Equities Implementation Plan

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2019

Annual Implementation Plan

- Equities Implementation Plan was presented and approved on 1/3/2019
  - Culmination of several months of work and concurrent research projects
- We have identified 'levers' that we expect to drive outperformance versus the global ACWI IMI benchmark

Lever	Expected Outperformance (bps)	Expected Tracking Error (bps)	Information Ratio
Benchmark Implementation	10	10	1.00
Internal Portfolios	10	5	2.00
Securities Lending	3	0	n/a
Factor Portfolios	150	450	0.33
Alpha Overlay	350	970	0.36
Private Equity	150	600	0.25
Total	100	300	0.33

Asset Allocation and Benchmark Policy

Asset Allocation

	Target	Low	High	Benchmark
Equities	50	35	65	ACWI-IMI
Real Estate	20	10	30	ODCE net
Credit	20	10	30	S&P/LSTA+250
Interest Rate Sensitive Bonds	10	0	20	Bloomberg Barclays Ag
Other	0	0	10	Investment Specific
Cash	0	0	5	90 day TBill

Notes:

- Transition Rule – during the buildout phase for real estate, any underweight in real estate will be allocated ratably to equities (83.3%) and interest rate sensitive bonds (16.7%)
- SIP002 (Tactical Positioning and Rebalancing) will govern the management of asset weights within ranges
- Multi-asset derivative strategies may be included in the "Other" portfolio or may be implemented as alpha overlays in the equity portfolio, but to the extent implemented as an overlay this will reduce the availability for investment in the Other category

Annual Implementation Plan

Implementation Plans Requirement

- Every asset class will have an implementation plan approved by the asset class committee
- Implementation plans will be reviewed and updated annually or more frequently at the request of the asset class committee
- The CIO will report to the investment committee on the implementation plans annually
- Each implementation plan will include
  - Near term strategy for the assets including goals ensuring portfolios are well diversified and expected performance from the strategies relative to benchmark
  - Review of the prior year plan and whether the outperformance goals were achieved
  - Any sub-allocations or benchmarks for internal performance measurement (but not modifying the overall SAA benchmarks)
  - Means of compliance with the SAA including liquidity and leverage constraints
  - Structures for implementing the plan including separate accounts, commingled funds, ETFs, etc

Annual Implementation Plan

- This report will outline the overall structure, specific strategies, future initiatives, and the ways we intend to measure performance for total equities
- We have identified 6 'levers' that we expect to drive outperformance versus the global ACWI IMI benchmark
  - S&P 1500 versus MSCI USA (benchmark implementation)
  - E portfolios
  - Securities Lending
  - Factor portfolios
  - Alpha overlay strategies
  - Private equity
- We have attached separate research reports on the benchmark implementation and alpha overlay strategies
  - Summarized results are presented in this report

Annual Implementation Plan

- Motion: approval of the 2019 equities implementation plan including:
  - Portfolio structure and benchmarks
  - Strategy estimates of excess returns and tracking error
  - PE pacing of $725M in commitments

Structure Implementation

For implementation purposes, the following benchmarks will be used:

Sub-asset class	Level 1: Benchmark	Level 2: Benchmark	Portfolio
US LC	MSCI USA LC	S&P 500	E2
US LC	MSCI USA LC	US LC SciBeta 4 factor EW	E11
US LC	MSCI USA LC	S&P 500	Overlay Managers
US MC	MSCI USA MC	S&P 400	E10
US SC	MSCI USA SC	S&P 600	E6
Int'l Developed LC	MSCI World Ex USA	MSCI World Ex USA	Blackrock SMA
Int'l Developed LC	MSCI World Ex USA	Int'l Dev LC SciBeta 4 factor EW	L&G SMA
Int'l Developed SC	MSCI SC World Ex USA	MSCI SC World Ex USA	Blackrock SMA
Emerging Markets	MSCI EM IMI	MSCI EM IMI	Blackrock CIT
Emerging Markets	MSCI EM IMI	Int'l Dev LC SciBeta 4 factor EW	L&G CIT
Private Equity	MSCI ACWI IMI	MSCI ACWI IMI	PE Portfolio

- Level 1 benchmark is the ACWI IMI
  - We have decomposed it here for illustration
  - For attribution purposes we will use the MSCI ACWI IMI component weights proportionately scaled to the liquid portion of equities
- Level 2 benchmarks are portfolio specific
  - We have added Canada to our current EAFE & EAFE SC mandates to align with the ACWI developed ex USA benchmark exposure
  - We are in the process of adding Emerging Markets Small Cap to our current EM mandate to align with the EM IMI benchmark exposure
- Private Equity will roll into Total Equity at its portfolio weight, benched against the ACWI IMI
  - Russell 2000 (and respective R2K sectors) will be used for underwriting specific strategies

Structure Implementation

Sub-asset class	ASRS	Proportionate Wght %
	Portfolio	(approximate)
US LC	E2	12.5%
US LC	E11 SciBeta	8.0%
US LC	Alpha Overlay	11.5%
US MC	E10	5.5%
US SC	E6	5.5%
Int'l Developed LC	Blackrock SMA	20.0%
Int'l Developed LC	L&G SciBeta SMA	6.5%
Int'l Developed SC	Blackrock SMA	4.5%
Emerging Markets	Blackrock CIT	7.5%
Emerging Markets	L&G SciBeta CIT	2.5%
Private Equity	PE Portfolio	16.0%
Public Equity Implementation		

- Notes:
    - Weights are proportionate to scale to 100% and illustrative for neutral positioning
        - 20% maximum governor for structures with lockups applied to PE
    - Weights will float to reflect underlying ACWI IMI benchmark weights
    - We intend to maintain a 75|25 ratio of enhanced passive to factor portfolios in US LC, Developed ex US, and EM

Performance Measurement Benchmarking

Sub-asset class	ASRS Portfolio	Expected Outperformance (bps)	Humbled Expected Outperformance (bps)	Expected Tracking Error
US LC	E2	4	2	2
US LC	E11 SciBeta	230	115	350
US LC	Alpha Overlay	700	350	970
US MC	E10	20	10	4
US SC	E6	25	12.5	5
Int'l Developed LC	Blackrock SMA	0	0	0
Int'l Developed LC	L&G SciBeta SMA	340	170	465
Int'l Developed SC	Blackrock SMA	0	0	0
Emerging Markets	Blackrock CIT	0	0	0
Emerging Markets	L&G SciBeta CIT	380	190	705
Private Equity	PE Portfolio	300	150	600
Public Equity Implementation		20	10	10

- Expected outperformance reflects ASRS history or modeled results (where applicable)
- Expected outperformance has been humbled by 50% for the purposes of creating realistic expectations and performance measurement cone charts

Performance Measurement Benchmarking

Sub-asset class	ASRS Portfolio	Proportionate Wght % (approximate)	Humbled Expected Outperformance (bps)	Weighted Outperformance (bps)
US LC	E2	12.5%	2	0.3
US LC	E11 SciBeta	8.0%	115	9.2
US LC	Alpha Overlay	11.5%	350	40.3
US MC	E10	5.5%	10	0.6
US SC	E6	5.5%	12.5	0.7
Int'l Developed LC	Blackrock SMA	20.0%	0	0.0
Int'l Developed LC	L&G SciBeta SMA	6.5%	170	11.1
Int'l Developed SC	Blackrock SMA	4.5%	0	0.0
Emerging Markets	Blackrock CIT	7.5%	0	0.0
Emerging Markets	L&G SciBeta CIT	2.5%	190	4.8
Private Equity	PE Portfolio	16.0%	150	24.0
Public Equity Implementation			10	10.0
Total				100

- Weighted average expected excess return: ~100 bps (assuming independent & uncorrelated alpha calculations)
  - Includes 10 bps from public equity benchmark implementation
- Weighted average tracking error: ~300 bps (assuming independent & uncorrelated alpha calculations)

Analysis of the ACWI-IMI Benchmark

- The SAA approved in June 2018 ascribed the ACWI IMI benchmark for total equities
  - A global benchmark gives the richest opportunity to deploy capital strategically and tactically
- We performed extensive analysis to determine the best way to manage against this benchmark
  - Objective: construct a portfolio that we expect to outperform the benchmark by decomposing its component parts to look for alternative ways to achieve comparable exposure with enhanced returns
- We present the results of this study separately but the following takeaways were noted:
  1. The MSCI ACWI-IMI best meets the CFA Institute Guidance Statement on Benchmarks among the global benchmark choices available
     1. There are some differences in the market cap weighting scheme but otherwise offer comparable geographic and sector coverage
  2. Historically, the differences in return among the global benchmarks is immaterial
  3. We found quality bias in the S&P indices & size bias in the MSCI weighting construction
     1. Both of which are modest sources of outperformance
  4. By breaking down the the index components domestically we find using the S&P indices with floating MSCI weights best captures this outperformance
     1. Internationally we will implement the MSCI ex US with floating weights
- In aggregate we model outperformance of 20 bps but humble our expectations to 10 bps

Analysis of the ACWI-IMI Benchmark

- We recommend keeping a modular build-up from the sub-asset class level to replicate ACWI IMI exposure
  - Domestically: we have ability to manage domestic portfolios internally & have generated alpha
  - Internationally: challenging to manage international portfolios internally & attractive fees structures are in place
- Attribution can be specified at the portfolio and sub-asset class levels

Enhanced 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
- Externally managed international portfolios managed by Blackrock: Developed World ex US, Developed World SC Ex US, and Emerging Markets IMI
  - Index replication of respective benchmark for core beta exposure
  - Highly liquid and cost competitive
  - In Q4 2017, we renegotiated these mandates in conjunction with the termination of active managers for meaningful fee savings of $1.7M annually

	Fee (in bps)	Fee (in bps)
	Old	New
EAFE	3	2.25
EAFE SC	11.5	7
EM	11.3	4.5

Performance Analysis

E portfolios:

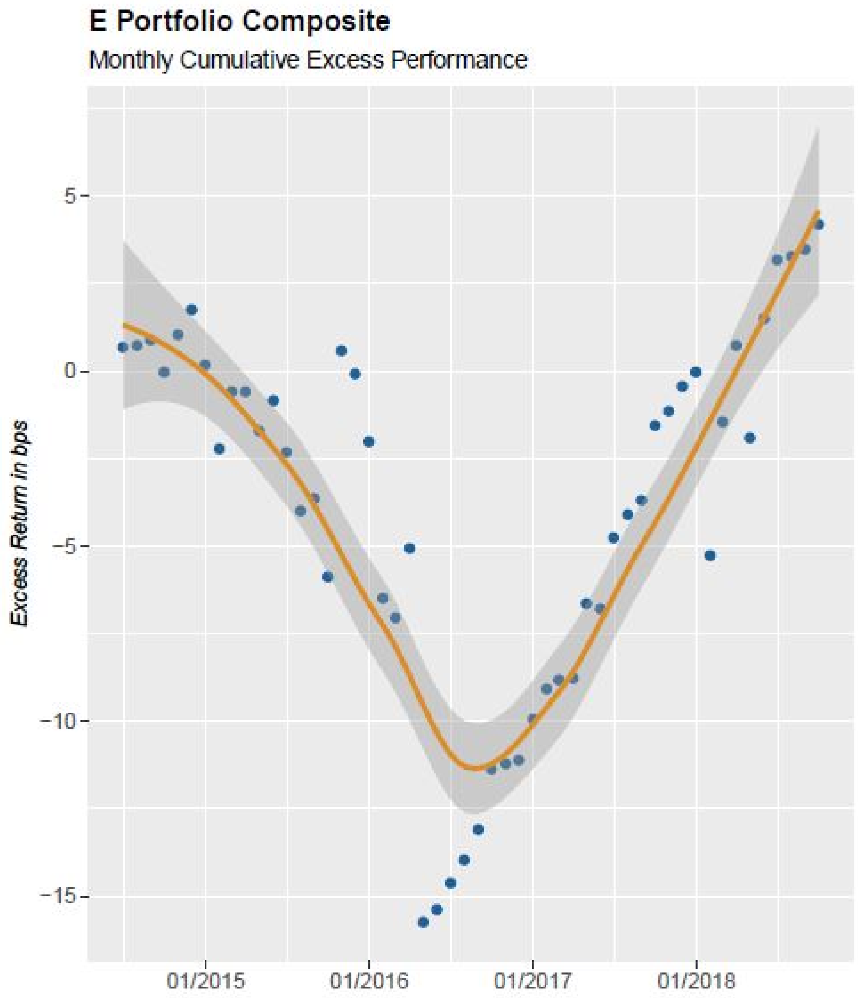
- We have found E10 and E6 portfolios have opportunities for alpha generation
  - Track 40+ categories of index actions
    - Best opportunities have been found with: index additions, M&A acquisitions, index migrations, and index weight changes
- E2 has been challenging to meet the 10 bps target
  - Few opportunities but continue to explore
  - Sector trades were unsuccessful
- In aggregate we expect to be able to meet the E portfolio composite target of 10 bps

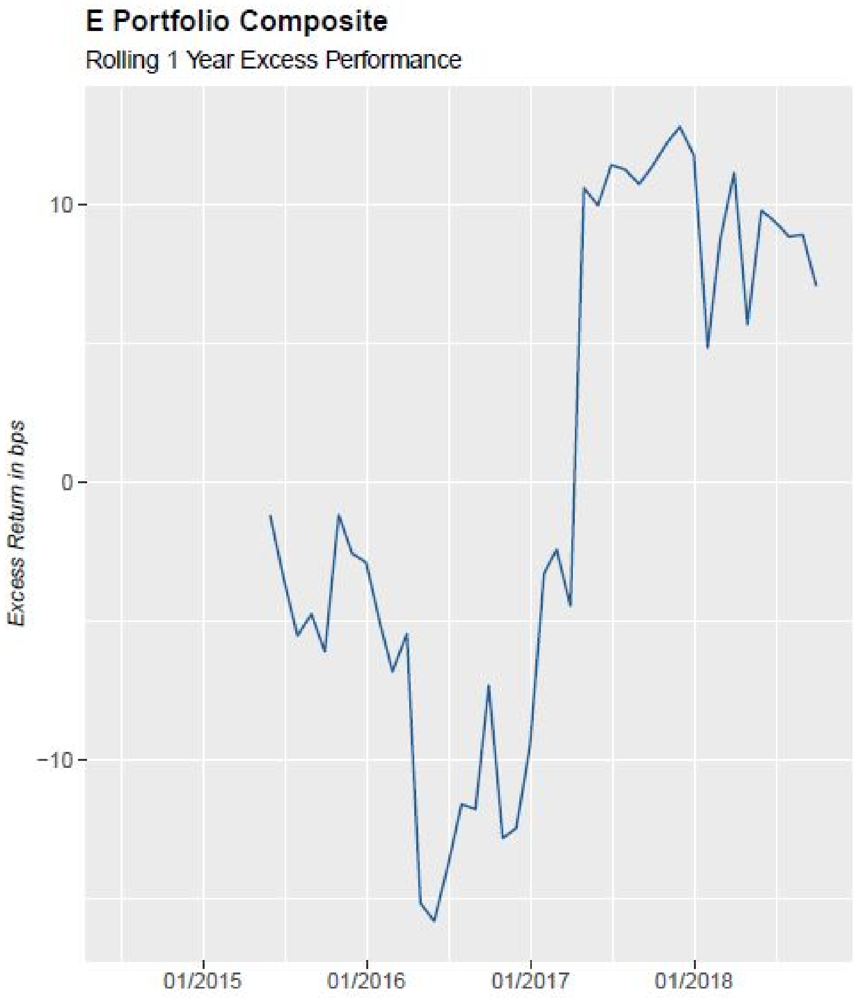
	Outperformance Target (in bps)
E2	4
E10	20
E6	25

BlackRock portfolios:

- Historical modest outperformance versus respective indices in EAFE and EAFE SC from tax reclaims & securities lending
  - EM has underperformed but fees have been reduced and securities lending started
- In aggregate we expect to perform in-line with the index

Performance Analysis





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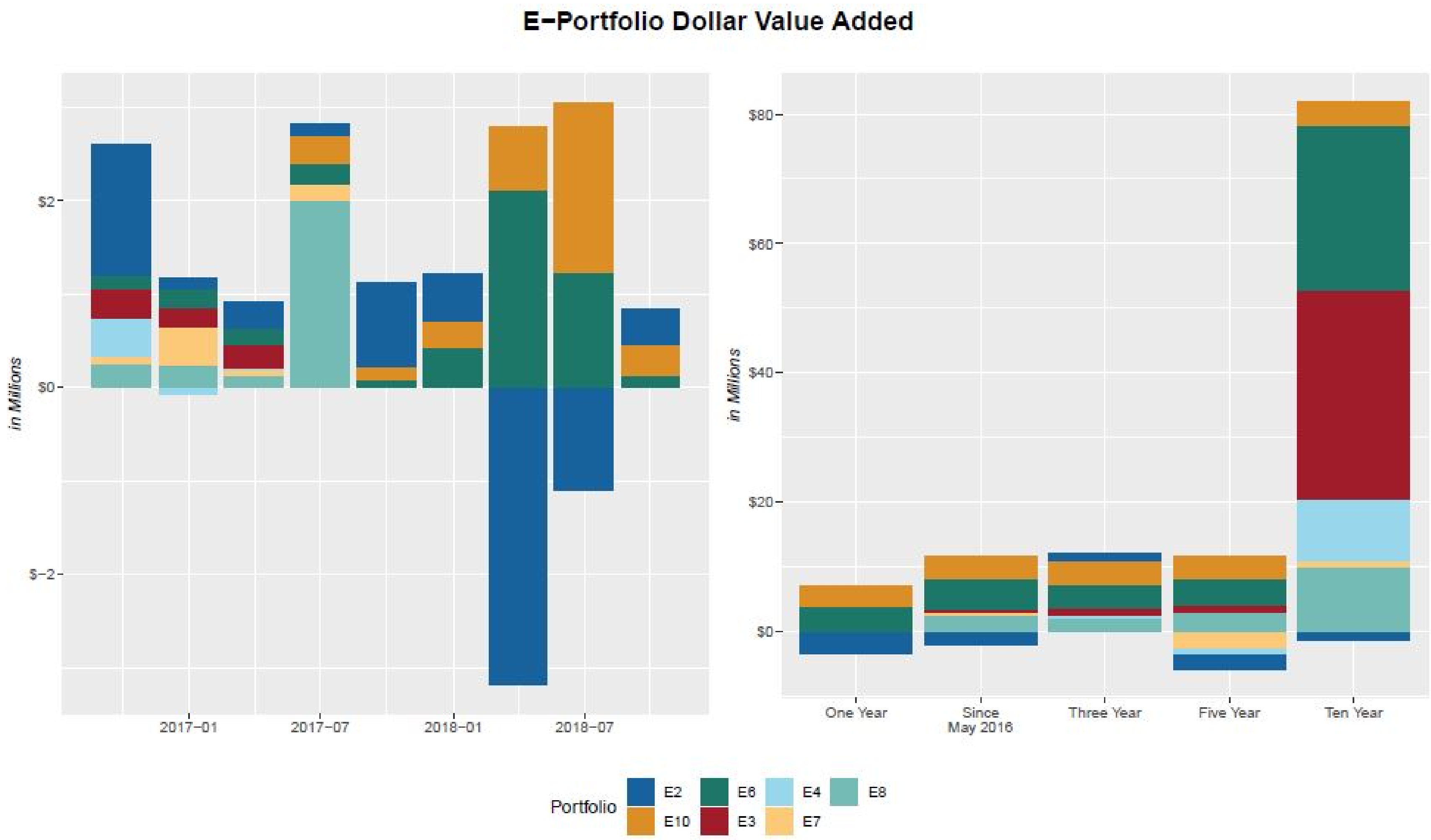

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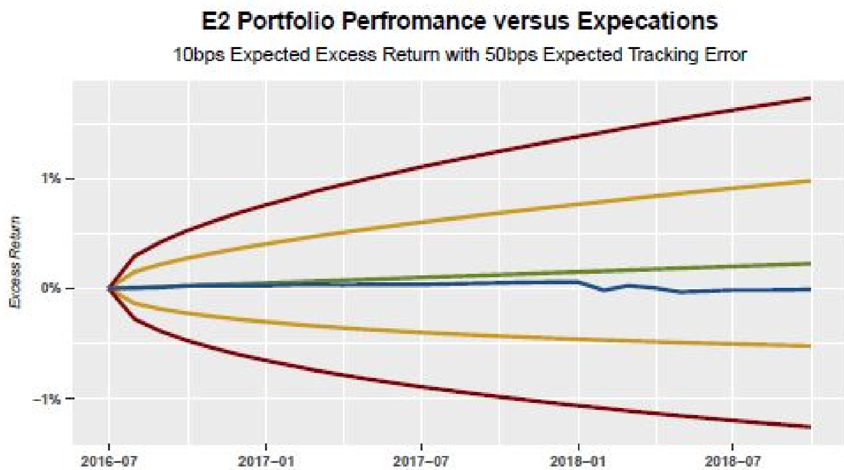

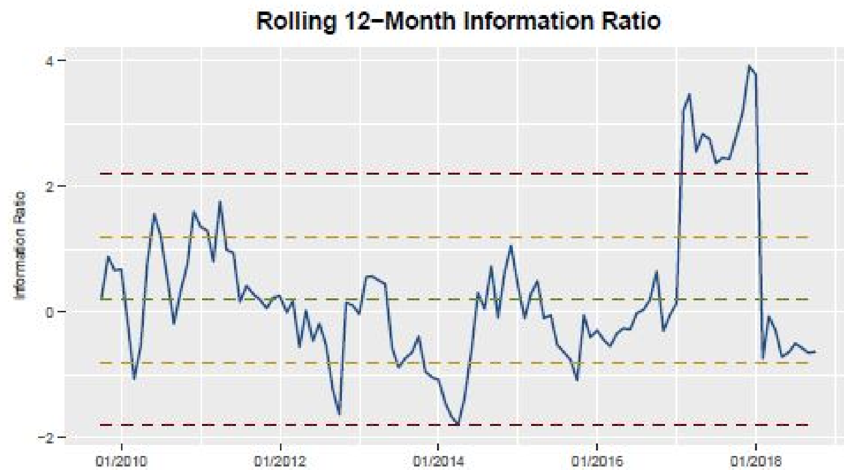

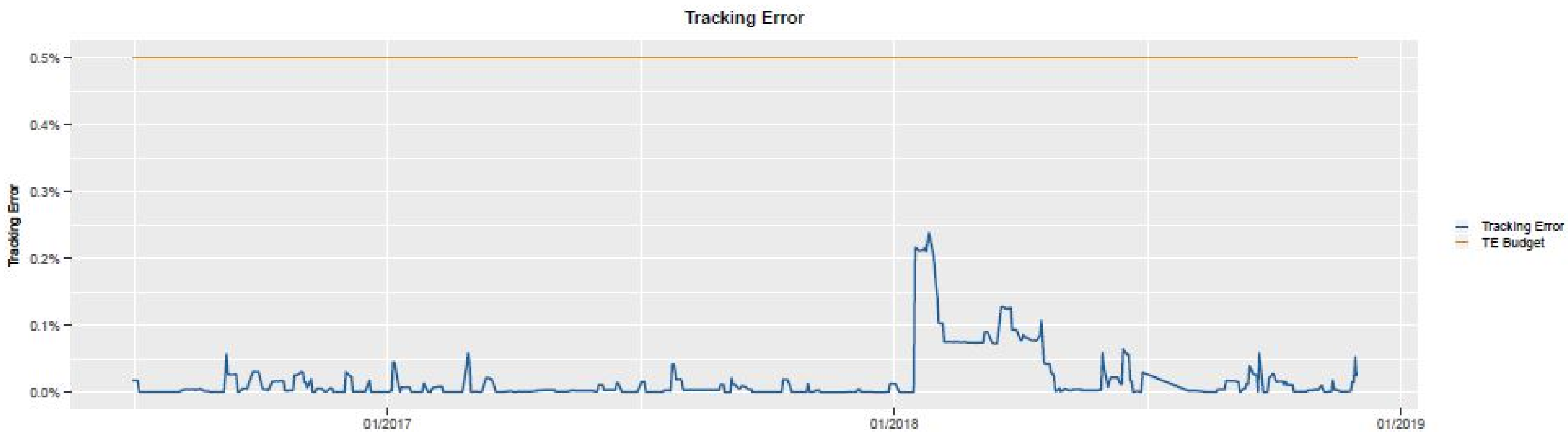

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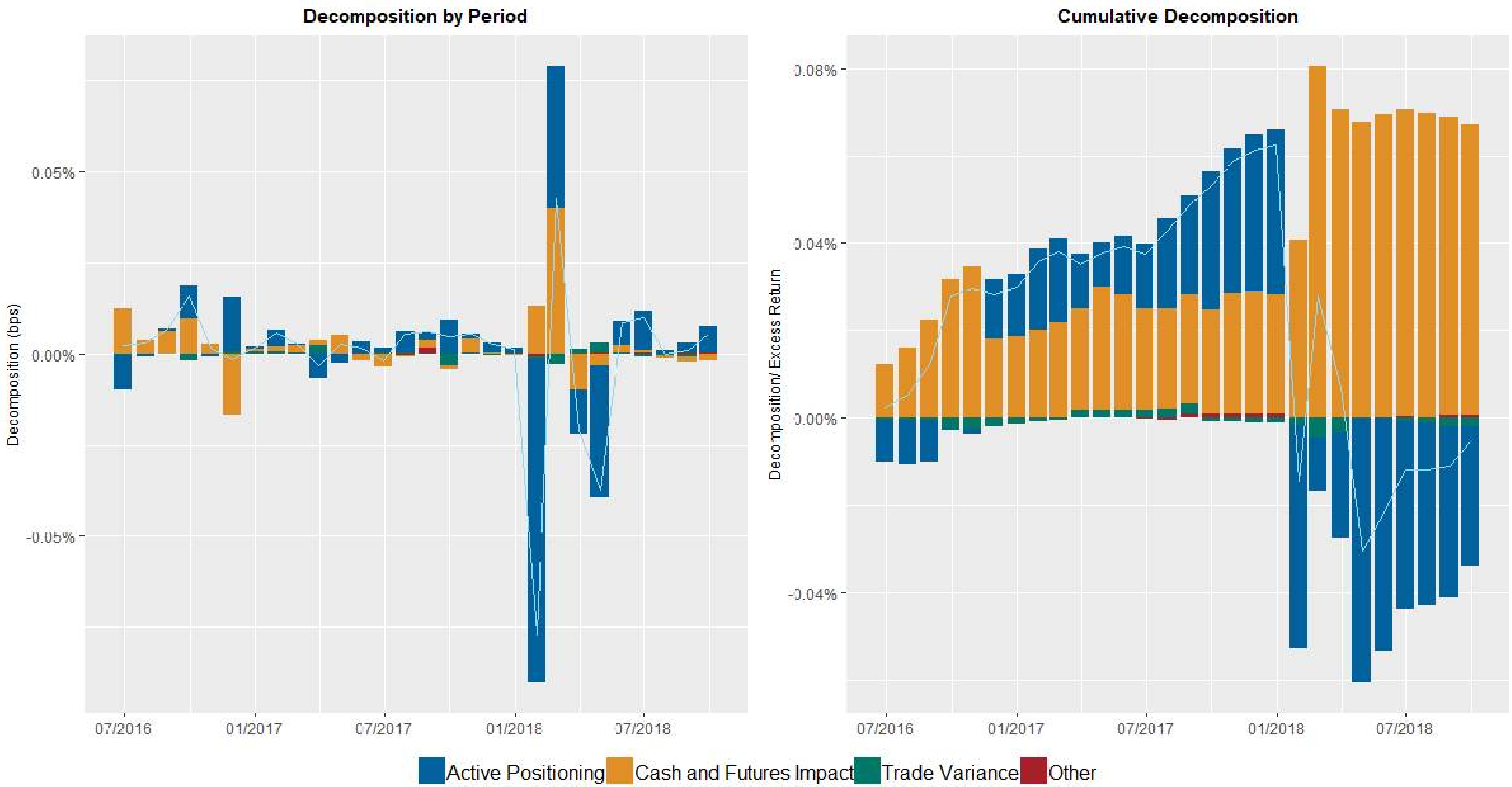

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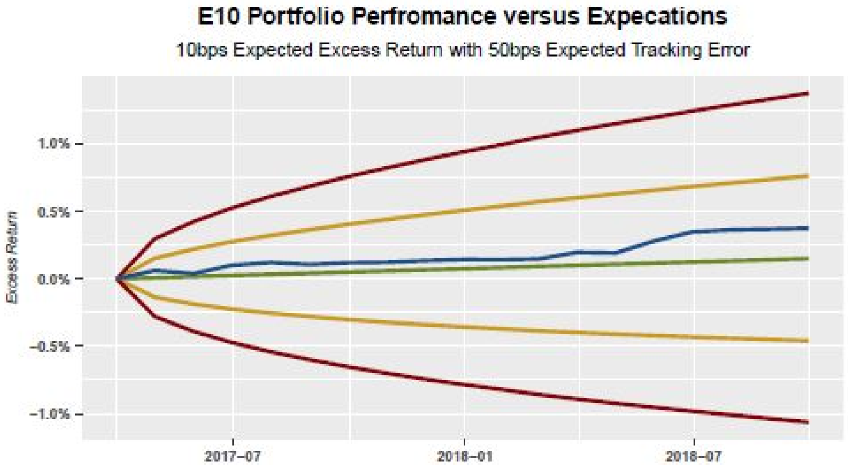

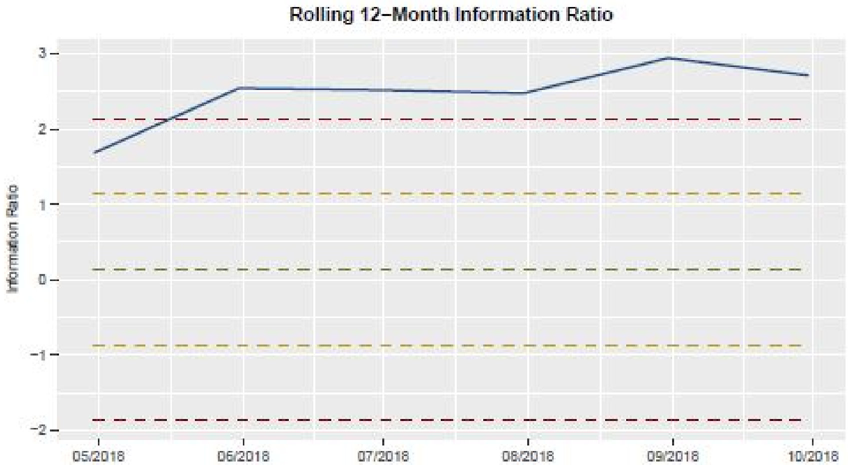

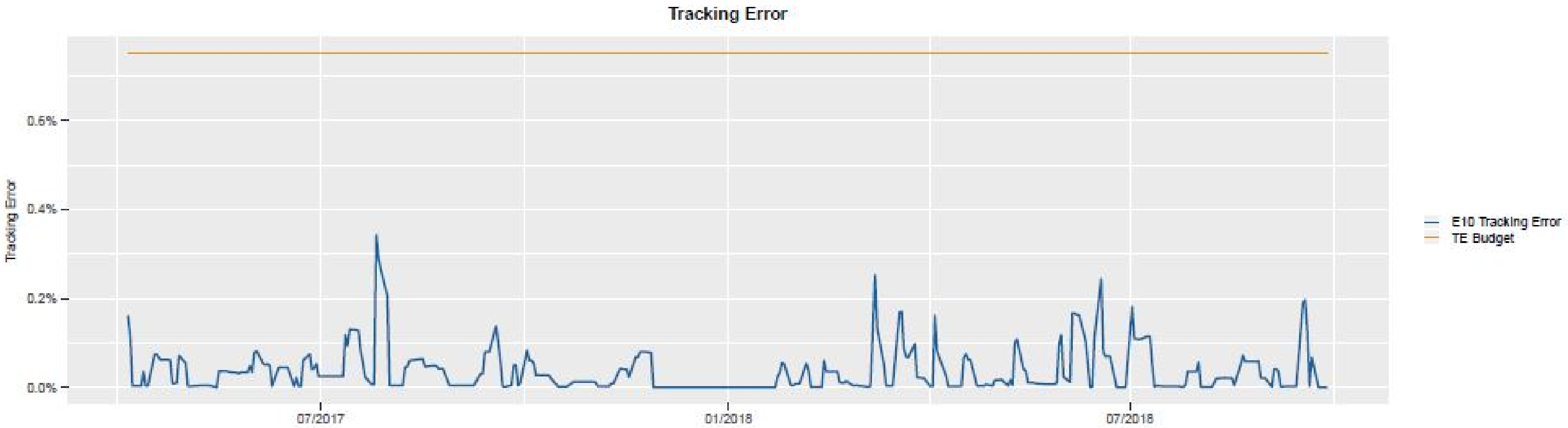

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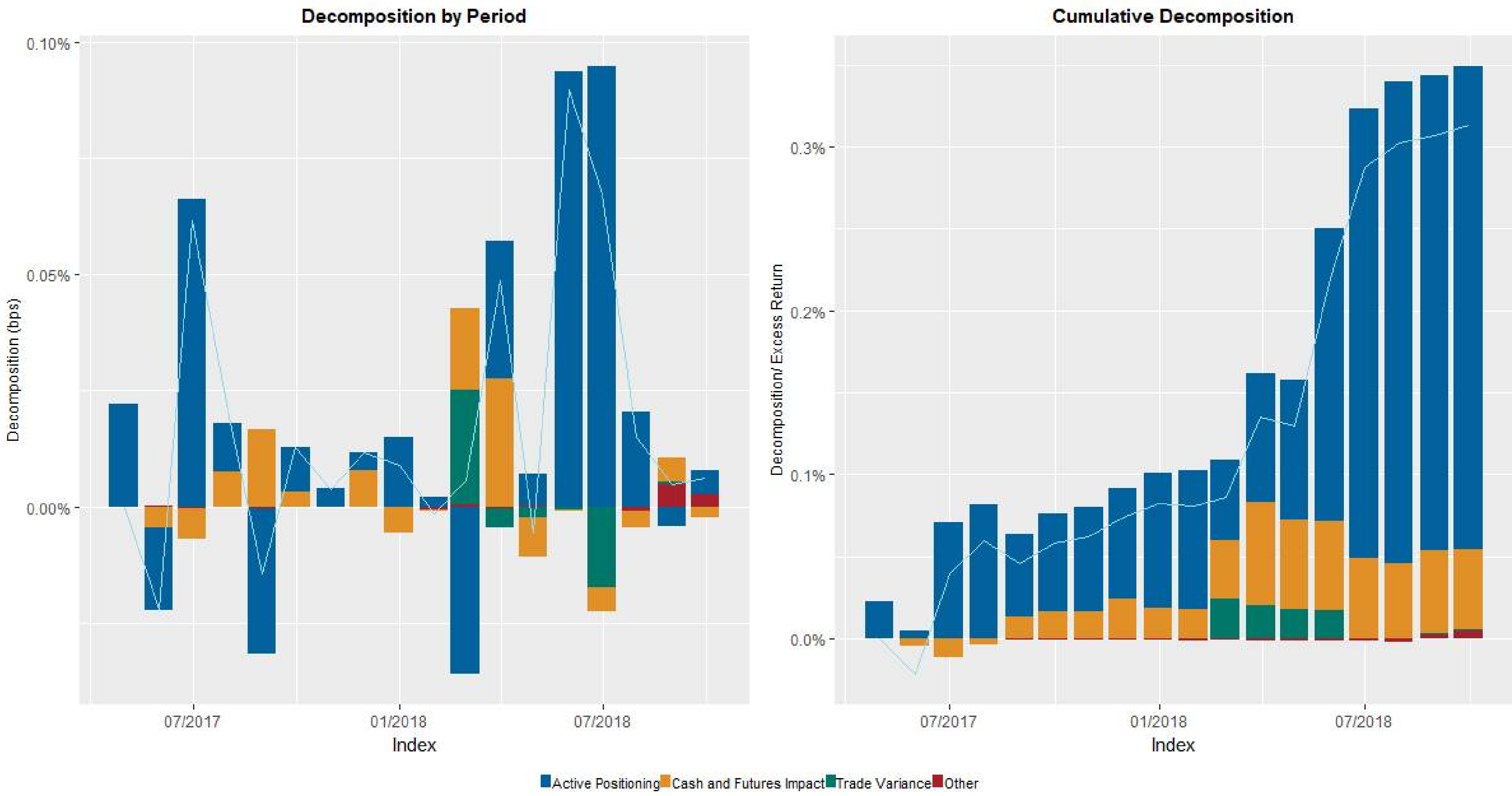

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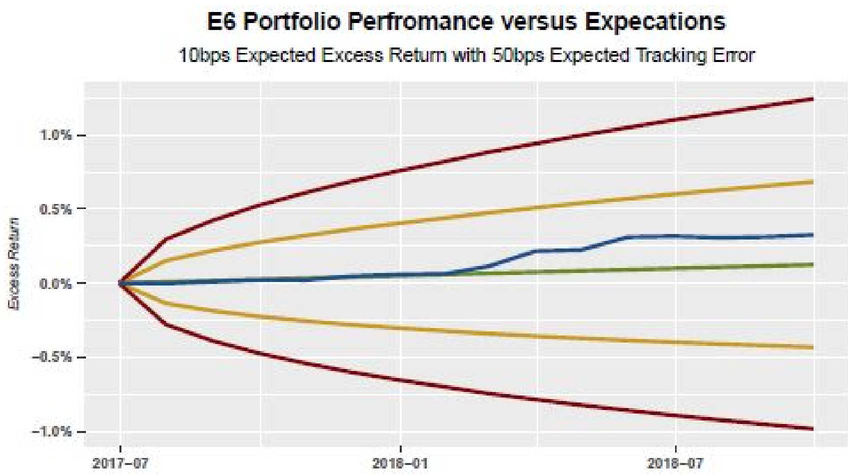

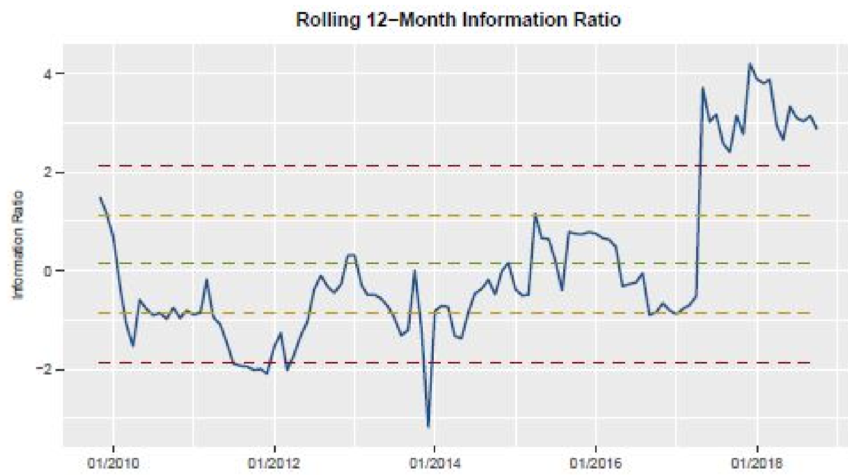

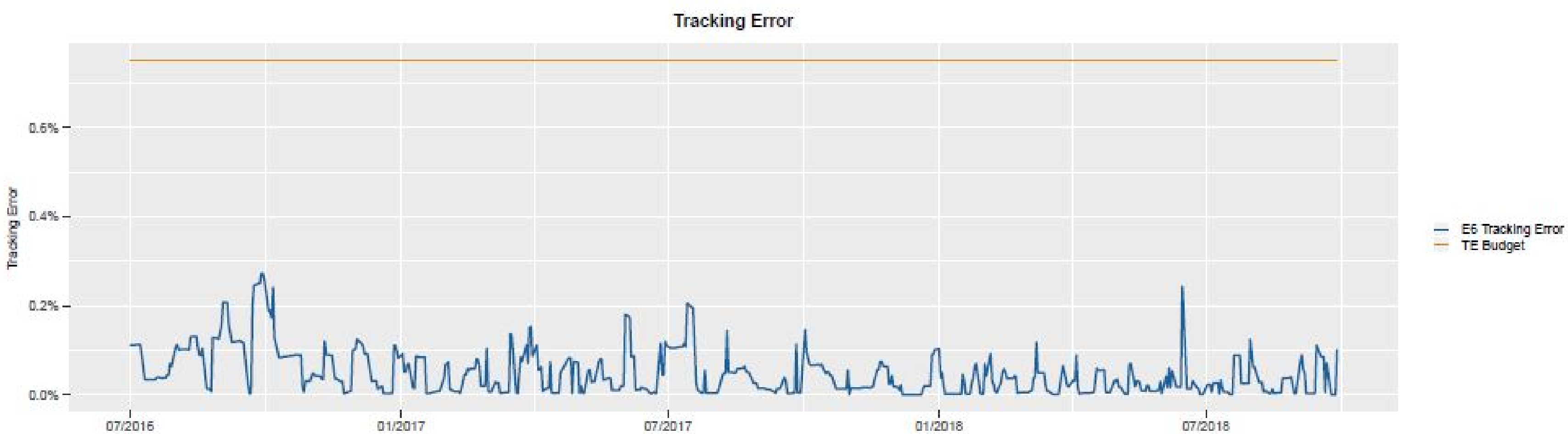

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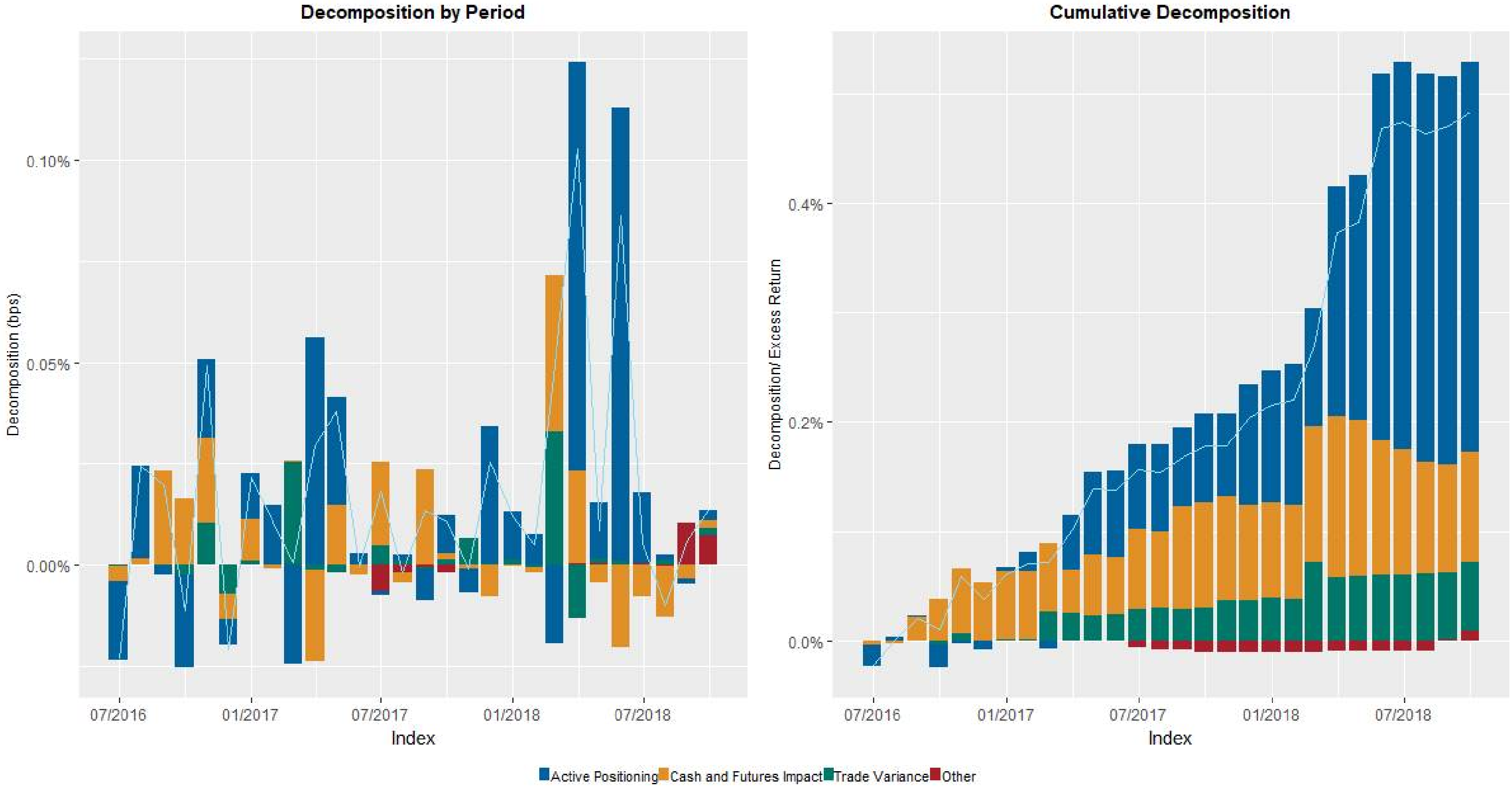


Initiatives for Consideration

- E Portfolios
  - News Quantified: real-time analysis of news events with algorithms to identify outsized impact on stock prices
  - New broker dealers: Blaylock Van and JP Morgan
  - Biggest movers study: determine if momentum or mean reversion show patterns
  - Options: explore selling covered calls to generate yield
  - Impact on S&P constituents from rebalancings in other indices
  - Corporate actions: study how indices generate positive returns from them
  - Sector relative rotation: study how relative strength & momentum interact
  - Cantor Comparative Advantage: utilizes portfolio position as the inventory source to satisfy the market's liquidity demands at premium prices by creating a zero beta long/short portfolio that "sits on top" of the client's positions to absorb (provide) liquidity depending on market supply & demand conditions
- Other products:
  - BlackRock Index+ and Alpha Advantage products
- Program wide initiatives/studies:
  - Segregate currency exposure and devise hedging strategy
  - Explore global SMA to enable beta implementation, tactical positioning, currency hedging & private equity overlay

Securities Lending

- 2018 SAA permits sec lending to be ascribed to the respective portfolios
  - Current sec lending splits between ASRS & the manager based on where assets are custodied:

State Street	L&G	Blackrock
87/13	85/15	60/40*

  - Split changes to 70/30 for Blackrock EM CIT if AUM is >$1B
  - State Street custodies all accounts except L&G SciBeta EM CIT and Blackrock EM CIT

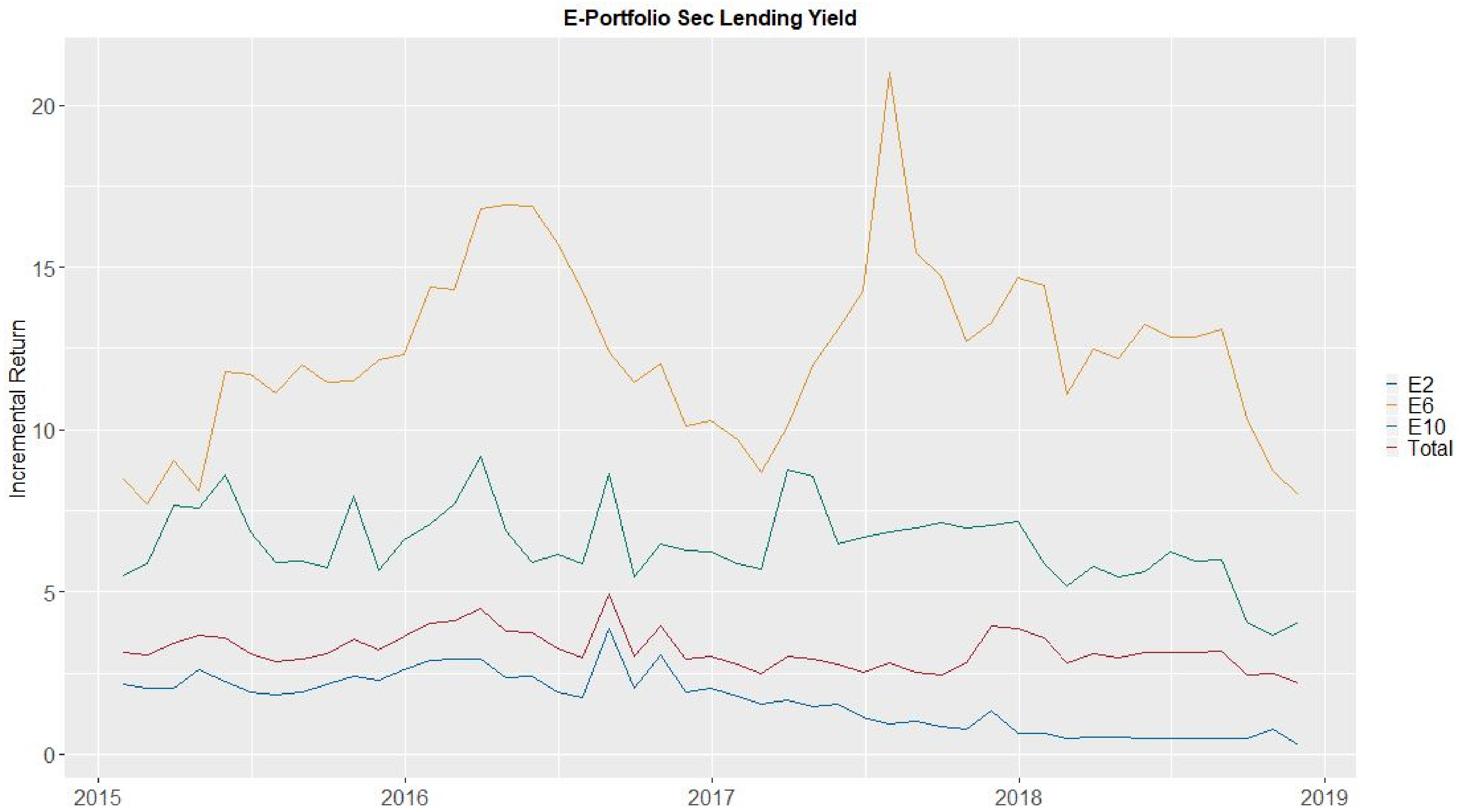
Securities Lending: Internal Portfolios

- For the E portfolios we expect a pick up of ~3bps based on history
  - E portfolio assumptions:

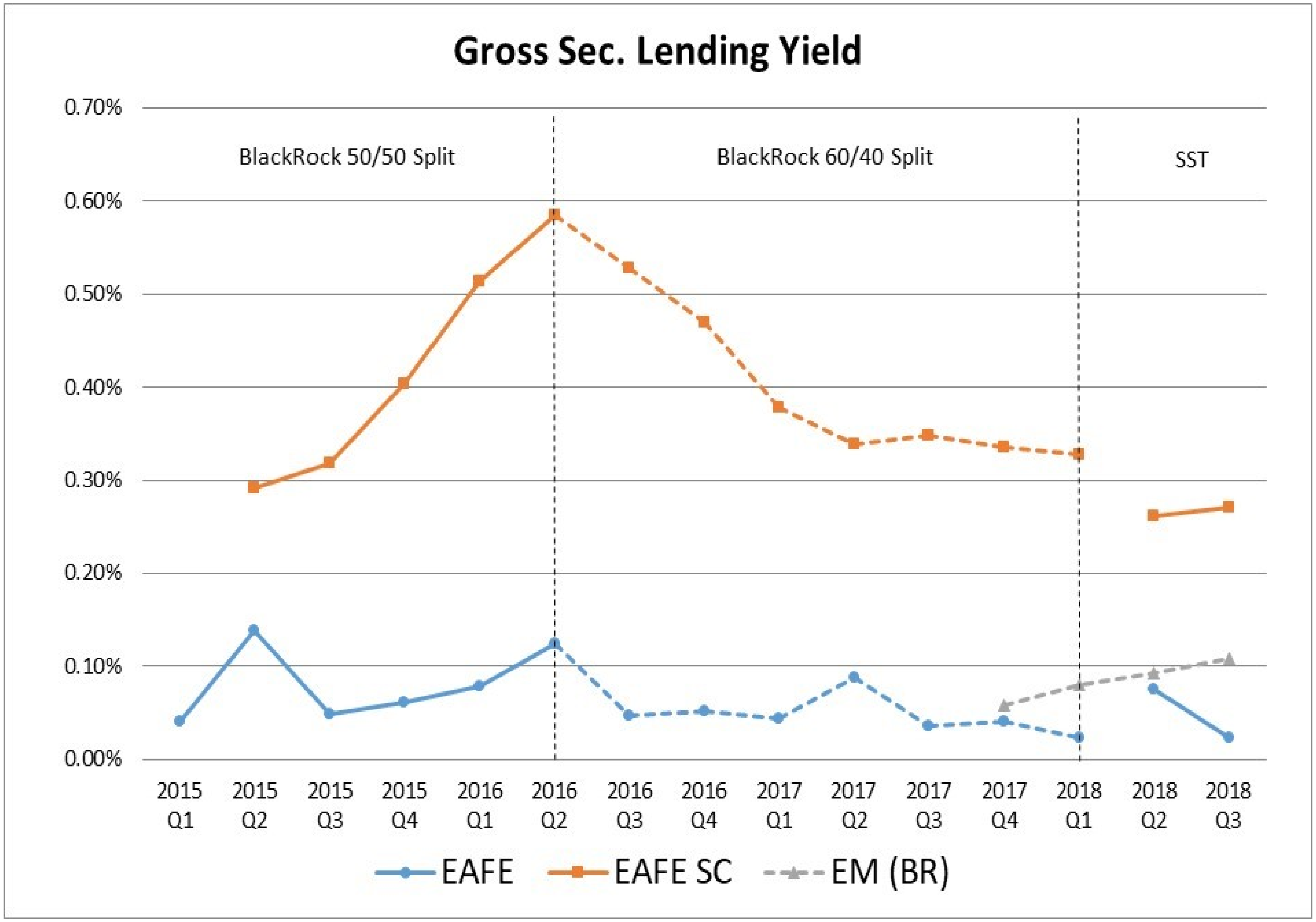
Portfolio	Yield
E2	1
E10	5
E6	10

- We intend to review the lending guidelines with State Street to look for opportunities to optimize the yield
  - In particular, aggregate and cash lending caps, participation rate, and cash collateral risk guidelines
  - We also intend to actively monitor the global sec lending risk environment and opportunistically participate in 'specials'

Securities Lending: Internal Portfolios



Securities Lending: BlackRock Portfolios



Factor Portfolios: Study

- ASRS presented to the Combined Asset Class Committee comprehensive studies on factor portfolios in February & October 2017
- Key takeaways:
  - Factors represent risk premia that are a source of outperformance 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 robustness [1][2][3]:
  - 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

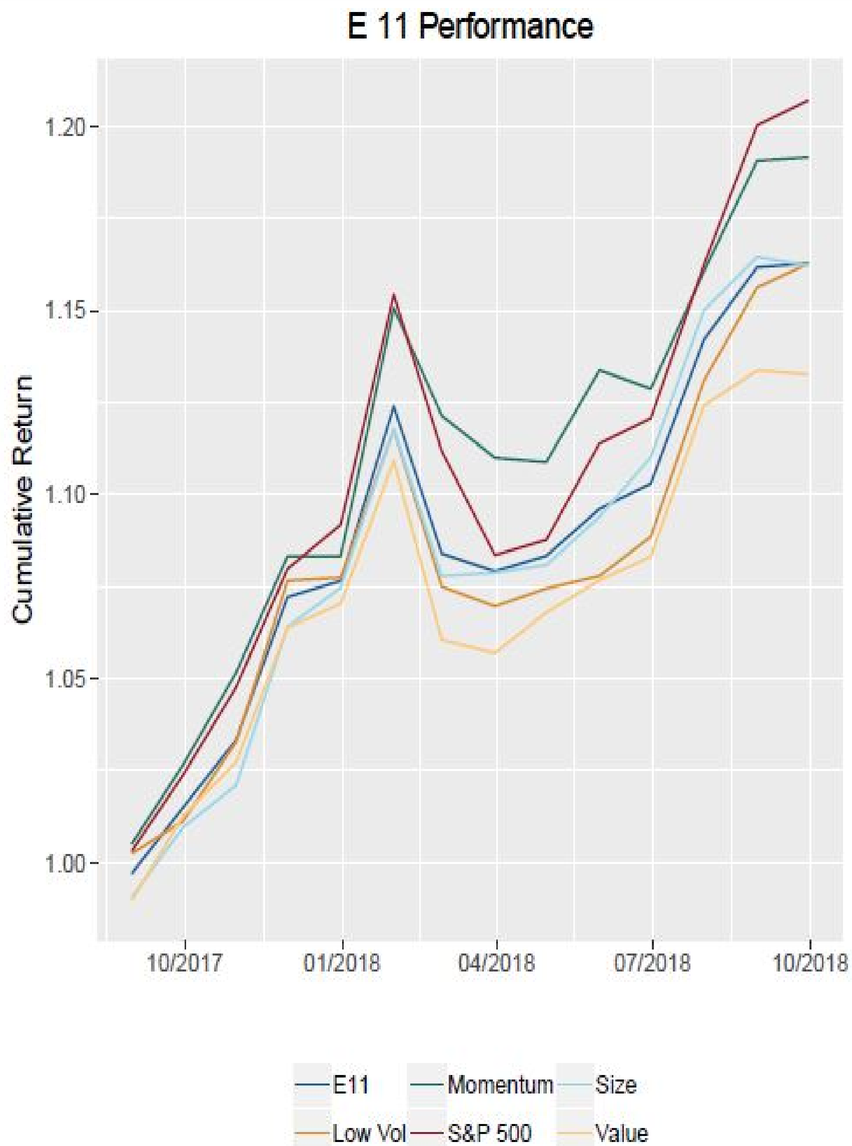
- ASRS selected Sci Beta to implement 4 factor equal weight portfolios in US LC, EAFE LC, and EM
  - US LC is run internally as the E11 portfolio; inception August 2017
  - EAFE LC and EM are managed by L&G; inception May 2018 (EM) | June 2018 (EAFE LC)
- We chose the 25% allocation weight because the probability of outperformance for an alpha target of 25 basis points starts to level off thereafter
- At the portfolio level we have the following excess return expectations:

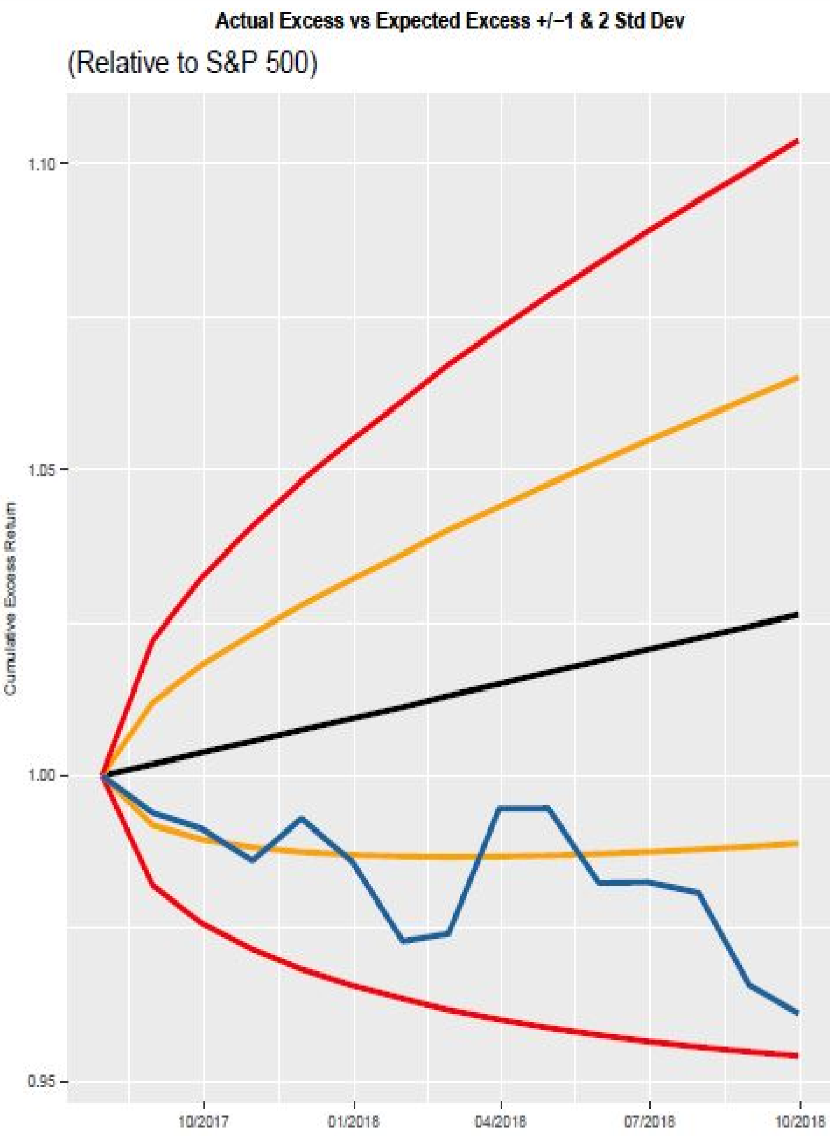
Standalone	1y Excess	1y TE
	bps	bps
US LC	+233	353
EAFE LC	+343	467
EM	+378	705

- At the total public equity level we modeled the following excess return expectations with a 25% allocation to the factor portfolios:

25% allocation to Total Equity	1y	3y	5y
est annual excess return (bps)	+59	+61	+62
hit rate to achieve 25 bps excess return	71%	82%	88%
90% confidence interval (bps)	-62 : +175	-13 : +121	+1 : +105

Factor Portfolios: Performance





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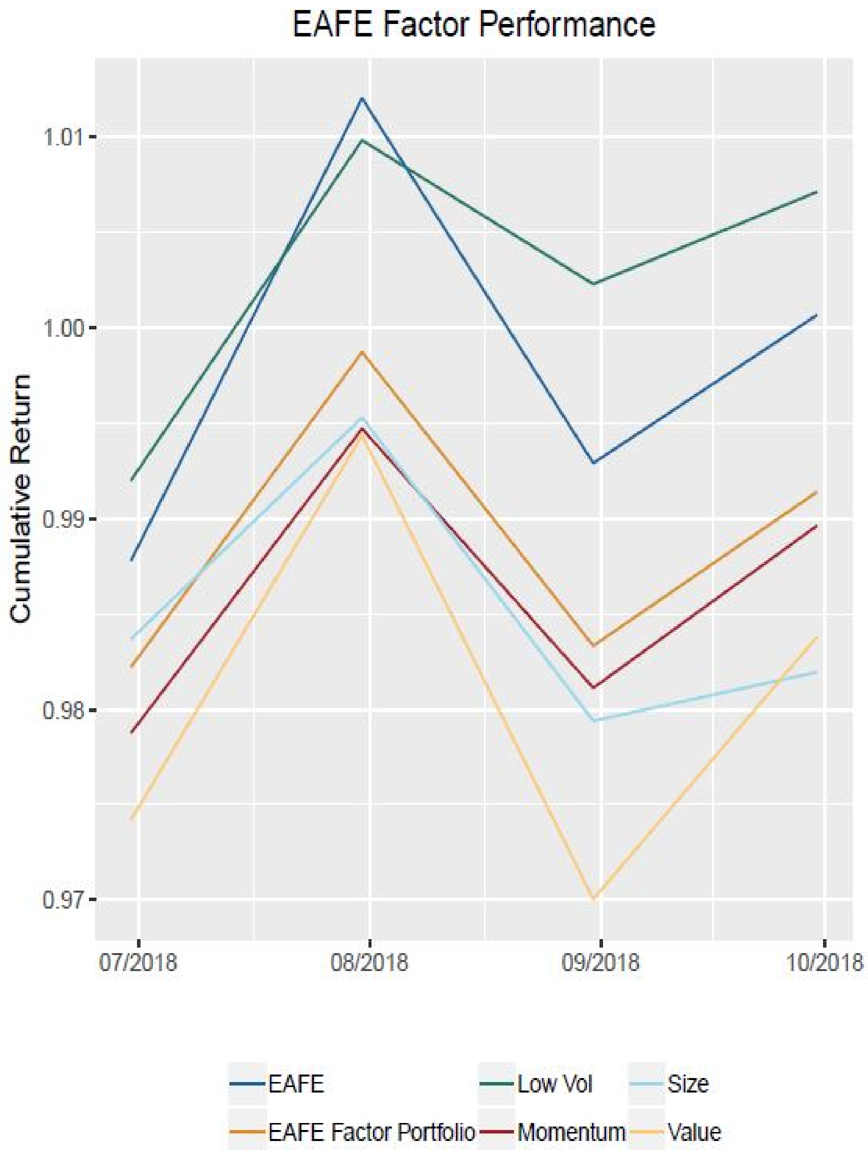

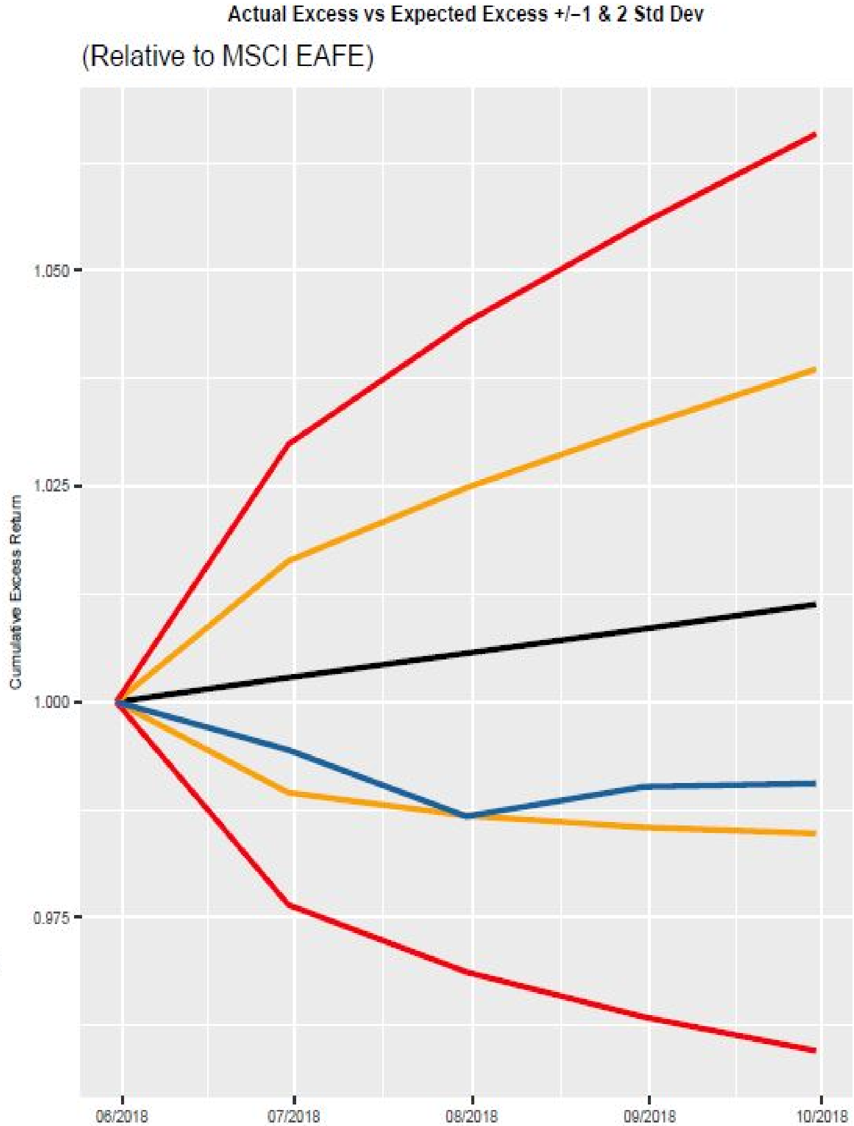

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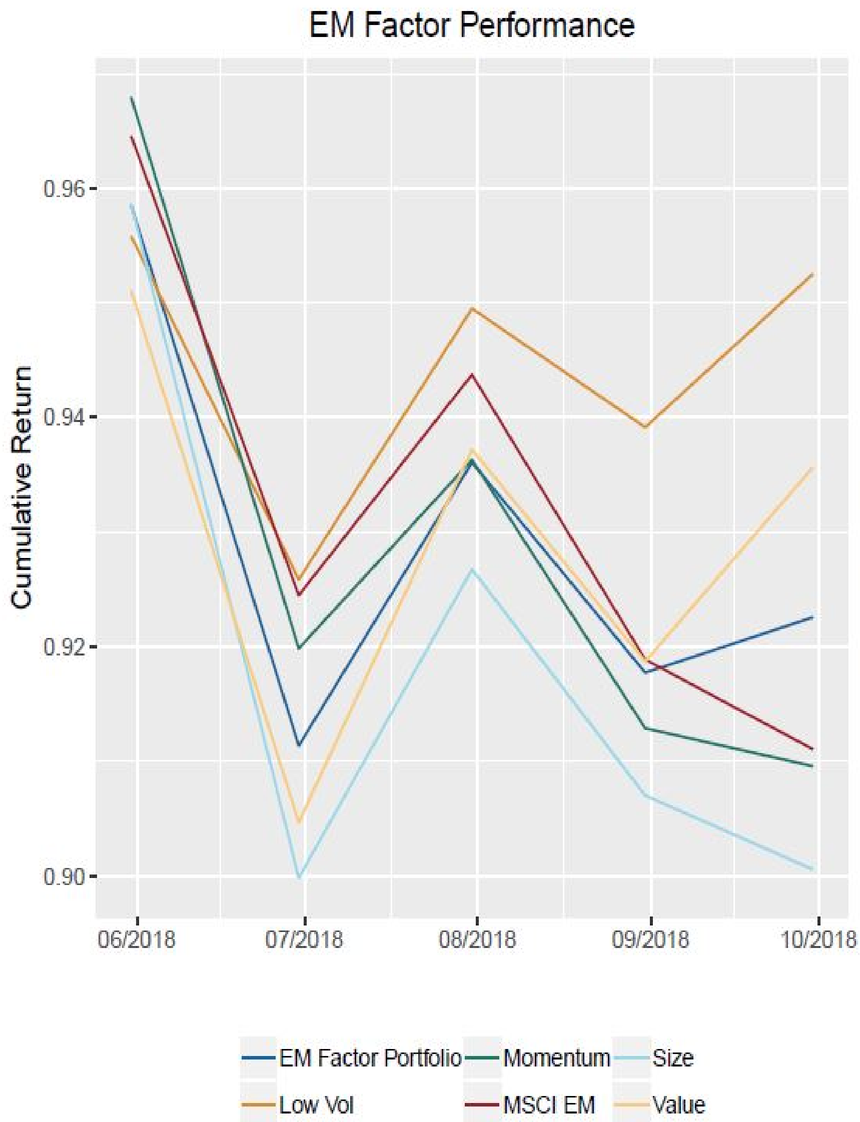
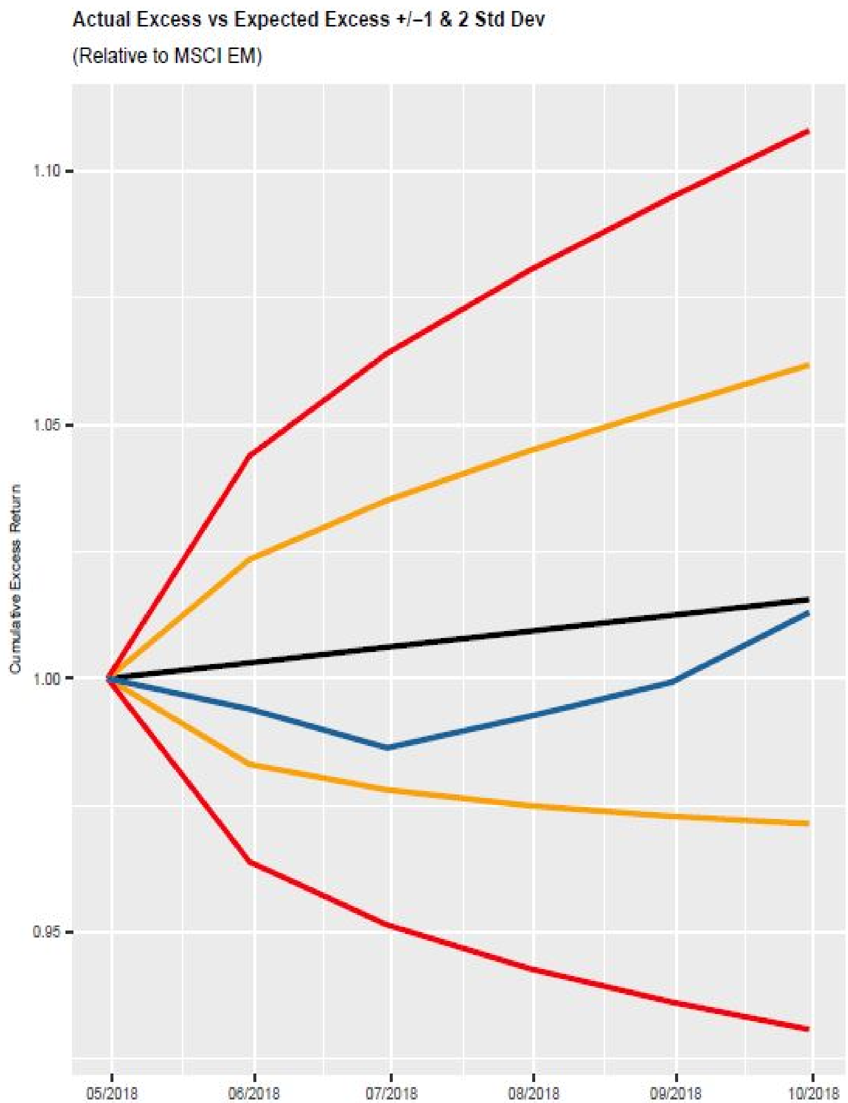




Active Portfolios

- ASRS presented to the Combined Asset Class Committee in April & June 2017 a comprehensive study on active management.
  - 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
  - ASRS decided to end its active management program and completed the transition out of these mandates

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
    - Strategies were unsuccessful and GTAA industry offerings have diminished
  - In the 2015 SAA, the Multi-Asset Class had a 5% Strategic Asset Allocation Policy target
- The 2018 SAA allows for Multi-Asset derivative strategies in the Other portfolio with a 10% maximum total fund weight (20% for equities)
  - May be implemented as strategy overlays in liquid asset class portfolios, but to the extent implemented as an overlay this will reduce the availability for investment in the Other category
  - Such a strategy is expected to have low correlation to the total fund and may be based on long/short strategies across multiple liquid asset classes and may be based on factor or style approaches including momentum, value, carry, volatility and other such strategies
  - Any such overlay will be implemented with liquid assets, available liquidity not less than quarterly and initial lockups not greater than two years
  - Targeted to add 25 - 50 bps of performance to the equity portfolio

Due Diligence Process

- We have completed a multi-phased study to contemplate implementing an overlay program:
  - Phase I: study the universe of overlay managers to understand categories & frame expectations for interactions with the total fund and equities
    - Must be portable over liquid asset class
    - Low correlation to total fund and respective asset class
    - Low dependence on specific events or key person
    - Quantitative and systematic
  - Phase II: select competing strategies to study from the manager categories
    - Global macro, trend (CTA), and risk premia
    - Multiple candidates in each strategy identified
    - Conducted rigorous quantitative & qualitative analysis of firms & strategies
    - Determined a short list of 7 mandates for serious consideration
  - Phase III: Build an optimized overlay portfolio subject to practical constraints
    - No mandate >50% of strategy budget
    - No category >50% of strategy budget
    - No mandate <10% of strategy budget
    - We also analyzed correlations among mandates and strategies
  - Phase IV: Select a blend of optimized portable alpha overlay portfolio and S&P exposure

Due Diligence Process

- Other considerations:
  - Strong preference for low base management fee with a performance incentive
  - Strategic partnership deemed critical: thought leadership, academic rigor, organizational depth, prior history & reputation
  - Need for a right-sized portfolio that balances a sufficiently diverse number of managers against their incremental program benefits
  - ASRS led the manager search & due diligence while utilizing outside consultants/vendors to perform portfolio optimization studies
- In separate appendices we provide work done by external parties

Summary of Research

Key takeaways:

- We independently verified:
  - Manager style categories are appropriate, consistent with data
  - Over a long period of time one global macro manager has performed well with low correlation to a liquid total fund proxy but has had stretches of poor performance
  - Trend managers have performed well over long periods of live track record data but have periods of elevated correlation to a liquid total fund proxy (and equities) while also exhibiting correlation to each other
  - Most risk premia managers have short track records and several have backtested results that warrant skepticism
- We conducted several rounds of in-person due diligence to incorporate qualitative analysis
- Managers' information ratios were humbled to reflect track record length, embedded biases, and plausibility/reliability of track record
- We established common sense heuristics to design an optimization that limits mandate and category concentration while also considering correlations among mandates and categories
  - We considered the practical implications of diversification among mandates such that mandate sizes would be meaningful while still providing incremental diversification
- Based on bootstrap simulation methods employed to analyze the factor portfolios, we found that the portfolio proposed with practical optimization constraints is promising to pursue
  - On a standalone basis we would expect positive net returns >70% of the time over 1, 3, and 5 year time horizons

Next Steps

- Complete site visits with all prospective managers
- Engage with consultant for IDD & ODD for those mandates that warrant further consideration
- Come back to the Combined Asset Class Committee with due diligence reports for managers that ASRS supports moving forward with
  - Propose structure for implementation

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

Investment Philosophy

- Private Equity is permitted as a type of equity investment under the new SAA but no longer has an 8% target
    - Instead, as a liquidity governor the SAA limits investment structures with lockups to 20% of the equity portfolio and private equity co-investments to 10% of the equity portfolio
    - Lockup structures are the most feasible way for ASRS to access PE investments
        - For most PE investments with an identified plan for growth or operational change, the investment horizon fits within the typical fund life
        - However, transacting is expensive and certain businesses would ideally be held long-term
- Private equity offers 5 principal benefits as a form of equity ownership
    - Operational change is incentivized for both the company and GP
    - Longer term time horizons for ownership and performance KPIs are often more appropriate than quarterly cadence of public listings
    - Small and medium sized businesses represent a large part of the economy (particularly as public listings have shrunk)
        - Economic diversification from the different industry exposures compared to public companies
    - Smoothed and lagged performance reporting represent a diversifying aspect to overall equity returns
    - Ability to outperform public equity market returns over a long-term investment horizon

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 equity[4]
  - Historically, Private Equity buyout funds outperform public markets by about 20% in total value over the life of a fund, although less so in more recent years
  - Persistence of returns is evasive [5]
  - Operational engagement matters [6]

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

[5] Braun, Jenkinson, and Stoff. How Persistent is Private Equity Performance? The Journal of Financial Economics, 2017.

[6] Cornelli, Kominek, and Ljungqvist. Monitoring Managers: Does it Matter? The Journal of Finance, November 2012.

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

Strategy

- With 10+ years of experience in the asset class ASRS is increasingly favoring:
  - Sector specialists
  - Managers with a discernible edge (sourcing, operational capabilities, and capital structuring)
  - Firms with a thoughtful succession plan
  - Ability to provide co-investment
- ASRS has typically invested in GPs during their 3rd fund or thereafter
  - Mitigates firm risk as team is built out and processes established
  - Mitigates track record risk as history demonstrates consistency
- ASRS continues to favor US but has modest diversification into Europe
  - Less jurisdiction & currency risk
  - Easier to conduct due diligence
  - More evolved industry & dynamic economy

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[7]

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

Track Record

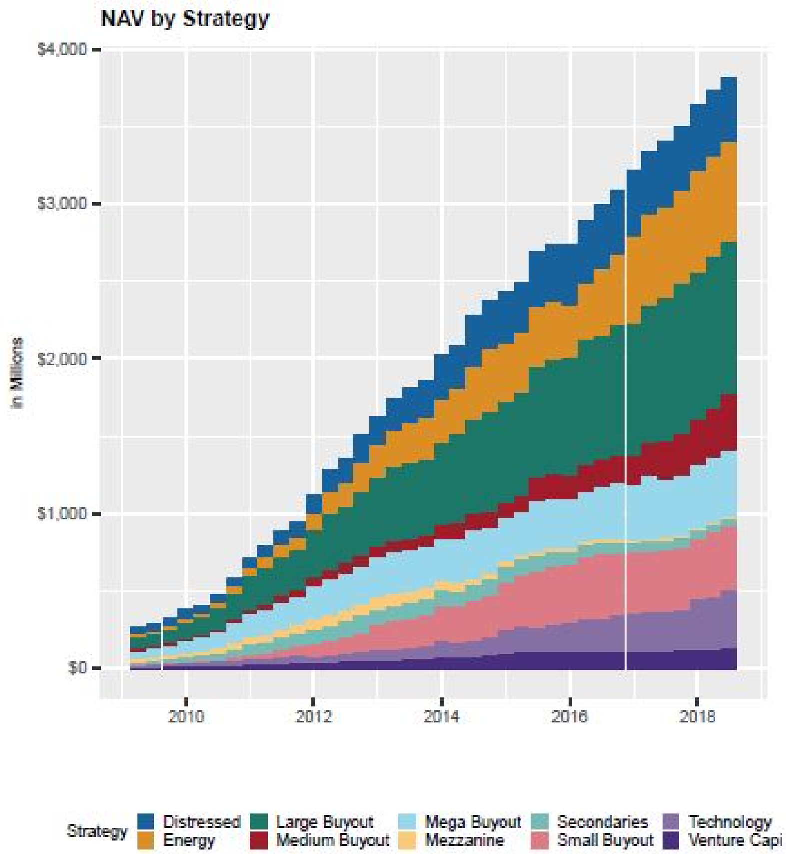
- Private equity performance has a fairly high level of dispersion
  - "Top quartile" funds outperform median funds by 5% to 10% depending on vintage
  - It is exceedingly rare for managers to perform persistently in the top quartile, but we do find managers persistently above median
  - ASRS implements 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 services[8]

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

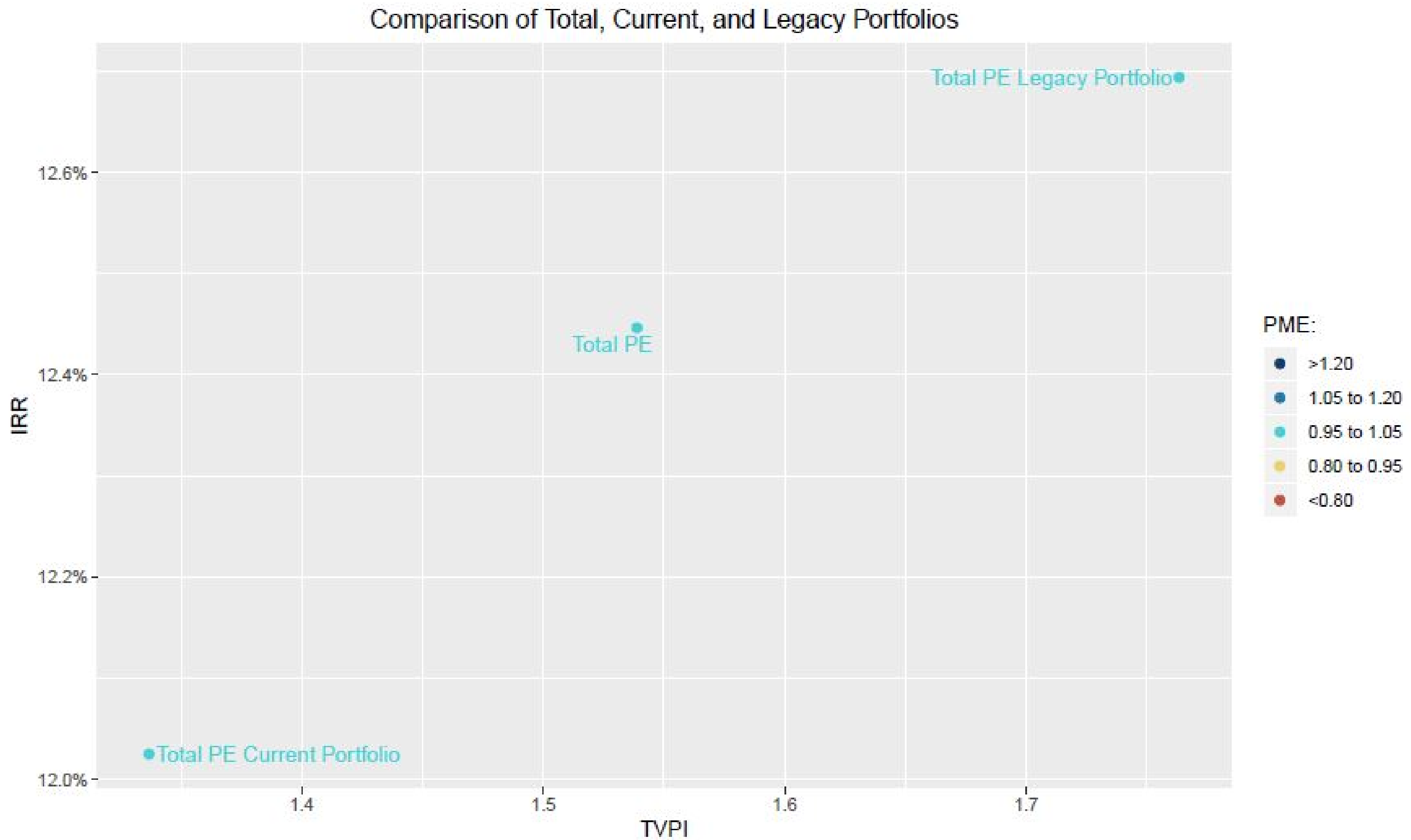
Performance History

Private Equity IRRs

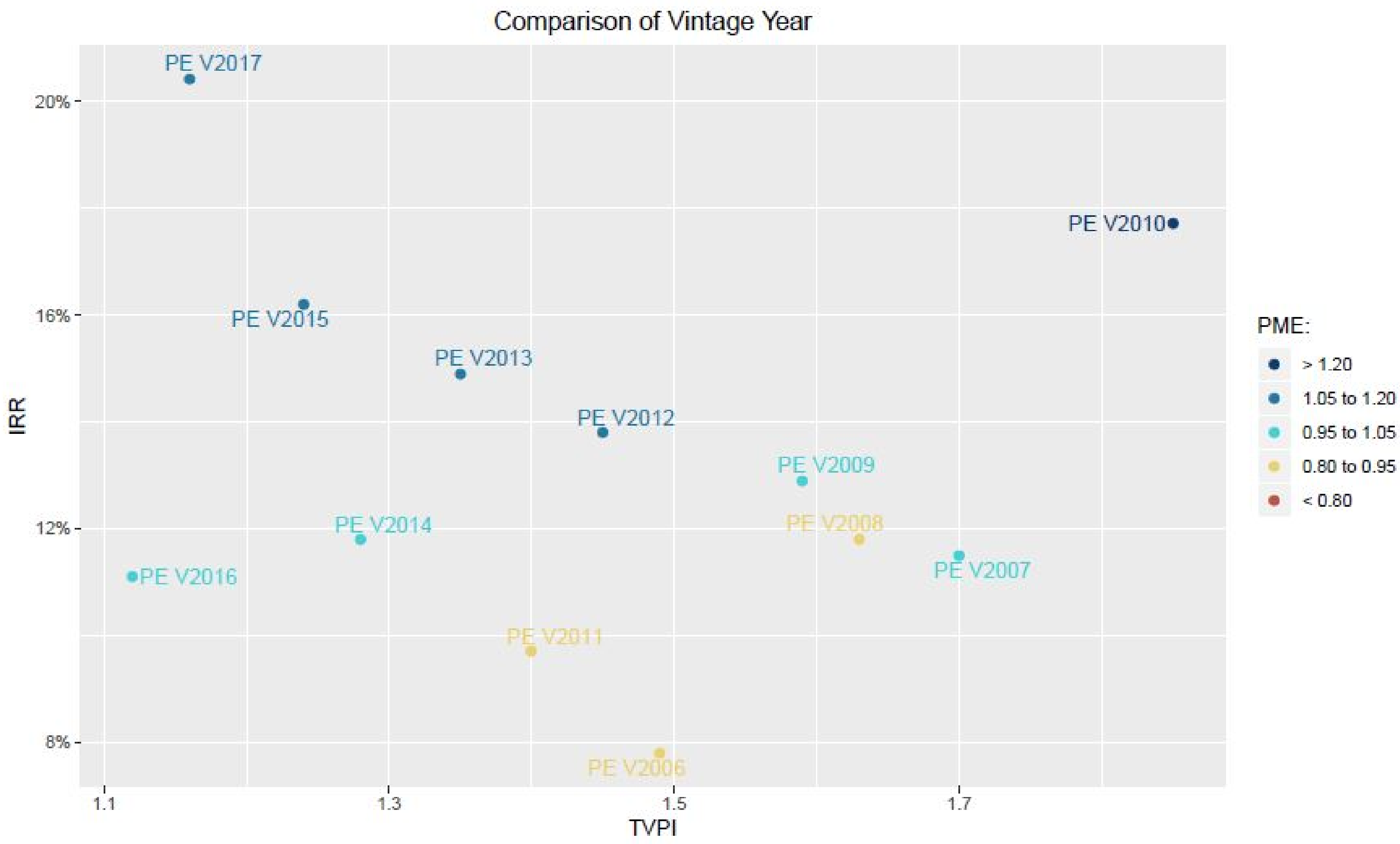
Category	Qtr	1 Year	3 Year	5 Year	ITD
Private Equity	4.4%	15.6%	12.5%	12.8%	12.8%
Benchmark	1.1%	8.9%	8.3%	10.4%	10.4%
Excess	3.3%	6.7%	4.2%	2.5%	2.5%
Technology	6.5%	27.4%	20%	21.2%	18.3%
Mega Buyout	6.7%	18.2%	16.9%	16.7%	13.6%
Medium Buyout	3.9%	20.6%	15.4%	18.6%	14.9%
Small Buyout	8.4%	18.7%	18.6%	17.9%	14.6%
Energy	2%	5.4%	6.1%	6.3%	8.3%
Venture Capital	5.3%	21.5%	10.4%	15.3%	11.3%
Distressed	2.9%	11.3%	4.8%	6.3%	8.5%
Secondaries	-0.7%	11.2%	4.9%	9%	9.5%
Large Buyout	3.5%	16.3%	13.8%	12.9%	13.5%
Mezzanine	6.3%	13.2%	7%	8%	9.6%



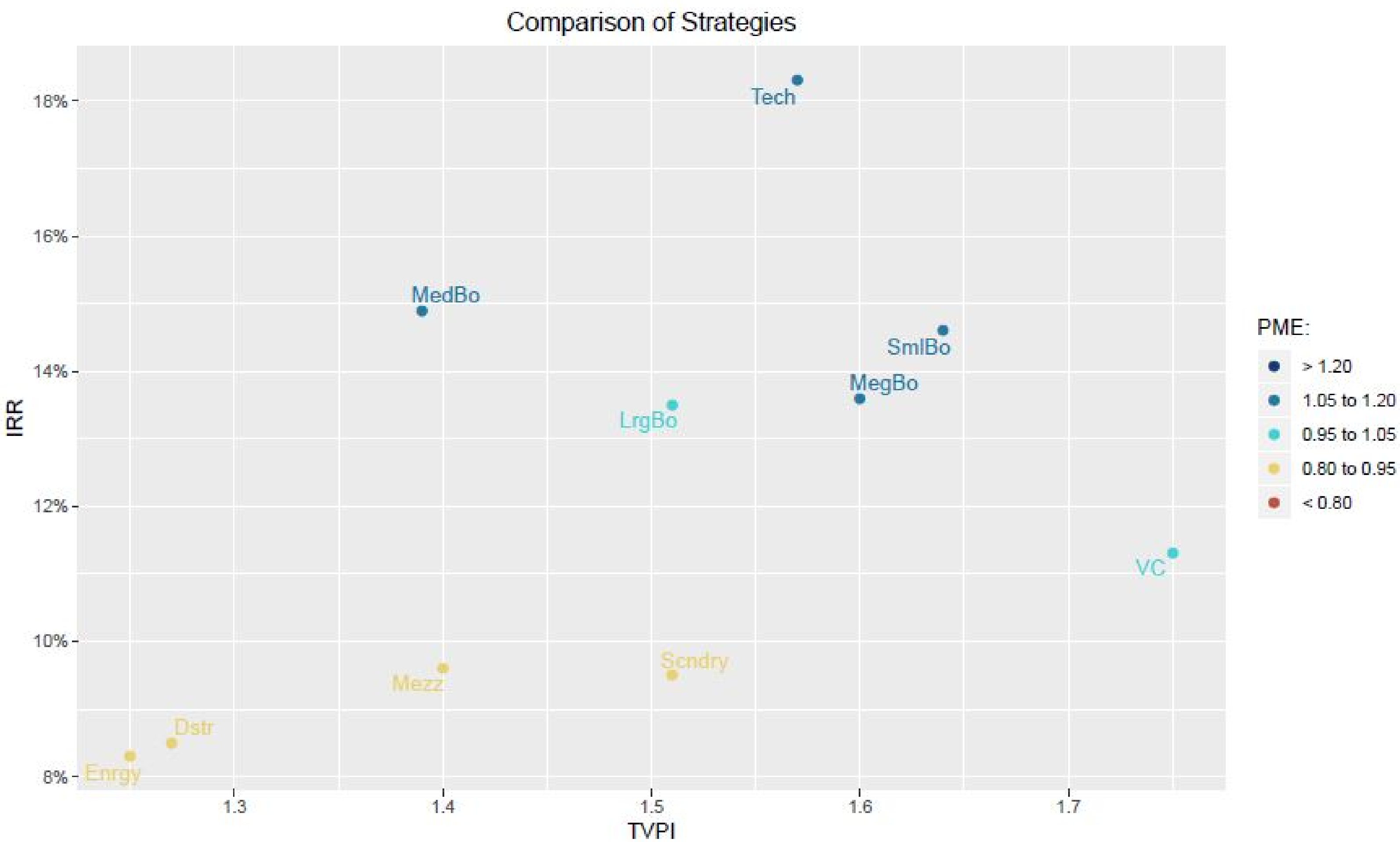
Performance Comparison



Performance Comparison



Performance Comparison



Performance Comparison

	R2K PME	IRR	R2K Dollar Matched IRR	PME vs R2K Sector	Dollar Matched IRR R2K Sector	ACWI IMI PME	ACWI IMI Dollar Matched IRR
Total PE	0.97	12.5%	13.4%	n/a	n/a	1.10	9.7%
PE Legacy	0.98	12.7%	13.3%	n/a	n/a	1.14	9.6%
PE Current	0.97	12.0%	13.5%	n/a	n/a	1.05	9.7%
PE Generalist	0.98	12.9%	13.4%	n/a	n/a	1.13	9.6%
PE Specialist	0.96	11.8%	13.3%	n/a	n/a	1.06	9.7%
Tech	1.11	18.4%	13.0%	0.97	17.41%	1.22	9.3%
HC	0.97	11.6%	13.4%	0.87	19.1%	1.04	9.5%
Energy	0.89	9.1%	13.8%	1.52	-7.0%	0.98	10.0%
Defense	1.25	20.7%	12.9%	1.32	11.2%	1.38	9.5%
Consumer Disc	1.00	13.4%	13.9%	0.99	13.94%	1.05	10.9%
Finance	0.97	9.7%	11.1%	0.95	12.09%	1.03	8.2%
VC	0.95	11.3%	12.8%	n/a	n/a	1.09	9.0%
Distressed	0.89	8.5%	13.2%	n/a	n/a	0.97	9.8%
Secondaries	0.85	9.5%	13.5%	n/a	n/a	0.91	10.0%
Mezzanine	0.85	9.7%	16.0%	n/a	n/a	1.15	12.0%

Performance Comparison

	R2K PME	IRR	R2K Dollar Matched IRR
2006	0.90	7.8%	10.0%
2007	0.97	11.5%	12.3%
2008	0.91	11.8%	14.3%
2009	0.96	12.9%	14.2%
2010	1.18	17.7%	12.6%
2011	0.90	9.7%	13.1%
2012	1.01	13.8%	13.3%
2013	1.03	14.9%	13.1%
2014	0.98	11.8%	12.6%
2015	1.01	16.2%	15.6%
2016	0.92	11.1%	19.7%
2017	1.04	20.4%	15.2%

Performance Comparison

	R2K PME	IRR	R2K Dollar Matched IRR
Mega	1.03	13.6%	12.7%
Large	1.00	13.6%	13.6%
Medium	1.05	14.9%	12.6%
Small	1.14	14.6%	12.9%

Takeaways

- Overall the portfolio has performed well to keep up with public benchmarks
  - To date no discernible difference between current and legacy portfolios
  - The last 10+ years have been a strong equity market in the 10%+ range
    - Russell has outperformed ACWI IMI by ~250bps
- In aggregate sector specialists have performed in line with generalists
  - ASRS tech and defense have been stand outs vs R2K overall
  - ASRS energy and defense have been stand outs vs respective R2K sectors
    - Tech and HC have been very strong as sectors while energy has been weak
- Difficult to draw meaningful conclusions comparing vintages
- Modestly better absolute performance in medium and small buyout categories

Strategy

- 2019 pacing plan calls for $725 in new commitments, consistent with 2018
- Initiatives to explore:
  - Increase co-investment throughput
  - Purchase GP stakes in strategically important relationships
  - PE as an overlay portfolio
  - Selling funds of non-core GP relationships

Co-Investment & Other Performance Enhancement Options

- The co-investment portfolio has demonstrated the ability to produce returns better than its funds and the Russell 2000 albeit at a modest scale
- ASRS has encountered the following challenges
  - Quick turnaround - can be as short as a few days
    - ASRS process is efficient but realistically need 30 days to conduct dd (including coordination with consultant), committee approval, and legal docs
  - Due diligence - consultant timing & availability
  - Legal - indemnification provisions have caused delays & prevented access to due diligence materials
- Improving throughput
  - Proactive relationship building with GPs
  - Side car vehicles - reduced fees but GP retains discretion. Early days with 3 GPs
  - Open end vehicles - long-dated funds modestly lower fees but with less liquidity options.
    - No true open end vehicles established to date
  - Hiring external manager consultant - additional fees without performance accountability

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
- While in continuous dialogue the equity team meets monthly to discuss positioning

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
    - Renegotiated fee structures and securities lending splits
  - We terminated active managers
- 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
  - When possible we aim to get fee discounts for size and timing of the close
    - Also pursue co-investments (typically 0 fee, 0 carry) and opted into reduced fee side car vehicles

Compliance

- Liquidity: checked for PE & co-investments via daily exposure report
  - Pacing plan annually adjusts based on PE cash flows and total fund value
  - Do not intend to sell PE positions for compliance but may opportunistically buy public equities using credit facility