

How ASRS employees deliver service with

PRIDE

REVISED

PROFESSIONALISM

"We promote, strive for and expect individuals, teams, and divisions to possess professional qualities and skills to lead the organization"

- Friendly, respectful and courteous
- Proactive and responsive
- Good communicator / active listener
- Trusted contributor / teammate
- Personally accountable
- Subject matter expert
- Critical thinker
- Honest, fair, non-judgmental
- Adaptable to change
- Adheres to the Code of Conduct

RESULTS

"We treasure the achievements of individuals, teams, divisions and the agency that energize the organization"

- Completes projects
- Attains individual accomplishments
- Meets goals and objectives
- Satisfies customers
- Produces quality work products
- Manages risks successfully

IMPROVEMENT

"We appreciate individuals, teams or divisions who drive the agency forward with new, innovative ideas and solutions"

- Promotes new ideas
- Enhances morale
- Enhances outcomes and performance
- Improves relationships
- Solves problems
- Increases efficiency, effectiveness or reduces costs

DIVERSITY

"We recognize that utilizing different talents, strengths and points of view, strengthens the agency and helps propel outcomes greater than the sum of individual contributor"

- Encourages the free flow of ideas and opinions
- Treats all people with dignity and respect
- Works effectively with dissimilar individuals
- Recognizes and promotes new skills in others

EXCELLENCE

"We celebrate individuals, teams and divisions who exceed expectations and deliver service with a PRIDE that permeates the organization"

- Surpasses expectations
- Engenders a positive public image
- Celebrates /rewards accomplishments and contributions of others
- Embraces change in a manner which inspires others
- Promotes teamwork /collaboration through communication
- Accepts personal responsibility and challenges with enthusiasm



ARIZONA STATE RETIREMENT SYSTEM

3300 NORTH CENTRAL AVENUE • PO BOX 33910 • PHOENIX, AZ 85067-3910 • PHONE (602) 240-2000 *Paul Matson*
4400 EAST BROADWAY BOULEVARD • SUITE 200 • TUCSON, AZ 85711-3554 • PHONE (520) 239-3100 *Director*
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AZASRS.GOV

AGENDA

NOTICE OF PUBLIC MEETING OF THE ARIZONA STATE RETIREMENT SYSTEM INVESTMENT COMMITTEE

June 15, 2020
1:30 p.m.

Pursuant to A.R.S. § 38-431.02(F), notice is hereby given to the Trustees of the Arizona State Retirement System (ASRS) Investment Committee (IC) and to the general public that the ASRS IC will hold a **telephonic** meeting open to the public on Monday, June 15, 2020, beginning at 1:30 p.m. In light of the Arizona Department of Health Services' recommendation to cancel or postpone mass gatherings of 10 or more people, and to help prevent community spread of COVID-19, the meeting will be audience free. **Trustees of the Committee and the public may attend by telephone conference call at 877-820-7831, using Participant Passcode: 682491#.**

This is a regularly scheduled meeting of the IC; however, due to possible attendance by other ASRS Board Trustees, this meeting may technically become a meeting of the Board or one of its Committees. Actions taken will be consistent with IC governance procedures. Actions requiring Board authority will be presented to the full Board for final decision.

The Chair may take public comment during any agenda item.

The Agenda for the meeting is as follows:

1. Call to Order; Roll Call; Opening Remarks (*Estimated time 4 minutes*) Mr. Michael Lofton
Chair, Investment Committee

2. Approval of the Minutes of the March 23, 2020 Public Meeting of the ASRS IC (*Action item; estimated time 1 minute*) Mr. Michael Lofton

3. Presentation, Discussion, and Appropriate Action Regarding Portfolio Positioning, House Views and General Discussion (*Informational and discussion item; estimated time 30 minutes*)
..... Mr. Karl Polen
Chief Investment Officer (CIO), ASRS
..... Mr. Al Alaimo
Sr. Portfolio Manager of Fixed Income, Cash, and Liquid Alternatives, ASRS
..... Mr. Samer Ghaddar
Sr. Portfolio Manager of Equities, ASRS
..... Mr. Taylor Mammen
Sr. Managing Director, Director of Institutional Advisory Services, RCLCO

Objective:

The CIO and portfolio managers of ASRS and Mr. Taylor Mammen of RCLCO will present their investment views and the committee will discuss the current economic and investment environment. *No action is expected on this item, but the IC may express views or offer guidance on the matters discussed.*

4. Presentation, Discussion, and Appropriate Action Regarding Investment Performance (*Informational and discussion item; estimated time 30 minutes*) Mr. Karl Polen
..... Mr. Al Alaimo
..... Mr. Samer Ghaddar
..... Mr. Taylor Mammen

Objective:

The CIO and portfolio managers of ASRS and Mr. Mammen of RCLCO will report on investment performance and performance attribution in each of the portfolios. The discussion will include returns and holdings based performance analysis and a review of current strategies for the portfolios. *No action is expected on this item, but the IC may express views or offer guidance on the matters discussed.*

5. Presentation, Discussion, and Appropriate Action Regarding the Equities Implementation Plan and Private Equity Liquidity Compliance (*Informational and discussion item; estimated time 20 minutes*) Mr. Samer Ghaddar
..... Mr. Cole Smith
Portfolio Manager, Public Equities
..... Mr. Micheal Copeland
Portfolio Manager, Private Markets

Objective:

ASRS portfolio managers will update the committee on the Equities Implementation Plan and Private Equity Liquidity Compliance. *No action is expected on this item, but the IC may express views or offer guidance on the matters discussed.*

6. Presentation, Discussion, and Appropriate Action Regarding Independent Reporting, Monitoring and Oversight (*Informational and discussion item; estimated time 20 minutes*) Mr. Allan Martin
Partner, NEPC

Objective:

NEPC will present total fund performance results for the period ending March 31, 2020 and will report on their monitoring of IMD activities. *No action is expected on this item, but the IC may express views or offer guidance on the matters discussed.*

7. Presentation, Discussion, and Appropriate Action Regarding Risk Management (*Informational and discussion item; estimated time 10 minutes*)..... Mr. Karl Polen

Objective:

The CIO will present the MSCI risk management report. *No action is expected on this item, but the IC may express views or offer guidance on the matters discussed.*

8. Presentation, Discussion, and Appropriate Action Regarding Compliance (*Informational and discussion item; estimated time 10 minutes*)..... Ms. Kerry White
Assistant Chief Investment Officer for Reporting, Compliance & Administration

Objective:

The Assistant CIO will report on compliance activities. *No action is expected on this item, but the IC may express views or offer guidance on the matters discussed.*

9. Request for Future Agenda Items (*Discussion item; estimated time 5 minutes*).Mr. Michael Lofton
..... Mr. Karl Polen

10. Call to the Public..... Mr. Michael Lofton

Those wishing to address the ASRS IC will be requested to do so telephonically. Trustees of the Committee are prohibited by A.R.S. § 38-431.01(H) from discussing or taking legal action on matters raised during an open call to the public unless the matters are properly noticed for discussion and legal action. As a result of public comment, the IC may direct staff to study and/or reschedule the matter for discussion and decision at a later date.

11. The next ASRS Investment Committee Meeting is scheduled for Monday, September 21, 2020 at 1:30 p.m.

12. Adjournment of the ASRS IC Meeting.

A copy of the agenda background material provided to IC Trustees (with the exception of material relating to possible executive sessions) is available for public inspection at the ASRS offices located at 3300 North Central Avenue, 14th Floor, Phoenix, Arizona, and 4400 East Broadway Boulevard, Suite 200, Tucson, Arizona. The agenda is subject to revision up to 24 hours prior to meeting. These materials are also available on the ASRS website <https://www.azasrs.gov/content/board-and-committee-meetings> approximately 48 hours prior to the meeting.

Persons with disabilities may request alternate formats of this document by contacting Tracy Darmer, ADA Coordinator at (602) 240-5378 in Phoenix, at (520) 239-3100, ext. 5378 in Tucson or 1-800-621-3778, ext. 5378 outside metro Phoenix or Tucson. Requests should be made as early as possible to allow time to arrange the accommodations.

Dated June 10, 2020

ARIZONA STATE RETIREMENT SYSTEM

Signed Copy on File

Joyce Williams
Committee Administrator

Signed Copy on File

Karl Polen
Chief Investment Officer

Agenda Item #2



ARIZONA STATE RETIREMENT SYSTEM

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Paul Matson
Director

MINUTES

PUBLIC MEETING OF THE ARIZONA STATE RETIREMENT SYSTEM INVESTMENT COMMITTEE

March 23, 2020
1:30 p.m.

The Arizona State Retirement System (ASRS) Investment Committee (IC) met telephonically.

Mr. Michael Lofton, Chair of the IC, called the meeting to order at 1:31 p.m.

1. Call to Order; Roll Call; Opening Remarks

Present: Mr. Michael Lofton, Chair – via teleconference
Mr. Kevin McCarthy, Vice-chair – via teleconference
Mr. Clark Partridge – via teleconference

A quorum of the IC was present for the purpose of conducting business.

2. Approval of the Minutes of the December 16, 2019 Public Meeting of the ASRS IC

Motion: Mr. Kevin McCarthy moved to approve the minutes of the December 16, 2019 public IC meeting. Mr. Clark Partridge seconded the motion.

By a roll call vote of 3 in favor, 0 opposed, 0 abstentions, 0 excused and 0 vacancies, the motion was approved. The trustee votes were as follows:

Mr. Michael Lofton – approved
Mr. Kevin McCarthy – approved
Mr. Clark Partridge – approved

3. Presentation, Discussion, and Appropriate Action Regarding Portfolio Positioning, House Views and General Discussion

Mr. Karl Polen, Chief Investment Officer (CIO), presented the following:

- Coronavirus impacts have created a high likelihood of a recession and markets have responded with unprecedentedly rapid sell off in stocks and increase in volatility.

- Severe pressure on liquidity has emerged with some financial firms in distress from calls on repo lines.
- Economic and market recovery will hinge on progress in dealing with the virus, particularly in testing and data analysis so that a plan for economic remobilization can be developed.
- Portfolio positioning as of March 20 was 6% underweight in equities, balanced by overweights in interest rate sensitive, credit, and real estate. However, Mr. Polen noted that target positions will adjust on April 1 and with that adjustment, the equities underweight would only be about 3%.

Mr. Samer Ghaddar, Sr. Portfolio Manager of Equities, reviewed equity markets, noting the following:

- Equity markets remain under pressure with markets still priced to trailing earnings.
- Markets are not cheap, with values only returning to historic levels on trailing and forward P/E and still slightly expensive on cyclically adjusted P/E.

Mr. Micheal Copeland, Assistant Portfolio Manager of Real Estate, reviewed real estate and private equity markets, noting the following.

- Private equity markets have seen a disruption in deal closings because of a near term withdrawal of credit but expect deals to pick up as distress situations emerge.
- Energy markets are facing substantial distress because of price changes resulting from Saudi production increases.
- Real estate will see near term impacts from reduced rent collections and new leasing.

Mr. Al Alaimo, Sr. Portfolio Manager of Fixed Income, reviewed credit and core bond markets, noting the following:

- There is a robust opportunity to invest in credit in both new loans at new market pricing and in distressed situations.
- Fed action has caused interest rates on the 10-year to hit all-time lows but there has been unusual volatility in certain parts of the credit market in light of liquidity pressures.

4. Presentation, Discussion, and Appropriate Action Regarding Investment Performance

Mr. Polen presented interim fiscal year-to-date noting that fund assets had declined to \$37 billion and estimated fiscal year-to-date returns was approximately -7.4%, both as of March 20.

The portfolio managers presented performance results for periods ending December 31, 2019.

Mr. Ghaddar reported that public equity performance of 25.5%, 11.7% and 8.4% underperformed benchmarks by 1.2%, .7% and .6% for the one-, three-, and five-year periods respectively. The underperformance is driven primarily from index selection and factor levers both of which were adjusted in early 2020 and have improved performance since then.

Mr. Copeland reported private equity performance of 9.1%, 13.8% and 11.6%, which outperformed benchmarks by 8.6%, 4.7%, and 2.9% for the one-, three-, and five-year periods, respectively. He further reported that real estate returns of 6.2%, 8.3%, and 9.8% outperformed benchmarks by 2.1%, 2.6%, and 2.1% for the one-, three-, and five-year periods, respectively.

Mr. Alaimo reported credit returns of 8.4%, 9.6%, and 8.0%, which outperformed benchmark by 2.7%, 2.6%, and 2.1% for the one-, three-, and five-year periods, respectively. Core bonds returns of 8.6%, 4.1%, and 3.3% underperformed benchmark by 8bp for the one-year periods but outperformed by 2bp and 25bp for the three- and five-year periods.

5. Presentation, Discussion, and Appropriate Action Regarding the Real Estate Implementation Plan

Mr. Taylor Mammen, Sr. Managing Director and Director of Institutional Advisory Services, RCLCO, and Mr. Jomar Ereso, Director of Asset Management, RCLCO, presented the real estate implementation plan, noting the following:

- The implementation plan was prepared in late 2019 and initially presented to ASRS in January. The plan was recalibrated in light of recent events by deferring indefinitely approximately \$2 billion in initiatives previously identified.
- Starting in February, RCLCO began implementing stricter guidelines for underwriting individual property acquisitions and as market conditions become more apparent, approximately \$300 million in individual transactions were cancelled or put on hold.
- The implementation plan does, however, contemplate continuing existing relationships, which have adequate unfunded commitments to pursue attractive opportunities as they arise and allows for limited new investments with strategic partners.
- The real estate program is designed to be overweight apartments and other residential strategies compared to the ODCE index and underweight to office and retail strategies.
- The target excess return is 1.5% per year with 2.7% of tracking error.

6. Presentation, Discussion, and Appropriate Action Regarding Independent Reporting, Monitoring and Oversight

Mr. Allan Martin, Partner, NEPC, reported that for periods ending December 31, 2019, total fund returns of 15.6%, 10.1%, 7.9%, and 9.2% exceeded benchmark by .9%, 1.8%, 1.6%, and 1.2% for the one-, three-, five-, and ten- year periods respectively. These returns place ASRS in the 74th, 17th, 11th, and 11th percentile among large public pension plans for the same time periods. He further noted that NEPC monitors ASRS asset class meetings and observed no instances of non-compliance with ASRS procedures or portfolio limitations.

7. Presentation, Discussion, and Appropriate Action Regarding Risk Management

Mr. Polen presented the risk management report prepared by MSCI noting that the measured risk in the actual portfolio is in line with the modeled risk in the SAA portfolio.

8. Presentation, Discussion, and Appropriate Action Regarding Compliance

Ms. Kerry White, Assistant Chief Investment Officer for Reporting, Compliance & Administration presented the compliance report noting that there were no instances of non-compliance for the reported period.

9. Request for Future Agenda Items

No requests for future agenda items were made.

10. Call to the Public

No members of the public requested to speak.

11. The next ASRS Investment Committee Meeting is scheduled for Monday, June 15, 2020 at 1:30 p.m.

Mr. Lofton noted the next IC meeting is scheduled for Monday, June 15, 2020 at 1:30 p.m.

12. Adjournment of the ASRS IC Meeting.

Motion: Mr. Clark Partridge moved to adjourn the meeting at 3:31 p.m. Mr. Kevin McCarthy seconded the motion.

Mr. Michael Lofton adjourned the meeting.

Respectfully submitted by:

Joyce Williams/Karl Polen
Investment Committee Administrator/Chief Investment Officer
ARIZONA STATE RETIREMENT SYSTEM

DRAFT

Agenda Item #3

House Views and Portfolio Positioning

Arizona State Retirement System

June 15, 2020

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Summary View

- We are positioned neutrally with all positions within 1% of target
- There is a high level of uncertainty on future economic direction
- Highly accommodative fiscal and monetary policies have supported asset prices

Current Positioning 5/29/2020

Total Fund Positioning

	NAV w/ Notional (\$ mm)	NAV Exposure (%)	Target (%)	Active Weight (%)	Active Weight (\$ mm)
Cash	382.0	1.0	0.0	1.0	382.0
Bonds	3751.5	9.4	10.4	-1.0	-406.1
Credit	8416.5	21.1	20.0	1.1	421.2
Equity	20869.7	52.2	52.3	-0.1	-38.0
Real Estate	6554.4	16.4	17.3	-0.9	-361.6
Other	0.4	0.0	0.0	0.0	0.4
Total Fund	39976.4	100.0	100.0	0.0	0.0

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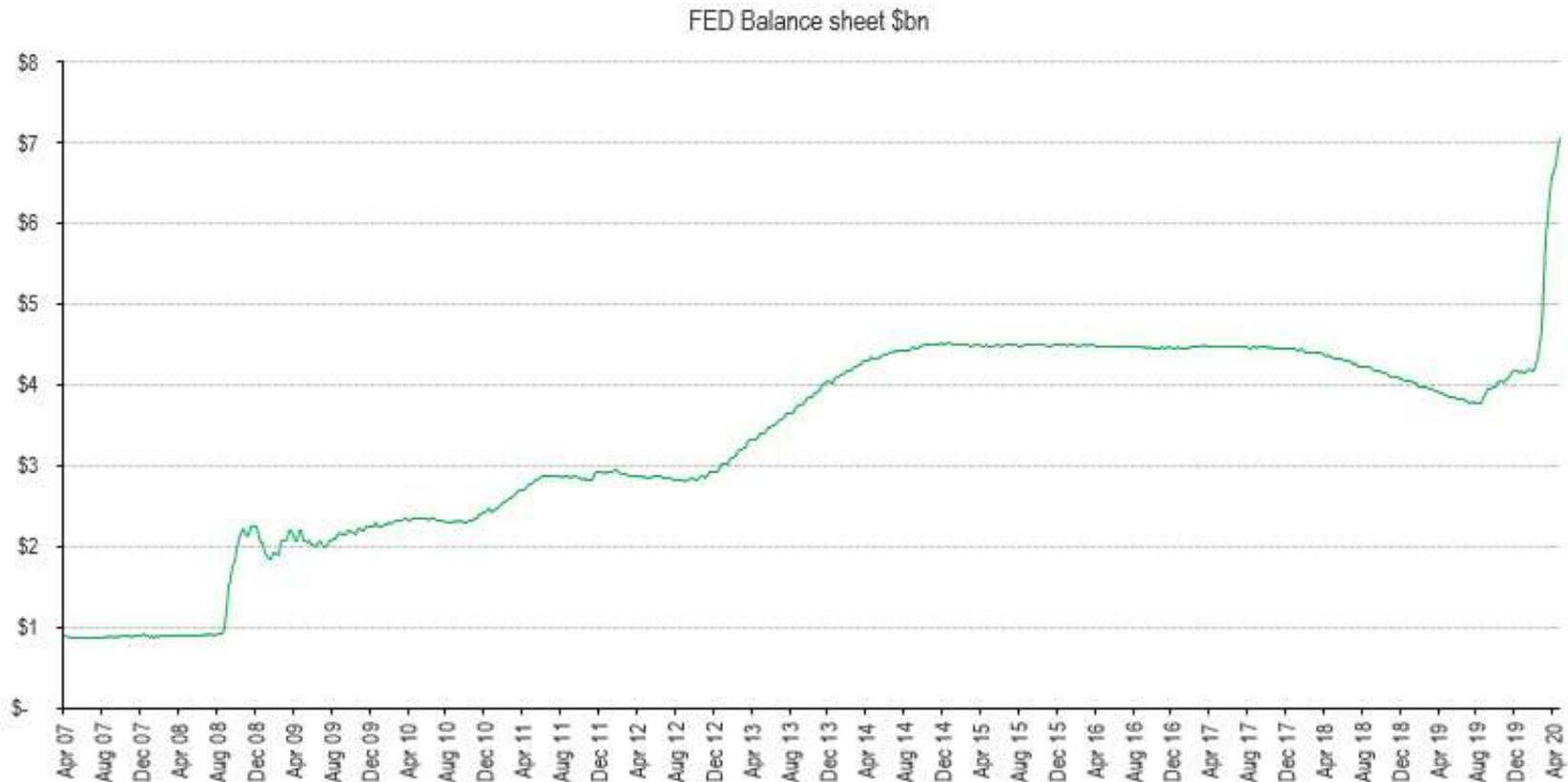
US Macro: GDP and Unemployment

- US GDP contraction is largest in recent history
 - US GDP growth projected to contract by ~5.5% in 2020, compared to expansion of 2.2% projected in 2019
 - However, growth rates are expected to accelerate in 2021 to ~4% (average projections)
 - The unprecedented fiscal stimulus of ~\$2.2 trillion, as well as the Fed's quantitative easing, QE5, is feeding into the system
 - These stimulus policies are creating a stabilization across assets markets.
 - Unemployment rate in the US is forecasted at 11% for 2020 and 8.1% in 2021

US Macro Forecasts	GDP Numbers (Growth % oya)		
	2020	2021E	2022E
US GDP Economic Forecast (QoQ)	-5.7	3.9	3.0
United States Household Consum	-6.5	3.9	3.0
United States Government Spend	2.2	1.6	1.2
United States Investment Econo	-9.8	5.4	4.7
United States Exports Economic	-7.1	3.3	4.2
United States Imports Economic	-9.7	4.2	4.6
US Unemployment Rate Forecast	11.0	8.1	6.8
United States Industrial Produ	-7.4	2.3	2.9
United States Government Debt	99.3	104.7	103.7
US CPI Economic Forecast (YoY	0.8	1.7	2.0
US Core PCE Economic Forecast	1.3	1.3	1.6

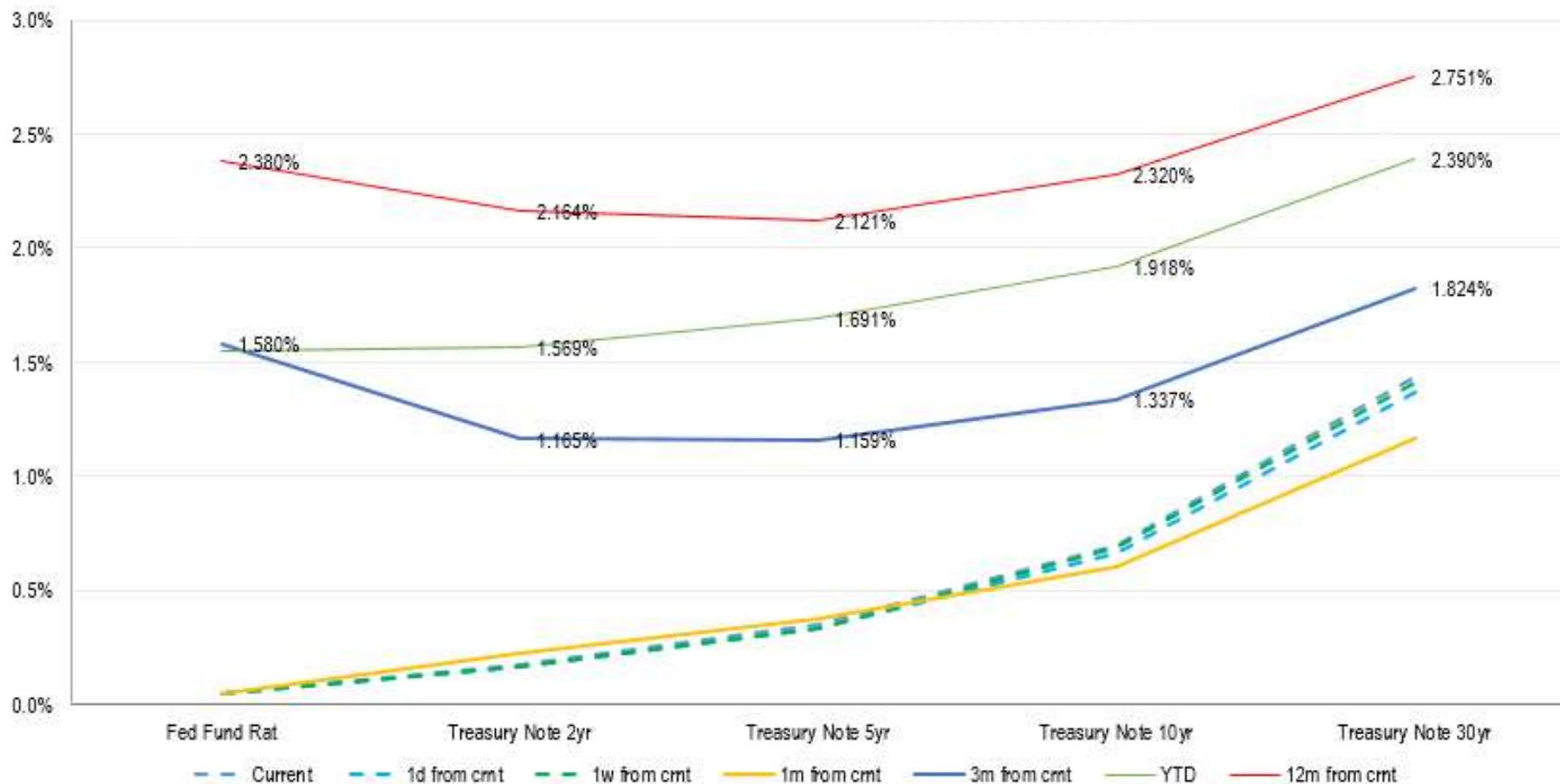
US Macro: Fed Balance Sheet

- Fed's balance sheet shows the unprecedented magnitude of the latest monetary policy implementation:



US Macro: Yield Curve

- Yield curve starting to steepen after fiscal and monetary stimulus programs:



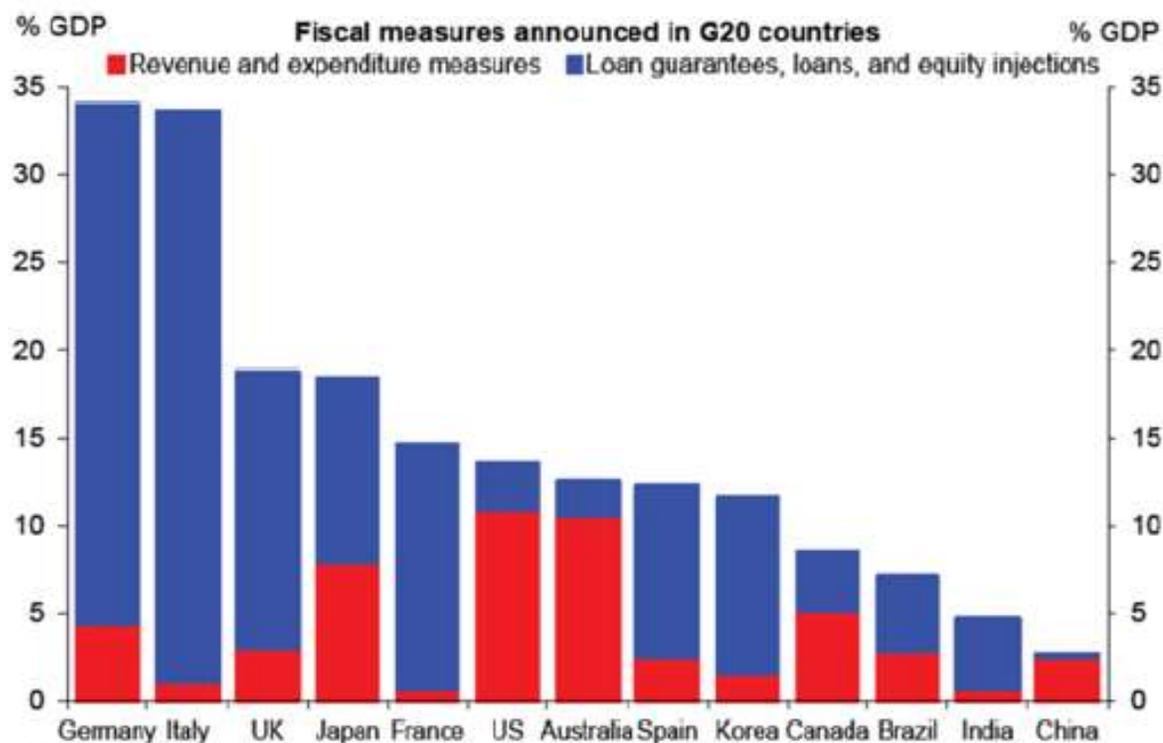
Global Macro

- Global GDP growth projected to reach -3% in 2020, compared to projections of +3% in 2019 (IMF projections)
 - This is mainly driven by the shock of the COVID-19 pandemic
 - Growth is projected to rebound to a 5% growth rate in 2021
- European Union GDP growth to reach -7% in 2020, and projected to rebound to a 5% growth rate in 2021
- Emerging Markets GDP growth to reach 0.2% in 2020, and projected to rebound to a 5.5% growth rate in 2021

	GDP Numbers (Growth %oya)		
EU Macro Forecasts	2020	2021E	2022E
European Union GDP Economic Fo	-7.1	5.0	2.2
European Union Unemployment Ra	8.7	5.0	2.2
European Union CPI Economic Fo	0.7	1.3	1.6
	GDP Numbers (Growth %oya)		
EU Macro Forecasts	2020	2021E	2022E
World GDP Economic Forecast (A	-3.0	4.9	3.4
	GDP Numbers (Growth %oya)		
Emerging Markets Macro Forecasts	2020	2021E	2022E
Emerging Economies GDP Economi	0.2	5.5	4.9
Emerging Economies Unemploymen	6.0	5.7	5.1
Emerging Economies CPI Economi	3.9	3.5	3.5

Global Macro: Stimulus Response by Country

- Among the G20, the United States has the highest direct revenue and expenditure measures¹ as percent of GDP
- The larger the stimulus, the faster the recovery:



Note: Data as of May 13, 2020.

Source: IMF, DB Global Research

¹Source: Deutsche Bank Global Research

Outline

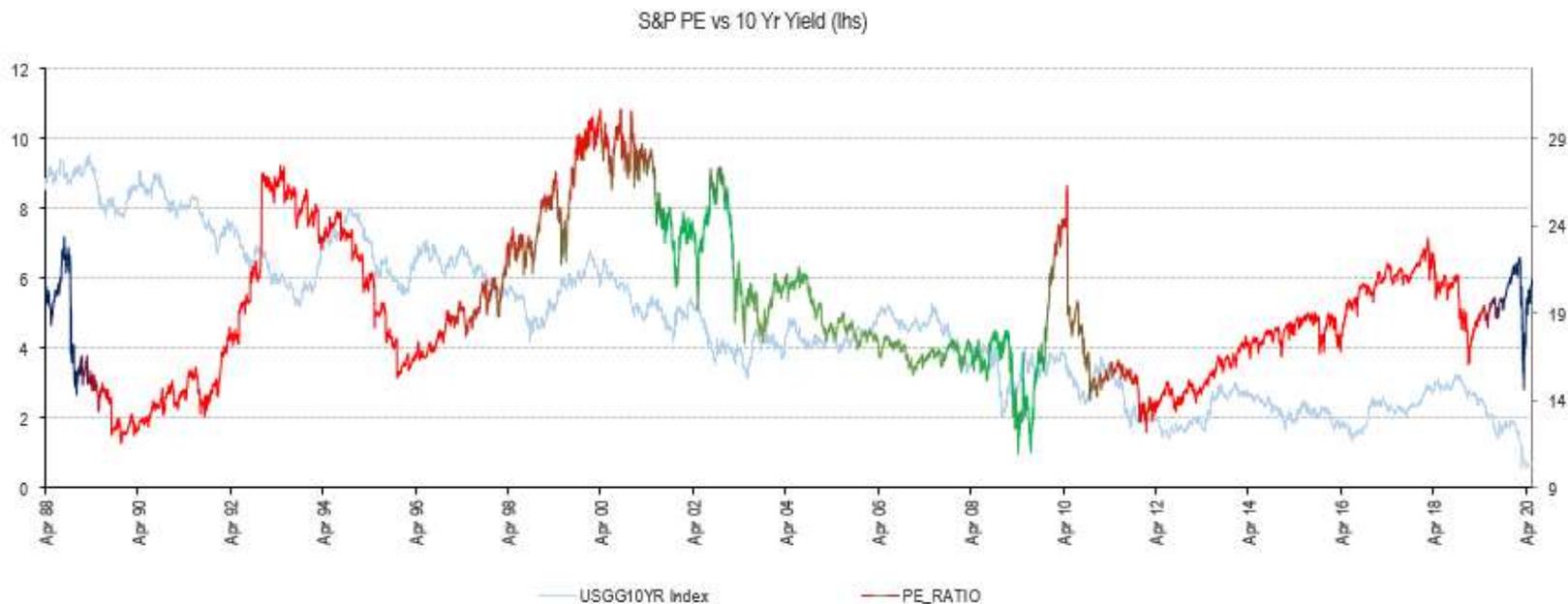
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Current Positioning

- We have positioned our public equity portfolio to be modestly underweight, which is currently -0.4% in aggregate:
 - We are at interim SAA target weight in domestic equities:
 - 0.6% underweight in US LC, 0.3% overweight in US MC & 0.3% overweight in US SC.
 - We are 0.4% underweight in international equities:
 - 0.3% underweight in World ex-US LC, equalweight in World ex-US SC & and 0.1% underweight Emerging Markets.

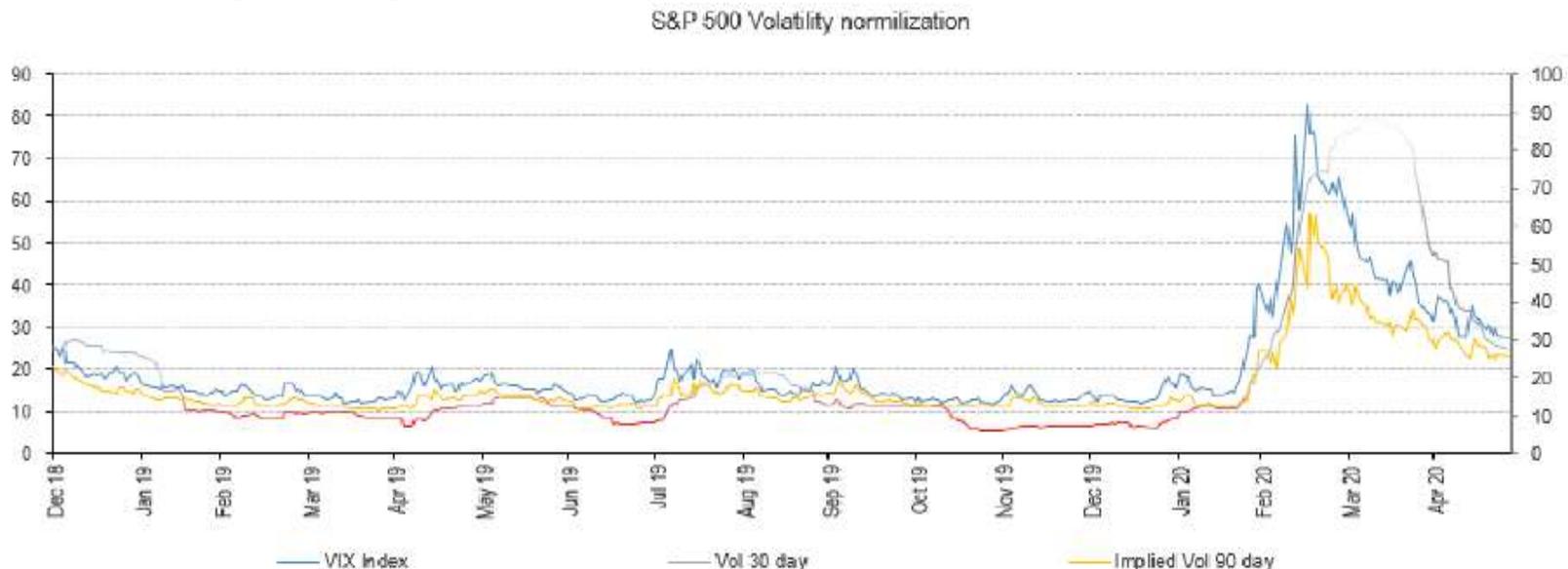
Equity Markets: Valuations

- We believe that the market has priced in a lot of positive news:
 - S&P is down -7% YTD, while earnings per share are projected to be down by ~30% for 2020
 - Market is discounting forward growth and quick recovery in earnings
 - Consensus EPS is projected to increase by ~40% in 2021
- Current S&P 500 trailing PE ratio stands at 20.5x, while the 10-year yield is at an all time low
- Lower yield would create a support mechanism for market valuations:



Equity Markets: Outlook

- We believe that the risk aversion witnessed in March 2020 is behind us and markets will trail back to normality in the coming quarters
- Given the size of the fiscal and monetary stimuli and the lower volatility as measured by the VIX, we are constructive on equity markets in general - and the United States, in particular - and believe that the asset class will outperform in the coming 9-12 months
- However, risks to the market recovery are a second wave of COVID-19 and difficulties with the re-opening of the global economy



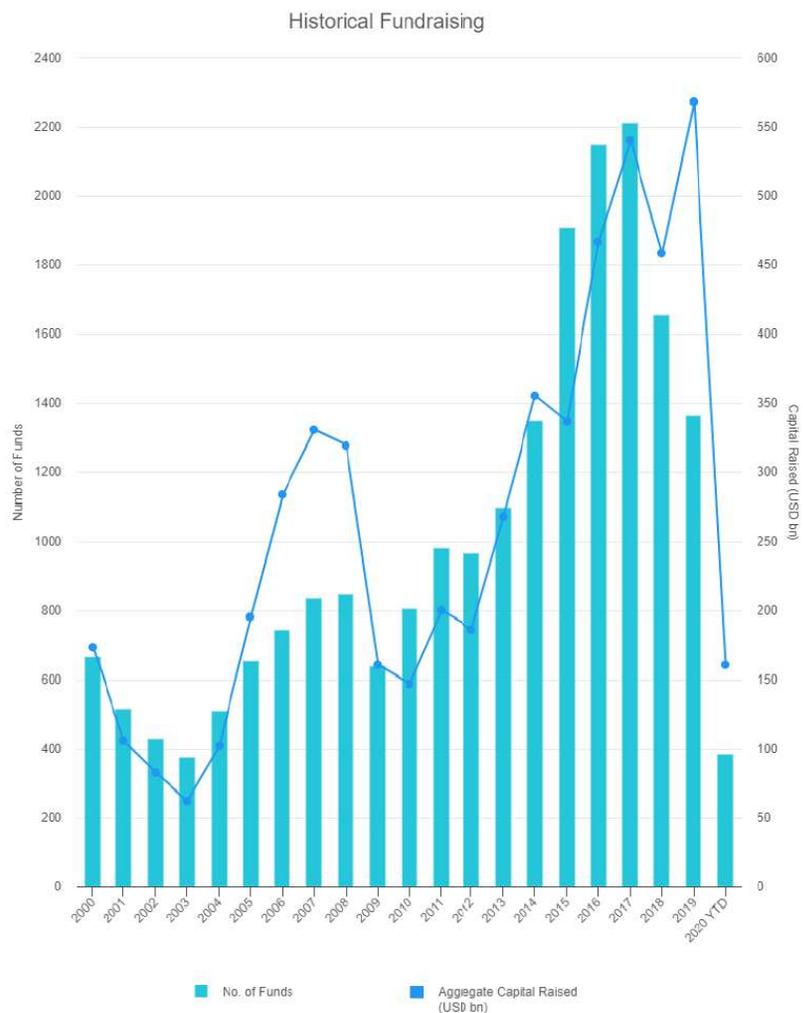
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Private Equity Environment

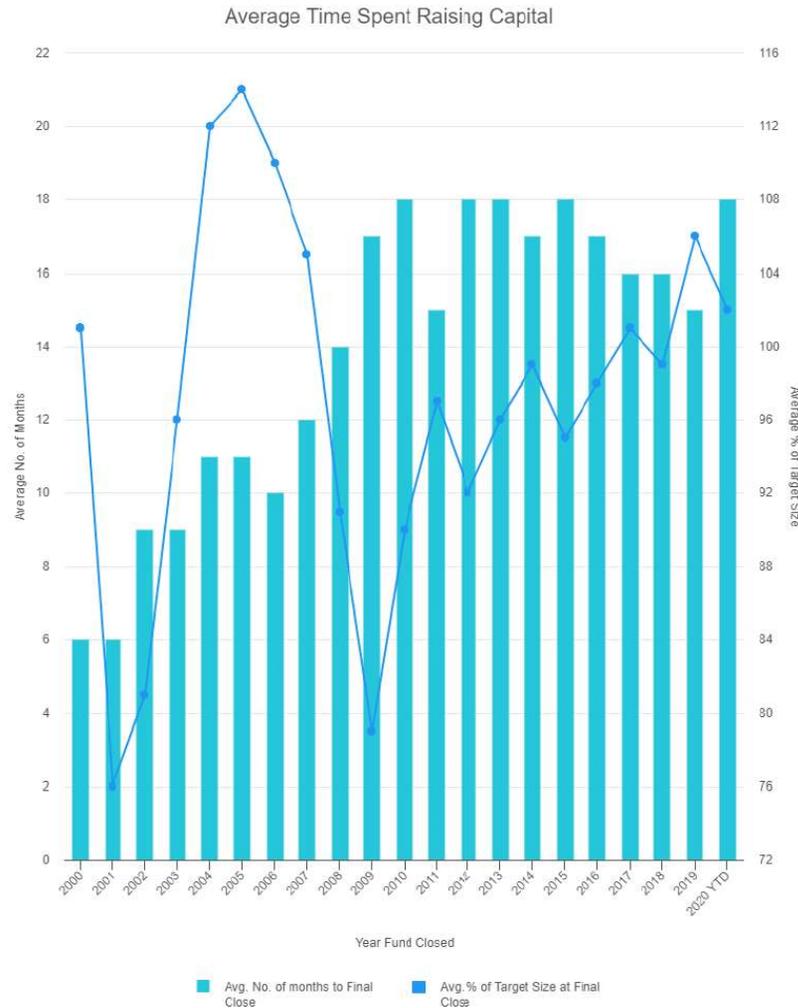
- As with the macro environment as well as the public markets, COVID-19 has had significant impacts on Private Equity
 - Transactions have declined precipitously; which is similar in nature with what occurred during the 2009 Global Financial Crisis
 - Multiples were at or close to cyclical highs but the severity and duration of a contraction in multiples is unclear
 - Leverage is high with 75% of deals completed in 2019 at $> 6 \times$
 - Similar to prior crises, high leverage combined with severe drops in revenue/cash flow creates opportunities
- Buyout dry powder has steadily risen as the asset class has also grown and successful managers have raised ever increasing fund sizes
- Given the long-dated nature of funds we do not attempt to time cycles but are paying close attention to the partners we select and their operational capabilities

Private Equity Fund Raising



Source: Preqin

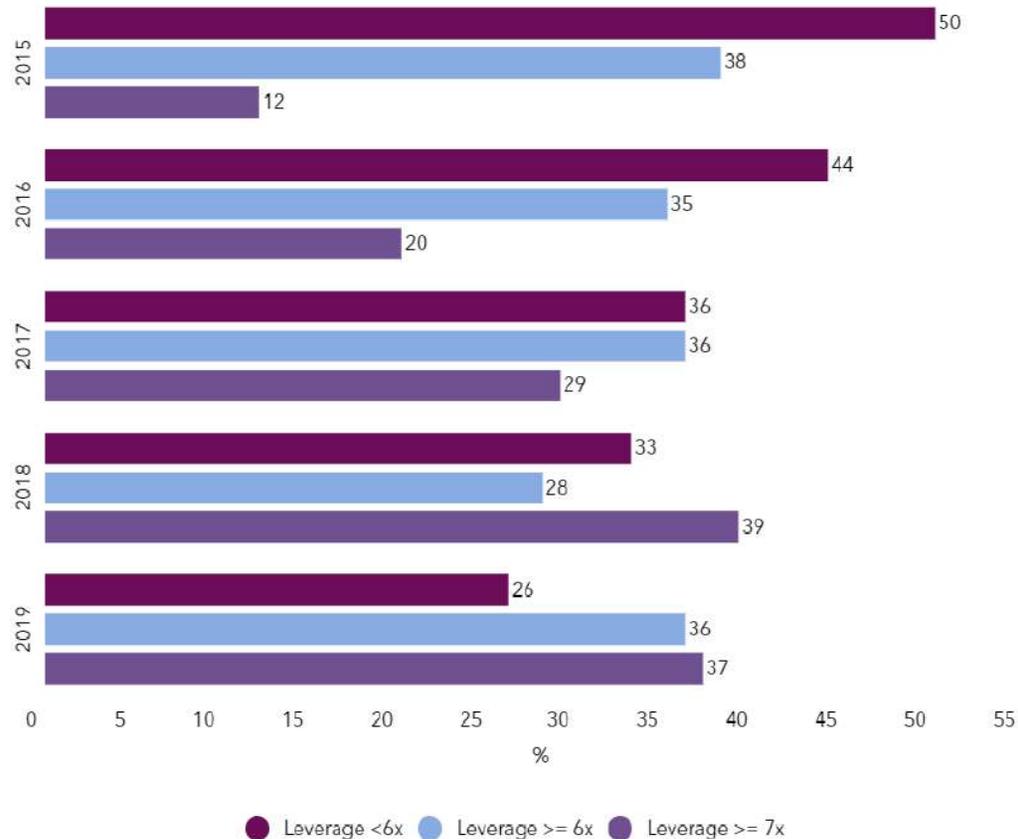
Private Equity Average Fund Raising Time



Source: Preqin

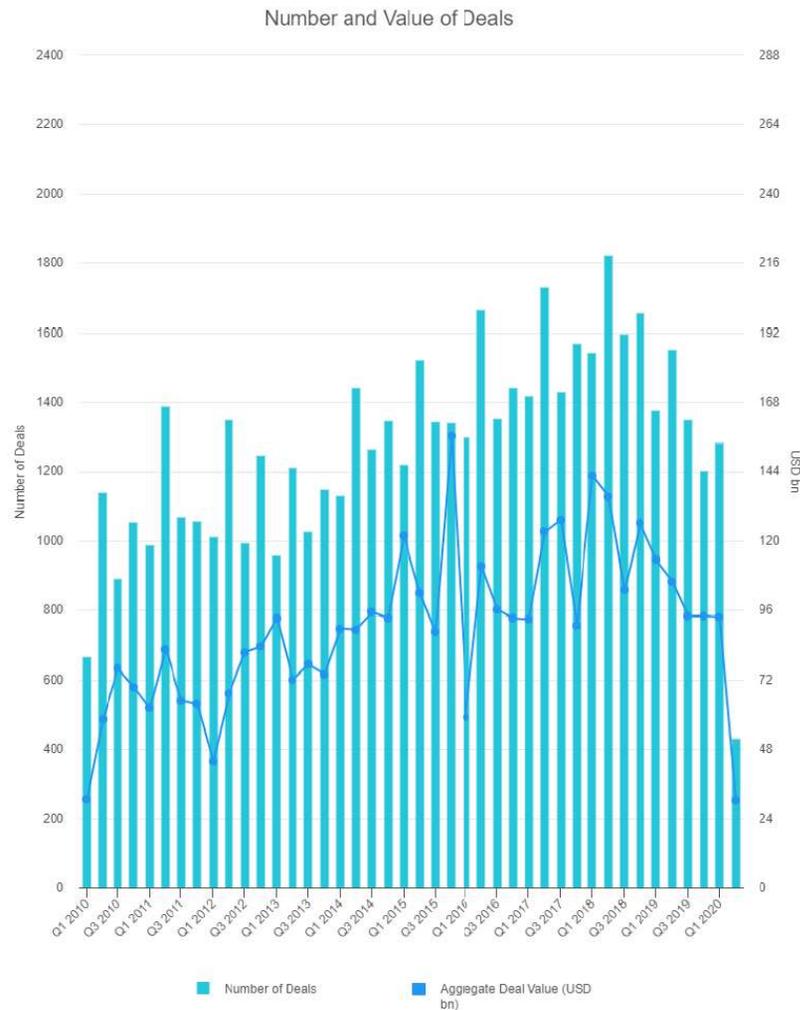
Private Equity Leverage

Deals with debt levels higher than six times EBITDA rose to more than 75% of total deal volume



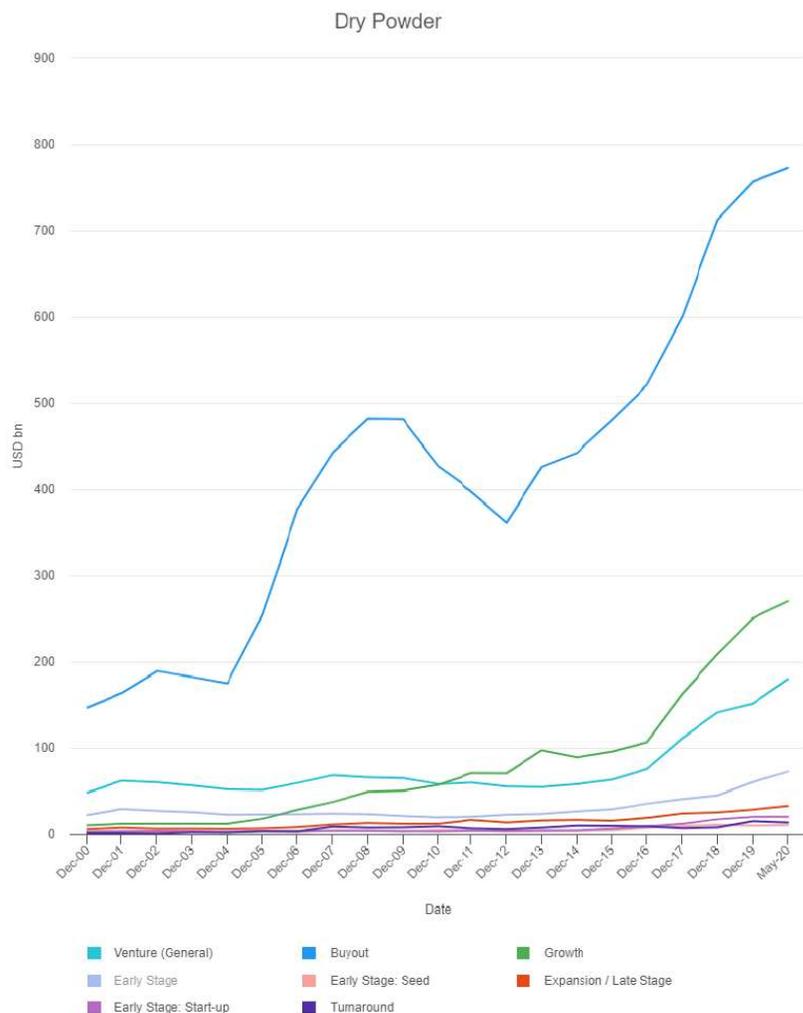
Source: Thomson LPC, Bain & Company Global Private Equity Report 2020

Private Equity Exits



Source: Preqin

Private Equity Dry Powder



Source: Preqin

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Commentary

- As of May 27, 2020, we had an 21.0% allocation to the Credit asset class versus an SAA target of 20.0%. Our commitments to partnerships in the Credit asset class, net of partnerships in liquidation (or pending liquidation), represent approximately 24.3% of the total fund.

- With the Credit asset class, we are allocated as follows:

	% of Total Fund
Private Debt	15.3%
Distressed Debt	3.6%
Other Credit	2.1%
Total Credit	21.0%

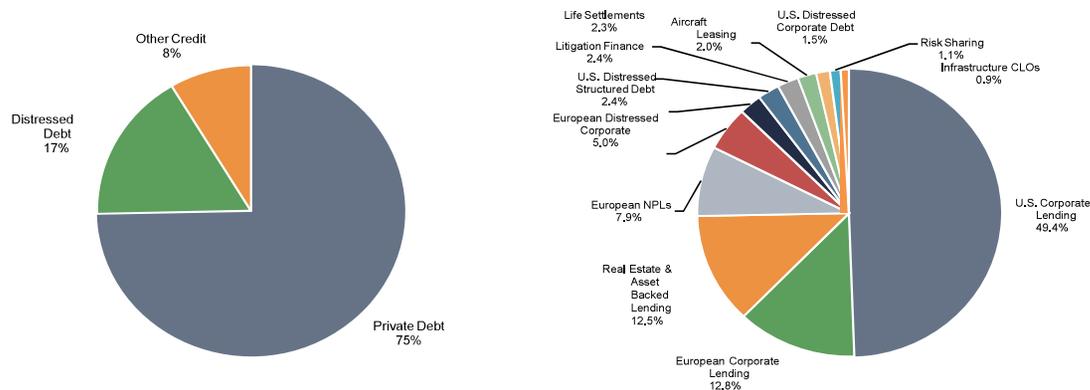
- The benchmark for the Credit asset class is the S&P/LSTA Leveraged Loan Index plus 250 bps (per annum). We are currently estimating that the Credit asset class will generate a return in the March 31 quarter of -2.5% vs. a benchmark return of -12.3%. However, as we have found in past selloffs of risky assets, our overall Credit portfolio tends to exhibit much more stable performance than the benchmark. Through May 27th, the benchmark for the asset class has posted a very strong recovery in the June 30 quarter with a return of approximately 8.25%. As a result, following substantial outperformance in the march 31 quarter, we expect the Credit asset class to substantially underperform the benchmark return in the current quarter.

Commentary

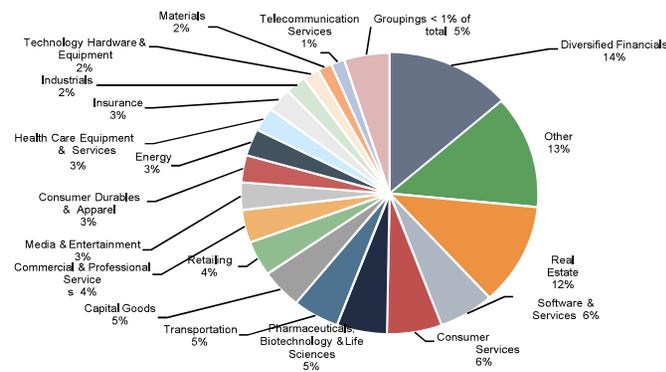
- For Credit, our house view is the following:
 - There are compelling investment opportunities to exceed the performance of the Credit asset class benchmark over time in Private Debt, Distressed Debt and Other Credit. These opportunities are almost exclusively in private rather than public markets or are in areas of the market, such as distressed debt, which typically require investments in locked-up vehicles with limited liquidity.
 - The recent sell-off in the credit and equities markets related to the economic disruption caused by COVID-19 has created the most attractive environment for private credit investment opportunities in years.
 - We generally do not believe that public credit markets (such high yield bonds, leveraged loans and asset-backed securities) offer as attractive investment opportunities in comparison to the private markets as public market opportunities will likely not meet the return of the Credit asset class benchmark over an extended, multi-year period of time. Moreover, in contrast to the private markets, the public credit markets do not provide investors with the opportunity for full due diligence and bespoke tailoring of deal terms.

Credit Asset Class Strategy & Industry Exposure as of March 31, 2020

Strategy Exposure

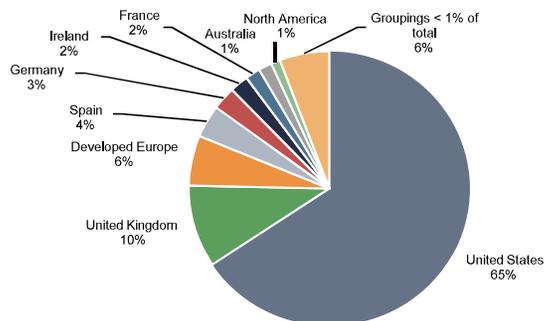


Industry Exposure

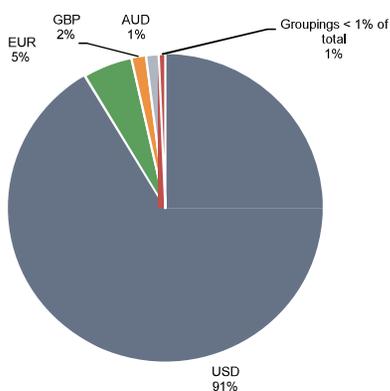


Credit Asset Class Geographic & Currency Exposure as of March 31, 2020

Geographic Exposure



Currency Exposure

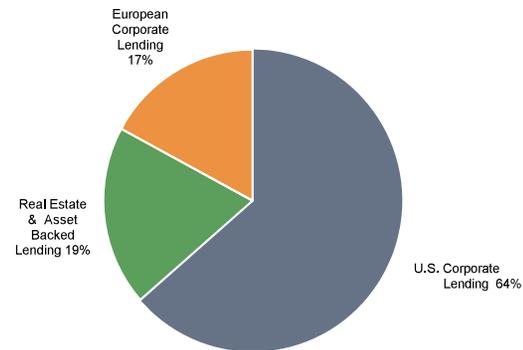


Private Debt

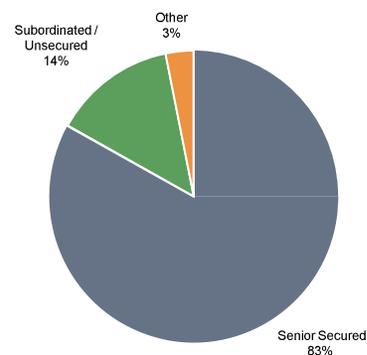
- We believe Private Debt asset offers the most attractive opportunity in the fixed income markets with double-digit yields available for investors willing to accept illiquidity, and when appropriate, employ leverage. Private Debt offers significantly higher expected returns than the public credit markets with lower volatility. We are currently estimating that Private Debt will generate a return in the March 31 quarter of -0.9% vs. a benchmark return of -12.3%.
- 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.
- The economic disruption from COVID-19 will undoubtedly lead to an increase in bankruptcies and restructurings of investments in Private Debt made prior to the pandemic. However, the vast majority of ASRS's investments are senior secured and should hold up relatively well. As of March 31, only 4% of the Private Debt portfolio has experienced an event of default. We believe potential write downs are mostly reflected in the March 31 quarter's performance.
- Meanwhile, the market for new private debt offerings is significantly more attractive with expected returns from higher spreads and fees increasing by 200-400 bps depending on the strategy with lower deal leverage and better covenants.

Private Debt Strategy & Security Exposure as of March 31, 2020

Strategy Exposure

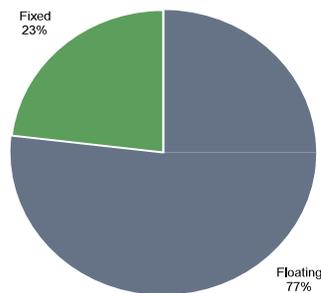


Security Exposure

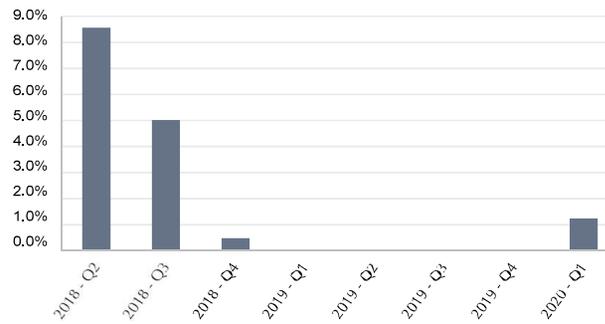
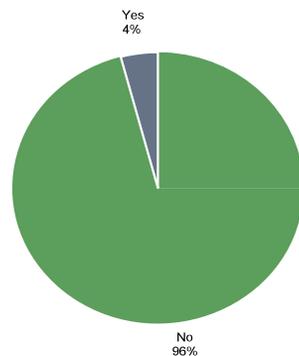


Private Debt Fixed/Floating Exposure & Event of Default/Payment Default as of March 31, 2020

Fixed / Floating Exposure



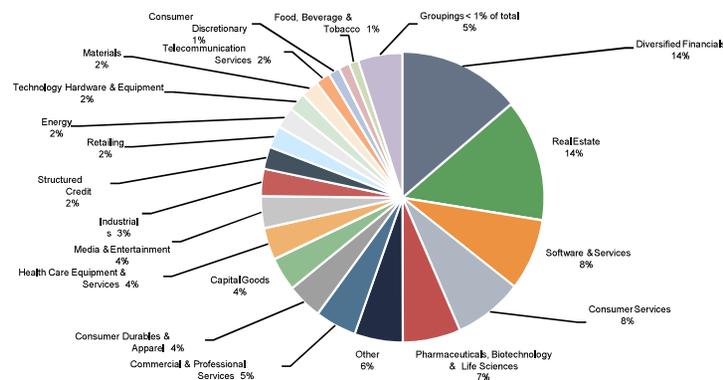
Event of Default / Payment Default During Life of Investment



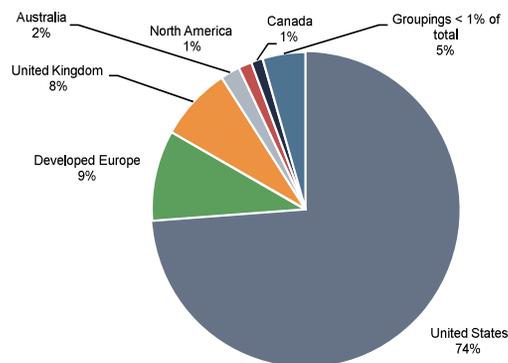
Please note: the table shows % of the deals underwritten in each quarter that have experienced a default.

Private Debt Industry & Geographic Exposure as of March 31, 2020

Industry Exposure

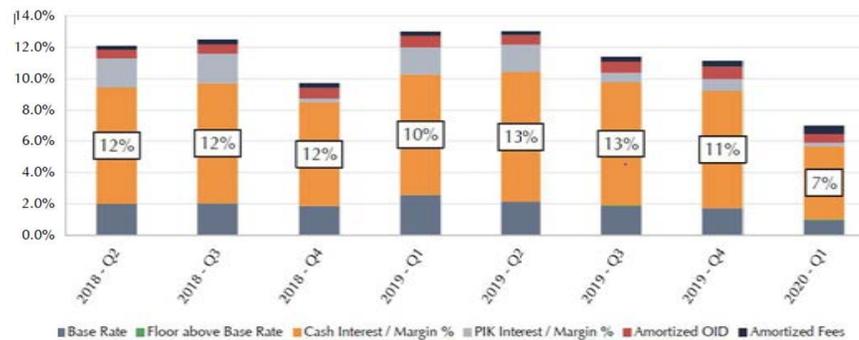


Geographic Exposure



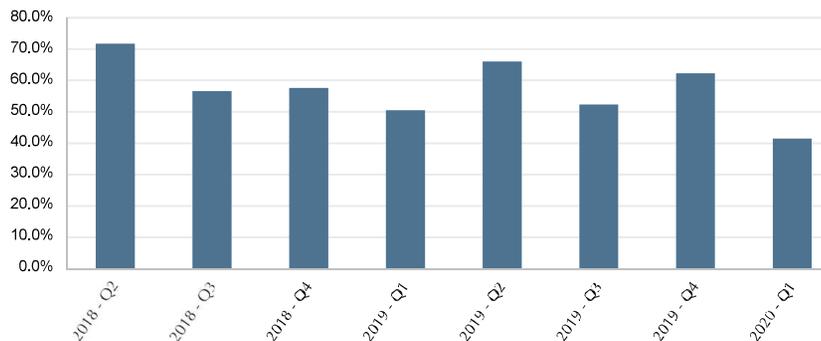
Private Debt Yield Components & Underwritten LTV % as of March 31, 2020

Yield Components of Transactions Underwritten – by Quarter



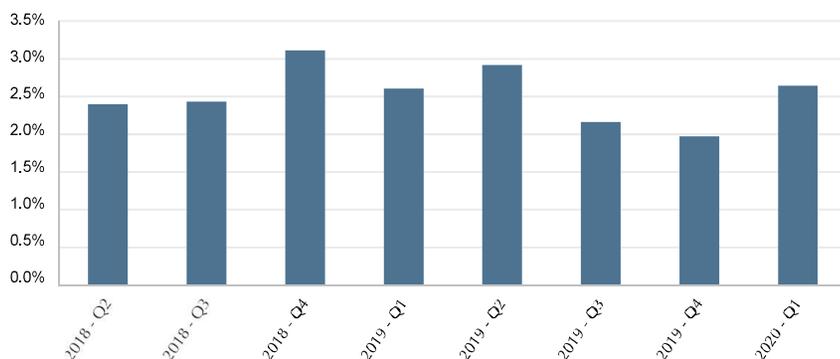
Fees

Underwritten LTV % – Weighted Average by Quarter

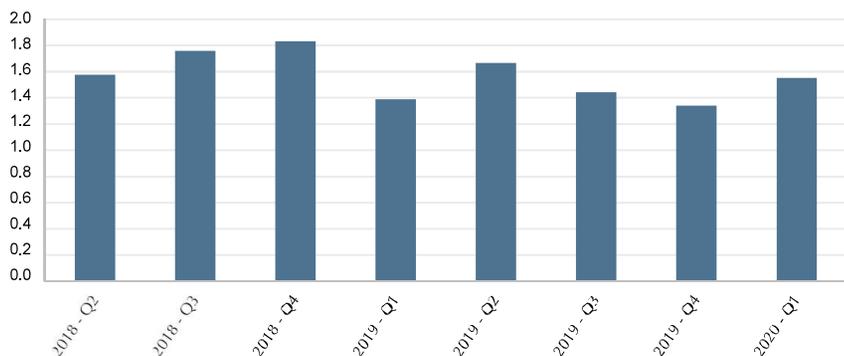


Private Debt Return/Unit of Leverage & Financial Maintenance Covenants as of March 31, 2020

Return / Unit of Leverage – Weighted Average by Quarter



Financial Maintenance Covenants – Weighted Average by Quarter

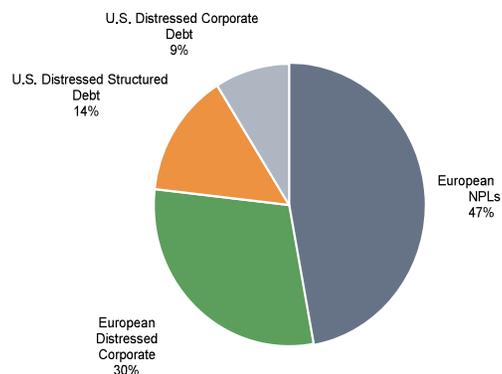


Distressed Debt as of March 31, 2020

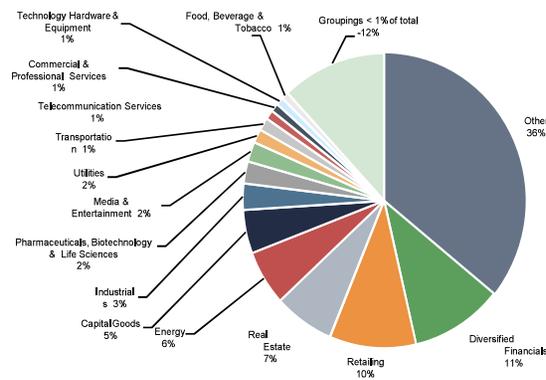
- The Distressed Debt environment is the most attractive it has been since the Global Financial Crisis in 2008-2009 as the economic disruption from COVID-19 will lead to a substantial increase in bankruptcies and restructurings.
- Some investments made prior to the pandemic face a challenging economic environment or have been repriced with higher required returns by the financial markets. However, we believe potential write downs are mostly reflected in the March 31 quarter's performance. We are currently estimating that Distressed Debt will generate a return in the March 31 quarter of -8.0% vs. a benchmark return of -12.3%.
- We have three fund-of-one partnerships in Europe which are actively investing in distressed opportunities. One partnership is targeting distressed corporate loans while the other two are targeting pools of small non-performing loans ("NPLs"). In addition, we are invested in a credit fund that opportunistically invests in U.S. and European distressed debt, both corporate and structured credit, as opportunities arise.

Distressed Debt Strategy & Industry Exposure as of March 31, 2020

Strategy Exposure

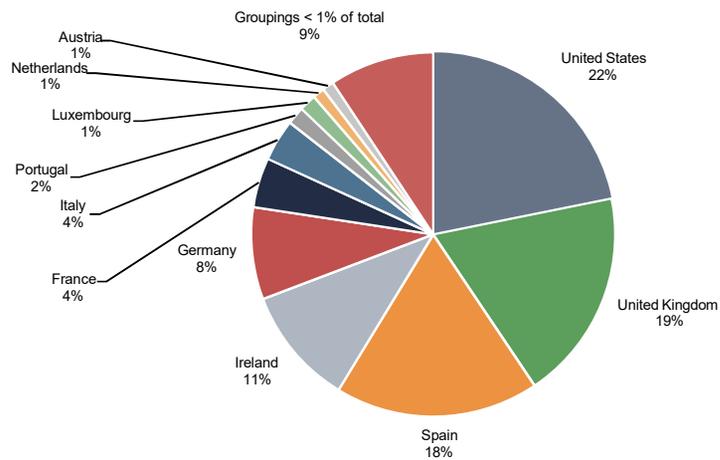


Industry Exposure



Distressed Debt Geographic Exposure as of March 31, 2020

Geographic Exposure

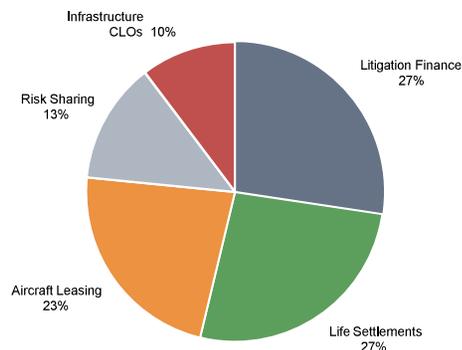


Other Credit as of March 31, 2020

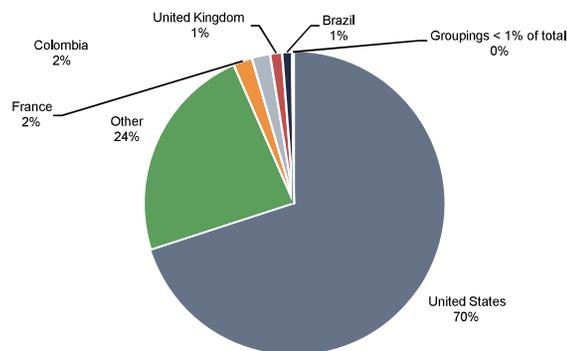
- We believe that select opportunities exist to achieve attractive returns in Other Credit, a sub-asset class which we characterize as credit opportunities that are not encompassed in Private Debt, Distressed Debt or High Yield, and offer an expected return which will likely meet or exceed the Credit asset class benchmark. We are currently estimating that Other Credit will generate a return in the March 31 quarter of -3.7% vs. a benchmark return of -12.3%.
- Currently, our Other Credit strategies include partnerships that invest in niche market opportunities that we believe are attractive including aircraft leasing, equipment leasing, life settlements, infrastructure loans, litigation finance and risk sharing transactions.
- The economic disruption from COVID-19, the repricing of risk in the credit markets, and the impaired liquidity and exit of some market participants (such as hedge funds) have meaningfully increased the expected return on new investments in Other Credit.
- That being said, some investments made prior to the pandemic such as aircraft leasing face a very tough economic environment. Aircraft leasing is a relatively small percentage of Other Credit. Meanwhile, other strategies such as life settlements and litigation finance, which represent larger investments for Other Credit, will generally be immune to the adverse economic environment.

Other Credit Strategy & Geography Exposure as of March 31, 2020

Strategy Exposure



Geography Exposure



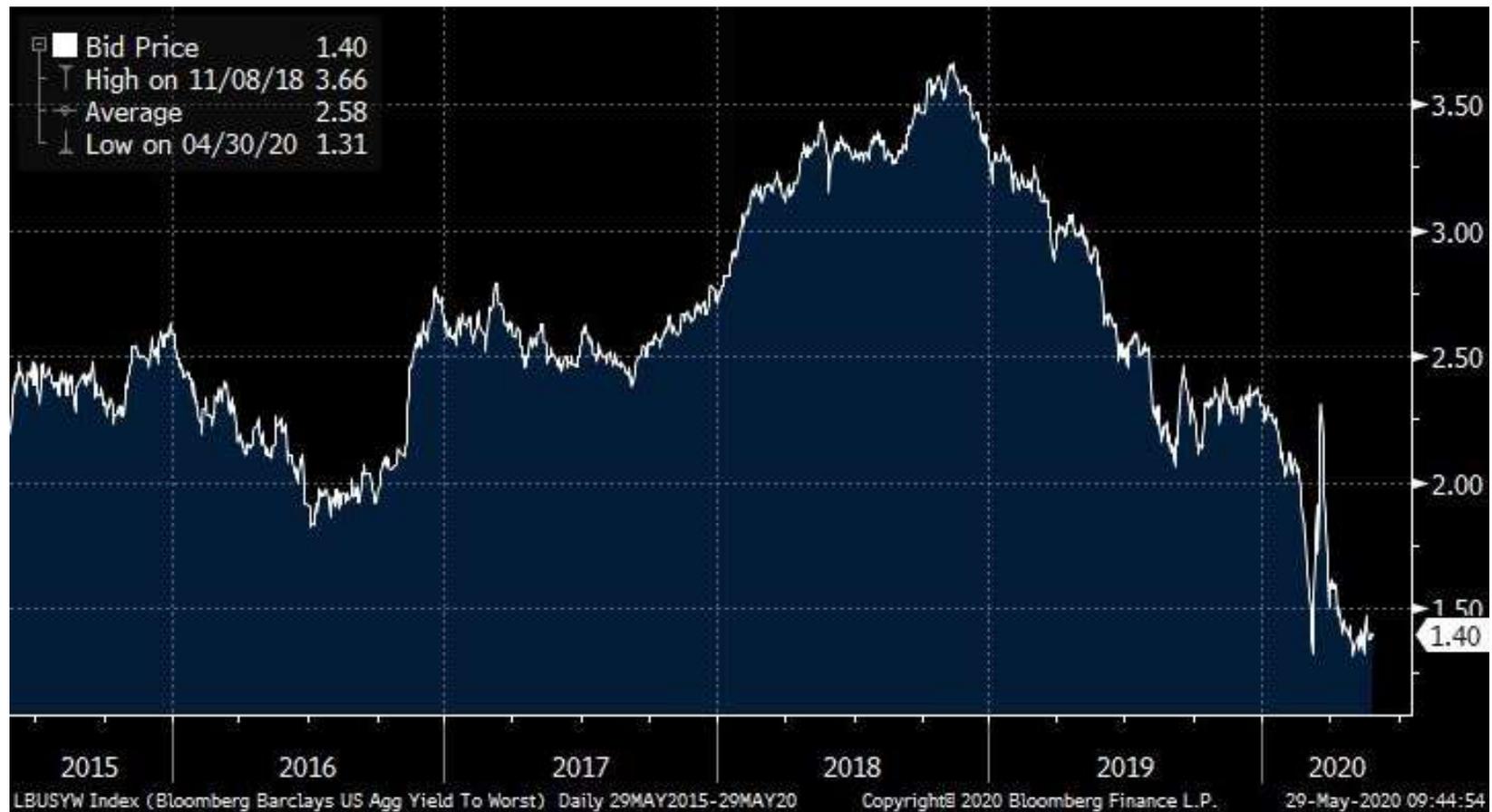
Outline

- 1 Summary View and Positioning
- 2 Macro Environment
- 3 Public Equity
- 4 Private Equity
- 5 Credit
- 6 Interest Rate Sensitive**
- 7 Real Estate
 - Commentary
 - COVID-19 Impacts
 - Trend
 - Property Markets Outlook
 - Capital Markets Dynamics
- 8 Historic Data

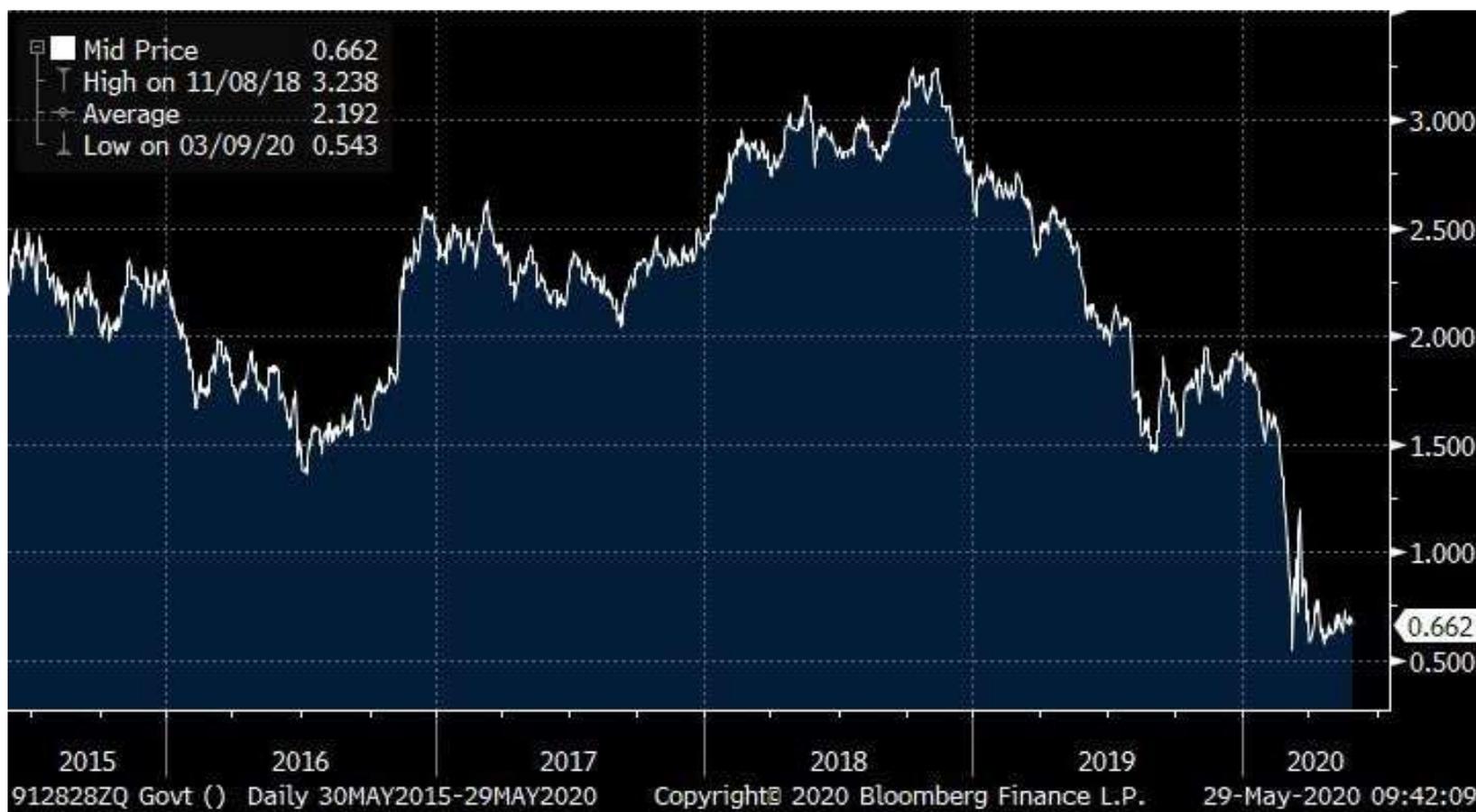
Commentary

- As of May 27, 2020, we are underweight Interest Rate Sensitive Fixed Income with an allocation of 9.4% versus a 10.4% Interim SAA target. In the past few months, we have reduced our weighting in the asset class to raise cash to meet the overall funding needs (benefit payments and capital calls) of the total fund.
- Since the beginning of 2020, interest rates have plunged due to the adverse global economic impact caused by the outbreak of the COVID-19 virus and related policy responses (ex. lockdowns). Furthermore, in response to the severe economic impact to the U.S. economy, the Federal Reserve has essentially renewed the playbook it employed following the 2008-2009 Global Financial Crisis: lowering its target for short-term interest rates to essentially zero, launching quantitative easing to purchase U.S. Treasury bonds and agency mortgage-backed securities, and adding a number of programs to support the credit markets.
- Long-term U.S. treasury rates are close to their lowest level ever with the 10 year U.S. Treasury bond yielding only 0.66%. The Bloomberg Barclays U.S. Aggregate Bond Index, the benchmark for Interest Rate Sensitive Fixed Income, is now yielding only 1.4% vs. 2.3% at the beginning of 2020 and 2.9% one year ago.
- With this low yield for the benchmark, we do not expect attractive returns in the asset class going forward relative to the total fund's target return. However, we expect to maintain a meaningful investment in the asset class to use as a source of liquidity to meet the total fund's needs and to serve as a counter-balance to potential sell-offs in risky assets such as equities.

Bloomberg Barclays U.S. Aggregate Yield-to-Worst



German 10 Year



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Commentary

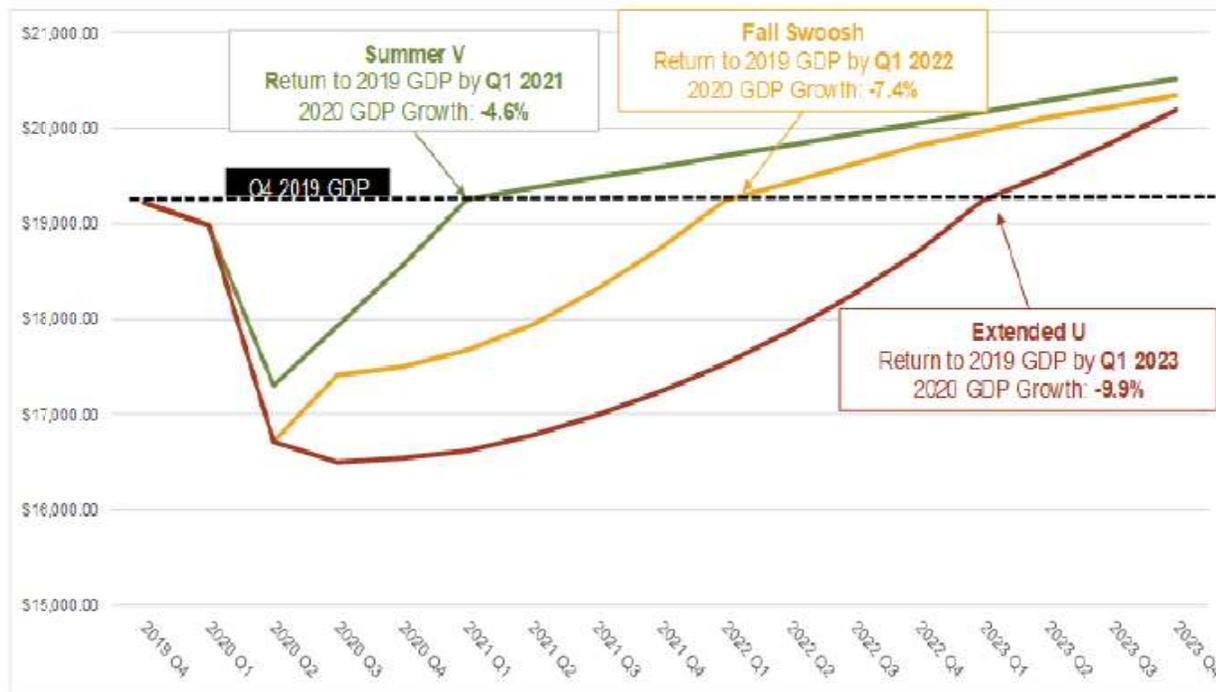
- The COVID-19 outbreak has produced a global economic shock, significantly distressing the U.S. economy and real estate markets.
- The U.S. has experienced record claims for unemployment insurance; however, many of these job losses are likely temporary. We believe there will be a relatively robust initial recovery as many jobs lost were merely deferred, but given the magnitude of the disruption, it will likely take some time to regain all of the lost ground—reemerging from this crisis is not going to be an “event,” rather it will be a “process”—and we will likely see elevated unemployment rates for the balance of 2020 and well into 2021. RCLCO’s “base line” economic scenario is the “Fall Swoosh” (see subsequent page), in which GDP again achieves Q4 2019 levels by Q2 2022.
- The effects on real estate vary by property type, with the hospitality and retail sectors experiencing the most severe and immediate impact.
- The impact on office product is uncertain, but a substantial amount of tenants are requesting rent relief and there likely will be declining occupancy and rent growth in the coming months.
- Multifamily and industrial will likely experience short-term pain and softening market fundamentals, although declining savings are expected to increase demand for rentership and consumer preferences for e-commerce are expected to increase demand for industrial warehouse product.
- There has been, and will continue to be, a steep drop in transactions as investors hold off on acquisitions until there is more clarity in the market. Debt capital markets are currently relatively more liquid for stabilized industrial or multifamily, and much less so for other property types and/or for construction. Despite record low reference rates, spreads widened in March and April, but may now be coming down to pre-COVID levels.

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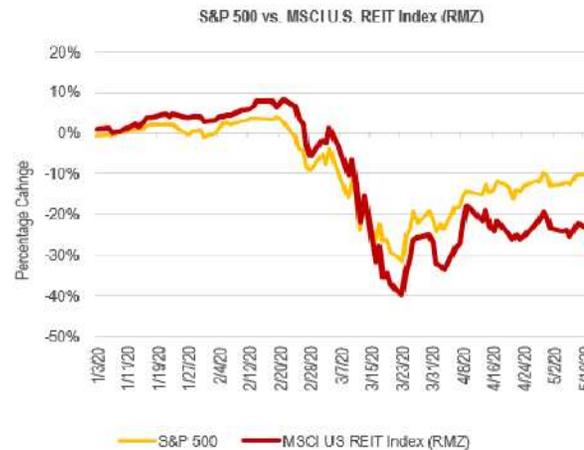
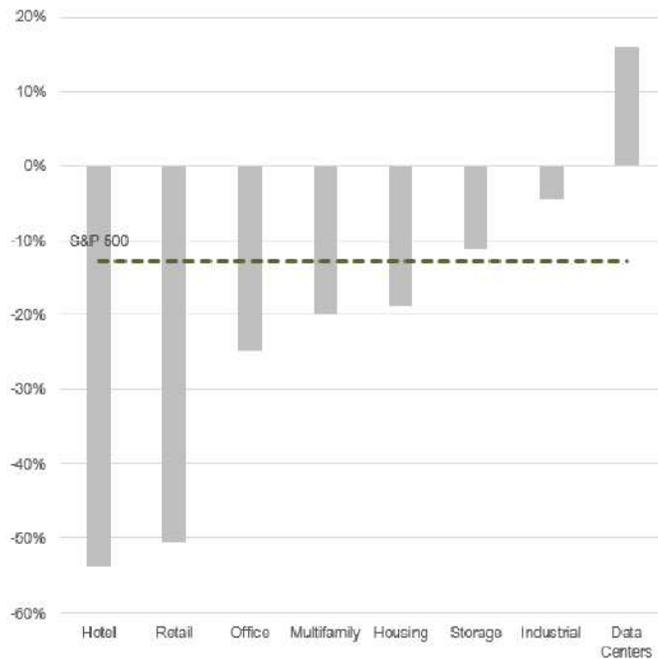
RCLCO Possible Recovery Scenarios

Currently assuming the “Fall Swoosh” as the baseline assumption



Public REIT Performance

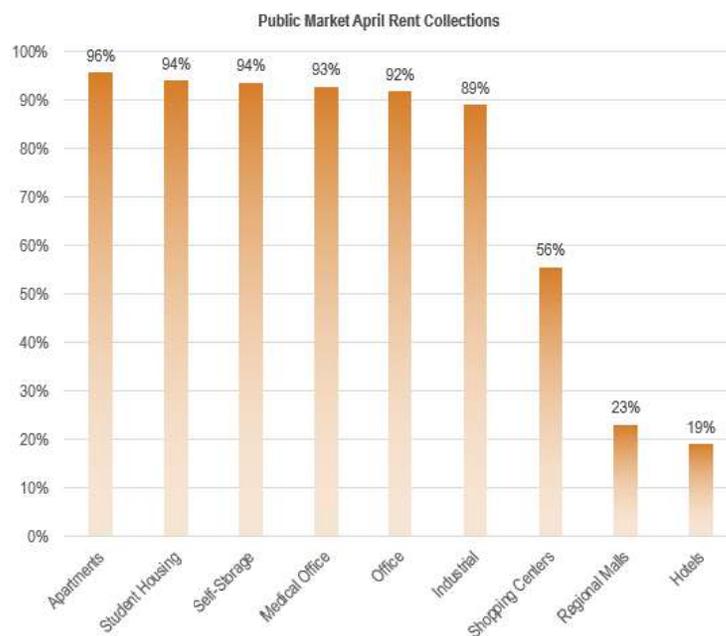
REITs have declined across nearly all sectors YTD as well as underperformed the S&P 500



*Data updated as of April 16, 2020
 Source: NAREIT; Cushman & Wakefield

Variation in Rent Collections

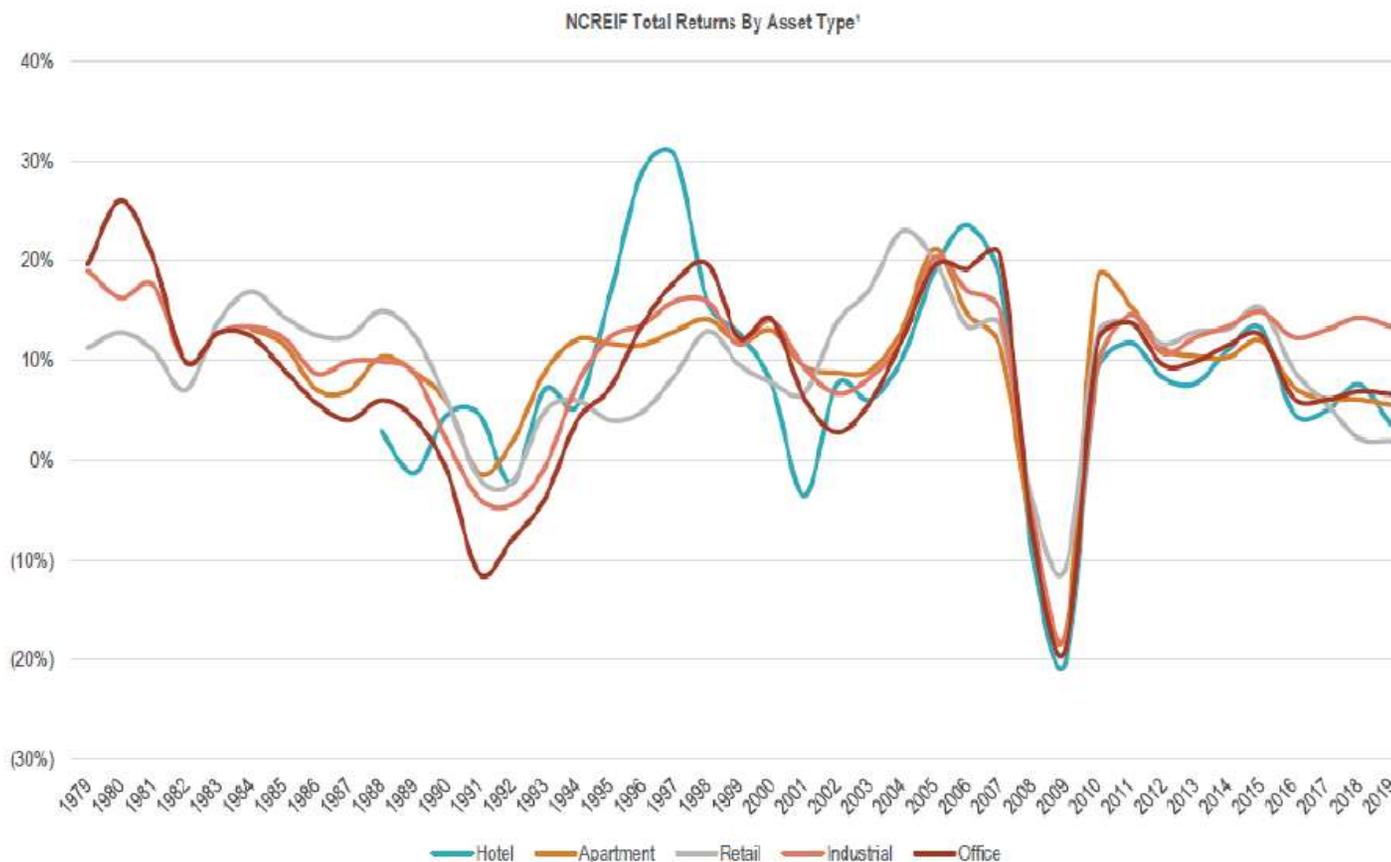
- Public market data reflects what we see in private portfolios:
 - Residential, office, and industrial have largely outperformed initially dire expectations, while (no surprise) retail and hospitality are lagging



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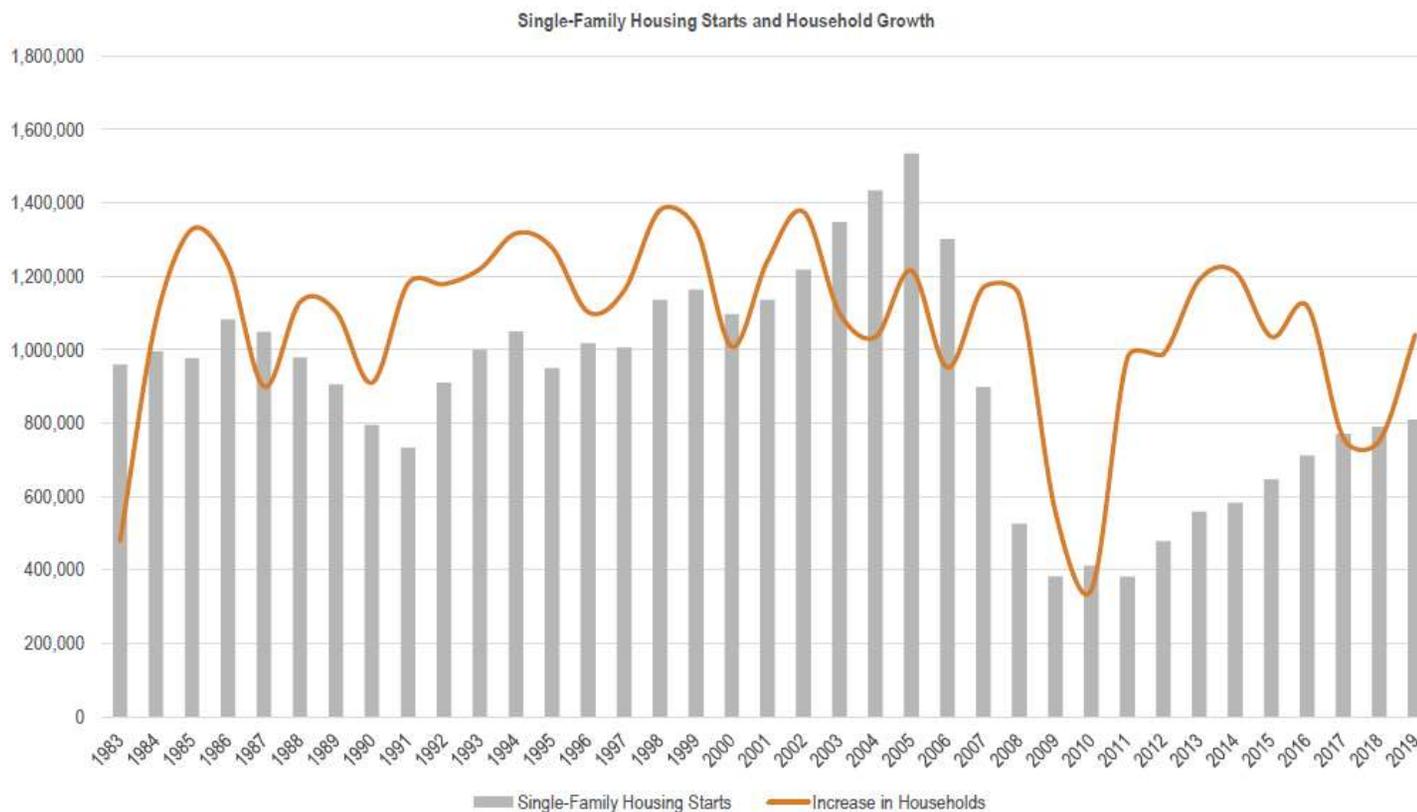
NCREIF Total Returns by Asset Type



¹Data available through Q4 2019

Source: National Council of Real Estate Investment Fiduciaries (NCREIF)

Housing Starts



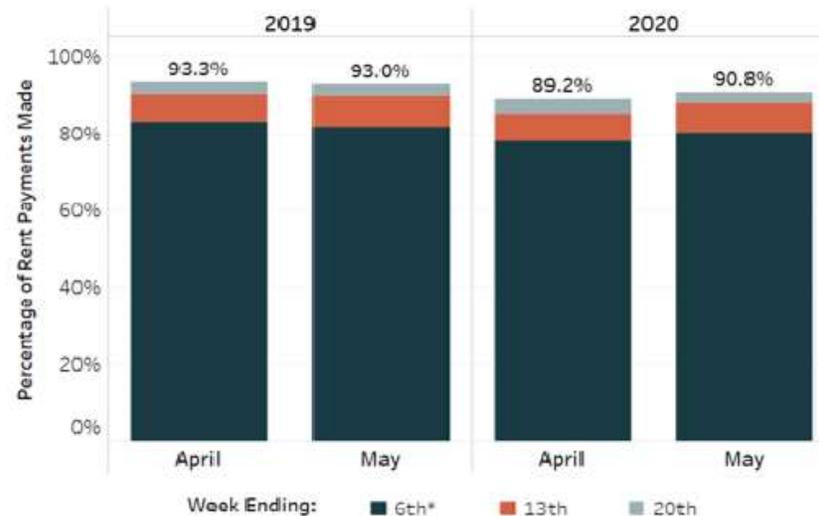
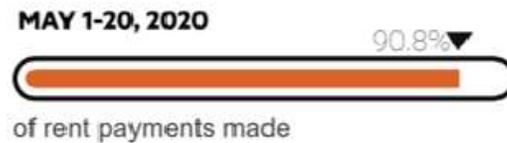
*Note: Single-Family Housing Starts include single-family detached and single-family attached (townhomes)
 Source: Moody's Analytics*

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Multifamily

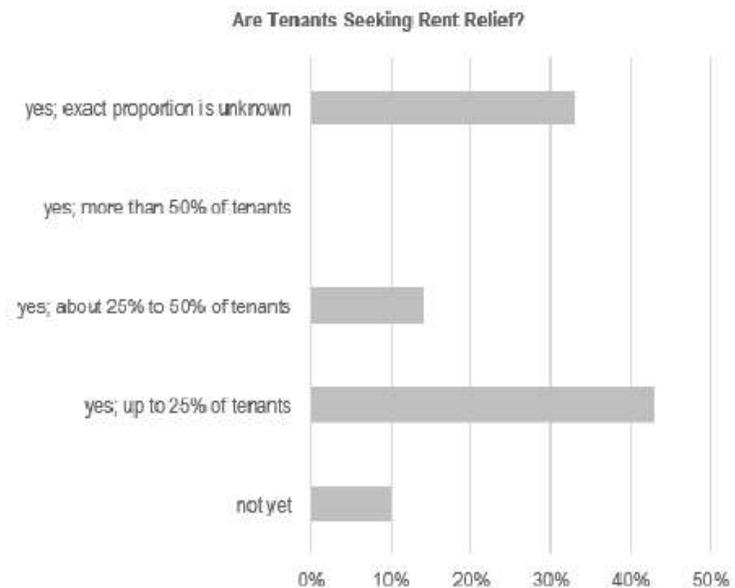
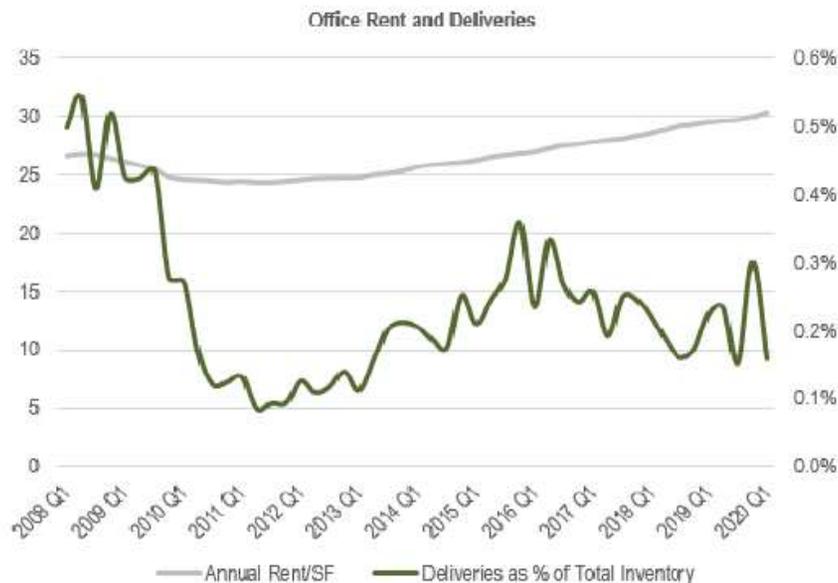
- The multifamily industry is dealing with tenants who have lost their income and are requesting rent relief. The duration of the crisis will determine the effects on operating performance, as it will impact the degree to which tenants can meet their monthly rent payments and the extent of downward pressure on effective rents in the coming months. While tenant traffic will likely slow, turnover may be lighter in stabilized properties.
- Rent collections have exceeded expectations: 90.8% of professionally managed apartment households made a full or partial rent payment by May 20 (compares to 93.0% from the same period in 2019).



*Data is collected from 11.5M apartment units
 Source: National Multifamily Housing Council

Office

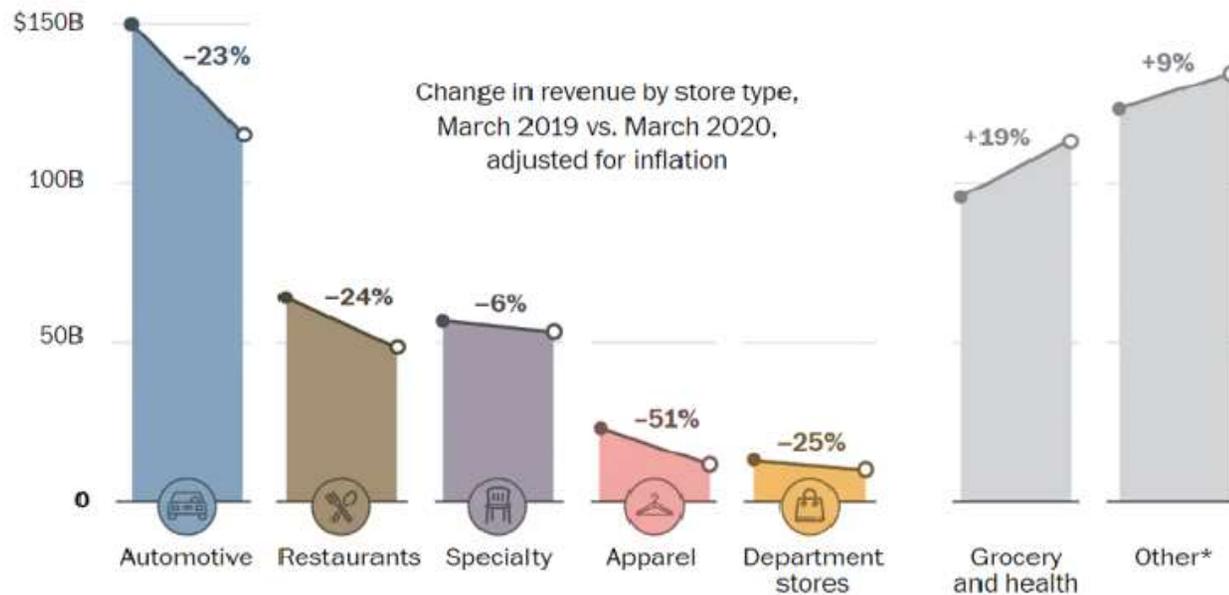
- Office rents are expected to decline and vacancy is projected to increase due to COVID-19. According to a survey conducted by PwC in early April, a substantial percentage of tenants are requesting rent relief; however, actual results suggest rent collections have been resilient.
- Deliveries have remained low over the past decade, and are projected to drop through the end of 2020 as construction and new developments are put on hold. The lack of new supply is expected to moderate downward pressure on rents. Operating expenses and capital expenditures will likely increase as safety protocols and HVAC system improvements are implemented.



Source: PwC; CoStar

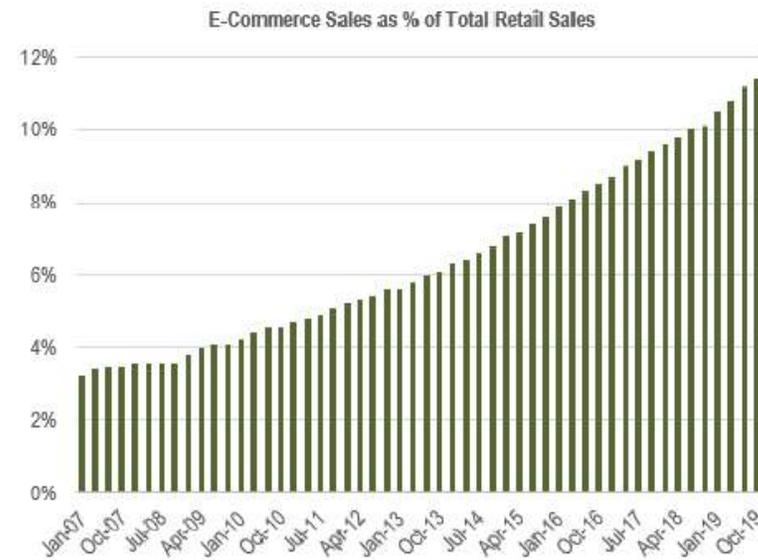
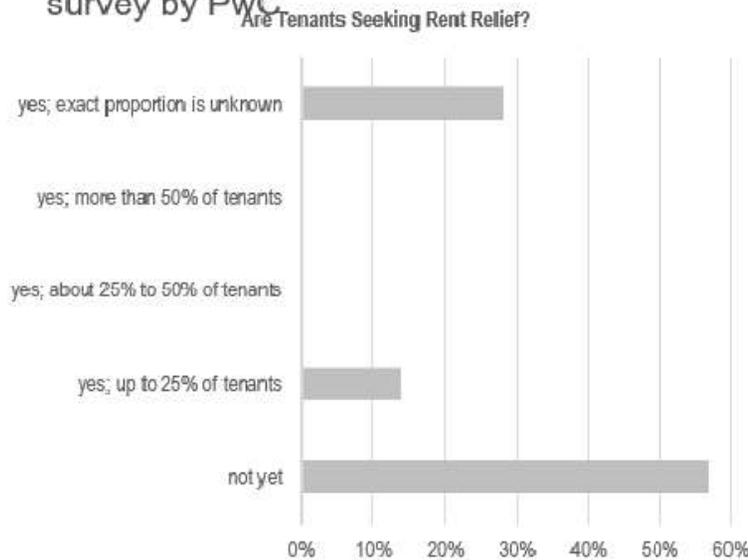
Retail

- Retail has been one of the industries most immediately and severely impacted COVID-19, though pain is not evenly felt.
- Overall retail sales were down 8.7% in March, ranging from -51% for apparel to +19% for groceries. We anticipate discretionary retail sales to remain subdued during the recession and recovery, and for this event to acceleration consumer adoption of e-commerce—hurting “stick and brick” retail



Industrial

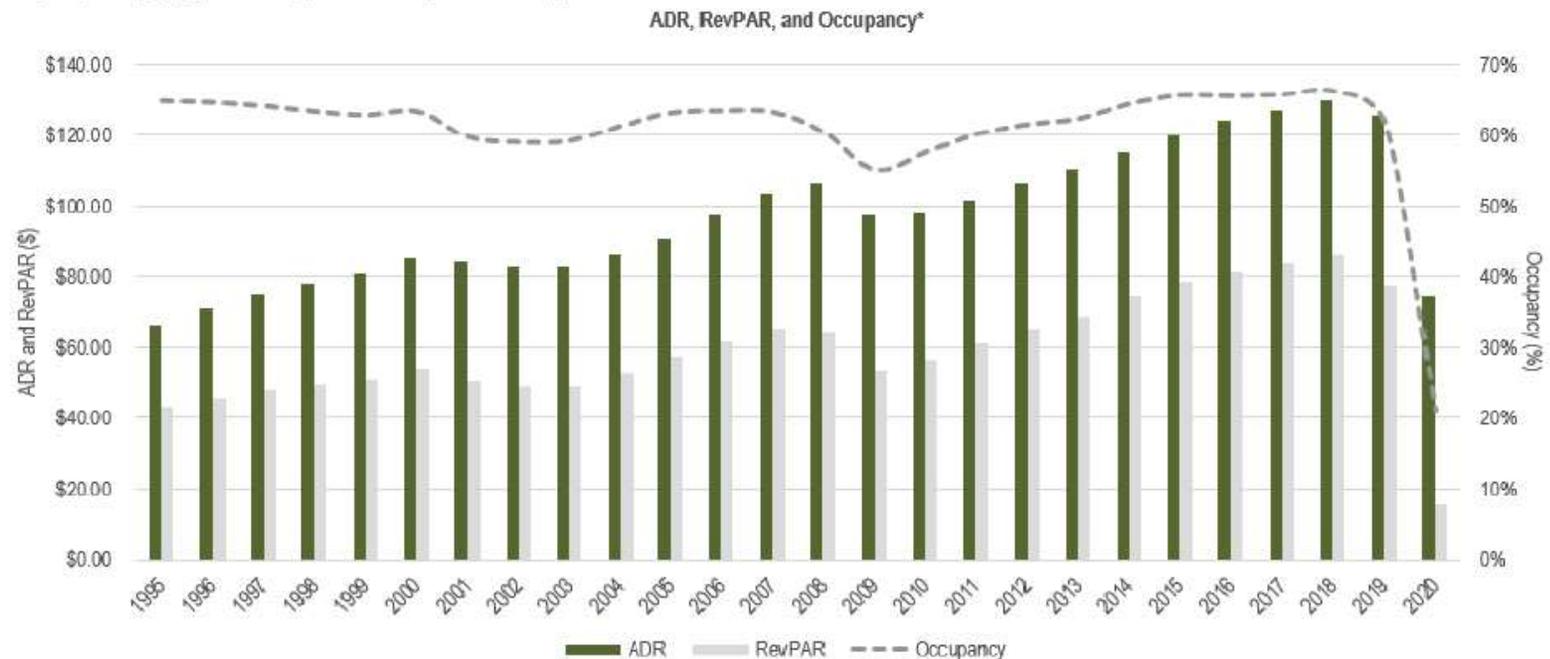
- Industrial has been among the more resilient property types due to significantly expanded use of e-commerce during the COVID-19 crisis. Though some tenants have been negatively impacted by decreases in demand or disruptions to the supply chain, others are expanding their footprints and keeping occupancies high.
- These trends likely continue post-COVID as consumer preferences continue to favor e-commerce and businesses rethink (and potentially onshore) their inventory and supply chains.
- Although some industrial tenants are seeking rent relief, the number is minimal according to a survey by PwC.



Source: PwC; U.S. Census Bureau

Hotels

- The hotel industry has been the most severely impacted by COVID-19, as hotels are on pace to lose \$3.5B in revenue per week due to the stay-at-home mandates.
- 70% of direct hotel employees have been laid off or furloughed, equating to a loss of \$2.4B in earnings per week.
- National occupancy levels dropped to 21% as of April 11, 2020, and are projected to remain at or below 20% through the end of the year.



*Data as of April 11, 2020

Source: STR; American Hotel and Lodging Industry



Outline

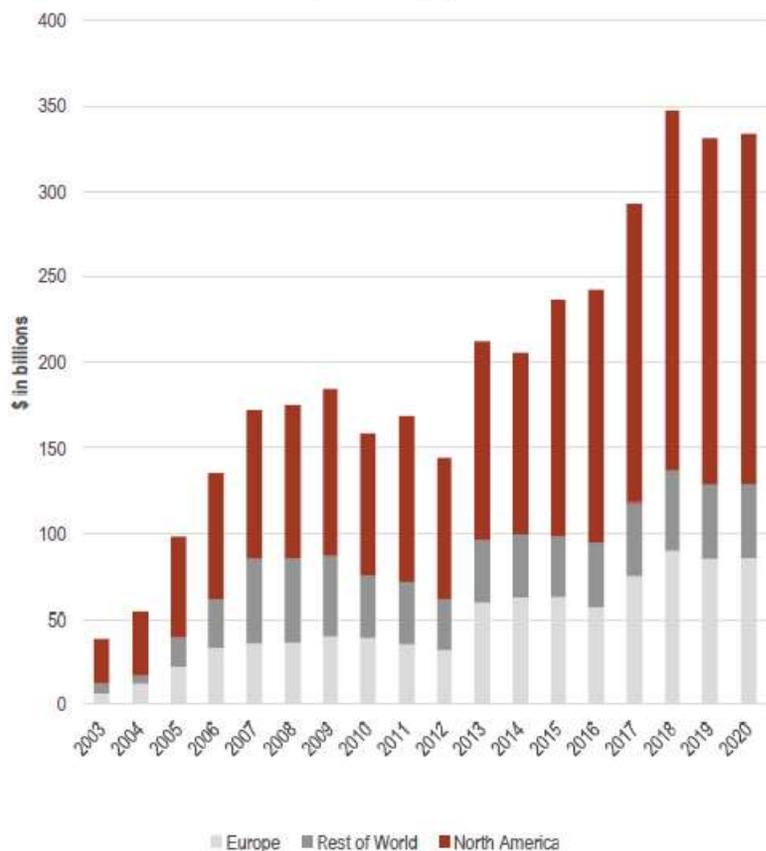
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Cap Rate Trends

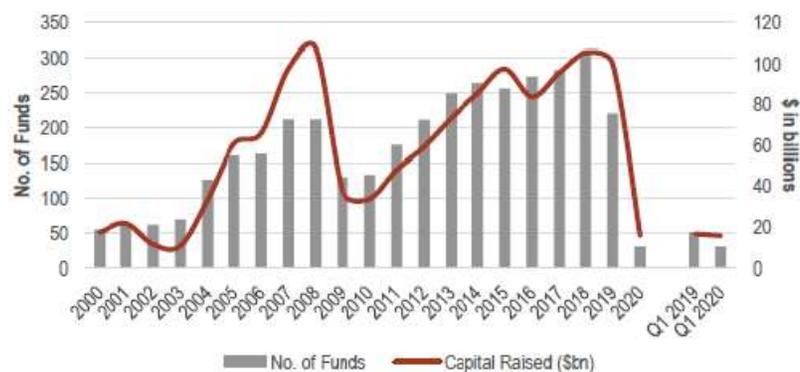


Real Estate Dry Powder

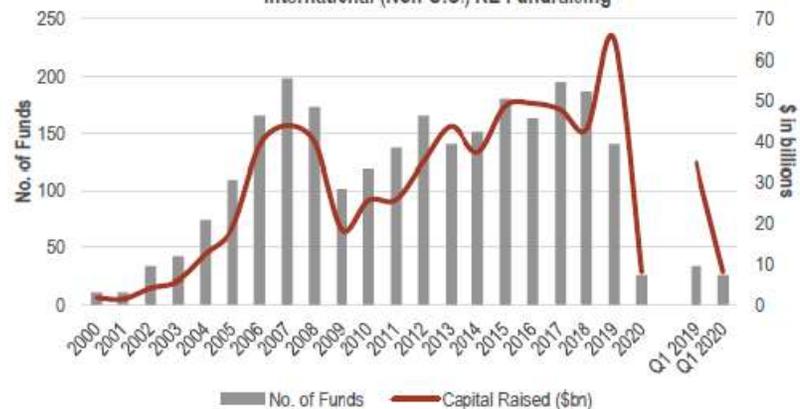
Dry Powder by Region



United States RE Fundraising



International (Non-U.S.) RE Fundraising



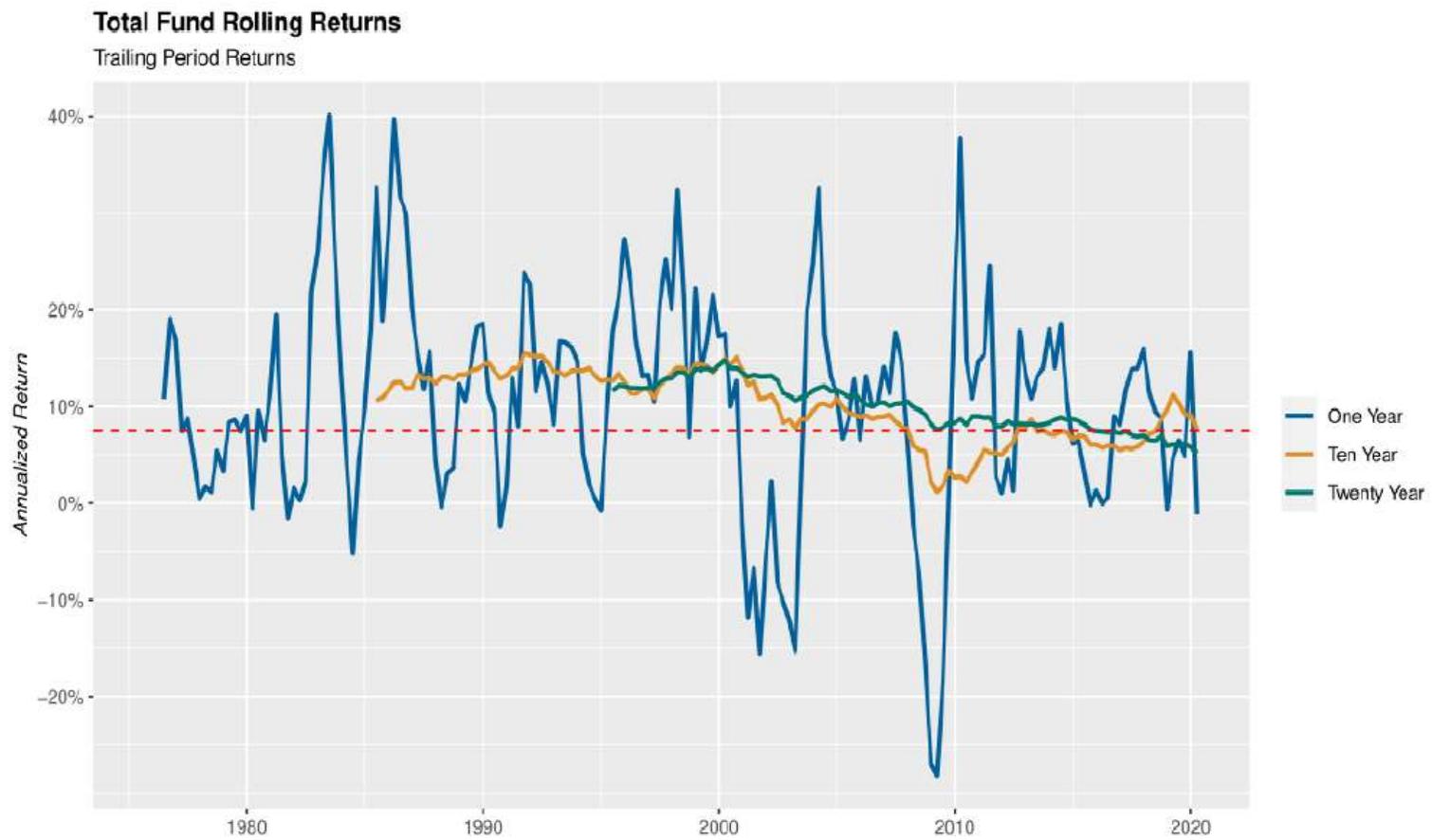
Source: Preqin

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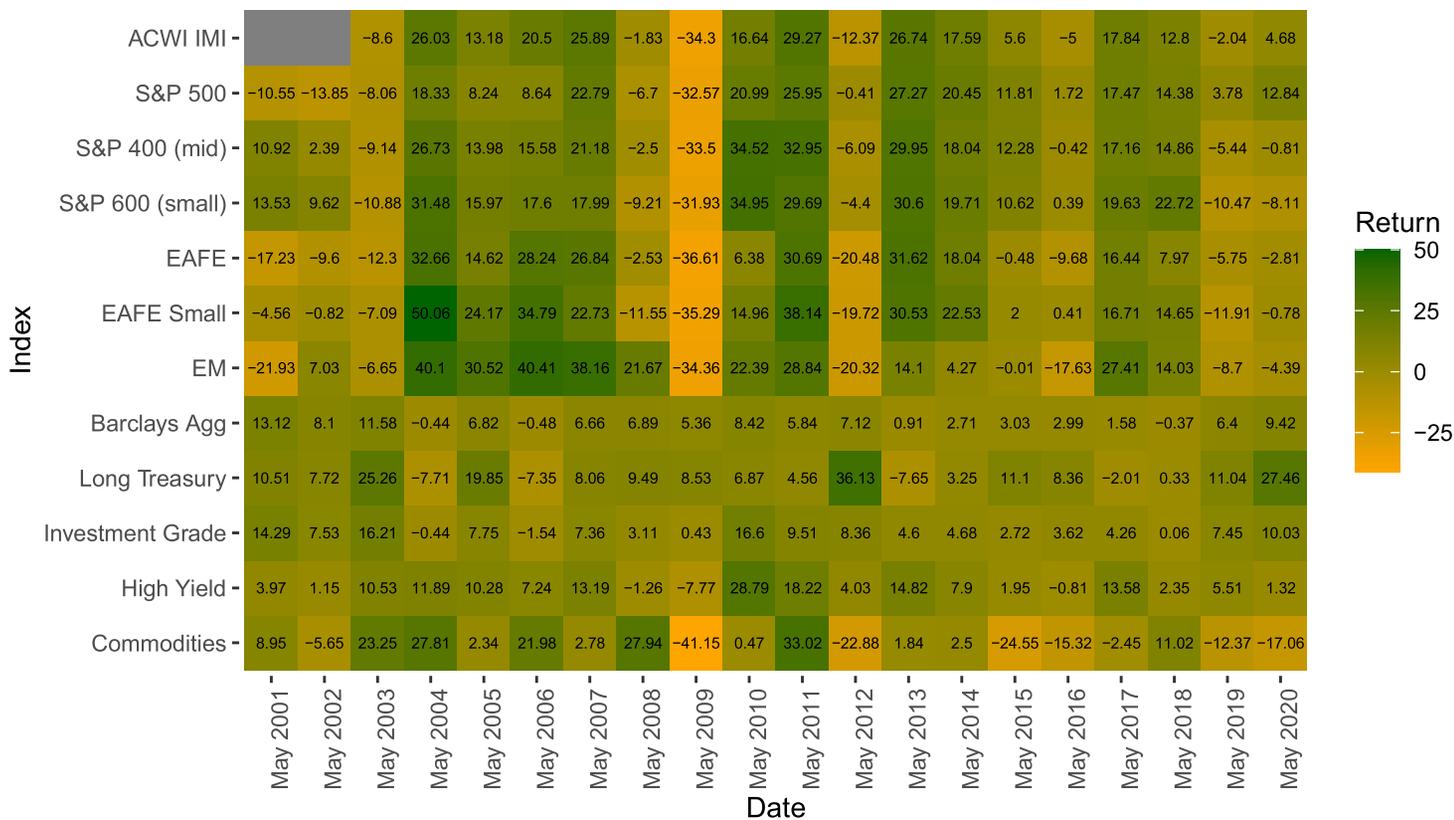
ASRS Returns



Source: NEPC data, ASRS graphics

Asset Class One Year Returns

One Year Returns
 for indicated end dates



Asset Class Hold Period Returns

Annualized Returns and Growth of a Dollar
 for hold periods ending May 2020

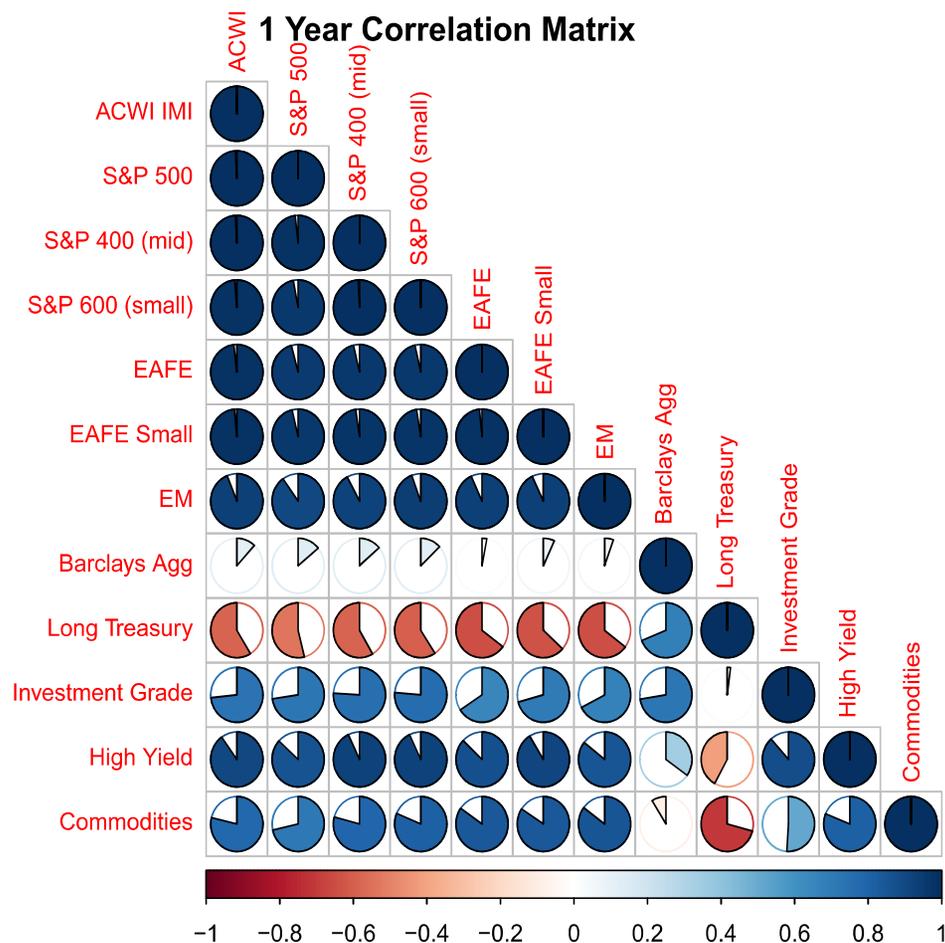


Asset Class Volatility

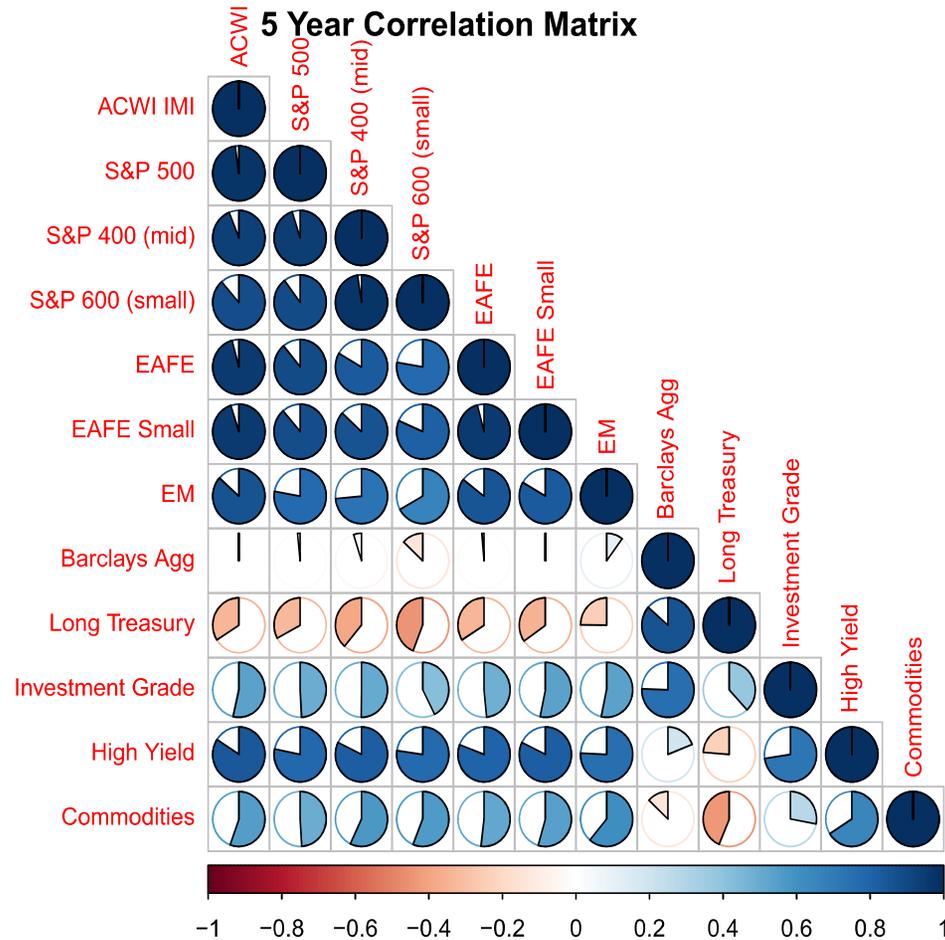
Volatility
 for hold periods ending May 2020



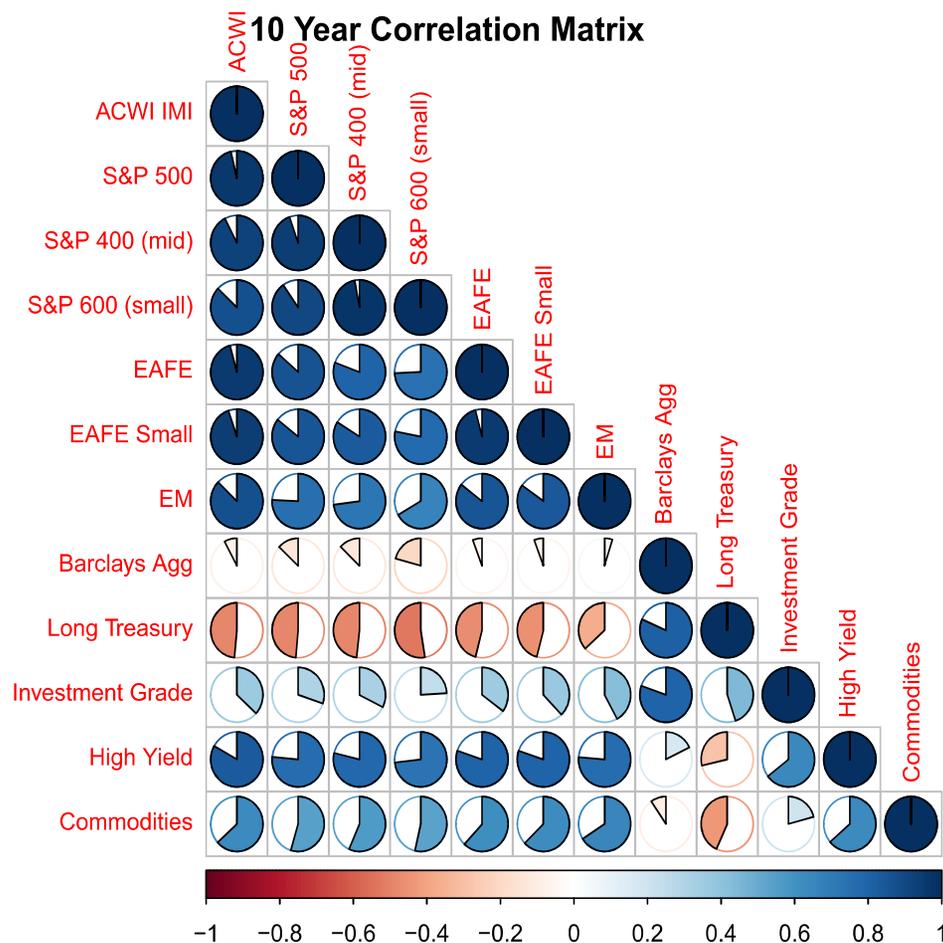
1 Year Correlation



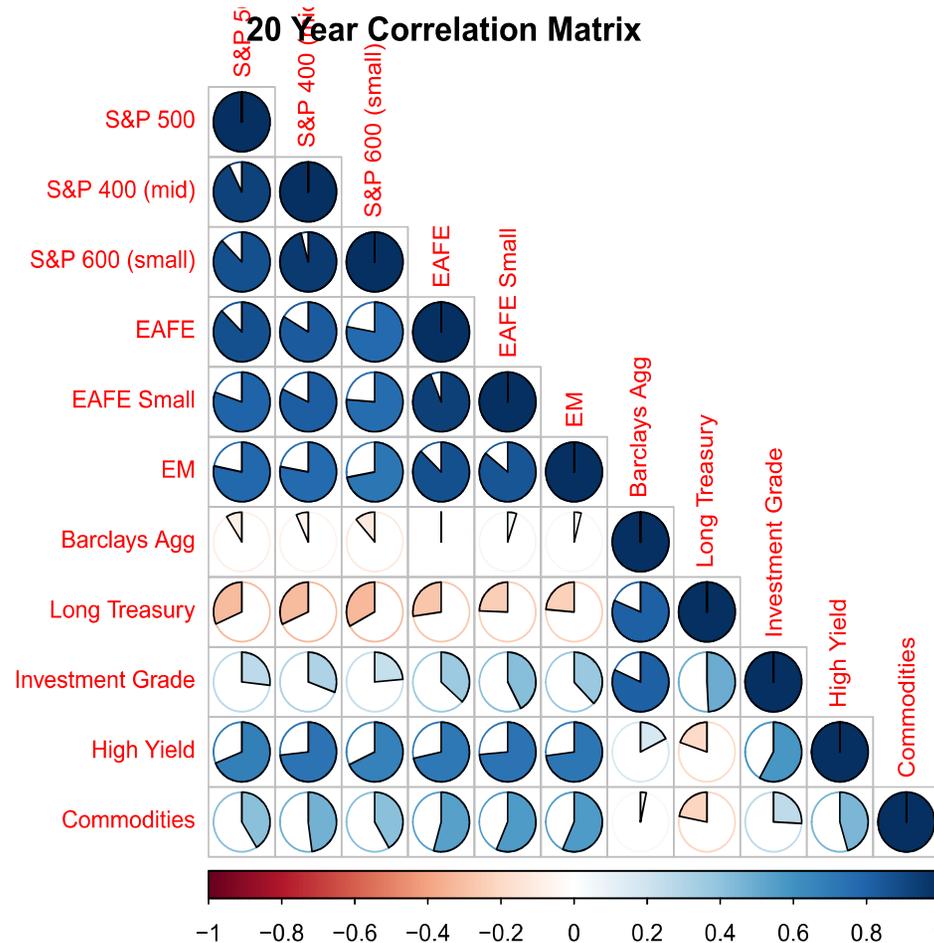
5 Year Correlation



10 Year Correlation



20 Year Correlation



Agenda Item #4

Performance Report

For Periods Ended March 31, 2020

Arizona State Retirement System

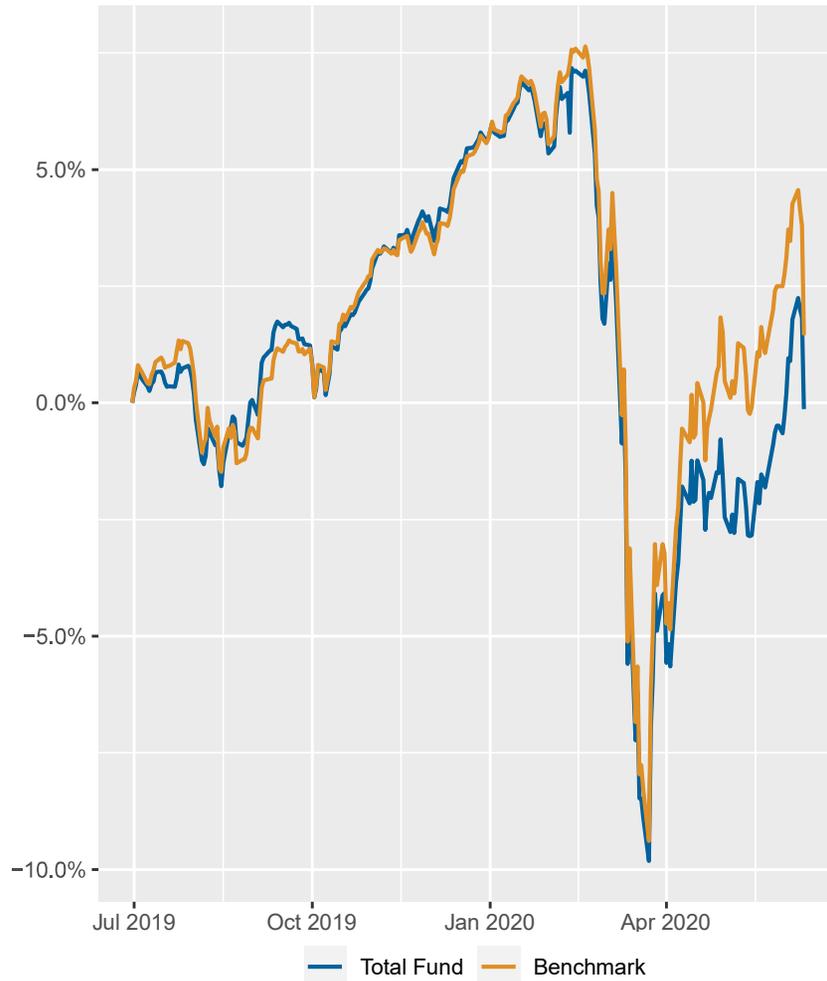
June 15, 2020

Estimating 6/30 returns with available information

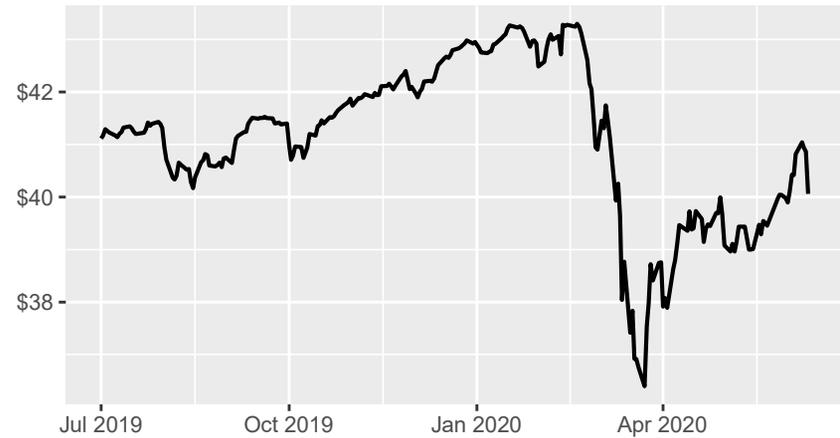
	Actual	Benchmark	
3/31 FYTD Total Fund Ret	-4.1	-3.2	Values in Black are known Values
add Q4 estimates			
Credit	-2.5	-12.3	Values in blue are estimates
Real estate	-2.8	0.8	
Private Equity	-13.0	-22.4	
Bonds (Q4 actual through June 12)	2.6	2.5	
Public Equities (actual through June 12)	17.7	17.9	
Public Equities and Bonds thru June 30	0	0	Values in red are hypothetical assumptions
Est 6/30 performance assuming public markets flat for rest of year	1.1	-0.3	

Total Fund Fiscal Year to Date through 6/11/2020

Return Fiscal Year to Date

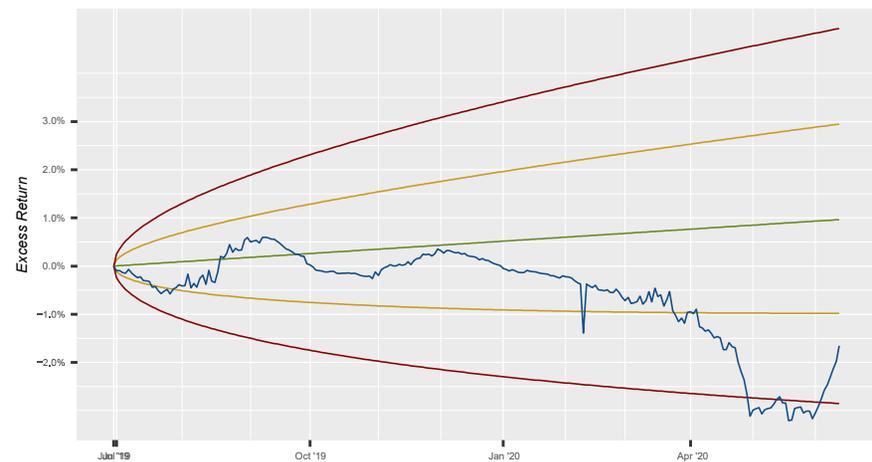


Total Fund Market Value (Billions)



Total Fund Performance versus Expectations

100 Basis Points Expected Excess Return with 200 Basis Points Tracking Error



Estimating June 30 returns from available information

Estimating 6/30 returns with available information

	<u>Actual</u>	<u>Benchmark</u>	
3/31 FYTD Total Fund Return	-4.1	-3.2	Values in Black are known Values
Add Q4 estimates:			
Credit	-2.5	-12.3	Values in blue are estimates
Real estate	-3.0	0.8	
Private Equity	-13.0	-22.4	
Bonds (Q4 actual through May 31)	2.4	2.3	
Public Equities (actual through May 31)	15.8	16.2	
Public Equities and Bonds thru June 30	0	0	Values in red are hypothetical
Est 6/30 performance assuming public markets flat for rest of year	0.3	-1.0	

Quarterly Performance

External Reports

State Street Performance Summary for the period ended 3/31/2020

ARIZONA STATE RETIREMENT SYSTEM
Investment Management Division
Mar-31-2020
Net Returns
Final

ASRS Performance Summary

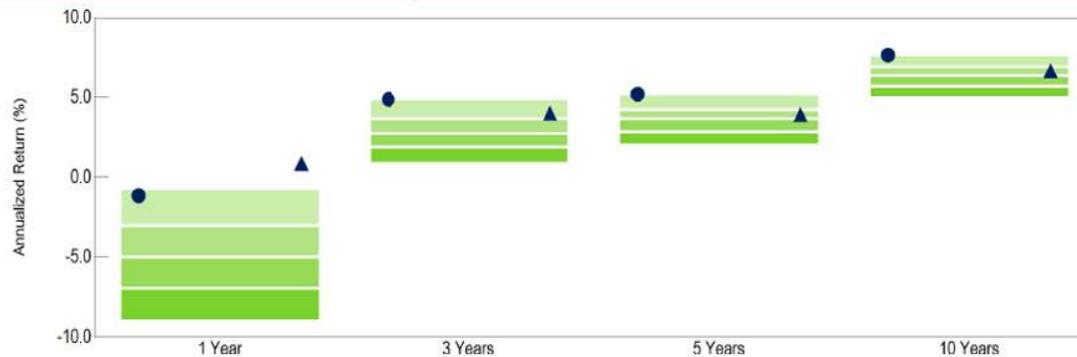


	Benchmark	Market Value (\$mil.)	1 Mth	3 Mth	FYTD	1 Year	3 Year	5 Year	ITD	Inception Date
TOTAL PLAN	INTERIM SAA POLICY	38,757	-5.68	-9.23	-4.08	-1.14	4.88	5.22	9.39	07-01-1975
Excess			-0.24	-0.84	-0.86	-2.03	0.87	1.27	0.39	
TOTAL EQUITY WPE and Opp	LEGACY Total Equity BM	19,227	-11.36	-18.72	-12.21	-9.11	2.45	3.91	6.43	07-01-2013
Excess			-0.44	-1.77	-1.86	-3.19	-0.40	-0.27	-0.37	
US EQUITY	COMBINED DOMESTIC EQUITY INDEX	8,459	-14.58	-22.97	-15.12	-11.74	2.13	4.77	10.61	07-01-1975
Excess			-0.82	-2.03	-2.41	-2.55	-1.87	-1.27	-0.22	
INTERNATIONAL EQUITY	INTERNATIONAL EQUITY INDEX	6,471	-14.88	-23.88	-18.49	-16.39	-2.18	-0.64	5.14	04-01-1987
Excess			0.23	0.23	0.06	-0.07	0.05	-0.02	0.24	
PRIVATE EQUITY	MSCI ACWI IMI w/USA GROSS (NET) LAGGED	4,298	2.82	2.57	7.13	11.92	12.88	12.03	7.74	09-01-2007
Excess			-0.76	-6.56	-5.65	-14.83	3.18	3.14	0.47	
INTEREST RATE SENSITIVE	BBG BARC Agg (Dly)	3,664	-0.46	3.36	5.88	9.10	4.92	3.65	7.87	07-01-1975
Excess			0.13	0.21	0.20	0.17	0.08	0.29		
CREDIT	LEGACY Total Credit BM	8,709	1.34	2.41	6.91	9.34	9.15	8.31	7.68	07-01-2013
Excess			-0.46	0.05	0.49	-2.02	2.40	1.85		
PRIVATE DEBT	S&P LEVERAGED LOAN INDEX LAGGED + 250BPS	6,291	1.37	1.87	7.21	9.12	10.05	10.15	11.63	10-01-2012
Excess			-0.43	-0.49	0.79	-2.23	3.08	3.10	4.49	
DISTRESSED DEBT	S&P LEVERAGED LOAN INDEX LAGGED + 250BPS	1,520	0.36	3.79	6.56	8.68			8.74	07-01-2018
Excess			-1.44	1.43	0.14	-2.67			1.88	
OTHER CREDIT	S&P LEVERAGED LOAN INDEX LAGGED + 250BPS	895	2.85	3.42	4.71	21.06			10.62	07-01-2018
Excess			1.05	1.05	-1.71	9.70			3.75	
REAL ESTATE	Custom ASRS ODCE (Net)	6,726	0.71	1.15	3.22	5.89	6.88	9.49	6.36	12-01-2005
Excess			0.32	0.07	0.15	1.25	0.51	1.35	-0.07	
CASH	CASH CUSTOM INDEX	430	0.16	0.42	2.16	2.80	5.26	2.57	3.99	04-01-1990
Excess			-0.13	-0.15	0.55	0.54	0.21	-0.77	0.66	
OTHER	ICE BofA US 3-Month Treasury Bill	0	297.21	337.14	1,361.14	1,335.76	147.03	70.66	51.79	07-01-2013
Excess			296.92	336.56	1,359.53	1,333.50	145.20	69.47	50.90	

ASRS Returns Compared to Public Fund Universe for the period ended 3/31/2020

UNIVERSE COMPARISON

InvMetrics Public DB > \$1B Net Return Comparison
Ending March 31, 2020



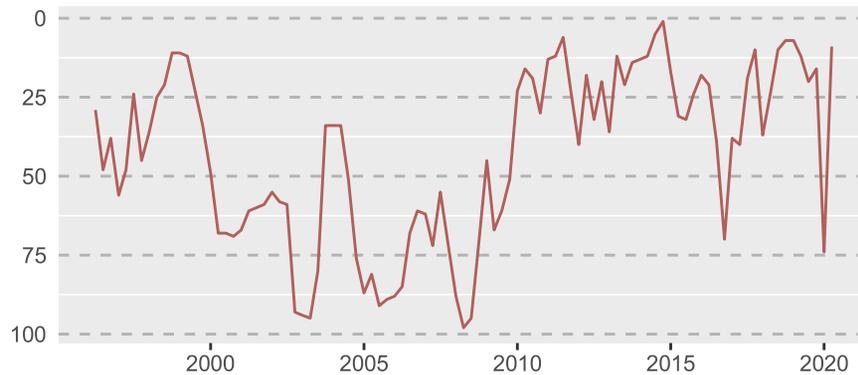
	1 Year	3 Years	5 Years	10 Years
5th Percentile	-0.7	4.9	5.2	7.7
25th Percentile	-3.0	3.7	4.2	6.9
Median	-5.0	2.8	3.7	6.4
75th Percentile	-6.9	1.9	2.9	5.7
95th Percentile	-9.0	0.9	2.0	5.0
# of Portfolios	62	62	59	55

	1 Year	3 Years	5 Years	10 Years
● Total Fund	-1.1	4.9	5.2	7.7
Total Fund Percentile Rank	9	5	6	6
Total Fund Ordinal Rank	6	3	4	3
Number of Funds In Universe	62	62	59	55
▲ Interim SAA Policy	0.9	4	3.9	6.7

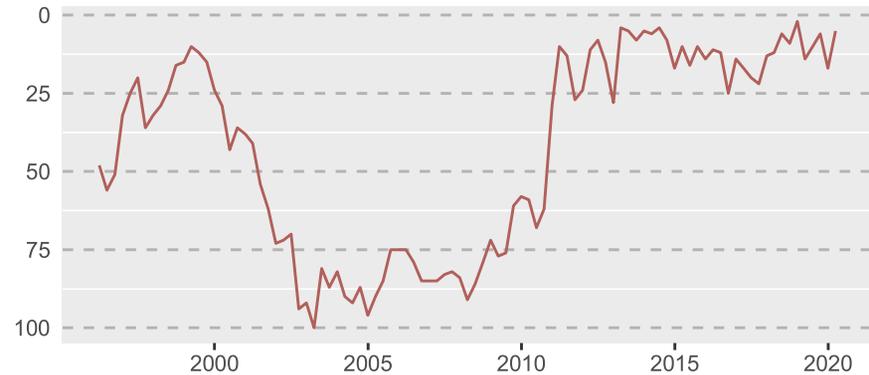


Total Fund Rolling Percentile Rankings for the period ended 3/31/2020

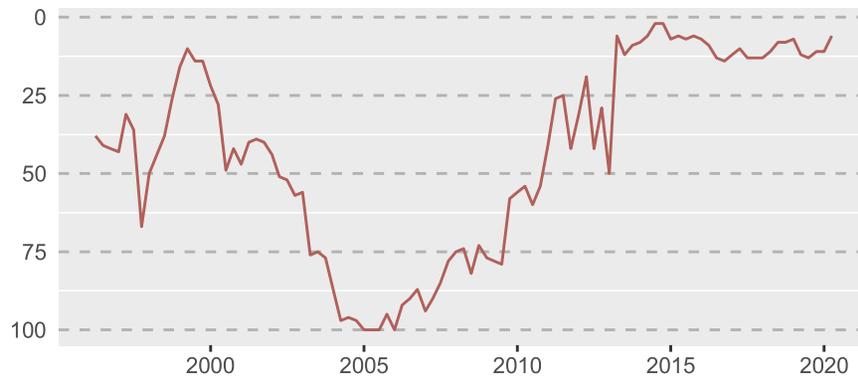
Total Fund One Year Rolling Percentile Rankings



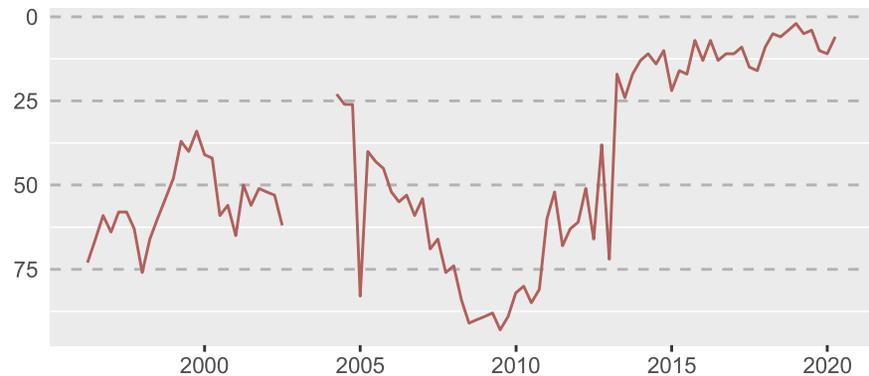
Total Fund Three Year Rolling Percentile Rankings



Total Fund Five Year Rolling Percentile Rankings

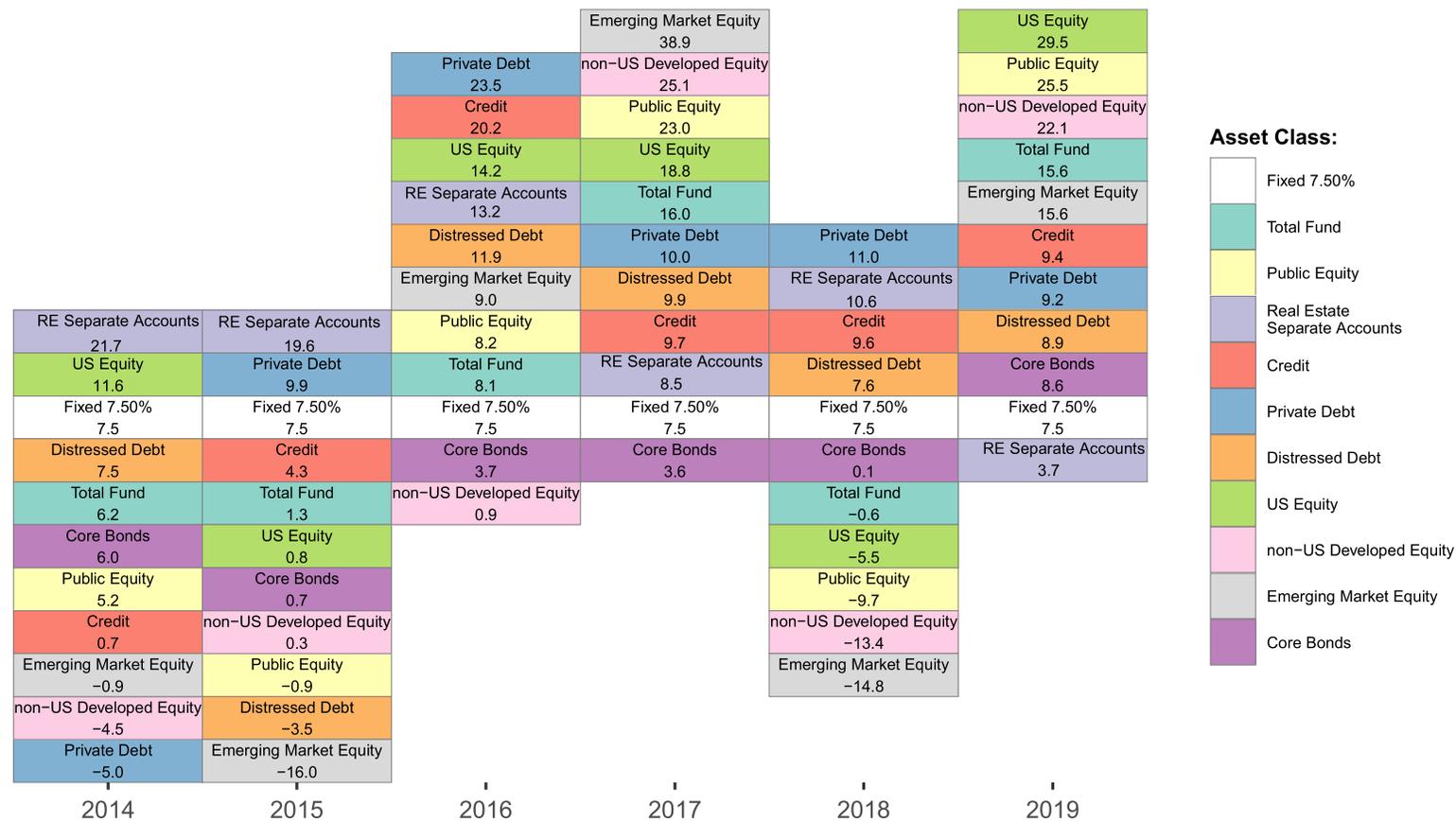


Total Fund Ten Year Rolling Percentile Rankings



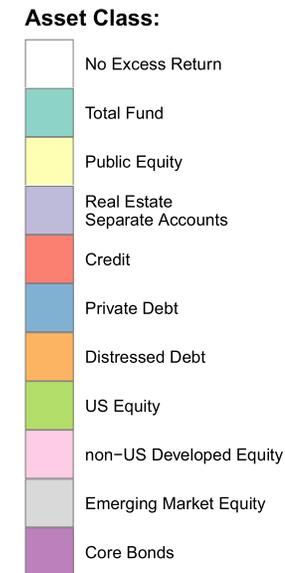
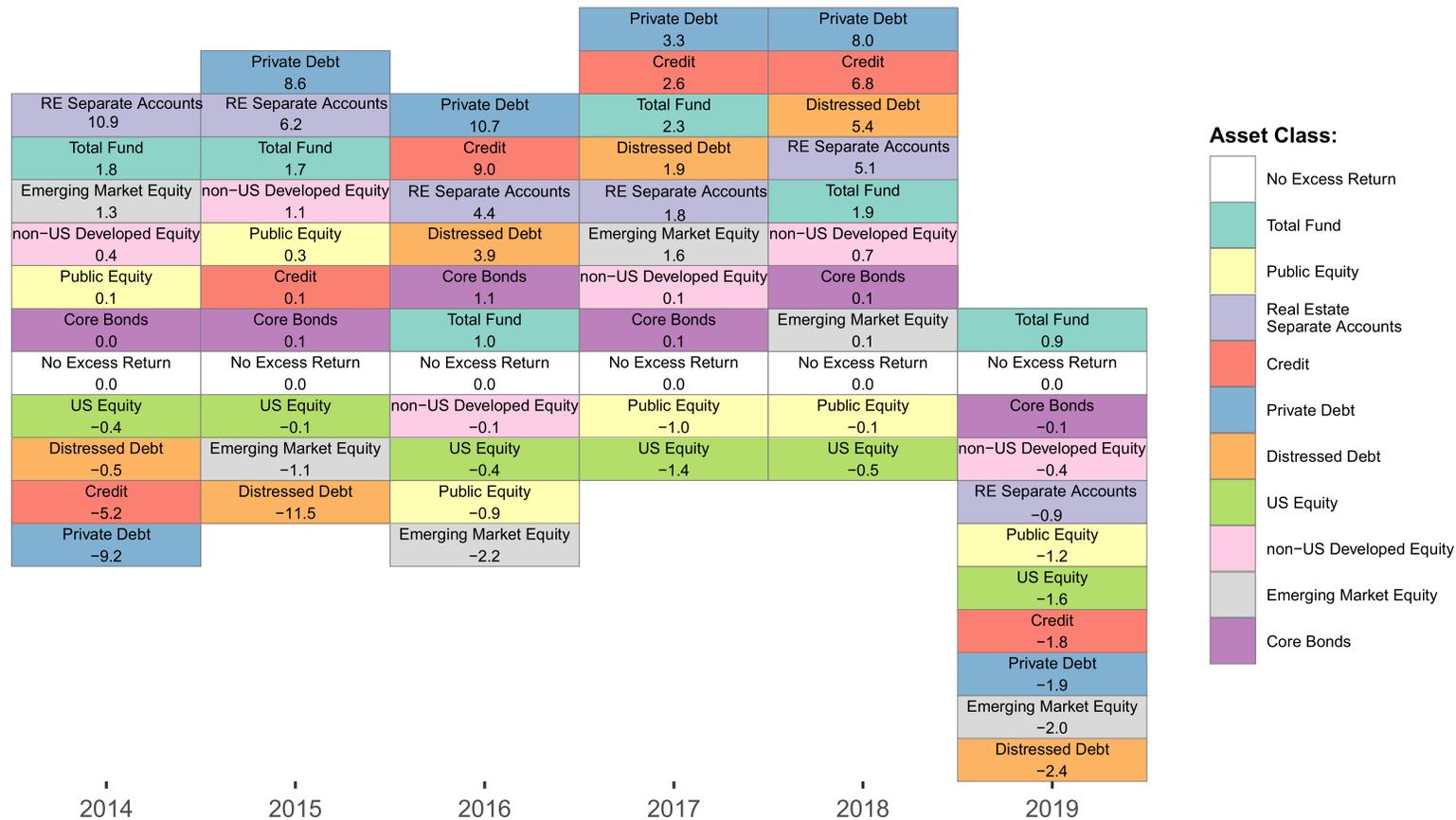
Annual returns for years ended 12/31/2019

ASRS Asset Class Net Returns 1-Year Returns ending December 31



Annual excess returns for years ended 12/31/2019

ASRS Asset Class Excess Returns 1-Year Returns ending December 31



ASRS Goals Met for the period ended 3/31/2020

ASRS INVESTMENT OBJECTIVES

Goal #4: Design, implement, and maintain an investment management program that maximizes rates of return for acceptable of levels of risk.

- a) Develop, approve and implement an Asset Allocation program that is expected to achieve a 20-year rolling average annual return at or above the actuarial assumed return
Goal met: Yes
- b) Achieve a total fund net return in the top quartile of the peer universe
Goal met: Yes
- c) Achieve a 1 year total fund net return greater than the Strategic Asset Allocation Benchmark
Goal met: No
- d) Achieve a 3-year total fund net return greater than the Strategic Asset Allocation Benchmark
Goal met: Yes
- e) Achieve 1 year asset class net returns greater than the respective Asset Allocation Benchmarks
Goal met: Partial
- f) Achieve 3 year asset class net returns greater than the respective Asset Allocation Benchmarks
Goal met: Partial
- g) Sufficient cash will be maintained to meet all payment requirements
Goal met: Yes

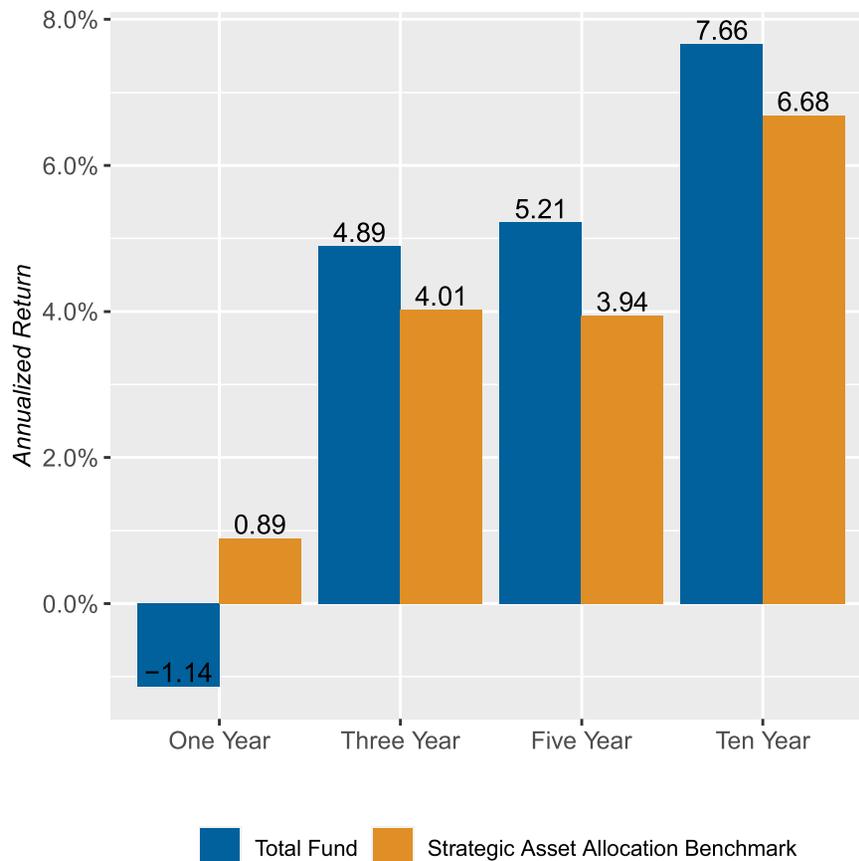


Source: ASRS Strategic Plan, August 2018

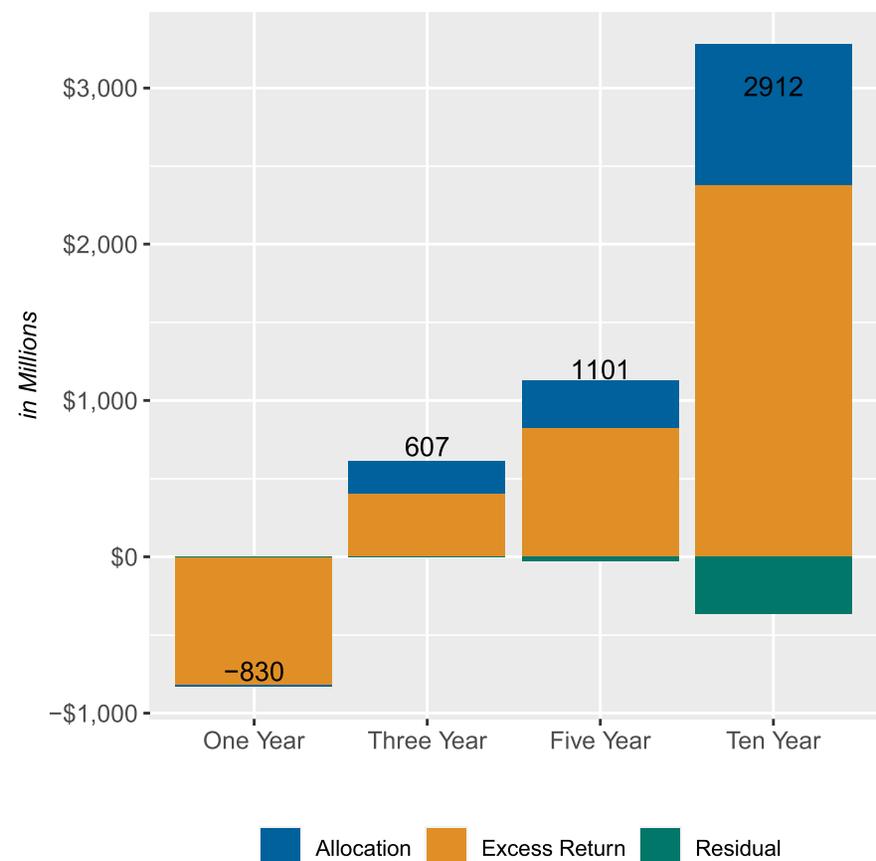
Total Fund

Trailing Returns & Dollar Value Add for the period ended 3/31/2020

Total Fund and Strategic Asset Allocation Benchmark
 Trailing Period Returns



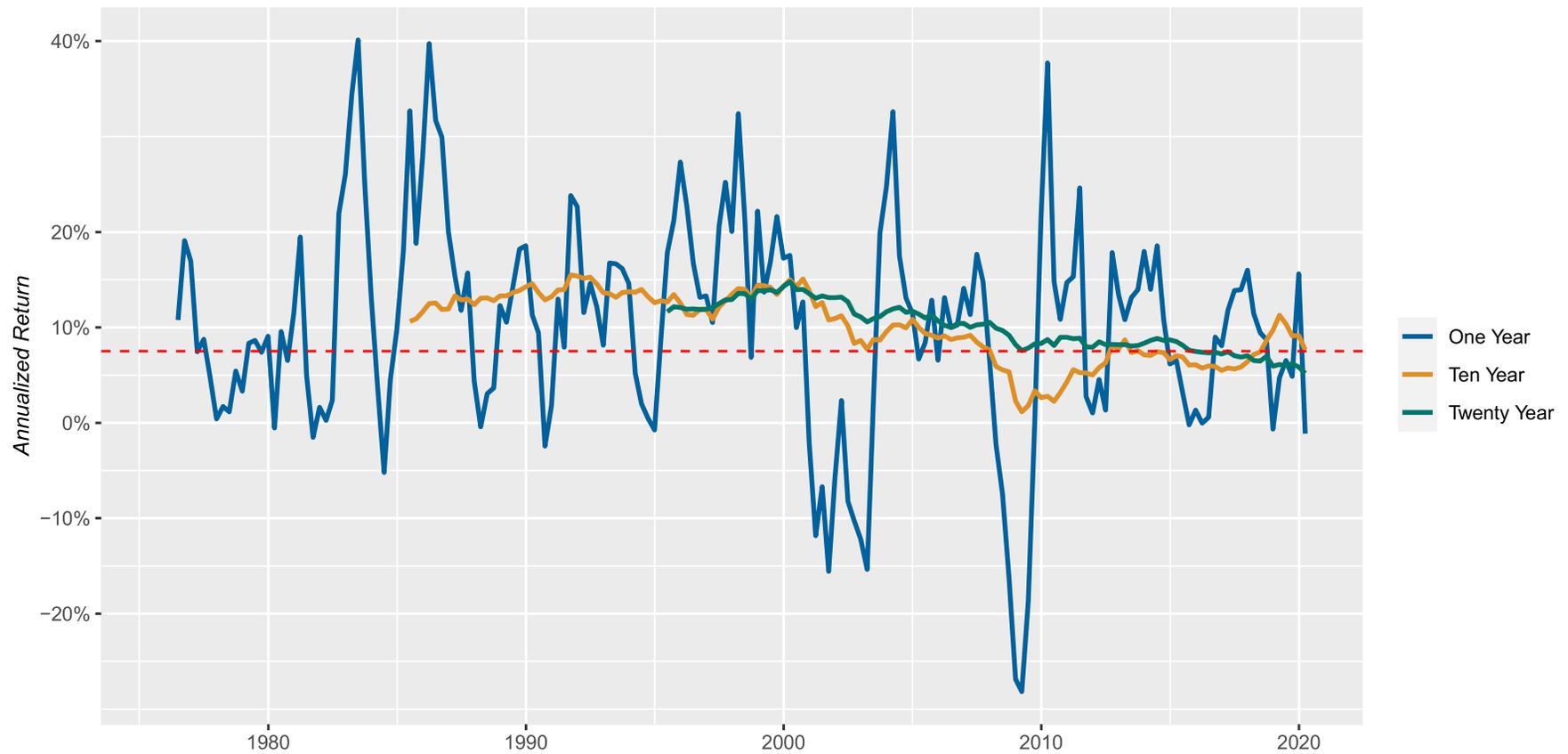
Total Fund Dollar Value Add
 Relative to Strategic Asset Allocation Benchmark



Total Fund Returns for the period ended 3/31/2020

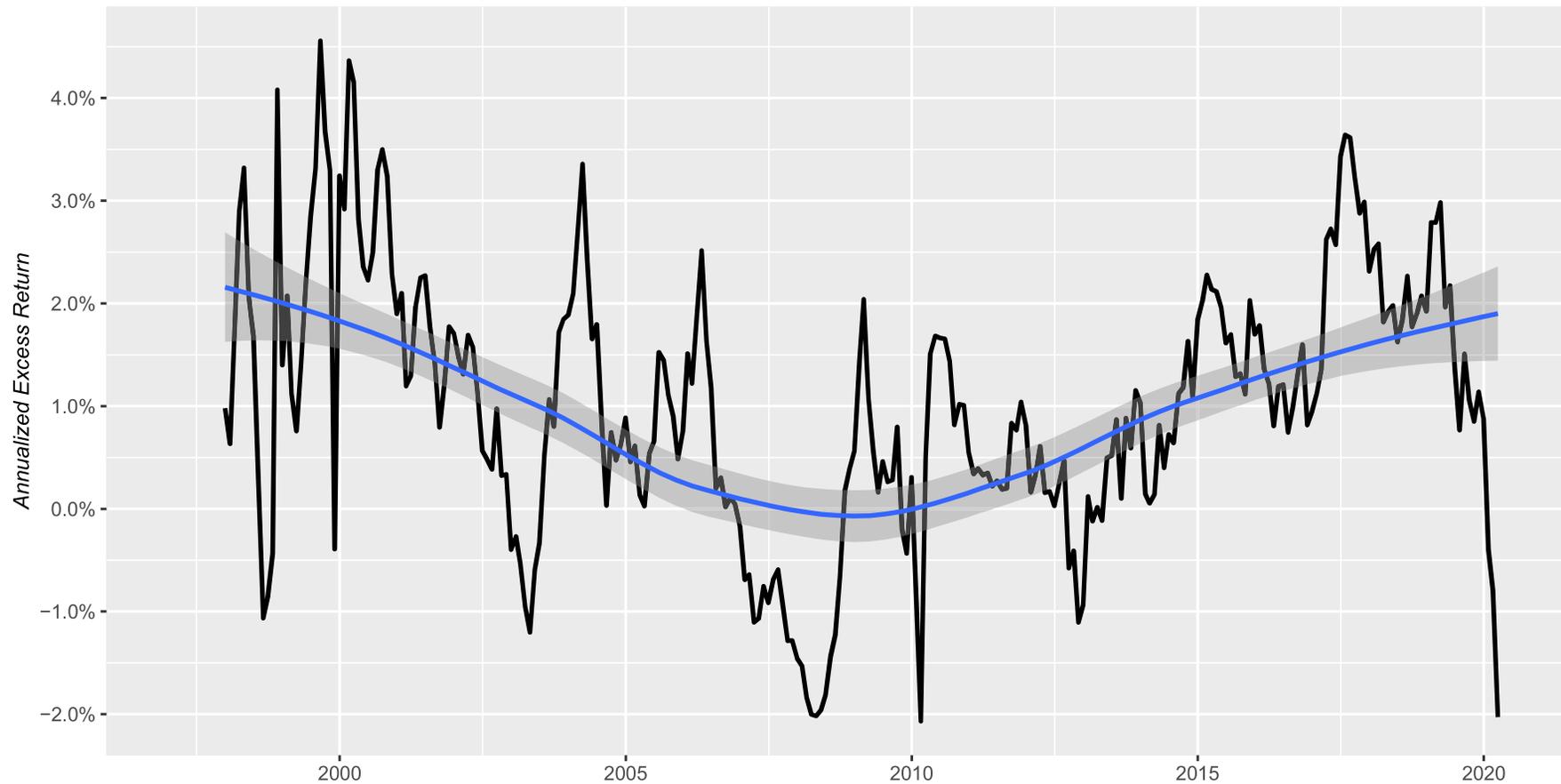
Total Fund Rolling Returns

Trailing Period Returns



Total Fund Rolling 1 Year Excess Return for the period ended 3/31/2020

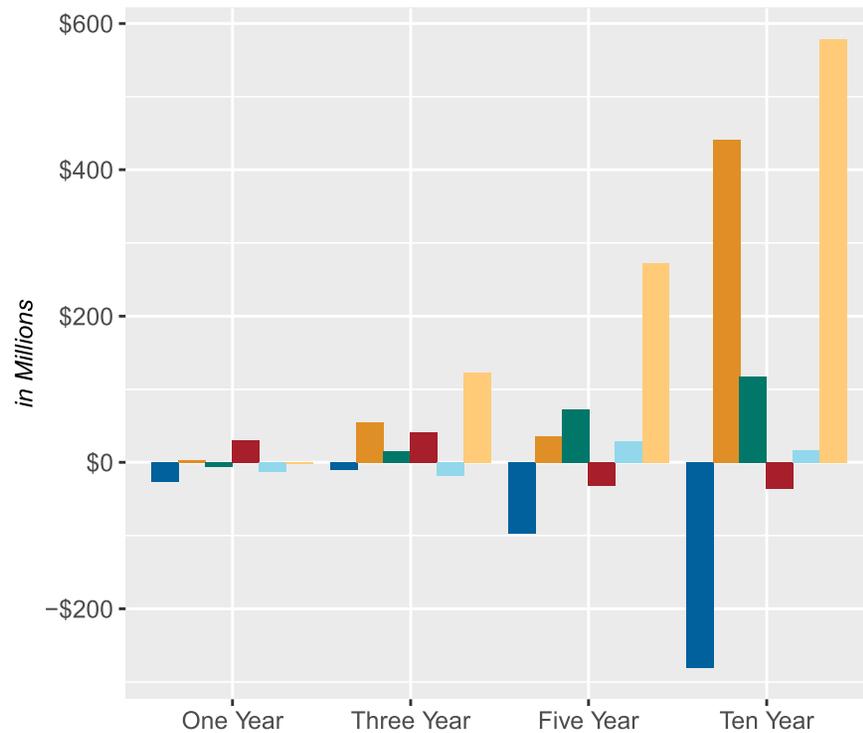
Total Fund Rolling 1 Year Excess



Allocation Effect for the period ended 3/31/2020

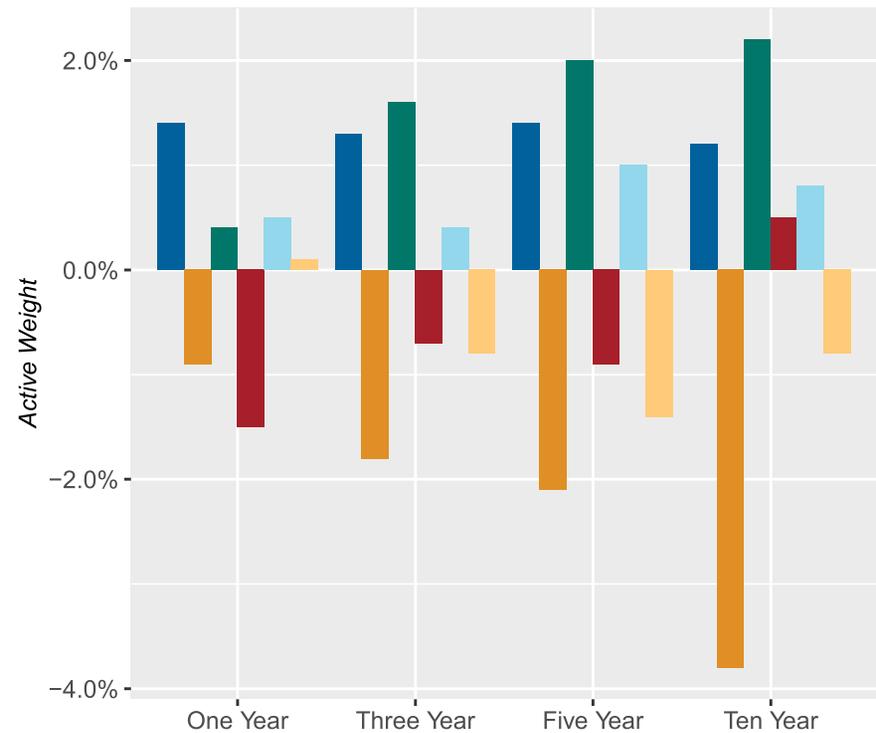
Allocation Effect by Asset Class

Relative to Strategic Asset Allocation Benchmark



Asset Class Average Active Weights

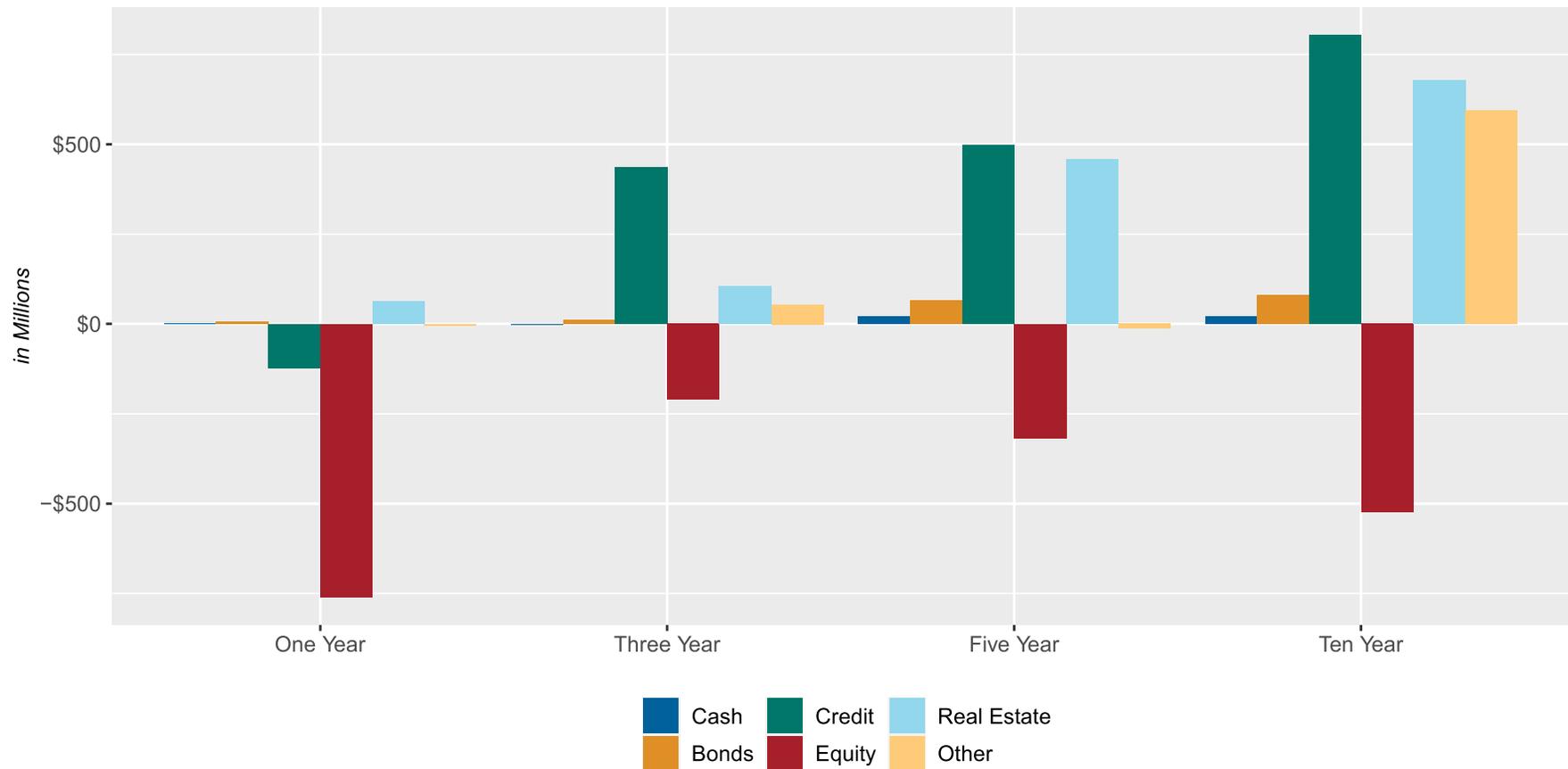
Relative to Strategic Asset Allocation Policy



Excess Return by Asset Class for the period ended 3/31/2020

Excess Return by Asset Class

Relative to Strategic Asset Allocation Benchmark



Equity

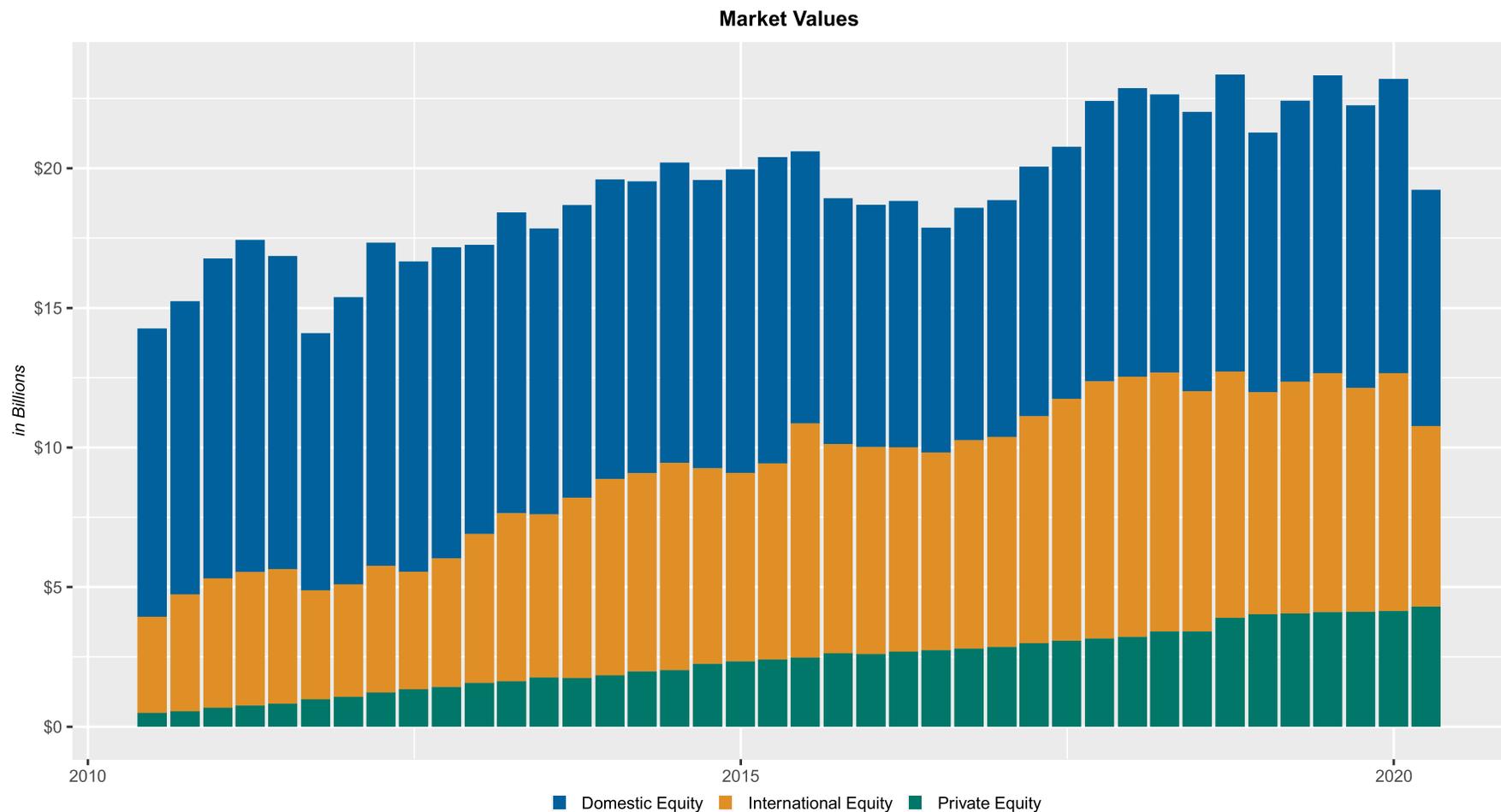
Total Equity

Total Equities for the period ended 3/31/2020

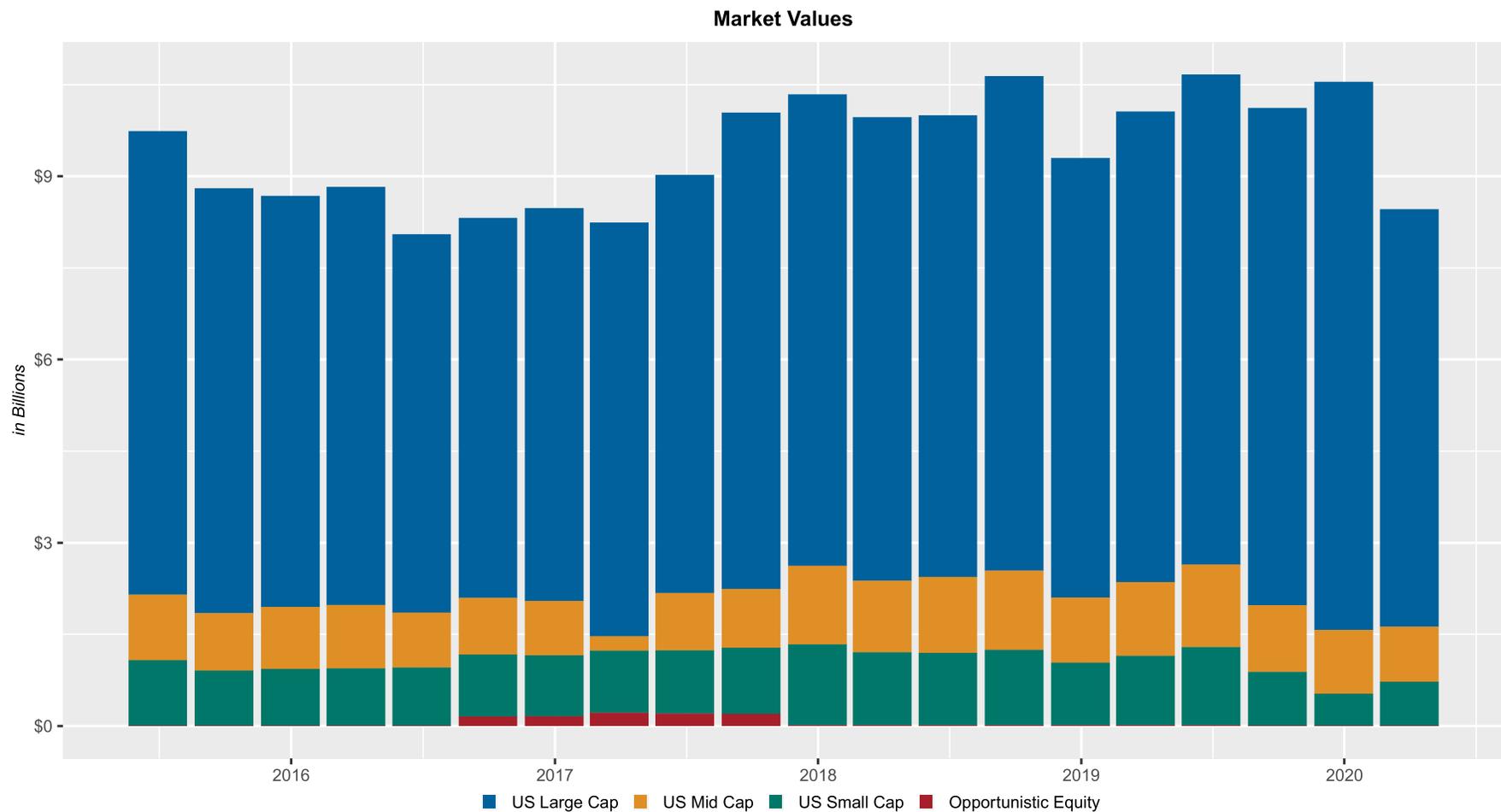
Returns for the period ended 3/31/2020

Composite	Quarter	One Year	Three Year	Five Year
Equity	-18.72	-9.11	2.44	3.90
Benchmark	-16.95	-5.92	2.84	4.17
Excess	-1.77	-3.19	-0.40	-0.26
Public Equity	-23.37	-13.84	0.10	2.19
Benchmark	-22.37	-12.45	1.13	2.93
Excess	-0.99	-1.39	-1.03	-0.74
US Equity	-22.97	-11.74	2.15	4.79
Benchmark	-20.94	-9.18	4.00	6.04
Excess	-2.03	-2.55	-1.84	-1.25
International Equity	-23.88	-16.39	-2.22	-0.66
Benchmark	-24.11	-16.32	-2.24	-0.62
Excess	0.23	-0.07	0.02	-0.04
Private Equity	0.70	10.58	11.86	11.53
Index IRR	9.12	26.78	9.10	8.65
Excess	-8.42	-16.20	2.75	2.88

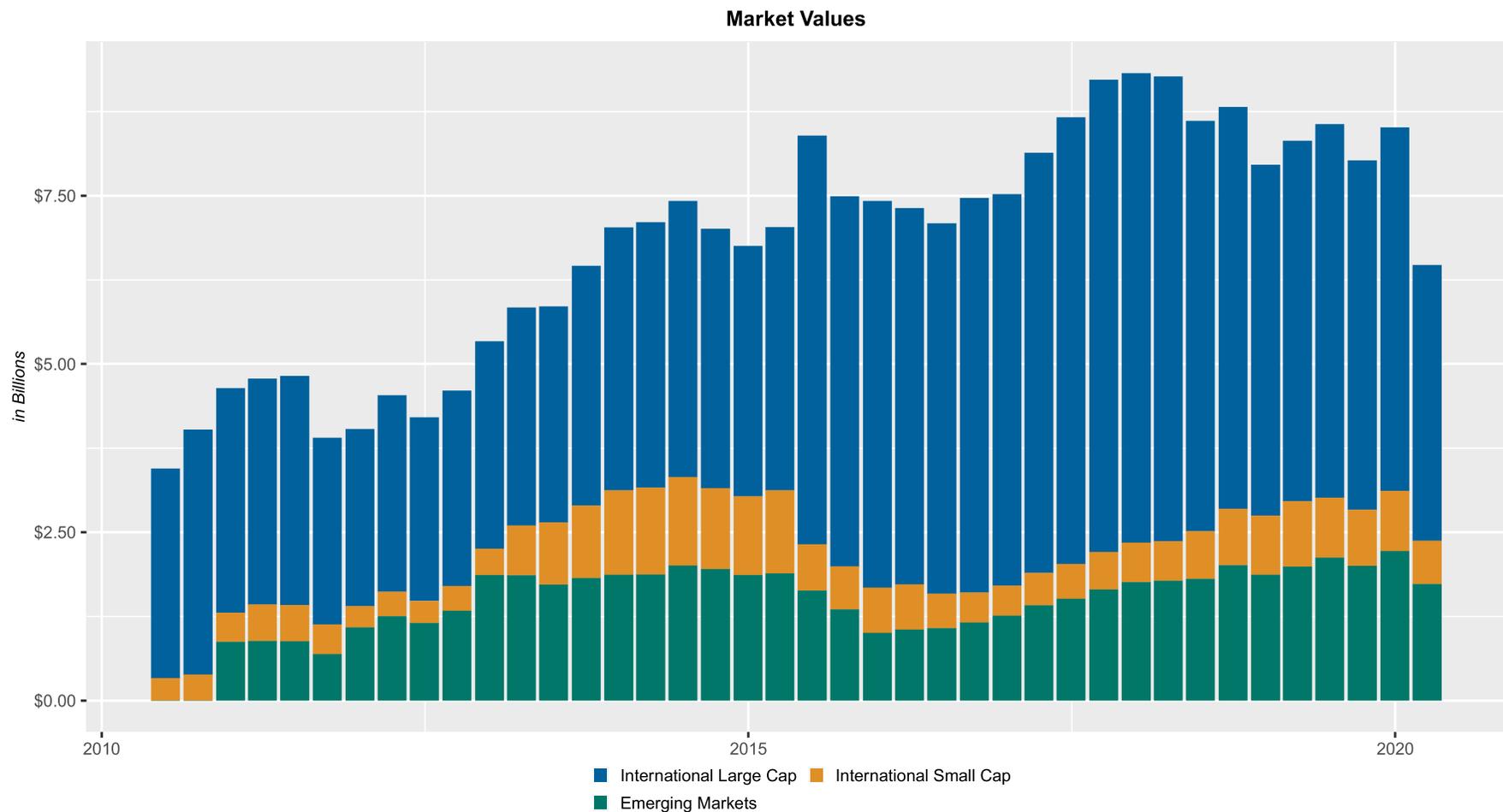
Total Equity Market Values for the period ended 3/31/2020



Domestic Equity Market Values for period ended 3/31/2020



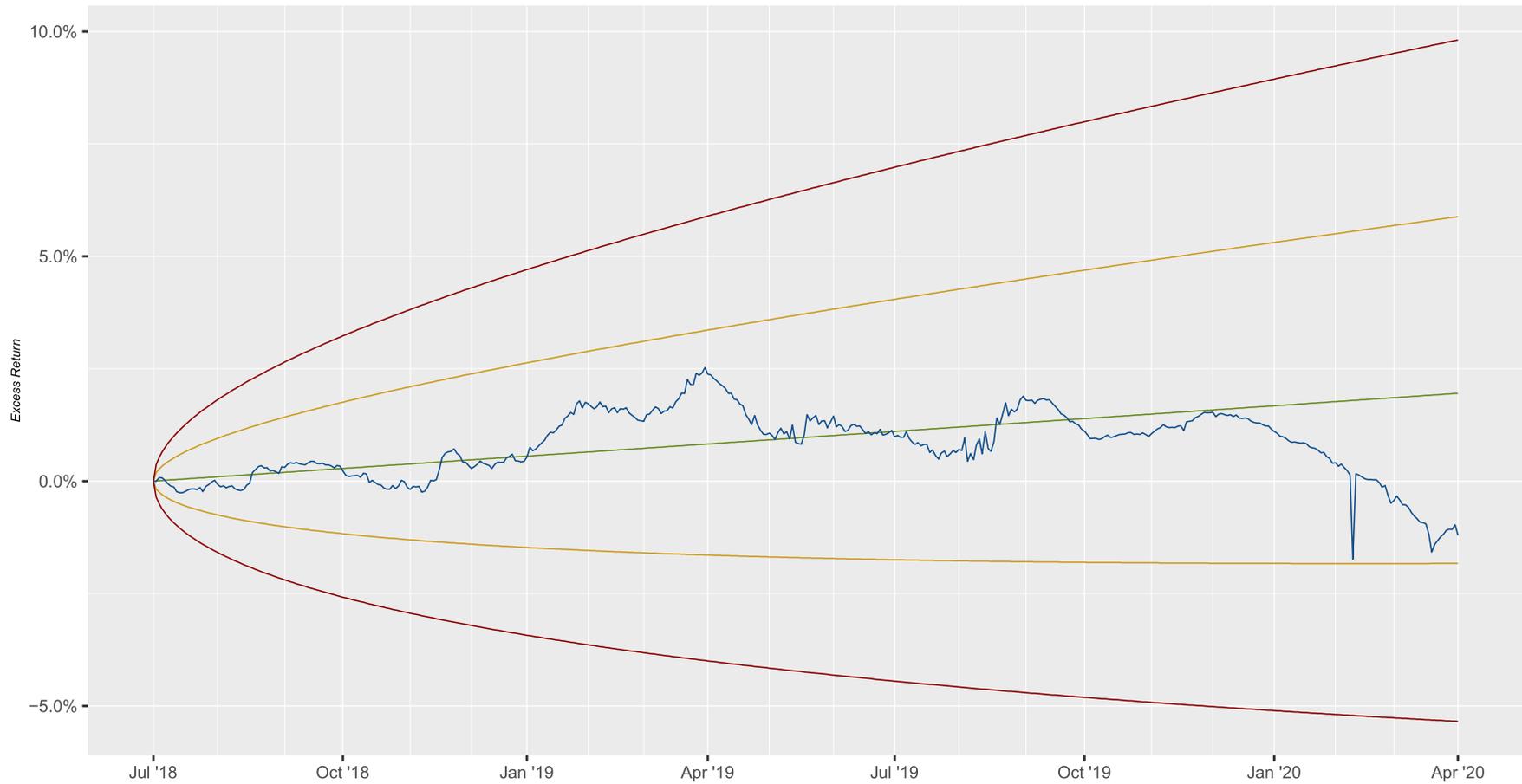
International Equity Market Values for period ended 3/31/2020



Total Equity Performance since July 2018

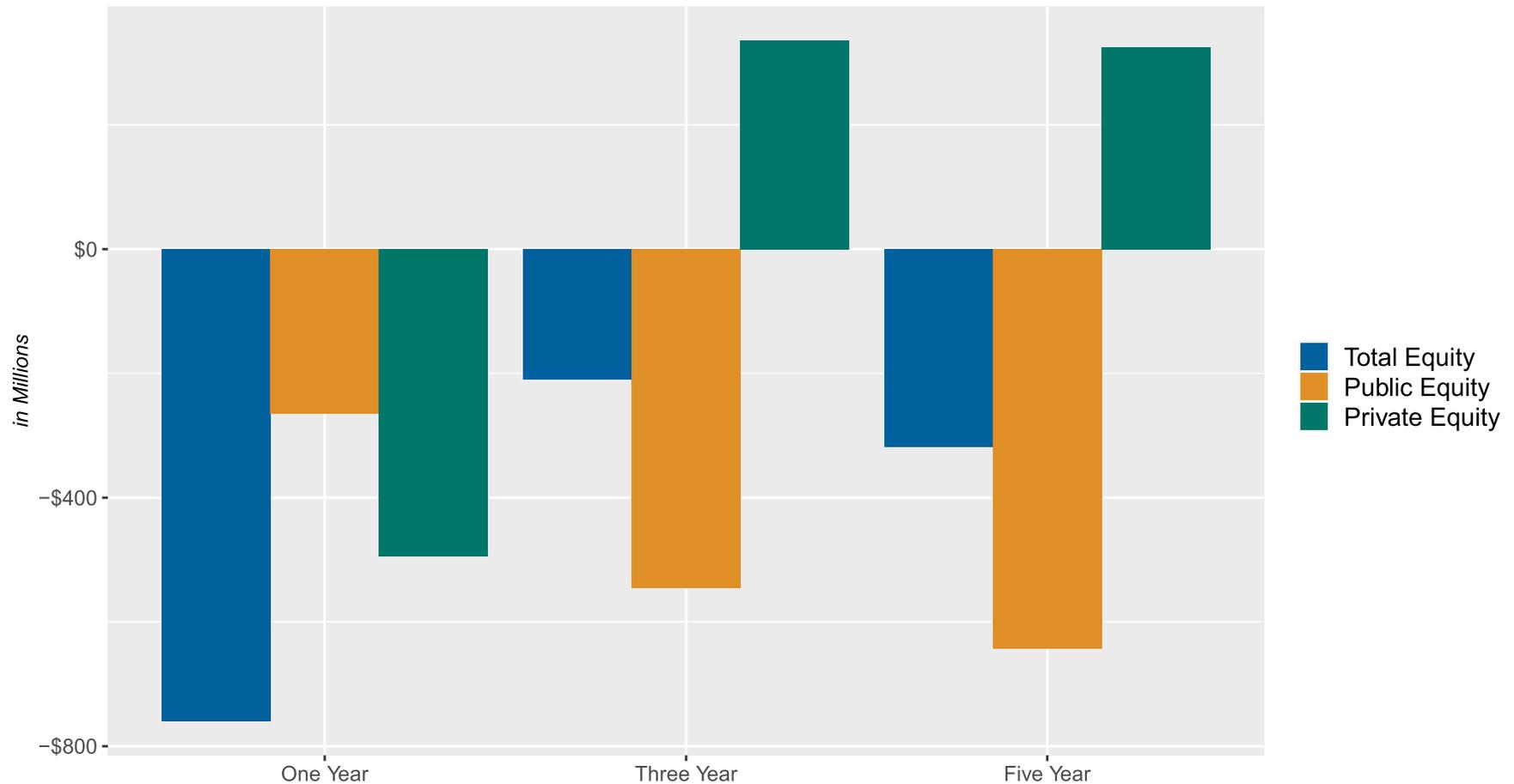
Total Equity Portfolio Performance versus Expectations

110 Basis Points Expected Excess Return with 290 Basis Points Tracking Error

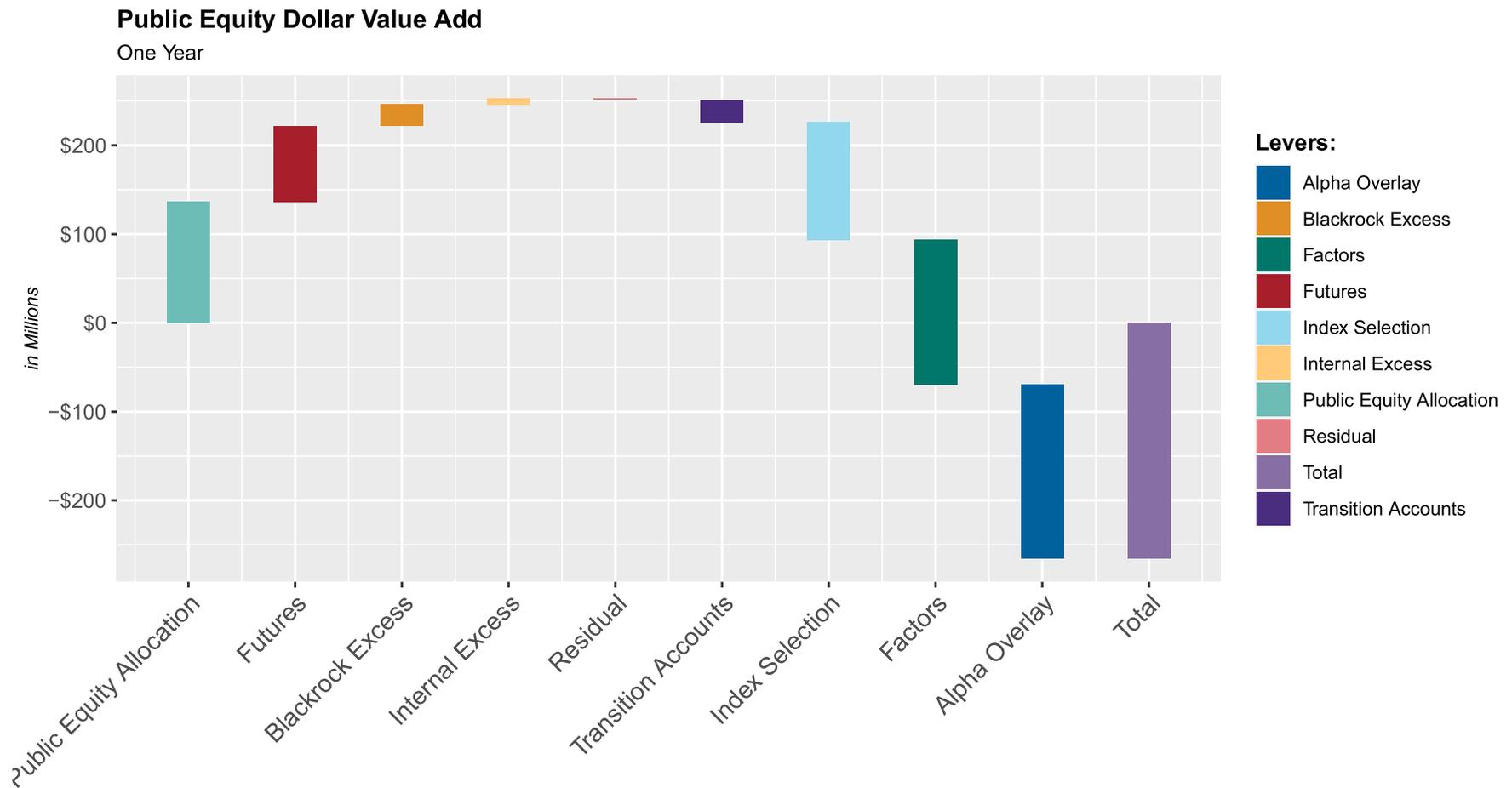


Public Equity

Total Equity Returns and Dollar Value Add for the period ended 3/31/2020



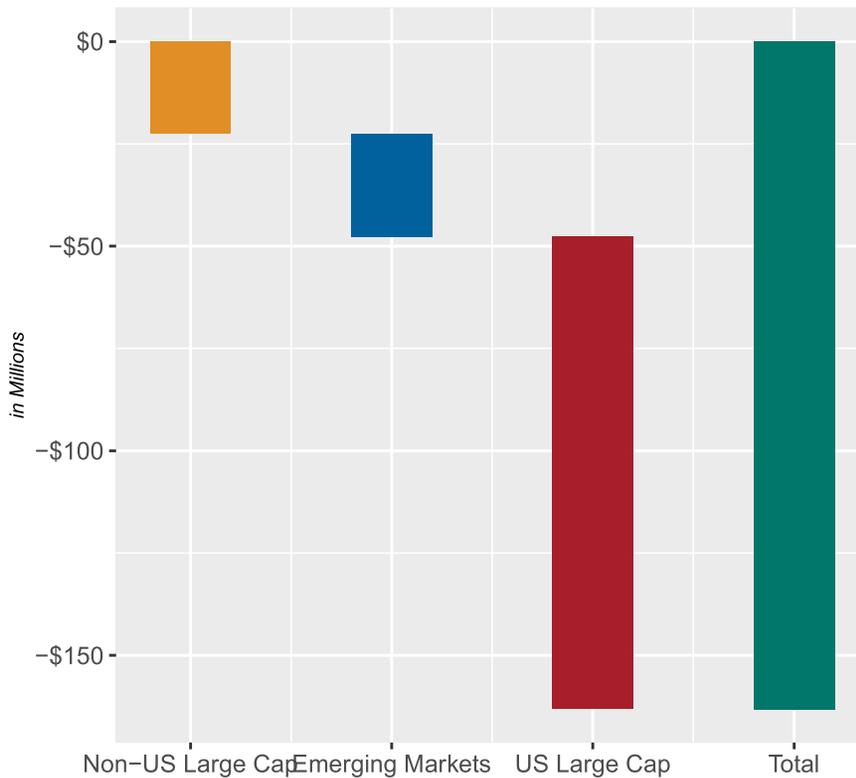
Public Equity “Levers” for the period ended 3/31/2020



Factor Portfolios for the period ended 3/31/2020

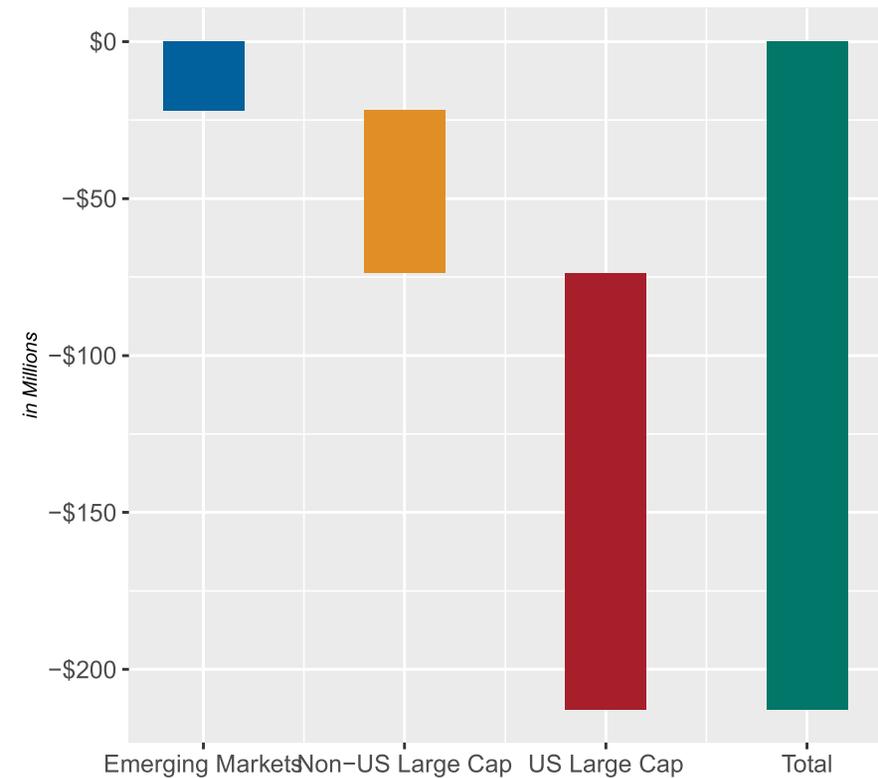
Factor Portfolio Dollar Value Add

Trailing 1 Year



Factor Portfolio Dollar Value Add

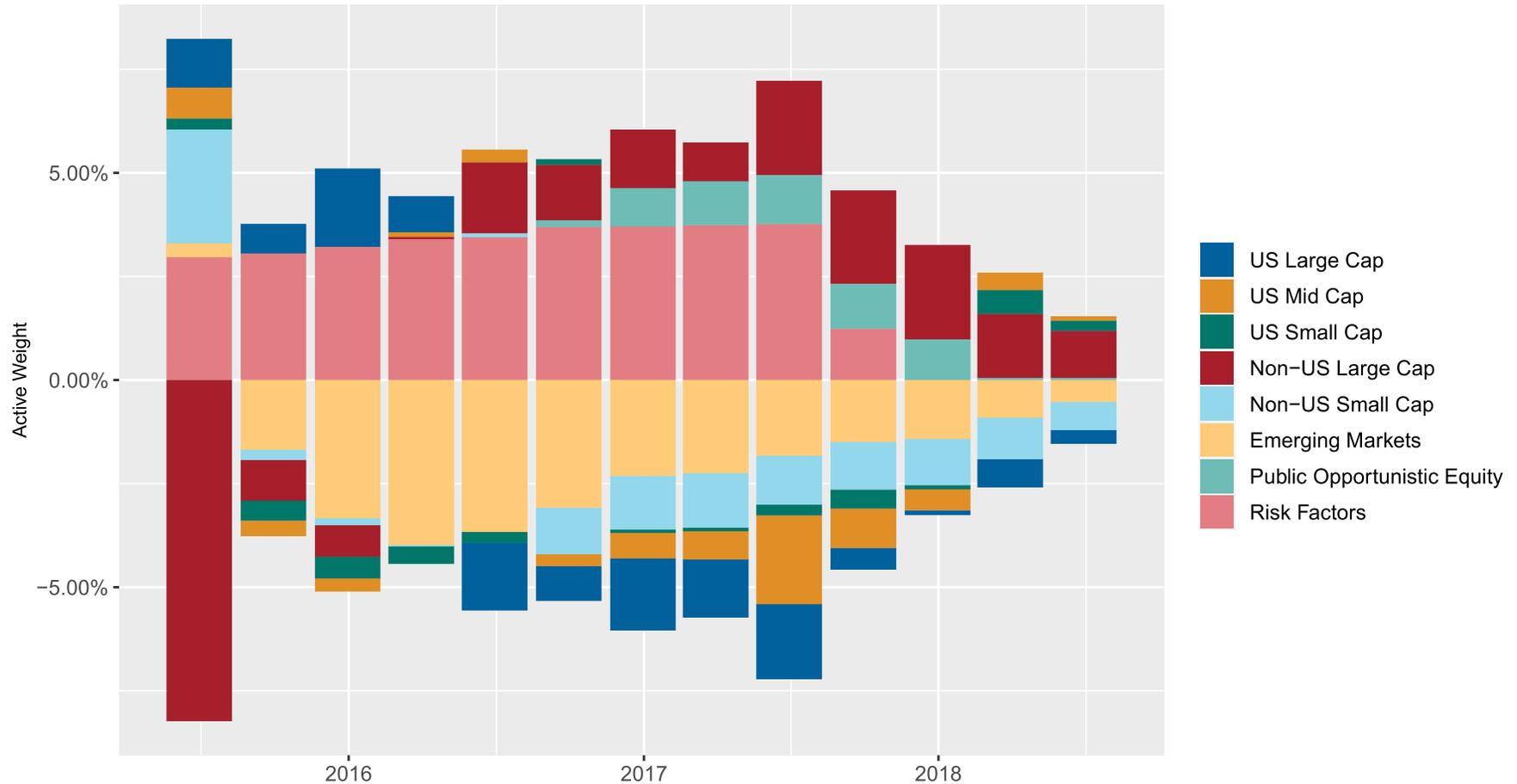
Trailing 5 Years



■ Emerging Markets
 ■ Non-US Large Cap
 ■ Total
 ■ US Large Cap

Public Equity Active Weights for the period ended 3/31/2020

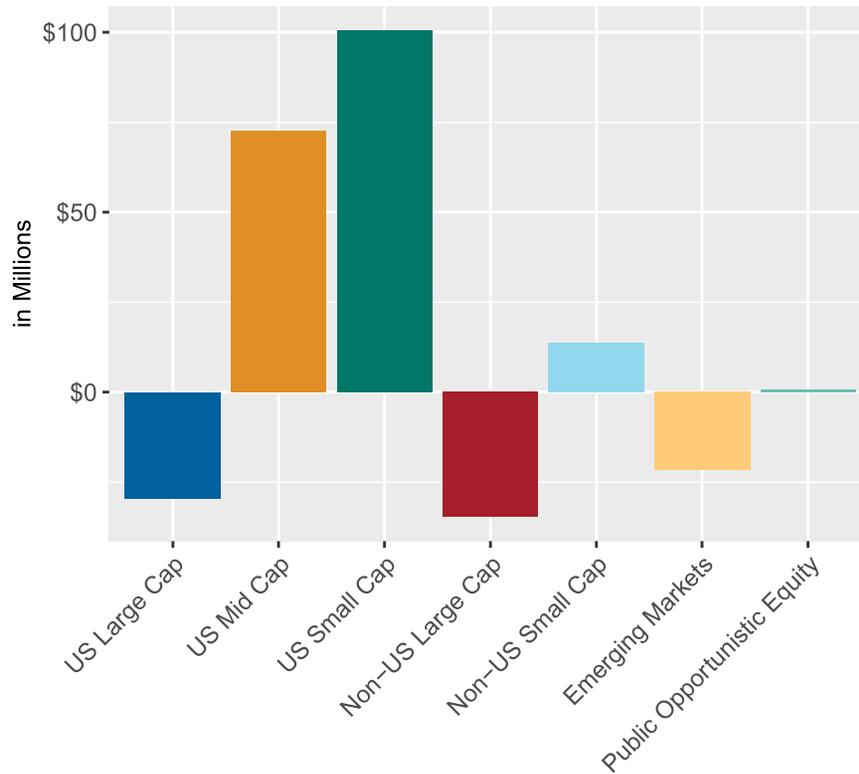
Average Quarterly Active Weight



Public Equity Allocation for the period ended 3/31/2020

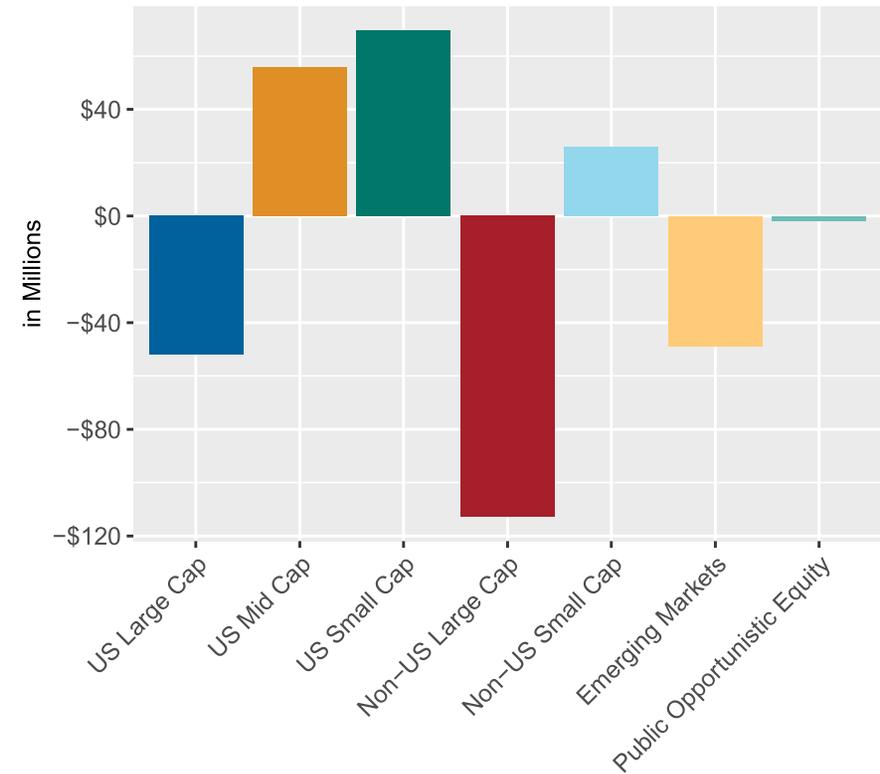
Allocation Effect by Sub Asset Classes

Relative to Target Weight – One Year



Allocation Effect by Sub Asset Classes

Relative to Target Weight – Five Year

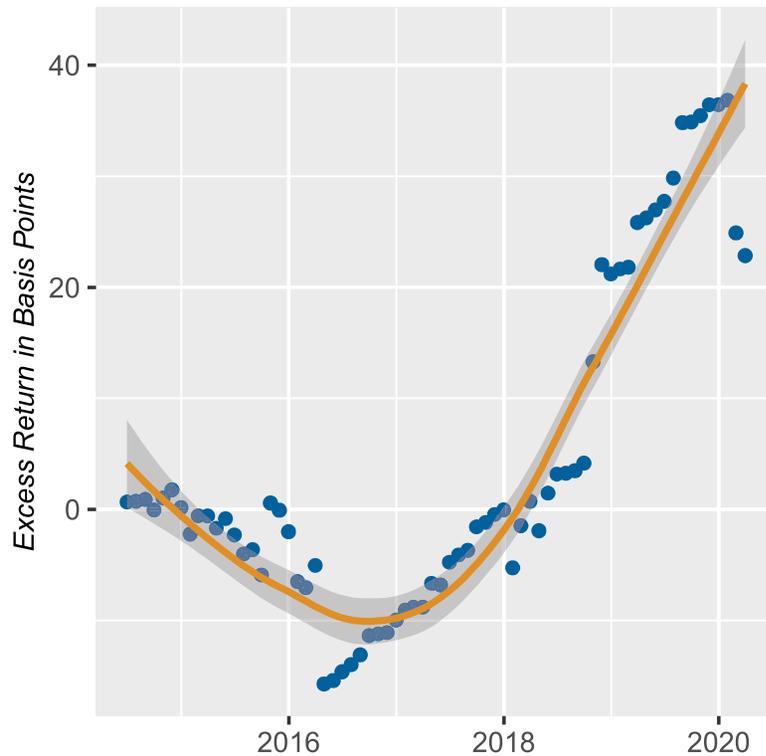


■ US Large Cap
 ■ US Small Cap
 ■ Non-US Small Cap
 ■ Public Opportunistic Equity
■ US Mid Cap
 ■ Non-US Large Cap
■ Emerging Markets

Internally Managed Portfolios Performance for the period ended 3/31/2020

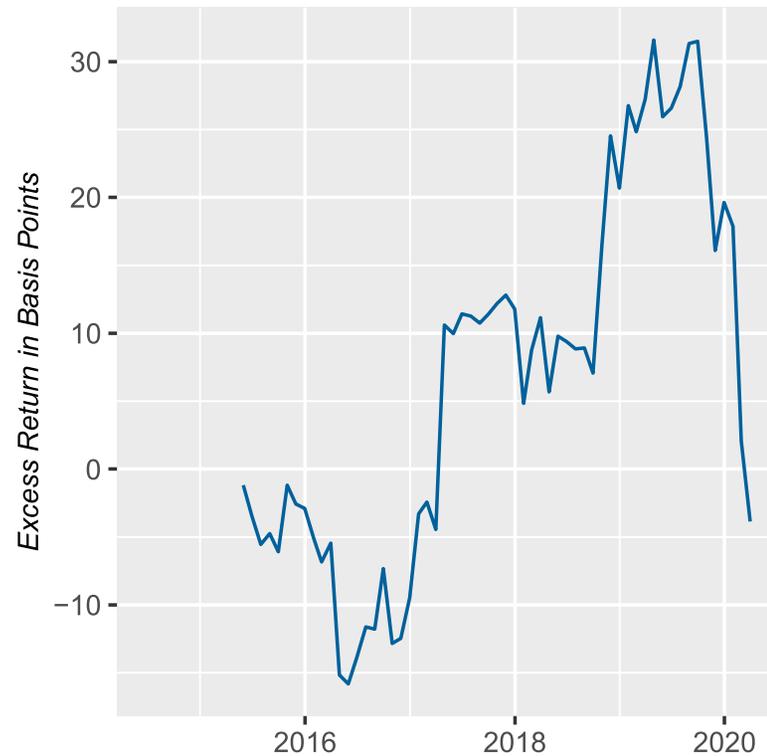
Internal Portfolio Composite

Monthly Cumulative Excess Performance



Internal Portfolio Composite

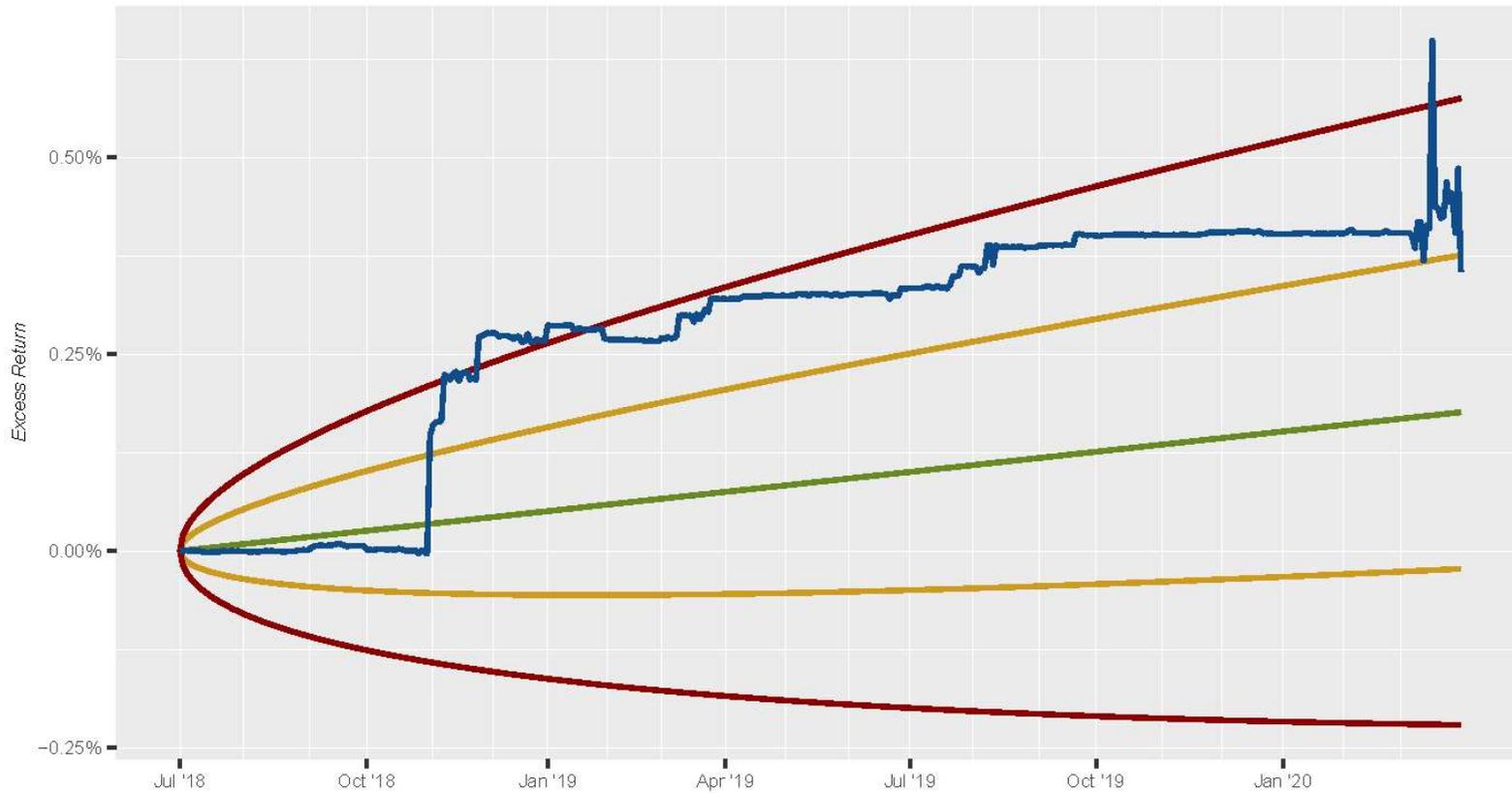
Rolling 1 Year Excess Performance



US Large Cap: Performance for the period ended 3/31/2020

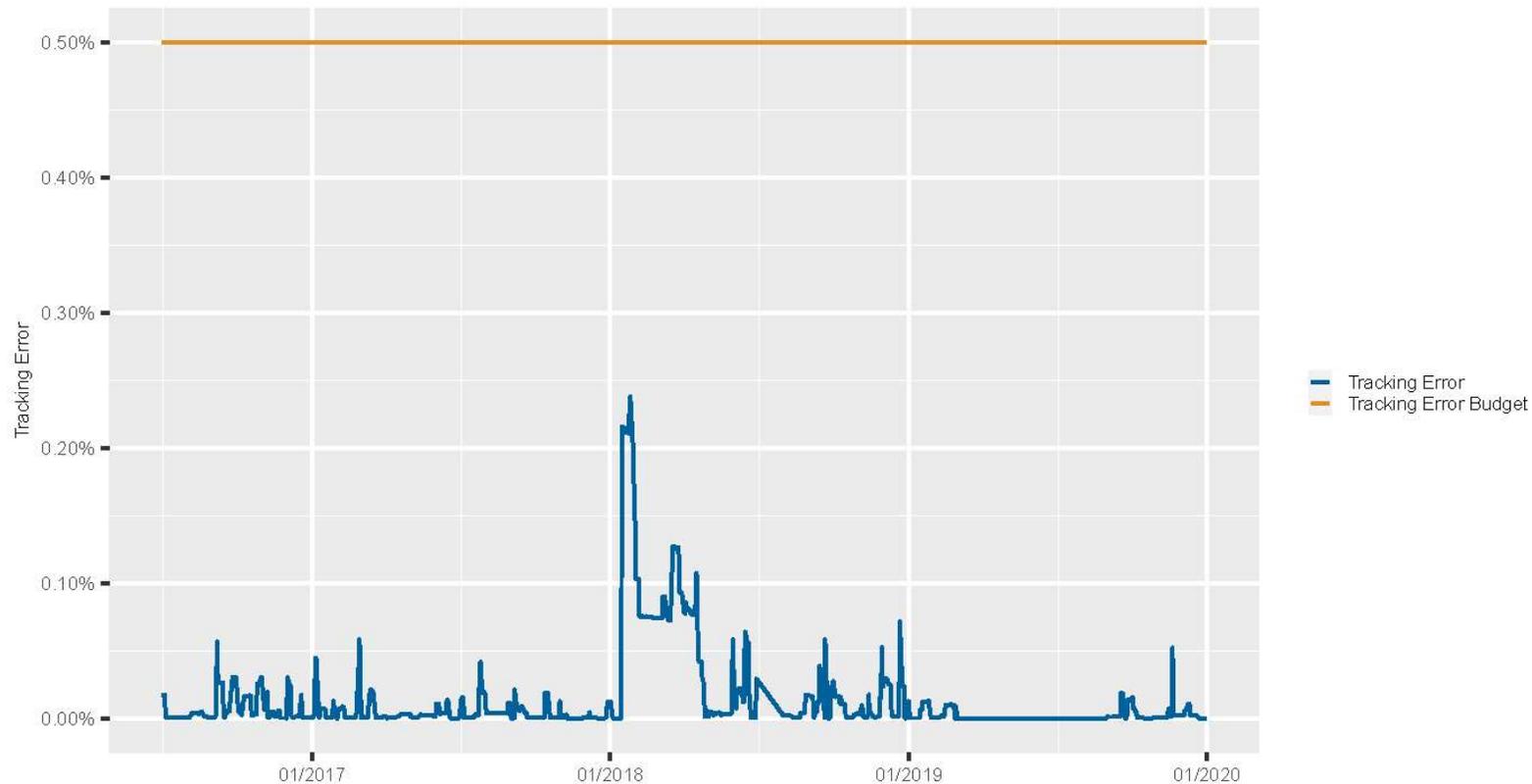
Internal US Large Cap Portfolio Performance versus Expectations

10.0 Basis Points Expected Excess Return with 15.0 Basis Points Tracking Error



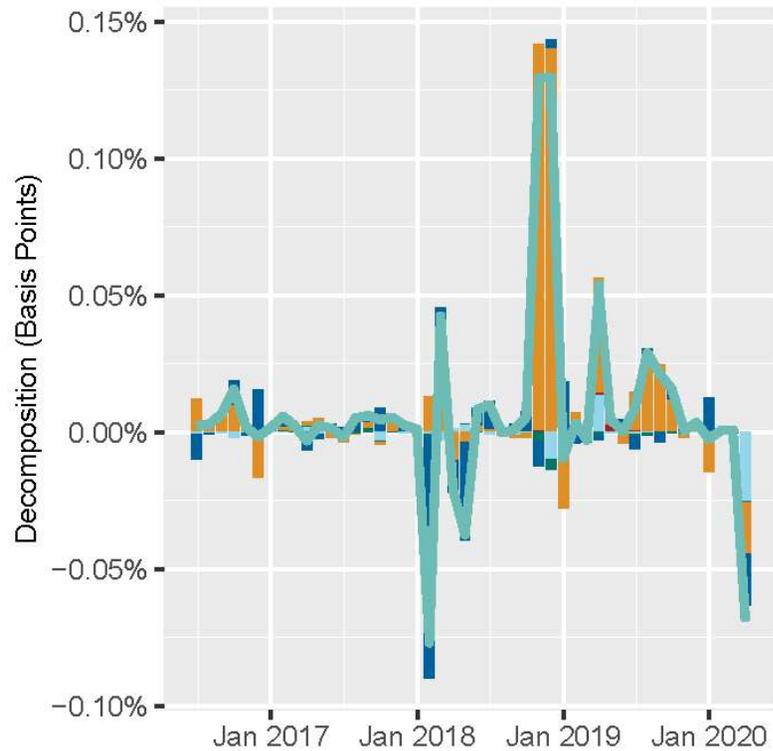
US Large Cap: Tracking Error for the period ended 3/31/2020

Internal US Large Cap Portfolio Tracking Error



US Large Cap: Net Asset Value Decompositions for the period ended 3/31/2020

Decomposition by Period



Cumulative Decomposition

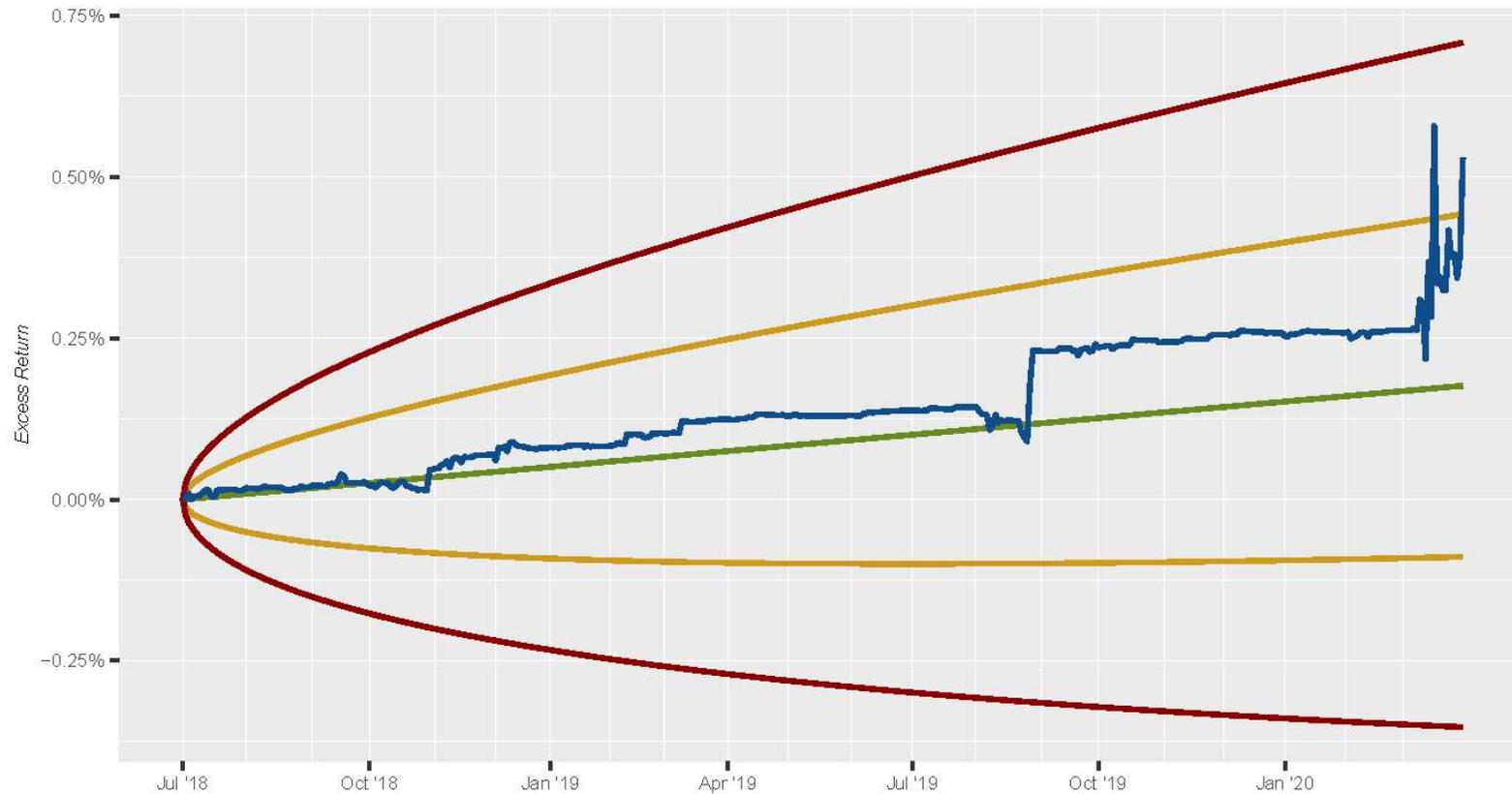


■ Active Positioning
 ■ Cash and Futures Impact
 ■ Other
 ■ Securities Lending
 ■ Trade Variance

US Mid Cap: Performance for the period ended 3/31/2020

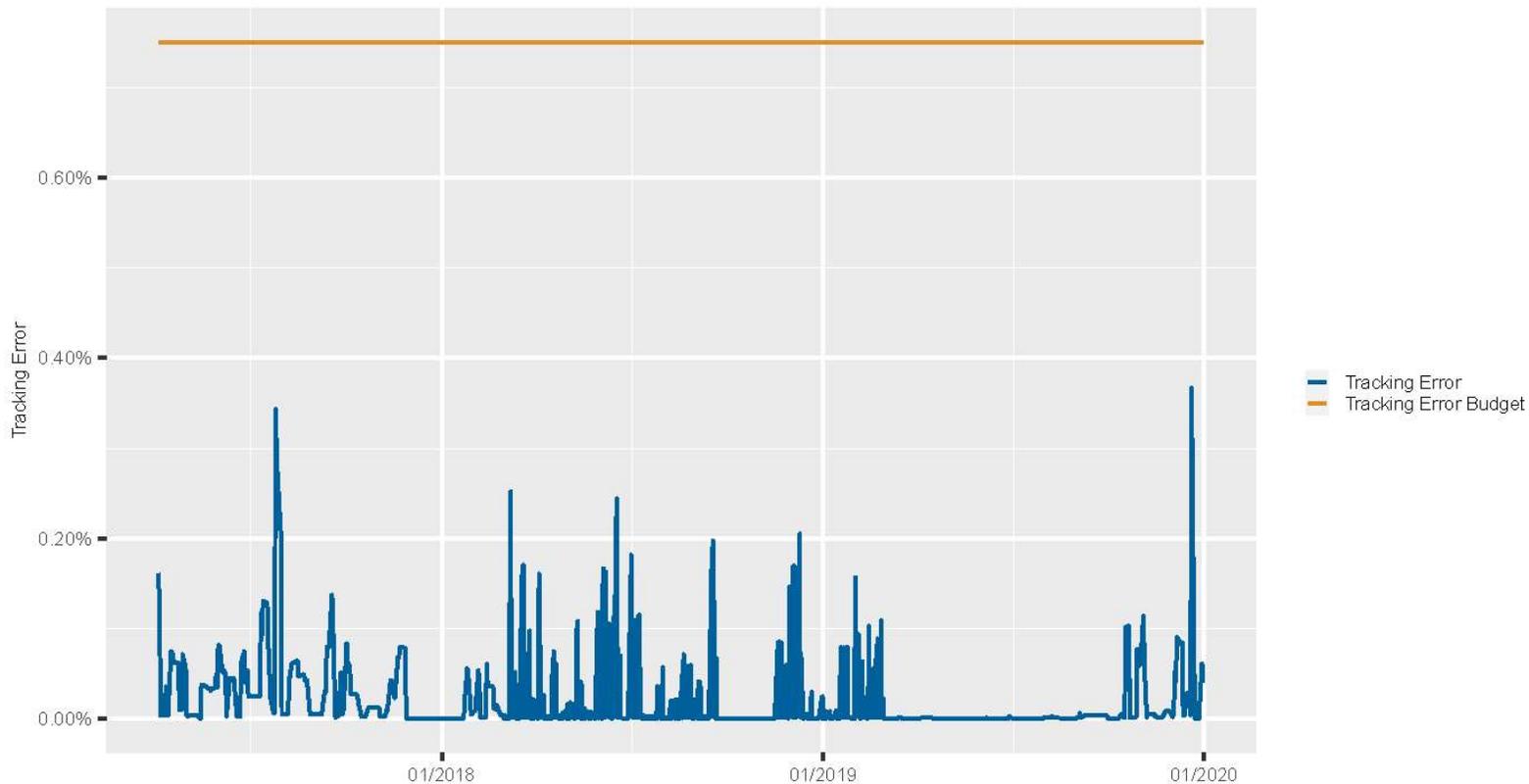
Internal US Mid Cap Portfolio Performance versus Expectations

10.0 Basis Points Expected Excess Return with 20.0 Basis Points Tracking Error



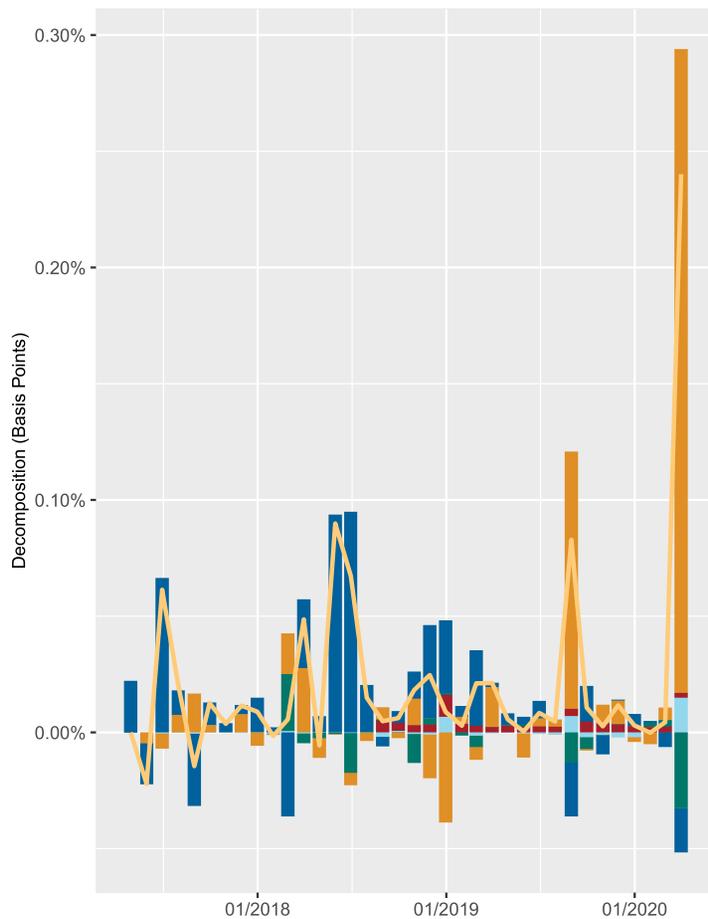
US Mid Cap: Tracking Error for the period ended 3/31/2020

Internal US Mid Cap Portfolio Tracking Error

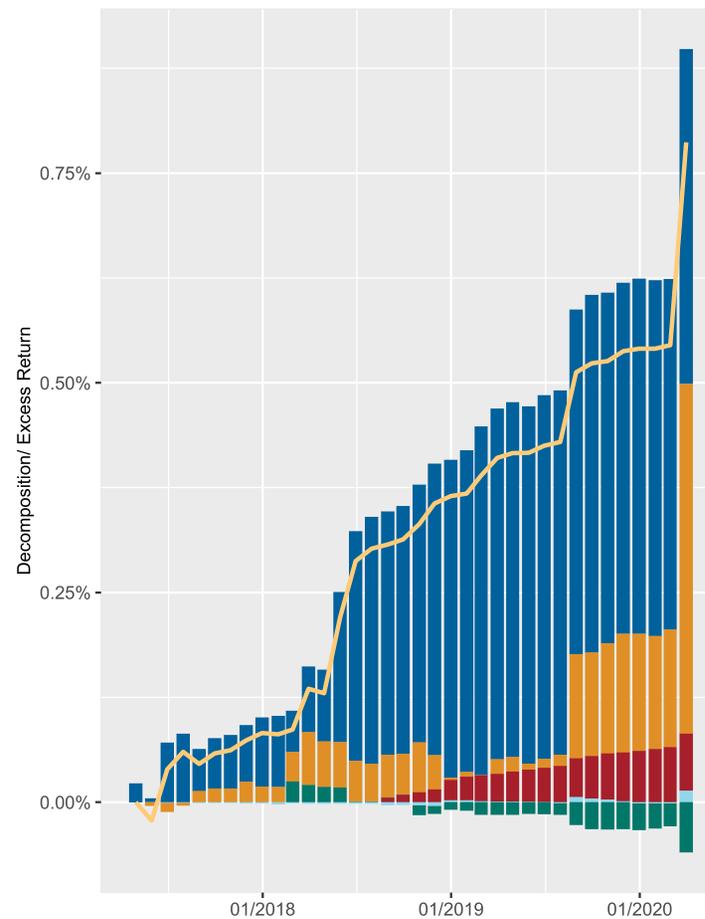


US Mid Cap: Net Asset Value Decompositions for the period ended 3/31/2020

Decomposition by Period



Cumulative Decomposition

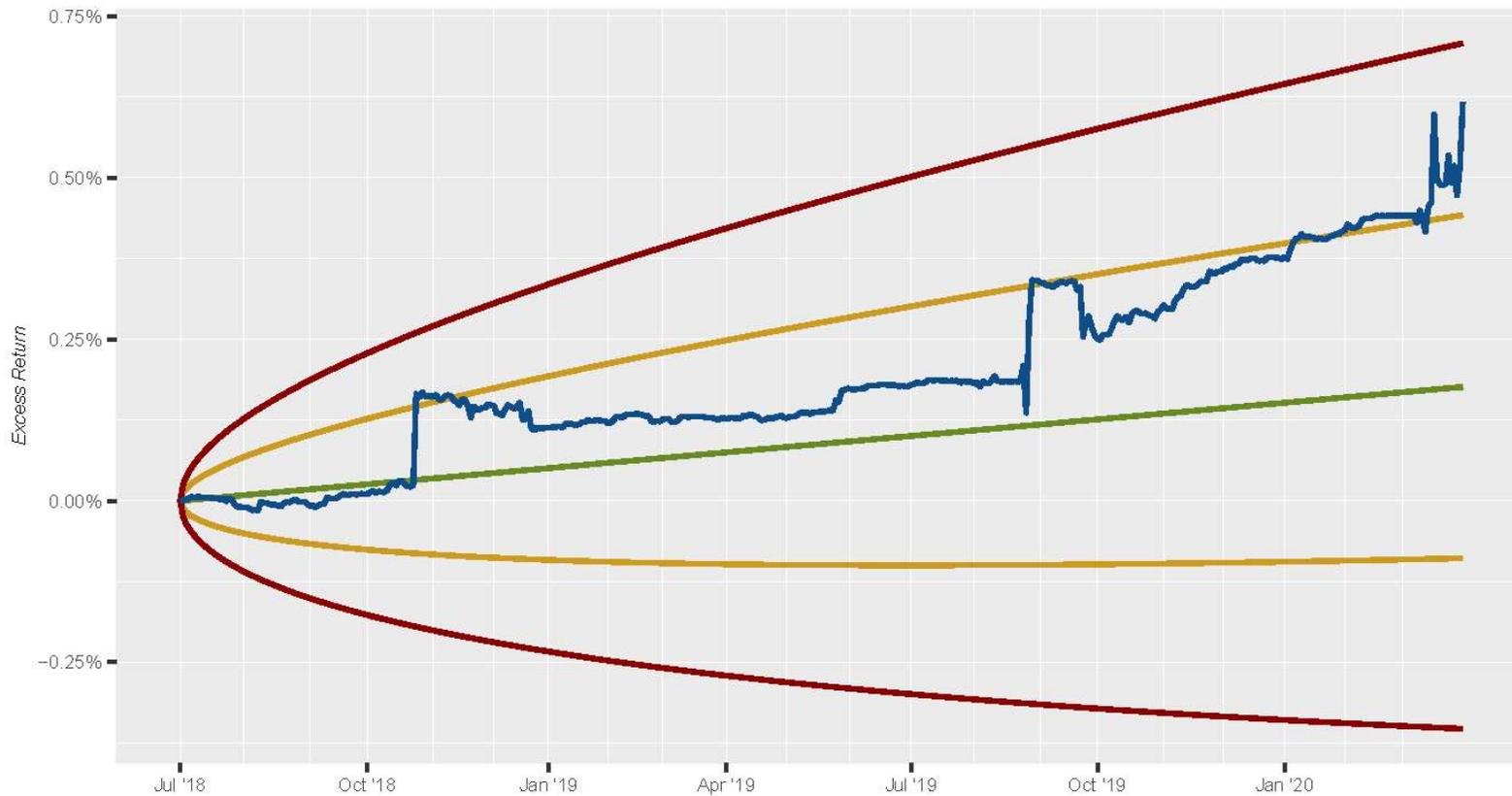


■ Active Positioning
 ■ Cash and Futures Impact
 ■ Trade Variance
 ■ Securities Lending
 ■ Other

US Small Cap: Performance & Risk Summary ended 3/31/2020

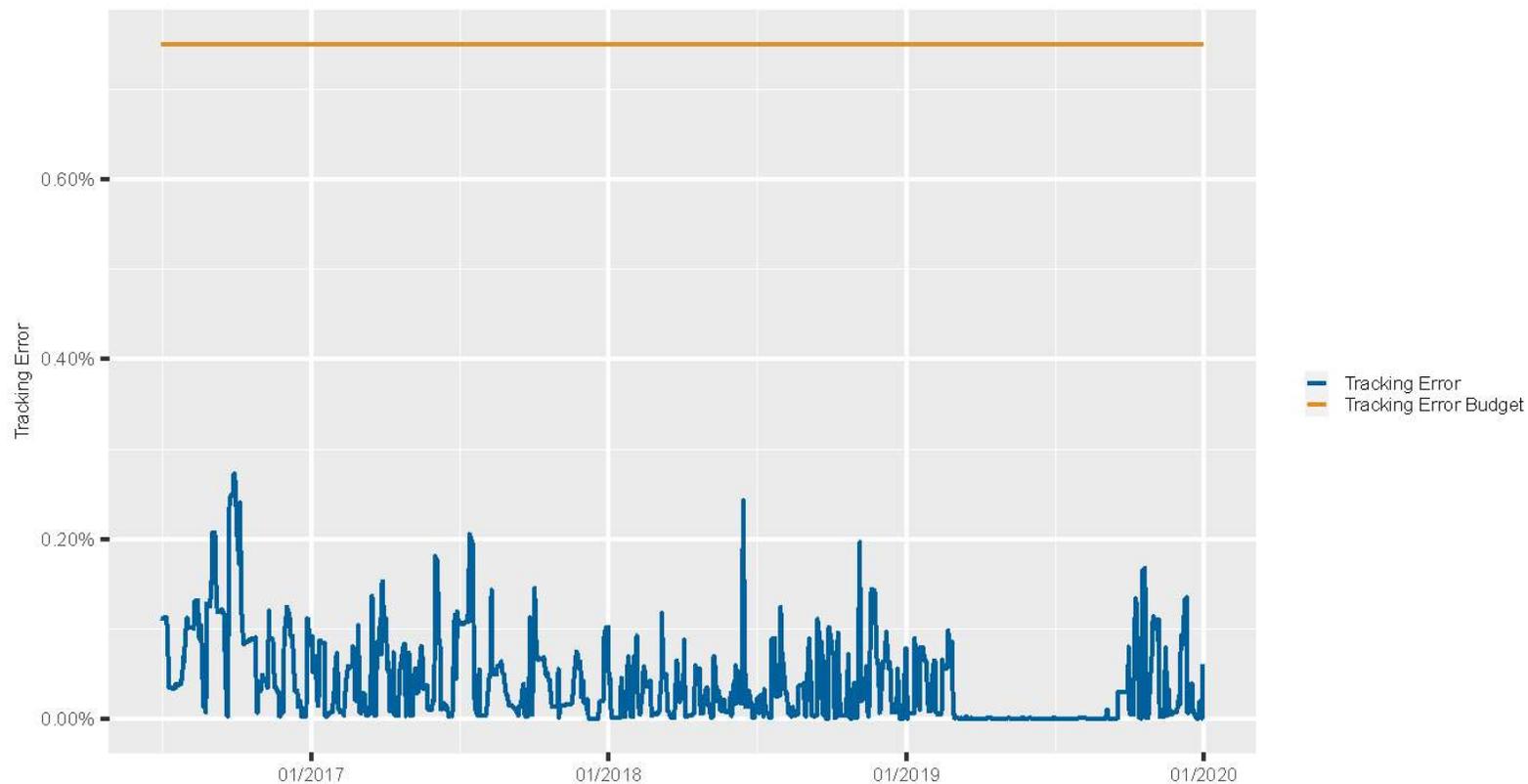
Internal US Small Cap Portfolio Performance versus Expectations

10.0 Basis Points Expected Excess Return with 20.0 Basis Points Tracking Error



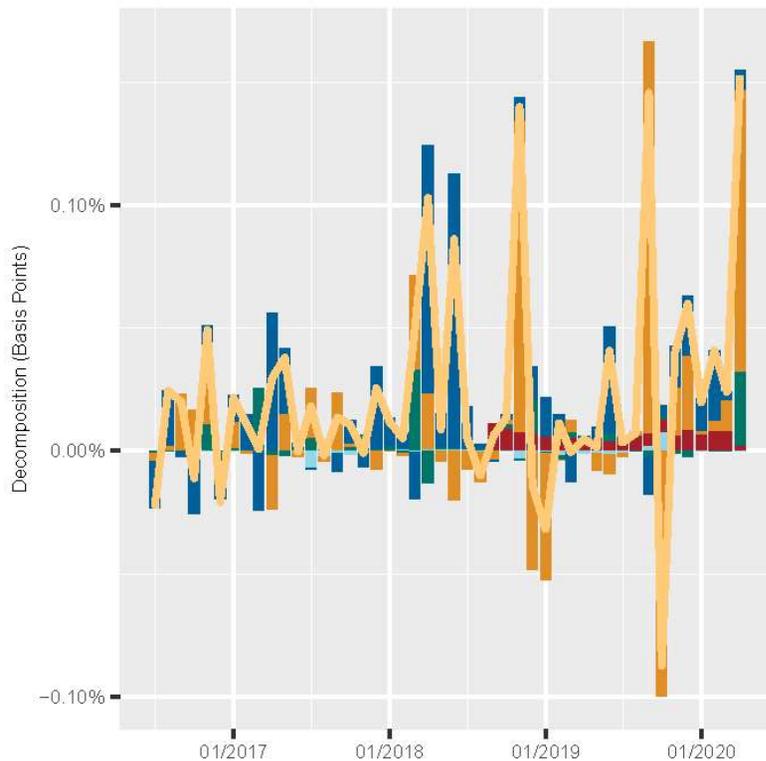
US Small Cap: Tracking Error for the period ended 3/31/2020

Internal US Small Cap Portfolio Tracking Error

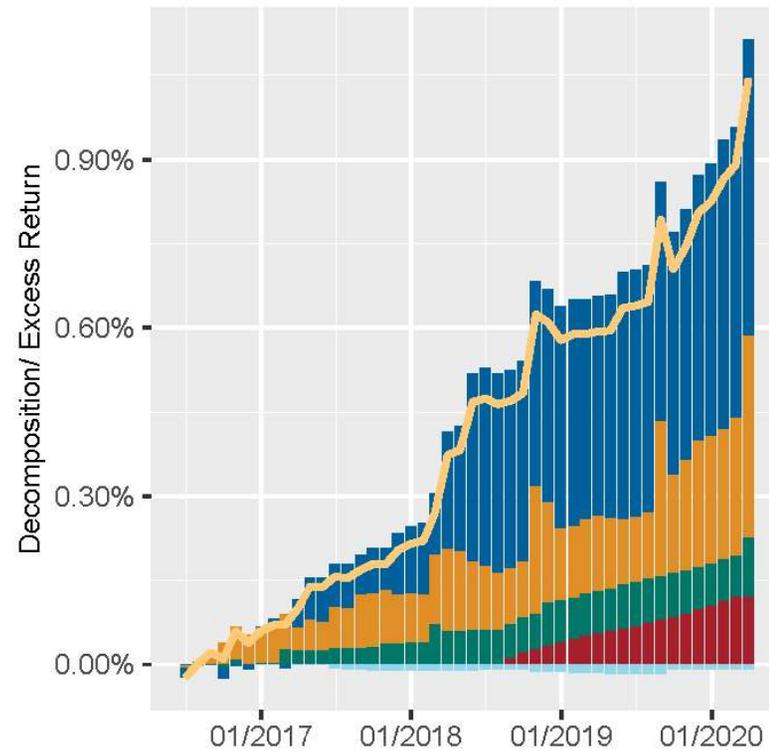


US Small Cap: Net Asset Value Decomposition for the period ended 3/31/2020

Decomposition by Period



Cumulative Decomposition



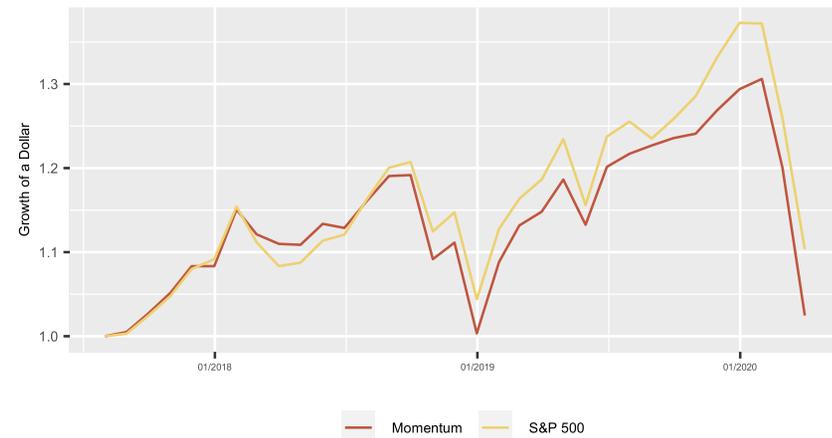
Active Positioning Cash and Futures Impact Trade Variance Securities Lending Other

US Large Cap Factor Performance Summary for the period ended 3/31/2020

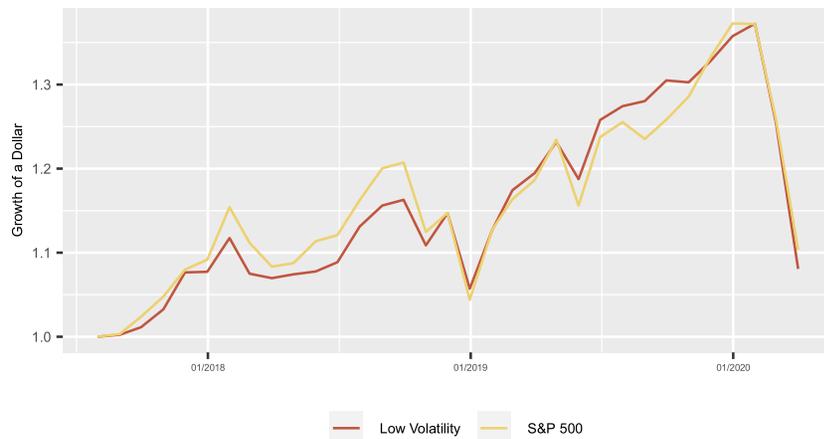
US Large Cap Value Factor Performance



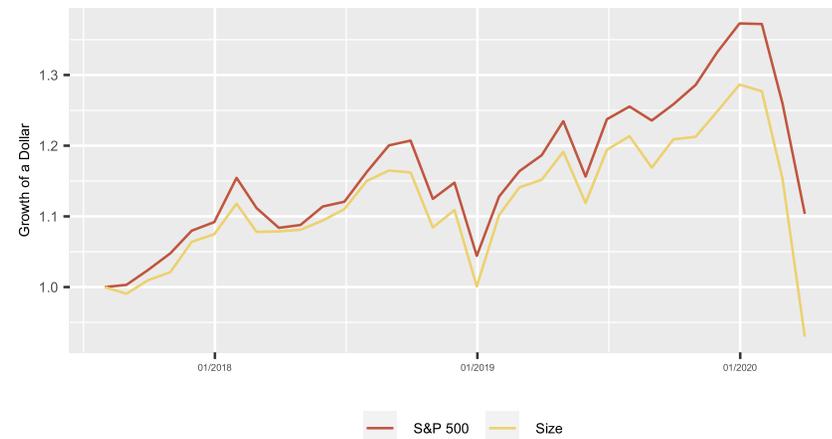
US Large Cap Momentum Factor Performance



US Large Cap Low Volatility Factor Performance



US Large Cap Size Factor Performance



Private Equity

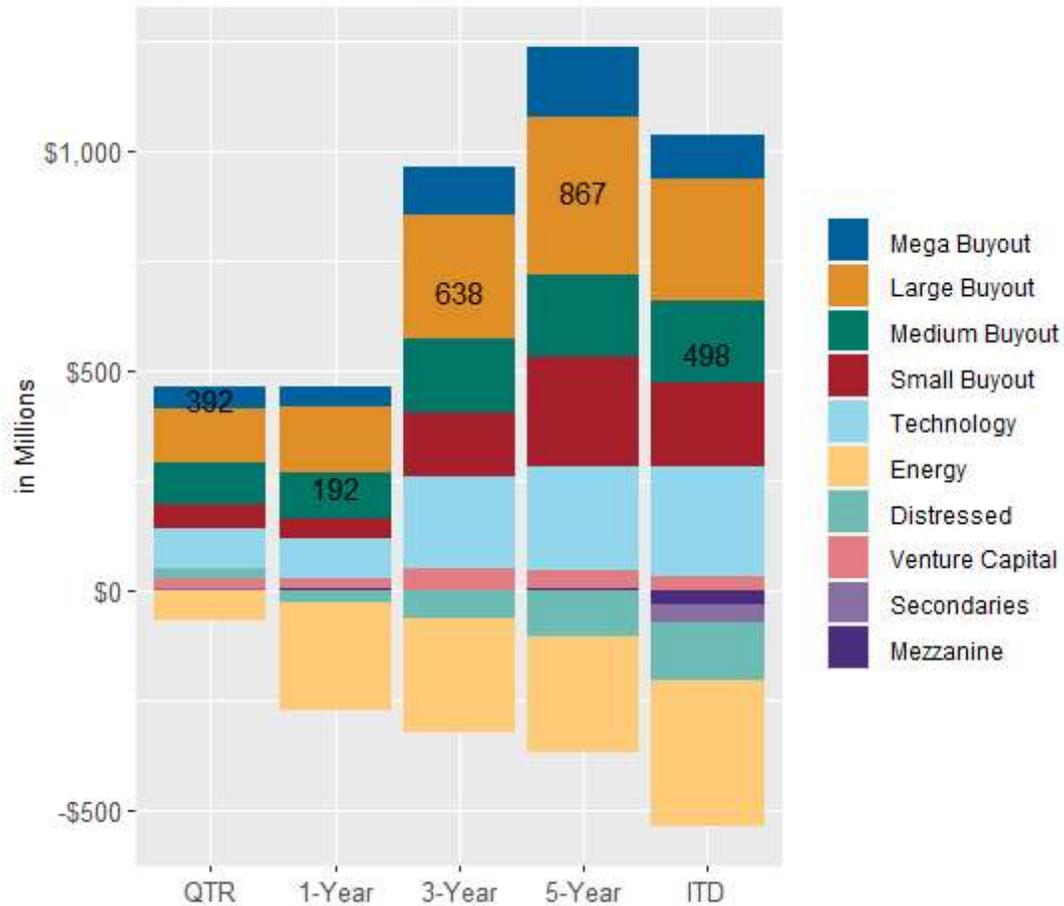
Private Equity Estimated Performance for 3/31/2020

The following table shows IRR data using the 135 Private Equity funds that have reported and 8 funds with March 31 2020 estimated NAVs.

Composite		Internal Rate of Return					% of NAV Reported
		QTR	1-Year	3-Year	5-Year	ITD	
Private Equity	IRR	-13.03	-8.21	6.23	8.13	10.03	94
Private Equity	Benchmark	-22.39	-12.97	-0.05	2.72	8.36	0
Private Equity	Excess	9.36	4.76	6.28	5.41	1.67	0
Mega Buyout	IRR	-12.22	-2.81	9.71	11.89	11.51	100
Large Buyout	IRR	-12.70	0.77	10.35	10.91	12.10	90
Medium Buyout	IRR	-6.98	4.57	12.60	12.99	13.22	90
Small Buyout	IRR	-6.39	3.49	16.46	18.20	15.39	100
Technology	IRR	-4.25	7.65	20.42	18.55	18.15	100
Energy	IRR	-34.13	-46.75	-16.96	-9.24	-4.00	100
Distressed	IRR	-13.53	-18.79	-5.14	-1.90	3.01	98
Venture Capital	IRR	-2.80	6.25	15.38	10.39	11.18	74
Secondaries	IRR	-15.58	-17.13	2.92	3.08	8.48	97
Mezzanine	IRR	-5.69	35.74	10.40	7.36	9.50	100

Private Equity Estimated Dollar Value Add for 3/31/2020

Private Equity Dollar Value Add
 Estimated as of 3/31/2020



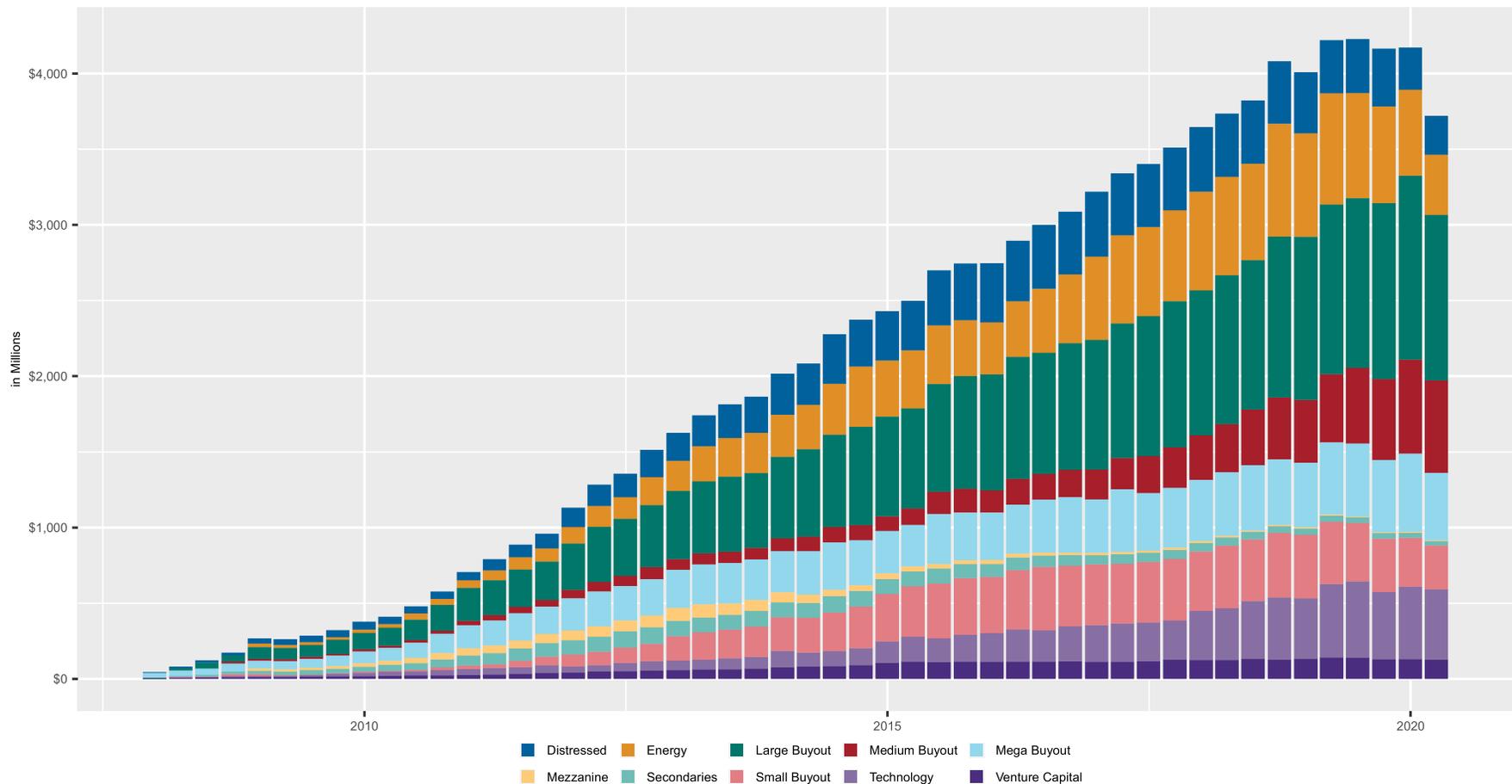
Private Equity Performance Overview & Allocation for the period ended 12/31/2019

Private Equity Internal Rate of Return

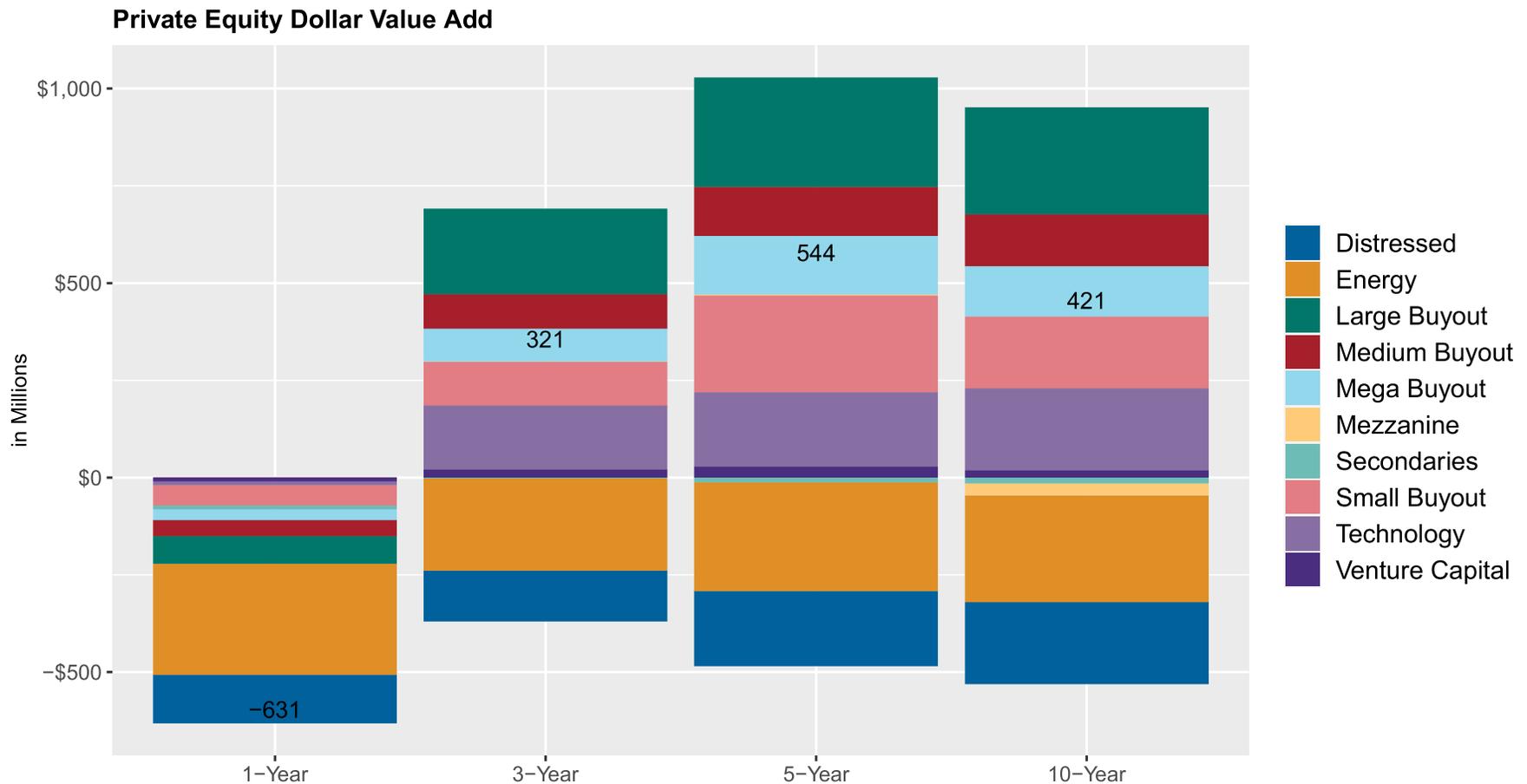
Composite	Quarter	One Year	Three Year	Five Year	Ten Year	Inception to Date
Private Equity	0.70	10.58	11.86	11.53	12.94	12.01
Index IRR	9.12	26.78	9.10	8.65	11.60	11.56
Excess	-8.42	-16.20	2.75	2.88	1.34	0.45
Burgiss	0.04	0.13	0.13	0.11	0.12	0.12
Burgiss Excess	0.66	10.45	11.72	11.42	12.82	11.89
Technology	5.62	24.15	24.42	20.93	20.70	19.45
Medium Buyout	5.63	17.17	17.63	17.98	17.46	15.66
Small Buyout	0.82	13.05	17.57	19.37	16.51	15.34
Energy	-10.15	-14.75	-3.17	-0.35	3.77	3.29
Mega Buyout	4.95	19.96	15.76	15.91	15.31	13.46
Venture Capital	4.09	18.96	14.20	12.48	13.03	11.67
Secondaries	0.76	0.91	8.19	4.02	11.25	8.97
Distressed	-15.86	-9.27	-2.09	0.02	4.56	5.02
Large Buyout	5.20	20.27	16.52	14.06	14.98	14.01
Mezzanine	36.49	31.12	10.81	8.61	9.87	9.56

Private Equity Decomposition for the period ended 12/31/2019

Net Asset Value by Strategy

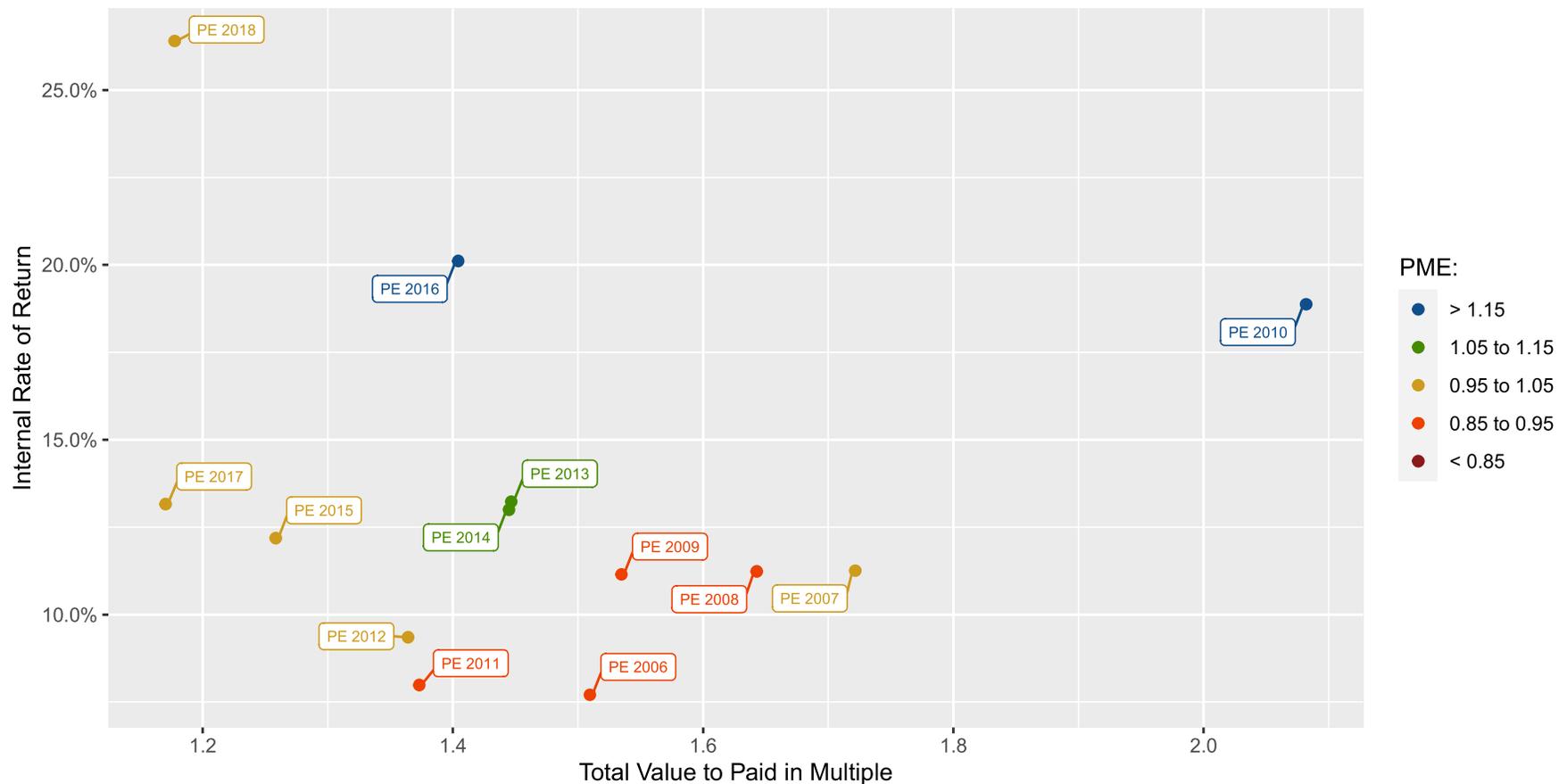


Private Equity Dollar Value Add for the period ended 12/31/2019

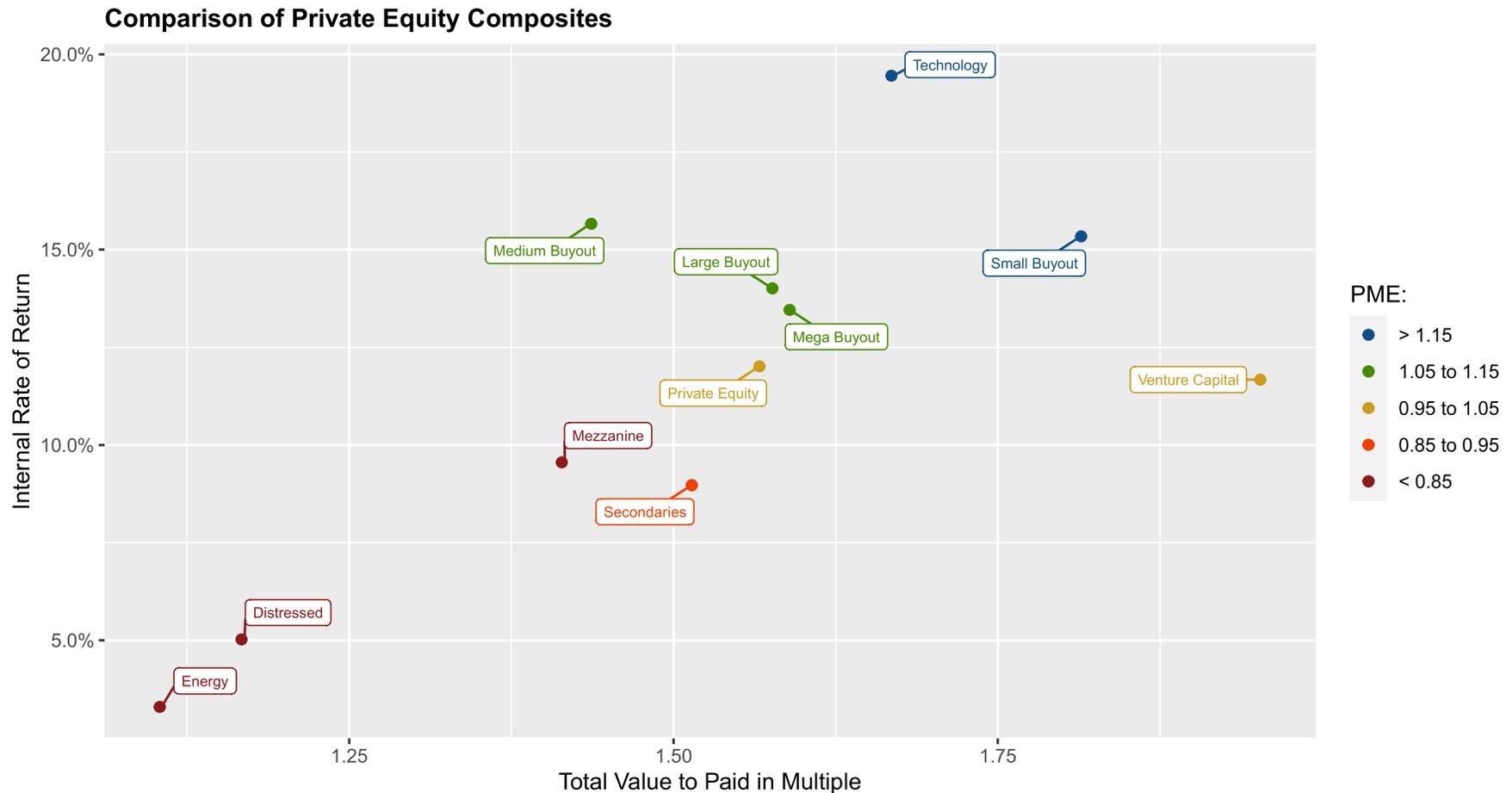


Private Equity Performance by Vintage for the period ended 12/31/2019

Comparison of Private Equity by Vintage



Private Equity Performance by Category for the period ended 12/31/2019



Real Estate

Real Estate Performance Overview

- The ASRS real estate portfolio underperformed the benchmark for the 2020Q1, 1-Year, and 3-Year periods, primarily driven by the initial impacts of COVID-19 on the economy and capital markets
 - Significant underperformance in Debt during Q1 2020 due to mark-to-market impacts of public securities
 - Moderate underperformance in the SMA portfolio during the most recent year, with significant outperformance long term
 - Underperformance in other categories, likely due to relatively higher leverage and potentially more aggressive revaluation than the benchmark as of 3/31
- Offset by outperformance from the Operating Company investments
- The ASRS real estate portfolio continues to outperform the benchmark over the long-term

Real Estate Estimated Performance for 3/31/2020

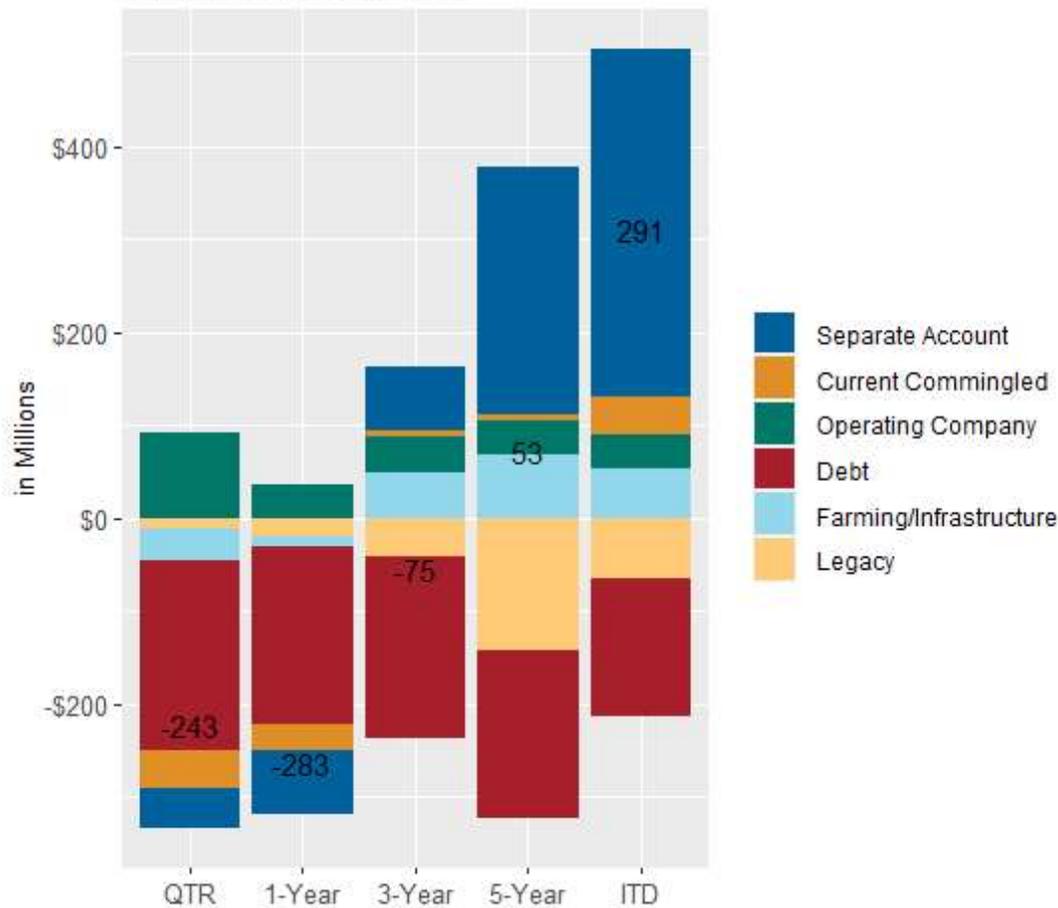
The following table shows IRR data using the 61 Real Estate funds that have reported and 6 funds which RCLCO has provided March 31 2020 estimated NAVs. The remaining 3 active funds use cash adjusted NAVs.

Composite		Internal Rate of Return					% of NAV Reported
		QTR	1-Year	3-Year	5-Year	ITD	
Real Estate	IRR	-2.91	-0.78	4.54	6.91	7.38	98
Real Estate	ODCE	0.75	3.81	5.04	6.68	6.53	0
Real Estate	Excess	-3.66	-4.59	-0.50	0.23	0.85	0
Separate Account	IRR	-0.33	1.89	5.85	8.92	10.12	100
Current Commingled	IRR	-4.83	-0.27	5.59	7.43	9.36	100
Operating Company	IRR	22.07	11.56	8.22	8.22	8.22	85
Debt	IRR	-28.52	-28.69	-12.80	-6.09	-1.96	100
Farming/Infrastructure	IRR	-5.59	1.91	8.06	7.73	6.91	100
Legacy	IRR	-3.75	-3.71	1.25	3.18	5.41	76

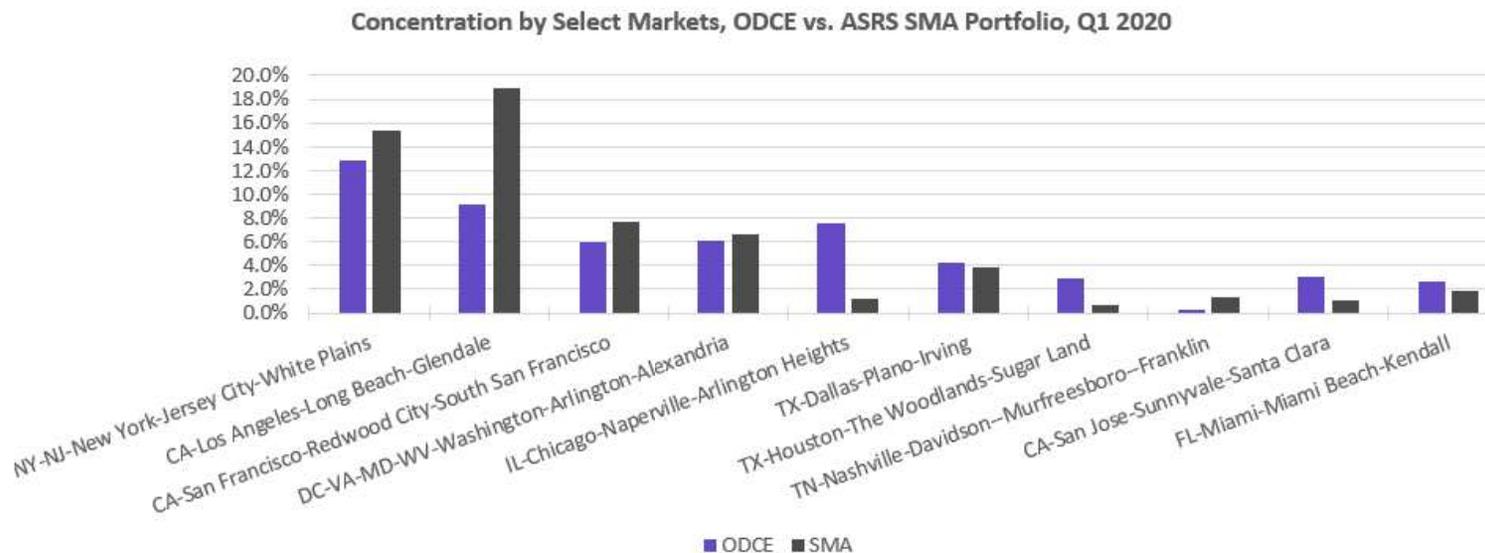
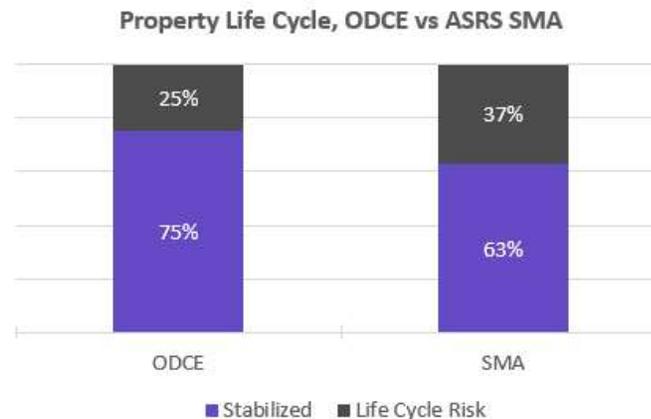
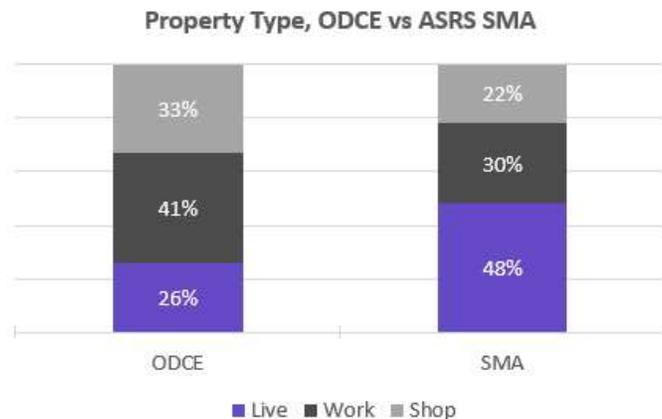
Real Estate Estimated Dollar Value Add for 3/31/2020

Real Estate Dollar Value Add

Estimated as of 3/31/2020



3/31/2020 Separate Account Comparisons to ODCE



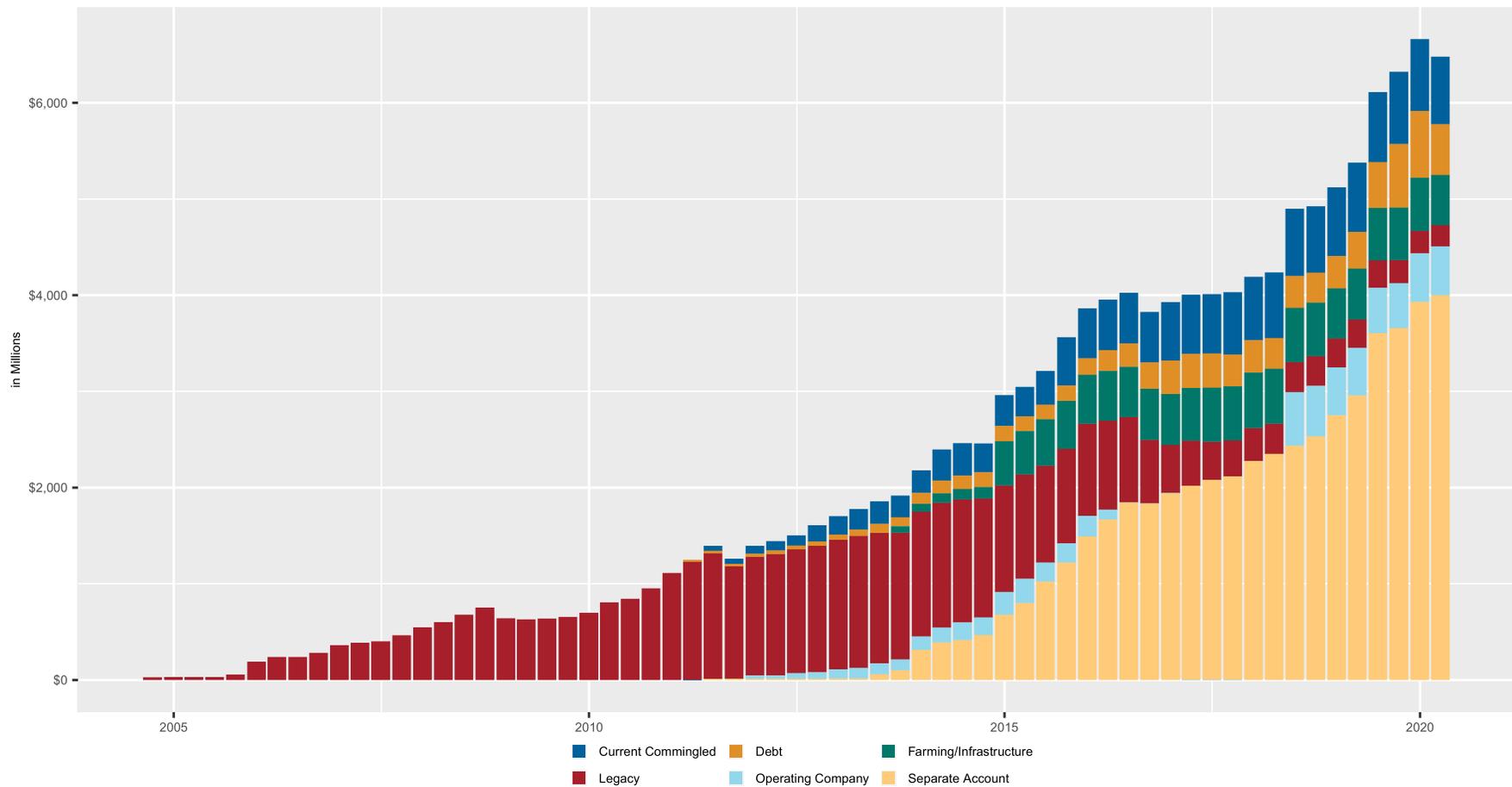
Real Estate Performance Overview & Allocation for the period ended 12/31/2019

Real Estate Internal Rate of Return

Composite	Quarter	One Year	Three Year	Five Year	Ten Year	Inception to Date
Real Estate	0.36	4.26	6.80	8.47	10.97	8.23
Index IRR	1.08	4.58	5.44	7.29	9.27	6.63
Excess	-0.72	-0.32	1.36	1.17	1.70	1.59
Legacy	-0.60	0.64	1.34	5.80	11.64	5.75
Separate Account	0.47	3.66	7.19	9.78		11.19
Current Commingled	1.44	6.81	8.18	8.97		10.63
Debt	2.42	8.05	6.65	8.89		10.80
Farming/Infrastructure	4.42	10.43	11.31	8.45		8.13
Operating Company	-9.10	-4.07	-1.65	1.45		10.81

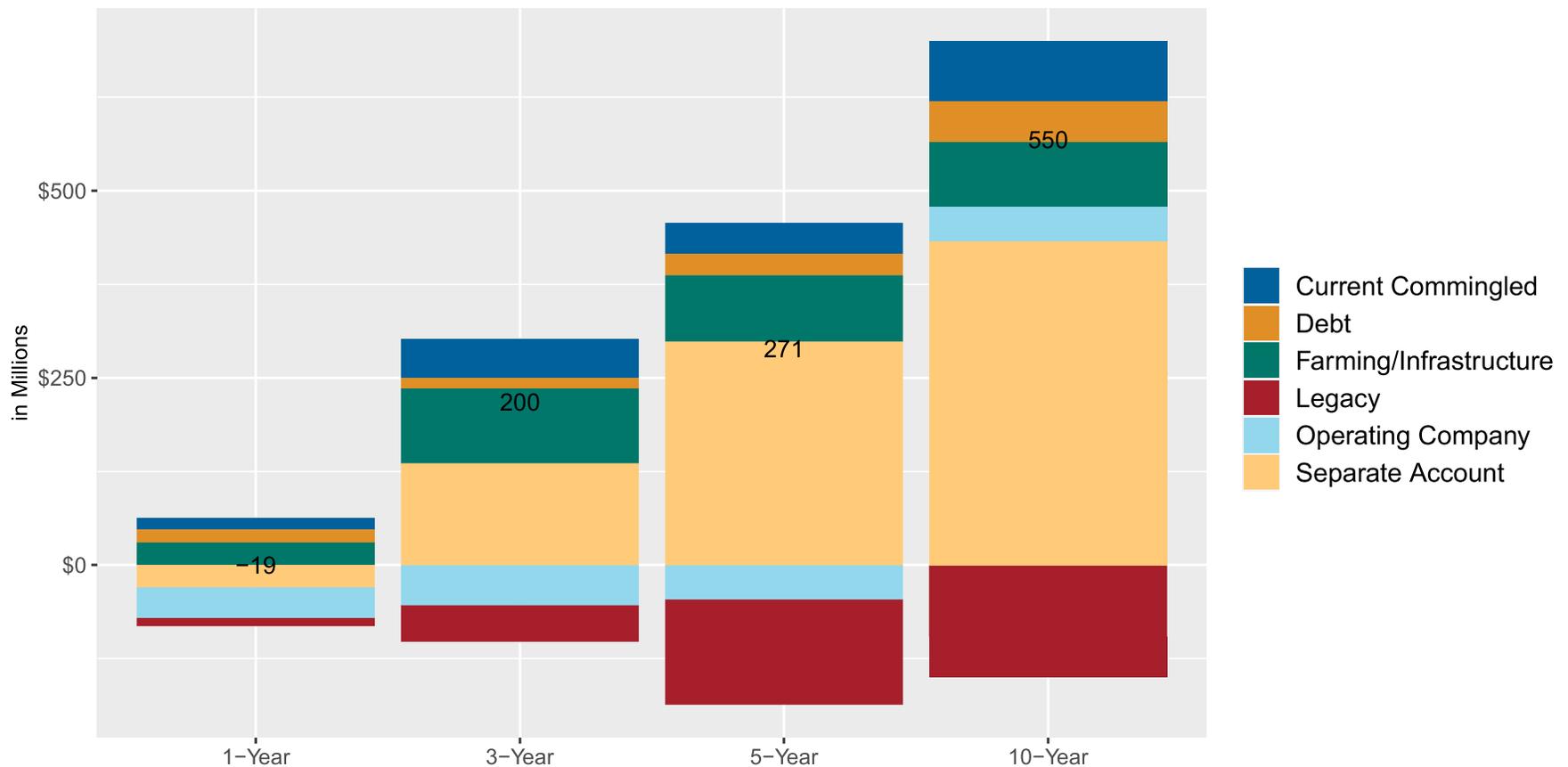
Real Estate Net Asset Value by Strategy for the period ended 12/31/2019

Net Asset Value by Strategy



Real Estate Dollar Value Add for the period ended 12/31/2019

Real Estate Dollar Value Add



Credit

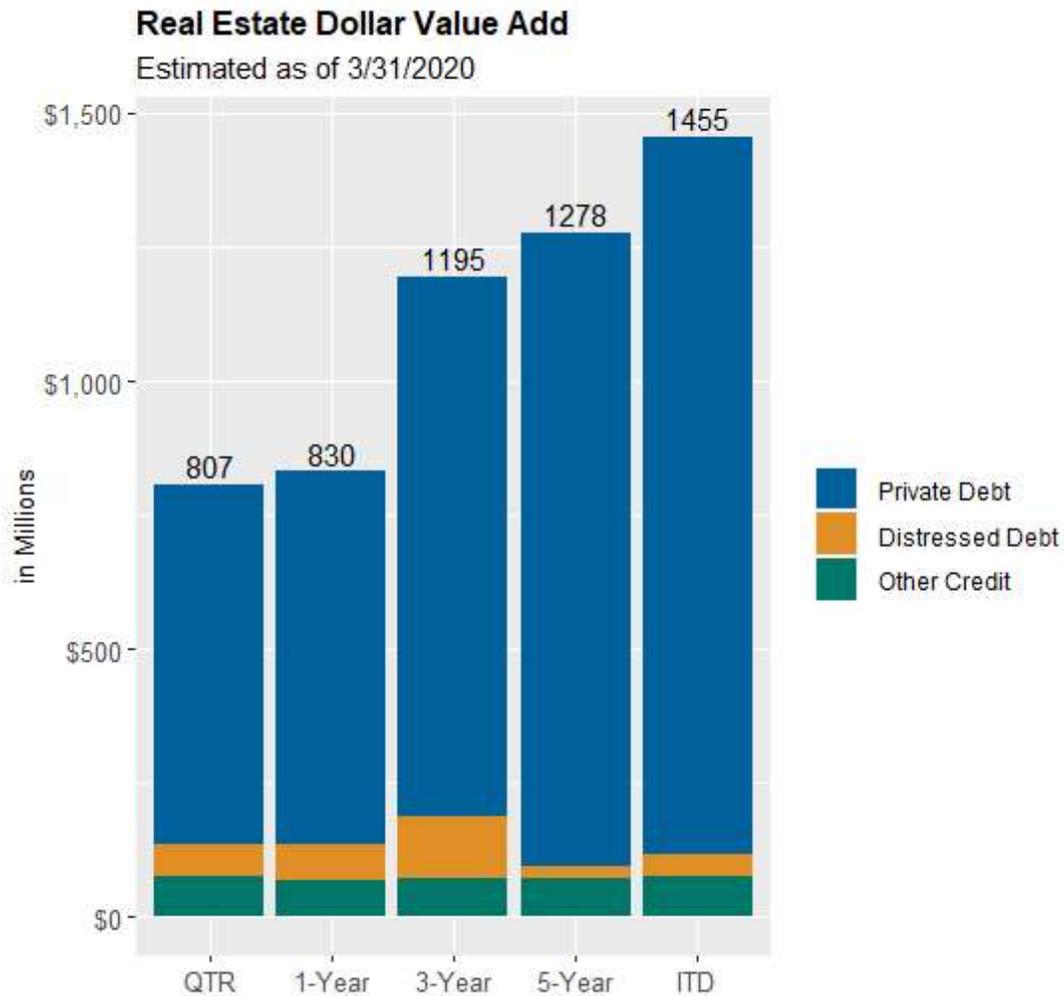
Total Credit

Private Credit Estimated Performance for 3/31/2020

The following table shows IRR data using the 27 Credit funds that have reported and 4 funds with March 31 2020 estimated NAVs.

Composite		Internal Rate of Return					% of NAV Reported
		QTR	1-Year	3-Year	5-Year	ITD	
Credit	IRR	-2.52	3.97	7.56	7.98	8.46	93
Credit	LSTA + 250bps	-12.29	-6.94	1.24	3.31	4.11	0
Credit	Excess	9.77	10.91	6.32	4.67	4.35	0
Private Debt	IRR	-0.87	5.97	8.60	9.36	9.79	92
Distressed Debt	IRR	-7.98	-0.89	5.07	4.71	5.71	100
Other Credit	IRR	-3.71	-1.25	2.05	2.47	5.66	90

Private Credit Estimated Dollar Value Add for 3/31/2020



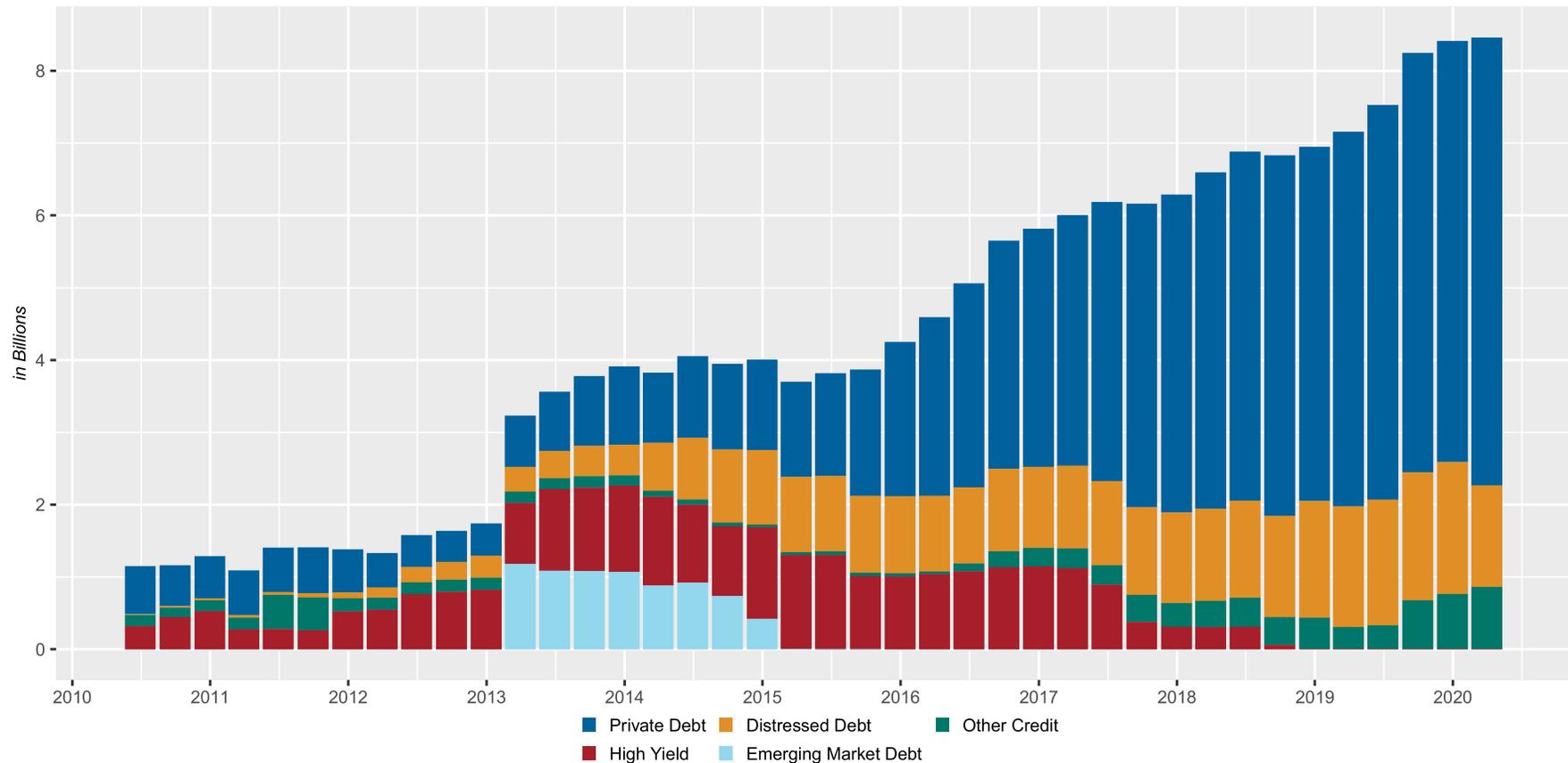
Total Credit for the period ended 3/31/2020

Credit Annualized Returns

Category	Quarter	One Year	Three Year	Five Year	Ten Year	Inception
Total Credit (TWR)	2.41	9.34	9.15	8.31	7.68	7.68
Blended Benchmark	2.36	11.36	6.75	6.46	5.14	5.14
Total Credit Excess	0.05	-2.02	2.40	1.85	2.54	2.54
Private Debt	2.20	9.22	10.08	12.34	11.07	11.05
Index IRR	2.35	11.17	6.97	7.31	7.39	8.07
Excess	-0.15	-1.94	3.11	5.02	3.68	2.98
Distressed Debt	2.91	8.89	8.78	6.95		7.38
Index IRR	2.36	11.28	7.29	7.56		7.66
Excess	0.55	-2.39	1.49	-0.61		-0.28
Other Credit	2.52	13.87	6.35	8.59	7.59	9.13
Index IRR	2.42	11.96	7.55	7.63	7.82	7.85
Excess	0.09	1.90	-1.20	0.96	-0.23	1.29

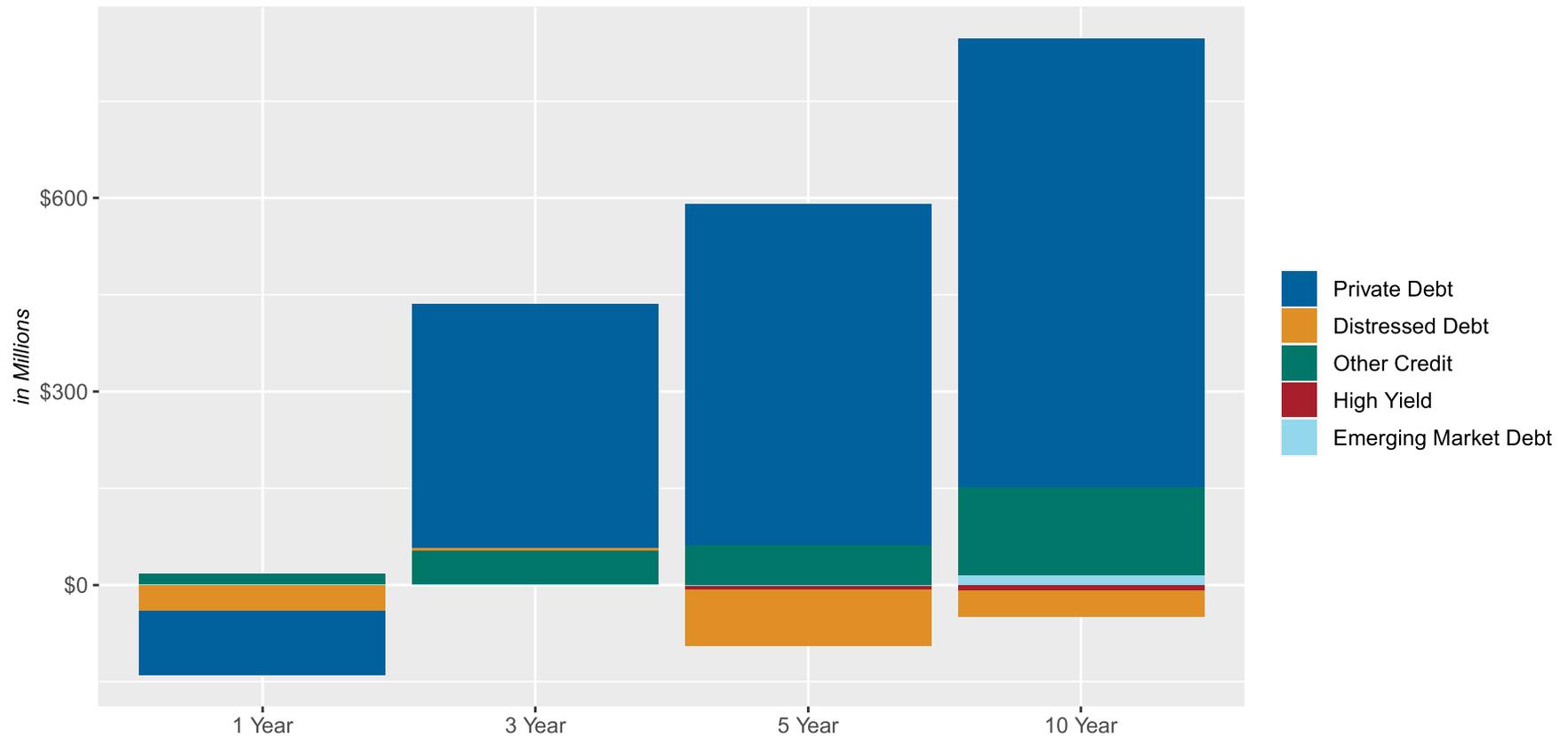
Credit Market Values and Performance for the period ended 3/31/2020

Credit Market Values

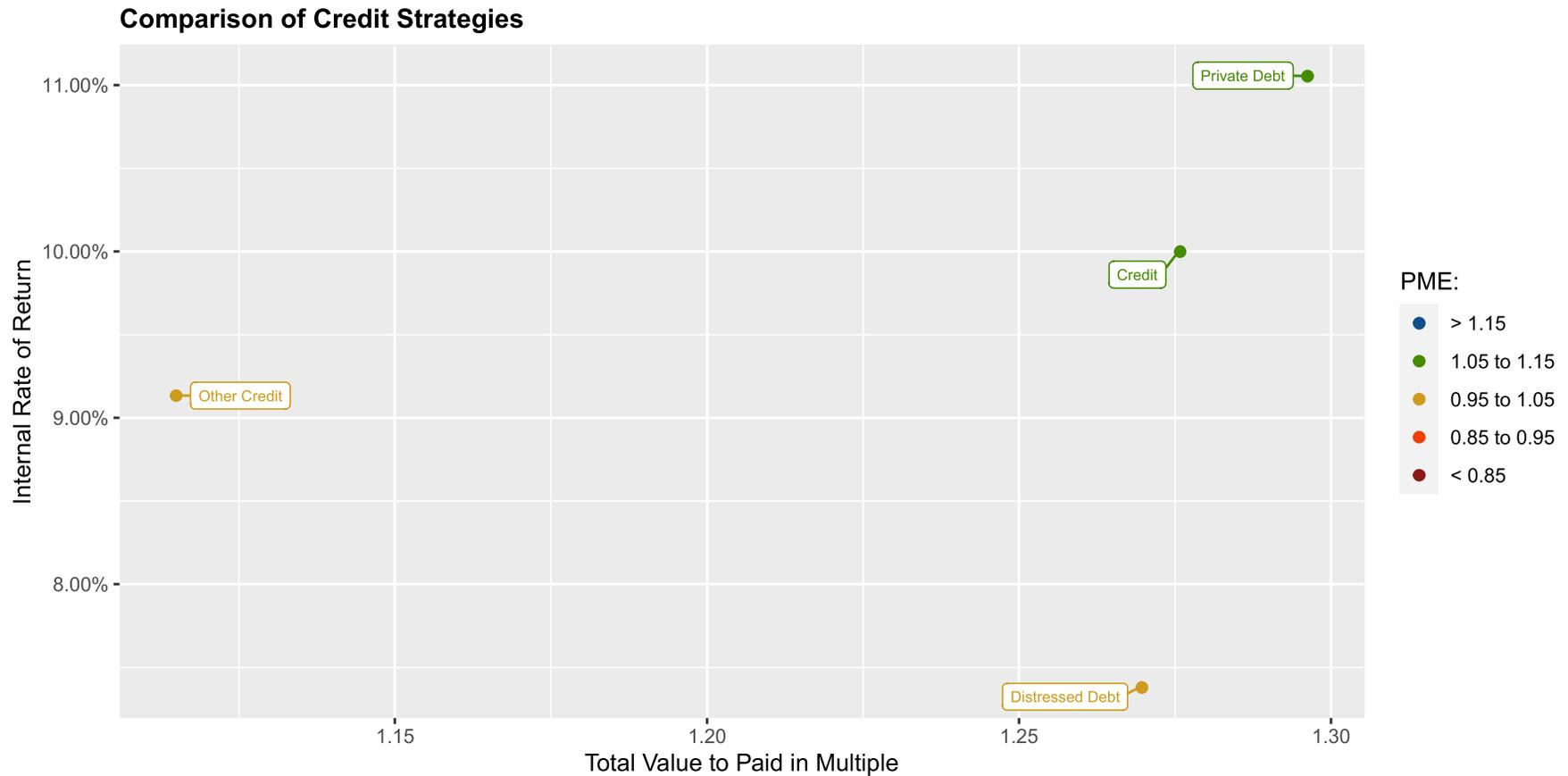


Credit Dollar Value Add for the period ended 3/31/2020

Credit Dollar Value Add versus Benchmark



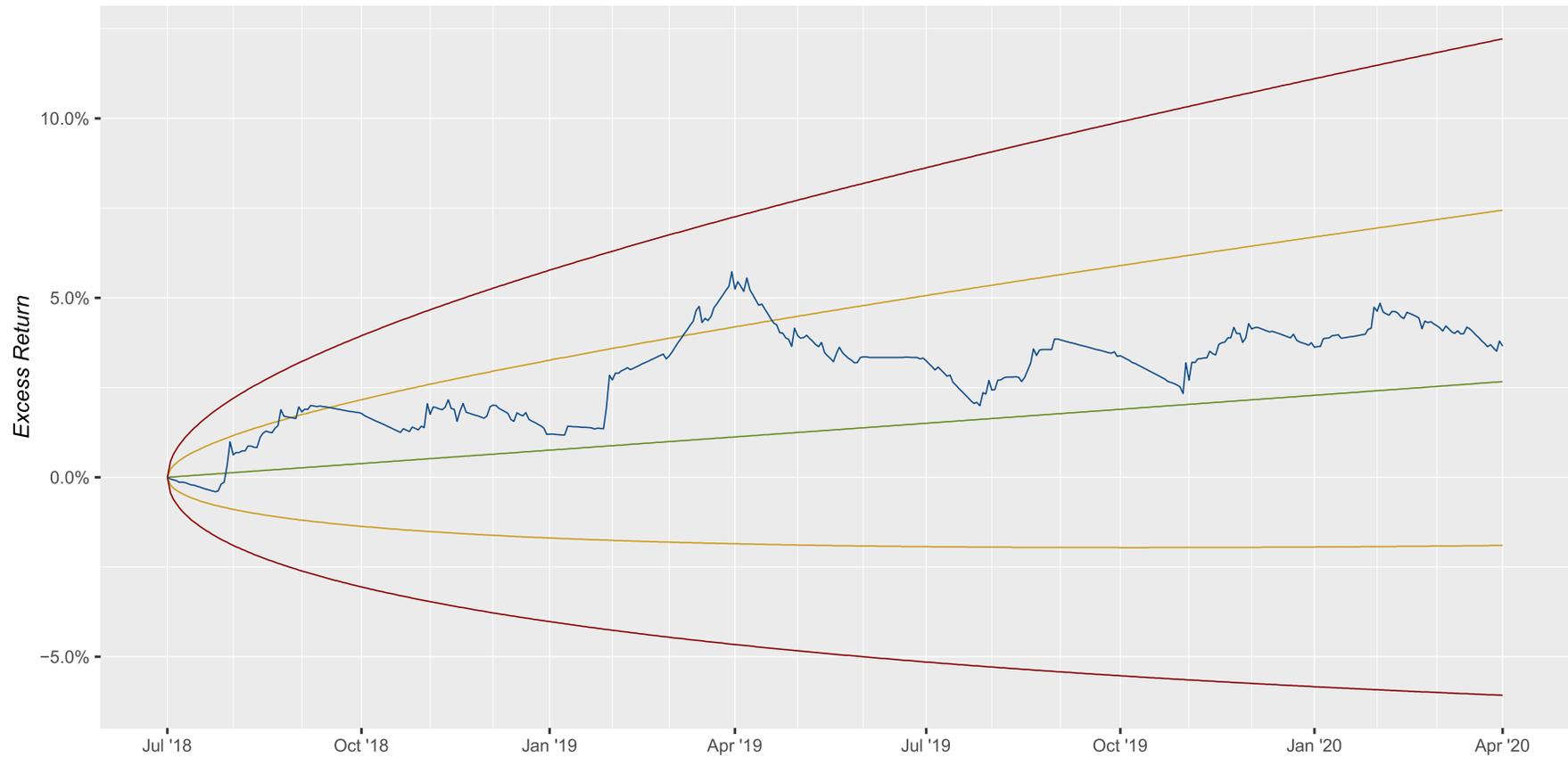
Credit: Total Value to Paid in Multiple & Public Market Equivalent for the period ended 3/31/2020



Credit Performance for the period ended 3/31/2020

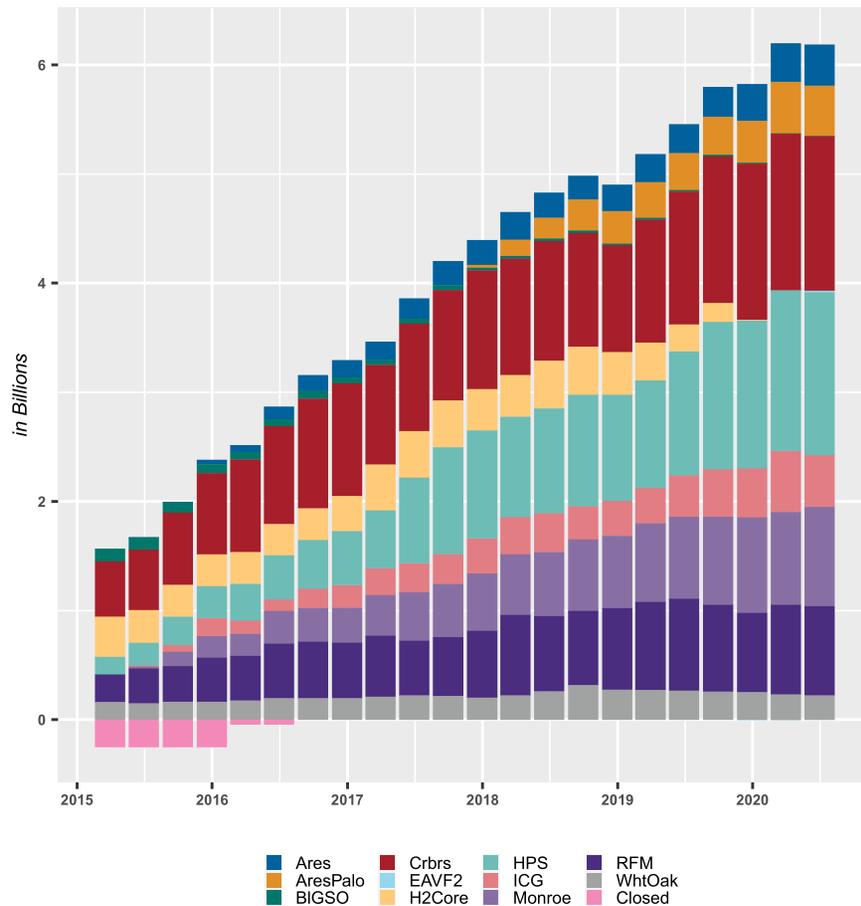
Total Credit Portfolio Performance versus Expectations

150 Basis Points Expected Excess Return with 350 Basis Points Tracking Error



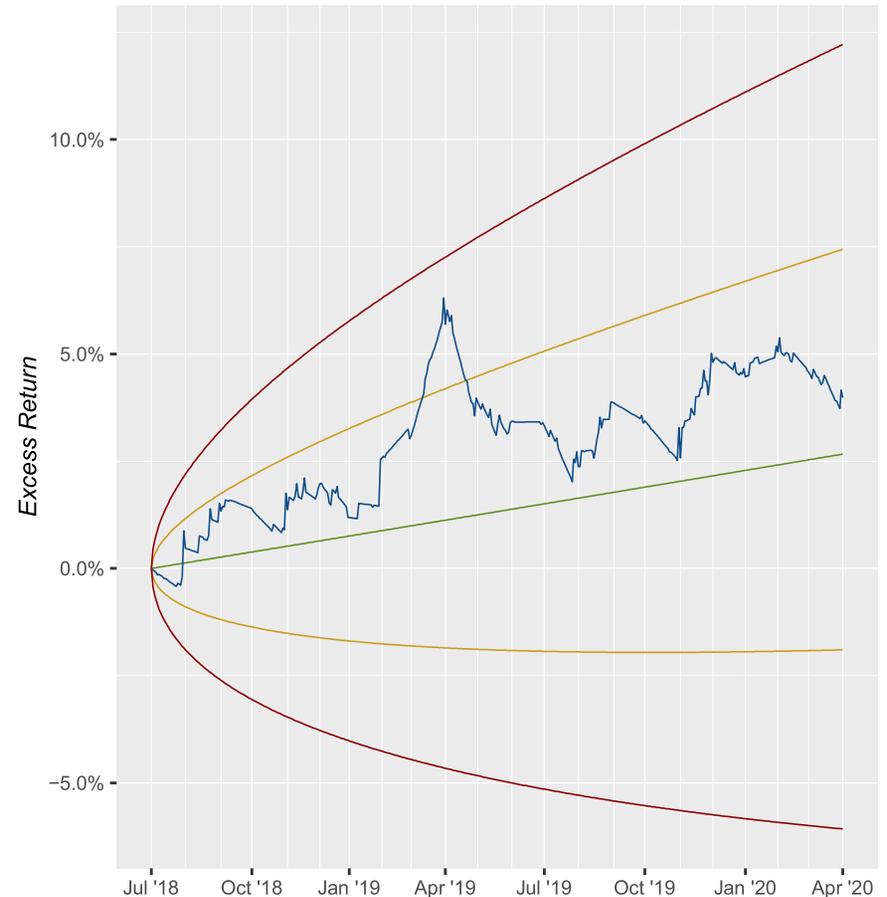
Private Debt Market Values for the period ended 12/31/2019

Private Debt Market Values



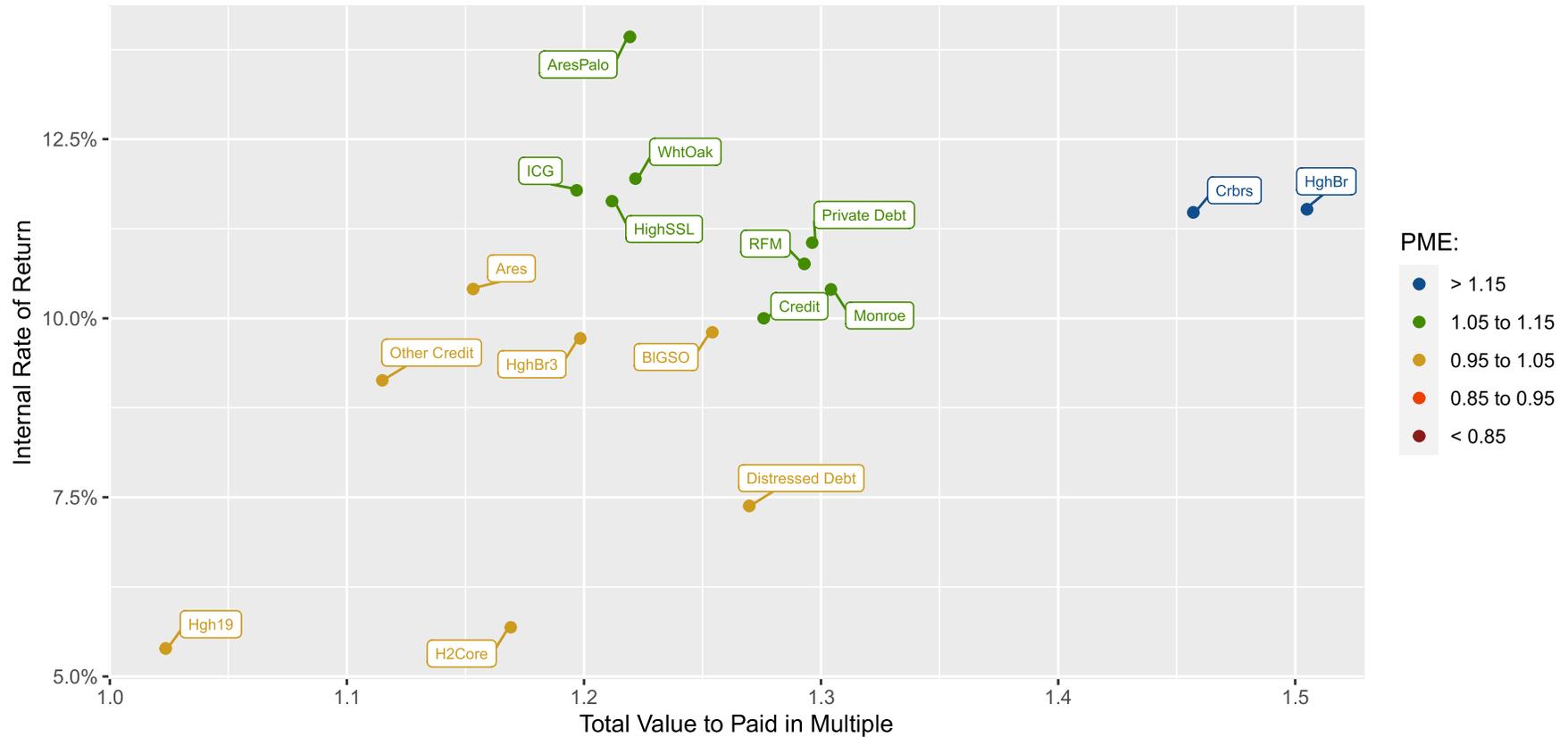
Private Debt Performance versus Expectations

150 Basis Points Expected Excess Return with 350 Basis Points Tracking Error



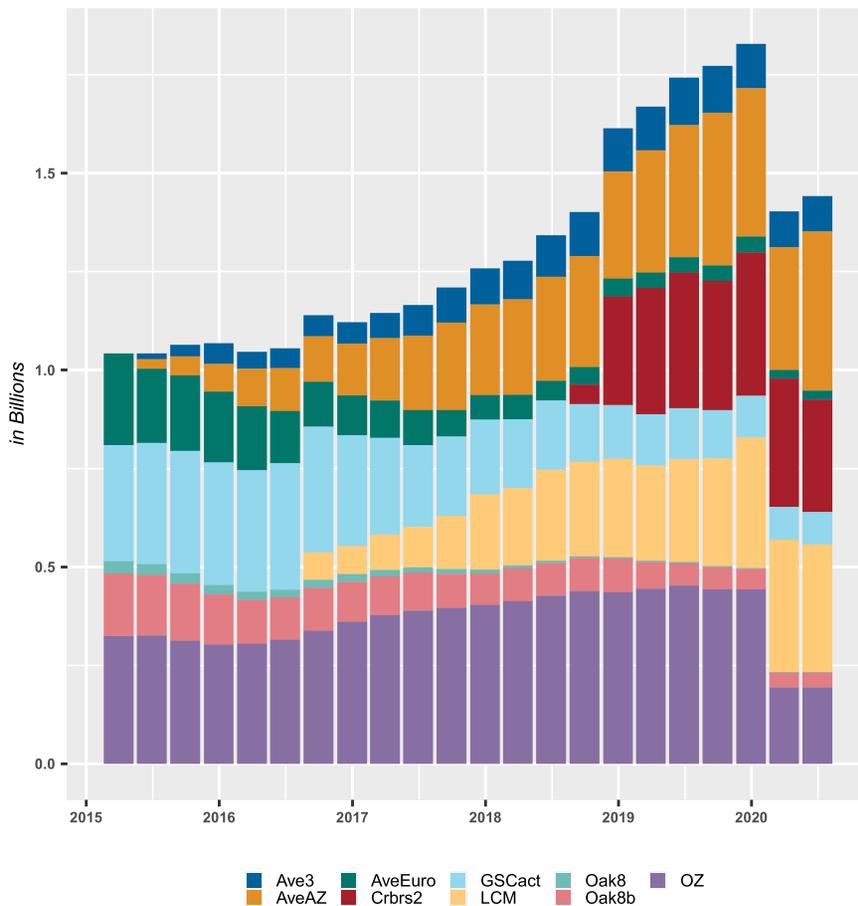
Private Debt: Total Value to Paid in Multiple & Public Market Equivalent for the period ended 12/31/2019

Comparison of Private Debt Funds



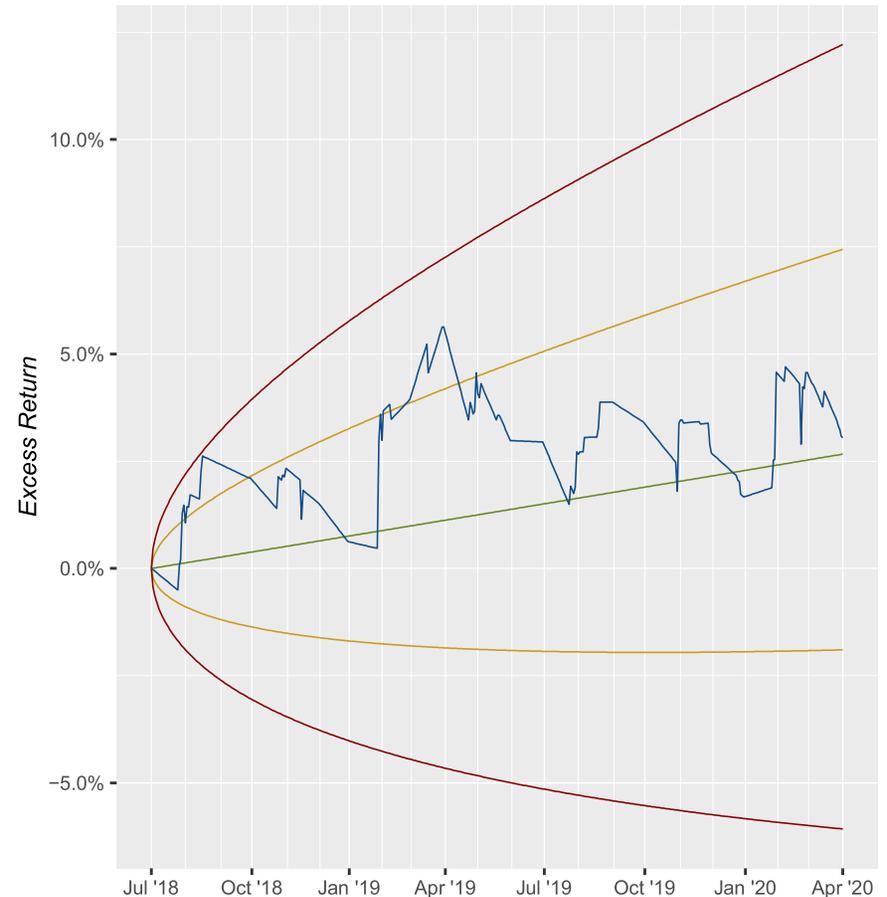
Distressed Debt Market Values for the period ended 12/31/2019

Distressed Debt Market Values



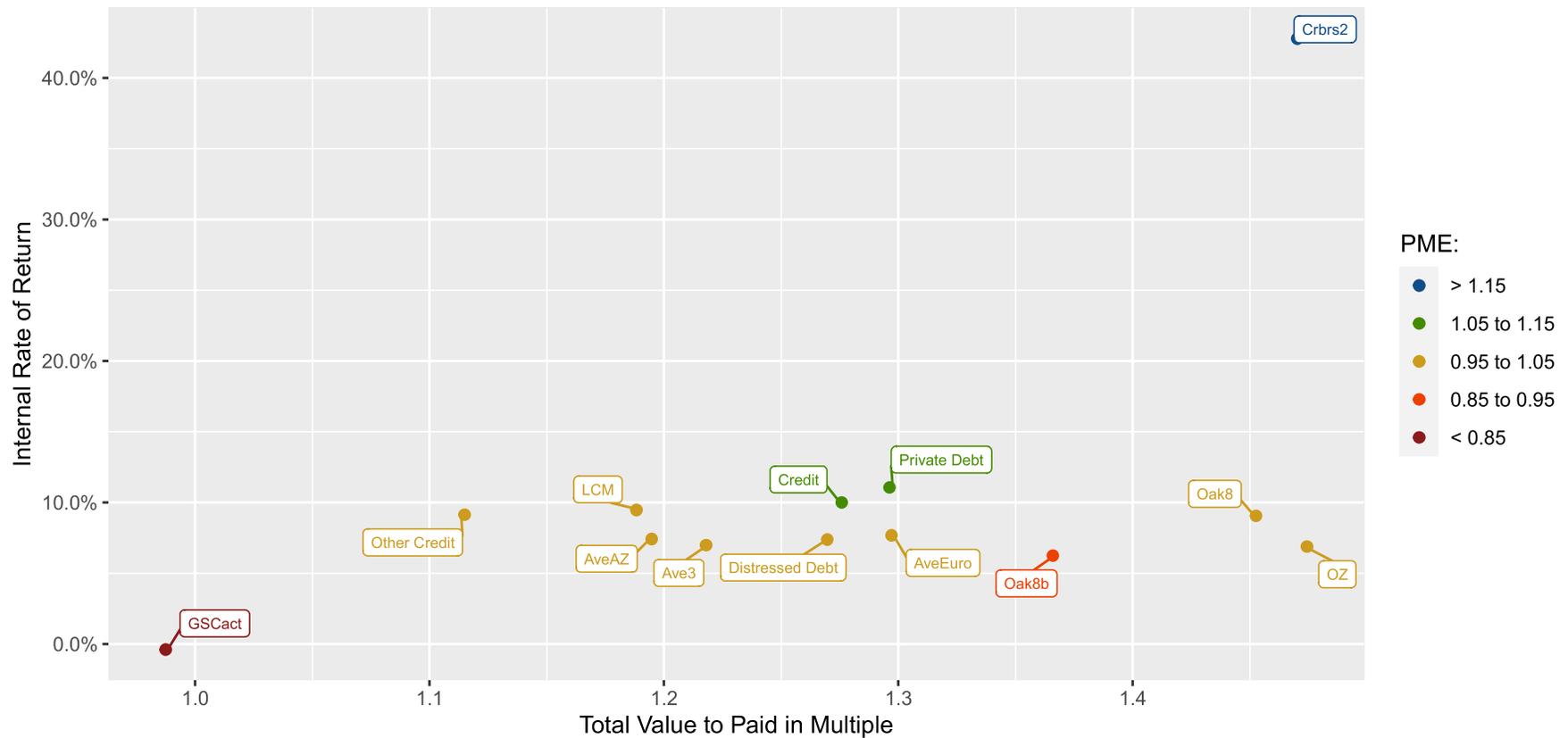
Distressed Debt Performance versus Expectations

150 Basis Points Expected Excess Return with 350 Basis Points Tracking Error



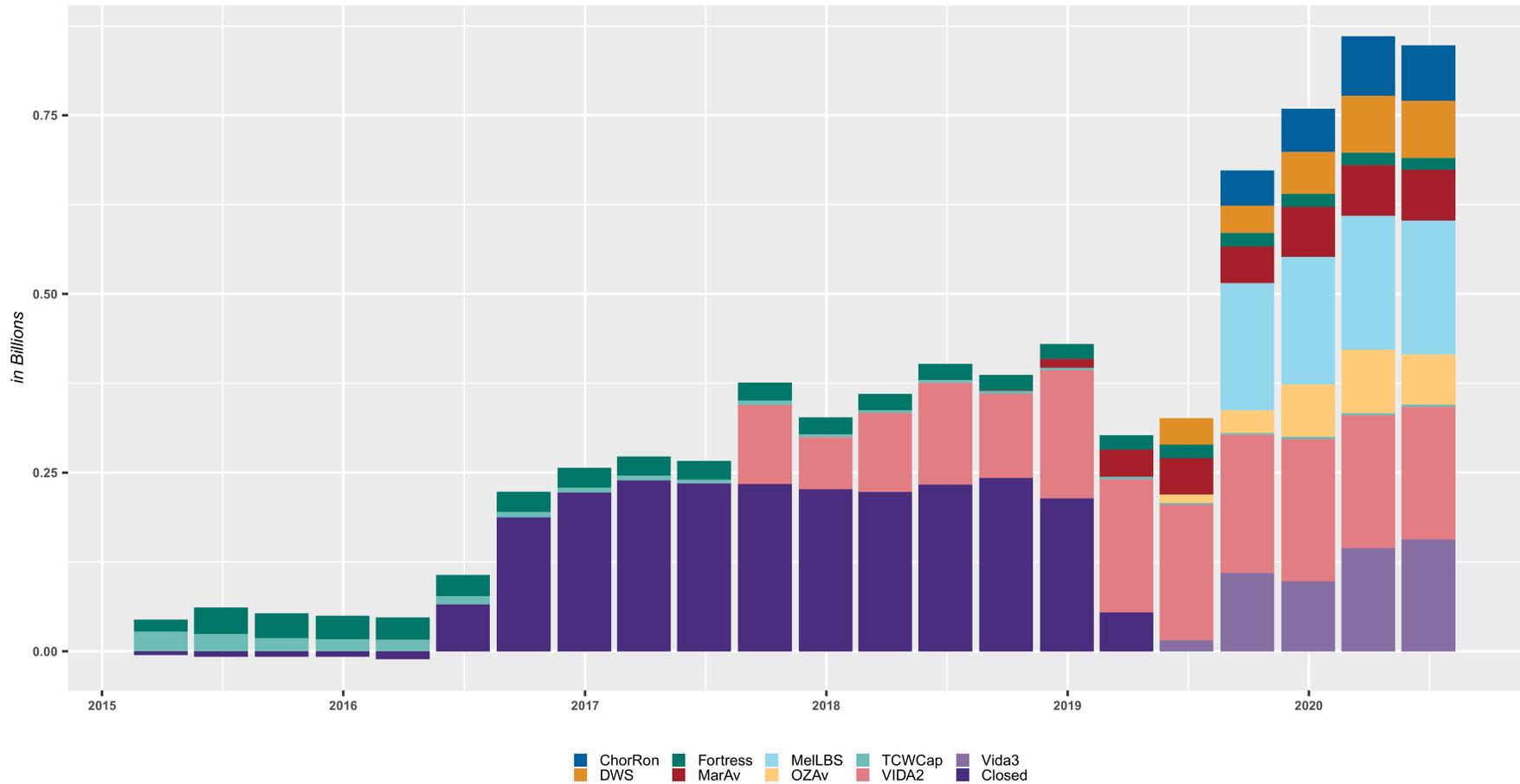
Distressed Debt: Total Value to Paid in Multiple & Public Market Equivalent for the period ended 12/31/2019

Comparison of Distressed Debt Funds



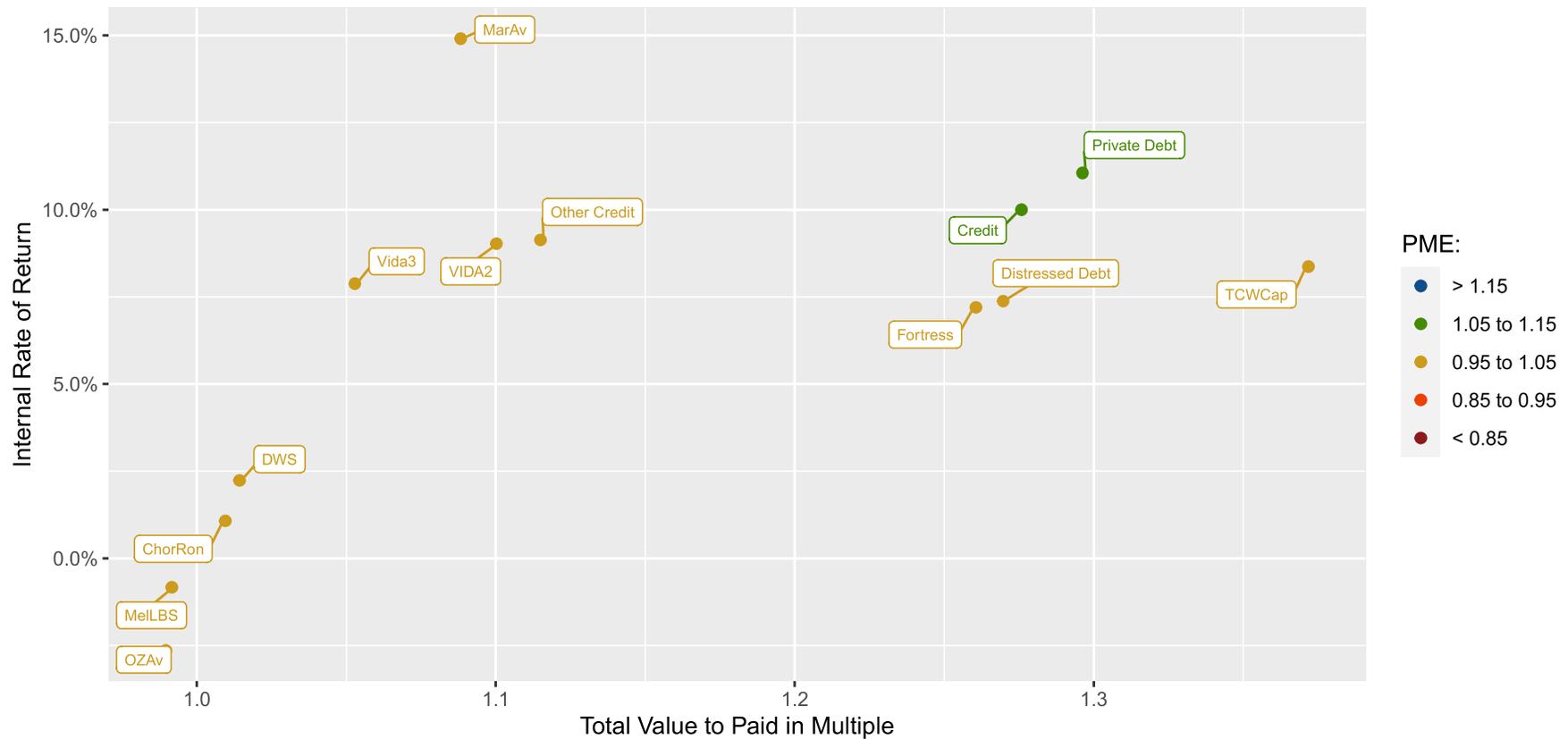
Other Credit Market Values for the period ended 12/31/2019

Other Credit Market Values



Other Credit: Total Value to Paid in Multiple & Public Market Equivalent for the period ended 12/31/2019

Comparison of Other Credit Funds



Core Bonds

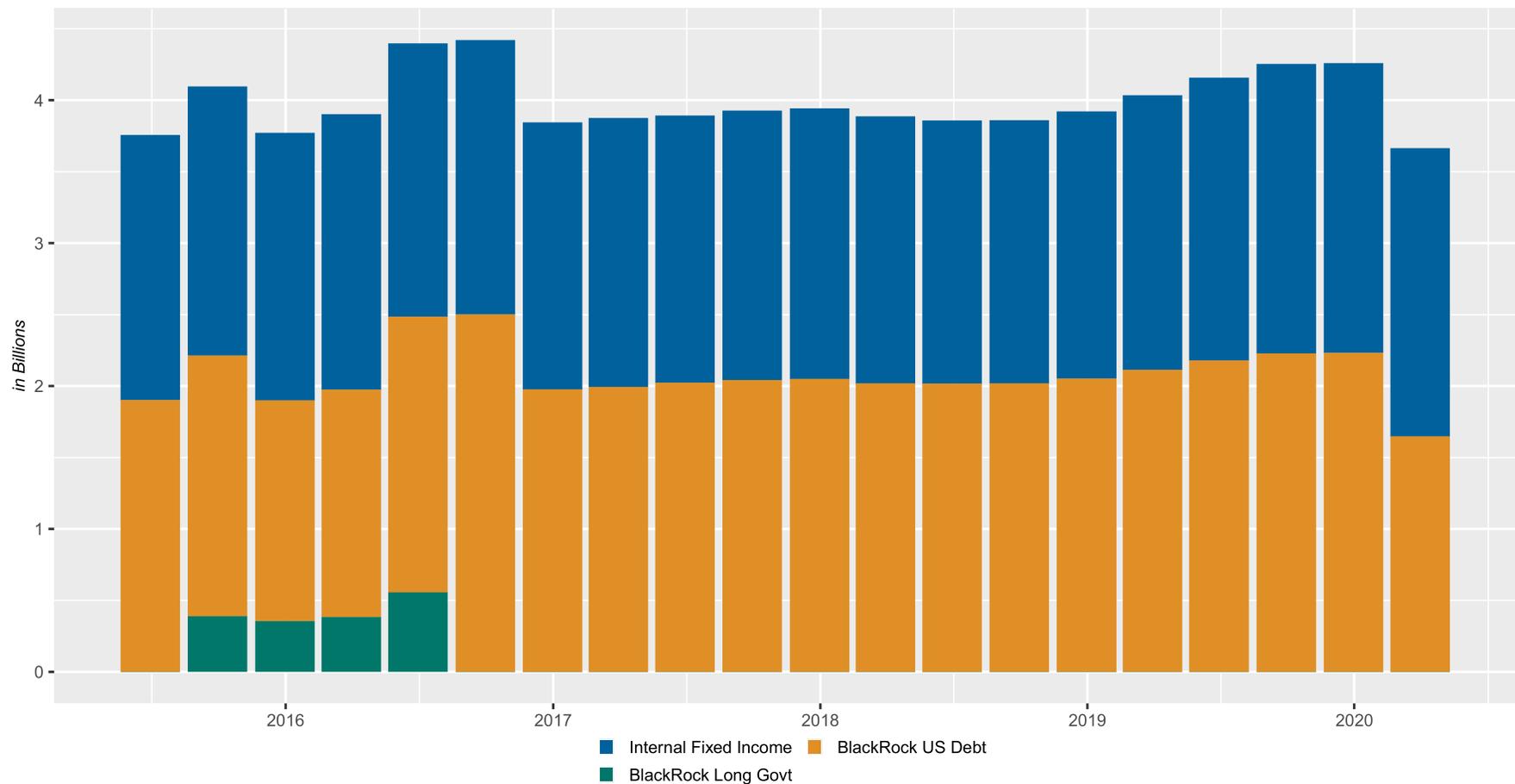
Core Fixed Income for the period ended 3/31/2020

Annualized Time-Weighted Returns

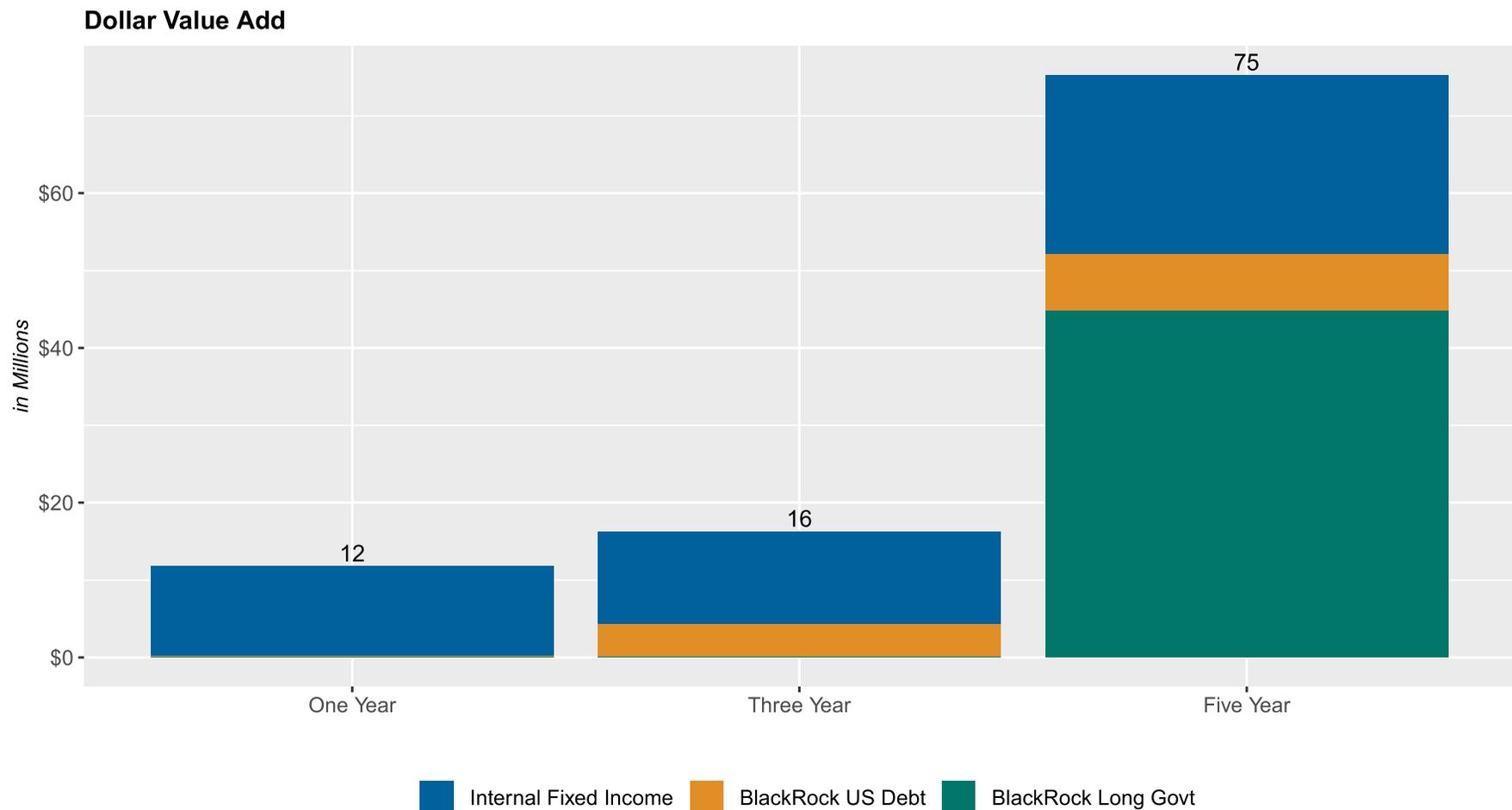
	Quarter	One Year	Three Year	Five Year
Core Bond Composite	3.36	9.10	4.92	3.65
Barclay's Aggregate	3.15	8.93	4.82	3.36
Core Composite Excess	0.21	0.17	0.09	0.29
Internal Fixed Income	3.83	9.53	5.03	3.58
Barclay's Aggregate	3.15	8.93	4.82	3.36
Internal Fixed Income Excess	0.69	0.60	0.20	0.22
BlackRock US Debt Fund	3.14	8.94	4.89	3.44
Barclay's Aggregate	3.15	8.93	4.82	3.36
BlackRock Excess	-0.01	0.01	0.07	0.08

Core Fixed Income Decomposition for the period ended 3/31/2020

Core Bonds Market Values

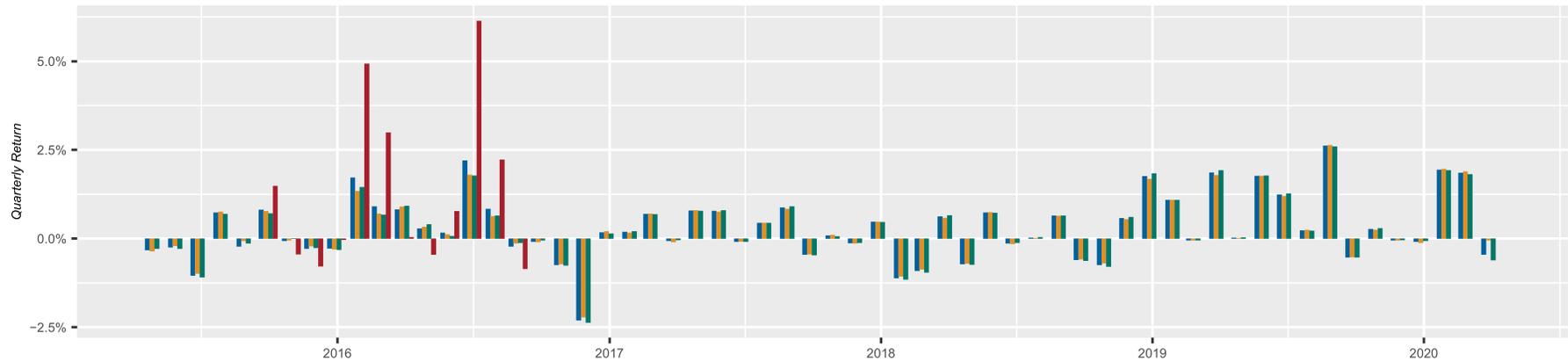


Core Fixed Income Dollar Value Added for the period ended 3/31/2020

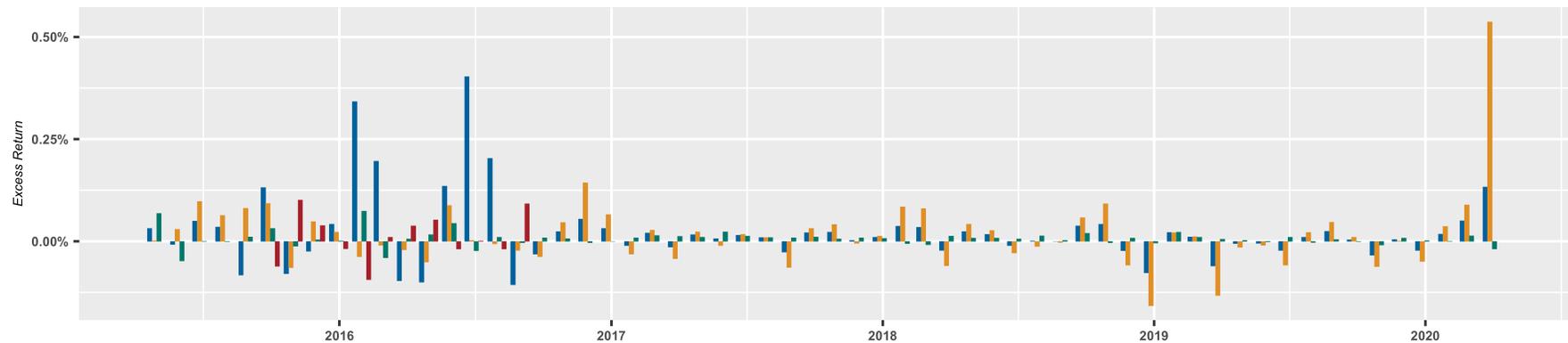


Core Fixed Income Quarterly Returns for the period ended 3/31/2020

Core Bonds Quarterly Return



Core Bonds Quarterly Excess Return

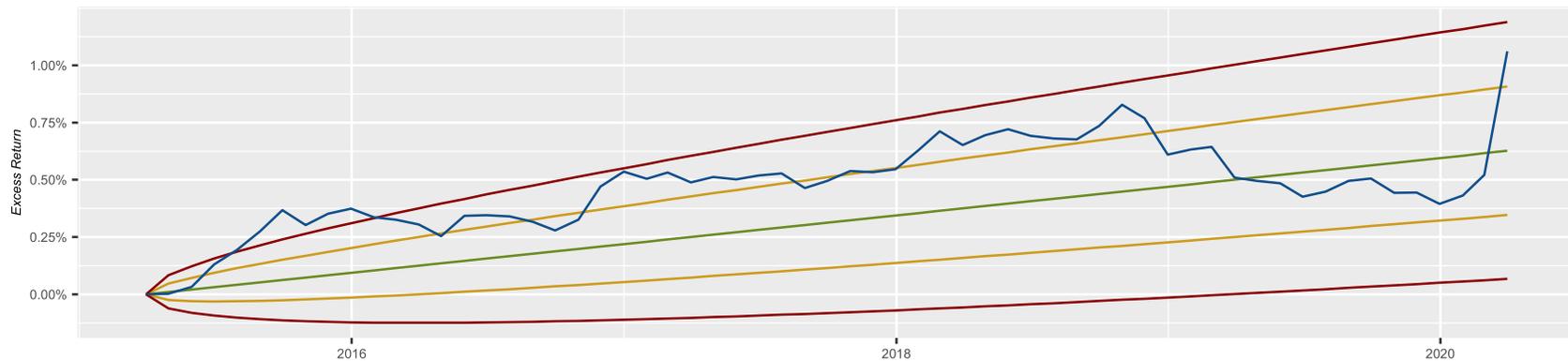


■ Core Bonds ■ Internal Fixed Income ■ BlackRock US Debt ■ BlackRock Long Govt

Core Fixed Income Performance for the period ended 3/31/2020

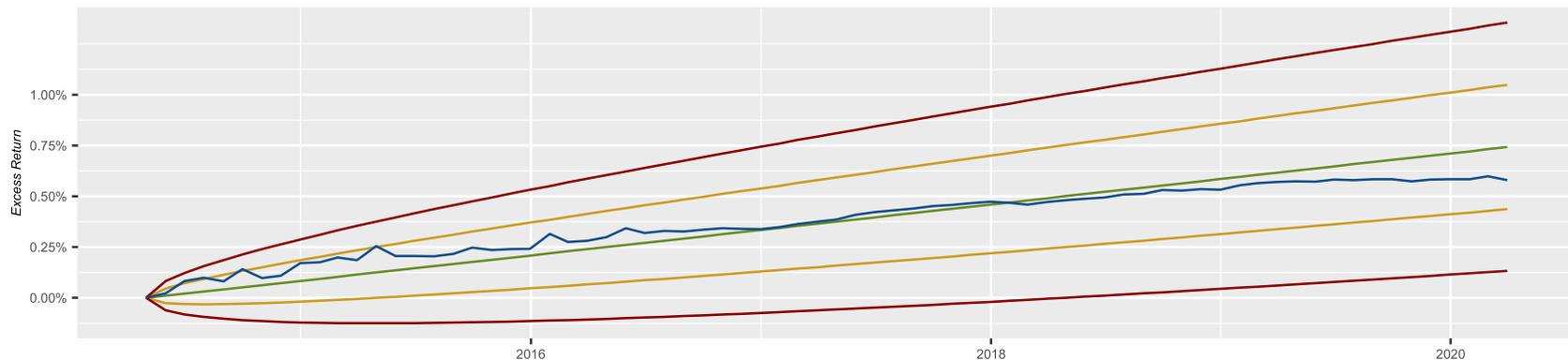
Internal Fixed Income Portfolio Performance versus Expectations

12.5 Basis Points Expected Excess Return with 12.5 Basis Points Expected Tracking Error



Blackrock US Debt Portfolio Performance versus Expectations

12.5 Basis Points Expected Excess Return with 12.5 Basis Points Expected Tracking Error



Agenda Item #5

Total Equity Implementation Plan 2020

Arizona State Retirement System

June 15, 2020

Outline

- 1 Review of Implementation Plan 2019
- 2 Structure of Equity Asset Class
- 3 Summary of Research
 - Domestic Equity Benchmark Selection
 - Factor Program
 - Alpha Overlay Program
 - Total Equity Portfolio Management
- 4 Private Equity
 - Background
 - Philosophy and Strategy
 - Portfolio Positioning
 - Cash Flow Analysis
 - Pacing Model
 - 2020 Implementation
- 5 Measuring & Monitoring

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Implementation Plan 2019 and Look Ahead

- In our previous implementation plan (IP 2019), we identified six strategies that we expected to drive outperformance against our benchmarks:
 - S&P 1500 versus MSCI USA (benchmark implementation)
 - Factor Program
 - Alpha Overlay Program
 - Internally managed portfolios
 - Securities lending
 - Private equity
- In this year's implementation plan, we have revisited the levers that did not perform
- We are recommending either defunding these strategies and moving to passive investing, or defunding the program(s) entirely
- Going forward, our focus will be based on outperformance from: enhanced passive investing, security lending, other index enhancing strategies, and sector over/under weights across both public and private equity

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Summary of Structure

The following slides present our proposed changes to the structure of the total equity asset class, summarized as follows:

- Portfolios/Strategies and Benchmarks
 - We have adopted the MSCI ACWI IMI index as our Total Equity benchmark
- Weights of Portfolios/Strategies
 - Target weights for both sub-asset class and total equity incorporate the recommended changes
- Public/Total Equity: Excess Return & Tracking Error Targets
 - We present the excess return and tracking error targets separately for public equities and total equities
 - Excess returns and tracking error targets are calculated based on live history of the portfolios, when applicable. Results are as follows:
 - Public equity: Excess return target is 25 basis points; tracking error target is 58 basis points
 - Total equity: Excess return target is 92 basis points; tracking error target is 210 basis points

Portfolios/Strategies and Benchmarks

Sub-Asset Class	Portfolio & Strategy	Benchmark	Manager
US LC	Internal US Large Cap	MSCI USA Large Cap	ASRS Internal
US MC	Internal US Mid Cap	MSCI USA Mid Cap	ASRS Internal
US SC	Internal US Small Cap	MSCI USA Small Cap	ASRS Internal
Int'l Developed LC	MSCI World ex-US SMA	MSCI World ex-US	Blackrock / Legal and General
Int'l Developed SC	MSCI World ex-US Small Cap SMA	MSCI World ex-US Small Cap	Blackrock
Emerging Markets	MSCI Emerging Markets IMI CIT	MSCI Emerging Markets IMI	Blackrock / Legal and General
Private Equity	ASRS PE Portfolio	MSCI ACWI IMI	Multiple

- The factor portfolios (US and EAFE) and the Alpha Overlay program are not included, pending decision

Weights of Portfolios/Strategies

Portfolio/Strategy	Sub-Asset Class	% of Sub-Asset Class		% of Total Equity	
		Current	Target	Current	Target
US LC	Internal US Large Cap	56%	100%	21%	37%
US MC	Internal US Mid Cap	100%	100%	4%	6%
US SC	Internal US Small Cap	100%	100%	4%	5%
Int'l Developed LC	MSCI World ex-US SMA	82%	100%	19%	22%
Int'l Developed SC	MSCI World ex-US Small Cap SMA	100%	100%	4%	4%
Emerging Markets	MSCI Emerging Markets IMI CIT	100%	100%	10%	9%
Private Equity	ASRS PE Portfolio	100%	100%	19%	18%

- Target weights will float with MSCI ACWI IMI

Public Equity: Excess Return & Tracking Error Targets

- Weighted average excess return is 25 bps, with 58 bps of tracking error

Sub-Asset Class	Portfolio/Strategy	Current Weight	Target Weight	Excess Return (bps)	Tracking Error (bps)
US LC	Alpha Overlay US Large Cap	12%	0%	0	0
US LC	Internal US Large Cap	26%	45%	25	70
US LC	Internal US Factors	8%	0%	0	0
US MC	Internal US Mid Cap	5%	7%	25	70
US SC	Internal US Small Cap	4%	6%	25	70
Int'l Developed LC	MSCI World ex-US SMA	23%	27%	30	30
Int'l Developed LC	EAFE Factor Portfolio	5%	0%	0	0
Int'l Developed SC	MSCI World ex-US Small Cap SMA	5%	4%	30	40
Emerging Markets	MSCI Emerging Markets IMI CIT	12%	12%	10	70

Total Equity: Excess Return & Tracking Error Targets

- Weighted average excess return is 92 bps, with 210 bps of tracking error

Sub-Asset Class	Portfolio/Strategy	Current Weight	Target Weight	Excess Return (bps)	Tracking Error (bps)
US LC	Alpha Overlay US Large Cap	9%	0%	0	0
US LC	Internal US Large Cap	21%	37%	25	70
US LC	Internal US Factors	7%	0%	0	0
US MC	Internal US Mid Cap	4%	6%	25	70
US SC	Internal US Small Cap	4%	5%	25	70
Int'l Developed LC	MSCI World ex-US SMA	19%	22%	30	30
Int'l Developed LC	EAFE Factor Portfolio	4%	0%	0	0
Int'l Developed SC	MSCI World ex-US Small Cap SMA	4%	4%	30	40
Emerging Markets	MSCI Emerging Markets IMI CIT	10%	9%	10	70
Private Equity	ASRS PE Portfolio	19%	18%	400	900

Total Equity: Expected & Trailing Performance

Sub-Asset Class	Portfolio/Strategy	Target Weight	Expected Outperformance (bps)	Trailing 1-yr Excess Return (bps)	Trailing 3-yr Excess Return (bps)
USA IMI	Internal Equity Portfolios	47%	25	-4	11
Int'l Developed LC	MSCI World ex-US SMA	22%	30	42	48
Int'l Developed SC	MSCI World ex-US Small Cap SMA	4%	30	48	63
Emerging Markets	MSCI Emerging Markets IMI CIT	9%	10	4	41
Private Equity	ASRS PE Portfolio	18%	400	476	628

● Note that Private Equity trailing returns are based on 94% of reported NAVs

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Background

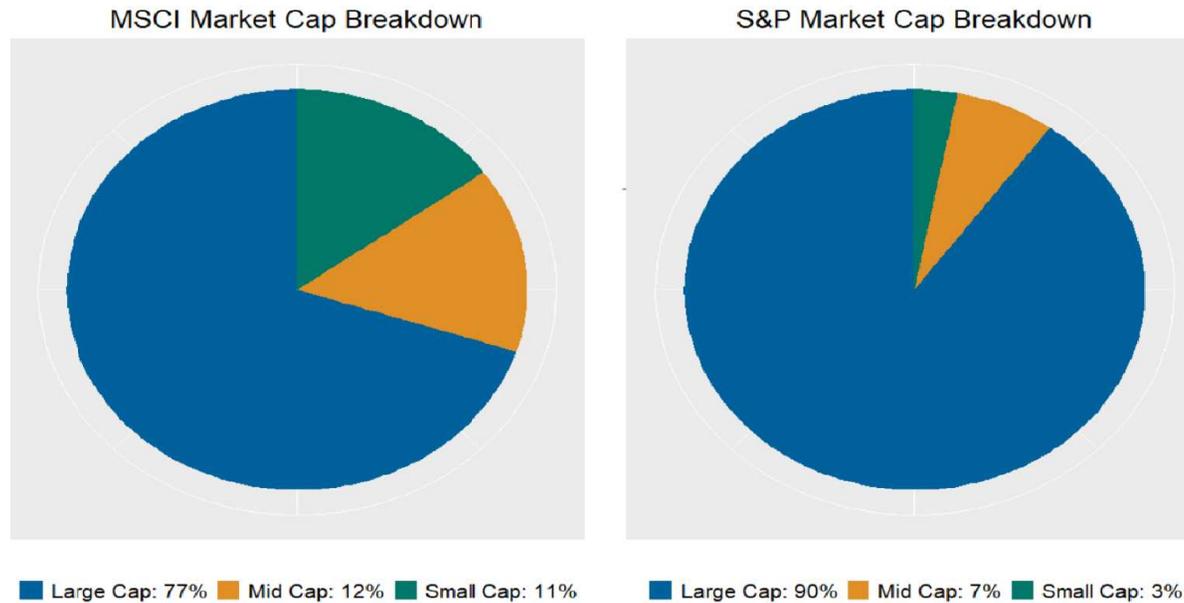
- In our prior implementation plan, the Equity team presented a study on the global MSCI ACWI IMI index as a benchmark for Total Equity
- Prior study showed potential for alpha when implementing S&P portfolios domestically
- In practice, tracking error was larger than previously expected, leading to periods of underperformance
 - To dampen the current tracking error, we implemented exposure control through optimization and regression analysis
 - Although this significantly reduced the drag, it was not the final solution
- We proposed transitioning our current S&P holdings to MSCI in all applicable instances

Why MSCI?

- Superior methodology:
 - Aims to provide comprehensive coverage of the relevant investable market, resulting in broader opportunity set
 - Builds on index liquidity, investability and replicability
 - Reflects an evolving market that does not allow for number-locking constituents within the indexes
 - MSCI is the only index provider with a consistent methodology across all regions, including the US
- Reduce unintended tracking error vs. the benchmark and tighter exposure via active control
- Increased yield in Securities Lending program
- Reduction in operational portfolio management, freeing up Equity team to focus on higher alpha generating strategies

MSCI vs. S&P

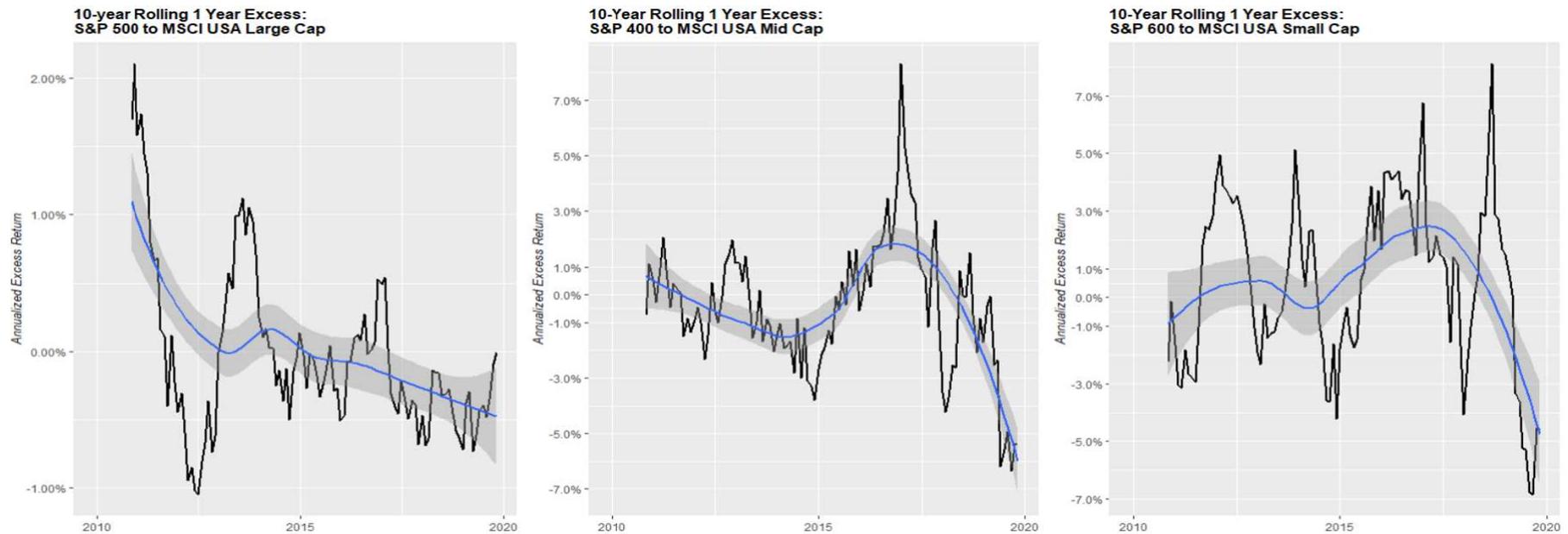
- MSCI USA IMI indexes provide better diversification among the large, mid, and small cap market segments:



- S&P indexes are locked by the number of companies in the index, i.e. 500/400/600. This leads to multiple weaknesses in the index construction, summarized as follows:
 - The market is largely represented by large cap at around 90%, with small cap at less than 3%
 - Total companies' capitalization in the combined S&P indexes is less than the total US market capitalization, ~90% of total market while MSCI captures ~99%
 - Cutoff inclusion for each index is set by number of companies, which leads, over the long run, to mid cap companies in the large cap index
 - The S&P mid cap index is more reflective of MSCI's small cap index, while the S&P small cap index leans more toward micro cap

Performance

- The following graphs show the excess returns of S&P versus MSCI
- MSCI has outperformed S&P in recent time periods and across market cap segments



Implementation

- Implementation
 - Engaged current brokers
 - Negotiated commission to reduce explicit costs
 - Completed switch on February 29th, 2020
 - We chose this day because it coincided with MSCI's quarterly rebalance and we were able to take advantage of the large liquidity event

Internal Equity Portfolios Impact

- The internal portfolios that previously tracked the S&P indices were transitioned to MSCI
 - Transition cost was determined to be de minimis when compared to unintended tracking error
 - Updated strategy papers detail objectives of the portfolios
- Our excess return targets for the internal equity portfolios are 25 basis points, and we plan to achieve this in the following ways:
 - Securities lending
 - Tactical constituent weighting
 - Equitization optimization
 - Futures versus physicals arbitrage
 - Index changes arbitrage between S&P and MSCI indexes
 - Sector baskets vs Sector
 - Sector rotation based on valuations
 - Statistical convergence trades within sectors, i.e. pair trading
 - Within sector relative valuations, i.e. CAPE vs forward and trailing index PE
 - Other trading opportunities for alpha capture

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Factor Program Background

- Sci-Beta multi-factor strategies were implemented within US Large Cap, EAFE Large Cap and EM equities
- The US Sci-Beta portfolio was funded in August 2017 with allocated capital of \$1.68 billion, inherited from the legacy MSCI factor portfolios (E7, E8 and E9). This stood at 8.1% of Public Equity and 6.8% of Total Equity
- EAFE & EM Sci-Beta factor portfolios were funded in June 2018 and May 2018, respectively, with allocated capital of \$1.53 billion & \$480 million. This stood at 10.6% of Public Equity and 9% of Total Equity
- In the first phase of Implementation Plan 2020, completed in February-March 2020, we implemented the following:
 - Implemented the Sci-Beta 6-factor index in both the US and EAFE, instead of the 4-factor index
 - Since implementation, the 6-factor index has outperformed the 4-factor index by 140 bps (as of May 29th, 2020)
 - Defunded EM factors and moved to EM passive strategy: \$500 million
 - Lowered allocation of EAFE factors program to \$1 billion from \$1.5 billion
 - Lowered allocation of US factors program to \$1.5 billion from \$1.75 billion

Factor Program Performance

Current exposure

As of May 4, 2020

US USD 1,210mm

EAFE USD 807mm

EM USD 0mm

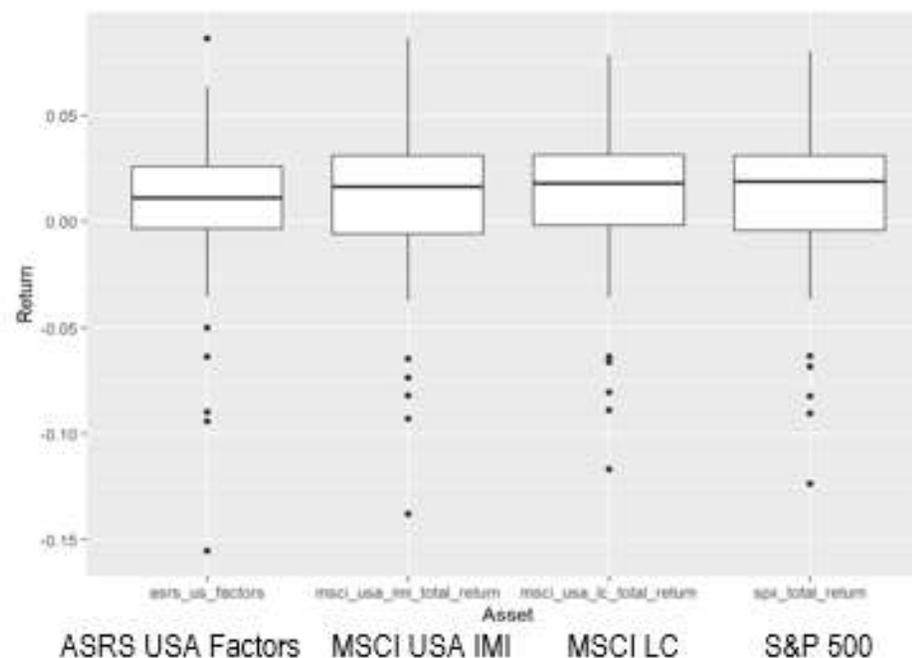
TOTAL USD 2,000mm

Percentage of Public Equity 13%

Percentage of Total Equity 10%

Performance , 2018 *

ASRS US Factors

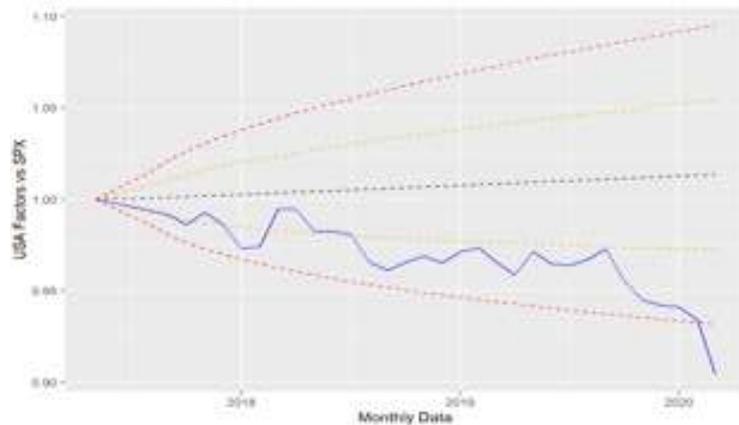


- US Factors have underperformed MSCI and S&P Indexes
- EAFE Factors have underperformed MSCI EAFE since the COVID-19 crisis, after outperforming fiscal year to Jan.
- EM factors have been underperforming MSCI EM Index pre and post COVID-19 crisis

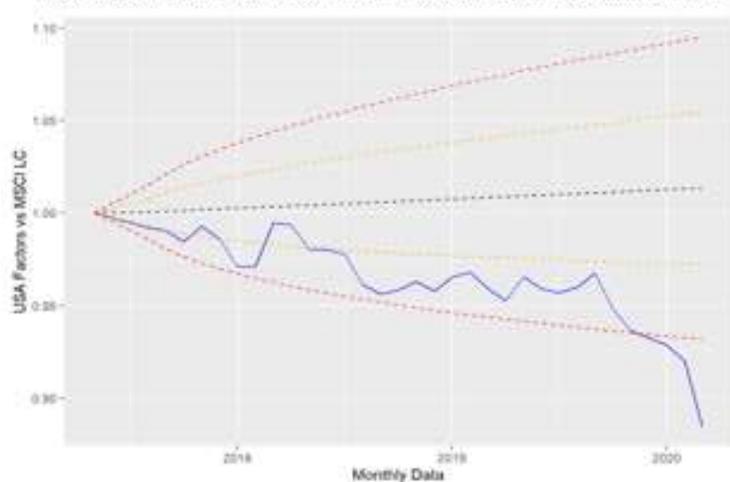
*New Sci Beta program

US Factors Performance

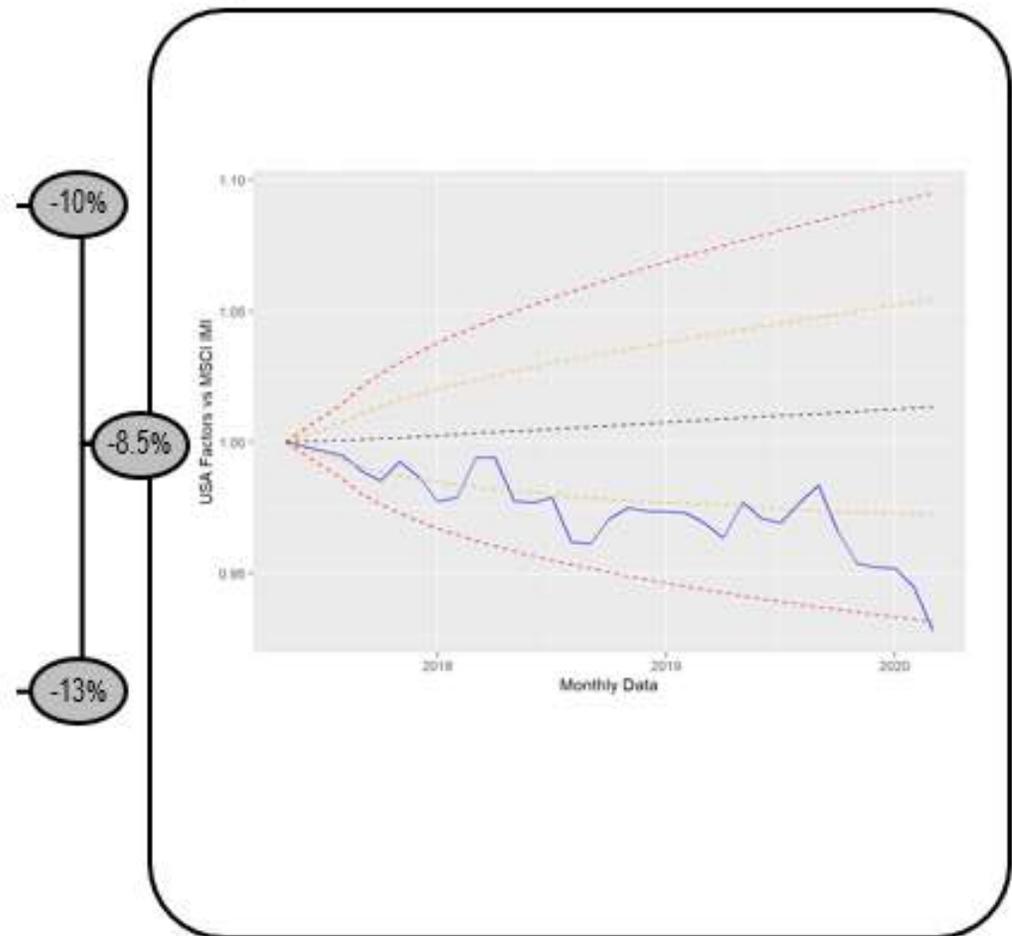
ASRS US factors' performance vs S&P 500 Index



ASRS US factors' performance vs MSCI USA Large Cap Index

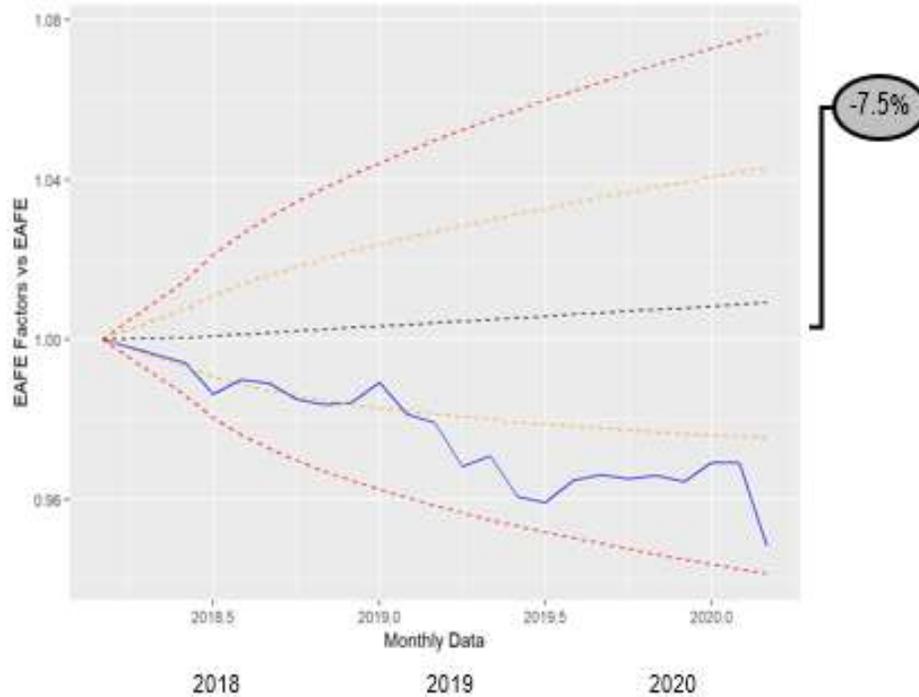


... Compared to US total Market: MSCI USA IMI

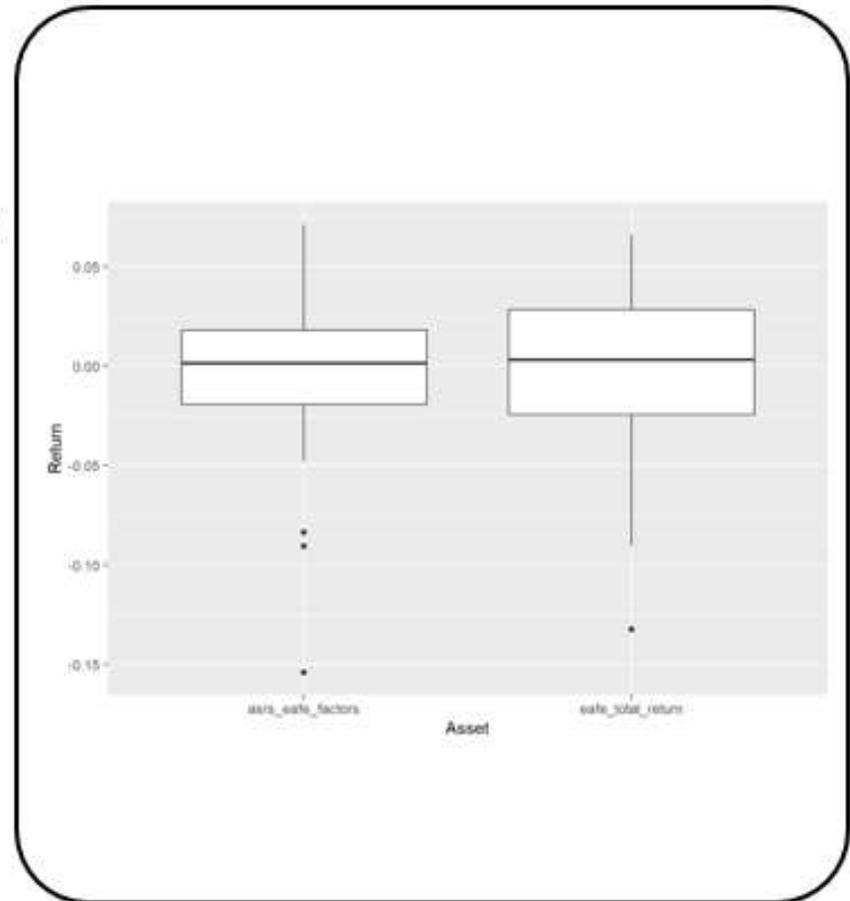


EAFE Factors Performance

ASRS EAFE factors' performance vs MSCI EAFE Index



...Boxplot EAFE factor vs MSCI EAFE



Quantitative Analysis of Factor Program

- Factor returns are statistically significant at lower than zero

US Factors vs S&P 500 Index one sample test

One Sample t-test
US factors vs S&P
t = -1.8098, df = 31, p-value = 0.04001
alternative hypothesis: true mean is less than 0
95 percent confidence interval:
-Inf -0.0001955631
sample estimates:
mean of x
-0.003096055

US Factors vs MSCI IMI Index one sample test

One Sample t-test
US Factors vs MSCI IMI
t = -1.5105, df = 31, p-value = 0.07053
alternative hypothesis: true mean is less than 0
95 percent confidence interval:
-Inf 0.0002810046
sample estimates:
mean of x
-0.002293583

US Factors vs MSCI Large Index one sample test

One Sample t-test
US Factors vs MSCI large
t = -1.9257, df = 31, p-value = 0.03168
alternative hypothesis: true mean is less than 0
95 percent confidence interval:
-Inf -0.0004502922
sample estimates:
mean of x
-0.003767237

EAFE Factors vs MSCI EAFE Index one sample test

One Sample t-test
EAFE Factors vs MSCI EAFE
t = -1.7362, df = 21, p-value = 0.04859
alternative hypothesis: true mean is less than 0
95 percent confidence interval:
-Inf -2.127513e-05
sample estimates:
mean of x
-0.002390897

Factor Program: Conclusion and Recommendation

- The Team recommends defunding the factor program and moving the assets to passive portfolios within the respective asset classes. Our recommendation is based on the following:
 - ASRS's plan was to reassess the program after 3 years of implementation, which coincides with July of this year (2020)
 - Throughout the investment period, the factors program has continuously underperformed
 - EDHEC Sci-Beta factors, like all other factor vendors, have been underperforming across markets and capitalizations
- Recommendation:
 - Defund US and EAFE factors and move to passive strategy
 - Target date for defunding will be by the end of the fiscal year: June 30, 2020

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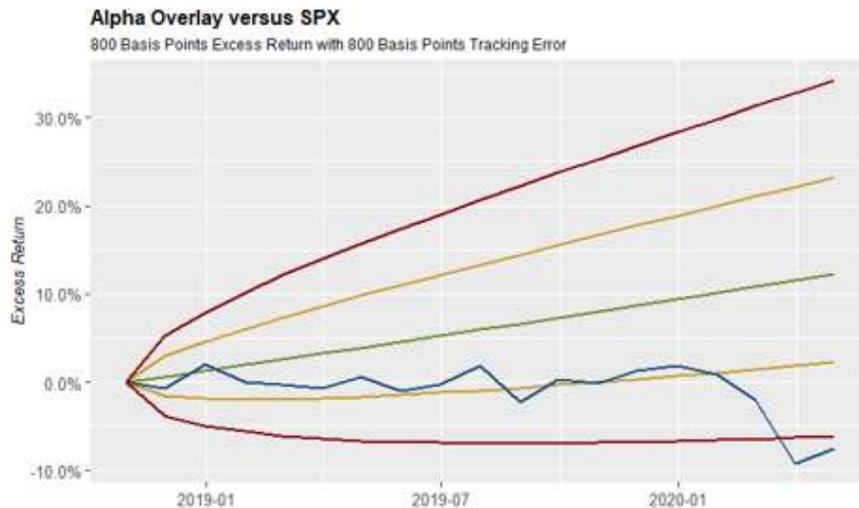
Alpha Overlay Program Background

- In November 2018, the Equity Team implemented an Alpha Overlay Program, ported over the S&P 500 with 8% targeted tracking error
- At the time of investment, the Alpha Overlay fund was 9.2% of Public Equity and 7.6% of Total Equity
- In 2018-2019, the Equity Team conducted a study and due diligence on potential funds that would be included in the alpha overlay underlying program.
 - The team concluded that the potential alpha strategies were not accretive to the performance of the program, thus no further investments were made

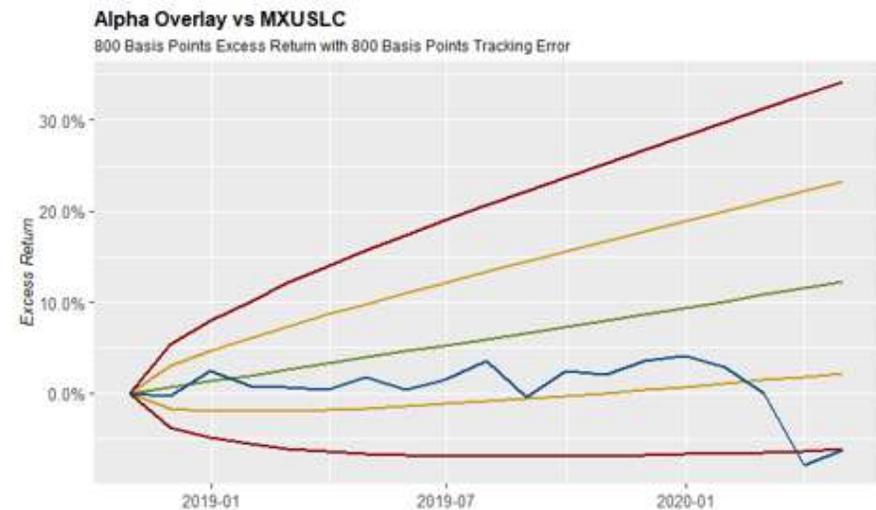
Alpha Overlay Program Performance

- Cone charts using strategy's stated objective of 800 basis points excess return, with 800 basis points tracking error:

Alpha overlay's performance vs S&P 500 Index

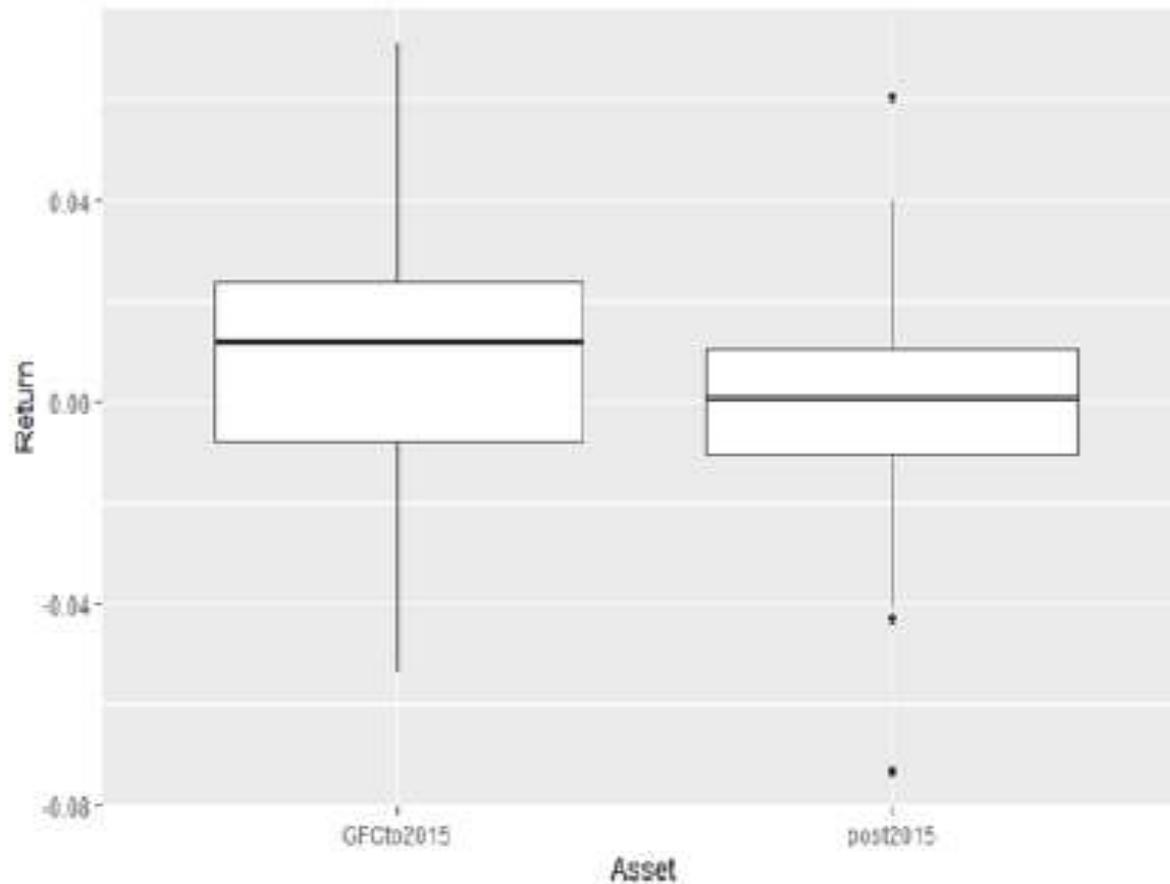


Alpha overlay's performance vs MSCI USA Large Cap Index



Alpha Overlay Program Performance

- Alpha Overlay shows higher returns and lower dispersion during GFC to 2015 vs 2015-to-date
- Since 2015: Median returns dropped to ~zero and exhibit higher dispersion and outliers:



Alpha Overlay Program: Conclusion and Recommendation

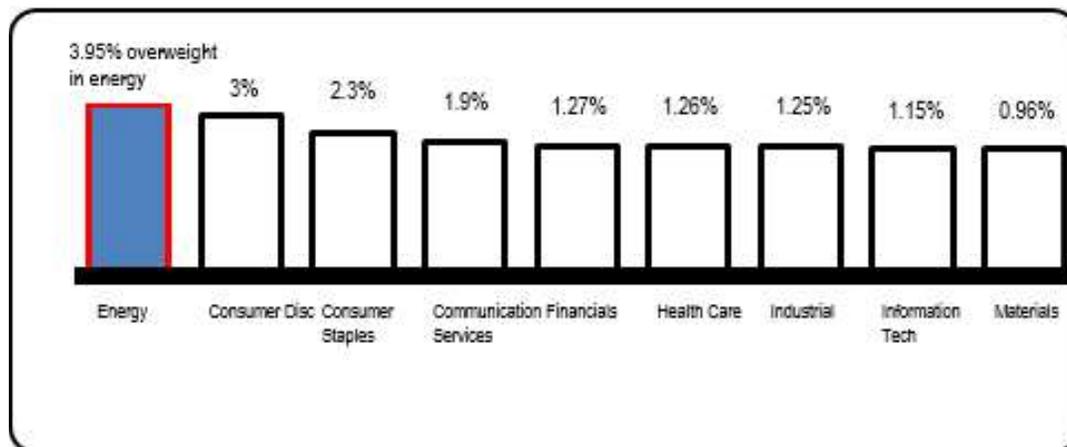
- The Team recommends:
 - Defund the alpha overlay strategy and move assets to internally managed portfolios
 - Target date for defunding will be by the end of the fiscal year: June 30, 2020

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Management of Sector Exposure

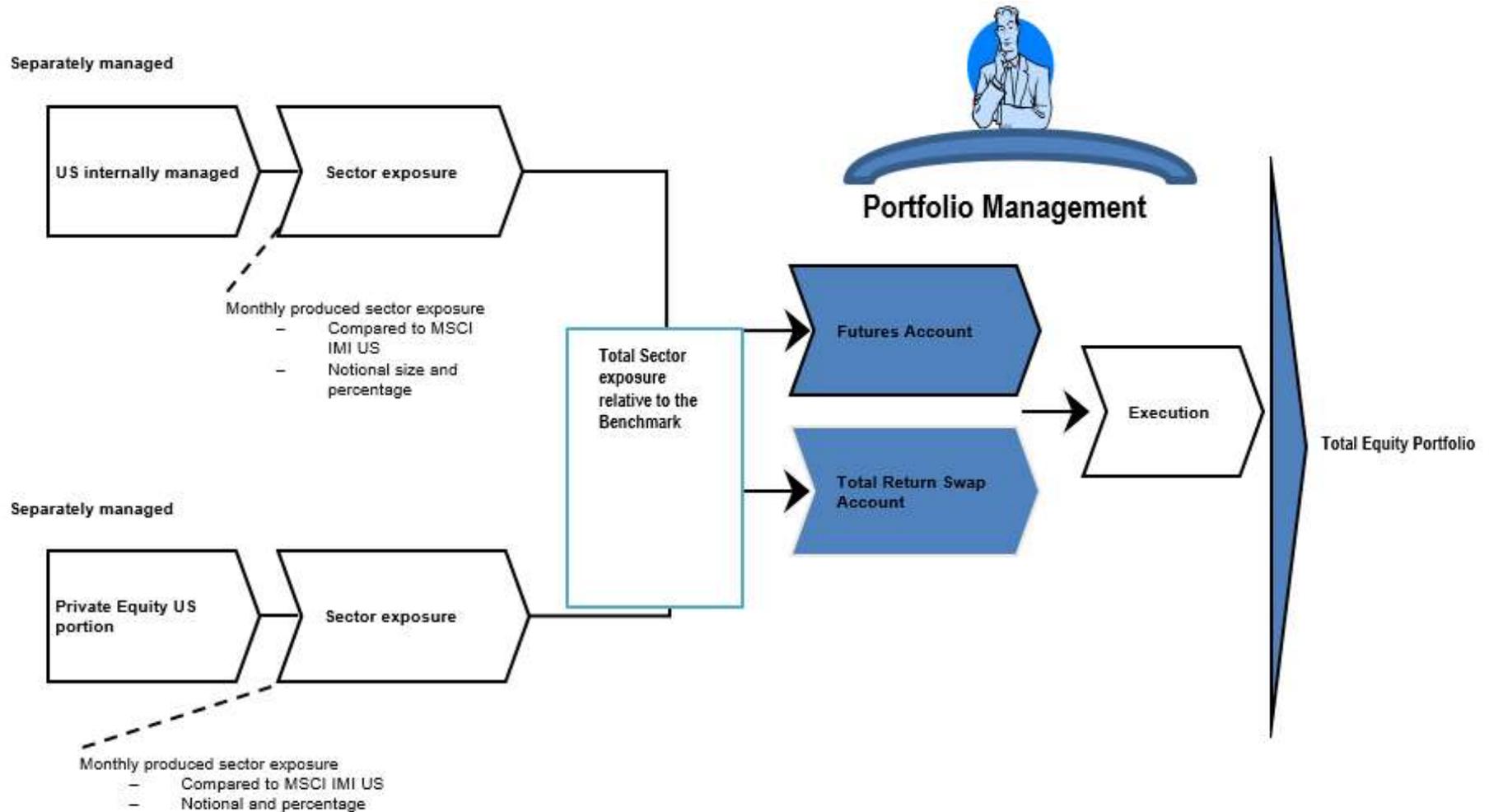
Example of Total US equity GICS sector exposure overweight vs Benchmark underweight



- Typically in a large, well-diversified US portfolio, sector concentration is inevitable as ASRS's private equity process is based on selecting top managers across matrices in their sector
- Managing the total equity portfolio on a total portfolio basis would allow ASRS to hedge Beta sector exposure
- This could be implemented with equity basket TRSs with different counterparties, and/or through equity futures
- This type of total portfolio management would be based on the following:
 - Limits on how much single sector concentration can be tolerated vs benchmark, i.e. 1% of total maximum exposure
 - Team view on that particular sector in the public market

- ASRS to set off-benchmark sector limit per each sector
- Risk management to monitor on a weekly basis that:
 $\Sigma Exposure(US\ Public\ Equity\ Sectors, US\ Private\ Equity\ Sectors, Open\ OTC\ TRS\ or\ Futures) vs\ Benchmark$

Total Equity Program Structure



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What is Private Equity?

- Private equity is an alternative form of private financing, away from public markets, in which funds and investors directly invest in companies or engage in buyouts of such companies
- Private equity companies raise funds from Qualified Investors to invest directly into companies across a range of strategies (leveraged buyouts, distressed, venture capital, growth equity, etc.)
- When committing to a private equity fund, it is a long term commitment (typically 10 - 12 years) whereby the commitment is deployed at the discretion of the general partner over 3 - 6 years in illiquid investments
- Investment Process
 - Deal structure and price are negotiated between the investor and company management
 - Unlike public markets, investor can request access to all information, including internal projections during due diligence
 - Investors typically remain heavily involved in the company after the transaction via board seats, operations groups working directly with management, and systematic data collection

Why invest in Private Equity?

- At ASRS, the goal of Private Equity is to enhance returns of the total equity portfolio by
 - Capturing the illiquidity premium relative to public markets (i.e. excess return earned for taking on the risk of owning illiquid assets over the long term)
 - Active investment approach to ownership by the General Partner to build better businesses through reorganization, acquiring competitors to gain market share, increasing efficiency of operations, optimizing balance sheet, acquiring at a discount, etc.
- The number of US publicly traded companies has declined by nearly 40% since 2000 and the trend is expected to continue while the growth of private equity has continued unabated ¹

Commingled Fund Structure

- General Partner (GP) /Limited Partner (LP) structure
 - General Partner is the manager of the fund
 - Limited Partners are the investors
 - Advisory Board comprised of a subset of limited partners
- GP has full discretion based on certain portfolio guidelines that
 - Describe the strategy, product type, and geography
 - Establish limits of the portfolio
 - For instance, maximum exposure of 25% to Europe
- Standard Terms
 - 4 - 6 year investment period with ability to recycle capital
 - 10 year life with 2 one year extensions at the approval of the Advisory Board
 - Asset management fee of 1.5% - 2% on commitment and 20% promote over 8% hurdle with 100% catchup

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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
 - We propose the Private Equity portfolio to maintain a target of 18% of Total Equity
- The team would be using in-depth macro research as well as sector bottom up research to pursue high absolute and risk-adjusted returns through cycles. This should be achieved by manager selection, while minimizing volatility and drawdowns compared to traditional equity markets
 - A bottom-up approach through diligent cross-sector, and industry research allows identification of both the best manager within each strategy, sector and subsector
 - The investable universe in the Canada, US and Europe region hosts more than 6,300 private equity managers, which makes bottom-up research a key piece of the investment strategy that would allow us to select the best potential manager within each identified sector

Investment Philosophy

- Private Equity offers key benefits as a form of equity ownership
 - Operational change is incentivized for both the company and the General Partner (GP), leading to higher IRR mainly due to higher operating income and/or multiple expansion
 - Longer term time horizons for ownership and performance Key Performance Indicators (KPIs) are often more appropriate than quarterly cadence of public listings
 - Small and medium sized businesses represent a large part of the economy
- Private equity outperforms public equity market returns over a long-term investment horizon
- Higher regulatory costs are leading many companies to stay private
- Higher liquidity and higher private markets multiples have contributed to make this asset class more attractive

Investment Philosophy

We believe successful private equity investing hinges on three considerations:

- Strategy
- Organizational Dynamics
- Track record (confirmation of the first two)

Strategy

- ASRS favors
 - Buyout strategies that emphasize organizational transformation instead of mere financial engineering
 - Sector specialists in growing sectors with high revenue growth potential
 - Investments in sectors impacted by regulatory change
 - Investments with sponsors having specialized expertise in restructuring, bankruptcy, and turnaround situations
 - Managers with a discernible edge (sourcing, operational capabilities, and capital structuring)
 - Firms with a thoughtful succession plan
 - Ability to provide co-investment
 - ASRS invests in GPs during their third fund or thereafter
- ASRS is underweight
 - Venture Capital
 - Europe
 - Emerging Markets

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 performance

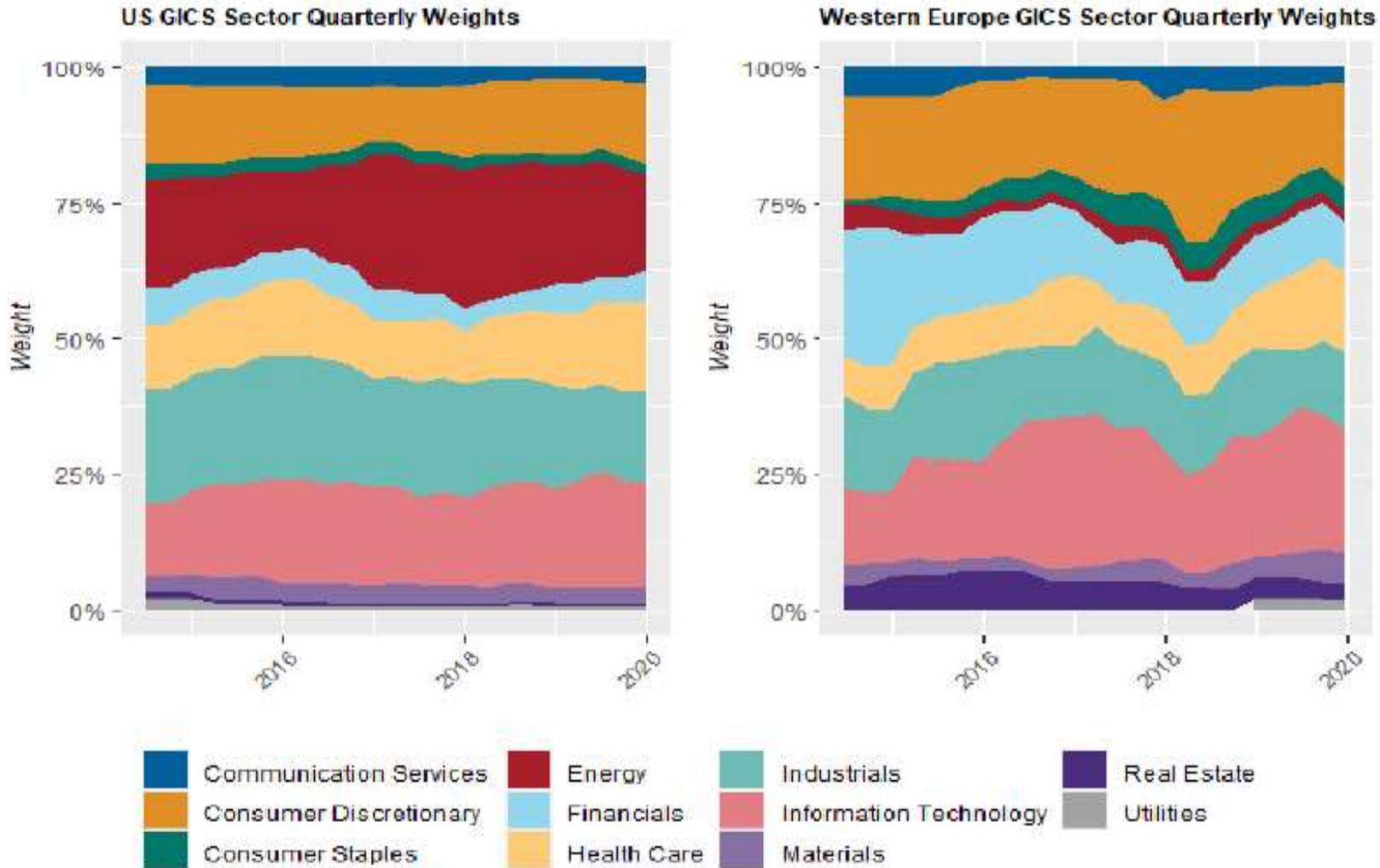
Risk Management & Portfolio Structuring

- Geographic Diversification
 - Minimum 60% NAV in North America
 - Maximum of 30% NAV in Western Europe
 - Maximum of 10% of NAV in all Other regions combined; with no single Other region having more than a 5% allocation
- Sponsor Diversification
 - No more than 5% of NAV in one single fund
 - Maximum of 15% of NAV in one sponsor
- Risk Management
 - Monitoring entry and exit multiples, uses of leverage, profitability trends, and growth of portfolio companies
 - Monitoring of market and sector valuations

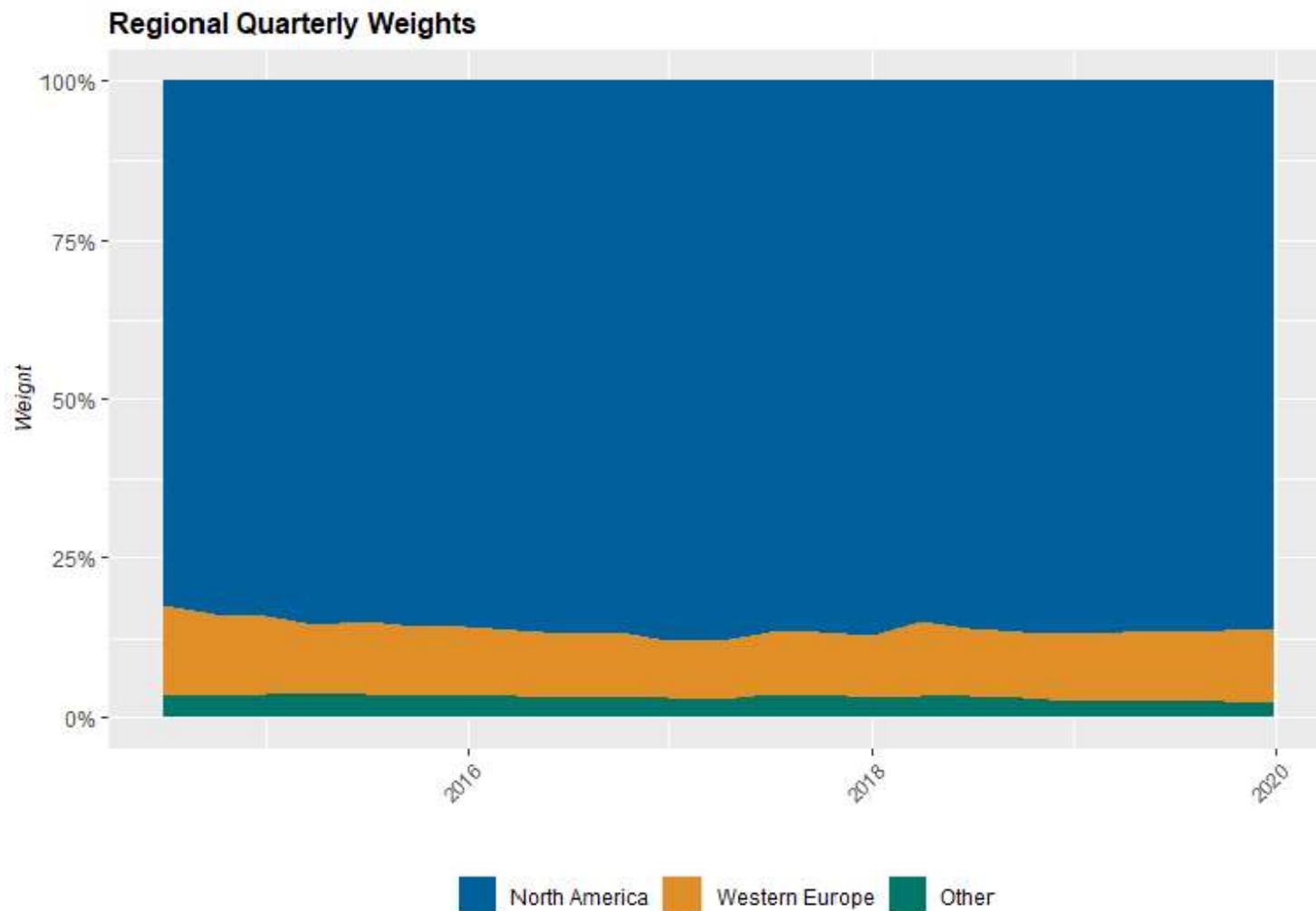
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Exposure by Sector



Exposure by Region

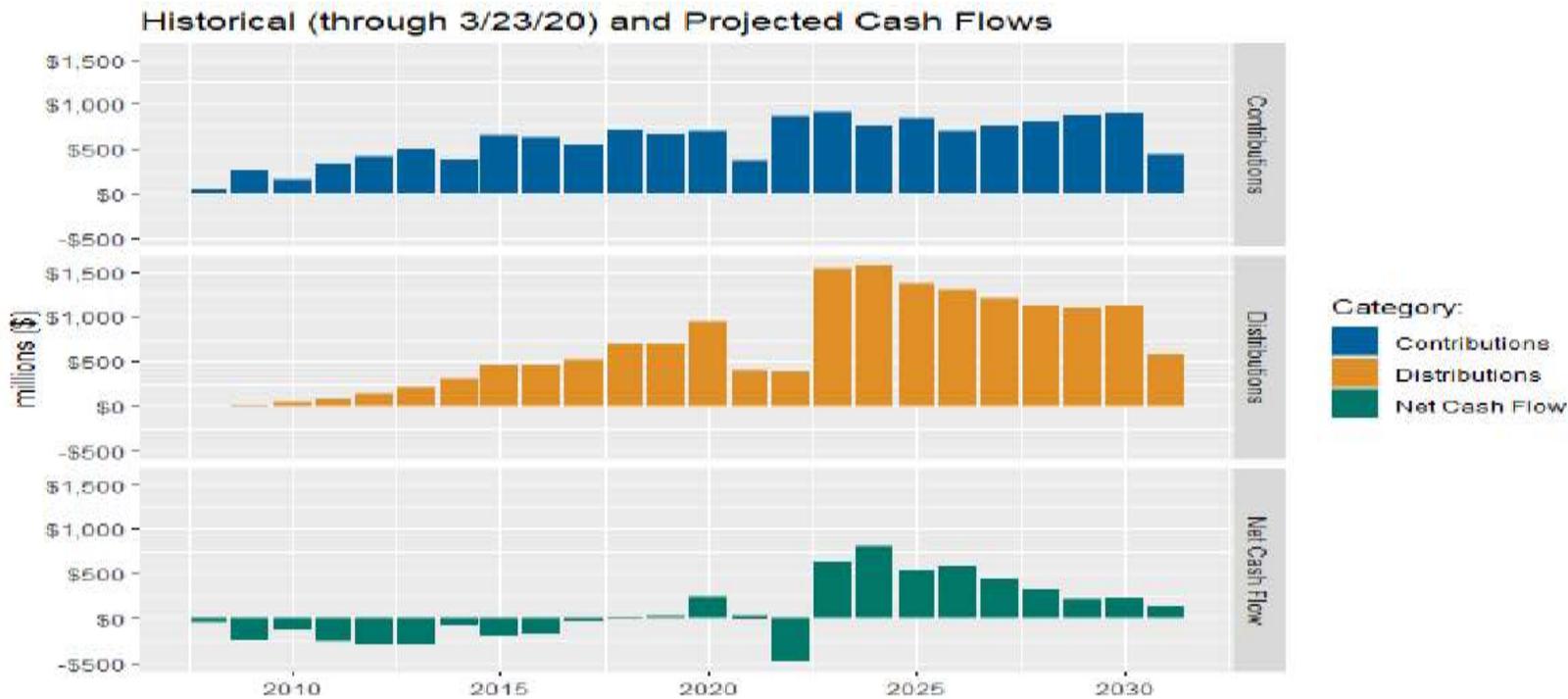


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ASRS Cash Flow History and Projected

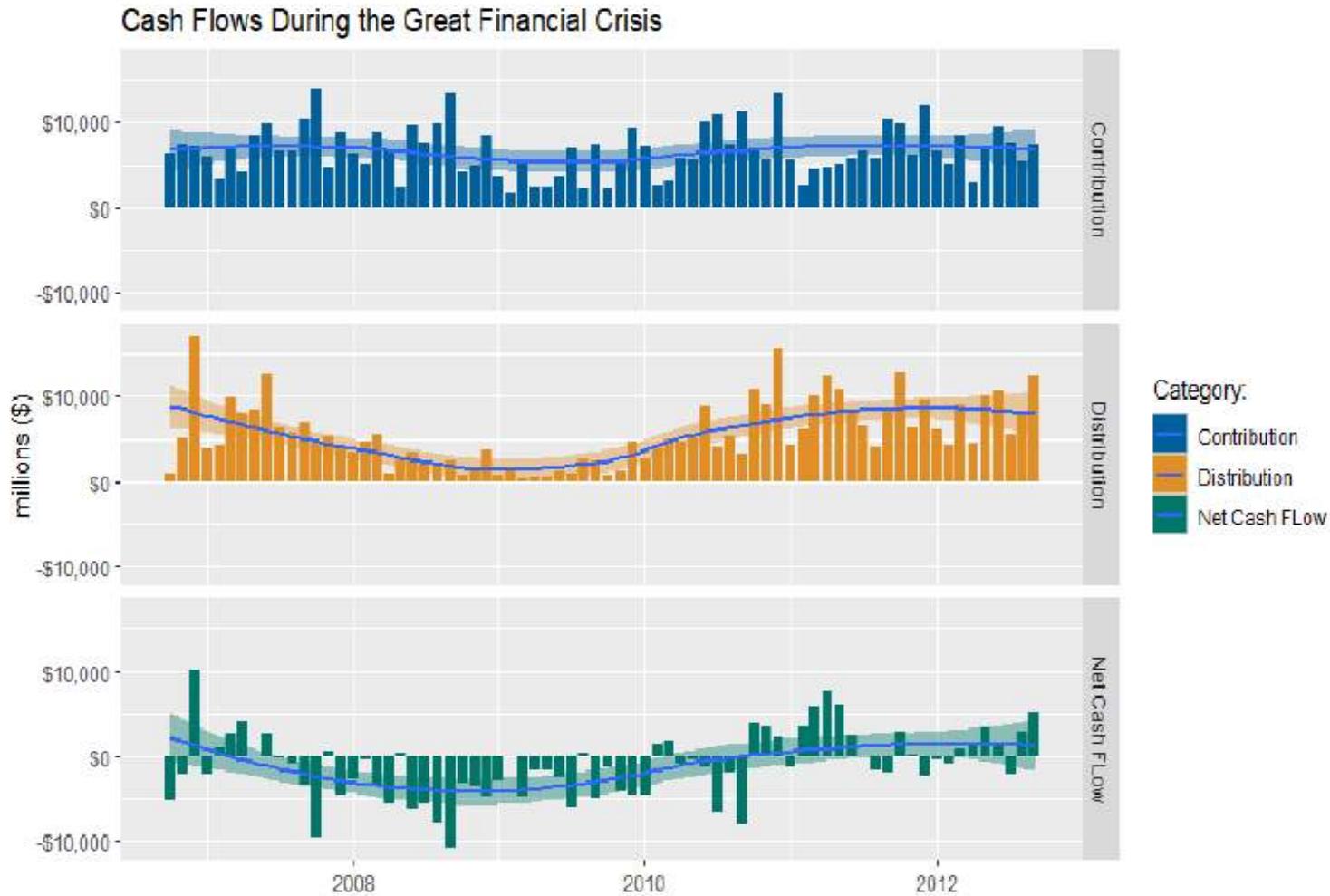
- Net cash flow for the private equity portfolio has been positive since 2016 but, with projected decreases in distributions, cash flows are expected to be marginally positive this year and negative next year



Cash Flows during Last Downturn

- ASRS maintains a database of over 1,100 private equity funds historical cash flows and NAVs as a byproduct of the underwriting process
- An analysis of cash flow activity during crises, such as COVID-19, was conducted on the 2 years before and after the 2008-2009 global recession
 - Capital calls declined significantly immediately after the Lehman bankruptcy but was back to long term averages relatively quickly
 - Distributions declined materially and stayed depressed before slowly recovering

Cash Flow Analysis Pre and Post Crisis



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Compliance

- The precipitous decline in public markets during the first quarter caused the private equity portfolio to breach the 20% of total equity constraint
- As per the strategic asset allocation, IMD staff is required to develop a plan to bring this breach into compliance within a reasonable timeframe
- Due to the illiquid nature of private equity, there are two feasible options
 - Liquidate by selling existing fund interests via the secondary market
 - Sub optimal due to the probable discount in normal market environments and potentially substantial discount during market dislocations
 - Reduce future commitments to bring back into compliance over time
- Pacing model has been revised to reflect reductions in commitments over the next 4 years to ensure compliance
- As of 6/2/2020, the increase in value of public equities since late March lows has resulted in private equity within compliance at approximately 18%

Pacing Model Background

- The private equity pacing model incorporates a number of assumptions regarding future commitment amounts, growth of those commitments, capital call pace, distributions, and future returns to forecast future cash flows, net asset values, and private equity percentage of total equity
- The capital call model changes are modeled to mimic the capital call behavior during the GFC. Specifically, the first quarter after the Lehman brothers bankruptcy, capital calls drastically fell followed by increased activity over the next 3 quarters. The model assumes that the same percentage of commitment will be called (90% of commitment) but that the timing of those capital calls shifts. The model is consistent with analysis released by Burgiss regarding capital calls in alternative assets in the 12 months following the onset of a recession or black swan type event.

Revised Model Highlights

- Net asset values are modeled to decline by 10% in 1Q2020
 - Total return assumed to be 5.5% over the next year
 - 11% growth thereafter
- Distributions are expected to significantly decline over the next two years
- Capital calls are also expected to decline over the short term but relatively quickly returning to normal over the next year

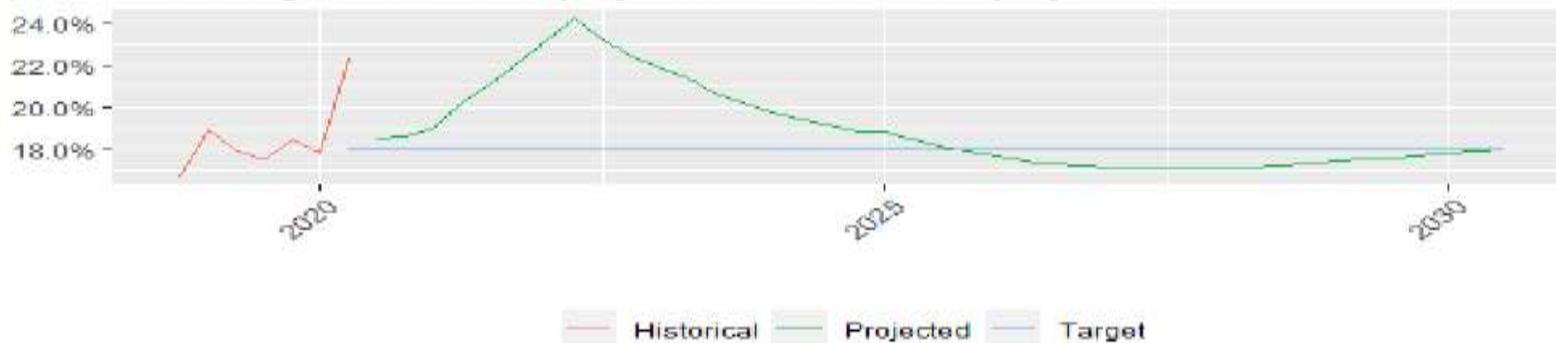
Model Conclusion

Calendar Year	Commitment (Millions)
2020	500
2021	600
2022	700
2023	800
2024	900
2025	915
2026	957
2027	1001
2028	1047
2029	1095

Private Equity Model

If no new commitments were made in 2020 or 2021, private equity is projected to peak at approximately 23% of total equity based on current unfunded commitments

Percentage of Private Equity Relative to Total Equity



Total Private Equity Net Asset Value



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Updated Recommendations

- Reduce new commitments in 2020 from \$750m to \$500m
 - Model assumes increases by \$100m each of the next four years followed by 4.5% thereafter
 - 2019 new commitments was \$725 m
- Target a 20% Europe exposure rather than the current approximately 10% weight
- Replicate US strategy in Europe of sector specialists and/or regional specialists

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Positioning

- We monitor markets considering:
 - Valuations compared to historic means, including cyclically adjusted P/E
 - Geographical and sectoral relative valuations
 - Relative valuation across asset classes, compared to historic averages
 - Relative valuation of currency, global interest rates and credit spreads
 - Trends and momentum
- We document this analytical work in House Views which are the basis for tactical decisions to overweight or underweight
- 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 weekly to discuss positioning

Monitoring

- Tools and resources to measure/monitor our strategies include the following:
 - State Street's Net Asset Value (NAV) Decomposition: Decomposes internal equity portfolio returns
 - Bloomberg Transaction Cost Analysis (BTCA) & IEX's Astral: Trade cost analysis tools that calculate performance of trades versus execution benchmarks
 - Barra Portfolio Manager: Decomposes returns into sectors, factors, currency and stock specific
 - Performance Levers: Decomposition of daily excess returns into dollar value added (DVA)
 - 2020 levers to include: Allocation, Futures, Internal Passive and External Passive
 - Cone Charts: Plots excess return and tracking error target expectations versus stated objectives

Costs

- We are highly cognizant of costs in managing the investment program
 - We manage approximately 40% 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
 - When possible we aim to get fee discounts for size and timing of the close
 - Also pursue co-investments in order to reduce fees and carry
 - Opted into reduced fee side car vehicles

Agenda Item #6

Arizona State Retirement System

Independent ASRS Investment Program Oversight for the Period Ending March 31, 2020

Allan Martin, Partner, NEPC
John Krimmel, Partner, NEPC
Michael Malchenko, Sr. Analyst, NEPC



CONTENTS

- ASRS Investment Objectives/Performance
- Independent Oversight/Compliance
 - SAA Policy Compliance
 - Total Fund and Asset Class Performance
 - Asset Class Committee Monitoring
- Market Environment Update and Outlook
- Appendix: SAA Policy History



DISCLOSURE

NEPC has developed reports for both the Investment Committee and Board designed to 1) provide the appropriate level of investment information for the purposes of independent oversight (ASRS SAAP compliance, Asset Class Committee minutes review, investment selection due diligence packet compliance and oversight of the investment program data used to compile NEPC and ASRS reporting); 2) provide ASRS investment program performance relative to its goals/objectives (presented quarterly); and 3) communicate NEPC's perspectives on the market environment, investment outlook or other initiatives or topics they believe are important to convey to the Board.

NEPC has completed a quarter-end quality control process and warrants that IMD Staff materials are accurate subject to the following process:

- Investment results were calculated using data provided by the Plan's custodian bank that is deemed "final" as of March 31, 2020.
- Investment performance oversight includes reconciliation and confirmation of portfolio level valuations, cash flows, transactions and composite construction including interpretation of investment accounting methods used to track IMD Staff instructed activities.
- Oversight of performance calculation includes verification of Staff data used to produce reporting as well verification of processes and procedures in custom investment performance calculations.
- NEPC performed tests of the data produced by IMD Staff and the Plan's custodian bank (book of record) using underlying financial records provided by the custodian bank and IMD Staff. The net effect of uncorrected misstatements is immaterial, and has been brought to the attention of IMD Staff.



ASRS INVESTMENT OBJECTIVES/PERFORMANCE

Note: All of the data shown on the following pages is as of March 31, 2020 and reflects the deduction of investment manager fees, unless otherwise noted.

NEPC, LLC

ASRS INVESTMENT OBJECTIVES

Goal #4: Design, implement, and maintain an investment management program that maximizes rates of return for acceptable of levels of risk.

- a) Develop, approve and implement an Asset Allocation program that is expected to achieve a 20-year rolling average annual return at or above the actuarial assumed return
Goal met: Yes
- b) Achieve a total fund net return in the top quartile of the peer universe
Goal met: Yes
- c) Achieve a 1 year total fund net return greater than the Strategic Asset Allocation Benchmark
Goal met: No
- d) Achieve a 3-year total fund net return greater than the Strategic Asset Allocation Benchmark
Goal met: Yes
- e) Achieve 1 year asset class net returns greater than the respective Asset Allocation Benchmarks
Goal met: Partial
- f) Achieve 3 year asset class net returns greater than the respective Asset Allocation Benchmarks
Goal met: Partial
- g) Sufficient cash will be maintained to meet all payment requirements
Goal met: Yes



Source: ASRS Strategic Plan, August 2018

Arizona State Retirement System

TOTAL FUND PERFORMANCE

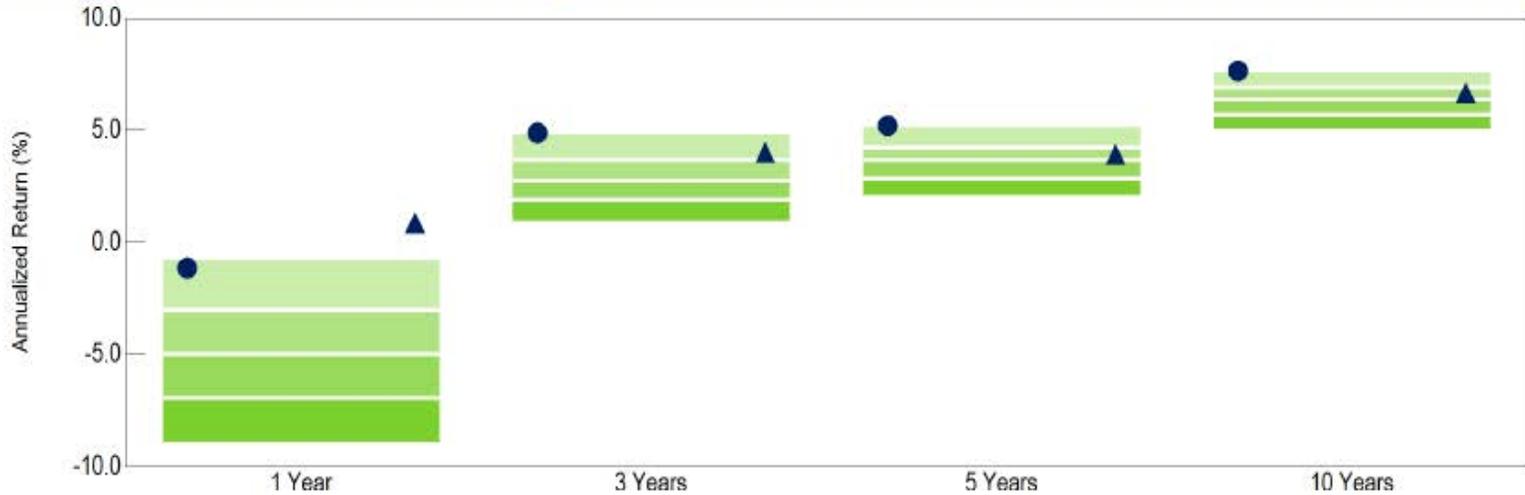
	3 Mo	Fiscal YTD	1 Yr	3 Yrs	5 Yrs	10 Yrs	Inception	Inception Date
Total Fund	-9.2%	-4.1%	-1.1%	4.9%	5.2%	7.7%	9.4%	Jul-75
<i>Interim SAA Policy</i>	<u>-8.4%</u>	<u>-3.2%</u>	<u>0.9%</u>	<u>4.0%</u>	<u>3.9%</u>	<u>6.7%</u>	<u>9.0%</u>	<i>Jul-75</i>
Excess Return	-0.8%	-0.9%	-2.0%	0.9%	1.3%	1.0%	0.4%	

Composition of SAA Policy can be found in the appendix.



UNIVERSE COMPARISON

InvMetrics Public DB > \$1B Net Return Comparison Ending March 31, 2020



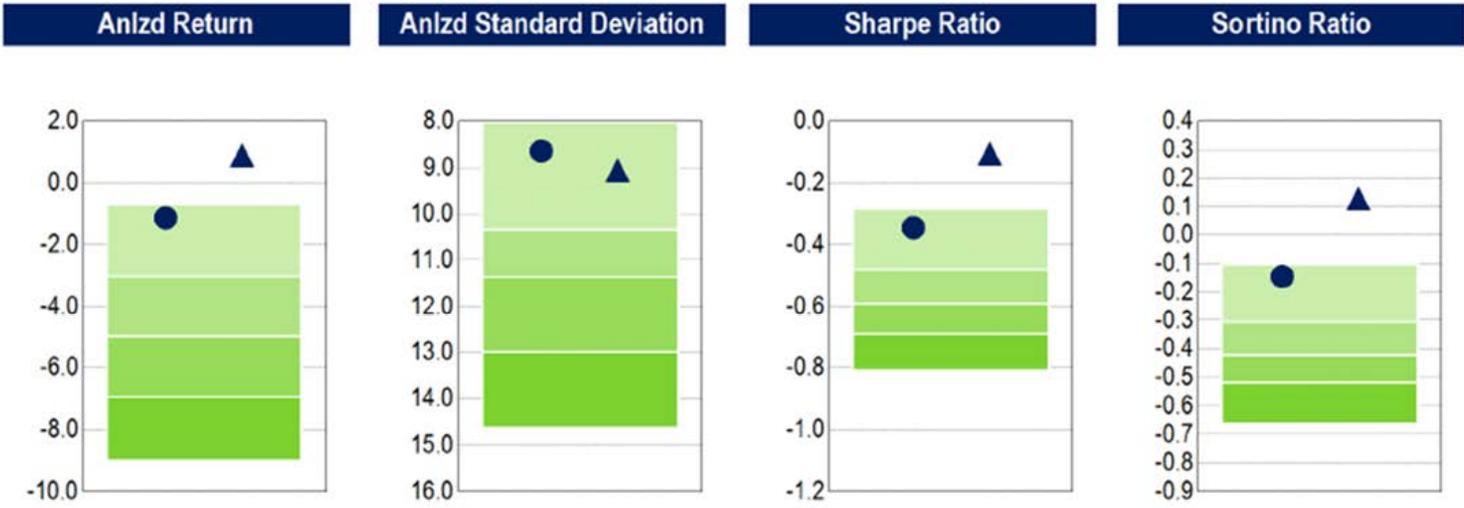
	Return (Rank)	Period	1 Year	3 Years	5 Years	10 Years
5th Percentile	-0.7			4.9	5.2	7.7
25th Percentile	-3.0			3.7	4.2	6.9
Median	-5.0			2.8	3.7	6.4
75th Percentile	-6.9			1.9	2.9	5.7
95th Percentile	-9.0			0.9	2.0	5.0
# of Portfolios	62			62	59	55

	1 Year	3 Years	5 Years	10 Years
● Total Fund	-1.1	4.9	5.2	7.7
Total Fund Percentile Rank	9	5	6	6
Total Fund Ordinal Rank	6	3	4	3
Number of Funds In Universe	62	62	59	55
▲ Interim SAA Policy	0.9	4.0	3.9	6.7



UNIVERSE COMPARISON

InvMetrics Public DB > \$1B Net (peer) 1 Year



●	Total Fund Return	-1.1	8.6	-0.3	-0.1
	Percentile Rank	9	12	11	9
	Ordinal Rank	6	7	7	6
▲	Interim SAA Policy Return	0.9	9.1	-0.1	0.1
	Percentile Rank	3	16	3	2
	Ordinal Rank	2	10	2	1

Universe		Universe		Universe		Universe	
5th %tile	-0.7	5th %tile	8.0	5th %tile	-0.3	5th %tile	-0.1
25th %tile	-3.0	25th %tile	10.3	25th %tile	-0.5	25th %tile	-0.3
Median	-5.0	Median	11.4	Median	-0.6	Median	-0.4
75th %tile	-6.9	75th %tile	13.0	75th %tile	-0.7	75th %tile	-0.5
95th %tile	-9.0	95th %tile	14.6	95th %tile	-0.8	95th %tile	-0.7

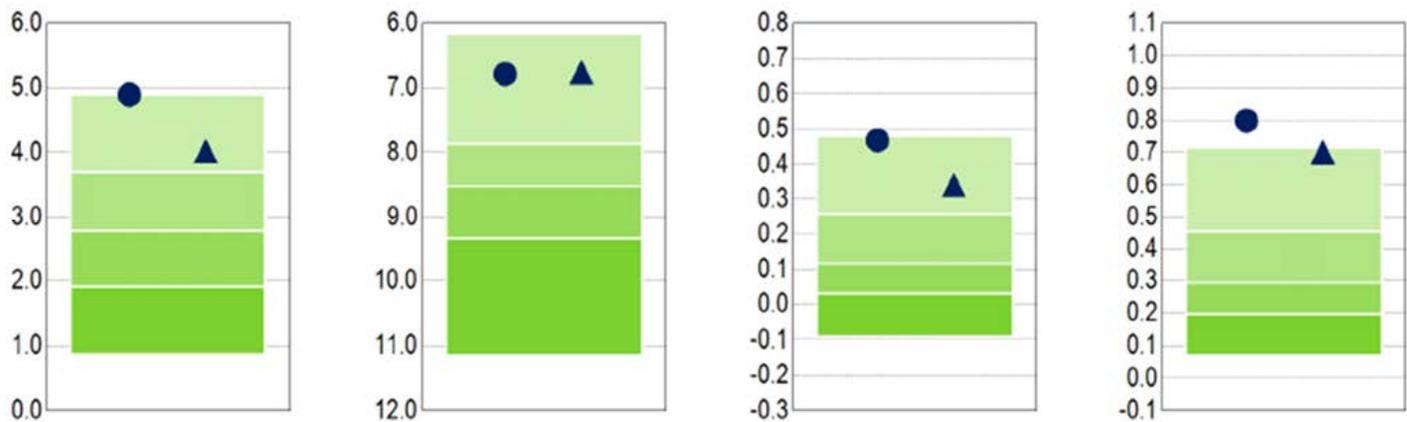


Universes are constructed using net of fee returns; therefore, ASRS rank is based on net of fee returns. Rankings are from highest (1) to lowest (100) in the InvMetrics Public Funds > \$1 Billion Net Universe. The InvMetrics Public Funds > \$1 Billion Net Universe contains 62 observations for the period ending March 31, 2020 with total assets of \$437.7 billion.

UNIVERSE COMPARISON

InvMetrics Public DB > \$1B Net (peer) 3 Year

Anlzd Return Anlzd Standard Deviation Sharpe Ratio Sortino Ratio



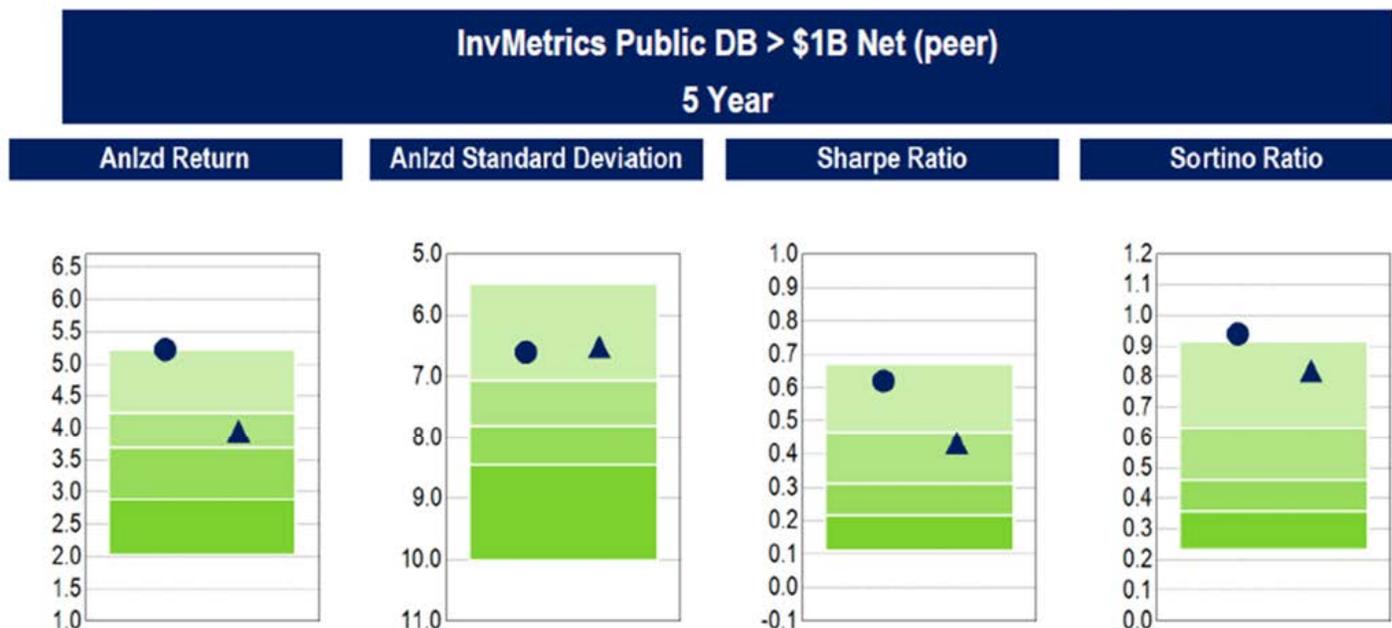
● Total Fund Return	4.9	6.8	0.5	0.8
Percentile Rank	5	13	8	4
Ordinal Rank	3	8	5	2
▲ Interim SAA Policy Return	4.0	6.8	0.3	0.7
Percentile Rank	22	12	20	6
Ordinal Rank	14	7	12	4

Universe	Universe	Universe	Universe
5th %tile	4.9	5th %tile	6.2
25th %tile	3.7	25th %tile	7.9
Median	2.8	Median	8.5
75th %tile	1.9	75th %tile	9.3
95th %tile	0.9	95th %tile	11.1
5th %tile	0.5	5th %tile	0.7
25th %tile	0.3	25th %tile	0.5
Median	0.1	Median	0.3
75th %tile	0.0	75th %tile	0.2
95th %tile	-0.1	95th %tile	0.1



Universes are constructed using net of fee returns; therefore, ASRS rank is based on net of fee returns. Rankings are from highest (1) to lowest (100) in the InvMetrics Public Funds > \$1 Billion Net Universe. The InvMetrics Public Funds > \$1 Billion Net Universe contains 62 observations for the period ending March 31, 2020 with total assets of \$437.7 billion.

UNIVERSE COMPARISON



● Total Fund Return	5.2	6.6	0.6	0.9
Percentile Rank	6	16	8	4
Ordinal Rank	4	9	5	2
▲ Interim SAA Policy Return	3.9	6.5	0.4	0.8
Percentile Rank	37	15	32	7
Ordinal Rank	22	9	19	4

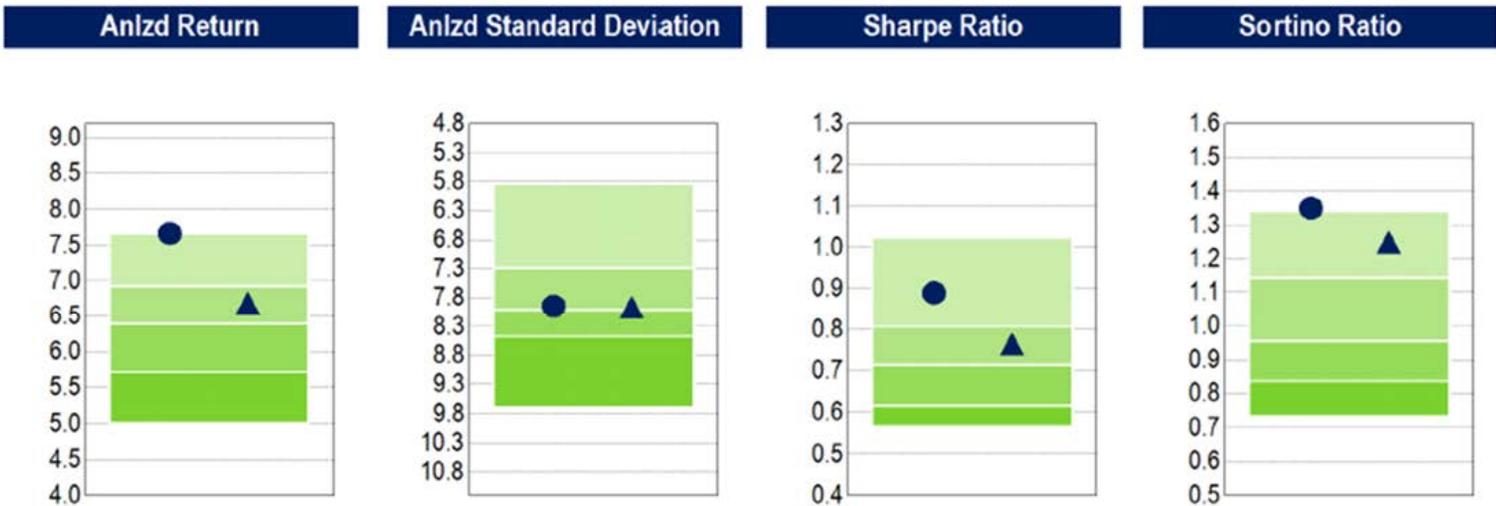
	Universe	Universe	Universe	Universe
5th %tile	5.2	5.5	0.7	0.9
25th %tile	4.2	7.0	0.5	0.6
Median	3.7	7.8	0.3	0.5
75th %tile	2.9	8.4	0.2	0.4
95th %tile	2.0	10.0	0.1	0.2



Universes are constructed using net of fee returns; therefore, ASRS rank is based on net of fee returns. Rankings are from highest (1) to lowest (100) in the InvMetrics Public Funds > \$1 Billion Net Universe. The InvMetrics Public Funds > \$1 Billion Net Universe contains 62 observations for the period ending March 31, 2020 with total assets of \$437.7 billion.

UNIVERSE COMPARISON

InvMetrics Public DB > \$1B Net (peer) 10 Year



● Total Fund Return	7.7	7.9	0.9	1.3
Percentile Rank	6	49	17	4
Ordinal Rank	3	27	9	2
▲ Interim SAA Policy Return	6.7	8.0	0.8	1.2
Percentile Rank	35	49	33	14
Ordinal Rank	19	27	18	8

Universe		Universe		Universe		Universe	
5th %tile	7.7	5th %tile	5.8	5th %tile	1.0	5th %tile	1.3
25th %tile	6.9	25th %tile	7.3	25th %tile	0.8	25th %tile	1.1
Median	6.4	Median	8.0	Median	0.7	Median	1.0
75th %tile	5.7	75th %tile	8.5	75th %tile	0.6	75th %tile	0.8
95th %tile	5.0	95th %tile	9.7	95th %tile	0.6	95th %tile	0.7



Universes are constructed using net of fee returns; therefore, ASRS rank is based on net of fee returns. Rankings are from highest (1) to lowest (100) in the InvMetrics Public Funds > \$1 Billion Net Universe. The InvMetrics Public Funds > \$1 Billion Net Universe contains 62 observations for the period ending March 31, 2020 with total assets of \$437.7 billion.

ASSET CLASS PERFORMANCE VS. BENCHMARK

	1 Year Return	3 Year Return
Total Equity (TWR)	-9.1%	2.4%
Custom Total Equity Benchmark (TWR)	-5.9%	2.9%
Excess Return	-3.2%	-0.5%
Interest Rate Sensitive (TWR)	9.1%	4.9%
Bloomberg Barclays US Aggregate Bond Index (TWR)	8.9%	4.8%
Excess Return	0.2%	0.1%
Total Credit (TWR)	9.3%	9.2%
Custom Credit Benchmark (TWR)	11.4%	6.8%
Excess Return	-2.1%	2.4%
Real Estate (IRR)	4.4%	6.8%
Custom Real Estate Benchmark (IRR)	4.6%	5.4%
Excess Return	-0.2%	1.4%

Note: Composition of ASRS Custom Asset Class Benchmarks can be found in the appendix.



CASH MANAGEMENT

Month	External CFs	Last day of the Month Ending Balance*
Mar - 19	(\$86.1)	\$453.1
Apr - 19	(\$105.8)	\$368.4
May - 19	(\$52.9)	\$175.5
Jun - 19	(\$97.3)	\$368.0
Jul - 19	(\$163.9)	\$465.2
Aug - 19	(\$108.9)	\$467.2
Sep - 19	(\$108.2)	\$365.2
Oct - 19	(\$87.3)	\$676.3
Nov - 19	(\$96.1)	\$404.2
Dec - 19	(\$75.4)	\$521.9
Jan - 20	(\$63.6)	\$412.7
Feb - 20	(\$107.4)	\$376.8
Mar - 20	(\$95.8)	\$730.4

* Includes assetized & unassetized cash balances (Inception of 1/26/15); represents monies to be used for funding needs that occur in subsequent month(s). Generally, monthly pension payments occur on the first day of month.

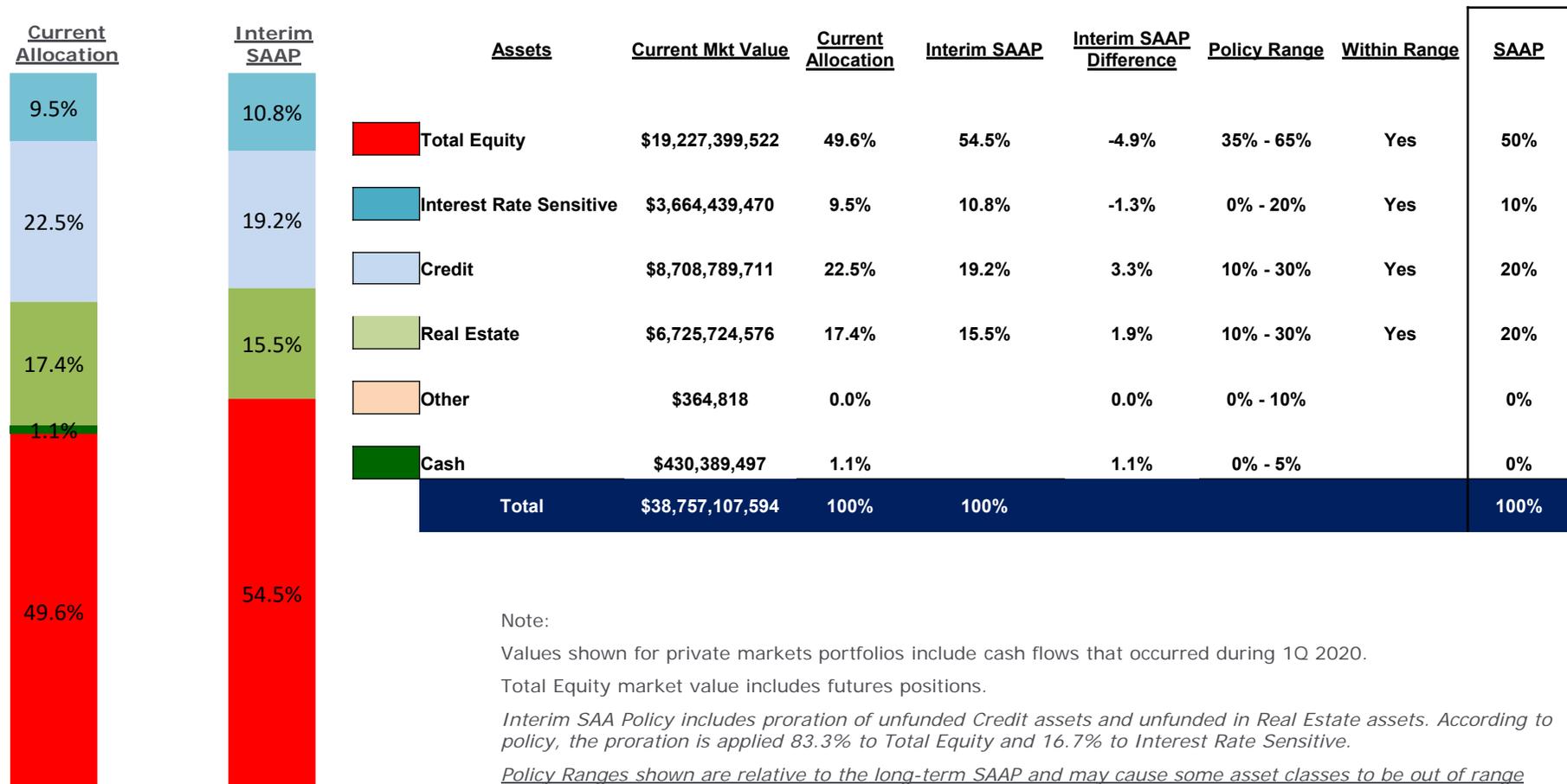


INDEPENDENT OVERSIGHT/COMPLIANCE

Note: All of the data shown on the following pages is as of March 31, 2020 and reflects the deduction of investment manager fees, unless otherwise noted.

NEPC, LLC

SAA POLICY COMPLIANCE



Note:

Values shown for private markets portfolios include cash flows that occurred during 1Q 2020.

Total Equity market value includes futures positions.

Interim SAA Policy includes proration of unfunded Credit assets and unfunded in Real Estate assets. According to policy, the proration is applied 83.3% to Total Equity and 16.7% to Interest Rate Sensitive.

Policy Ranges shown are relative to the long-term SAAP and may cause some asset classes to be out of range while implementation of the long-term SAAP is in process.

Market values include manager held cash.

- Interest Rate Sensitive ■ Credit
- Real Estate ■ Other
- Cash ■ Total Equity



Arizona State Retirement System

PERFORMANCE SUMMARY - PUBLIC MARKETS

	Market Value (\$)	% of Portfolio	3 Mo (%)	Rank	Fiscal YTD (%)	Rank	1 Yr (%)	Rank	3 Yrs (%)	Rank	5 Yrs (%)	Rank	Inception (%)
Total Fund	38,757,107,594	100.0	-9.2	9	-4.1	7	-1.1	9	4.9	5	5.2	6	9.4
<i>Interim SAA Policy</i>			<u>-8.4</u>	6	<u>-3.2</u>	4	<u>0.9</u>	3	<u>4.0</u>	22	<u>3.9</u>	37	<u>9.0</u>
Over/Under			-0.8		-0.9		-2.0		0.9		1.3		0.4
<i>InvMetrics Public DB > \$1B Net Median</i>			-12.6		-8.0		-5.0		2.8		3.7		--
Total Public Equity	14,929,643,222	38.5	-23.4	79	-16.6	72	-13.8	82	0.1	67	2.2	61	5.8
<i>ASRS Custom Total Public Equity Benchmark</i>			<u>-22.4</u>	32	<u>-15.4</u>	24	<u>-12.4</u>	28	<u>1.1</u>	22	<u>2.9</u>	21	<u>5.5</u>
Over/Under			-1.0		-1.2		-1.4		-1.0		-0.7		0.3
<i>InvMetrics Public DB > \$1 Billion Total Equity Net Median</i>			-22.9		-16.1		-13.0		0.6		2.4		5.1
Total Domestic Equity	8,458,504,004	21.8	-23.0	61	-15.1	50	-11.7	49	2.1	57	4.8	44	10.6
<i>ASRS Custom Domestic Equity Benchmark</i>			<u>-20.9</u>	15	<u>-12.7</u>	15	<u>-9.2</u>	18	<u>4.0</u>	14	<u>6.0</u>	3	<u>10.8</u>
Over/Under			-2.1		-2.4		-2.5		-1.9		-1.2		-0.2
<i>InvMetrics Public DB > \$1 Billion US Equity Net Median</i>			-22.4		-15.1		-11.8		2.6		4.6		--
Total International Equity	6,471,099,796	16.7	-23.9	44	-18.5	63	-16.4	63	-2.2	59	-0.6	69	5.1
<i>ASRS Custom Int'l Equity Benchmark</i>			<u>-24.1</u>	52	<u>-18.5</u>	63	<u>-16.3</u>	60	<u>-2.2</u>	59	<u>-0.6</u>	69	<u>4.9</u>
Over/Under			0.2		0.0		-0.1		0.0		0.0		0.2
<i>InvMetrics Public DB > \$1 Billion Global ex-US Equity Net Median</i>			-24.1		-17.9		-15.0		-2.1		-0.2		--
Interest Rate Sensitive Fixed Income	3,664,439,470	9.5	3.4	15	5.9	13	9.1	12	4.9	8	3.6	16	7.9
<i>BBgBarc US Aggregate TR</i>			<u>3.1</u>	15	<u>5.7</u>	14	<u>8.9</u>	12	<u>4.8</u>	8	<u>3.4</u>	22	--
Over/Under			0.3		0.2		0.2		0.1		0.2		--
<i>InvMetrics Public DB > \$1 Billion US Fixed Income Net Median</i>			-0.4		1.4		4.3		3.4		3.0		--
Other	364,818	0.0											

Note: See appendix for custom benchmark definitions.



PERFORMANCE SUMMARY – PRIVATE MARKETS ONE QUARTER LAGGED IRR

	Market Value (\$)	% of Portfolio	3 Mo (%)	1 Yr (%)	3 Yrs (%)	5 Yrs (%)	10 Yrs (%)	Since
Total Fund (TWR)	38,757,107,594	100	-9.2	-1.1	4.9	5.2	7.7	Jul-75
<i>Interim SAA Policy</i>			<u>-8.4</u>	<u>0.9</u>	<u>4.0</u>	<u>3.9</u>	<u>6.7</u>	<i>Jul-75</i>
Over/Under			-0.8	-2.0	0.9	1.3	1.0	
Total Private Equity (IRR)	4,297,756,300	11.1	0.9	10.6	11.9	11.6	12.9	
<i>MSCI ACWI Blended</i>			<u>9.1</u>	<u>26.8</u>	<u>9.1</u>	<u>8.7</u>	<u>11.6</u>	
Over/Under			-8.2	-16.2	2.8	2.9	1.3	
Credit (IRR)	8,708,789,711	22.5	2.4	9.9	9.6	9.9	9.9	
<i>S&P LSTA/Leveraged Loan Index + 2.5%</i>			<u>2.4</u>	<u>11.2</u>	<u>7.1</u>	<u>7.4</u>	<u>7.5</u>	
Over/Under			0.0	-1.3	2.5	2.5	2.4	
Total Real Estate (IRR)	6,725,724,576	17.4	0.5	4.4	6.8	9.0	11.0	
<i>NCREIF ODCE 1 QTR Lagged (net)</i>			<u>1.1</u>	<u>4.6</u>	<u>5.4</u>	<u>7.3</u>	<u>9.3</u>	
Over/Under			-0.6	-0.2	1.4	1.7	1.7	

Note: See appendix for custom benchmark definitions
Private Equity, Credit sub-asset classes and Real Estate returns are money-weighted (IRR) and one-quarter lagged
Market Values include cash flows within 1Q 2020



Arizona State Retirement System

PUBLIC MARKET ASSET CLASS ANALYSIS

	3 Years Ending March 31, 2020												
	% of Tot	Anlzd Ret	Rank	Anlzd Std Dev	Rank	Tracking Error	Rank	Info Ratio	Rank	Anlzd AJ	Rank	Beta	Sharpe Ratio
Total Public Equity	38.5%	0.1%	67	15.4%	70	0.7%	9	-1.4	93	-1.0%	61	1.0	-0.1
ASRS Custom Total Public Equity Benchmark	--	1.1%	22	15.3%	66	--	--	--	--	--	26	--	0.0
Total Domestic Equity	21.8%	2.1%	57	16.3%	58	1.3%	41	-1.4	84	-1.9%	61	1.0	0.0
ASRS Custom Domestic Equity Benchmark	--	4.0%	14	15.8%	30	--	--	--	--	--	17	--	0.1
Total International Equity	16.7%	-2.2%	59	15.2%	55	0.6%	2	0.1	38	0.0%	40	1.0	-0.3
ASRS Custom Int'l Equity Benchmark	--	-2.2%	59	15.4%	60	--	--	--	--	--	40	--	-0.3
Interest Rate Sensitive Fixed Income	9.5%	4.9%	8	3.2%	17	0.1%	1	0.8	2	0.1%	19	1.0	1.0
BBgBarc US Aggregate TR	--	4.8%	8	3.2%	20	--	--	--	--	--	23	--	1.0

Note: Performance is reported net of fees.

Underlying composites do not add up to 100% because the chart excludes private market composites.

Ranks for statistics shown above are based on the respective universe against which the portfolio is ranked on the asset class performance summary that precedes this section of the analysis.

Rankings are from highest (1) to lowest (100) in the eVestment Universe.

Composition of Interim SAA Policy and ASRS Custom Benchmarks can be found in the appendix.



Arizona State Retirement System

PUBLIC MARKET ASSET CLASS ANALYSIS

	5 Years Ending March 31, 2020												
	% of Tot	Anlzd Ret	Rank	Anlzd Std Dev	Rank	Tracking Error	Rank	Info Ratio	Rank	Anlzd AJ	Rank	Beta	Sharpe Ratio
Total Public Equity	38.5%	2.2%	61	13.9%	54	0.7%	12	-1.0	97	-0.7%	69	1.0	0.1
ASRS Custom Total Public Equity Benchmark	--	2.9%	21	13.9%	61	--	--	--	--	--	25	--	0.1
Total Domestic Equity	21.8%	4.8%	44	14.4%	43	1.1%	28	-1.2	89	-1.3%	56	1.0	0.3
ASRS Custom Domestic Equity Benchmark	--	6.0%	3	14.1%	27	--	--	--	--	--	16	--	0.3
Total International Equity	16.7%	-0.6%	69	14.4%	44	0.8%	1	0.0	62	-0.1%	61	1.0	-0.1
ASRS Custom Int'l Equity Benchmark	--	-0.6%	69	14.7%	68	--	--	--	--	--	60	--	-0.1
Interest Rate Sensitive Fixed Income	9.5%	3.6%	16	3.1%	37	0.3%	3	0.9	1	0.3%	22	1.0	0.8
BBgBarc US Aggregate TR	--	3.4%	22	3.1%	35	--	--	--	--	--	57	--	0.7

Note: Performance is reported net of fees.

Underlying composites do not add up to 100% because the chart excludes private market composites.

Ranks for statistics shown above are based on the respective universe against which the portfolio is ranked on the asset class performance summary that precedes this section of the analysis.

Rankings are from highest (1) to lowest (100) in the eVestment Universe.

Composition of Interim SAA Policy and ASRS Custom Benchmarks can be found in the appendix.



ASSET CLASS COMMITTEE MEETING

- **March 24, 2020 – Combined Asset Class Committee**
 - Real Estate manager recommendation (\$125mm)
 - Extension consultant and staff recommendation to commit new capital to an existing investment management relationship
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation
 - Real Estate manager recommendation (\$325mm)
 - Extension consultant and staff recommendation to commit new capital to an existing investment management relationship
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation

- **March 31, 2020 – Combined Asset Class Committee**
 - Credit manager investment recommendation (\$100mm)
 - Staff recommendation to reallocate committed capital to an existing investment manager relationship
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation
 - Real Estate manager recommendation
 - Extension consultant and staff recommendation to sell an asset
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation



ASSET CLASS COMMITTEE MEETING

- **April 14, 2020 – Combined Asset Class Committee**
 - Total Fund portfolio positioning and performance discussion
 - Cash flow forecasting and liquidity analysis reviewed
 - Monthly Real Estate report reviewed
 - Private Equity implementation plan for 2020
 - Staff recommendation to implement private equity according to strategic initiatives outlined in the plan
 - The committee approved strategic implementation plan
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight

- **April 28, 2020 – Combined Asset Class Committee**
 - Public Equity manager recommendation
 - Staff recommendation to commit new capital to a new external investment management relationship
 - The committee approved strategic implementation plan
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Public Equity software acquisition and implementation
 - Staff recommendation to implement software to integrate operational systems and streamline manual processes
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - The committee approved the acquisition
 - Real Estate manager recommendation (\$25mm)
 - Staff recommendation to commit new capital to an existing investment manager relationship
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation
 - Real Estate strategic discussion and plan positioning discussion



ASSET CLASS COMMITTEE MEETING

- **May 5, 2020 – Combined Asset Class Committee**
 - Real Estate monthly report reviewed and public equity positioning reviewed
 - Private Equity manager recommendation (\$100mm)
 - Staff recommendation to commit new capital to an existing investment manager relationship
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation
- **May 6, 2020 – Combined Asset Class Committee**
 - Real Estate manager recommendation (\$1.9mm)
 - Staff recommendation to commit new capital to an existing investment manager relationship
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation
- **May 13, 2020 – Combined Asset Class Committee**
 - Real Estate manager recommendation
 - Extension consultant and staff recommendation to sell an asset
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation
 - Real Estate manager recommendation (\$400mm)
 - Extension consultant and staff recommendation to commit new capital to a new investment management relationship
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation



ASSET CLASS COMMITTEE MEETING

- **May 26, 2020 – Combined Asset Class Committee**
 - Private Equity manager recommendation (\$75mm)
 - Staff recommendation to commit new capital to an existing investment manager relationship
 - Due diligence process was followed in accordance with SIP 006 – Investment Manager, Partner, and Co-Investment Selection and Oversight
 - Committee approved the recommendation
 - Public Equity asset class implementation plan for 2020
 - Staff recommendation to implement private equity according to strategic initiatives outlined in the plan
 - The committee asked for revisions to the strategic implementation plan and postponed a motion to approve the plan



GENERAL OBSERVATIONS

- **Staff continues to be proactive with driving change in internally managed portfolios and driving operational efficiency**
 - This includes reviewing and revising strategic plans, implementing new strategic initiatives and buying software that further integrates and streamlines the investment operation
- **The Plan has experienced strong outperformance versus the SAAP in the short-run and over longer periods**
 - Strong performance in private markets is driving the outcome and suggests strong implementation
- **The active manager Public Equity program has contributed negatively to performance over the past five years**
 - Longer-term (5 year) Public Equity relative performance contributing negatively to relative performance; strategic plans in 2020 are aimed at addressing this underperformance
- **Private markets contributing to positive longer-term results**
 - Real Estate is contributing positively to relative performance over the long-term (5 years and longer)
 - Private Equity program has contributed positively in absolute terms
 - Credit NAV continues to grow and is only 0.8% underweight vs SAAP; Credit is expected to grow to an overweight over the next couple of years
 - Real Estate as an asset class is 2.6% underweight (based on NAV) but has approximately \$4.2 billion in remaining capital commitments as of Q4 2019 (or approximately 10.9% of Total Fund NAV); strategic implementation plan accounts for shorter-term underweight positioning
- **Current positioning is consistent with IMD House Views and strategic implementation plans**



INDEPENDENT OVERSIGHT/COMPLIANCE: LTD

Note: All of the data shown on the following pages is as of March 31, 2020 and reflects the deduction of investment manager fees, unless otherwise noted.

NEPC, LLC

LONG TERM DISABILITY PERFORMANCE

	Quarter	1 Year	3 Years	5 Years	10 Years	Since Inception (July-02)
Long Term Disability	-9.2%	-1.1%	4.9%	4.6%	6.9%	6.1%
LTD SAA Policy ¹	-8.4%	0.9%	4.2%	4.4%	6.9%	6.3%
Excess Return	-0.8%	-2.0%	0.7%	0.2%	0.0%	-0.2%



¹LTD SAA Policy composition can be found in the appendix.

MARKET ENVIRONMENT UPDATE AND OUTLOOK

NEPC, LLC

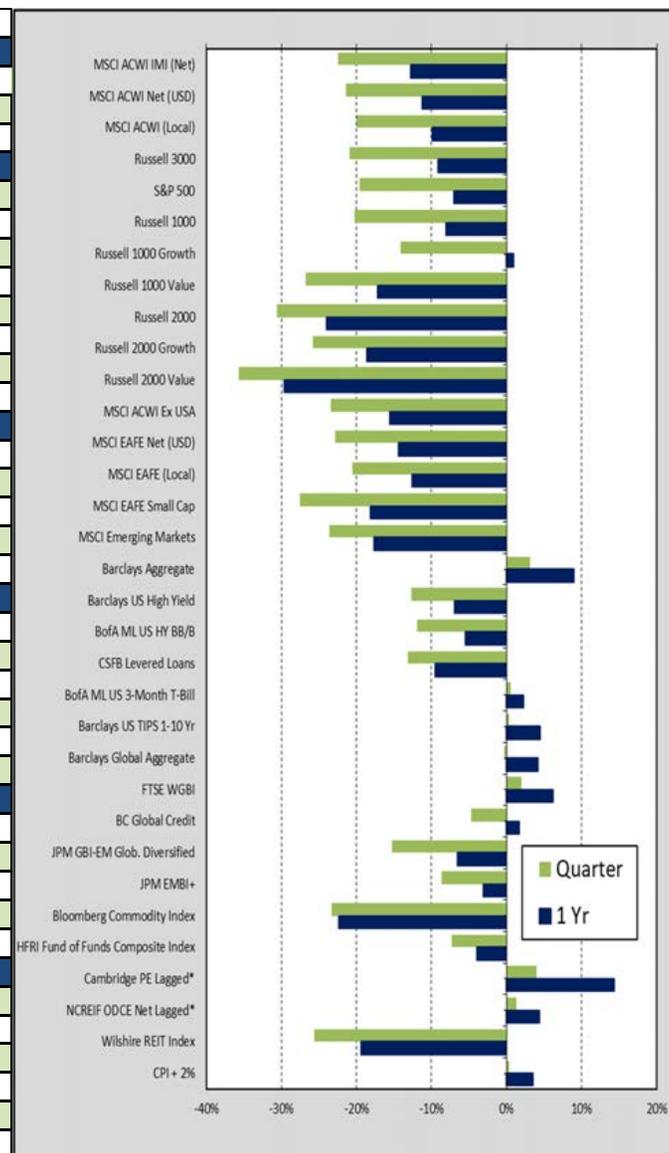
ECONOMIC ENVIRONMENT

- **Q1 Real GDP (advance estimate) decreased at an annual rate of 4.8%.**
 - Retail sales ended January at +4.5% on a YoY basis. In the same period last year the YoY growth rate was 1.9%.
 - Corporate profits (ended September) as a percent of GDP increased to 8.8% from 8.5% (in June) and remain elevated relative to historical levels.
 - The inventory-to-sales ratio ended January flat at 1.4 from December levels and has remained relatively constant since early 2010.
 - The U.S. trade deficit fell ended January (-6.7%) as imports fell and exports fell due to the coronavirus.
- **The unemployment rate ticked up to 4.4% ended March, up from 3.6% in Q4; U-6, a broader measure of unemployment, increased to 8.7% in Q1 from 6.7% in Q4.**
- **The Case-Shiller Home Price Index (ended February) increased to 213.2 from 212.4 (in December) and remains at levels higher than that of pre-financial crisis levels of 150.9.**
- **Rolling 12-month seasonally-adjusted CPI saw a down-tick to 1.52% in Q1 from 2.29% ended Q4; Capacity Utilization decreased to 72.7% from 77.1% in Q1.**
- **Fed Funds rate was cut 1.50% to a targeted range of 0.00%-to-0.25%. The 10-year Treasury Yield (constant maturity) finished Q1 down to 0.9% from 1.9%.**
- **The Fed announced an unlimited expansion of the balance sheet to support the US economy. This move expanded on previous announcements for smaller QE denominations**
- **S&P valuations decreased in Q1 to 24.9x, and is lower than the 10-year average of 25.8x.**
 - Cyclically adjusted Shiller PE ratio remains above the long-term average of 16.7x



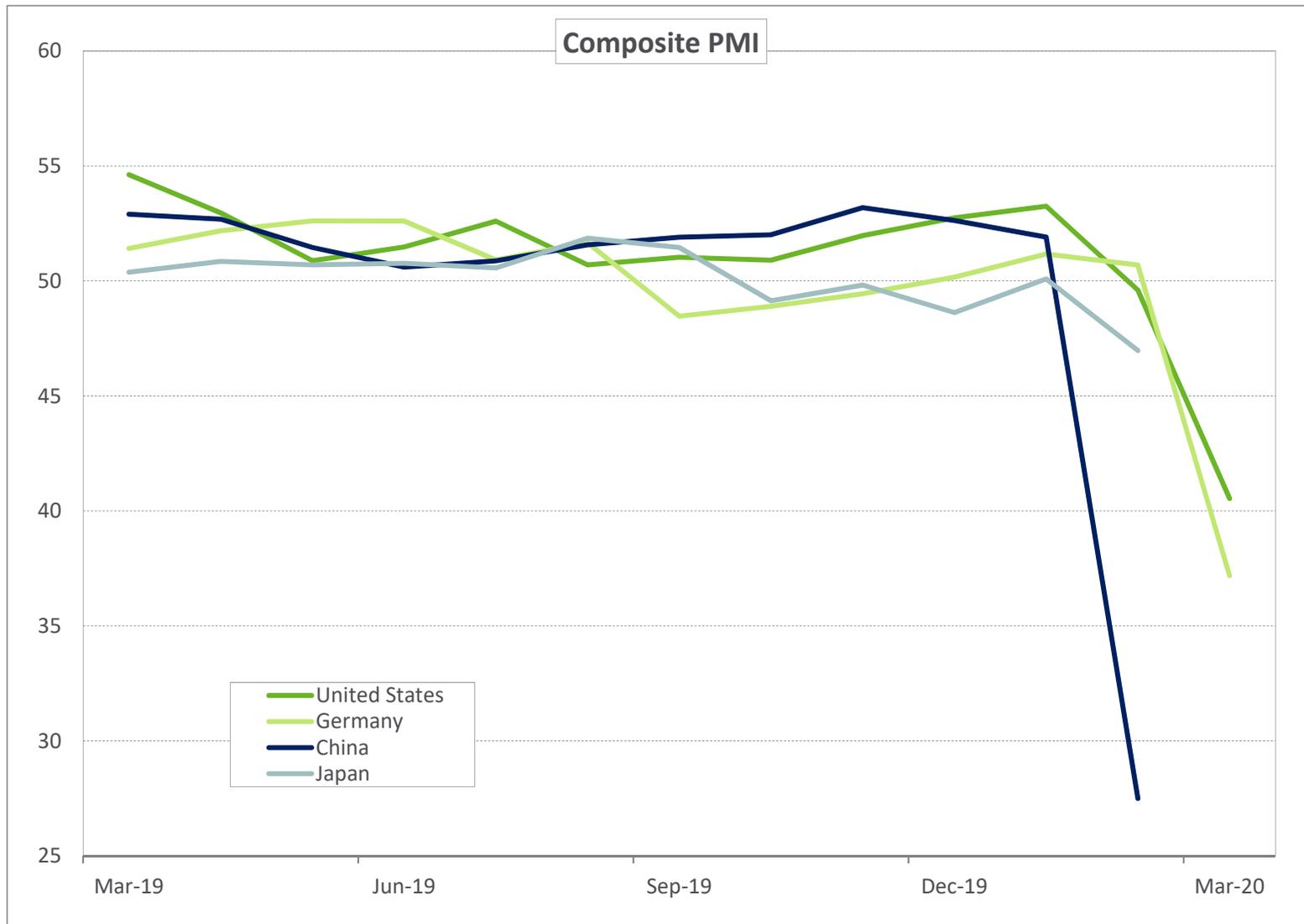
MARKET ENVIRONMENT – Q1 2020 OVERVIEW

		Qtr.	1 Yr.	3 Yr.	5 Yr.	10 Yr.
World Equity Benchmarks						
MSCI ACWI IMI (Net)	World with Small Cap	-22.44%	-12.73%	0.76%	2.45%	5.80%
MSCI ACWI Net (USD)	World W/O Small Cap	-21.37%	-11.26%	1.50%	2.85%	5.88%
MSCI ACWI (Local)	World (Local Currency)	-19.97%	-9.87%	1.69%	3.14%	6.80%
Domestic Equity Benchmarks						
Russell 3000	Domestic All Cap	-20.90%	-9.13%	4.00%	5.77%	10.15%
S&P 500	Large Core	-19.60%	-6.98%	5.10%	6.73%	10.53%
Russell 1000	Large Core	-20.22%	-8.03%	4.64%	6.22%	10.39%
Russell 1000 Growth	Large Growth	-14.10%	0.91%	11.32%	10.36%	12.97%
Russell 1000 Value	Large Value	-26.73%	-17.17%	-2.18%	1.90%	7.67%
Russell 2000	Small Core	-30.61%	-23.99%	-4.64%	-0.25%	6.90%
Russell 2000 Growth	Small Growth	-25.77%	-18.58%	0.10%	1.70%	8.89%
Russell 2000 Value	Small Value	-35.66%	-29.64%	-9.51%	-2.42%	4.79%
International Equity Benchmarks						
MSCI ACWI Ex USA	World ex-US	-23.36%	-15.57%	-1.96%	-0.64%	2.05%
MSCI EAFE Net (USD)	Int'l Developed	-22.83%	-14.38%	-1.82%	-0.62%	2.72%
MSCI EAFE (Local)	Int'l Developed (Local Currency)	-20.55%	-12.58%	-1.80%	-0.15%	4.36%
MSCI EAFE Small Cap	Small Cap Int'l	-27.52%	-18.15%	-2.88%	0.97%	4.81%
MSCI Emerging Markets	Emerging Equity	-23.60%	-17.69%	-1.62%	-0.37%	0.68%
Domestic Fixed Income Benchmarks						
Barclays Aggregate	Core Bonds	3.15%	8.93%	4.82%	3.36%	3.88%
Barclays US High Yield	High Yield	-12.69%	-6.94%	0.76%	2.78%	5.64%
BofA ML US HY BB/B	High Yield	-11.88%	-5.46%	1.31%	2.92%	5.63%
CSFB Levered Loans	Bank Loans	-13.19%	-9.51%	-0.73%	1.21%	3.26%
BofA ML US 3-Month T-Bill	Cash	0.57%	2.26%	1.83%	1.19%	0.64%
Barclays US TIPS 1-10 Yr	Inflation	0.31%	4.50%	2.54%	2.18%	2.52%
Global Fixed Income Benchmarks						
Barclays Global Aggregate	Global Core Bonds	-0.33%	4.20%	3.55%	2.64%	2.47%
FTSE WGBI	World Gov. Bonds	2.00%	6.17%	4.27%	2.96%	2.19%
BC Global Credit	Global Bonds	-4.68%	1.67%	3.09%	2.42%	3.39%
JPM GBI-EM Glob. Diversified	Em. Mkt. Bonds (Local Currency)	-15.21%	-6.52%	-0.80%	0.25%	0.49%
JPM EMBI+	Em. Mkt. Bonds	-8.67%	-3.13%	0.53%	2.93%	4.77%
Alternative Benchmarks						
Bloomberg Commodity Index	Commodities	-23.29%	-22.31%	-8.61%	-7.76%	-6.74%
HFRI Fund of Funds Composite Index	Fund of Hedge Funds	-7.30%	-3.94%	0.50%	0.33%	1.91%
Cambridge PE Lagged*	Private Equity	4.03%	14.33%	14.07%	12.14%	13.81%
NCREIF ODCE Net Lagged*	Real Estate	1.27%	4.39%	6.13%	7.99%	10.39%
Wilshire REIT Index	REIT	-25.63%	-19.39%	-2.50%	-0.19%	7.66%
CPI + 2%	Inflation/Real Assets	0.31%	3.55%	3.96%	3.84%	3.76%



* As of 12/31/2019

GLOBAL ECONOMY EXPECTED TO CONTRACT



Source: Markit, FactSet



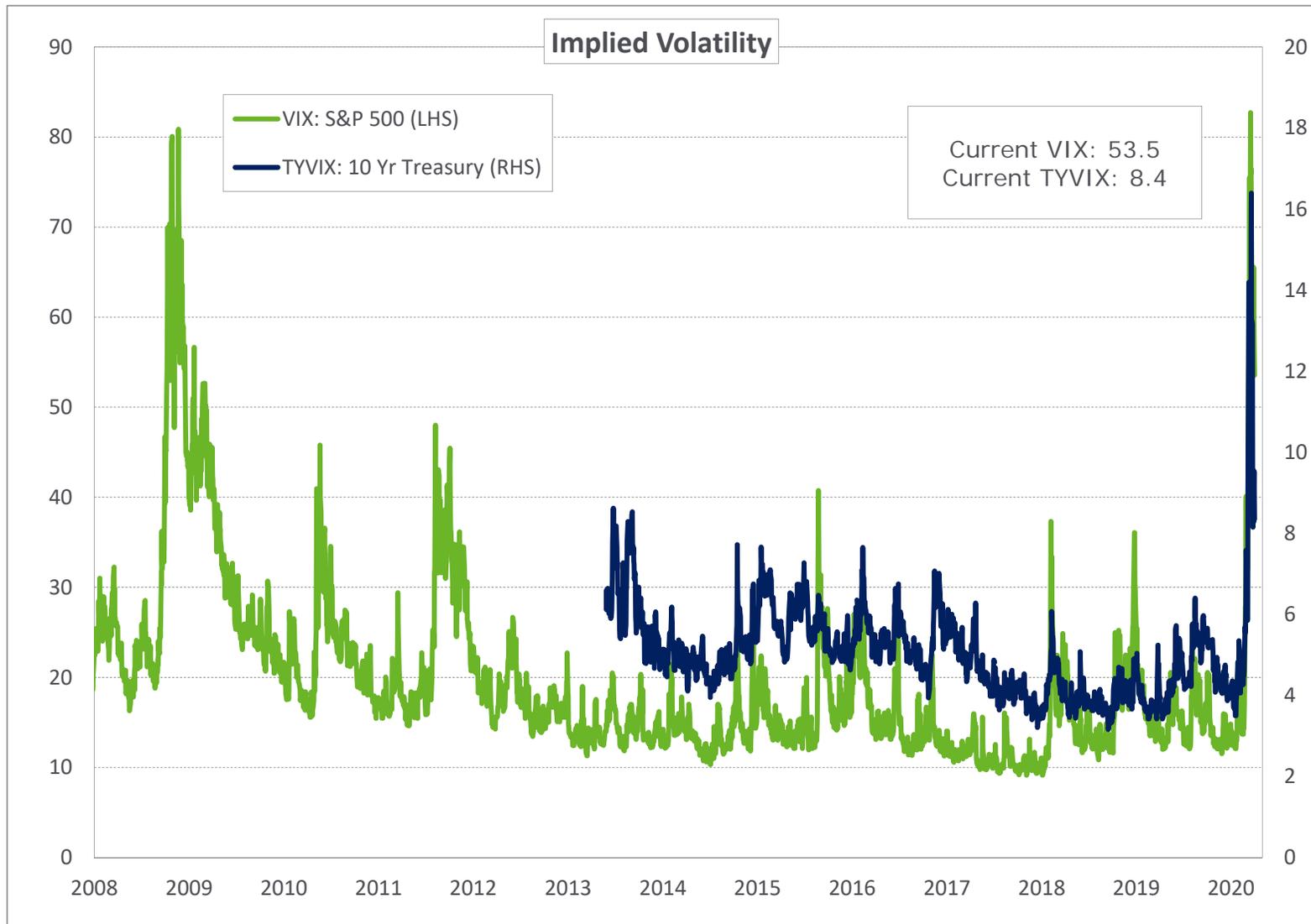
MONETARY AND FISCAL RESPONSES

Fed Action	Description
Fed Rate Cuts	The Fed cut rates in two emergency sessions by a total of 1.50% to a range of 0.00% - 0.25%.
Balance Sheet Expansion	The Fed announced an unlimited expansion of the balance sheet to support the US economy. This move expanded on previous announcements for smaller QE denominations
Liquidity Support Facilities	The Fed announced additional measures to ensure market liquidity, including facilities to support money market funds, commercial paper, and broad credit support systems
Credit Support Facilities	The Fed established programs aimed at supporting consumers and businesses, such as the Term Asset-Backed Securities Loan Facility (TALF) and a Main Street Business Lending Program. These programs provide preferential borrower agreements, such as deferred interest and principal payments, for consumers and small businesses.

US Government Action	Description
Families First Coronavirus Response Act	The bill was passed to provide sick leave, expand food assistance and unemployment benefits, and provide additional protection for health care employees
Fiscal Stimulus Package	Congress is finalizing a \$2 trillion economic stimulus package aimed at providing direct financial assistance, expanded benefits programs, and loans to individuals, small businesses, and industries impacted by COVID-19



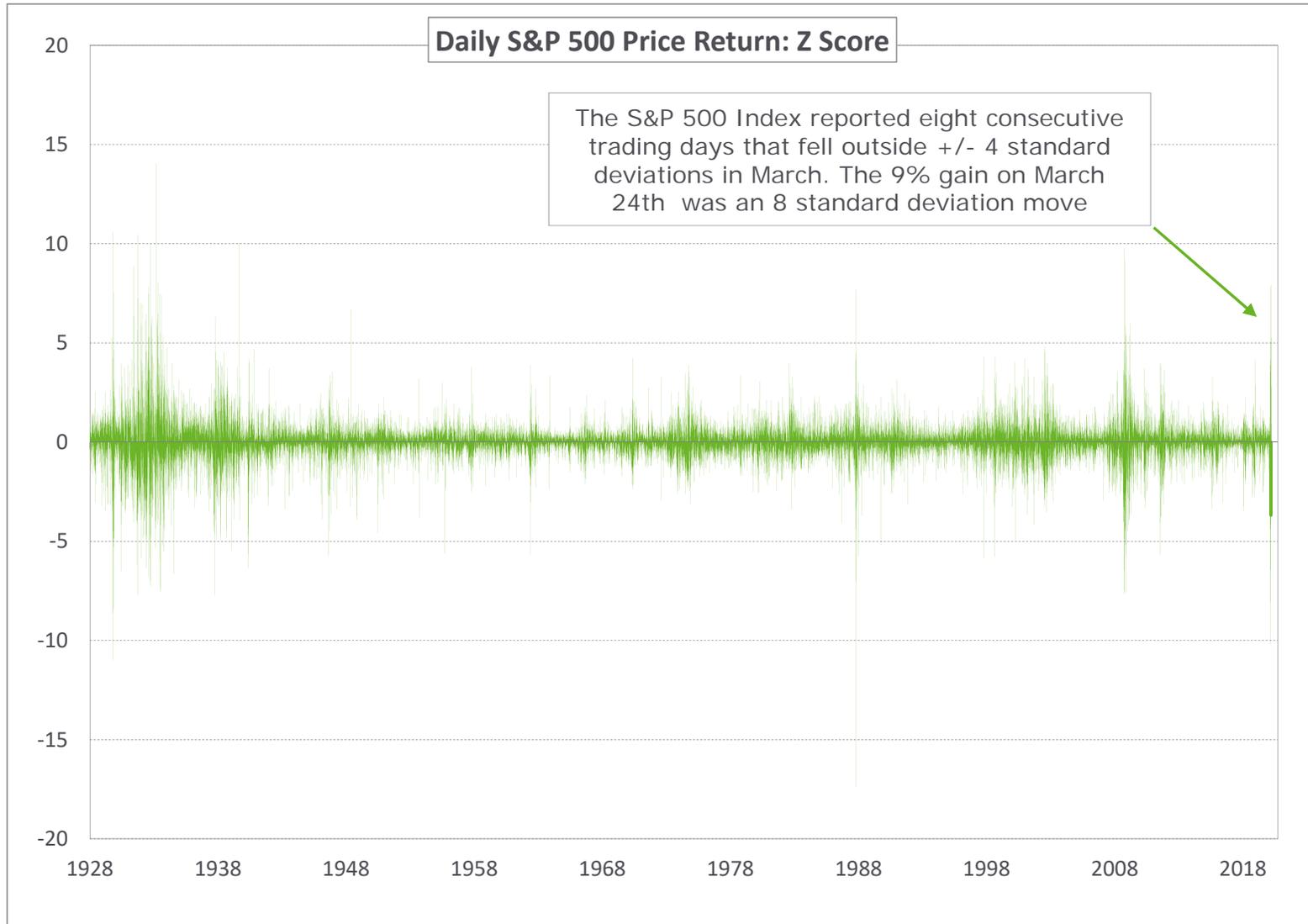
CORRELATIONS AND VOLATILITY ARE ELEVATED



Source: CBOE, FactSet
Data as of 3/31/2020



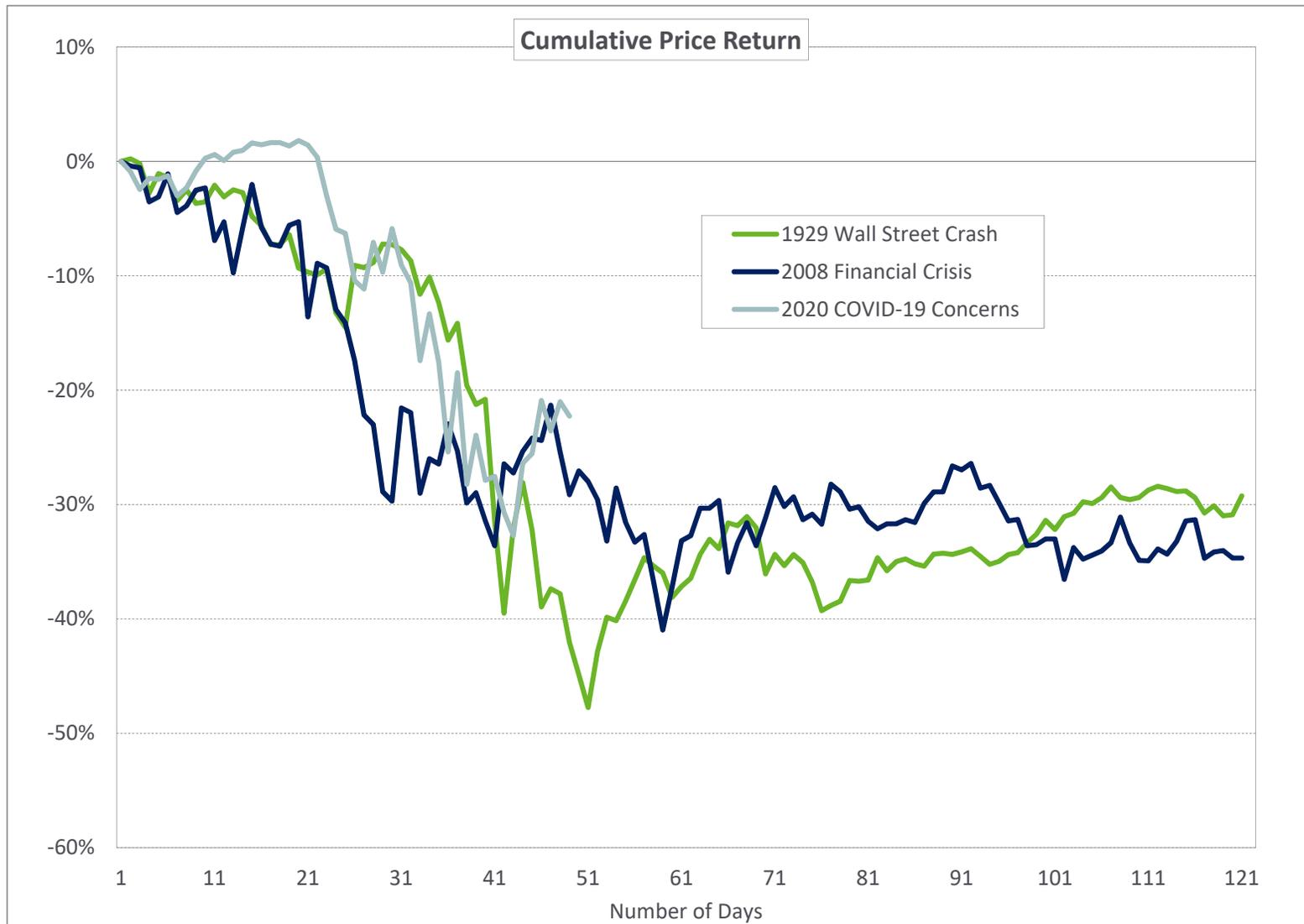
ABNORMALLY LARGE PRICE MOVEMENTS



Source: S&P, FactSet
Calculated of as 1/04/28 - 3/31/2020



US EQUITY DURING MARKET DELEVERAGING

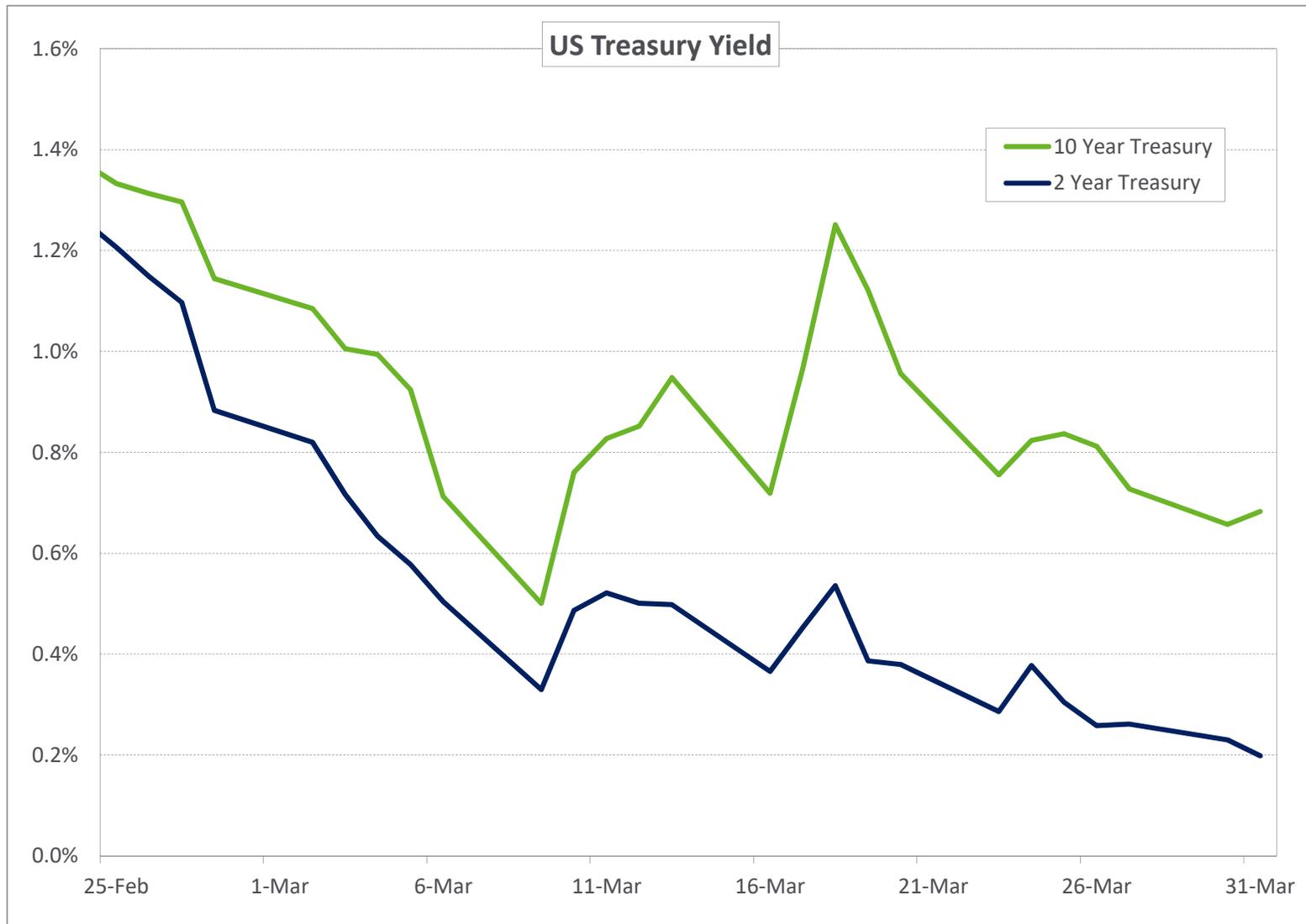


Source: S&P, Dow Jones, FactSet

Financial Crisis represents S&P returns from 9/1/2008 – 3/9/2009; Wall Street Crash represents Dow Jones returns from 8/30/1929 – 2/26/1930; COVID-19 represents S&P returns from 1/23/2020 (representing the start of the Wuhan, China lockdown) – 3/31/2020



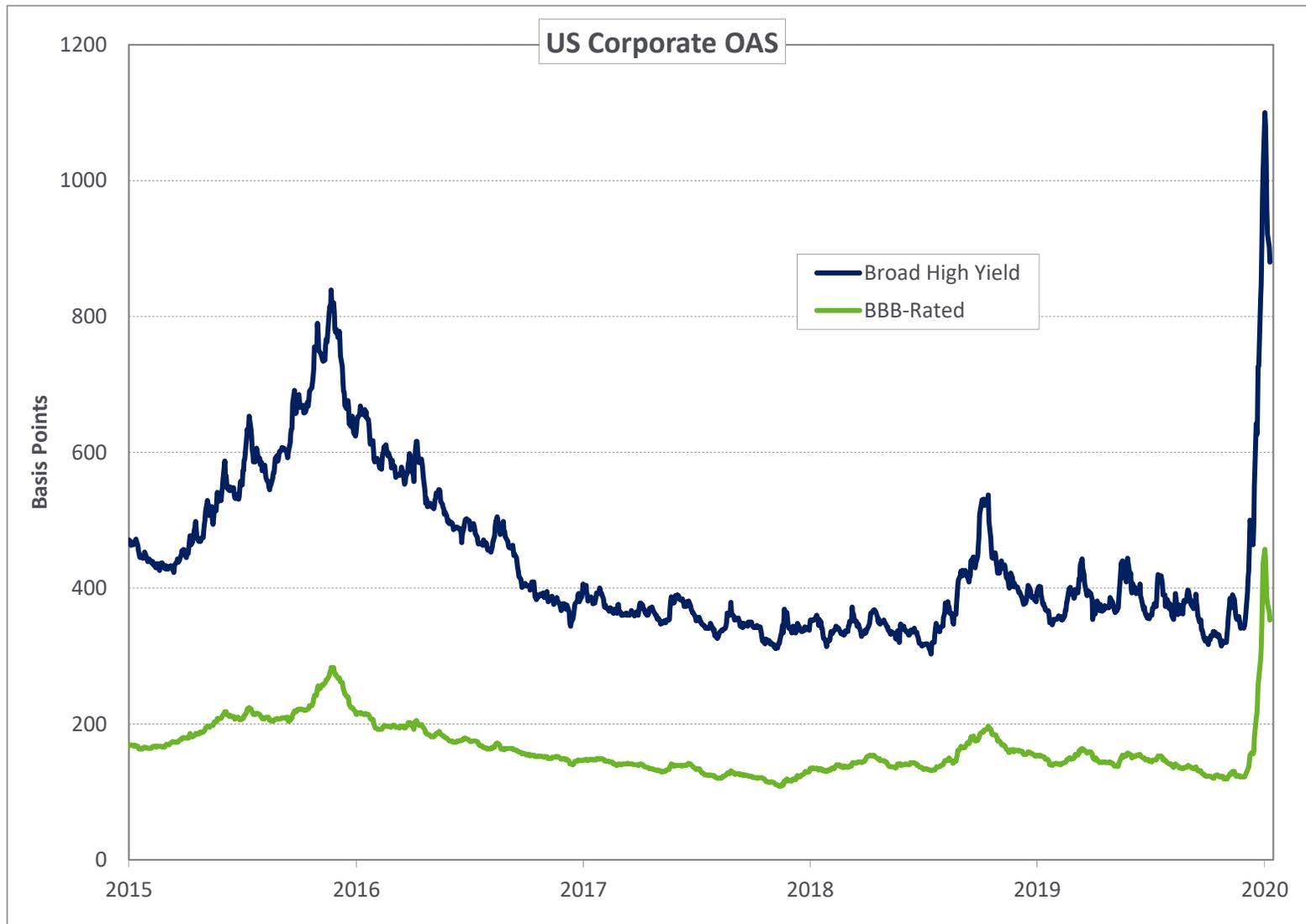
U.S. TREASURY YIELDS ARE STRESSED



Source: FactSet
Data as of 3/31/2020



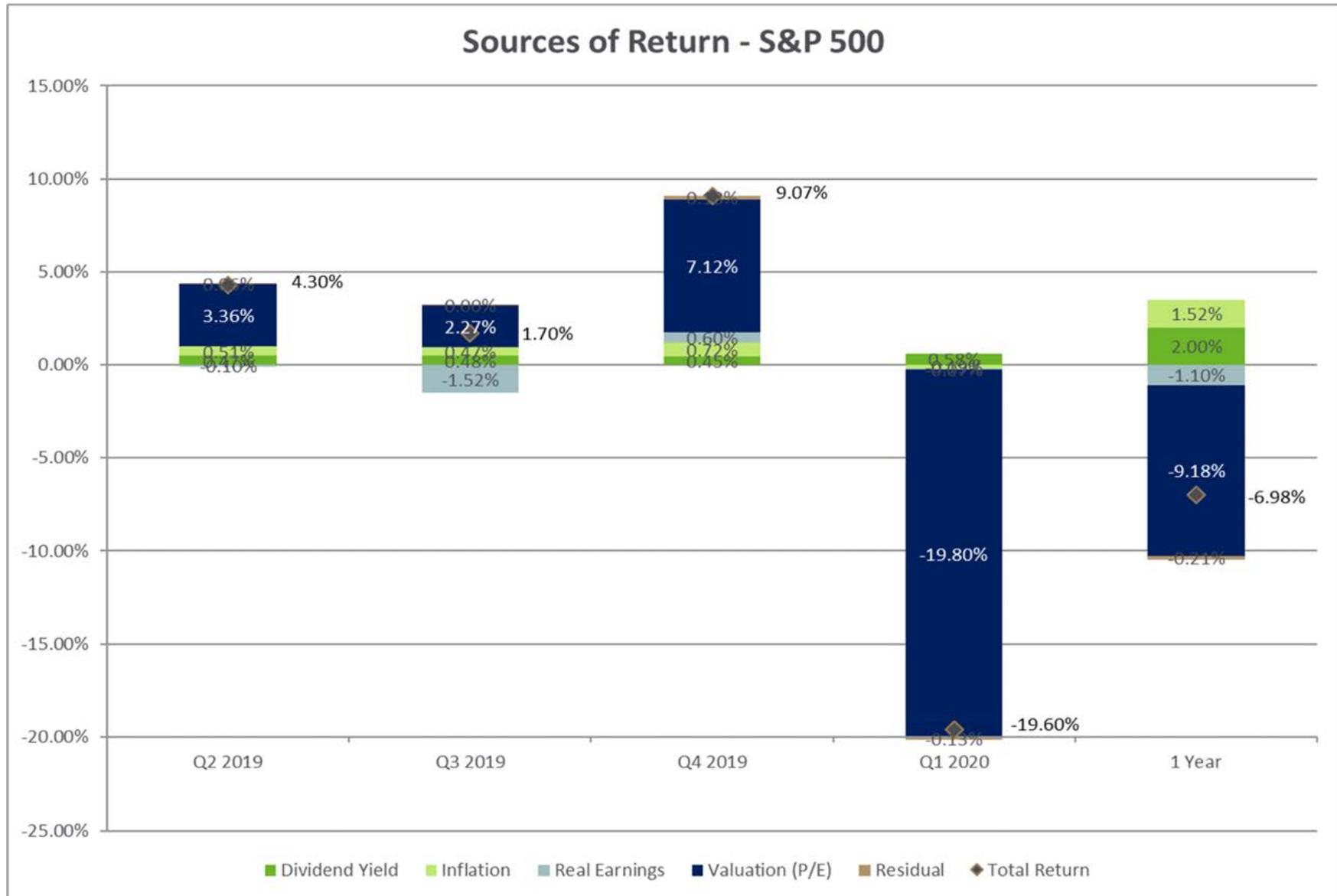
CREDIT SPREADS HAVE WIDENED



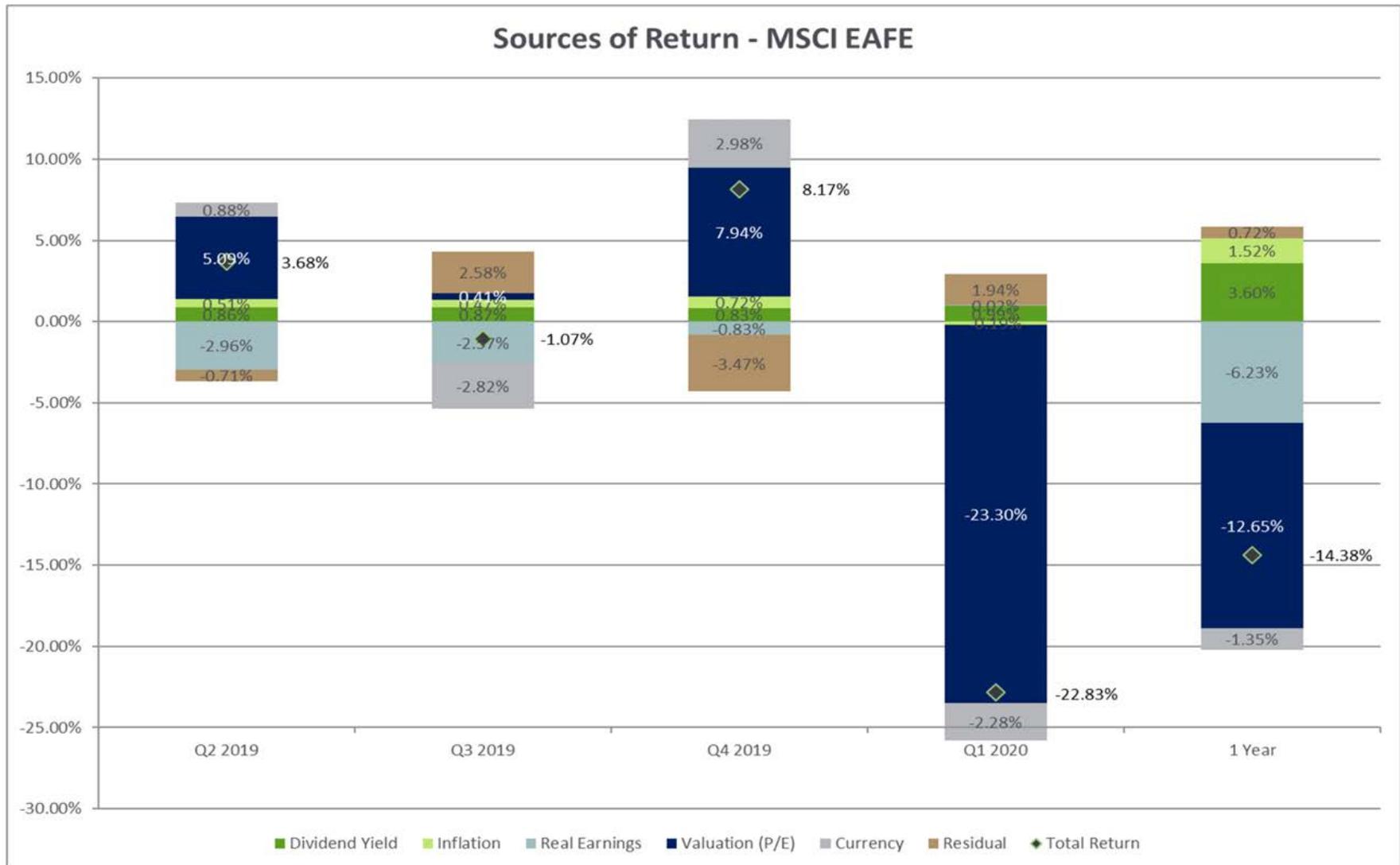
Source: Bloomberg, FactSet
Data as of 3/31/2020



1 YEAR ATTRIBUTION OF S&P 500 RETURNS



1 YEAR ATTRIBUTION OF MSCI EAFE RETURNS



Spot Rates

1 USD = 0.880 Euro

1 USD = 0.917 Euro

1 USD = 0.891 Euro

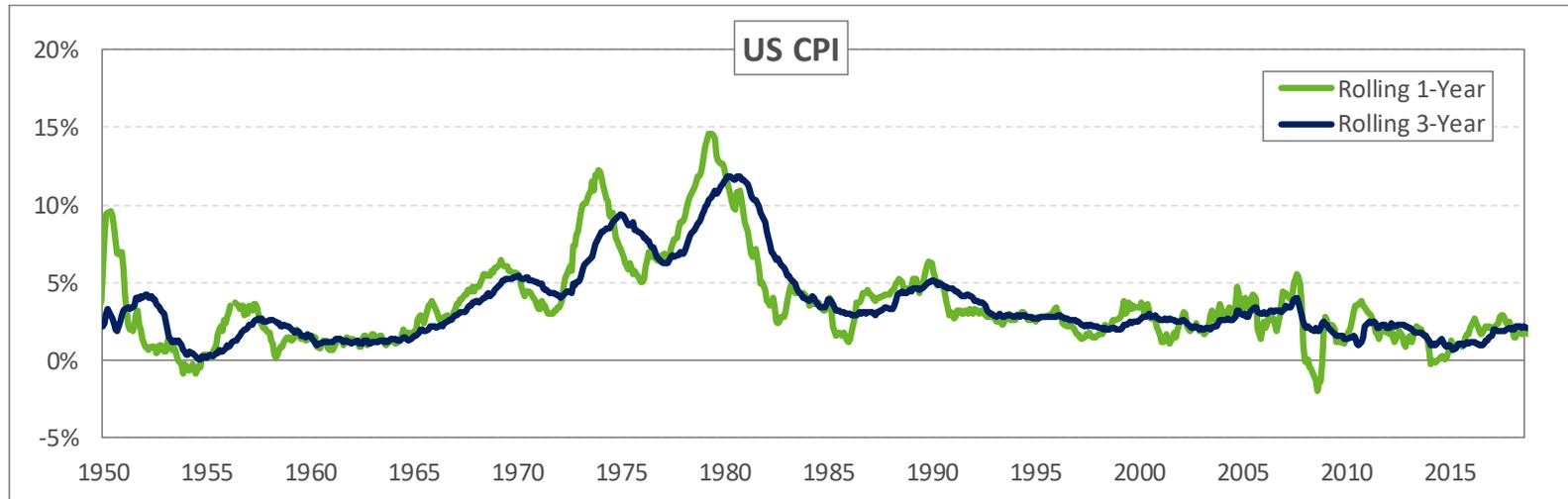
1 USD = 0.901 Euro



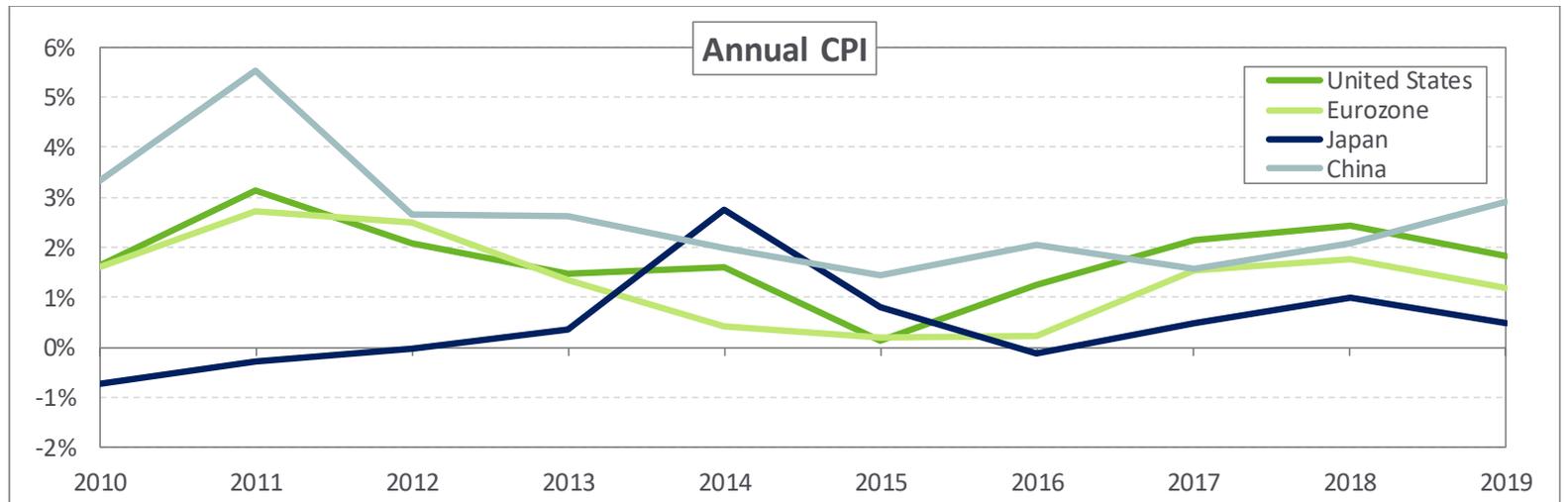
MACRO

NEPC, LLC

INFLATION



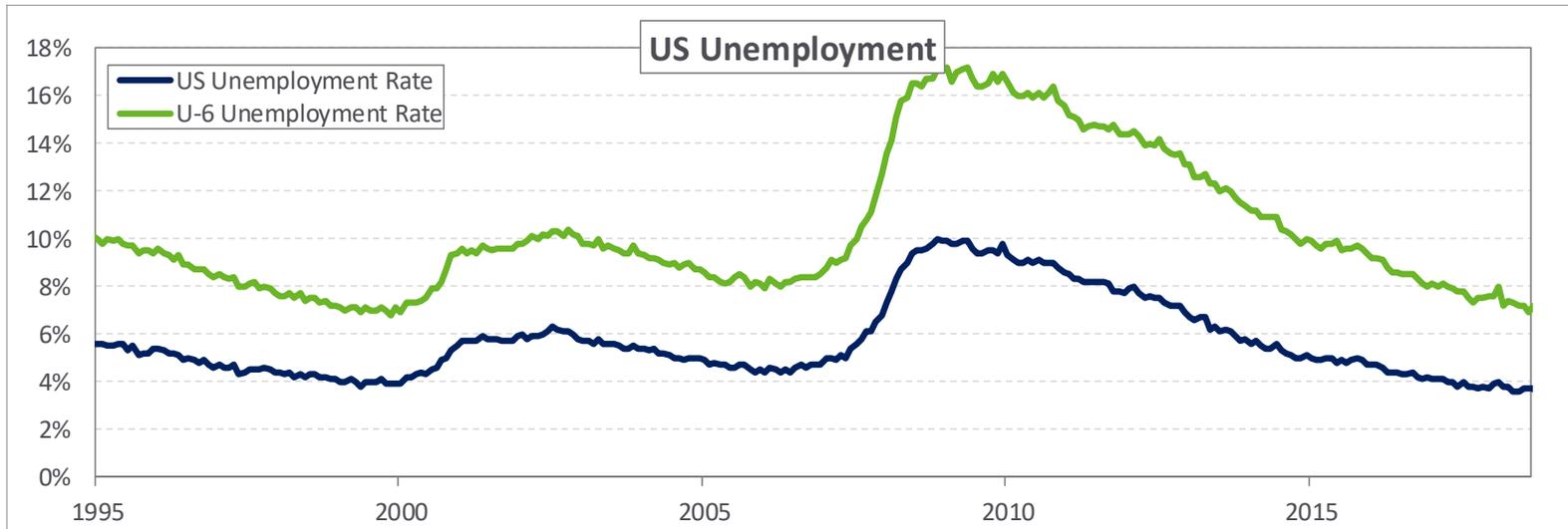
Source: Bureau of Labor Statistics, FactSet



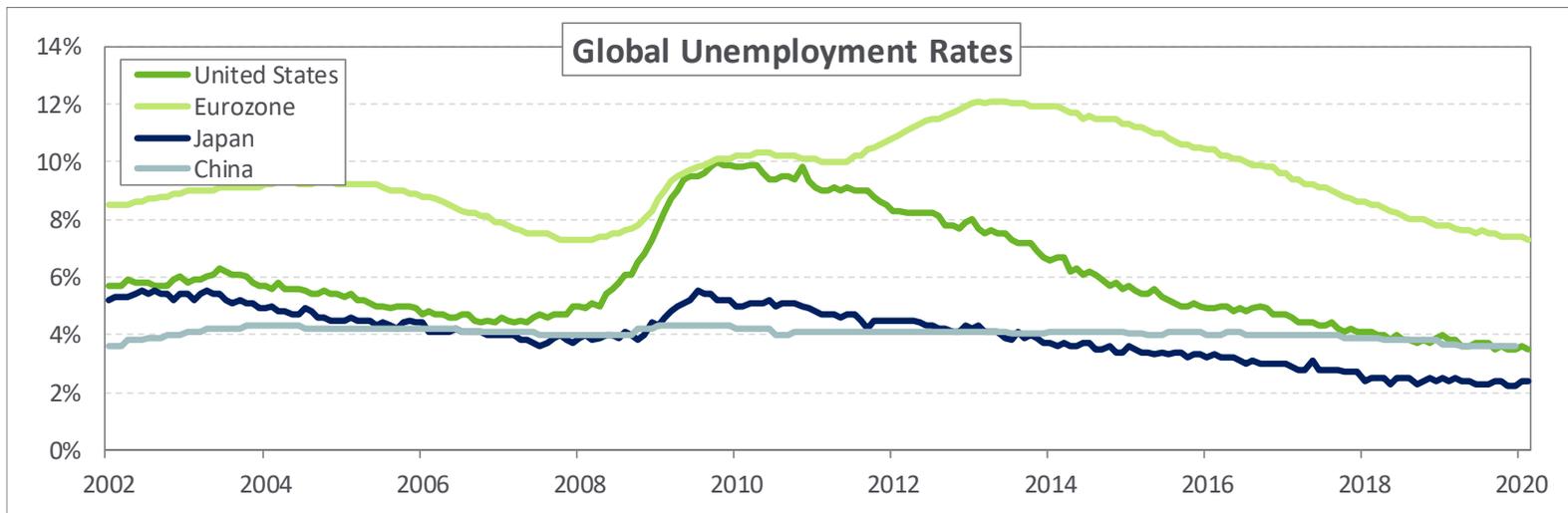
Source: FactSet



UNEMPLOYMENT



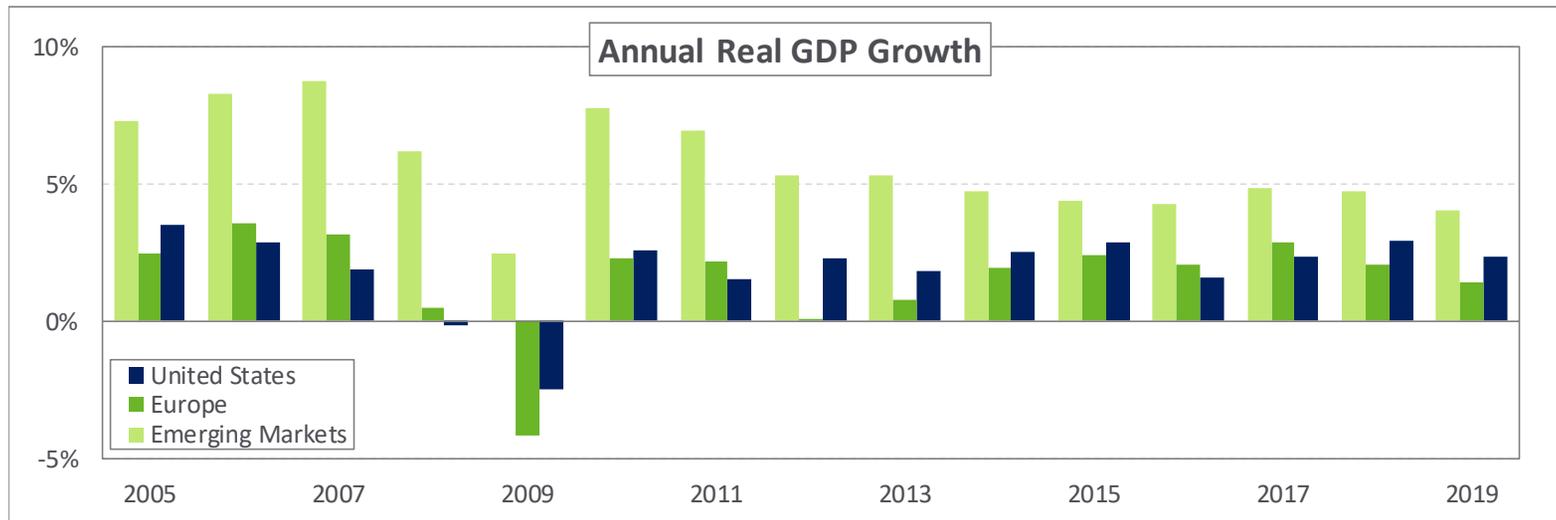
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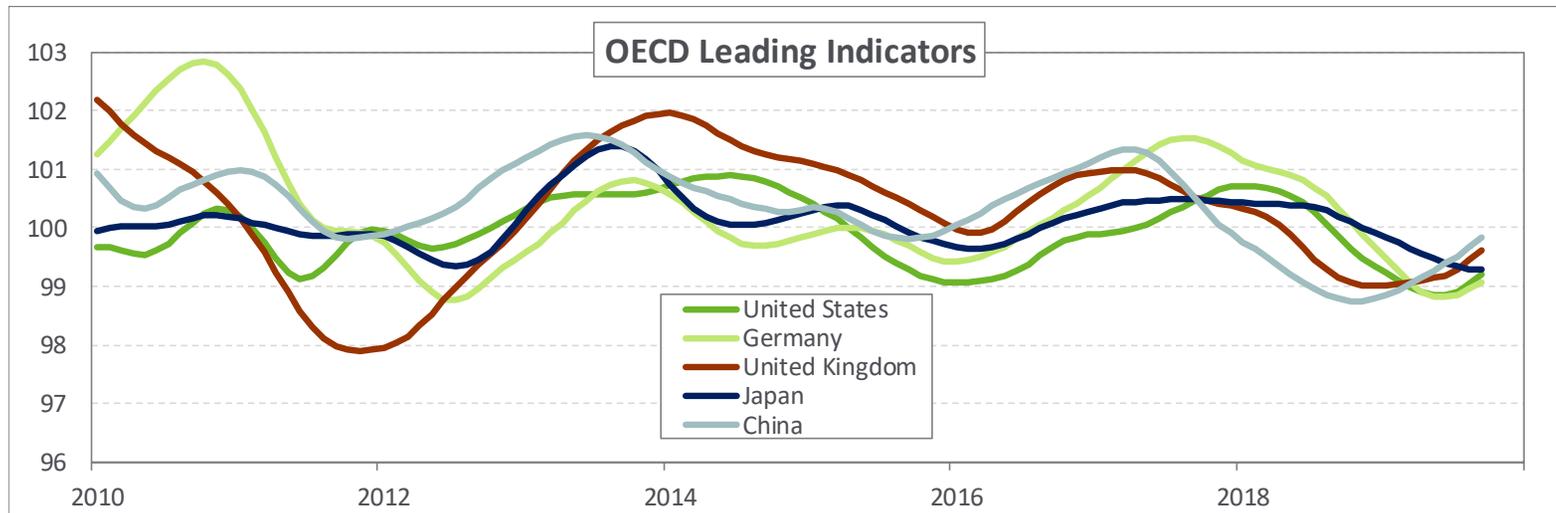
Source: FactSet



ECONOMIC INDICATORS



Source: Bureau of Economic Analysis, Oxford Economics, FactSet



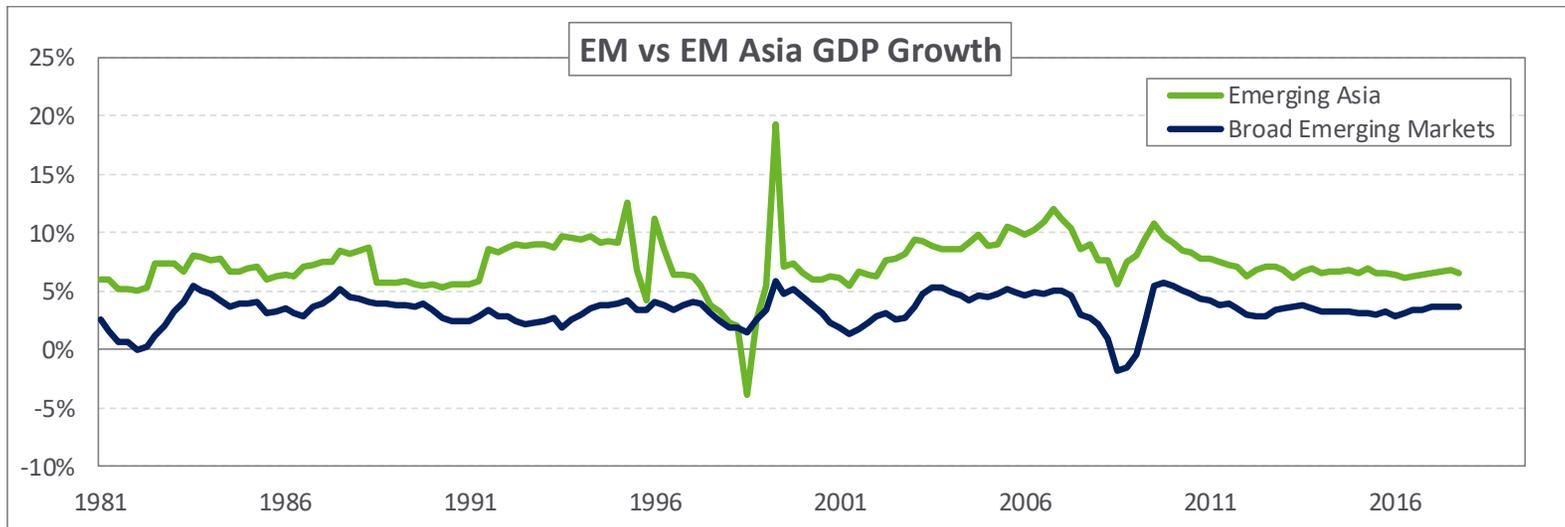
Source: OECD, FactSet



GROSS DOMESTIC PRODUCT



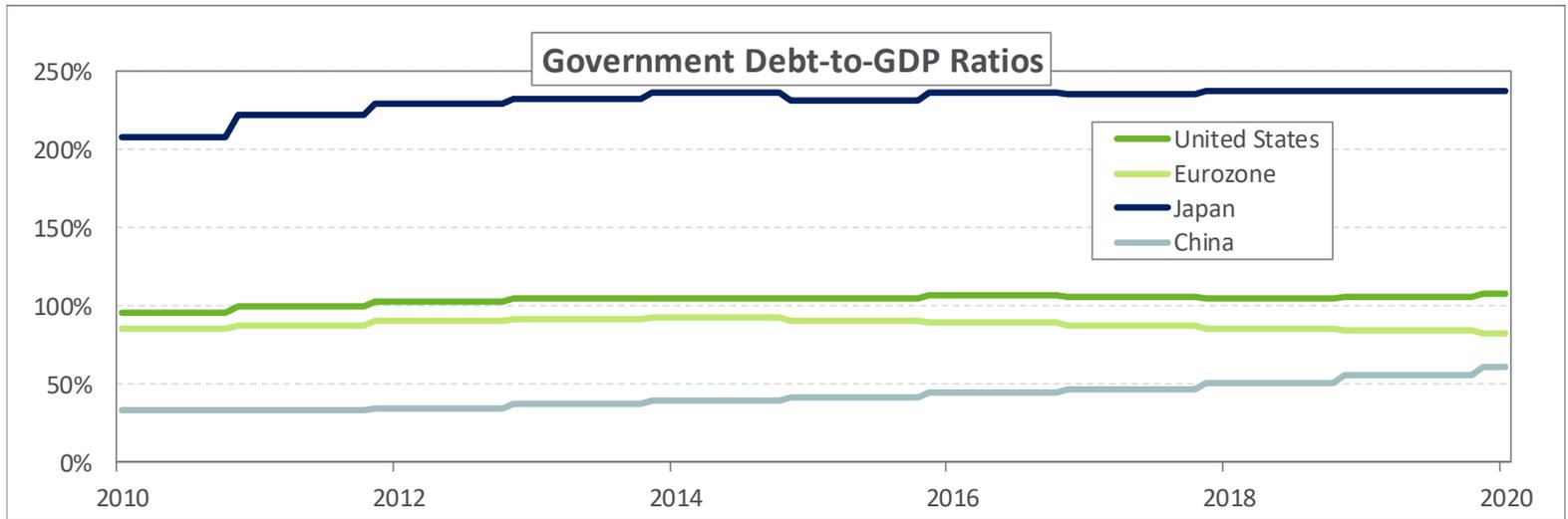
Source: Bureau of Economic Analysis, FactSet



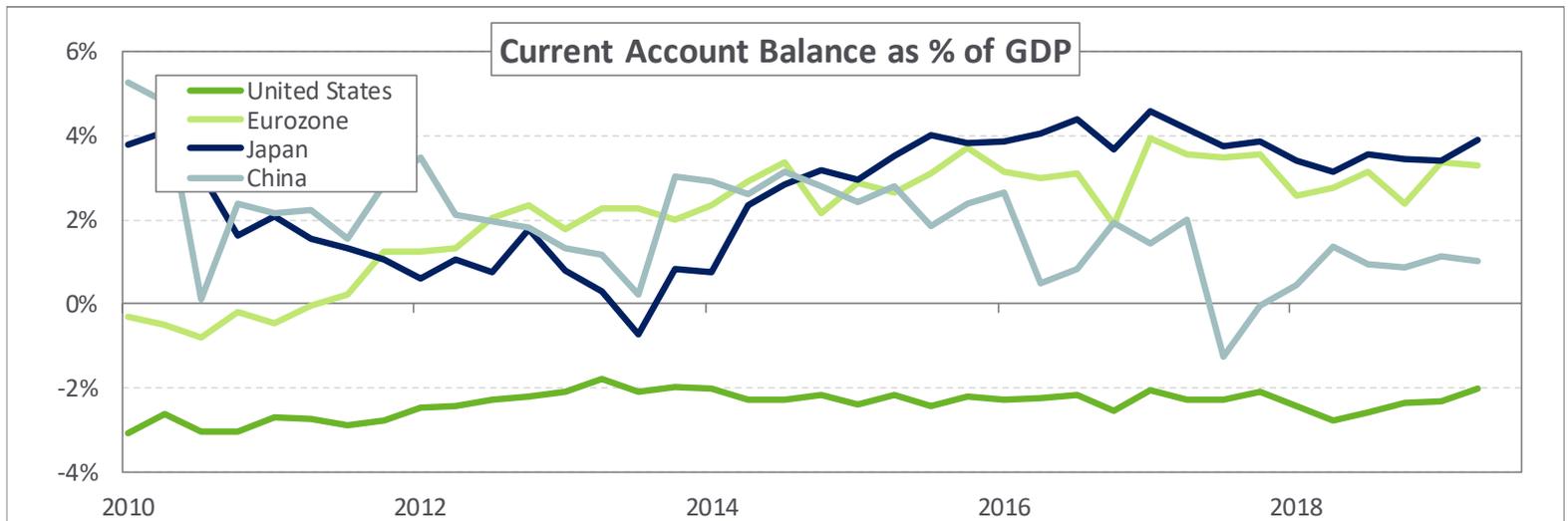
Source: IMF, FactSet



GROSS DOMESTIC PRODUCT METRICS



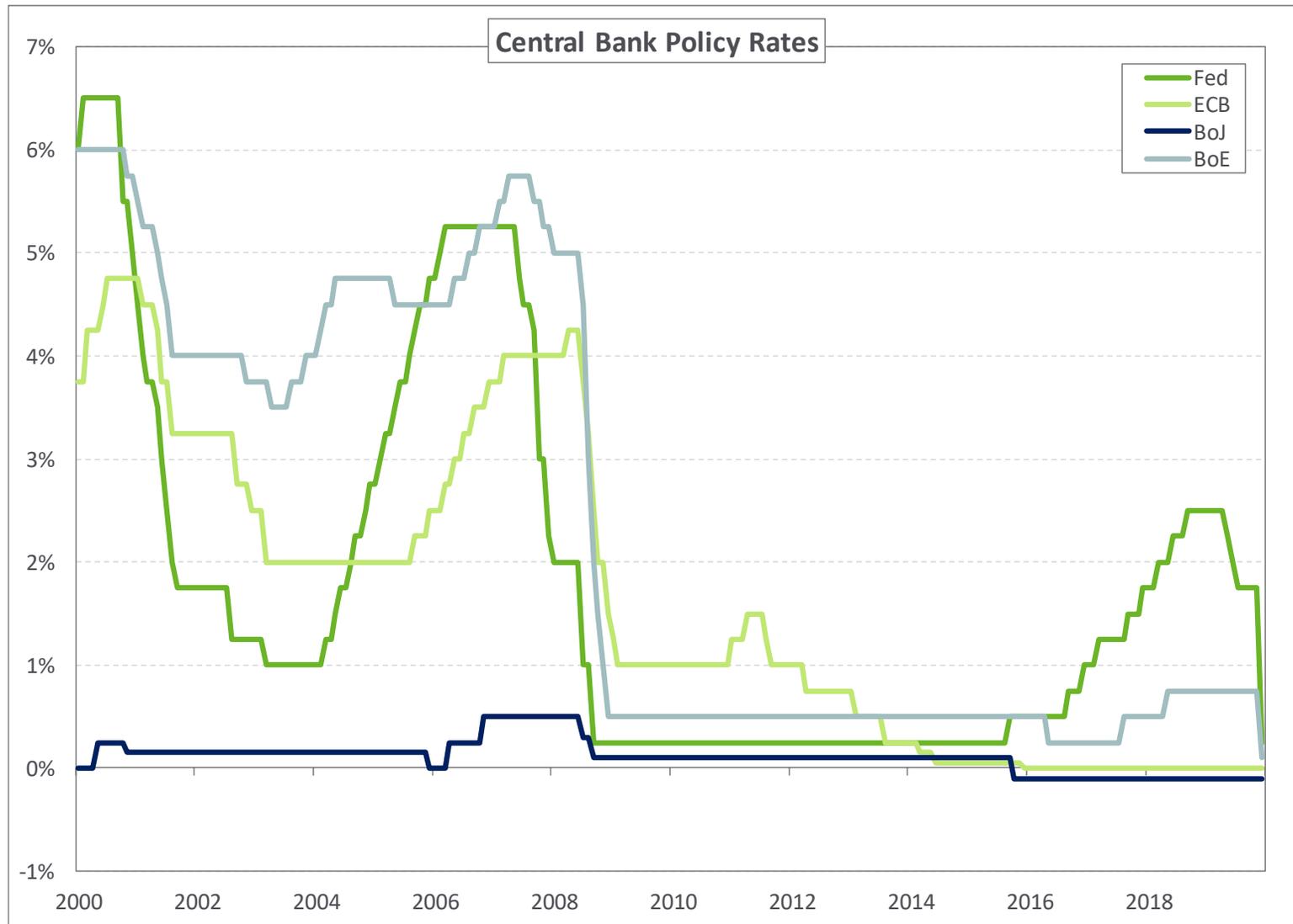
Source: IMF, FactSet



Source: FactSet



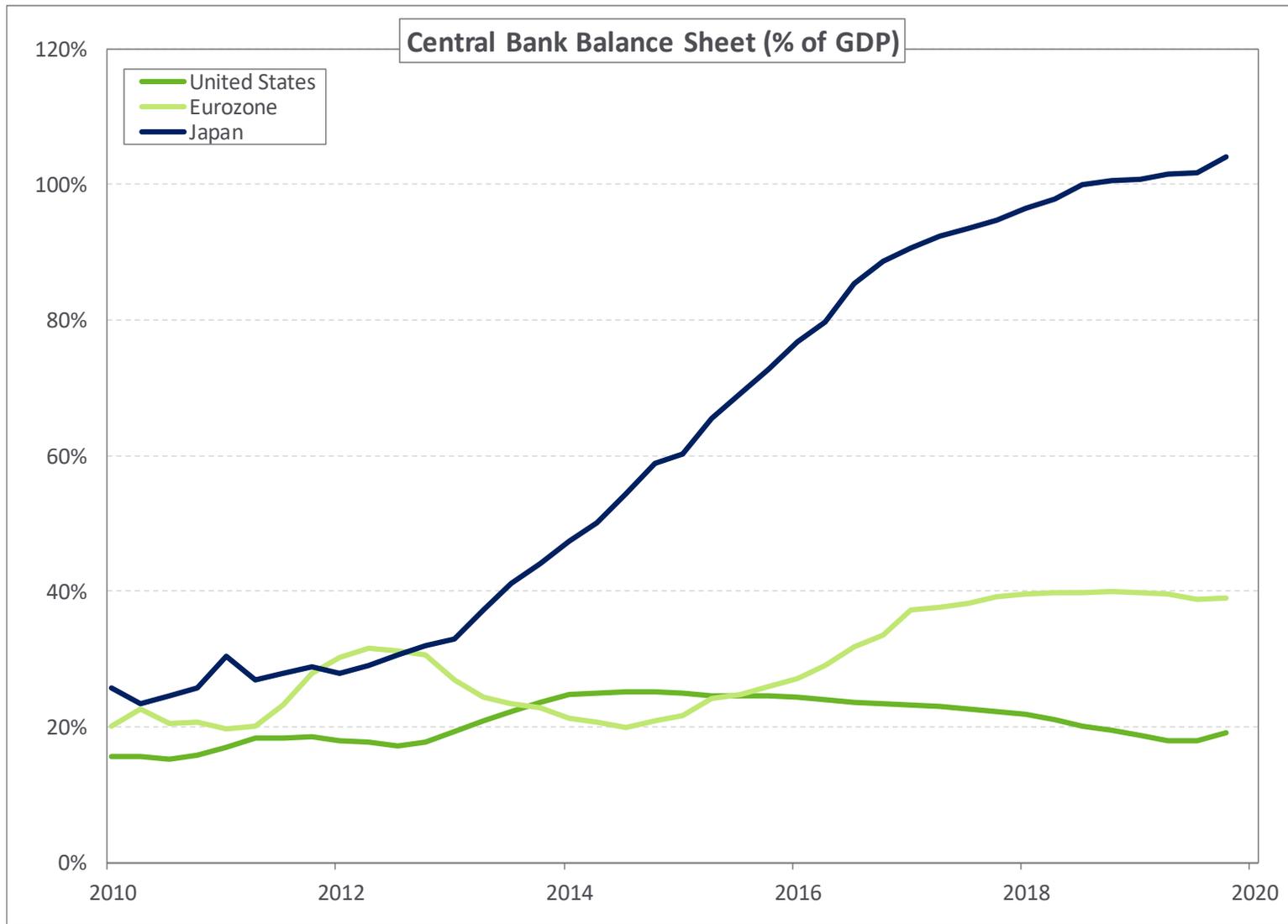
CENTRAL BANK RATES



Source: Federal Reserve, ECB, Bank of Japan, Bank of England, FactSet



CENTRAL BANK BALANCE SHEETS



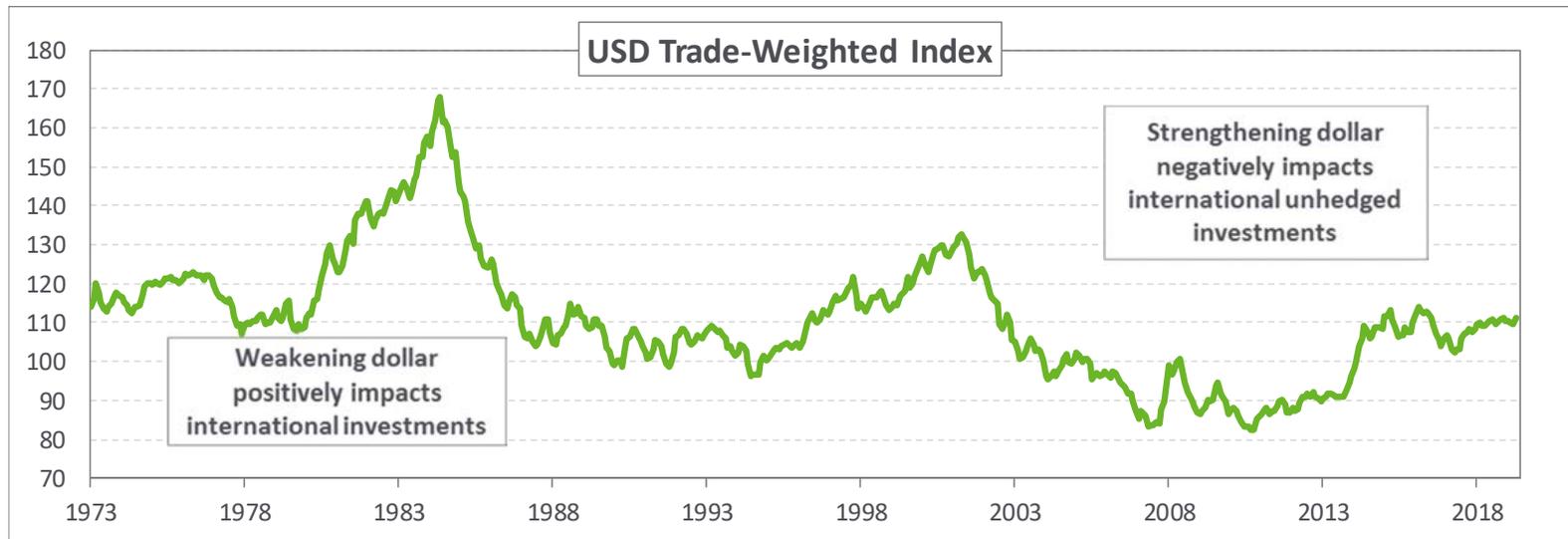
Source: FactSet



CURRENCIES

% Change Relative to USD				
Currencies	Spot	1 Month	YTD	1 Year
Euro	1.10	-0.11%	-2.25%	-2.28%
British Pound	1.24	-2.92%	-6.40%	-4.84%
Japanese Yen	107.96	0.08%	-0.66%	-2.47%
Swiss Franc	0.97	-0.04%	-0.08%	-2.85%
Australian Dollar	0.61	-5.07%	-12.93%	-13.84%
Chinese Yuan	7.09	1.47%	1.83%	5.55%
Brazilian Real	5.19	14.96%	28.93%	33.27%
Russian Ruble	78.13	16.27%	25.80%	18.93%
Indian Rupee	75.65	4.83%	5.99%	9.20%
Mexican Peso	23.46	18.50%	24.23%	20.94%
South African Rand	17.86	13.53%	27.72%	23.85%

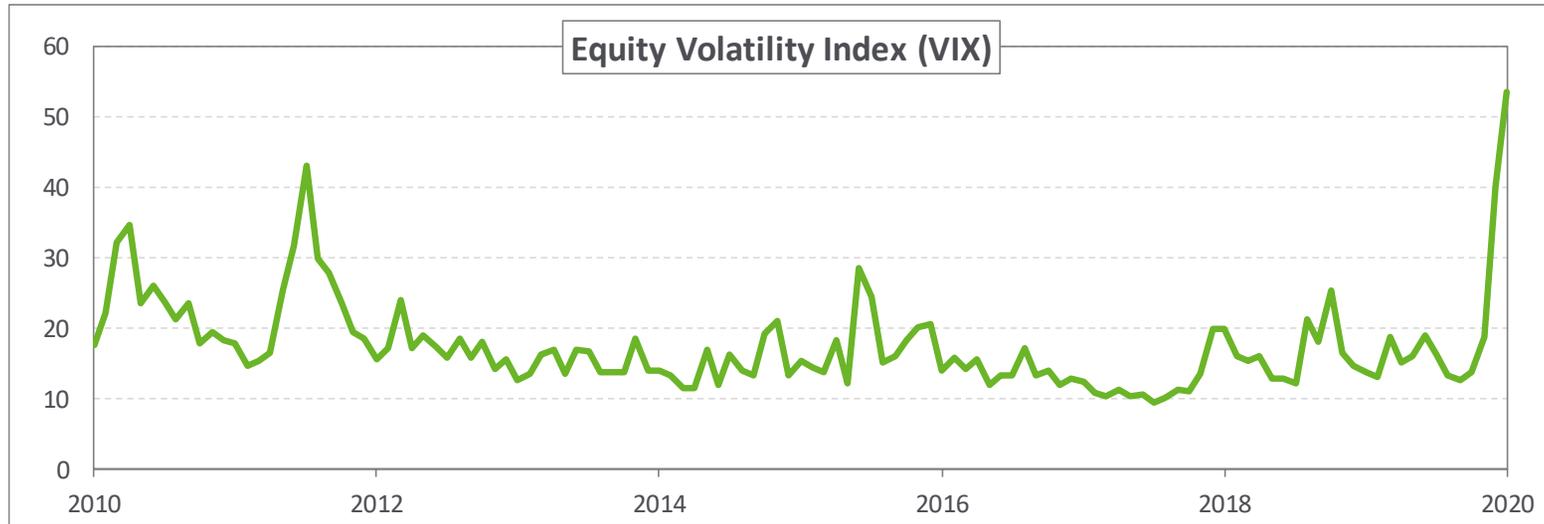
Source: FactSet



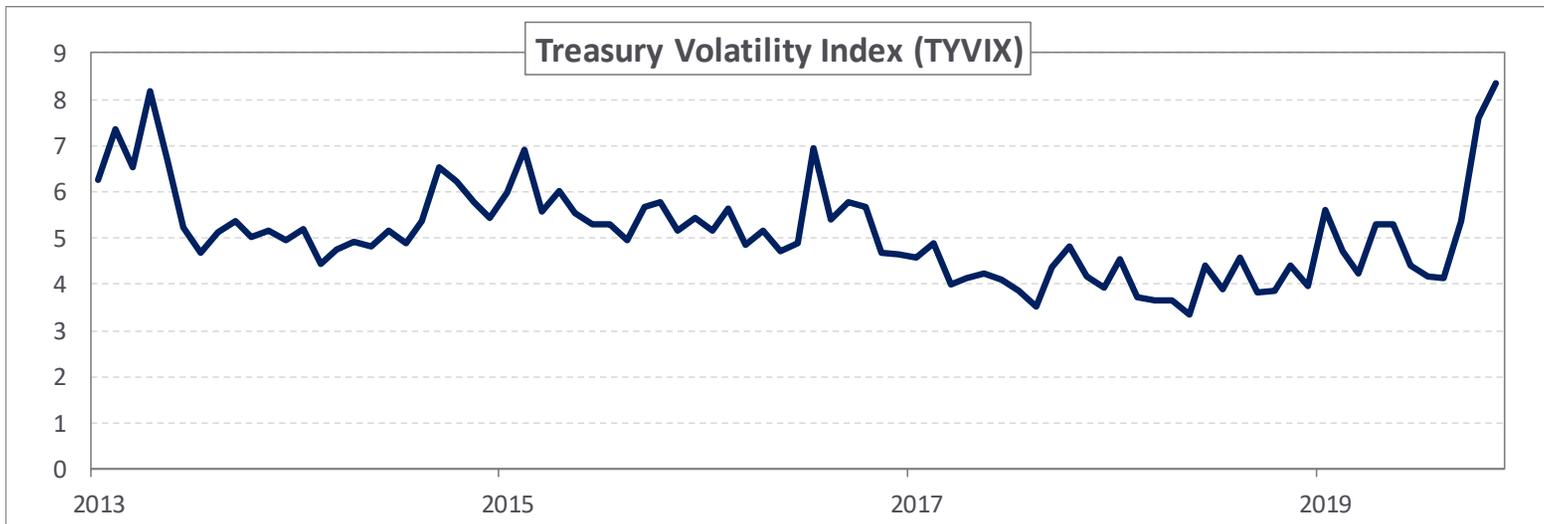
Source: FactSet



VOLATILITY



Source: CBOE, FactSet



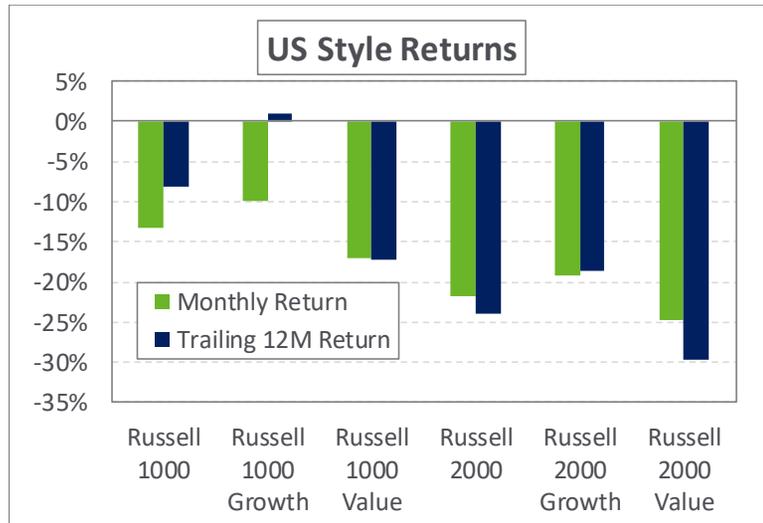
Source: CBOE, FactSet



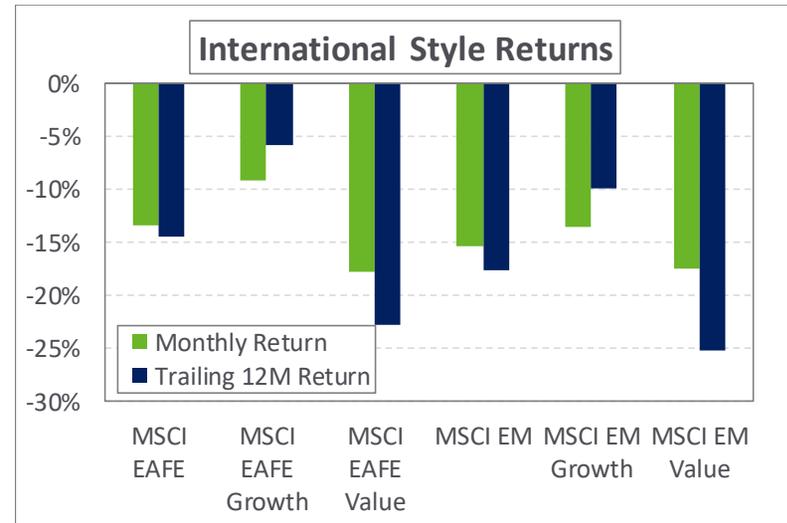
EQUITY

NEPC, LLC

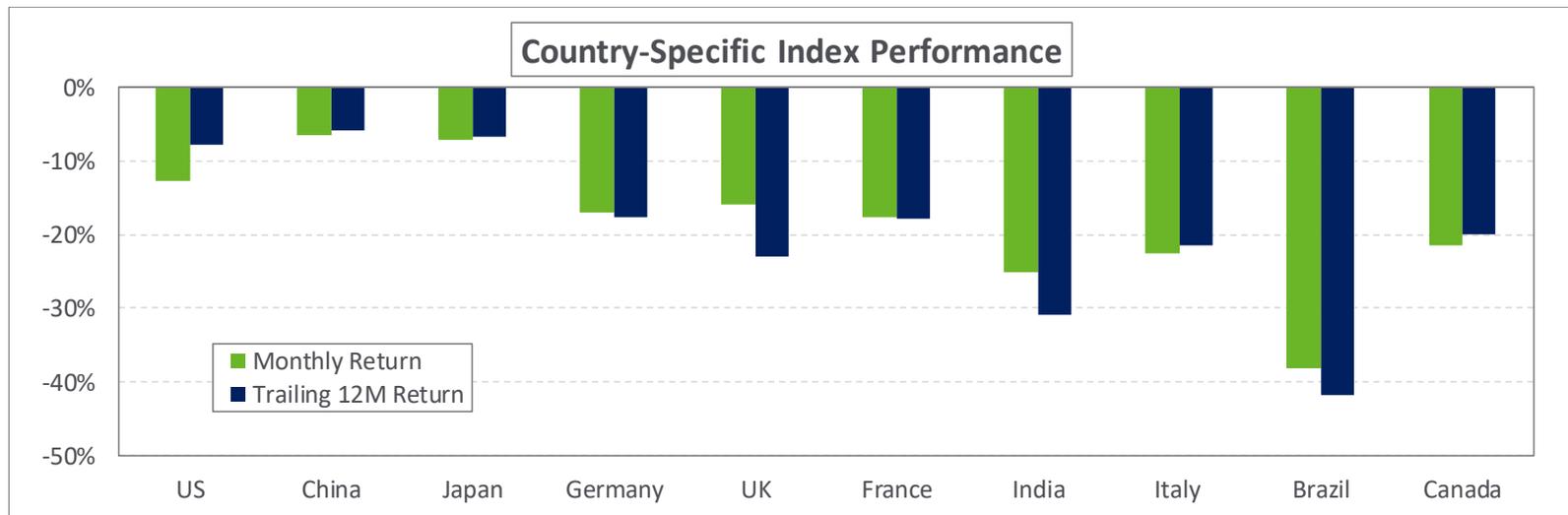
EQUITY INDEX PERFORMANCE



Source: Russell, FactSet



Source: MSCI, FactSet



Source: MSCI, FactSet
Represents returns in USD



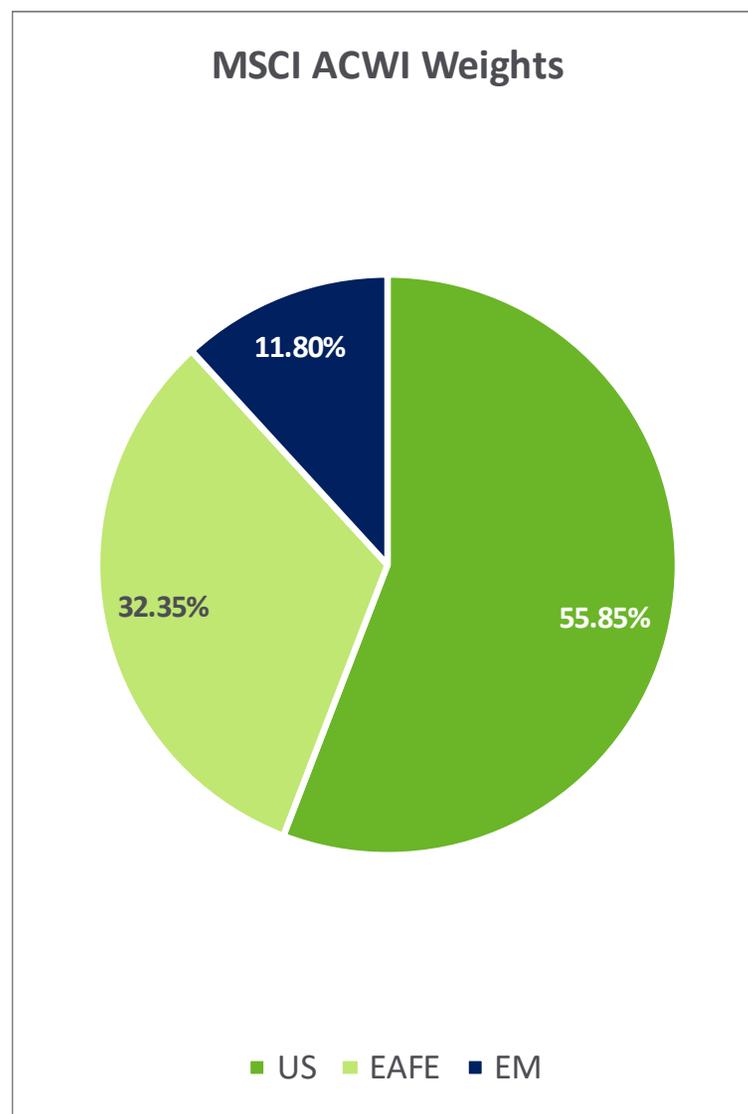
INDEX COMPOSITION

	MTD	QTD	YTD	Index Weight
S&P 500	-12.4%	-19.6%	-19.6%	100.0%
Communication Services	-1.3%	-1.8%	-1.8%	10.7%
Consumer Discretionary	-1.2%	-1.8%	-1.8%	9.8%
Consumer Staples	-0.6%	-1.1%	-1.1%	7.8%
Energy	-1.2%	-2.0%	-2.0%	2.6%
Financials	-2.5%	-4.0%	-4.0%	10.9%
Health Care	-0.8%	-1.9%	-1.9%	15.4%
Industrials	-1.7%	-2.4%	-2.4%	8.2%
Information Technology	-1.9%	-2.7%	-2.7%	25.5%
Materials	-0.3%	-0.7%	-0.7%	2.4%
Real Estate	-0.6%	-0.7%	-0.7%	3.0%
Utilities	-0.4%	-0.6%	-0.6%	3.6%

Source: S&P, FactSet

	MTD	QTD	YTD	Index Weight
MSCI ACWI	-13.5%	-21.4%	-21.4%	100.0%
Communication Services	-1.0%	-1.4%	-1.4%	9.3%
Consumer Discretionary	-1.4%	-2.2%	-2.2%	10.8%
Consumer Staples	-0.6%	-1.2%	-1.2%	8.8%
Energy	-1.2%	-2.1%	-2.1%	3.7%
Financials	-3.6%	-5.3%	-5.3%	14.4%
Health Care	-0.5%	-1.4%	-1.4%	13.3%
Industrials	-1.8%	-2.7%	-2.7%	9.6%
Information Technology	-1.6%	-2.3%	-2.3%	18.8%
Materials	-0.6%	-1.2%	-1.2%	4.4%
Real Estate	-0.7%	-0.9%	-0.9%	3.1%
Utilities	-0.5%	-0.6%	-0.6%	3.6%

Source: MSCI, FactSet



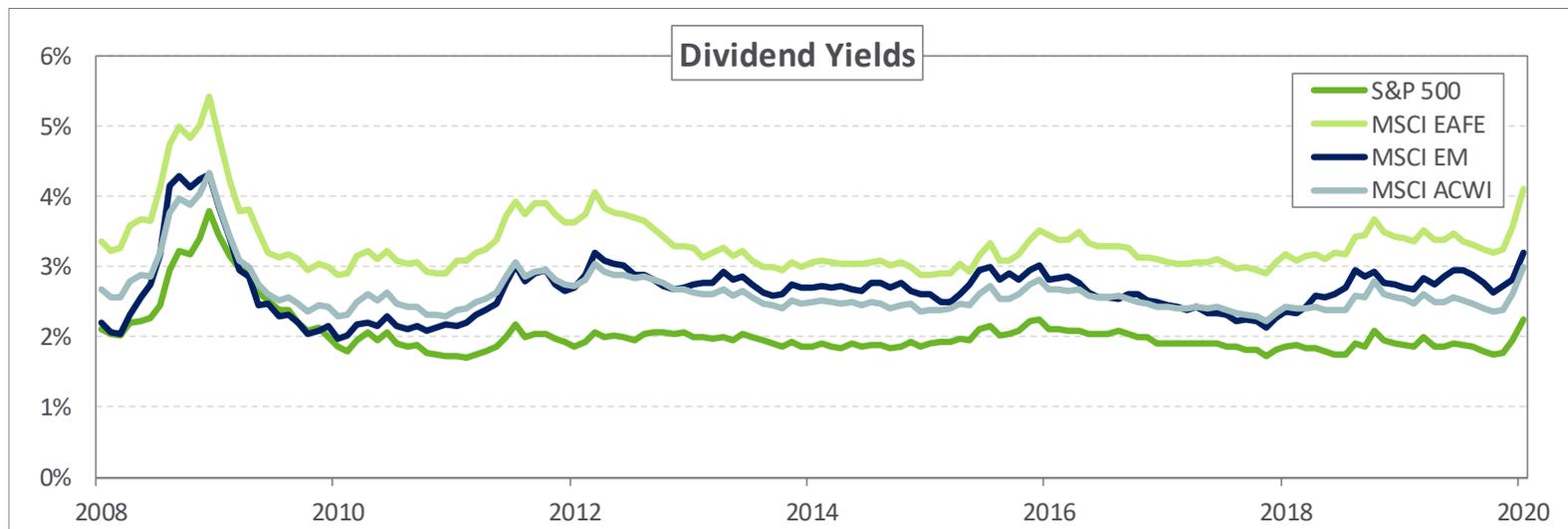
Source: MSCI, FactSet



EARNINGS & YIELDS



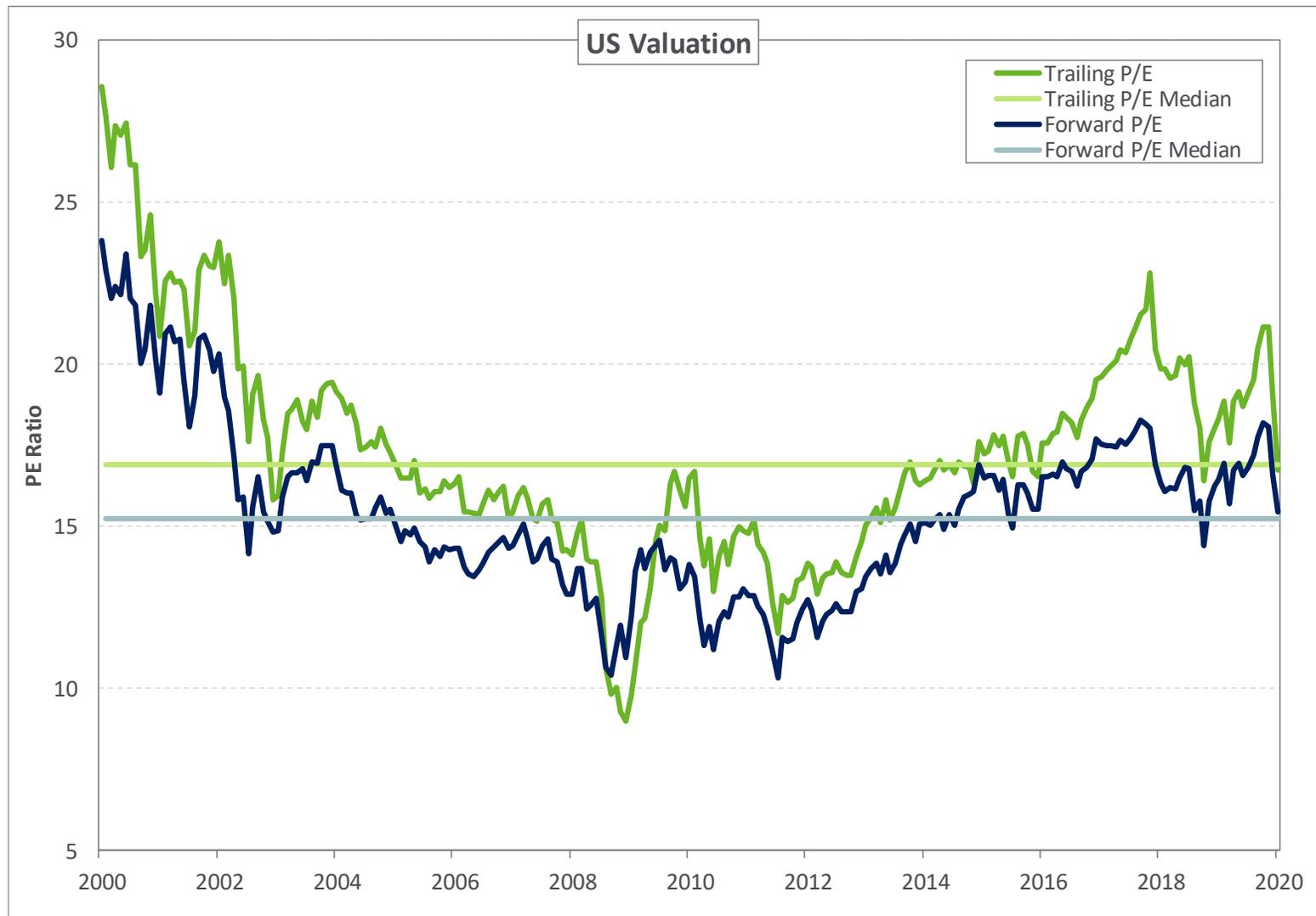
Source: FactSet



Source: FactSet



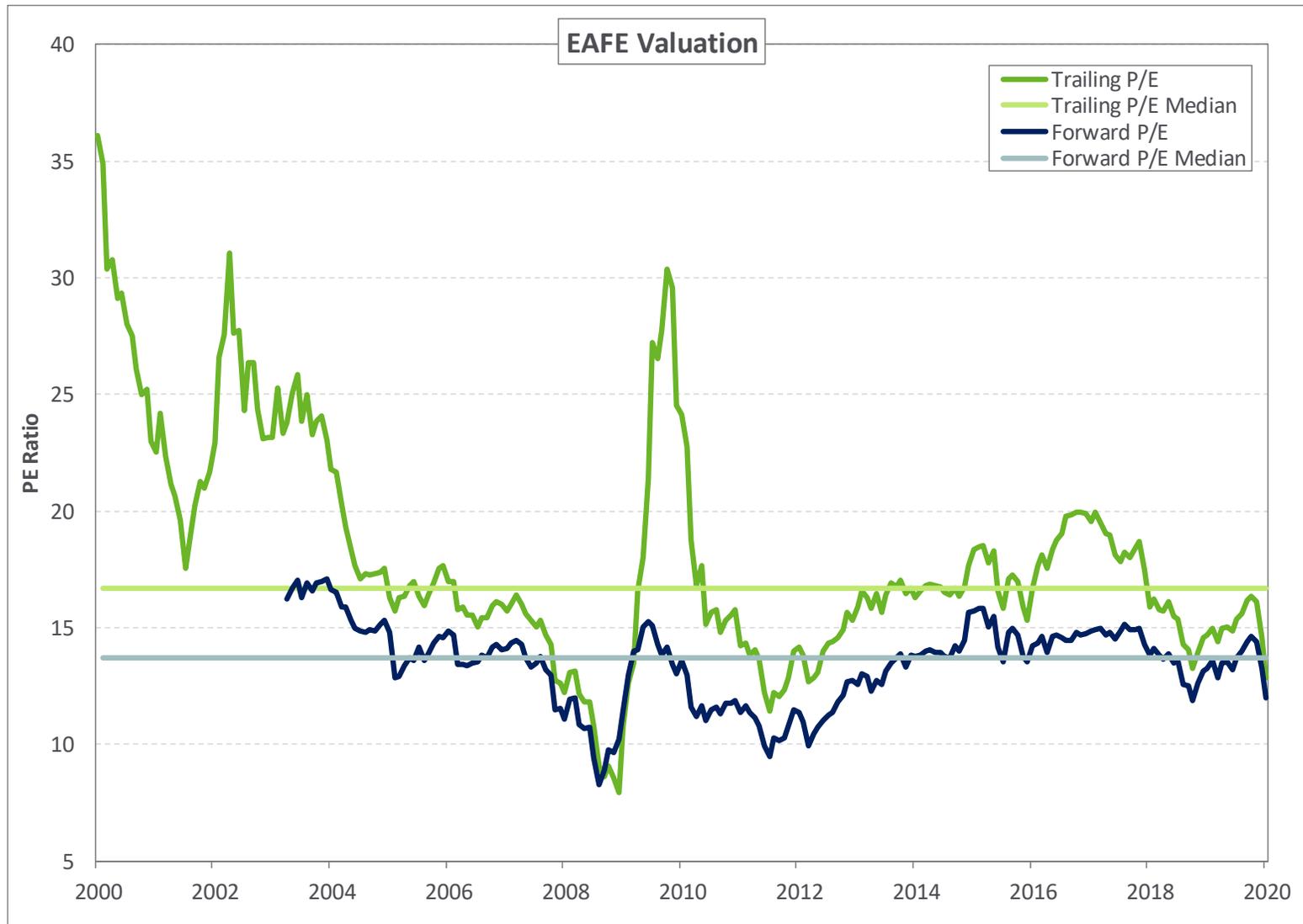
US EQUITY VALUATIONS



Source: S&P, FactSet



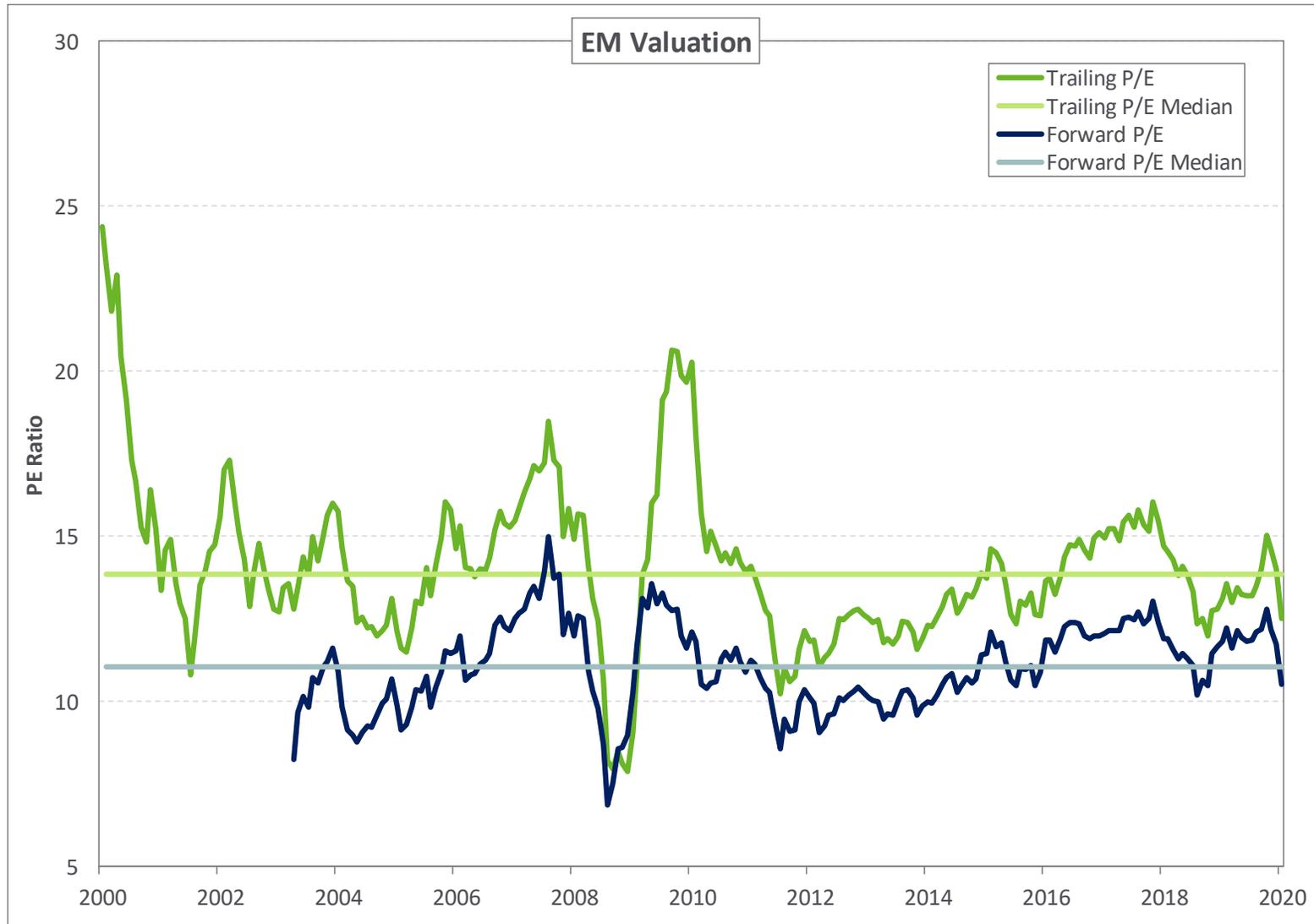
EAFE EQUITY VALUATIONS



Source: MSCI, FactSet



EM EQUITY VALUATIONS



Source: MSCI, FactSet



CREDIT

NEPC, LLC

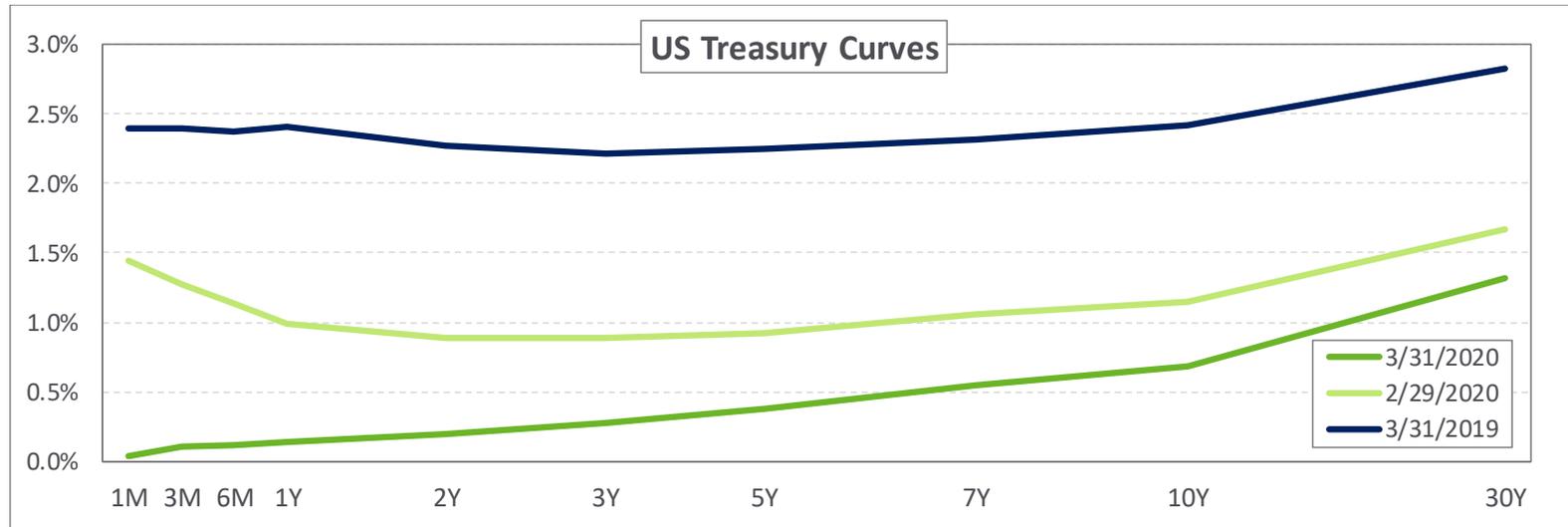
FIXED INCOME CHARACTERISTICS

	Averages			Total Returns (%)		
	Yield to Worst	Spread (bps)	Duration (Years)	1-Month	YTD	1-Year
Barclays Aggregate	1.59%	95	5.7	-0.6%	3.1%	8.9%
Barclays Treasury	0.58%	-	7.0	2.9%	8.2%	13.1%
Barclays Agency	0.94%	49	3.9	1.0%	4.1%	8.2%
Barclays MBS	1.34%	60	1.7	1.1%	2.8%	7.0%
Barclays ABS	2.40%	213	2.1	-2.1%	-0.2%	2.8%
Barclays CMBS	1.80%	130	5.6	-1.3%	3.6%	8.2%
Barclays Corp IG	3.43%	272	8.0	-7.1%	-3.6%	4.9%
Barclays Muni	2.01%	-	5.4	-3.6%	-0.6%	3.8%
Barclays HY Muni	5.24%	-	10.0	-11.0%	-6.9%	-0.7%
Barclays TIPS	0.93%	-	6.7	-1.8%	1.7%	6.8%
Barclays HY	9.44%	880	4.1	-11.5%	-12.7%	-6.9%
Barclays Global Agg	1.22%	82	7.0	-2.2%	-0.3%	4.2%
JPM EMBI Glob Div	-	627	7.1	-13.8%	-13.4%	-6.8%
JPM GBI - EM	4.61%	-	5.3	-11.1%	-15.2%	-6.5%

Source: Barclays, JP Morgan, FactSet



TREASURIES



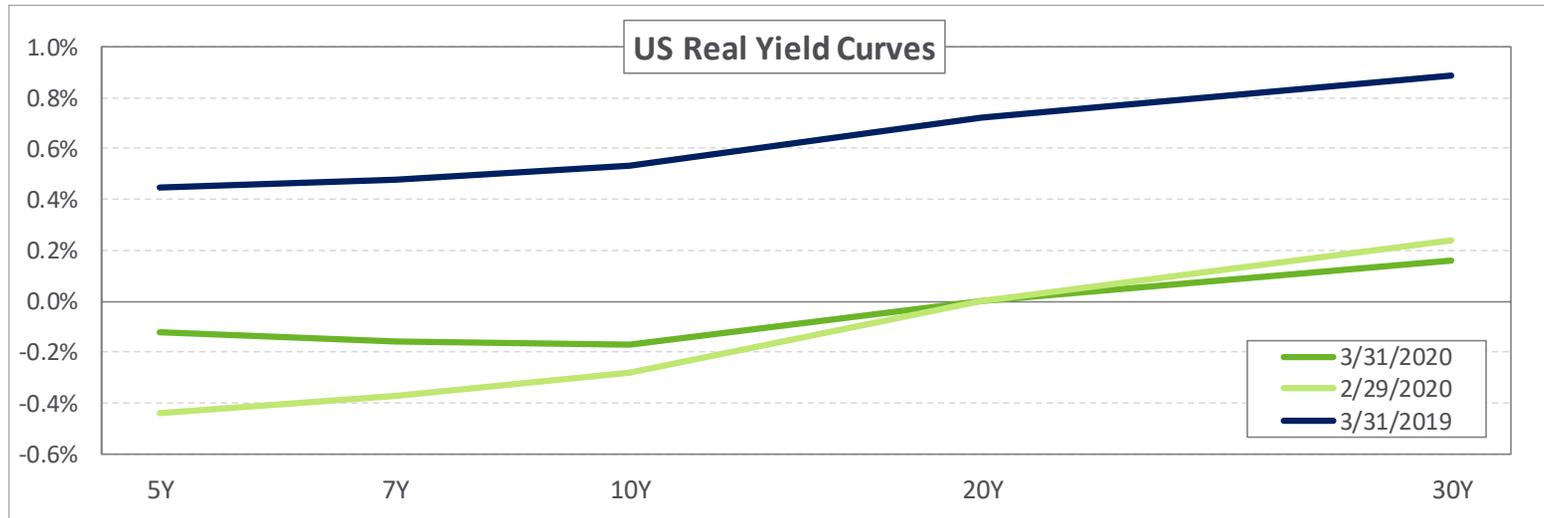
Source: FactSet

	Yield (%)			Total Return (%)	
	Current	1 Month Ago	12 Months Ago	1 Month	12 Months
3M Treasury	0.10%	1.27%	2.39%	0.29%	2.25%
6M Treasury	0.11%	1.14%	2.37%	0.52%	2.85%
2Y Treasury	0.20%	0.88%	2.27%	1.32%	5.38%
5Y Treasury	0.37%	0.92%	2.24%	2.62%	10.88%
10Y Treasury	0.68%	1.14%	2.42%	4.16%	18.25%
30Y Treasury	1.32%	1.67%	2.82%	7.57%	39.50%

Source: FactSet



REAL YIELDS



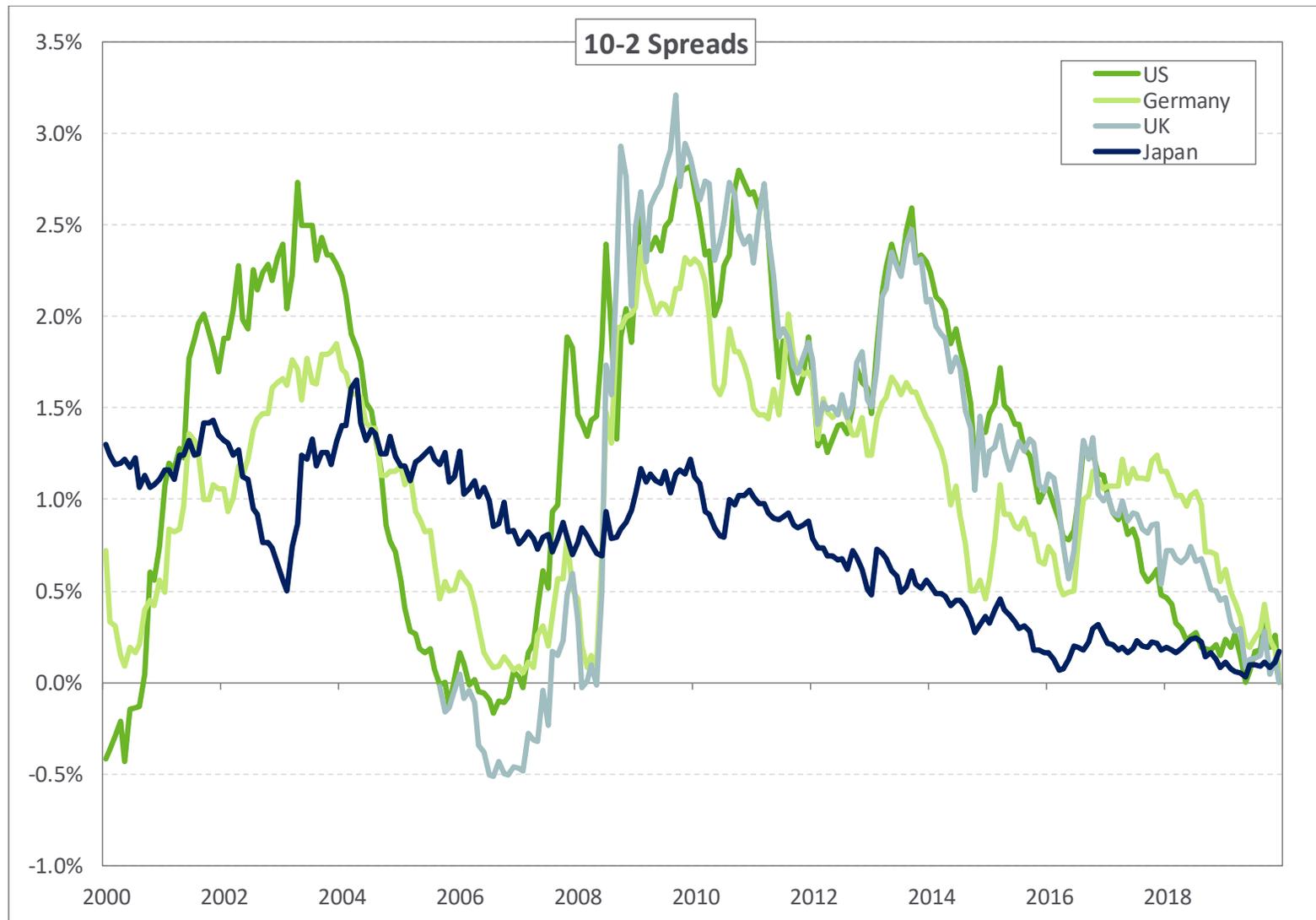
Source: FactSet

	Real Rates			Breakeven Rates	
	Current	1 Month Ago	12 Months Ago	Current	12 Months
5-Year	-0.12%	-0.44%	0.45%	0.49%	1.79%
7-Year	-0.16%	-0.37%	0.48%	0.71%	1.84%
10-Year	-0.17%	-0.28%	0.53%	0.85%	1.89%
30-Year	0.16%	0.24%	0.89%	1.16%	1.93%

Source: FactSet



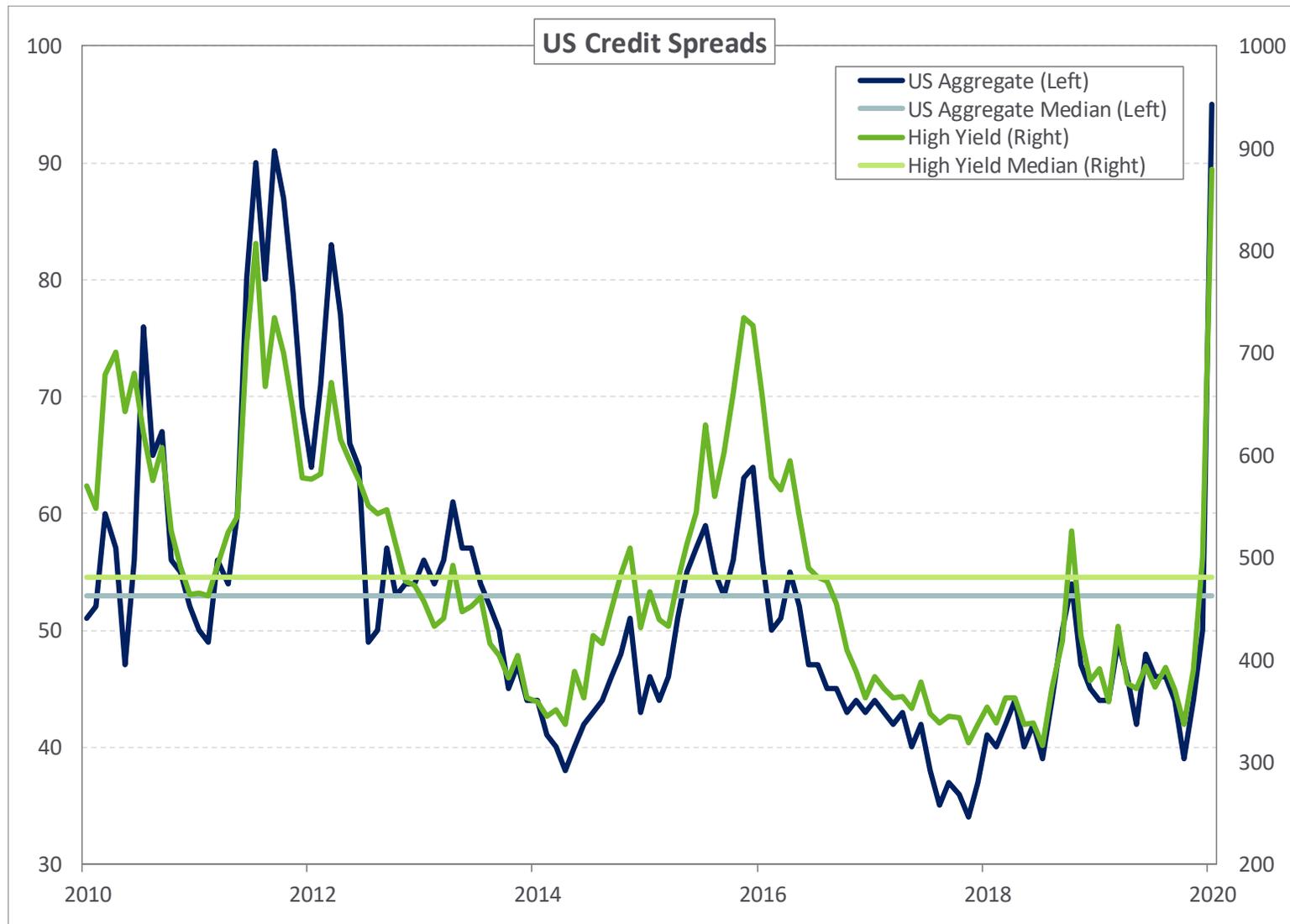
NOMINAL YIELDS



Source: FactSet



CREDIT SPREADS



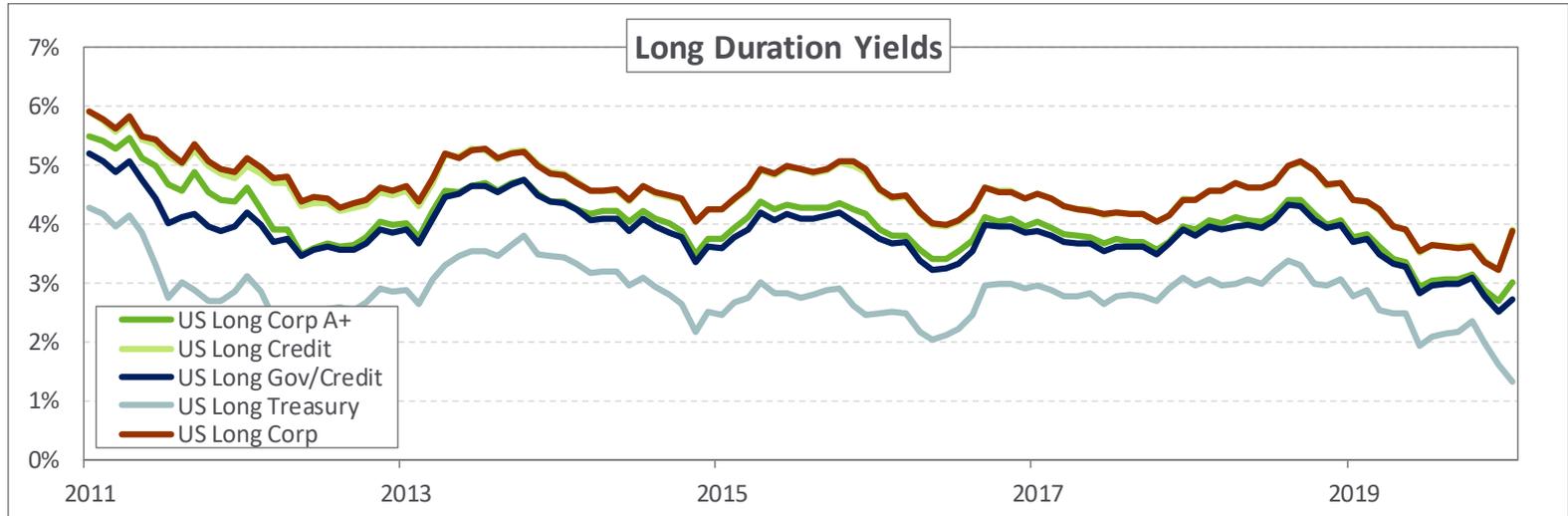
Source: Barclays, FactSet



LONG DURATION

Index	Current	1 Month Ago	12 Months Ago	Duration
Barclays Long Treasury	1.3%	1.6%	2.8%	19.0
Barclays 20+ STRIPS	1.4%	1.7%	2.8%	26.8
Barclays Long Credit	3.9%	3.2%	4.4%	14.1
Barclays Long Gov/Credit	2.7%	2.5%	3.7%	16.4
Barclays Long Corp A+	3.3%	2.8%	4.0%	15.2

Source: Barclays, FactSet



Source: Barclays, FactSet



REAL ASSETS

NEPC, LLC

REAL ASSETS INDEX PERFORMANCE

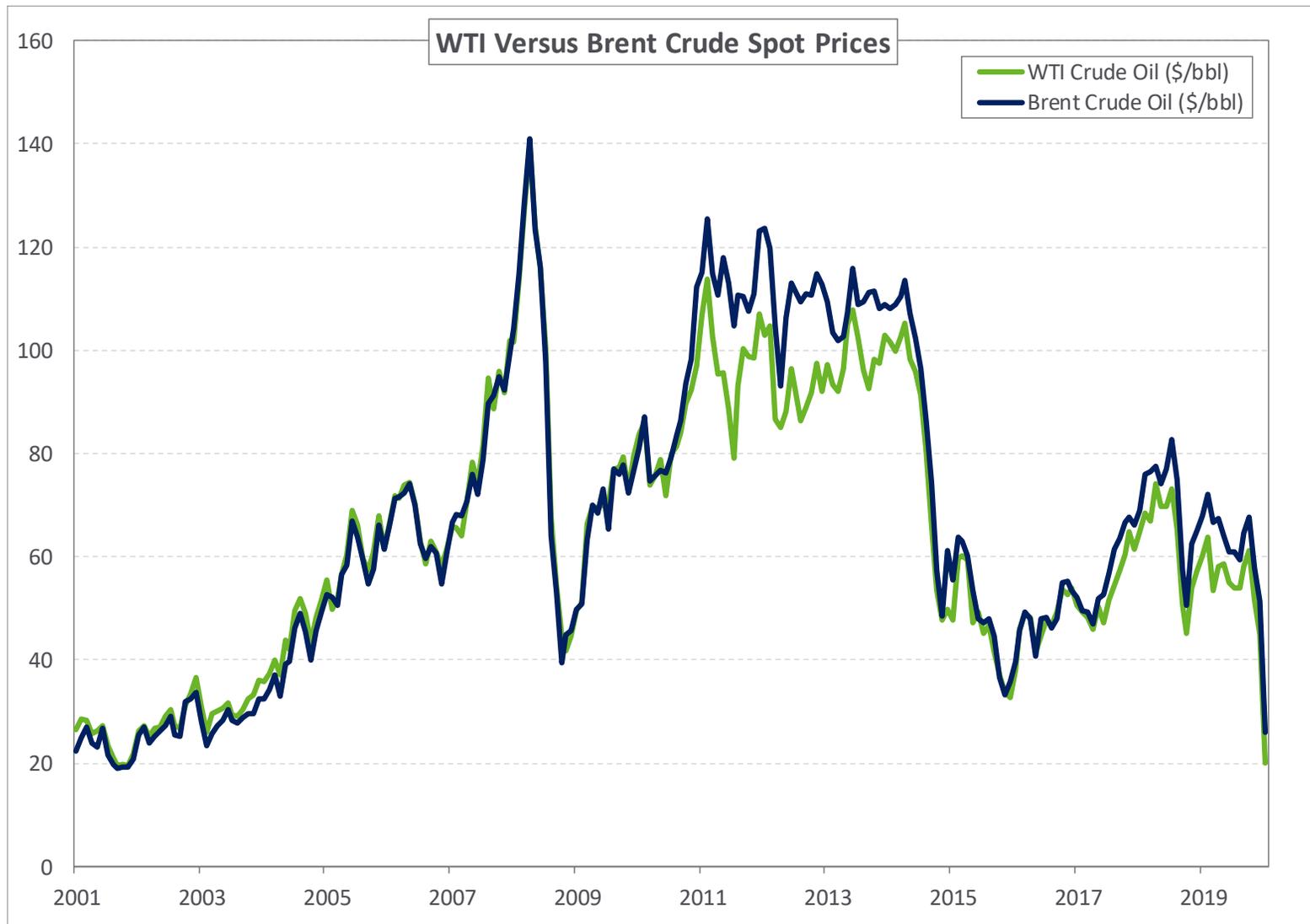
Index	1 Month	3 Month	YTD	1 Year	3 Year	5 Year
Bloomberg Commodity Index	-12.8%	-23.3%	-23.3%	-22.2%	-8.6%	-7.7%
Bloomberg Sub Agriculture Index	-3.3%	-9.9%	-9.9%	-5.3%	-9.1%	-7.2%
Coffee	7.4%	-9.4%	-9.4%	12.1%	-14.4%	-11.5%
Corn	-7.4%	-12.9%	-12.9%	-11.8%	-12.0%	-11.4%
Cotton	-16.8%	-26.4%	-26.4%	-35.0%	-12.6%	-4.7%
Soybean	-0.7%	-8.2%	-8.2%	-6.7%	-7.4%	-5.2%
Soybean Oil	-5.8%	-23.0%	-23.0%	-8.8%	-8.7%	-6.0%
Sugar	-26.3%	-20.0%	-20.0%	-22.8%	-19.4%	-8.5%
Wheat	8.4%	2.1%	2.1%	22.4%	-0.2%	-7.2%
Bloomberg Sub Energy	-35.1%	-51.1%	-51.1%	-52.6%	-19.8%	-18.7%
Brent Crude	-43.2%	-56.3%	-56.3%	-52.4%	-14.5%	-15.3%
Heating Oil	-32.0%	-50.0%	-50.0%	-47.6%	-12.4%	-13.6%
Natural Gas	-5.3%	-27.5%	-27.5%	-50.3%	-29.6%	-26.4%
Unleaded Gas	-59.9%	-68.1%	-68.1%	-63.3%	-27.1%	-20.7%
WTI Crude Oil	-54.4%	-66.5%	-66.5%	-65.1%	-25.5%	-23.3%
Bloomberg Sub Industrial Metals	-9.7%	-18.5%	-18.5%	-22.5%	-5.5%	-3.4%
Aluminum	-10.6%	-16.8%	-16.8%	-22.3%	-8.9%	-5.1%
Copper	-12.2%	-20.3%	-20.3%	-23.5%	-6.2%	-4.9%
Nickel	-6.4%	-18.4%	-18.4%	-10.8%	4.5%	-2.2%
Zinc	-5.9%	-16.2%	-16.2%	-31.2%	-7.7%	0.1%
Bloomberg Sub Precious Metals	-1.4%	-1.1%	-1.1%	15.6%	3.7%	3.2%
Gold	1.8%	4.5%	4.5%	22.1%	7.7%	5.4%
Silver	-13.9%	-21.1%	-21.1%	-7.6%	-9.2%	-4.4%
Bloomberg Sub Livestock	-13.5%	-28.1%	-28.1%	-35.3%	-11.0%	-9.7%
Lean Hogs	-19.9%	-36.8%	-36.8%	-51.9%	-20.4%	-15.1%
Live Cattle	-9.1%	-22.6%	-22.6%	-23.3%	-5.9%	-6.8%

Source: Bloomberg, FactSet

Bloomberg subindex total return indices reflects the return of the underlying one month commodity futures price movements



OIL MARKETS



Source: FactSet



APPENDIX: SAA POLICY HISTORY

NEPC, LLC

STRATEGIC ASSET ALLOCATION POLICY HISTORY

- 7/1/75 – 12/31/79 – 40% S&P 500/60% Barclays Capital Aggregate
- 1/1/80 – 12/31/83 – 50% S&P 500/50% Barclays Capital Aggregate
- 1/1/84 – 12/31/91 – 60% S&P 500/40% Barclays Capital Aggregate
- 1/1/92 – 12/31/94 – 50% S&P 500/10% MSCI EAFE/40% Barclays Capital Aggregate
- 1/1/95 – 6/30/97 – 45% S&P 500/15% MSCI EAFE/40% Barclays Capital Aggregate
- 7/1/97 – 12/31/99 – 50% S&P 500/15% MSCI EAFE/35% Barclays Capital Aggregate
- 1/1/00 – 9/30/03 – 53% S&P 500/17% MSCI EAFE/30% Barclays Capital Aggregate
- 10/1/03 – 12/31/06 – 53% S&P 500/15% MSCI EAFE/ACWI ex-U.S.¹/26% Barclays Capital Aggregate/6% NCREIF ODCE (lagged one quarter)
- 1/1/07 – 10/31/2009 – 31% S&P 500/7% S&P 400/7% S&P 600/18% MSCI ACWI ex-U.S./5% Russell 2000 (lagged one quarter)/26% Barclays Capital Aggregate/6% NCREIF ODCE (lagged one quarter)
- 11/1/2009 – 6/30/2012 – 28% S&P 500/6% S&P 400/6% S&P 600/13% MSCI EAFE/2% MSCI EAFE Small Cap/3% MSCI Emerging Markets/7% Russell 2000 (lagged one quarter)/24% Barclays Capital Aggregate/2% Barclays Capital High Yield/6% NCREIF ODCE (lagged one quarter)/3% Dow Jones/UBS Commodities Index
- 7/1/2012 – 3/31/2015 – 23% S&P 500/5% S&P 400/5% S&P 600/14% MSCI EAFE/3% MSCI EAFE Small Cap/6% MSCI Emerging Markets/7% Russell 2000 (lagged one quarter)/13% Barclays Capital Aggregate/5% Barclays Capital High Yield/4% JP Morgan GBI-EM Global Diversified/3% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/8% NCREIF ODCE (lagged one quarter)/4% Dow Jones/UBS Commodities Index
- 4/1/2015 – 3/31/2017 – 20% S&P 500/3% S&P 400/3% S&P 600/17% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/8% Russell 2000 (lagged one quarter)/11% Barclays Capital Aggregate/4% Barclays Capital High Yield/10% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/10% NCREIF ODCE (lagged one quarter)/2% Bloomberg Commodities Index TR/5% Multi-Asset Class Custom Index
- 4/1/2017 – 6/30/2018 – 20% S&P 500/3% S&P 400/3% S&P 600/17% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/8% Russell 2000 (lagged one quarter)/11% Barclays Capital Aggregate/2% Barclays Capital High Yield/12% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/10% NCREIF ODCE (lagged one quarter)/2% Bloomberg Commodities Index TR/5% Multi-Asset Class Custom Index
- **7/1/2018 – Present – 50% MSCI ACWI IMI Net w/ USA Gross, 20% NCREIF ODCE, 20% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter), 10% Barclays US Capital Aggregate**

***Interim SAA Policy:** 54.5% MSCI ACWI IMI Net w/ USA Gross, 10.8% BBG Barclays US Aggregate Bond Index, 15.5% NCREIF ODCE, 19.2% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)

Note: Interim SAA Policy includes proration of a total of Credit and Real Estate. Unfunded amounts were allocated 83.3% to Equity and 16.7% to Interest Sensitive Fixed Income. Recently approved Strategic Asset Allocation Policy effective July 1, 2018.



¹MSCI EAFE/ACWI ex-U.S. Benchmark is the MSCI EAFE Index prior to 10/1/2005 and the MSCI ACWI ex-U.S. thereafter.

Note: All MSCI indices changed from Gross to Net dividend withholding taxes effective 1/1/2014.

LONG TERM DISABILITY STRATEGIC ASSET ALLOCATION POLICY HISTORY

- 7/1/2002 – 12/31/2004 - 53% S&P 500/17% MSCI EAFE/30% Barclays Capital Aggregate Bond Index
- 1/1/2005 – 2/28/2007 - 53% Russell 3000/15% MSCI EAFE/26% Barclays Capital Aggregate Bond Index/6% DJ Wilshire Real Estate Securities Index
- 3/1/2007 – 12/31/2010 - 50% Russell 3000/18% MSCI EAFE/26% Barclays Capital Aggregate Bond Index/6% DJ Wilshire Real Estate Securities Index
- 1/1/2011 – 12/31/2012 - 40% Russell 1000/7% Russell 2000/13% MSCI EAFE/2% MSCI EAFE Small Cap/3% MSCI Emerging Markets/24% Barclays Capital Aggregate/2% Barclays Capital High Yield/6% DJ Wilshire Real Estate Securities Index/3% Bloomberg Commodity Index
- 1/1/2013 – 2/28/2016 - 34% Russell 1000/6% Russell 2000/14% MSCI EAFE/3% MSCI EAFE Small Cap/6% MSCI Emerging Markets/13% Barclays Capital Aggregate/8% Barclays Capital High Yield/4% JP Morgan GBI-EM Global Diversified/8% DJ Wilshire Real Estate Securities Index/4% Bloomberg Commodity Index
- 2/29/2016 – 7/26/2017 - 24% Russell 1000/12% Russell 2000/18% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/19% Barclays Capital Aggregate/7% Barclays Capital High Yield/11% DJ Wilshire Real Estate Securities Index/2% Bloomberg Commodity Index
- 7/27/2017 – 6/30/2018 – 20% S&P 500/3% S&P 400/3% S&P 600/17% MSCI EAFE/2% MSCI EAFE Small Cap/5% MSCI Emerging Markets/8% Russell 2000 (lagged one quarter)/11% Barclays Capital Aggregate/2% Barclays Capital High Yield/12% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)/10% NCREIF ODCE (lagged one quarter)/2% Bloomberg Commodities Index TR/5% Multi-Asset Class Custom Index
- **7/1/2018 – Present – 50% MSCI ACWI IMI Net w/ USA Gross, 20% NCREIF ODCE, 20% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter), 10% Barclays US Capital Aggregate**

* **Interim SAA Policy:** 54.5% MSCI ACWI IMI Net w/ USA Gross, 10.8% BBG Barclays US Aggregate Bond Index, 15.5% NCREIF ODCE, 19.2% S&P/LSTA Levered Loan Index + 250 basis points (lagged one quarter)



Note: All MSCI indices changed from Gross to Net of dividend withholding taxes effective 1/1/2014.

CUSTOM ASSET CLASS BENCHMARK HISTORY

- **ASRS Custom Total Public Equity Benchmark** was 77% S&P 500, 23% MSCI EAFE through 12/31/1999; 76% S&P 500, 24% MSCI EAFE through 9/30/2003; 78% S&P 500, 22% MSCI EAFE/ACWI ex-U.S.¹ through 12/31/2006; 49% S&P 500, 11% S&P 400, 11% S&P 600, 29% MSCI ACWI ex-U.S. through 10/31/2009; 48% S&P 500, 10% S&P 400, 10% S&P 600, 23% MSCI EAFE, 4% MSCI EAFE Small Cap, 5% MSCI Emerging Markets through 6/30/2012; 41% S&P 500, 9% S&P 400, 9% S&P 600, 25% MSCI EAFE, 5% MSCI EAFE Small Cap, 11% MSCI Emerging Markets through 3/31/2015; 40% S&P 500, 6% S&P 400, 6% S&P 600, 34% MSCI EAFE, 4% MSCI EAFE Small Cap, 10% MSCI Emerging Markets through 6/30/2018; Asset weighted ACWI IMI w/USA Gross (Net) (public equity assets) and ACWI IMI w/USA Gross (Net) 1 qtr Lagged (private equity assets) thereafter
- **ASRS Custom Domestic Equity Benchmark** was S&P 500 through 12/31/2006; 74% S&P 500, 13% S&P 400, 13% S&P 600 through 12/31/2010; 70% S&P 500, 15% S&P 400, 15% S&P 600 through 3/31/2015.; 77% S&P 500, 11.5% S&P 400, 11.5% S&P 600 through 6/30/2018; 100% MSCI USA IMI thereafter.
- **ASRS Custom Domestic Large Cap Equity Benchmark** was the S&P 500 Index through 6/30/2018; MSCI USA Large Cap Index thereafter.
- **ASRS Custom Domestic Mid Cap Equity Benchmark** was the S&P 400 Index through 6/30/2018; MSCI USA Mid Cap Index thereafter.
- **ASRS Custom Small Cap Equity Benchmark** was the Russell 2000 Index through 12/31/2006; S&P 600 Index through 6/30/2018; MSCI USA Small Cap Index thereafter.
- **ASRS Custom International Equity Benchmark** was MSCI EAFE through 9/30/2005; MSCI ACWI ex-U.S. through 12/31/2010; 72% MSCI EAFE, 11% MSCI EAFE Small Cap and 17% MSCI Emerging Markets through 6/30/2012; 61% MSCI EAFE, 13% MSCI EAFE Small Cap and 26% MSCI Emerging Markets through 3/31/2015; 71% MSCI EAFE, 8% MSCI EAFE Small Cap and 21% MSCI Emerging Markets through 6/30/2018; MSCI ACWI IMI ex USA thereafter.
- **ASRS Custom Private Equity Benchmark** was the Russell 2000 Index 1 quarter lagged from inception to 6/30/2018; MSCI ACWI IMI Net w/ USA Gross 1 quarter lagged thereafter.



¹MSCI EAFE/ACWI ex-U.S. Benchmark is the MSCI EAFE Index prior to 10/1/2005 and the MSCI ACWI ex-U.S. thereafter.

Note: All MSCI indices changed from Gross to Net of dividend withholding taxes effective 1/1/2014.

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- Past performance is no guarantee of future results.
- All investments carry some level of risk. Diversification and other asset allocation techniques are not guaranteed to ensure profit or protect against losses.
- NEPC's source for portfolio pricing, calculation of accruals, and transaction information is the plan's custodian bank. Information on market indices and security characteristics is received from other sources external to NEPC. While NEPC has exercised reasonable professional care in preparing this report, we cannot guarantee the accuracy of all source information contained within.
- Some index returns displayed in this report or used in calculation of a policy, allocation or custom benchmark may be preliminary and subject to change.
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Reporting Methodology

- The client's custodian bank is NEPC's preferred data source unless otherwise directed. NEPC generally reconciles custodian data to manager data. If the custodian cannot provide accurate data, manager data may be used.
- Trailing time period returns are determined by geometrically linking the holding period returns, from the first full month after inception to the report date. Rates of return are annualized when the time period is longer than a year. Performance is presented gross and/or net of manager fees as indicated on each page.
- For managers funded in the middle of a month, the "since inception" return will start with the first full month, although actual inception dates and cash flows are taken into account in all Composite calculations.
- This report may contain forward-looking statements that are based on NEPC's estimates, opinions and beliefs, but NEPC cannot guarantee that any plan will achieve its targeted return or meet other goals.



Cash Management

- Objective #4: Ensure sufficient monies are available to meet pension benefits, health insurance, member refunds, administrative payments, and other cash flow requirements.

Month	External CFs	Last day of the Month Ending Balance*
Mar - 19	(\$86.1)	\$453.1
Apr - 19	(\$105.8)	\$368.4
May - 19	(\$52.9)	\$175.5
Jun - 19	(\$97.3)	\$368.0
Jul - 19	(\$163.9)	\$465.2
Aug - 19	(\$108.9)	\$467.2
Sep - 19	(\$108.2)	\$365.2
Oct - 19	(\$87.3)	\$676.3
Nov - 19	(\$96.1)	\$404.2
Dec - 19	(\$75.4)	\$521.9
Jan - 20	(\$63.6)	\$412.7
Feb - 20	(\$107.4)	\$376.8
Mar - 20	(\$95.8)	\$730.4

* Includes assetized & unassetized cash balances (Inception of 1/26/15); represents monies to be used for funding needs that occur in subsequent month(s). Generally, monthly pension payments occur on the first day of month.

**Goal Met:
Yes**

Agenda Item #7

Arizona State Retirement System

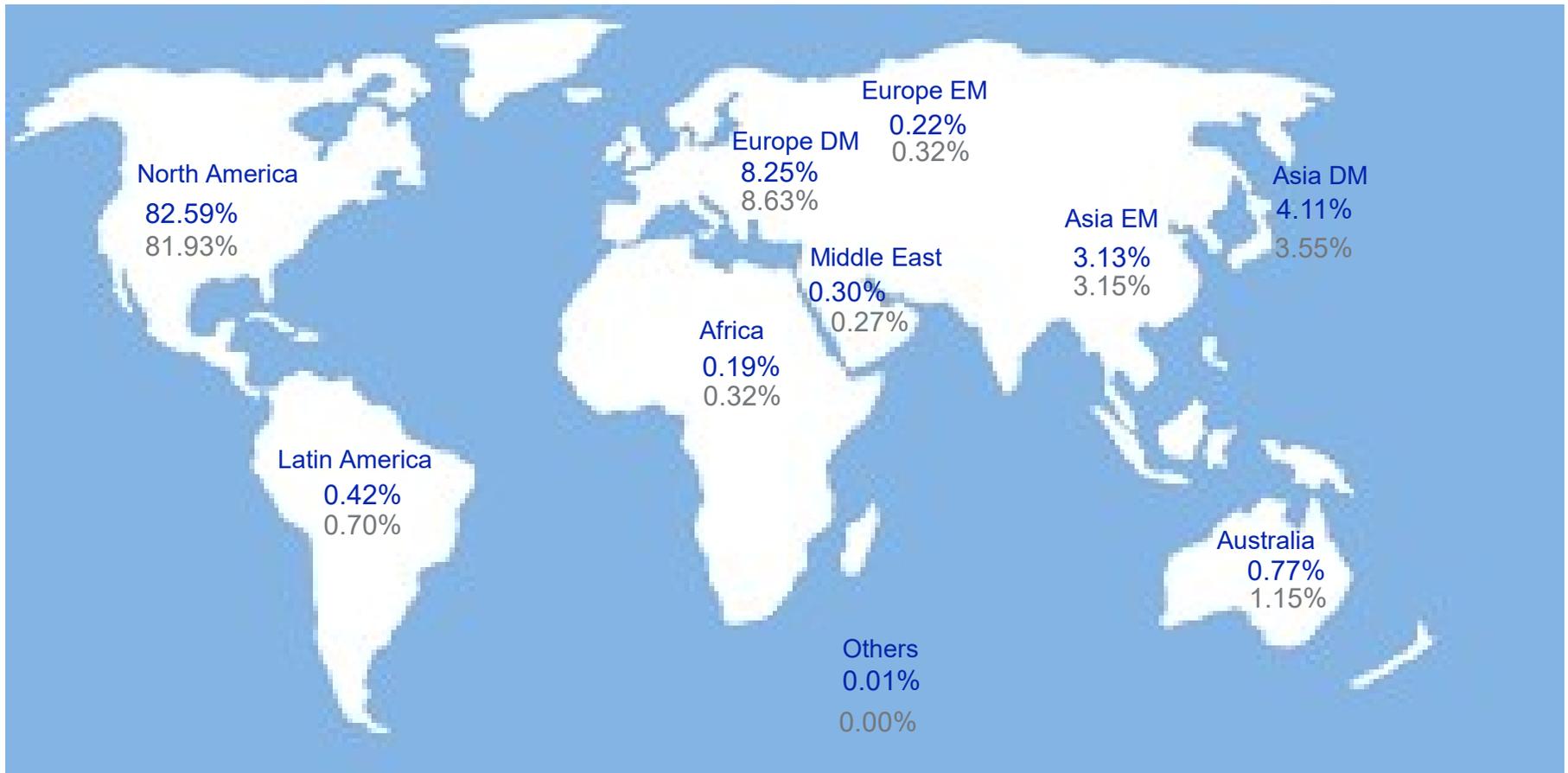
Total Plan Risk and Exposure Report

April 2020

Agenda

- Country Diversification
- Asset Class Diversification
- Exposure Analysis
- Asset Class Correlation
- Asset Class Risk Contribution
- Total Portfolio Value-At-Risk (VAR)
- Stress Test and Tail Risk Summary

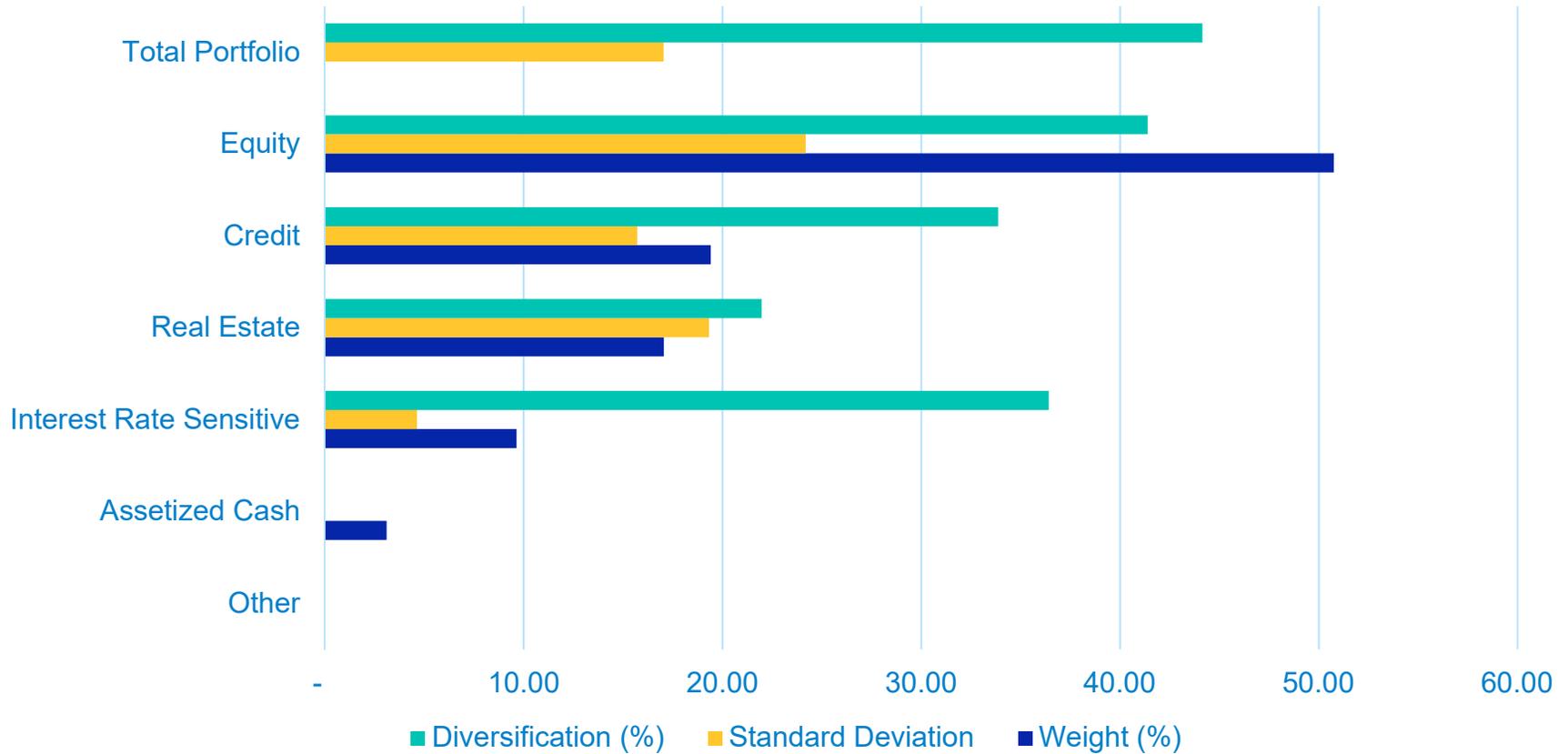
ASRS ASSETS ARE DIVERSIFIED ACROSS REGIONS



%Weight

%Contribution to Total Risk

ASRS ASSETS AND RISK SOURCES ARE DIVERSIFIED ACROSS DIFFERENT ASSET CLASSES



VARIOUS EXPOSURE ANALYSIS VS. THE SAA

Asset Type	Weight of Total Plan (%)	Weight of SAA (%)	Active Weight (%)
Equity	50.76%	50.00%	0.76%
Credit	19.42%	20.00%	-0.58%
Real Estate	17.06%	20.00%	-2.94%
Interest Rate Sensitive	9.64%	10.00%	-0.36%
Assetized Cash	3.11%	0.00%	3.11%
Other	0.01%	0.00%	0.01%
Total	100.00%	100.00%	0.00%

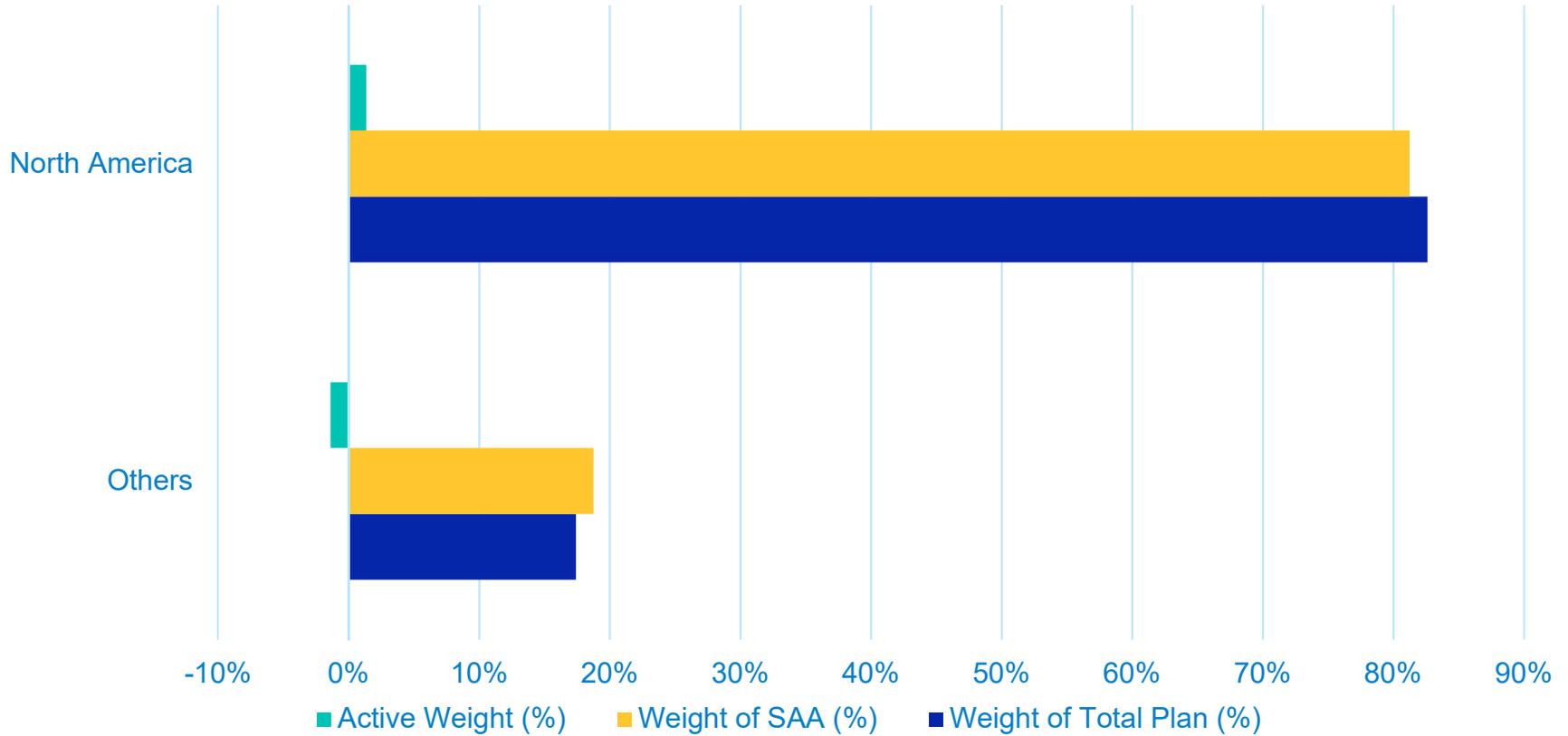
Country	Weight of Total Plan (%)	Weight of SAA (%)	Active Weight (%)
North America	82.59%	81.23%	1.66%
Europe DM	8.25%	10.20%	-1.95%
Asia DM	4.89%	5.38%	-0.49%
Asia EM	3.13%	2.24%	2.89%
Latin America	0.42%	0.38%	0.04%
Middle East	0.30%	0.22%	0.08%
Europe EM	0.22%	0.18%	0.04%
Africa	0.19%	0.13%	0.06%
Others	0.01%	0.04%	0.00%
Total	100.00%	100.00%	0.00%

Top 15 Foreign Currency Exposures			
Currency	Weight of Total Plan (%)	Weight of SAA (%)	Active Weight (%)
EUR	4.06%	3.84%	0.22%
JPY	3.21%	3.47%	-0.26%
GBP	1.80%	1.97%	-0.17%
HKD	1.55%	1.26%	0.29%
CAD	1.28%	0.00%	1.28%
CHF	1.10%	1.30%	-0.20%
AUD	0.76%	0.85%	-0.09%
TWD	0.63%	0.44%	0.19%
KRW	0.57%	0.40%	0.17%
INR	0.41%	0.29%	0.12%
SEK	0.40%	0.42%	-0.02%
DKK	0.26%	0.29%	-0.03%
BRL	0.23%	0.16%	0.07%
CNY	0.23%	0.16%	0.07%
SGD	0.19%	0.17%	0.02%

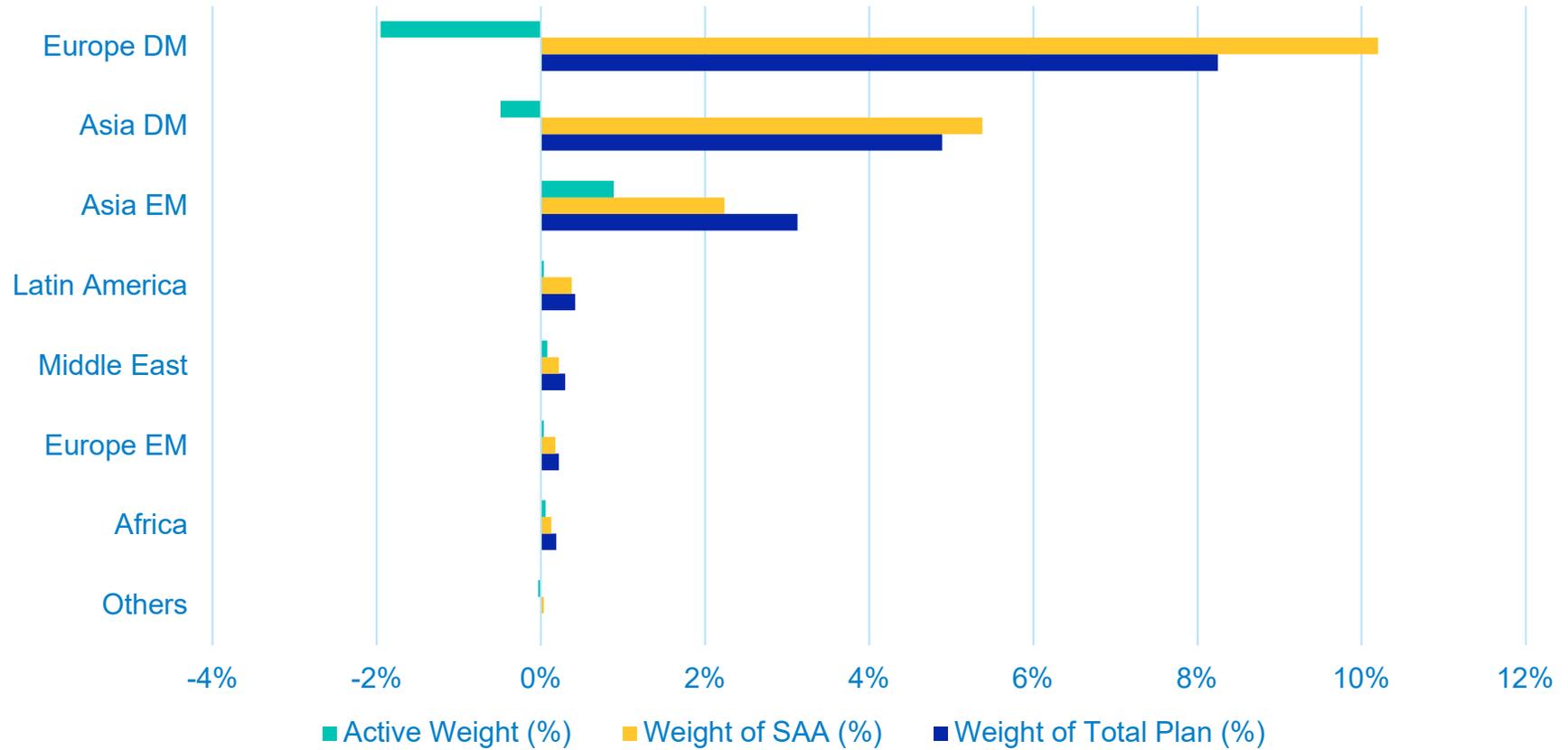
EXPOSURE ANALYSIS: ASSET CLASS COMPARISON



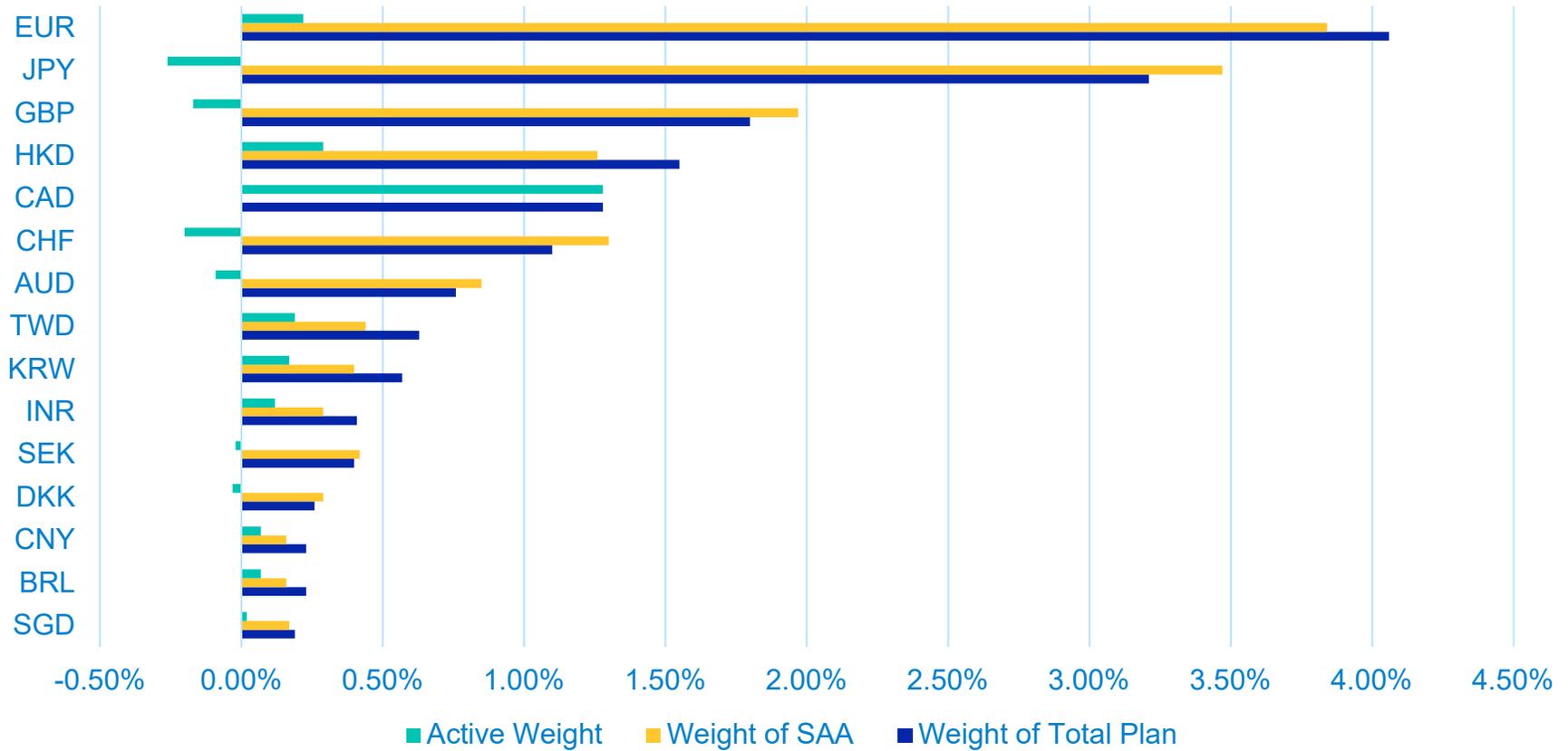
EXPOSURE ANALYSIS: AMERICA VS. OTHERS



EXPOSURE ANALYSIS: OTHER REGIONS



Exposure Analysis: Foreign Currency



CORRELATION REPORT OF THE MAJOR ASSET CLASSES

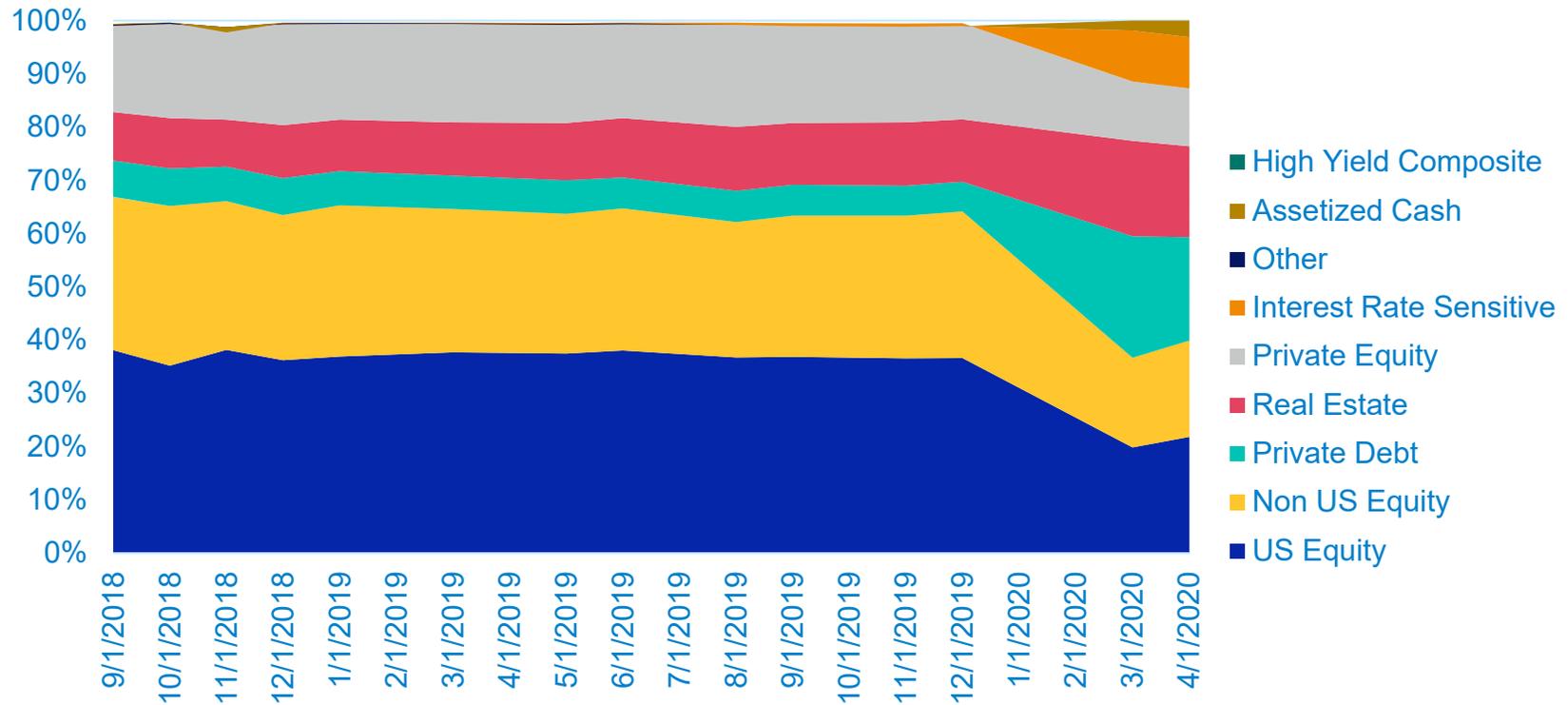
ASRS Assets are fairly diversified across different asset classes. While Fixed Income investments are a major source of portfolio diversification, private assets also add meaningful diversification benefits.

Portfolio	US Equity	Non US Equity	Private Equity node	Interest Rate Sensitive	Private Debt US Corporate	High Yield Composite	Emerging Market Debt	Real Estate	Assetized Cash	Other
US Equity	1									
Non US Equity	0.91	1								
Private Equity	0.79	0.73	1							
Interest Rate Sensitive	0.24	0.27	0.19	1						
Private Debt US Corporate	0.57	0.58	0.69	0.33	1					
High Yield	0.24	0.25	0.19	-0.01	0.1	1				
Emerging Market Debt	0.1	0.24	0.1	0.18	0.11	0.03	1			
Real Estate	0.7	0.65	0.56	0.33	0.52	0.15	0.11	1		
Assetized Cash	0	0	0	0	0	0	0	0	1	
Other	0	0	0	0	0	0	0	0	0	1

HISTORICAL RISK CONTRIBUTION OF THE MAJOR ASSET CLASSES

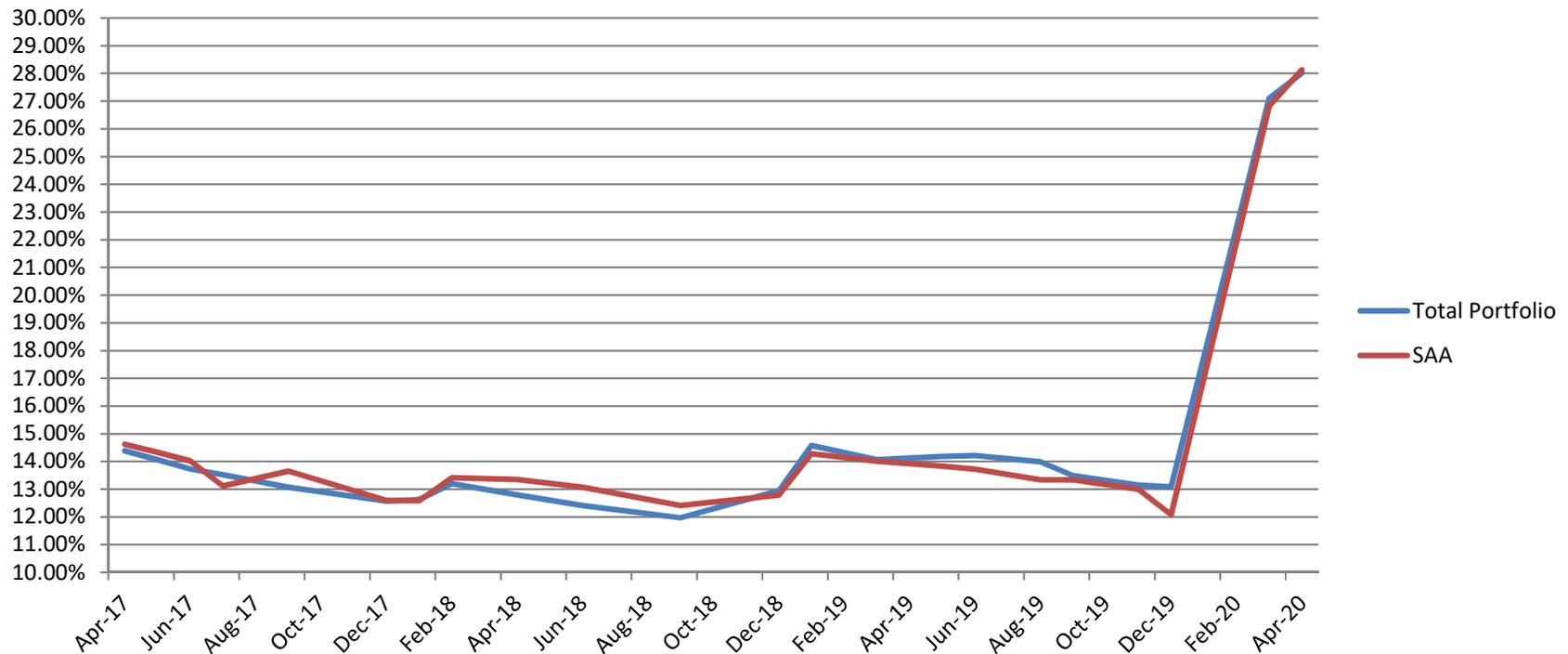
Equities continue to account for more than 80% of the overall portfolio risk.

Asset Class % Contribution to Risk

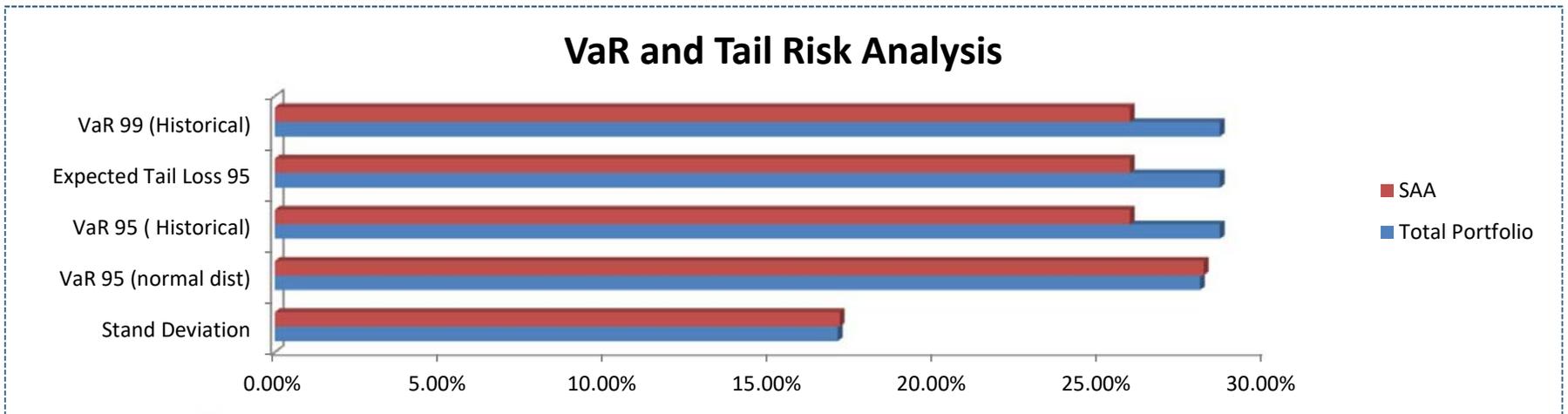
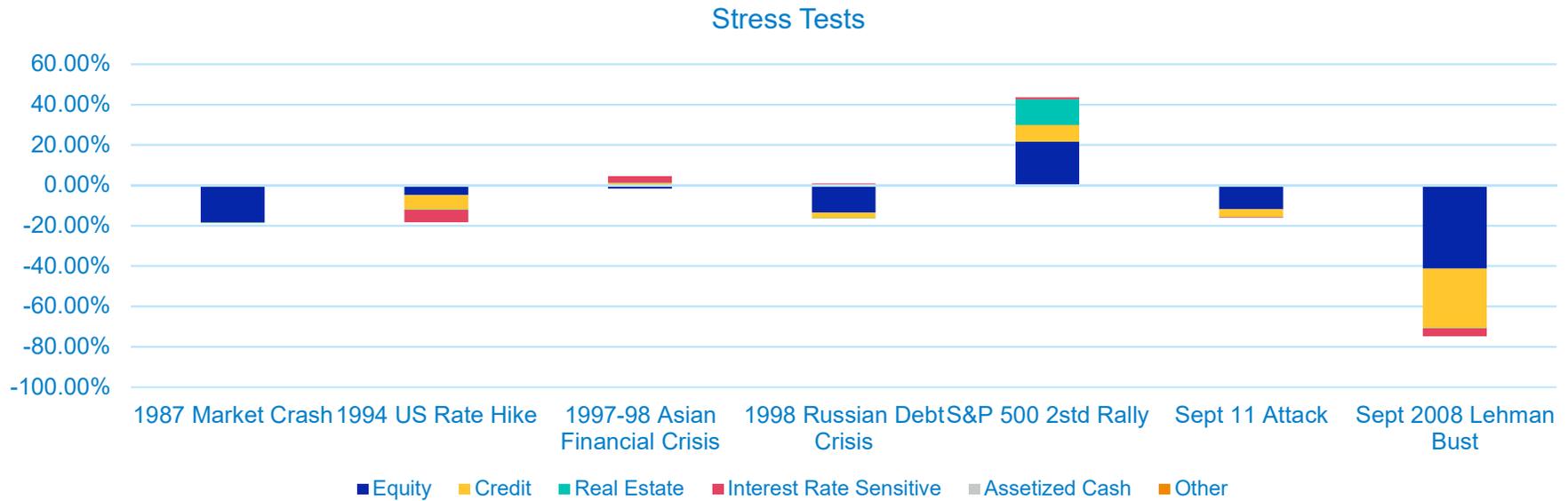


▀ Total Portfolio Value-At-Risk (VAR)

As of April 30th, 2020 Total VaR for ASRS Portfolio was 28.02%, indicating that there is a 5% chance that portfolio could lose ~\$10.84B in a given year. Note that a 5% event is expected to occur every 20 years



Stress Test and Tail Risk Summary



▼ GLOSSARY

- Diversification: shows the diversifying effect of covariance on portfolio risk. For example, a diversification figure of 60% means that you are diversifying away 60% of portfolio risk. A higher number thus indicates greater diversification arising from covariance.
- Standard Deviation: distribution of asset's return, expressed in percent. We forecast volatility using normal distribution with two-third probability in Barra's multiple factor model (BIM). The total risk for an asset depends on the asset's exposures to the risk factors, the factor variance/covariance matrix, and the forecast selection risk of the asset.
- Parametric VaR Confidence Level: 95%
- Historical VaR & Expected Tail Loss Settings:
- Holding Period: 252 days (1 year)
- Decay Factor: 0.94
- Look Back Period: trailing 10 years
- Decay Factor: this parameter means that older observations are given less weight than more recent ones. Its magnitude determines how fast the weight on the observations used in the simulation decays over the historical period. BarraOne's decay factor default is 0.94.

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Agenda Item #8

Investment Compliance Reporting

Arizona State Retirement System

June 15, 2020

Compliance Summary Overview

- The Investment Management Division regularly monitors and reviews compliance through several means:
 - Public Portfolios:
 - Pre-Trade Compliance
 - Post-Trade Compliance
 - Private Markets:
 - Independent consultant reviews on Commingled Private Equity and Real Estate Funds
 - Independent consultant reviews on Separate Accounts in Credit and Real Estate
 - Total Fund:
 - Statutory Compliance
 - Restricted Country tests
- No material instances of non-compliance were noted during the periods reported on in this report

Pre-Trade Compliance Review

- For the internally managed portfolios, the Investment Management Division (IMD) utilizes Bloomberg's Trade Order Management System (OMS) for executing and processing trades
- The OMS platform runs pre-trade compliance rules to ensure trades will not violate established portfolio guidelines
- Compliance rules are based on the investment guidelines:
 - Approved Investment Strategy Papers
 - Applicable Arizona Revised Statutes

Pre-Trade Summary Results

- Period reported on: February - April 2020
- Portfolios monitored: Internally managed fixed income and equity portfolios
- Exceptions: No exceptions occurred during the period under review

Post-Trade Compliance Review

- State Street provides daily and monthly compliance monitoring at the individual portfolio level, for all the internal and external investment portfolios on a post-trade basis
- Daily monitoring allows for closer insight into the managers' activity
- The investment compliance rules are based on guidelines from:
 - Letters of Direction & Clarification (LODs) for the externally managed portfolios
 - Investment Strategy Papers for the internally managed portfolios
 - Applicable Arizona Revised Statutes

Post-Trade Summary Results

- Period reported on: February - April 2020
- Portfolios monitored: All public markets portfolios
- Public Markets Investment Limits Exceptions:
 - Five public markets portfolios for the period February - April 2020 (equities, fixed income) were reviewed
 - State Street's review found a few findings resulting from index changes, corporate actions, and informational flags
- All findings were researched and resolved to both State Street and ASRS's satisfaction, for all periods

Investment Compliance Review

- Reviews perform the following steps:
 - Review and note if financial statements are prepared on a fair value basis noting whether liabilities are marked to market
 - Review the calculation of ASRS Net Asset Value (i.e. the waterfall calculation) and comment to the manager and ASRS if any errors are noted
 - Review the management fee calculation, including review of the Net Operation Income (NOI) calculation to determine if it has been calculated correctly and if appropriate reserves have been deducted, then comment to the manager and ASRS if any errors are noted
 - Work with the manager and ASRS as necessary to address concerns and questions
 - Review audited financial statements at a high level for significant issues
 - Review valuation policies for consistency with ASRS policies, operating agreements and standards
 - Review expense policies for consistency with ASRS policies, operating agreements, and standards

Compliance Summary Results

- The current consultant is currently working on the compliance reviews for the 2018 review period

Investment Compliance Review

- Review managers' calculations of:
 - Asset management fees
 - Partnership expenses
 - Carried interest
- Review investment valuation policy
- Ensure calculation and policy agree to investment documentation, agreements, and manager policies
- If a deficiency is noted, the consultant will address with the sponsor and work to resolve deficiencies
- All results are communicated to ASRS
- A summary report will be presented to the ASRS to communicate findings on an annual basis

Compliance Summary Results

- The current consultant is currently working on the compliance reviews for the 2018 review period

Total Fund Compliance

- State Street Compliance Group provides compliance reporting and monitoring at the Total Fund level, known as the “Monthly Statute Tests Compliance” for:
 - Five mandated Arizona Revised Statutes on investment limits, under §A.R.S. 38-718.H-L
 - 1 Max 80% Equity Test (§A.R.S. 38-718.H)
 - 2 Max 40% Non-US Public Investments Test (§A.R.S. 38-718.I)
 - 3 Max 60% Internally Managed Assets Test (§A.R.S. 38-718.J)
 - 4 Max 5% Issuer Test (§A.R.S. 38-718.K)
 - 5 Max 10% Debt of Multinational Development Banks Test (§ A.R.S. 38-718.L)
 - Arizona Restricted Country Test
 - The test is setup to look at the Fund’s investment’s country of incorporation to identify companies that do business in or with countries currently designated by the United States Department of State as State Sponsors of Terrorism, pursuant to §A.R.S. 35-392, as added by Laws 2007, Chapter 201
- Per statute requirements, the results are measured using market value

Compliance Summary Results

- Period reported on: February - April 2020
- Total Fund Monthly Statutory Investment Limits:
 - Total Fund investments passed the five mandated statutes on investment limits, as well as the Arizona Restricted Country Test for all periods.

Agenda

Items #9-12

No Materials



Arizona State Retirement System *Investment Beliefs*

FRAME OF REFERENCE

The following *Investment Beliefs* have been established to ensure the development of congruent and synergistic investment strategies, and to ensure the effective and efficient allocation of resources. These *Investment Beliefs* determine the general paradigm within which investment strategies are developed, investment ideas are reviewed, and investment decisions are implemented.

Modifications to these *Investment Beliefs* will occur if experiential, academic, conceptual, and/or practical perspectives suggest that a superior belief system exists.

INVESTMENT BELIEFS

1. Asset Class Decisions are Key

In general, decisions with respect to which asset classes and sub-asset classes to invest in, and the allocations to these asset classes and sub-asset classes, have a greater impact on total fund investment returns than decisions in which specific securities to invest.

2. Theories and Concepts Must be Sound

Over longer periods of time, investment outcomes (e.g. rates of return, volatility) conform to logical theories and concepts. Significant deviations (e.g. internet bubble, pre-subprime erosion of risk premiums) from theoretically and conceptually sound investment constructs are usually not sustainable and are typically self-reverting.

3. House Capital Market Views Are Imperative

The development and articulation of sound *House Views* (e.g. views on interest rates, corporate spreads, asset valuations) will ensure consistency among investment decisions, clarity of investment direction, baselines for debates, and conformity of understanding.

4. Investment Strategies Must be Forward Looking

Investment strategies will be developed based on forward-looking insights, rather than simply on successful strategies of the past.

Asset class valuations and security valuations are significantly affected by endogenous outcomes (e.g. earnings, GDP growth rates, competitive barriers) that are probabilistic, and these outcomes are typically well analyzed by the investment industry.

Asset class valuations and security valuations are also significantly affected by random outcomes (e.g. natural disasters, certain supply & demand shocks) that are virtually unpredictable, and these outcomes are typically not analyzed directly by the investment industry.

Asset class valuations and security valuations are also significantly affected by exogenous outcomes (e.g. foreign policies, global cultural interactions) that can possibly be modeled, and these outcomes are typically not analyzed by the investment industry.

5. Public Markets are Generally Informationally Efficient

Asset Class Valuations

Asset class valuations (e.g. stock market levels versus interest rate levels) are often in equilibrium with one another, but anomalous situations do occur which result in disequilibria between asset class valuations. These disequilibria offer valuable investment opportunities which we will pro-actively seek and capitalize on.

Security Valuations

Security valuations (e.g. IBM versus Cisco) are often in equilibrium with one another, but private markets and anomalous public market situations do occur which result in disequilibria between security valuations. These disequilibria offer valuable investment opportunities which we will pro-actively seek and capitalize on.

The extent of informational efficiency varies across asset classes.

Private markets offer significant opportunities for asset mispricing and manager excellence which we will pro-actively seek and capitalize on.

6. Market Frictions are Highly Relevant

Market frictions (e.g. management fees, carried interest, revenue sharing, expenses, costs, transaction spreads, market impacts, taxes, commissions) can be significantly detrimental to investment performance and as a result transactions will be initiated only to the extent there is a strong level of conviction that they will result in increased investment returns or decreased risks net of all market frictions.

7. Internal Investment Professionals are the Foundation of a Successful Investment Program

In-house investment management capability engaged in direct portfolio management results in superior investment decision-making.

In-house investment management pro-actively monitors capital markets in order to determine mispricing opportunities & allocate capital and will successfully increase risk adjusted returns.

In-house investment professionals are more closely aligned with, and have a better understanding of, the purpose and risk & reward tolerance of the ASRS than external parties.

In-house investment professionals will impact direct investment negotiations, better align economic interests, and influence investment industry conditions (e.g. private deal structures, fee levels, introduction of innovative products & strategies).

8. External Investment Management is Beneficial

External investment organizations can often offer greater expertise, resources, and/or flexibility than internal personnel for various investment strategies.

9. Investment Consultants

Investment consultants will be effectively utilized in the following four general categories, and utilization of consultants will be focused on situations where there is a demonstrable need in at least one of the four areas:

- Independence: When oversight or controls should be enhanced
- Perspective: When internal perspectives are not broad enough
- Special Skills: When internal skills are not deep enough
- Resource Allocation: When internal resources are not broad enough

10. Trustee Expertise

Trustees often have expertise in various areas of investment management, and this expertise should be utilized while ensuring separation between Board oversight and staff management.