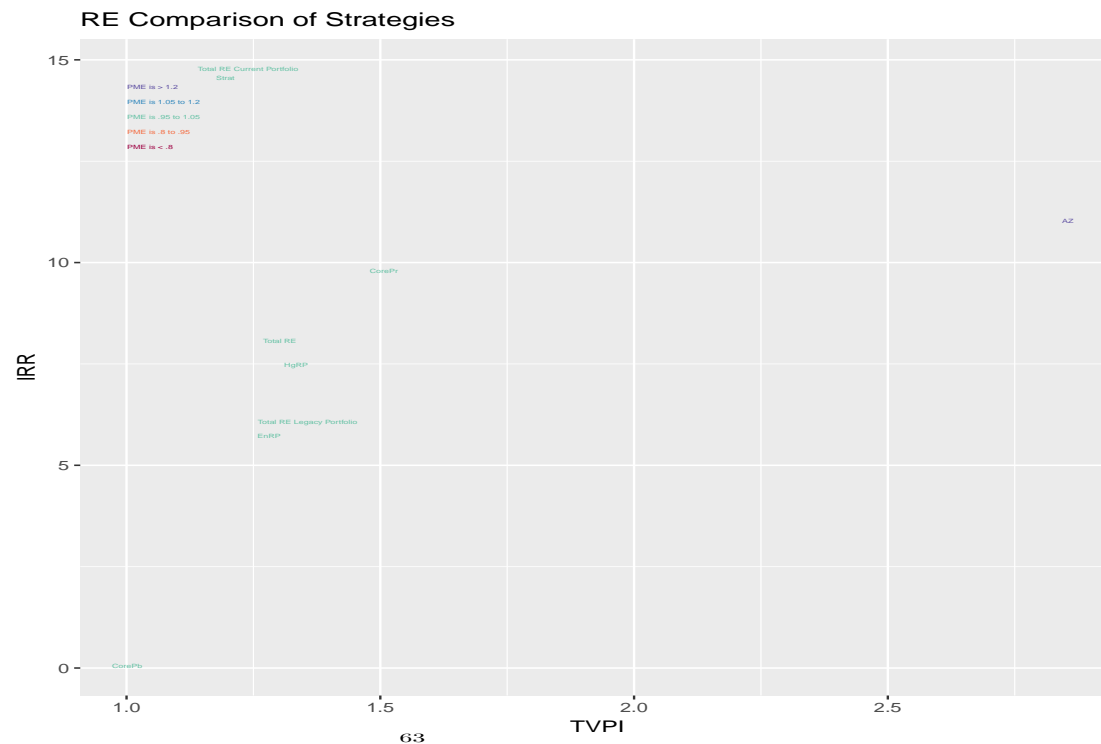
**Real Estate
 Quarterly Draws and Distributions**



Performance by Vintage Year



Performance by Strategy Type



Returns for Periods Ended September 30, 2016

IRRs

	One Quarter	One Year	Three Years	Five Years	Inception
Real Estate IRR	5.04%	10.67%	13.21%	13.28%	8.50%
ODCE IRR	1.83%	9.04%	11.45%	11.41%	7.30%

Performance Accountability

The following table shows performance for legacy real estate investments and those by the current management team.

Portfolio Returns

	Portfolio IRR	ODCE IRR	Outperformance
Total RE Legacy Portfolio	6.04	6.06	-0.03
Total RE Current Portfolio	15.90	11.29	4.61
Real Estate Opportunistic	24.08	12.23	11.85
Combined Current Real Estate	17.22	11.46	5.77

The following table shows performance of the current consulting team.

Consultant Returns

	Portfolio IRR	ODCE IRR	Outperformance
RCLCO Real Estate	16.48	10.97	5.50
RCLCO Opportunistic	27.44	11.82	15.62
RCLCO Combined	17.44	11.05	6.38

Farm Land Investing

- ASRS invests in farm land for its long-term inflation protection linked to the value of land and its income generation
- ASRS invested \$175 million International Farming Corp (IFC)
 - IFC is a multi-generational U.S. farming corporation with deep operational expertise
 - They pursue a diversified and value add approach to agricultural investing
 - Diverse crop mix and geography with high crop optionality
 - Prefer properties with natural resource optionality (water and mineral rights)
 - Avoids the expensive Midwest 'I' states (Iowa, Illinois, and Indiana)
 - ASRS negotiated custom structure with right-of-first-offer (ROFO) rights to buy assets upon sale from the fund
 - Inception IRR through June 30, 2016 is 3.82% which has underperformed the benchmark return of CPI+350 by 1.8%
 - The portfolio is still young with average hold of less than 3 years
 - Value add business plans are still in course of implementation with productivity improvements being realized in the current crop year
 - Recent distressed investments in citrus and organic farming seem very promising
 - Commodity grain investments have been impacted by prices

Infrastructure

- ASRS invests in infrastructure for long-term inflation protected income streams from assets and systems that support transportation, energy, shipping, and communications
 - Global needs exist to support rising populations and antiquated operations
- ASRS invested \$300 million with Industry Funds Management (IFM), an Australian-based infrastructure manager that invests globally using a core strategy in an open-end fund structure
 - Fund structure provides diversity of exposure across strategies and geography
 - Long term vehicle structure is aligned with long term character of assets
 - Focused on OECD countries; current portfolio invests across US, UK, and Europe
 - Investments include airports, toll roads, a petroleum pipeline, power generation & transmission facilities, a regulated water & wastewater treatment company, and broadcast and wireless communication infrastructure
 - Projects are heavily regulated and have predictable revenue patterns
- The \$300 million commitment was called in December 2014
- Inception IRR through June 30, 2016 is 6.48%, which has outperformed the benchmark return of CPI+350 by 0.8%
 - The portfolio has performed well (albeit over a short measurement period) but with gains largely offset by currency impacts

Timber

- Timber is a permitted asset in the inflation linked group because it can provide long-term inflation protection income derived from the rising utilization of timber and shrinking forest sizes
- Timber has a low correlation with other asset classes combined with low volatility
- ASRS has made no investments in timber but monitors the space
- Should ASRS pursue this strategy, it will seek alignment of asset and vehicle life similar to other private markets inflation-linked assets

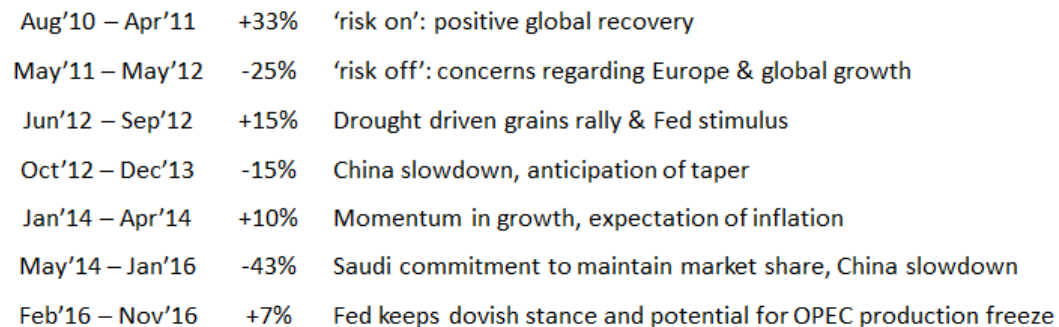
Background of ASRS Commodities Program

- ASRS approved a 3% (0%-5%) strategic allocation to commodities in October 2009. After an in-depth search, ASRS invested just over half of the allocation with two long-only commodities investment managers
 - Gresham - \$200M on 8/30/2010
 - Systematic rules-based approach is used to construct and re-balance the portfolio. A discretionary, market-driven approach is used to implement and roll commodity futures.
 - Cargill - \$200M on 9/30/2010
 - Fundamental, bottom up approach using trading desks to construct a regional and global supply/demand balance sheet for each commodity market in which Cargill participates
- ASRS legged into its allocation to avoid chasing returns and because of valuation concerns.
- ASRS GTAA managers' benchmark also included a 3% allocation to commodities.

Background of ASRS Commodities Program (2)

- The 2012 Strategic Asset Allocation Study increased target allocation from 3% to 4%, with a range of 1% - 7%
- The 2015 Strategic Asset Allocation Study reduced the target allocation from 4% to 2%, with a range of 0% - 4%
 - Over the past 2 years, ASRS maintained a tactical underweight to commodities and reduced its exposure:
 - ASRS has reduced its tactical underweight as certain commodities markets begin to re-balance and a new administration that has indicated a desire for less regulation and more fiscal stimulus
 - ASRS maintains its single manager relationship in commodities with Gresham. ASRS is comfortable with Gresham's role due to inception-to-date out-performance, exceptional client service, and low fees

Bloomberg Commodities Total Return Index



Arizona State Retirement System

Commodities Performance

as of 2/28/2017:

Arizona State Retirement System

Inflation-Linked Assets Performance Summary

	Market Value (\$)	% of Portfolio	1 Mo (%)	YTD (%)	3 Mo (%)	Fiscal YTD (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Return (%)	Since
Total Inflation-Linked Assets	447,574,343	1.25	0.23	0.80	2.82	1.95	18.36	-12.67	-9.32	--	-4.58	Feb-10
ASRS Custom Inflation-Linked Benchmark			<u>0.21</u>	<u>0.34</u>	<u>2.15</u>	<u>-0.97</u>	<u>15.95</u>	<u>-13.02</u>	<u>-9.82</u>	<u>-2.33</u>	<u>-5.80</u>	Feb-10
Over/Under			0.02	0.46	0.67	2.92	2.41	0.35	0.50		1.22	
Total Commodities	447,574,343	1.25	0.23	0.80	2.82	1.95	18.36	-12.67	-9.31	--	-4.59	Sep-10
Bloomberg Commodity Index			<u>0.21</u>	<u>0.34</u>	<u>2.15</u>	<u>-0.97</u>	<u>15.95</u>	<u>-13.02</u>	<u>-9.82</u>	<u>-5.87</u>	<u>-5.85</u>	Sep-10
Over/Under			0.02	0.46	0.67	2.92	2.41	0.35	0.51		1.26	
Gresham	447,574,343	1.25	0.23	0.80	2.82	1.95	18.36	-12.67	-9.46	--	-4.34	Sep-10
Bloomberg Commodity Index			<u>0.21</u>	<u>0.34</u>	<u>2.15</u>	<u>-0.97</u>	<u>15.95</u>	<u>-13.02</u>	<u>-9.82</u>	<u>-5.87</u>	<u>-5.85</u>	Sep-10
Over/Under			0.02	0.46	0.67	2.92	2.41	0.35	0.36		1.51	

Multi-Asset Class

- The Multi-Asset Class invests in broad mandates that span liquid public equity, fixed income, foreign exchange, commodities and other assets with an attractive risk return profile and low correlations to the total fund.
- These strategies are generally implemented on a long/short basis and often use derivatives.
- Previously, ASRS has invested in various global tactical asset allocation managers.
- The Multi-Asset Class has a 5% Strategic Asset Allocation Policy target and is currently populated with a single 3.2% allocation (\$1.16 billion) to Bridgewater's Pure Alpha Fund.

Bridgewater Pure Alpha Fund

- Bridgewater's Pure Alpha targets a 12% return gross of fees with an expected 12% annualized volatility.
- Pure Alpha is designed with no bias to market betas using long and short positions across global equities, nominal interest rates, corporate credit, commodities, and currencies.
- Pure Alpha investment philosophy is based on a fundamental understanding of the cause and effect linkages within and across markets combined with a systematic portfolio construction process that incorporated rigorous quantitative inputs to generate each position's expected return and risk.
- The ASRS funded the Pure Alpha Strategy in late 2003, initially running the portfolio as an 'Alpha Overlay' with Bridgewater managing a beta allocation that broadly replicated the liquid portion of the total fund Strategic Asset Allocation.
- At the end of March 2015, the portfolio was transition to a standalone Pure Alpha account and the beta was reallocated throughout total fund.

Multi-Asset Class Market Values

```
## Error in eval(expr, envir, enclos): could not find function  
"xts"  
## Error in eval(expr, envir, enclos): could not find function  
"xts"  
## Error in eval(expr, envir, enclos): could not find function  
"xts"
```

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## Error: could not find function "xts"  
## Error in 'colnames<-('(*tmp*', value = c("Bridgewater",  
"Windham"))): attempt to set 'colnames' on an object with less  
than two dimensions  
## Error in hasTsp(x): cannot assign 'tsp' to zero-length vector  
## Error in eval(expr, envir, enclos): could not find function  
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```

Multi-Asset Class Performance

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Bridgewater Performance

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not found
```

Multi-Asset class Strategy Review Project

- The Multi-Asset Class portfolio is currently under review.
- ASRS retained Mercer Consulting to assist defining strategies that may fit within the Multi-Asset Class. Mercer has helped develop criteria for inclusion in the asset class, supplied portfolio data on risk and return, and provided research notes on managers that are highly recommended.
- TIMD has begun preliminary calls with candidates of interest, focusing on each manager's investment process, portfolio construction methodology.
- Strategies that meet the ASRS search criteria and prove of interest in preliminary calls will be subject to full due diligence of their investment and operational capabilities.
- IMD has not yet reached any conclusions on the recommendations as a result of this process.