Equities, Real Estate, Farmland & Infrastructure, and Commodities

Arizona State Retirement System

April 17, 2018

Outline

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Strategy

- Domestic Equity
  - Enhanced Index: managed internally for enhanced beta exposure
  - Factors: managed internally
  - Active: transitioned away from
- International Equity
  - Enhanced Index: managed externally in SMAs for beta exposure
  - Factors: recent study reached same conclusions as domestic initiative
    - To be implemented in EAFE large cap and Emerging Markets
  - Active: transitioning away from

Update: Transitions

Transition Event	Date	Amount	Total Cost	Market Avg Cost	Net $ vs. Avg	# of Weeks
US LC Factors	July 2017	$1,670 MM	+5	-23	$4.7 MM	1
US MC Active	Sep 2017	$240 MM	-35	-42	$0.2 MM	1
US SC Actives	Sep 2017	$650 MM	-51	-57	$0.4 MM	4
EAFE SC Actives	Oct 2017	$400 MM	-69	-76	$0.3 MM	4
US LC Active	Nov 2017	$760 MM	-25	-23	-$0.2 MM	1
EM/EM Factors	Apr 2018	$1,200 MM	TBD	-92	TBD	TBD
EAFE LC/EAFE LC Factors	Apr 2018	$1,800 MM	TBD	-53	TBD	TBD

- EAFE Small Cap is complete. EM and EAFE LC transitions to factor portfolios are underway.
- Net total savings versus market average cost is $5.4 M for completed transitions
  - Market average cost is calculated by averaging the cost data provided by BlackRock, Northern Trust, Russell and Jimmy Elkins

Allocation: Public Equity

Sub-asset class	Benchmark	Allocation	Current Positioning	Enhanced Index	Factors	Active
US LC	S&P 500	20%	-1.0%	75%	25%	0%
US MC	S&P 400	3%	-0.1%	100%	0%	0%
US SC	S&P 600	3%	0.0%	100%	0%	0%
Int'l Developed LC	MSCI EAFE	17%	+0.7%	75%	0%	25%
Int'l Developed SC	MSCI EAFE SC	2%	-0.5%	100%	0%	0%
Emerging Markets	MSCI EM	5%	-0.5%	76%	0%	24%

- 1.3% underweight in aggregate and using the transitions to rebalance in international

Enhanced Index Portfolios

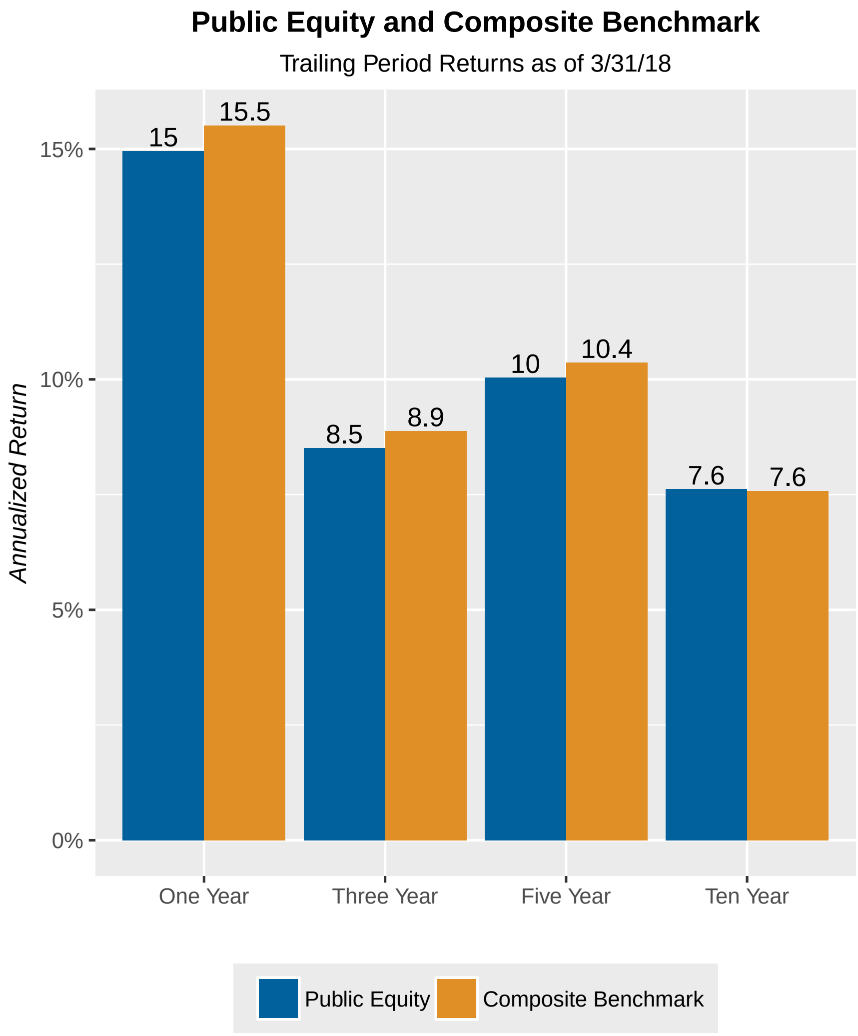
Portfolio	Benchmark	YTD	Fiscal YTD	1Y
		alpha (bps)	alpha (bps)	alpha (bps)
E2	S&P 500	-5	-3	-3
E10	S&P 400	+6	+11	+23
E6	S&P 600	+15	+23	+29

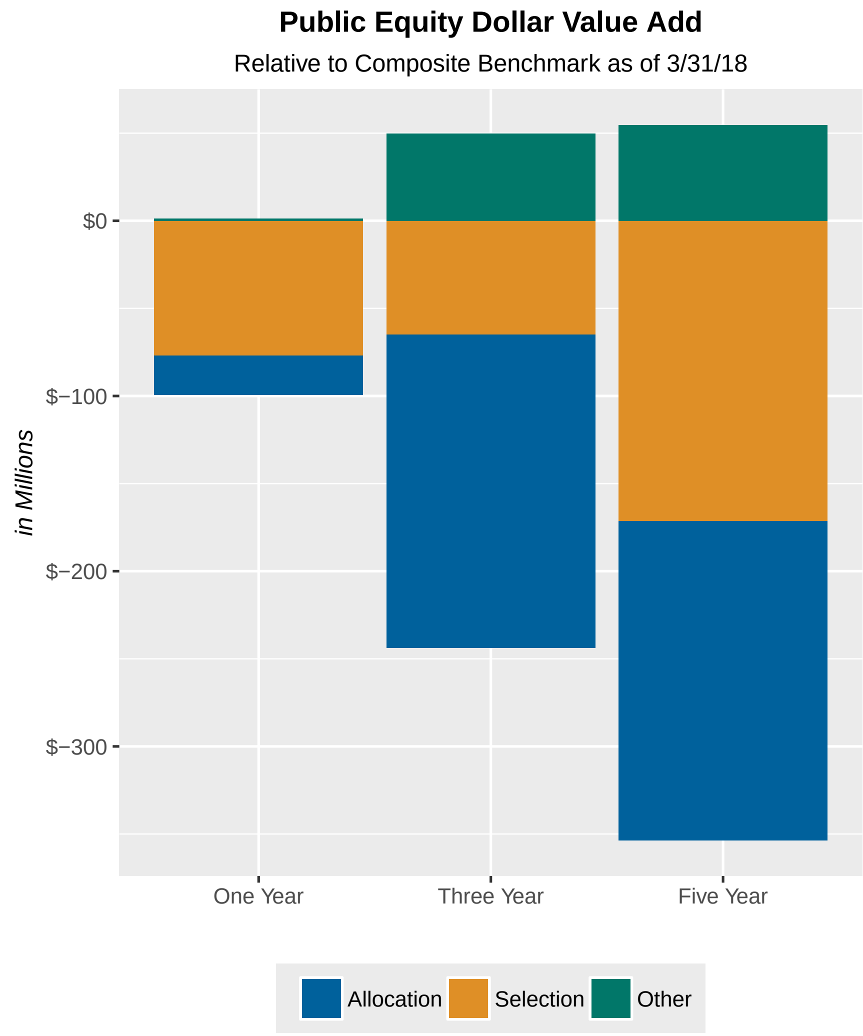
- The team has found fewer arbitrage opportunities in US LC fiscal YTD compared to last year
  - Tactical sector tilt trades in E2 have been mixed

Factor Portfolios

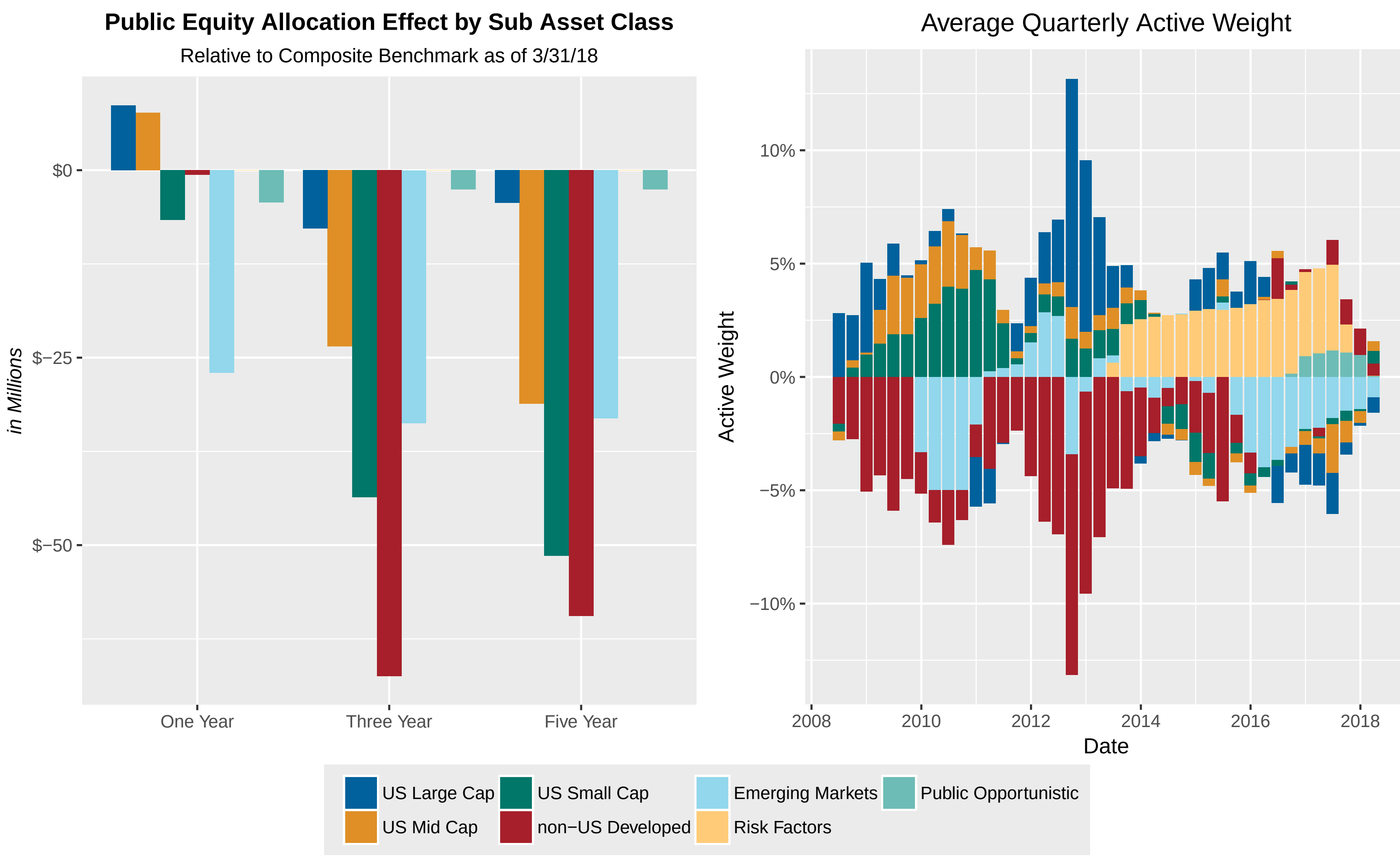
- Internally managed: E11 (US LC Factors)
  - Designed as return premium seeking portfolios
  - 4 factor equal-weight: size, value, momentum, and min vol
  - Internally managed portfolio performance matches the strategy benchmark
  - Since inception (August 2017) trailing S&P 500 by 45 bps
    - Outperformance by 230 bps since recent market volatility (Jan 2018)
- International Large Cap and Emerging Markets factor implementation underway
  - Same strategy as domestic with regional weighting balance versus MSCI benchmarks
  - Implement using external manager

Public Equities Returns & DVA (Preliminary 3/31/18)

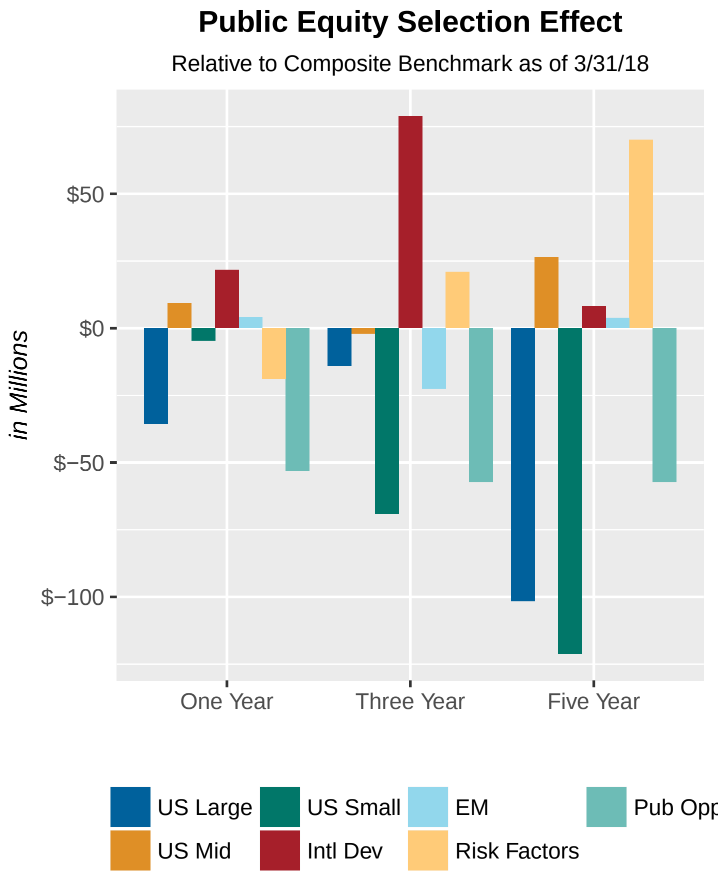




Allocation Effect (Preliminary 3/31/18)



Selection Effect (Preliminary 3/31/18)

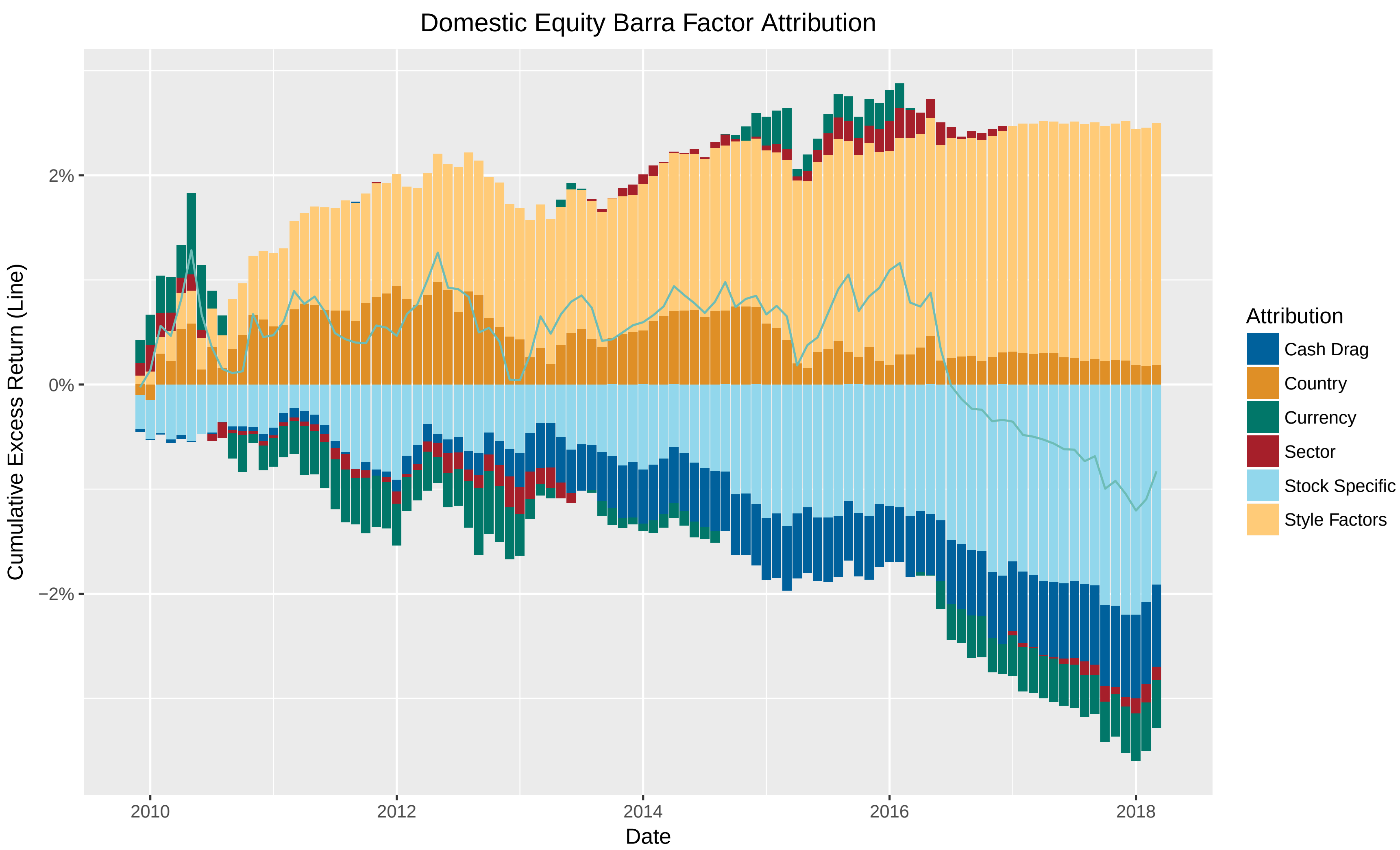


Annualized Returns

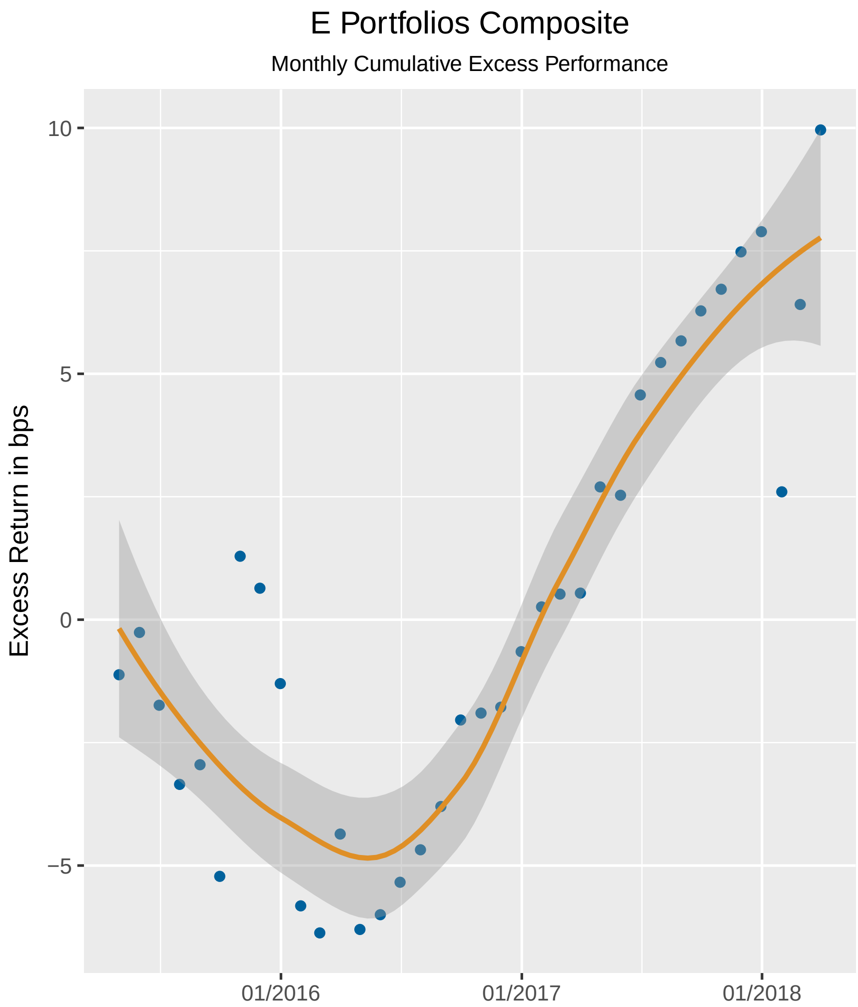
as of 3/31/18

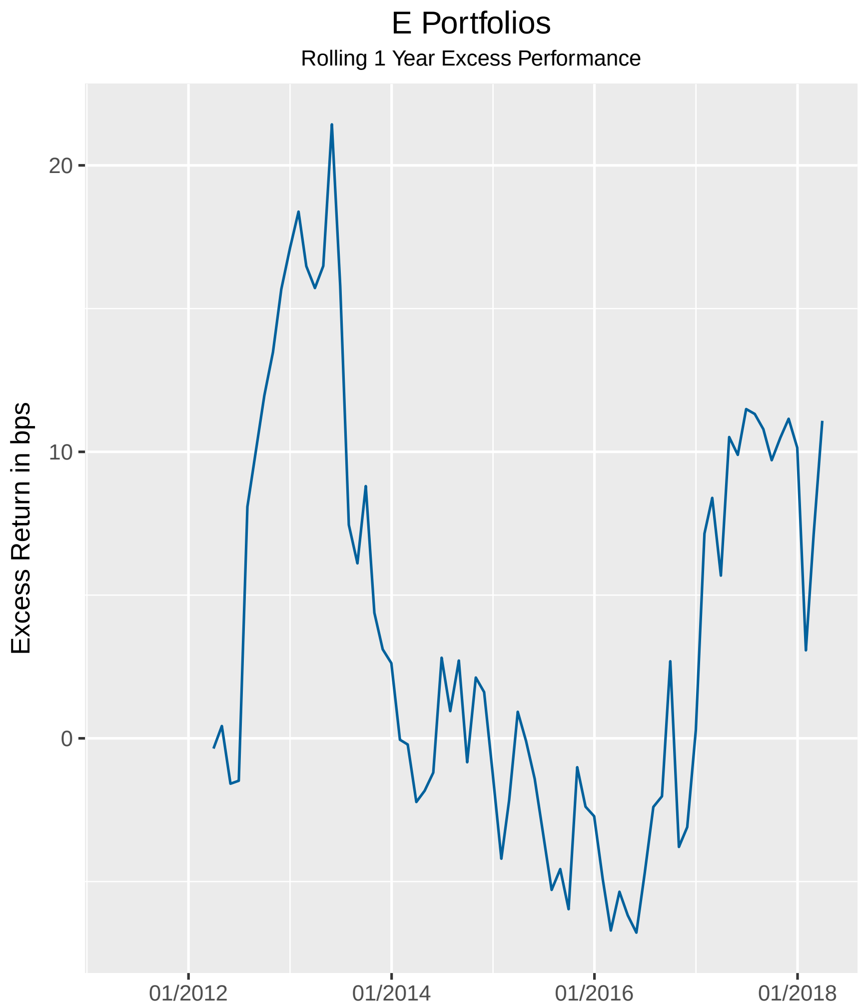
Composite	One Year	Three Year	Five Year	Ten Year
US Large Cap	13.48%	10.72%	13.07%	9.56%
Benchmark	13.99%	10.78%	13.31%	9.49%
Excess	-0.51%	-0.06%	-0.23%	0.07%
US Mid Cap	12.15%	8.9%	12.2%	10.82%
Benchmark	10.97%	8.96%	11.97%	10.9%
Excess	1.17%	-0.06%	0.24%	-0.08%
US Small Cap	12.26%	8.43%	11.59%	10.95%
Benchmark	12.68%	10.76%	13.56%	11.35%
Excess	-0.42%	-2.34%	-1.97%	-0.41%
non-US Developed	16.06%	6.65%	7.1%	3.86%
Benchmark	15.73%	6.28%	7.11%	3.99%
Excess	0.33%	0.37%	-0.01%	-0.14%
Emerging Markets	25.34%	8.31%	4.97%	NA%
Benchmark	24.93%	8.81%	5.05%	NA%
Excess	0.41%	-0.5%	-0.08%	NA%
Public Opportunistic	-19.55%	NA%	NA%	NA%
Benchmark	13.55%	NA%	NA%	NA%
Excess	-33.1%	NA%	NA%	NA%

Holdings Based Performance Attribution (Preliminary 3/31/18)

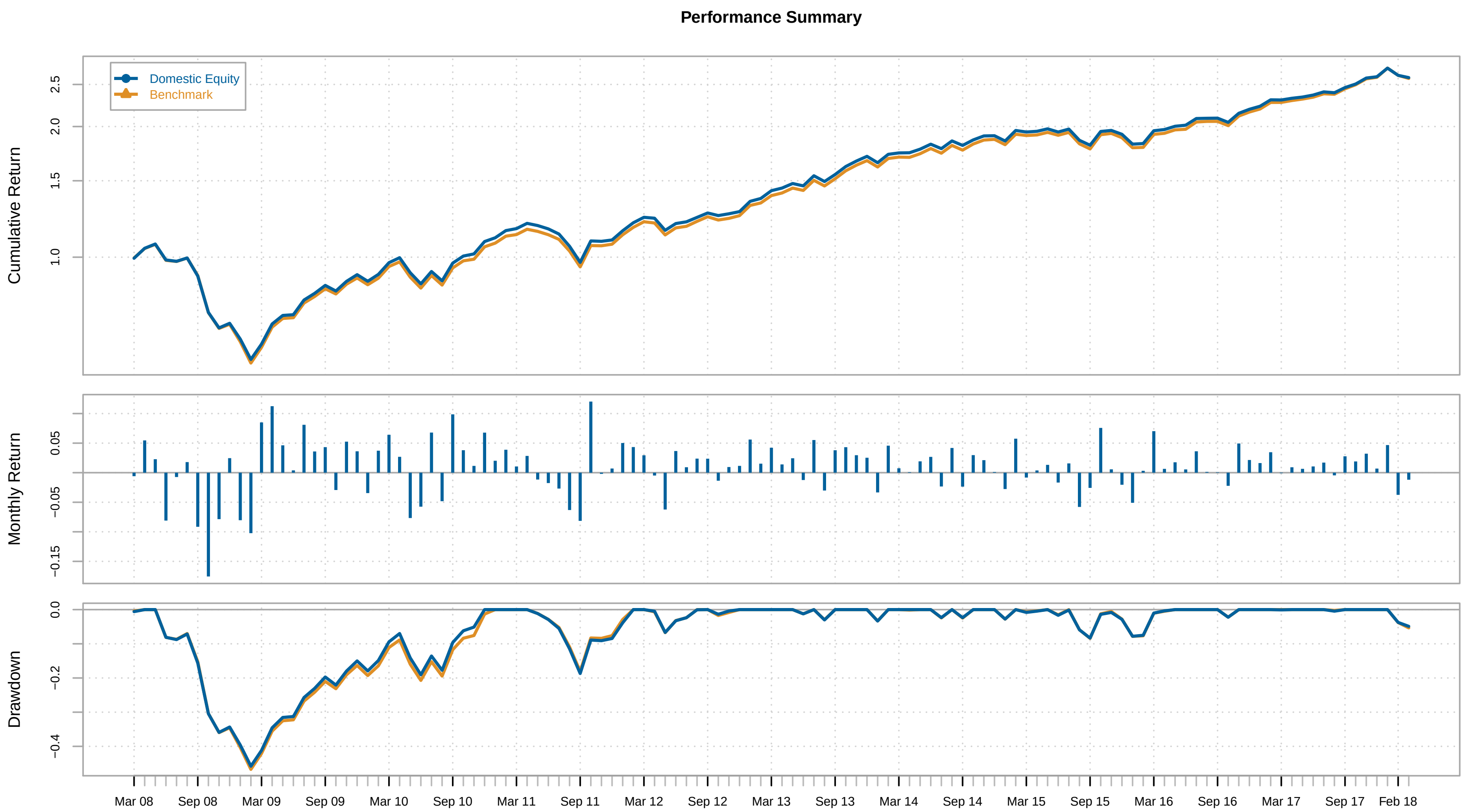


Internal Portfolios (Preliminary 3/31/18)

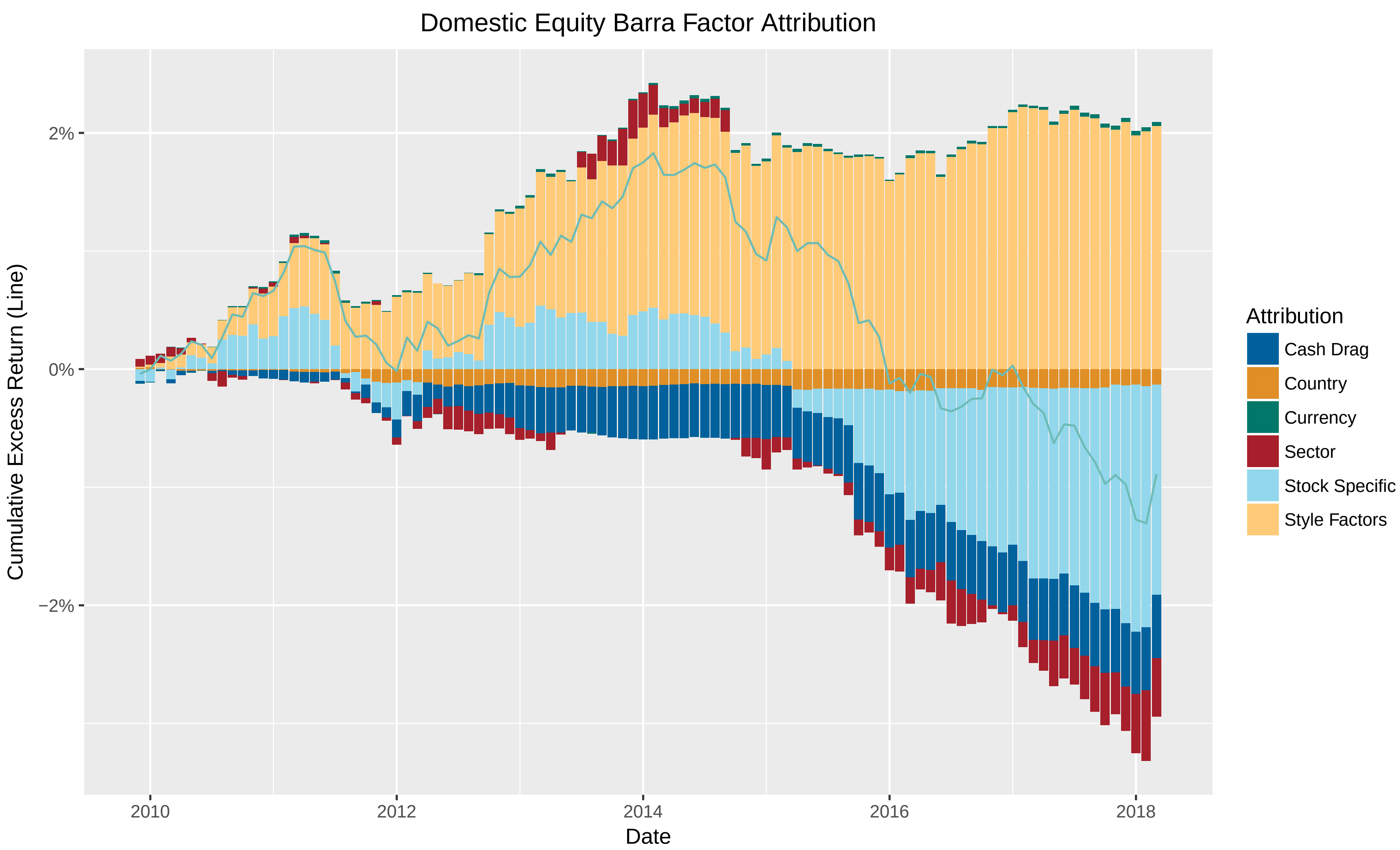




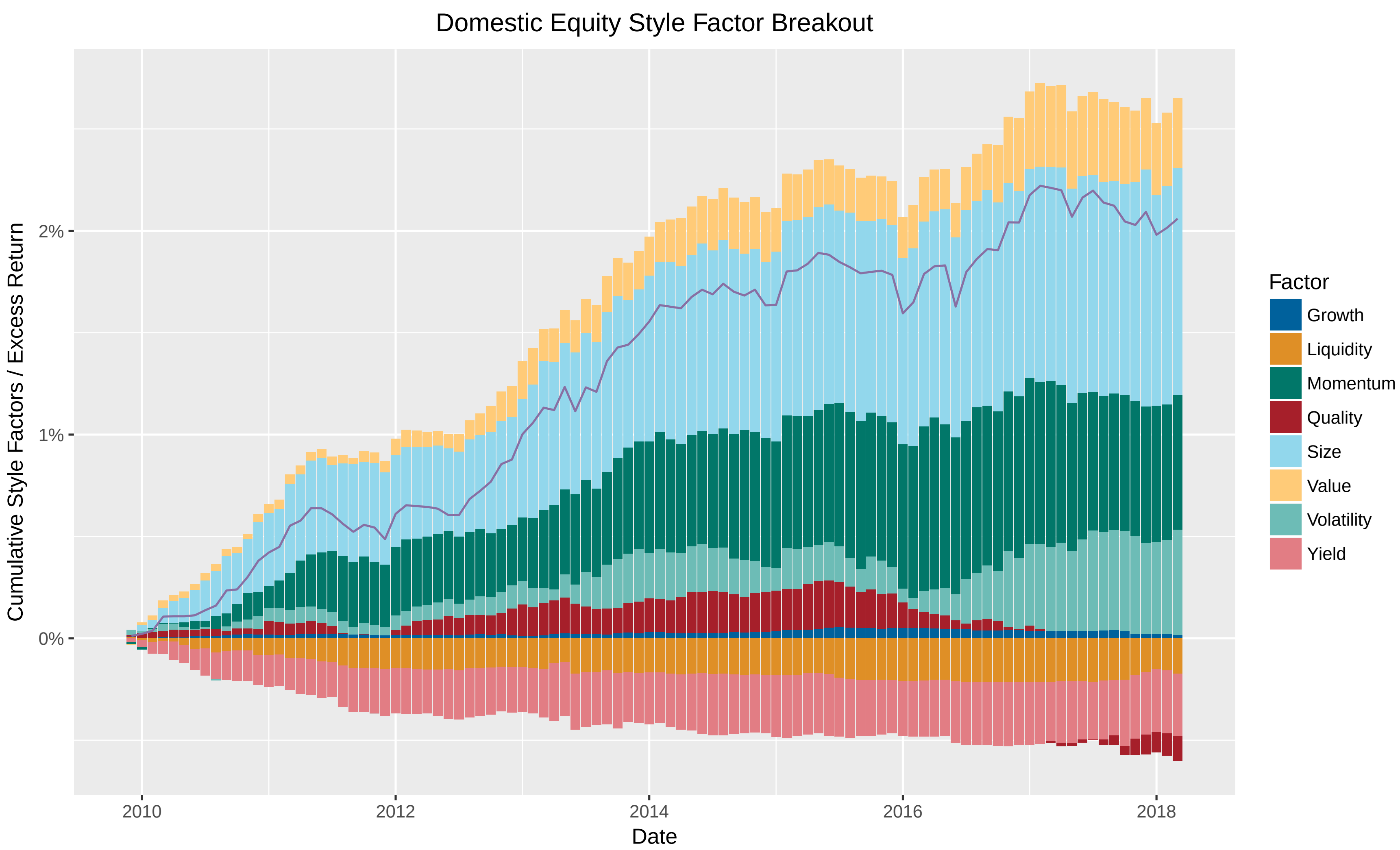
Domestic Equity: Performance Summary (Preliminary 3/31/18)



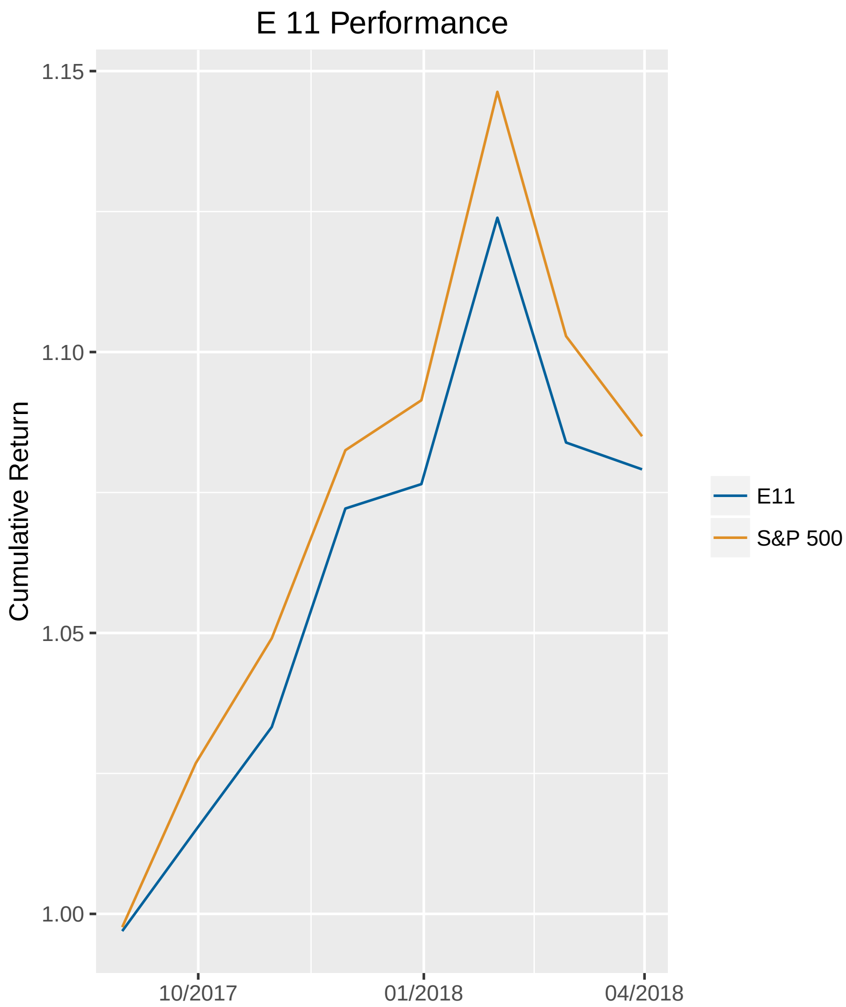
Domestic Equity: Barra Attribution (Preliminary 3/31/18)

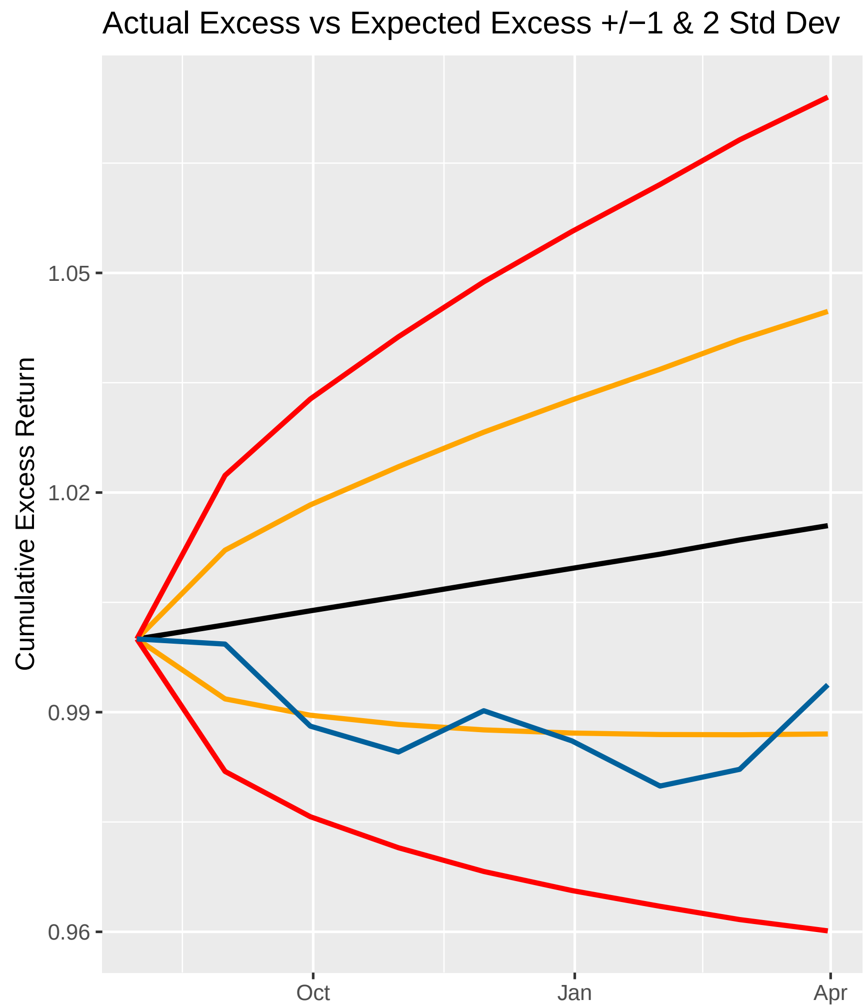


Domestic Equity: Style Factors (Preliminary 3/31/18)

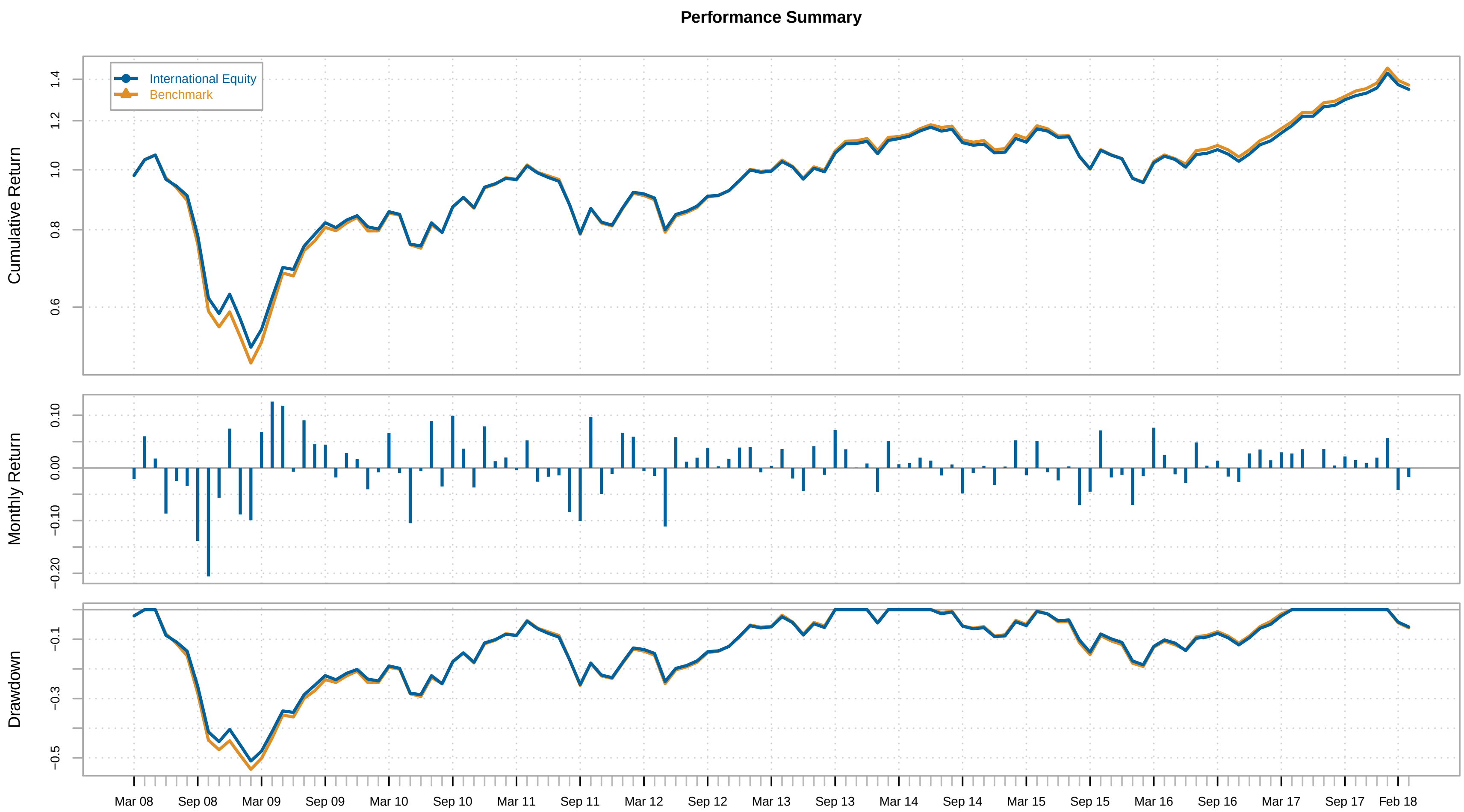


E 11 Performance Summary (Preliminary 3/31/18)

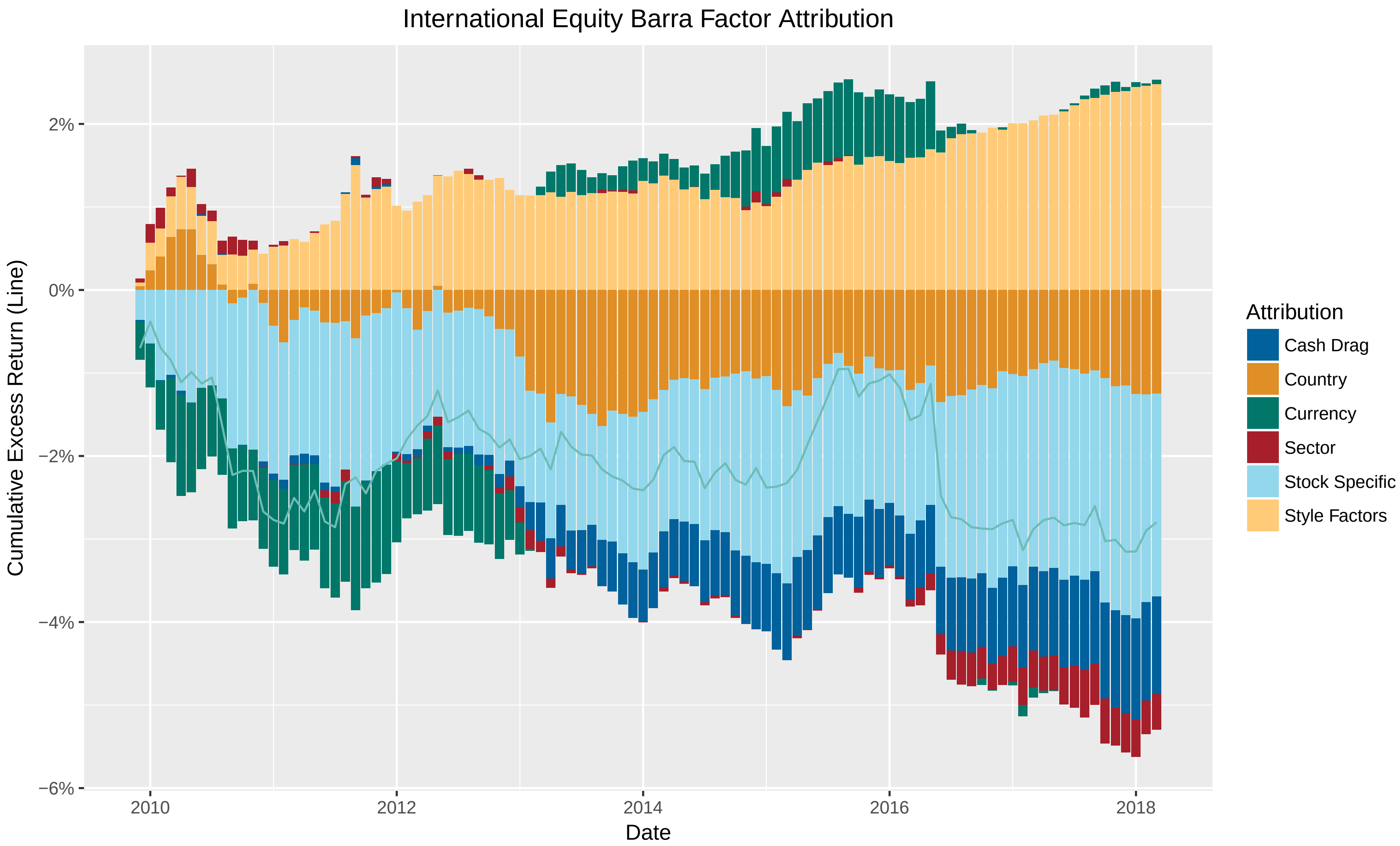




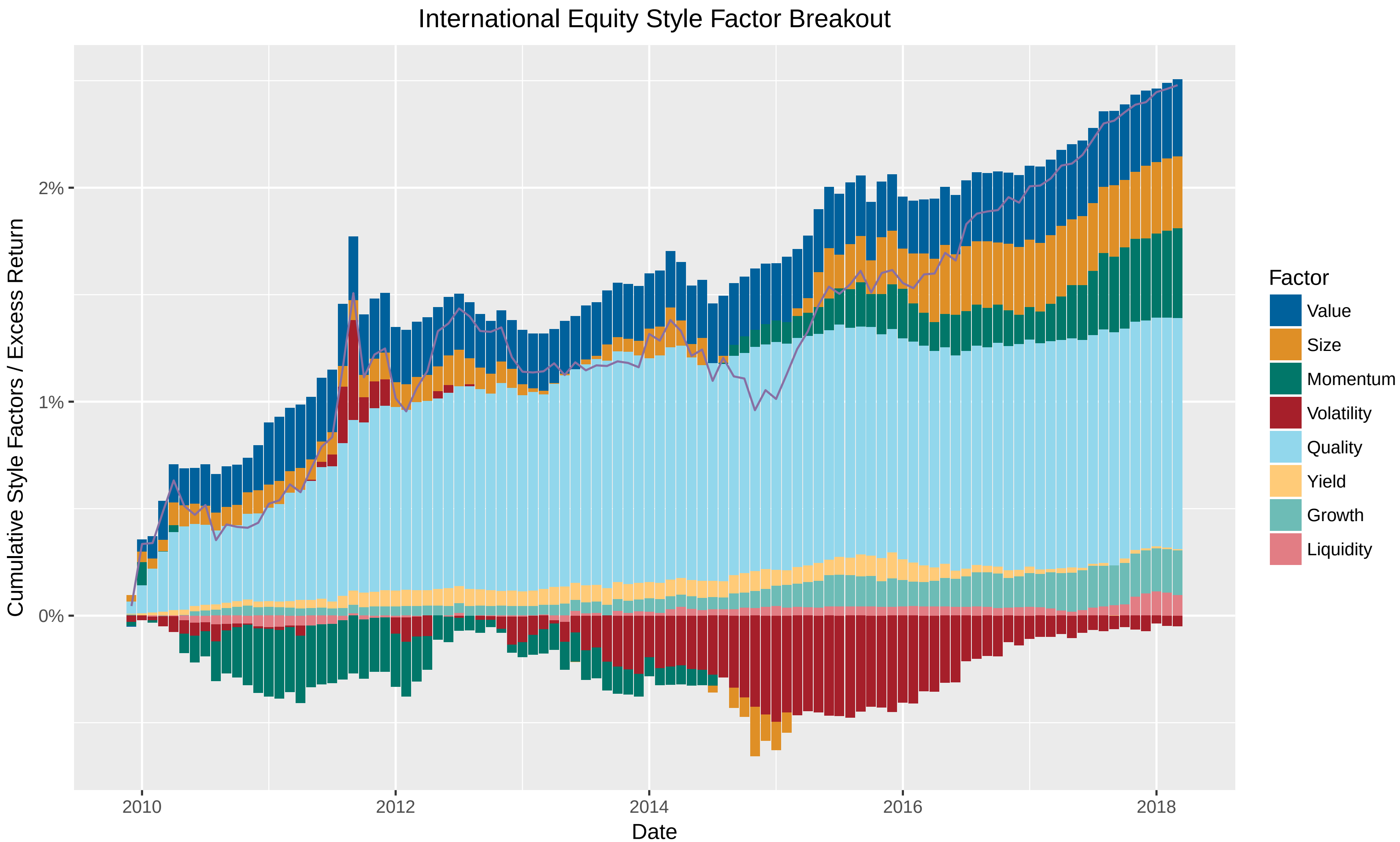
International Equity: Performance Summary (Preliminary 3/31/18)



International Equity: Barra Attribution (Preliminary 3/31/18)



International Equity: Style Factors (Preliminary 3/31/18)



Takeaways

- Selection:
  - Selection effect is poor due to active managers in both domestic and international
    - Shrinking as we exit active management
- Allocation:
  - The underweight to emerging markets has been a detractor over the past year
  - Longer time periods reflect the legacy positioning of overweight develop international equity and underweight US LC
    - Have recently gotten closer to benchmark weights
- Other notables:
  - E-Portfolios are generating alpha but behind last year's pace
  - Risk Factor program reconfiguration to further enhance returns
    - Complete in domestic, transition underway in international

Initiatives

- Recently completed:
  - Trading operations review - implement best practices for selection process of brokers, utilization of transition managers, and trade execution
    - Onboard new Bloomberg transaction cost analysis (BTCA) platform
    - Net savings in execution of transitions and brokers' trades
- Underway:
  - Transition away from active management & to factors and enhanced passive
  - Testing arbitrage opportunities from index change data
- Upcoming:
  - Event studies: biggest movers, news sentiment, intraday index momentum, spin-offs
  - Matrix utilization: statistical studies for trade optimization

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
  - Thesis of participating in the rebound of oil prices didn't materialize as expected and was substantively liquidated in December 2017

Outline

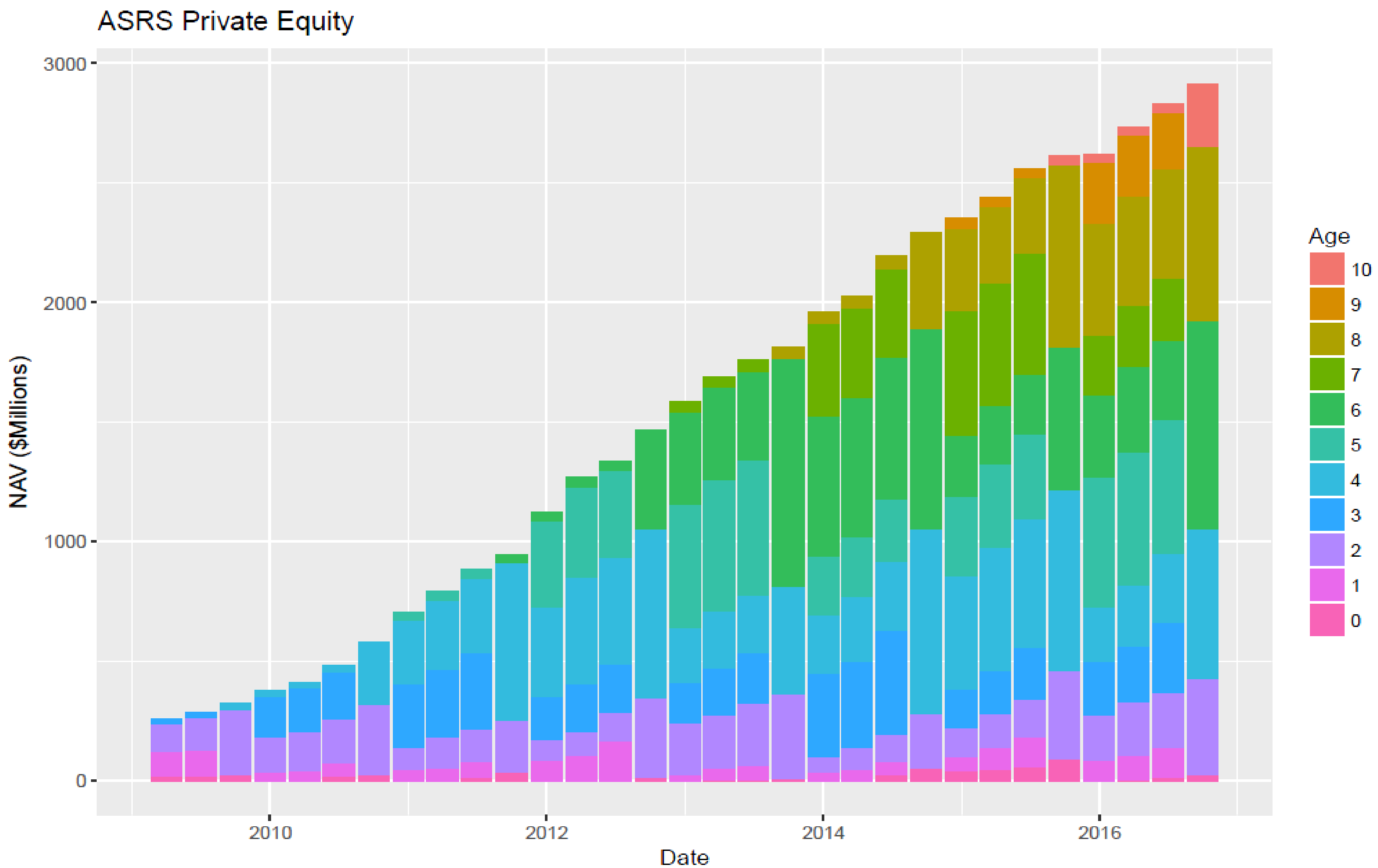
Private Equity (Preliminary 3/31/18)

- 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 $ 3399 million on December 31, 2017
  - This is 8.59% of total fund and the NAV is $ 235 million above target funding
- We update pacing plans annually to adjust investment levels to achieve and maintain target funding
- Investment pace for 2018 is $725 million in new commitments

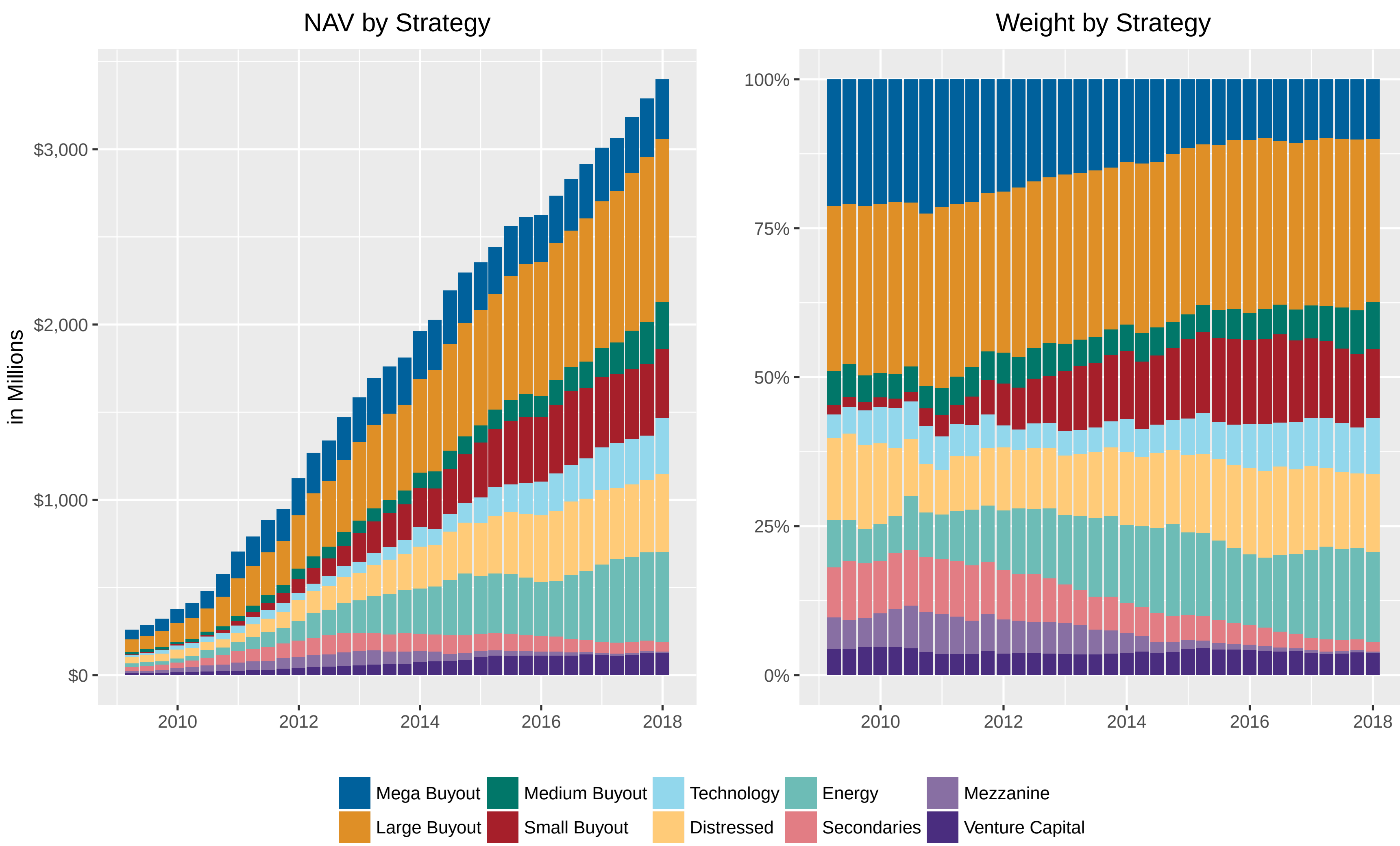
ASRS Portfolio Commitments by Vintage

	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
2017	740	9	82
	6,261	119	53

ASRS Portfolio NAV by Age



Allocation


NAV by Strategy
in Millions
$3,000
$2,000
$1,000
$0
2010
2012
2014
2016
2018
Weight by Strategy
100%
75%
50%
25%
0%
2010
2012
2014
2016
2018
Mega Buyout
Large Buyout
Medium Buyout
Small Buyout
Technology
Distressed
Energy
Secondaries
Mezzanine
Venture Capital

Strategy

- ASRS favors
  - Buyout strategies that emphasize organizational transformation instead of mere financial engineering
  - Investments in growing sectors with high revenue growth potential and agility (technology, healthcare, energy)
  - 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 - large dispersion in returns and difficult to access top tier firms
  - Europe - less deep PE market, regional/regulatory differences, and access challenges but target top-tier organizations that meet PME objectives
  - Emerging Markets - several levels of risk, access difficulties, size/scale challenges

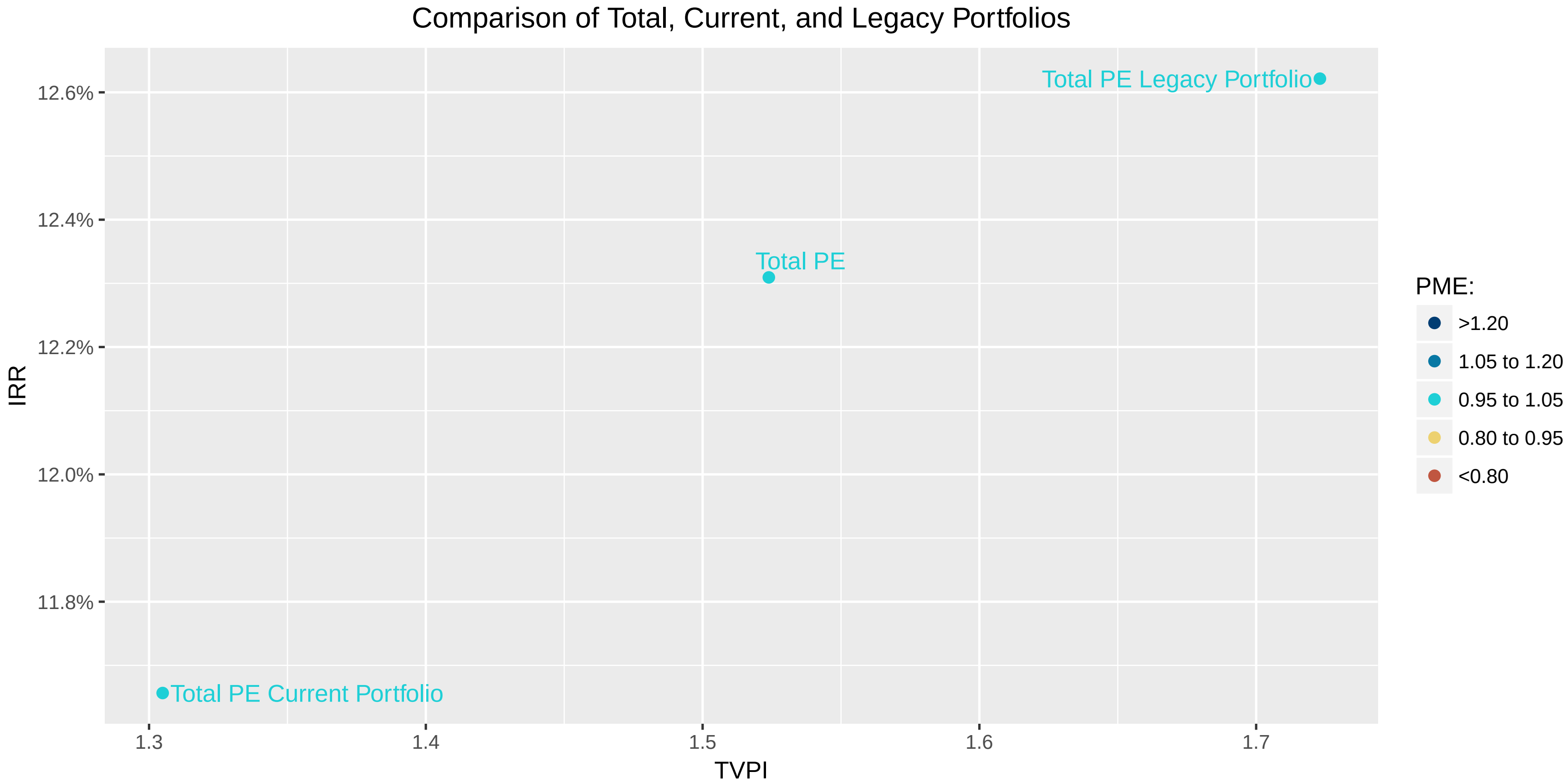
Performance Tracking

- 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

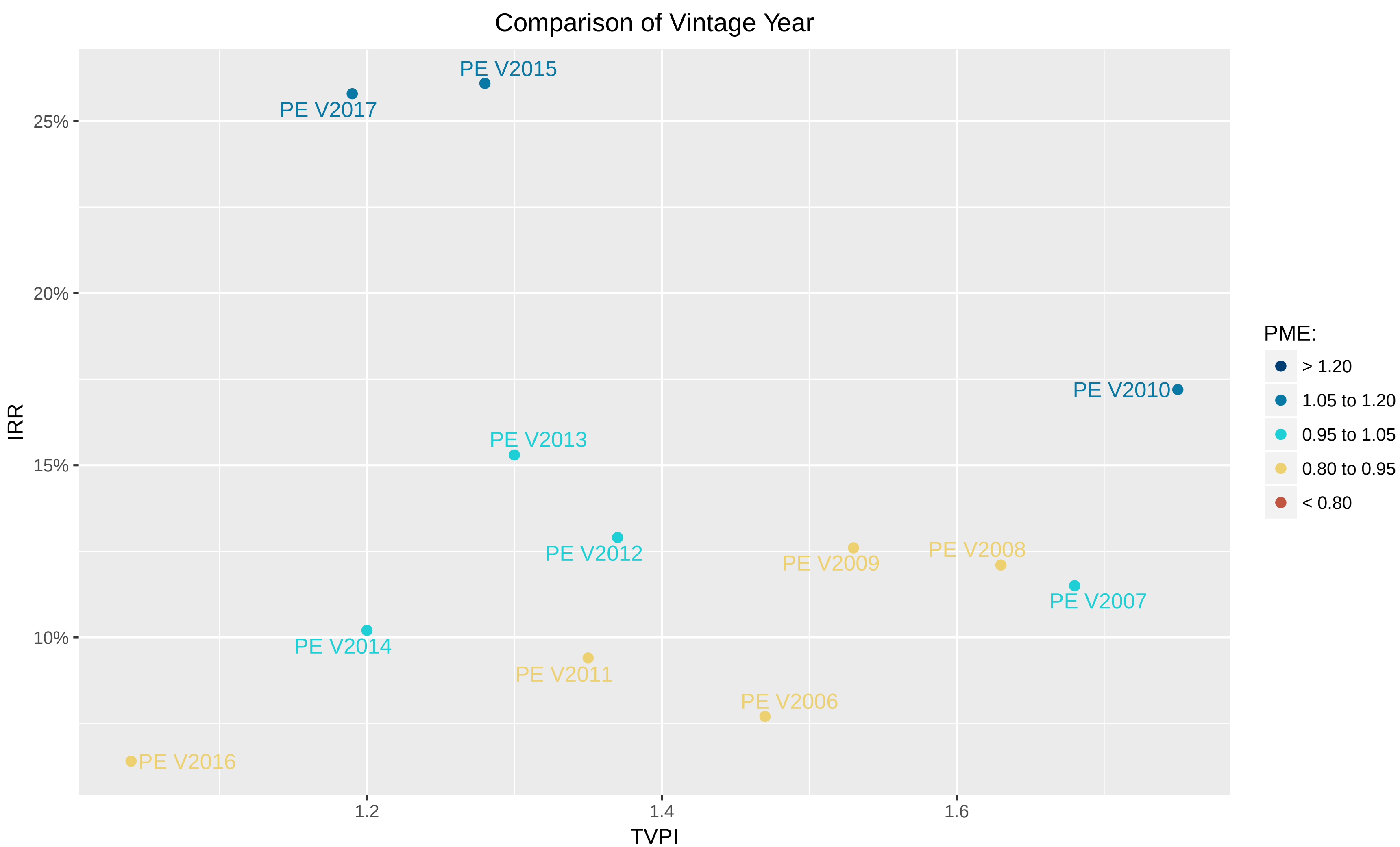
Performance Overview (Preliminary 3/31/18)

Private Equity Comparative Performance

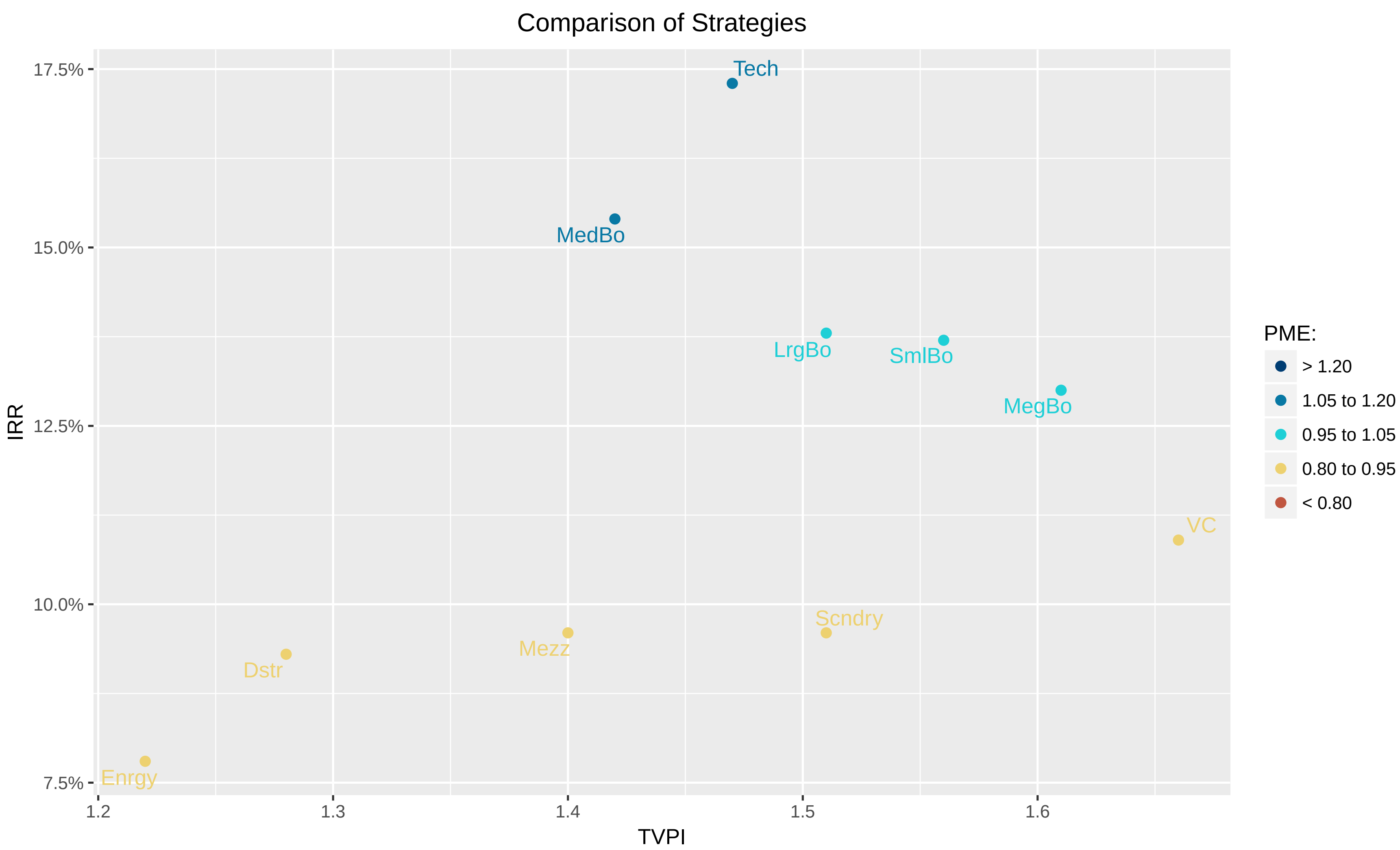
	One Quarter	One Year	Three Years	Five Years	Inception
Private Equity IRR	3.93%	15.68%	10.65%	12.89%	11.95%
Russell 2000 IRR	6.12%	21.24%	12.33%	13.58%	13.18%
Burgiss IRR	3.01%	13.99%	10.39%	12.33%	11.05%



Performance by Vintage (Preliminary 3/31/18)



Performance by Category (Preliminary 3/31/18)



Private Opportunistic Equity (Preliminary 3/31/18)

Private Opportunistic Performance

	One Quarter	One Year	Three Years	Five Years	Inception
Private Opportunistic IRR	-0.94%	13.17%	14.47%	20.56%	21.19%
Absolute 8 IRR	1.96%	8.00%	7.99%	8.00%	8.00%

- The NAV in private opportunistic equity assets was $290 million as of December 31, 2017
- 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 10.66%

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 by dynamic, evolving with changing conditions, weeding out weak performers and promoting high performers
  - Research has found that stability is a negative indicator of performance[1]
- We are using this lens to better understand firm culture and have fewer but deeper GP relationships
  - Larger commitments often also provide better fees and access to co-investments

[1] Cornelli, Simintzi and Vig. Team Stability and Performance in Private Equity. 2014 Working Paper. http://www.collerinstitute.com/Research/Paper/264

Outline

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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

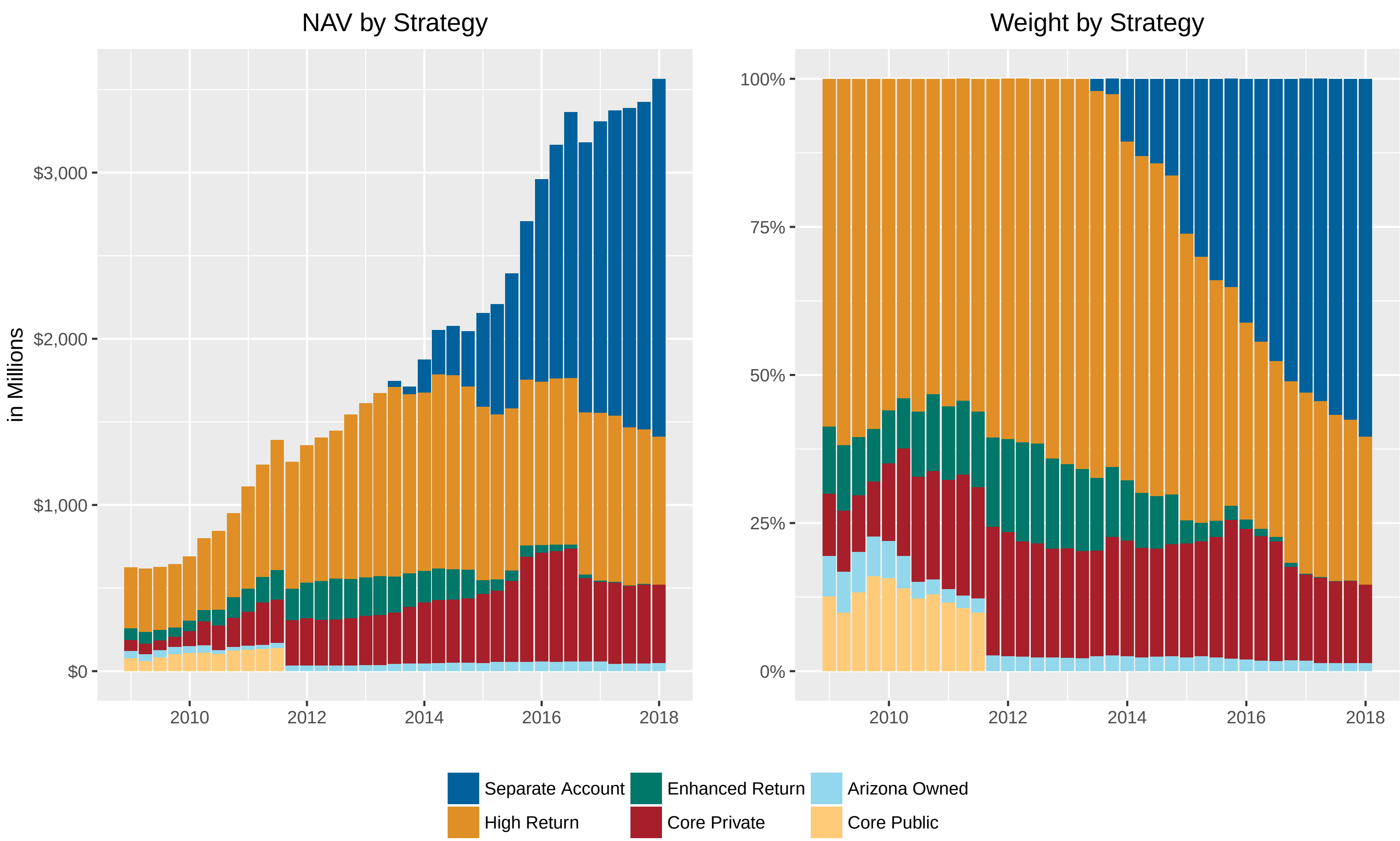
Separate Account Program

- Selected managers will manage across Stable & Value Creation investments to achieve the 8% net return objective on an inception IRR basis
- "Discretion in a box"
  - Custom investment criteria by strategy, market, life cycle, and return targets
- ASRS will be the majority owner and will have significant control rights
  - Right to terminate the investment period preventing new investments being made in the account
  - Right to utilize a consultant to validate each property meets the investment criteria and return hurdles applicable to the investemnt
  - Ability to expand the commitment amount
- Firms are expected to be vertically integrated with full service capabilities (property construction, leasing, management, etc.) in their targeted investment class(es)

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 be 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

Allocation

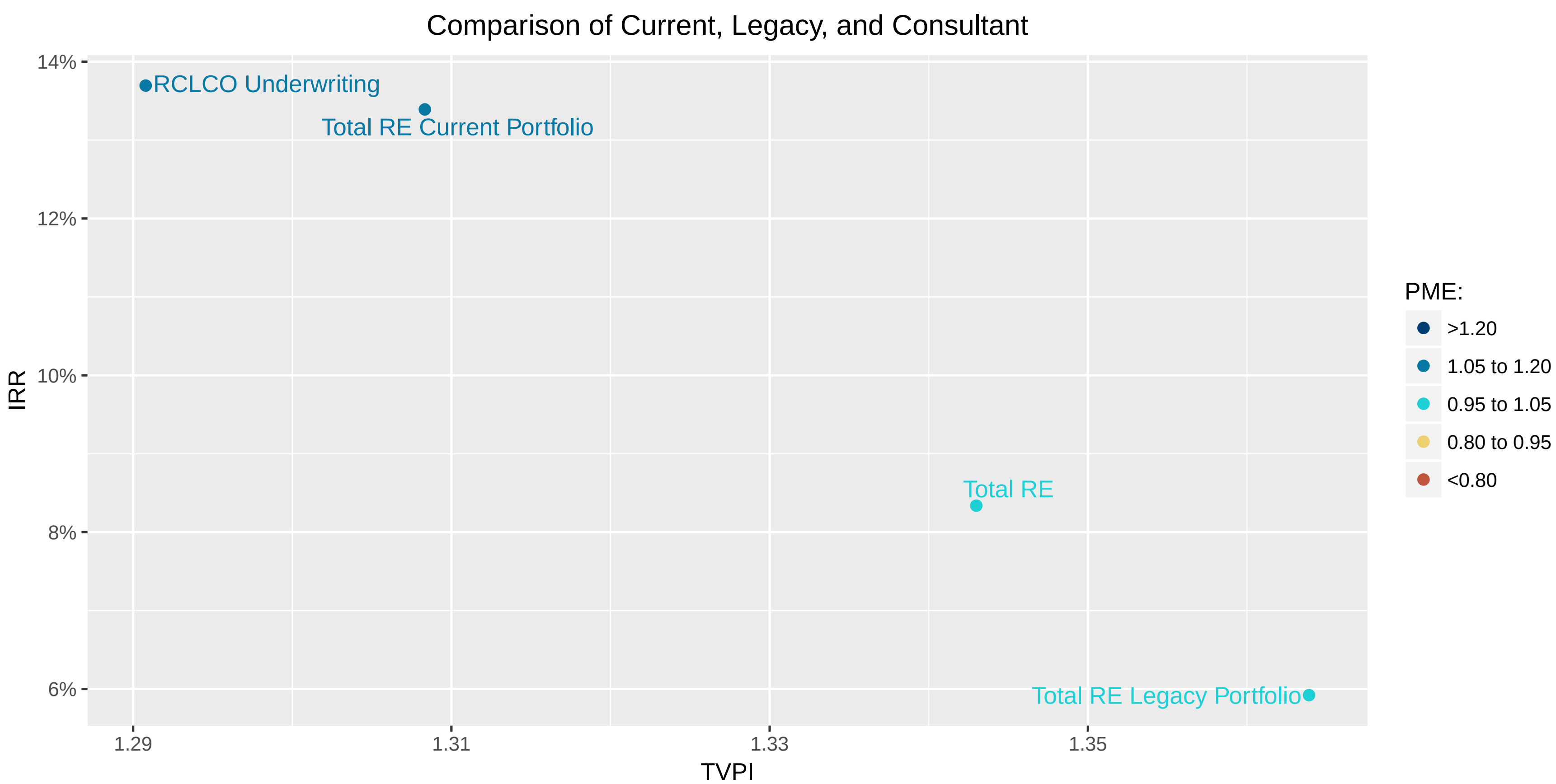

NAV by Strategy
in Millions
$3,000
$2,000
$1,000
$0
2010
2012
2014
2016
2018
Weight by Strategy
100%
75%
50%
25%
0%
2010
2012
2014
2016
2018
Separate Account
Enhanced Return
Arizona Owned
High Return
Core Private
Core Public

Outline

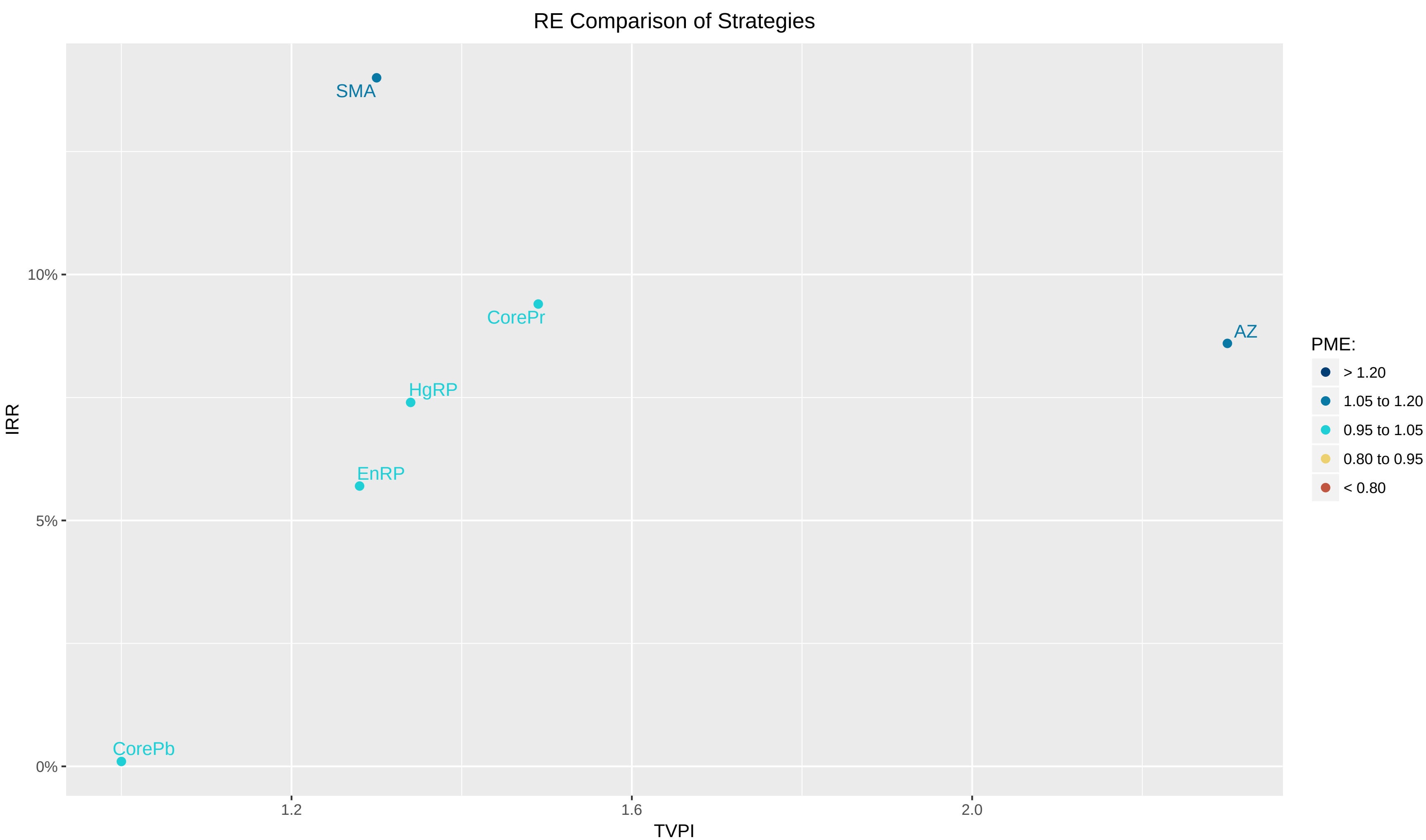
Performance Overview (Preliminary 3/31/18)

IRR Compared to ODCE Net

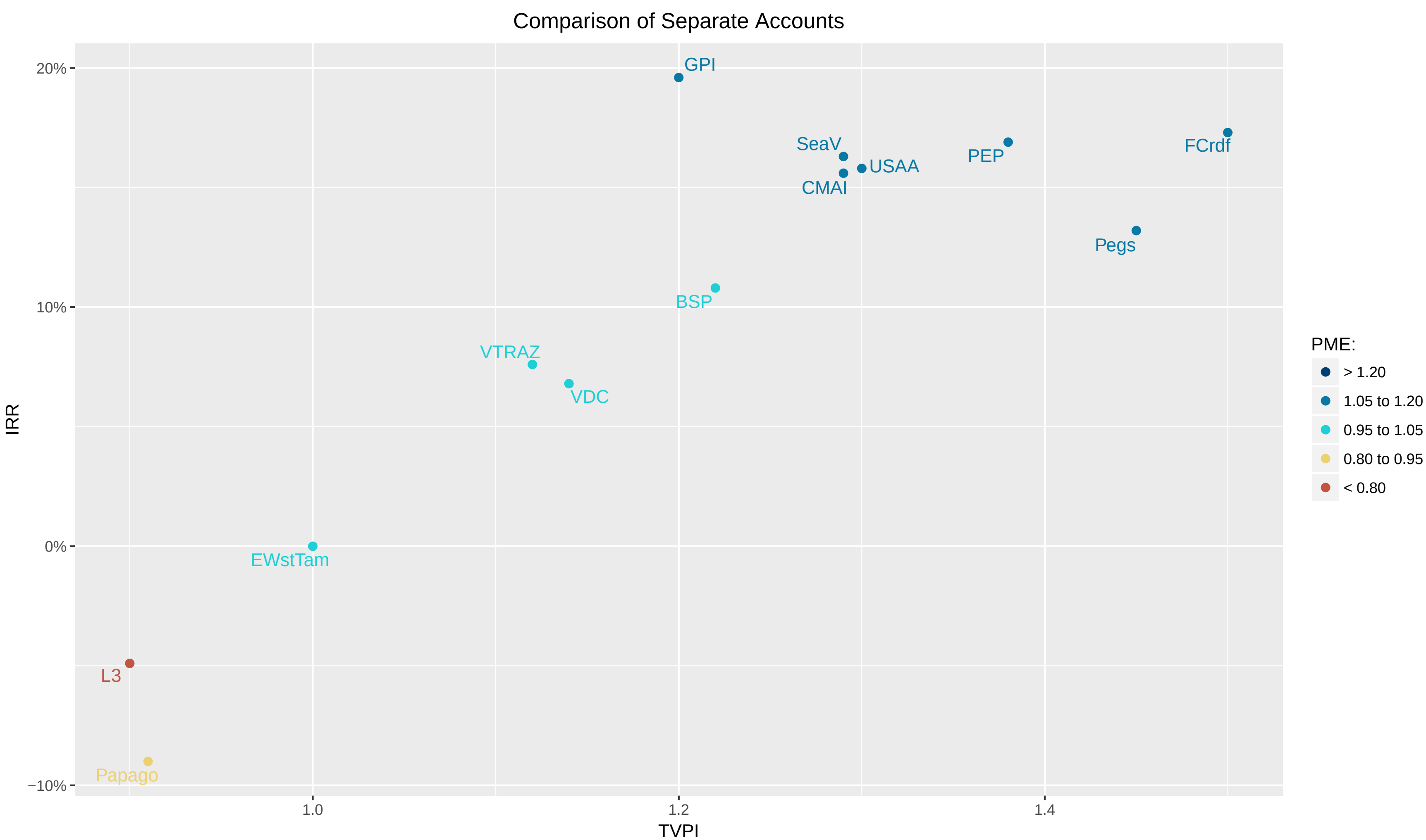
	One Quarter	One Year	Three Years	Five Years	Inception
Real Estate IRR	1.68%	11.02%	12.26%	12.77%	8.42%
ODCE IRR	1.64%	7.01%	10.31%	10.80%	7.26%



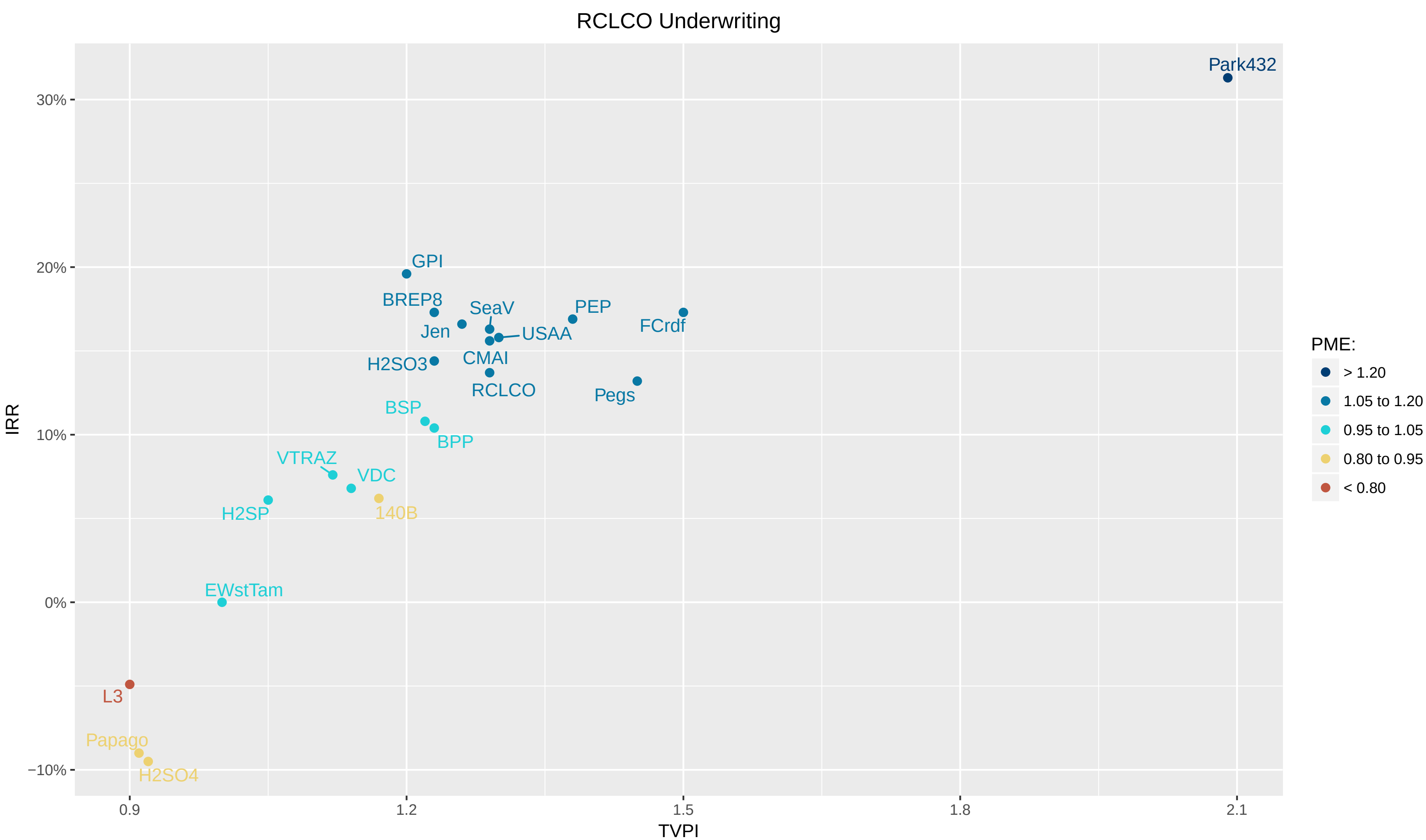
Performance by Strategy (Preliminary 3/31/18)



Performance by Seperate Accounts (Preliminary 3/31/18)



Performance by RCLCo Underwritting (Preliminary 3/31/18)



Performance Accountability (Preliminary 3/31/18)

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	5.92%	6.09%	-0.17%
Total RE Current Portfolio	13.39%	9.96%	3.43%
Real Estate Opportunistic	23.55%	12.03%	11.52%
Combined Current Real Estate	14.65%	10.24%	4.41%

The following table shows performance of the current consulting team.

Consultant Returns

	Portfolio IRR	ODCE IRR	Outperformance
RCLCO Real Estate	12.92%	9.39%	3.53%
RCLCO Opportunistic	25.38%	11.25%	14.13%
RCLCO Combined	13.7%	9.51%	4.19%

Outline

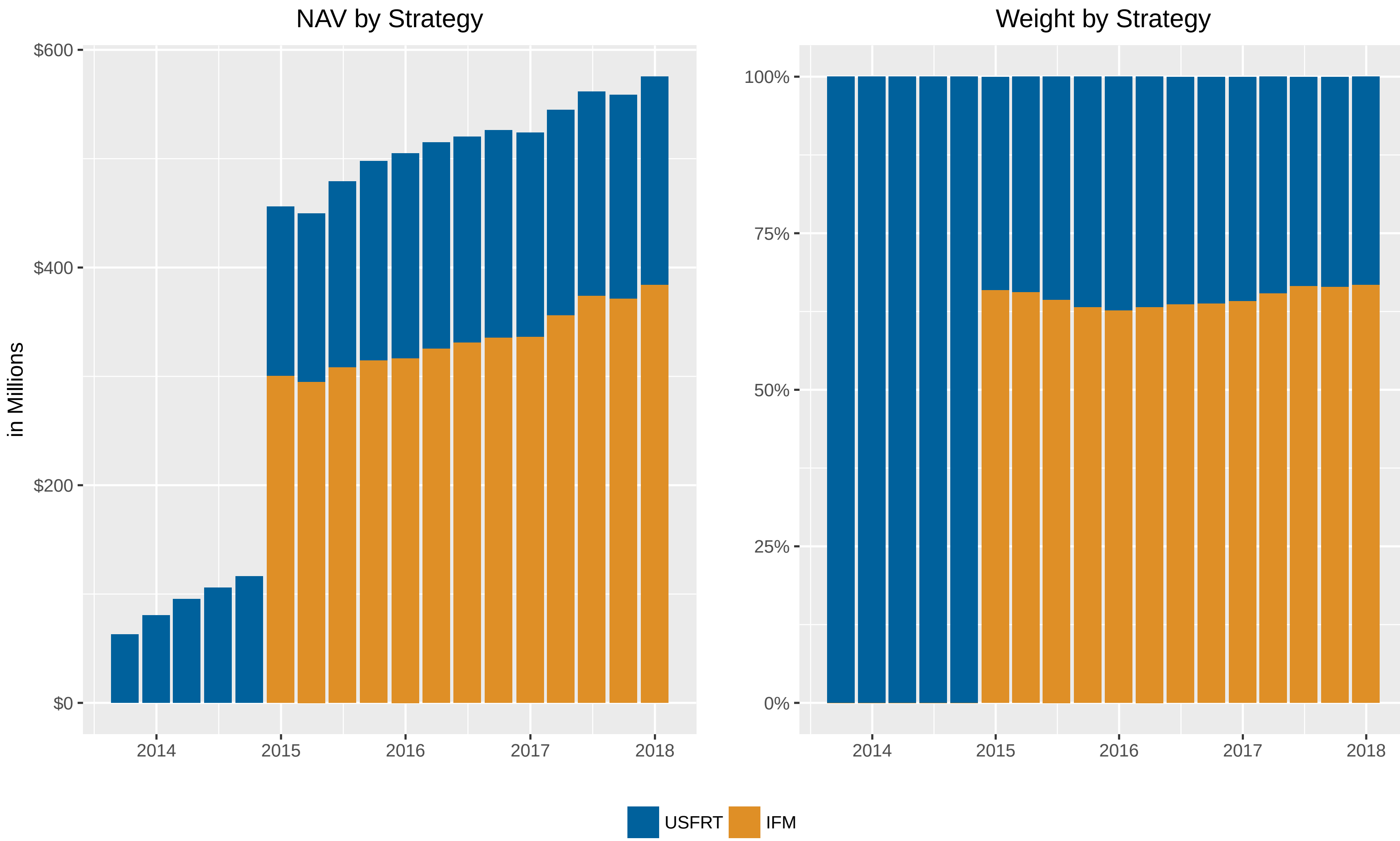
Farmland

- 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
  - The portfolio is still young with average hold of less than 3 years
    - Value add business plans are still being implemented with productivity improvements being realized in the current crop year
    - Recent distressed investments in citrus and organic farming seem 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

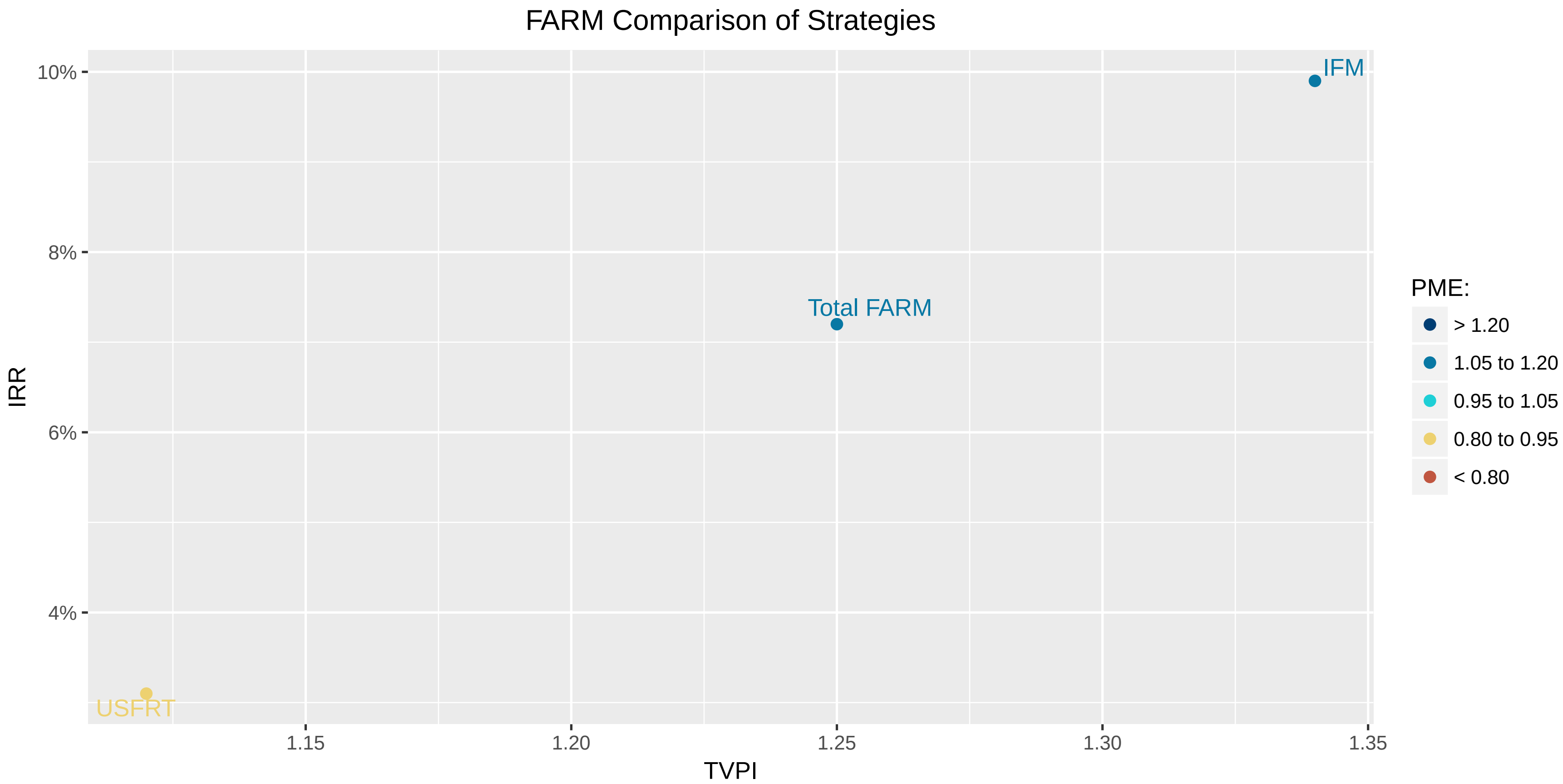
Allocation


NAV by Strategy
in Millions
$600
$400
$200
$0
2014
2015
2016
2017
2018
Weight by Strategy
100%
75%
50%
25%
0%
2014
2015
2016
2017
2018
USFRT
IFM

Performance Overview (Preliminary 3/31/18)

IRR Compared to CPI ex Food & Energy + 350 bps

	One Quarter	One Year	Three Years	Five Years	Inception
Farmland IRR	2.11%	9.71%	7.01%	NA%	6.64%
CPI + 350	1.36%	5.25%	5.52%	NA%	5.50%



Outline

Background of ASRS Commodities Program

- ASRS approved a 3% (0%-5%) strategic allocation to commodities in October 2009
- 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 time ASRS maintained a tactical underweight to commodities:
        - While recent inflation prints have indicated a modest uptick there has not been an expected strengthening of the US dollar
    - 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

Commodities Performance

Portfolio	Benchmark	3M	Fiscal YTD	1Y	3Y	5Y	ITD
		alpha (bps)	alpha (bps)	alpha (bps)	alpha (bps)	alpha (bps)	alpha (bps)
Gresham	B'berg Commod Tot Ret	+15	+378	+358	+91	+100	+173

- While commodities have had negative absolute returns, Gresham has consistently delivered outperformance