

# CIO Board Report

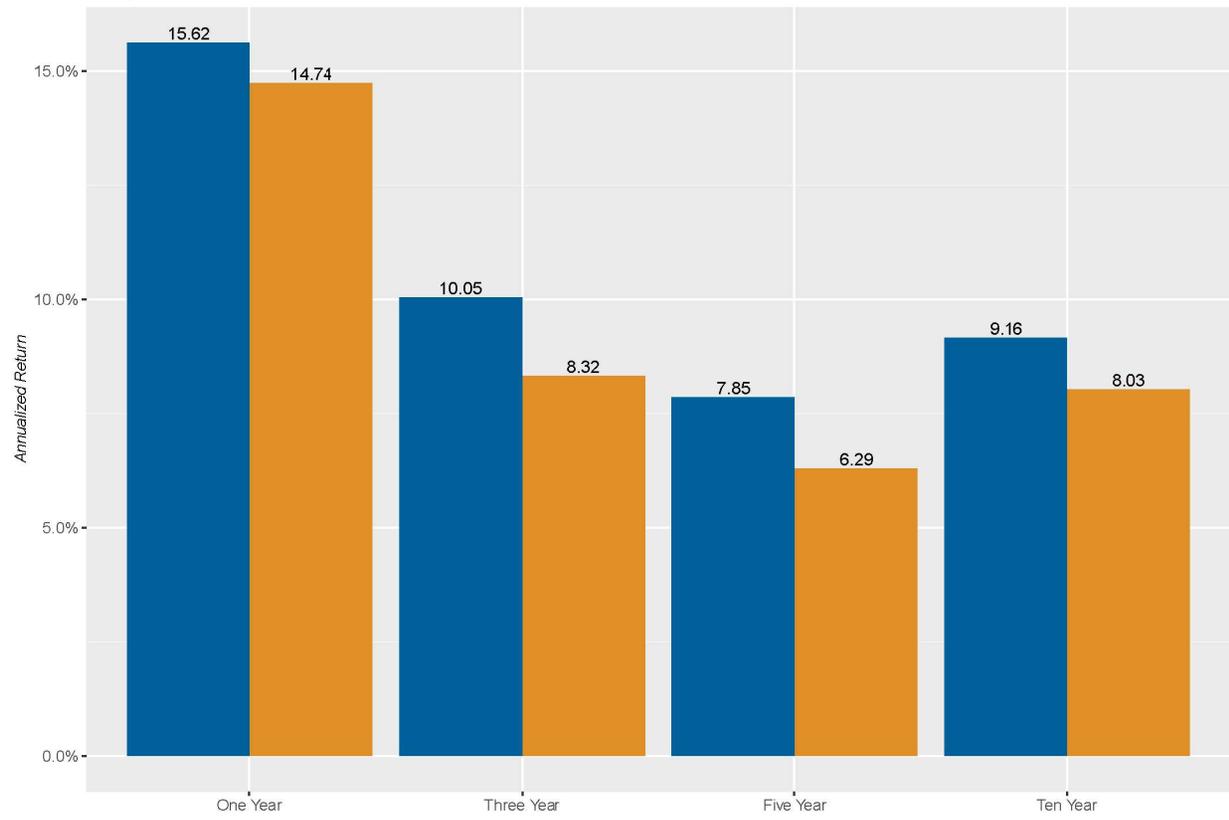
Arizona State Retirement System

January 31, 2020

# December 31, 2019 Estimated

# Total Fund Estimated Returns for the period ended 12/31/2019

**Total Fund and Strategic Asset Allocation Benchmark**  
Trailing Period Returns



## Fiscal Year to Date

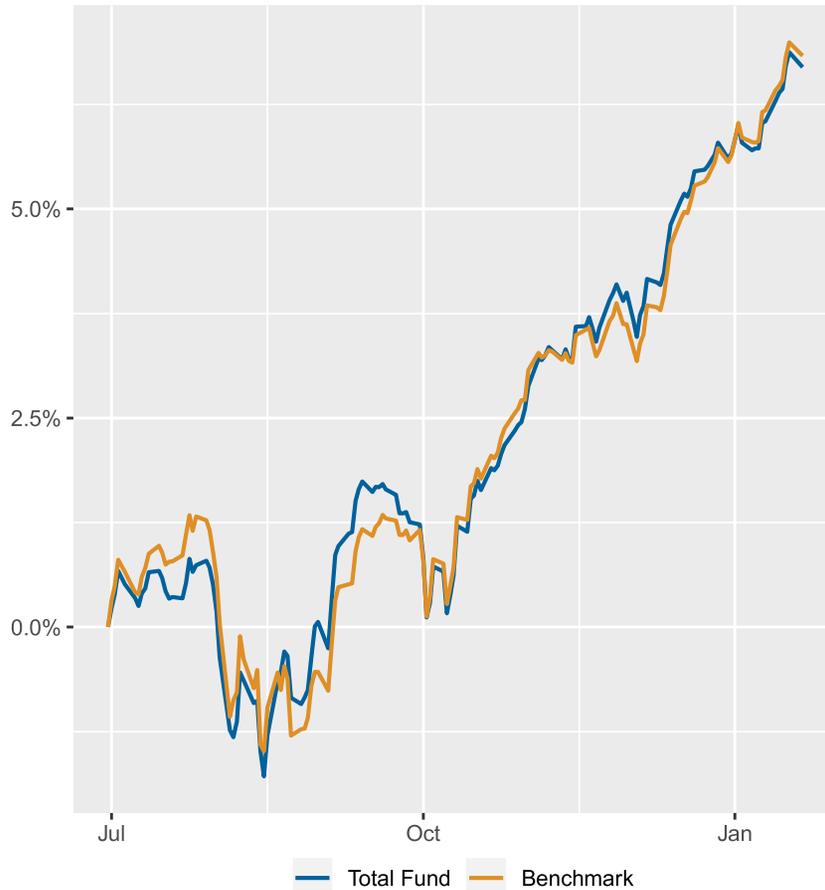
December 31, 2019 Estimated  
Fiscal Year to Date  
Quarterly Performance  
Quarterly Performance  
Equity  
Private Equity  
Real Estate  
Credit  
MSCI Risk Report

Summary  
Total Fund Attribution  
Decomposition of Equity Excess Return

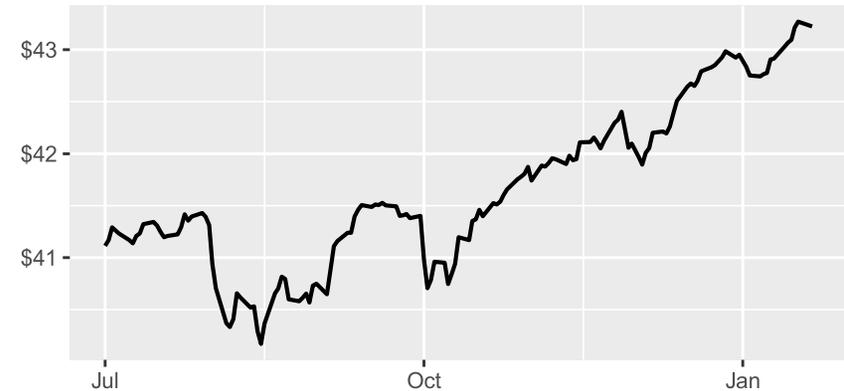
## Summary

# Total Fund Fiscal Year to Date through 1/21/2020

Return Fiscal Year to Date

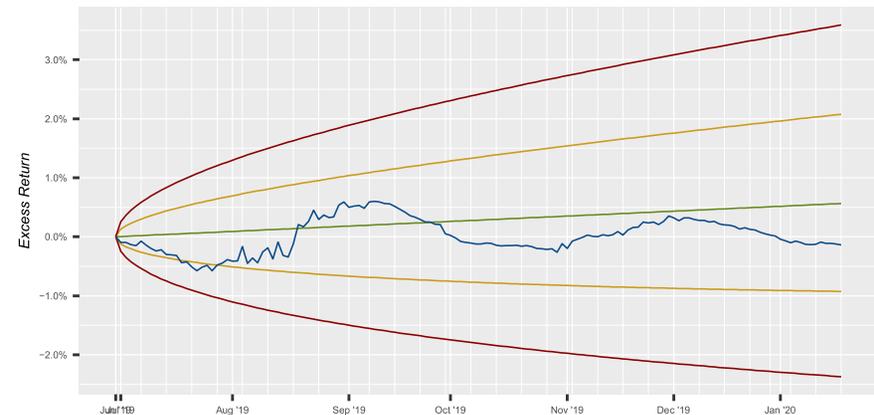


Total Fund Market Value (Billions)



Total Fund Performance versus Expectations

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



# Total Fund Current Positioning through 1/21/2020

## Total Fund Positioning

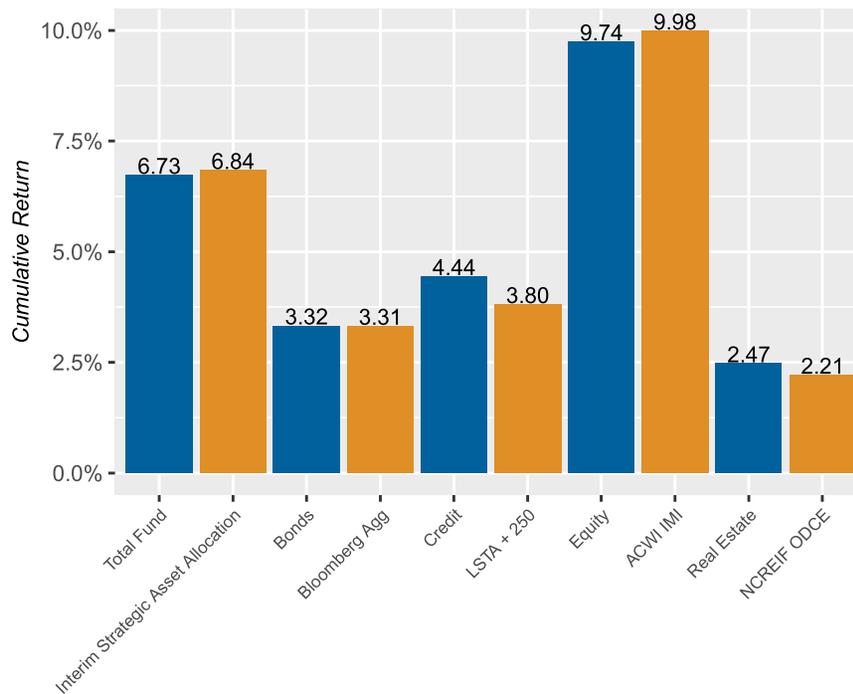
	NAV w/ Notional (\$ mm)	NAV Exposure (%)	Target (%)	Active Weight (%)	Active Weight (\$ mm)
Cash	539.3	1.2	0.0	1.2	539.3
Bonds	4295.9	9.9	10.8	-0.9	-372.2
Credit	8102.0	18.7	19.2	-0.5	-196.8
Equity	23583.1	54.6	54.5	0.1	26.4
Real Estate	6717.2	15.5	15.5	0.0	17.6
Other	0.4	0.0	0.0	0.0	0.4
Total Fund	43223.2	100.0	100.0	0.0	0.0

## Total Fund Attribution

# Fiscal Year to Date Total Fund Returns & Dollar Value Add through 1/21/2020

**Asset Class and Benchmark**

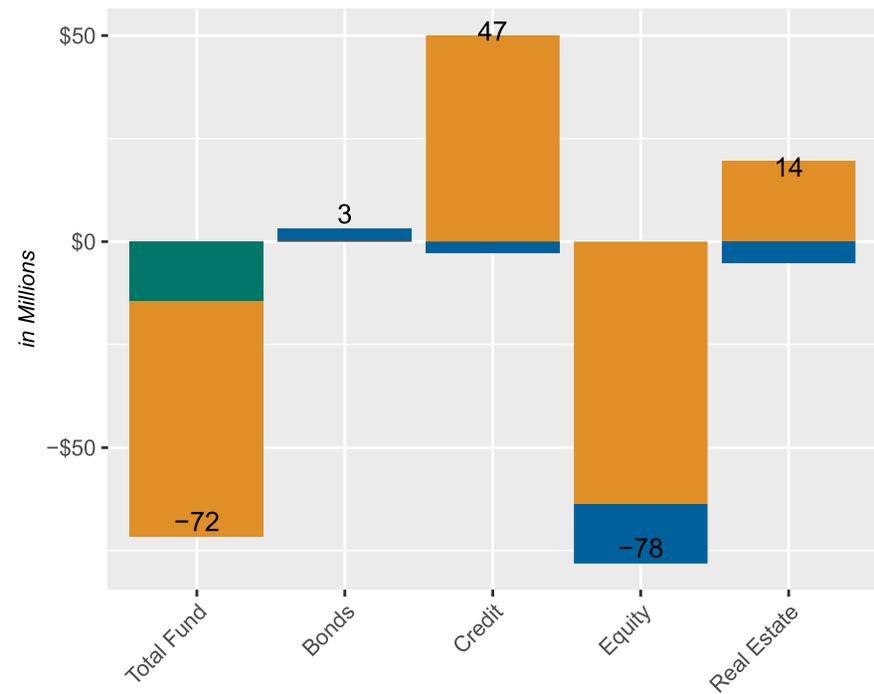
Fiscal Year to Date



Asset Class Benchmark

**Dollar Value Add**

Fiscal Year to Date Dollar Value Add

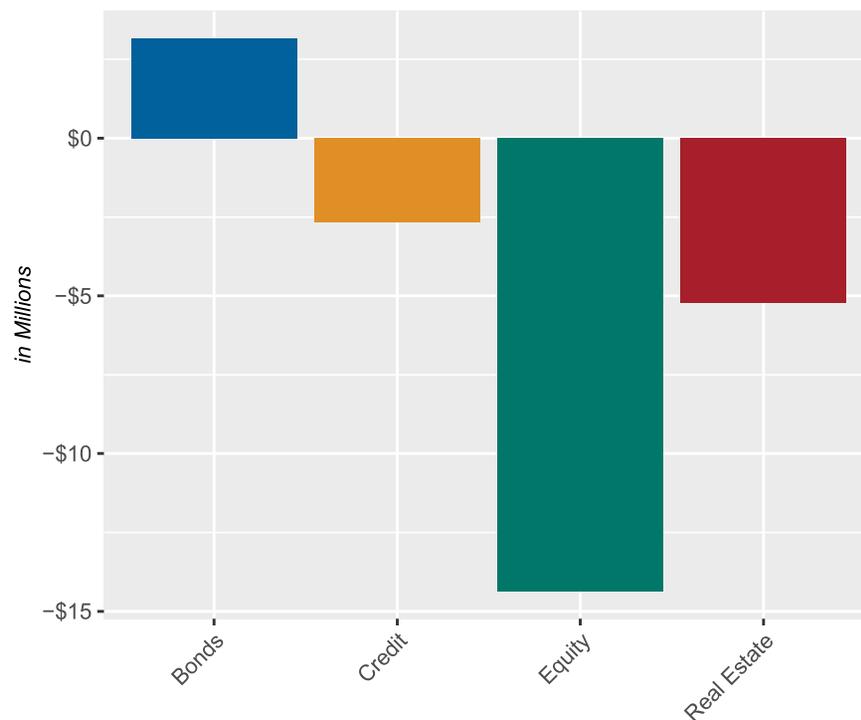


Allocation Excess Return Residual

# Fiscal Year to Date Allocation Effect and Excess Return by Asset Class through 1/21/2020

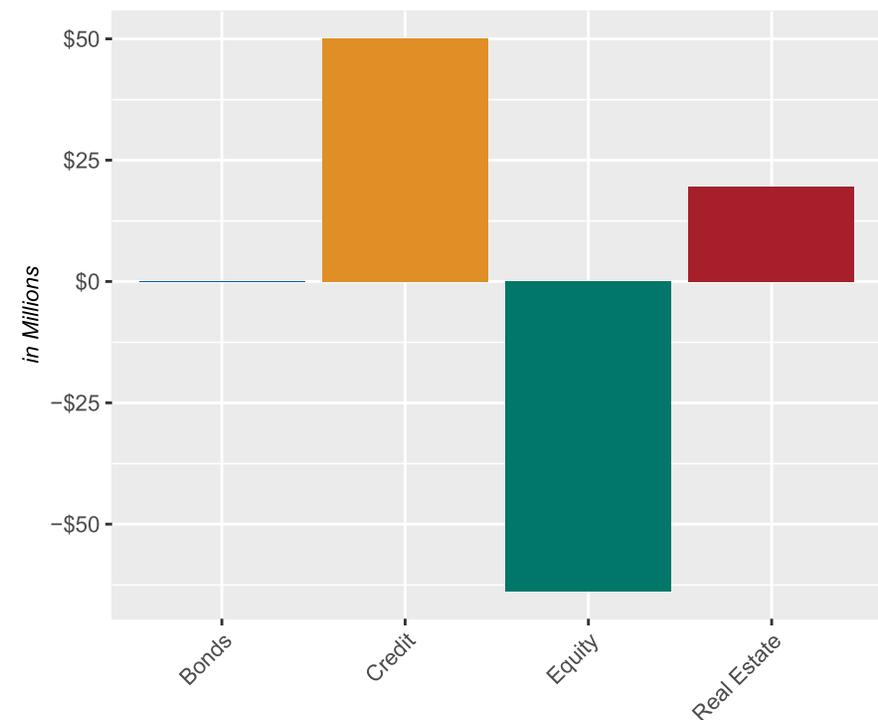
**Allocation Effect by Asset Class**

Relative to Strategic Asset Allocation Benchmark



**Excess Return by Asset Class**

Relative to Benchmark

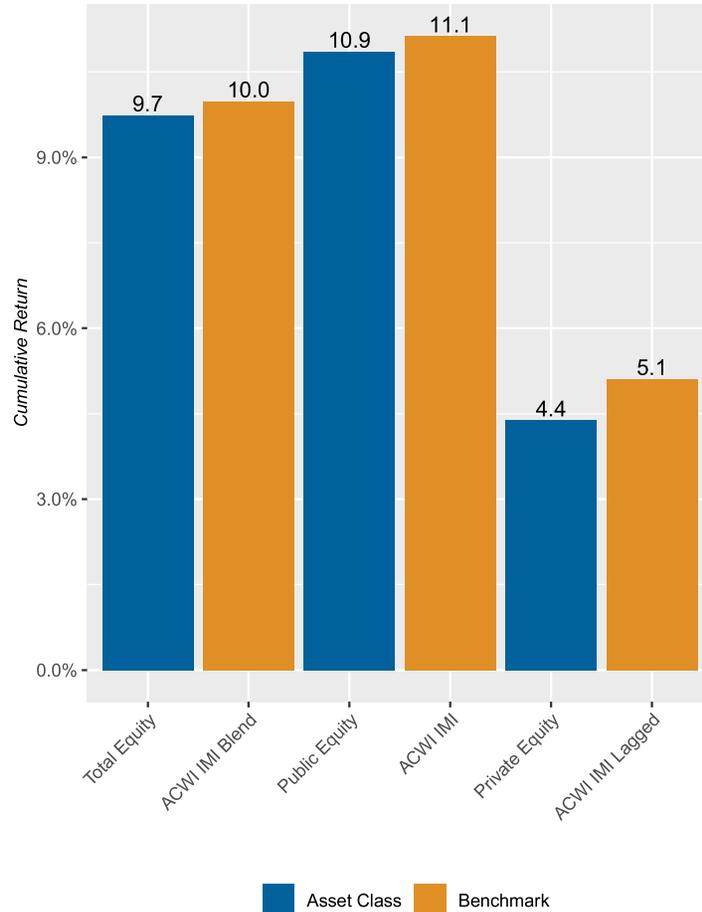


■ Bonds 
 ■ Credit 
 ■ Equity 
 ■ Real Estate

# Total Equity & Dollar Value Add through 1/21/2020

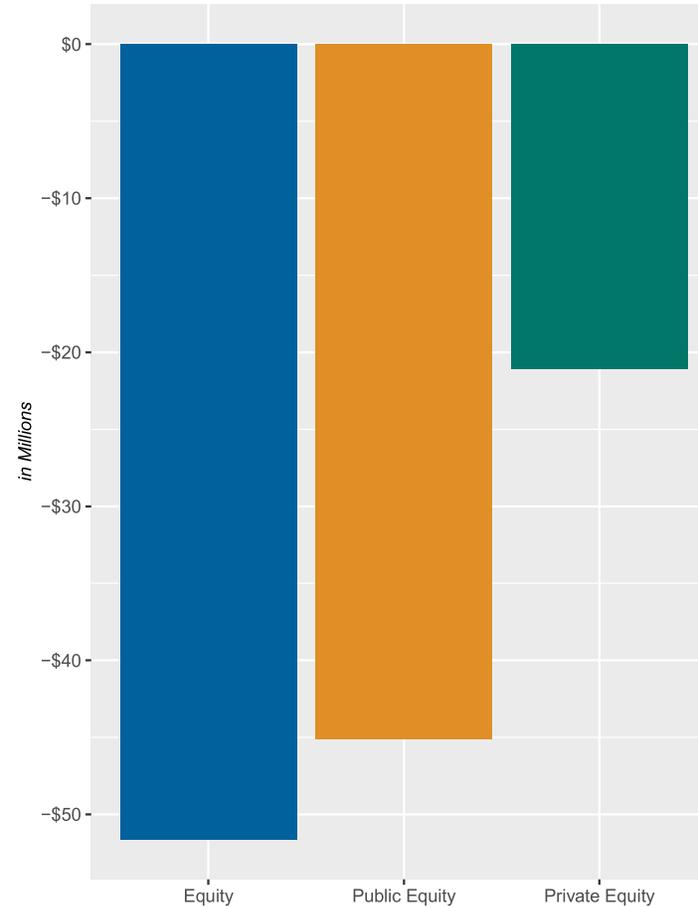
**Total Equity and Benchmark**

Fiscal Year to Date



**Total Equity Dollar Value Add**

Fiscal Year to Date Dollar Value Add

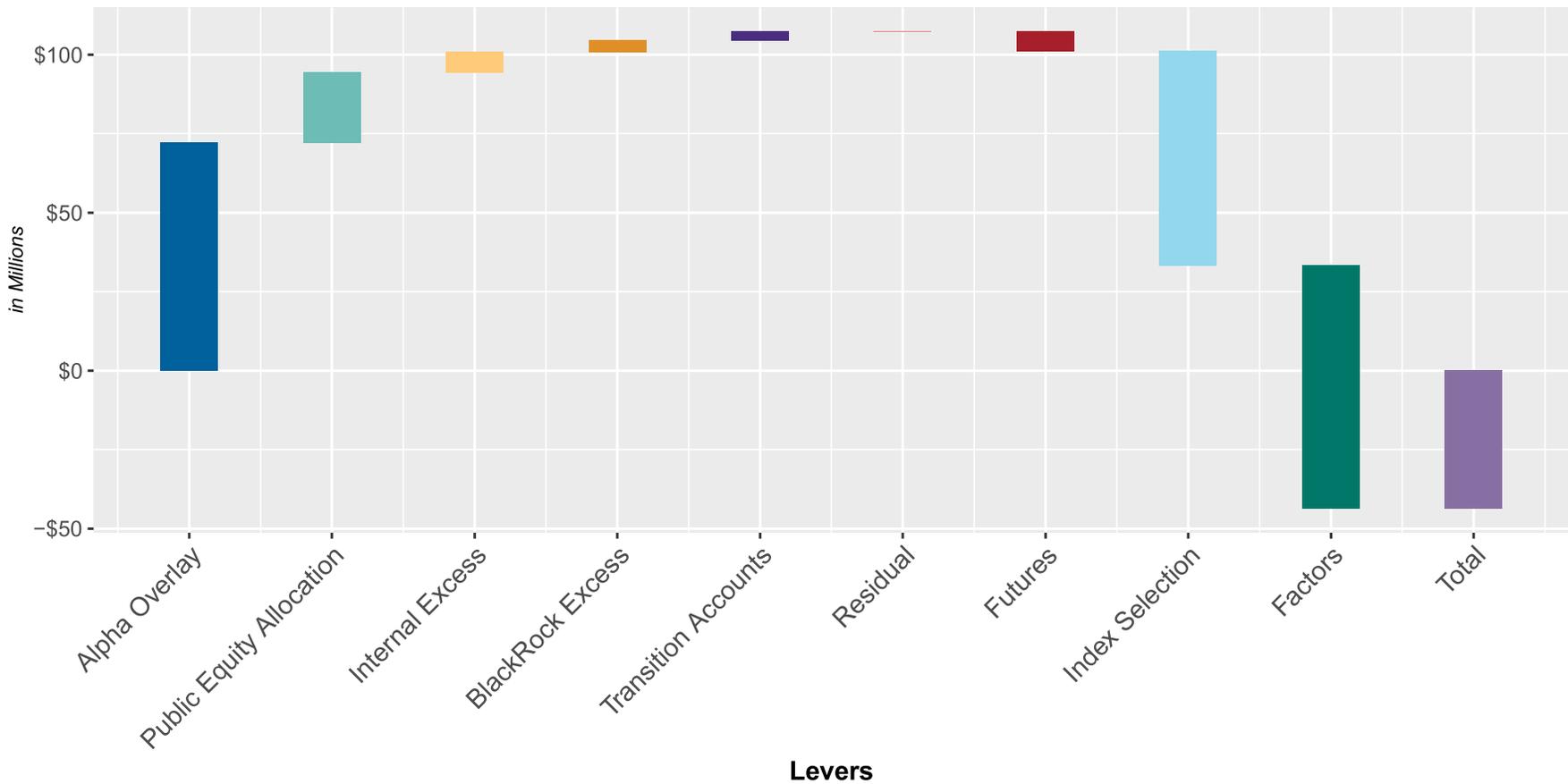


## Decomposition of Equity Excess Return

# Public Equity Levers through 1/21/2020

## Public Equity Dollar Value Add

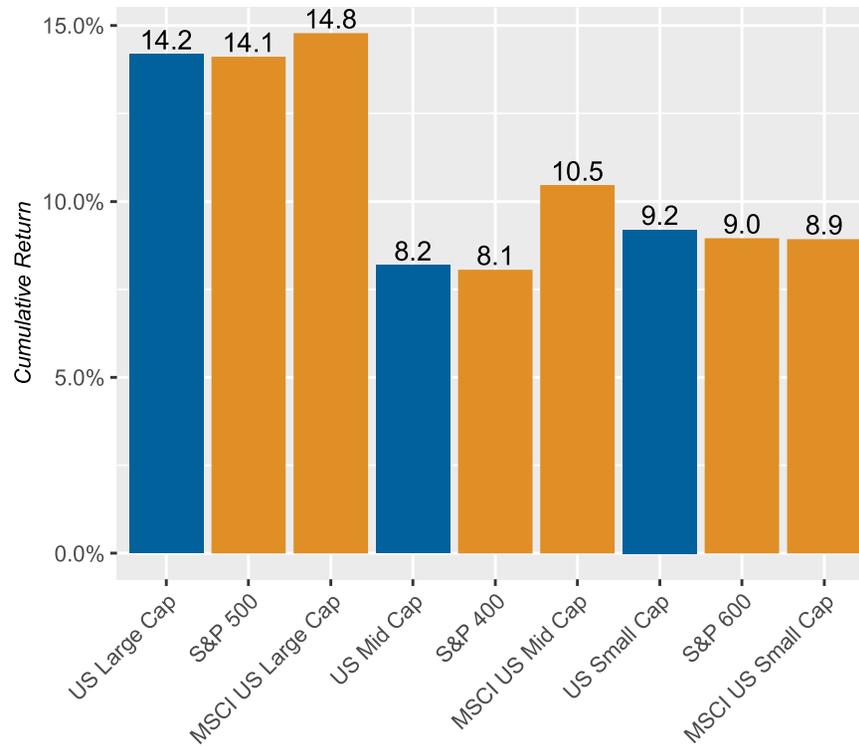
Fiscal Year to Date Dollar Value Add



# Internally Managed Portfolios through 1/21/2020

## Internal Portfolios and Benchmarks

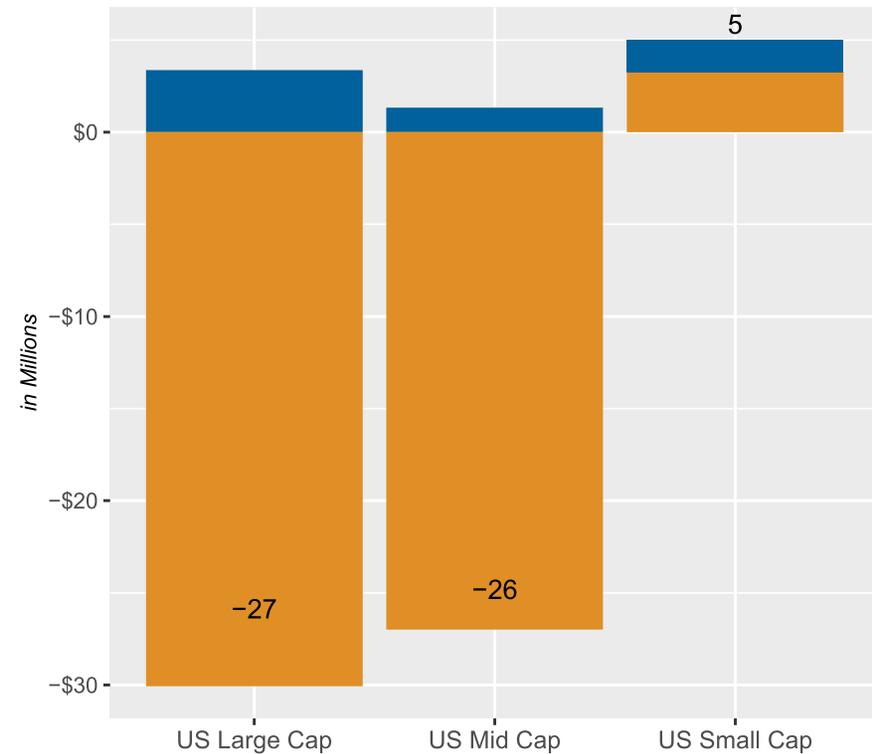
Fiscal Year to Date Returns



Portfolio Benchmark

## Internal Portfolio Dollar Value Add

Fiscal Year to Date Dollar Value Add

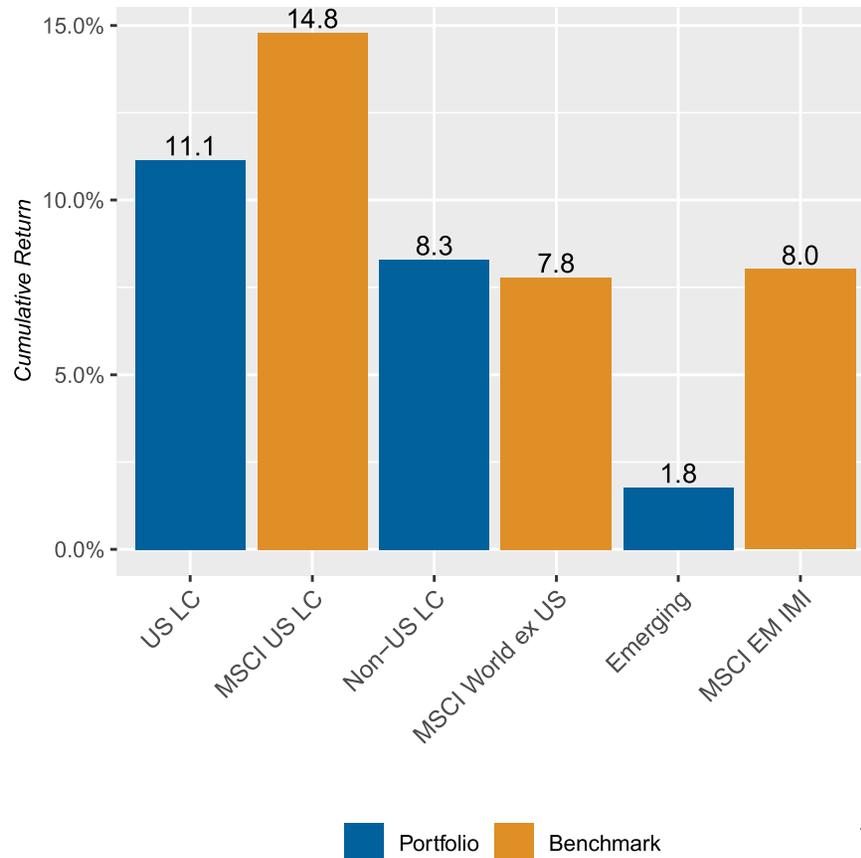


Excess Index Selection

# Factor Portfolios through 1/21/2020

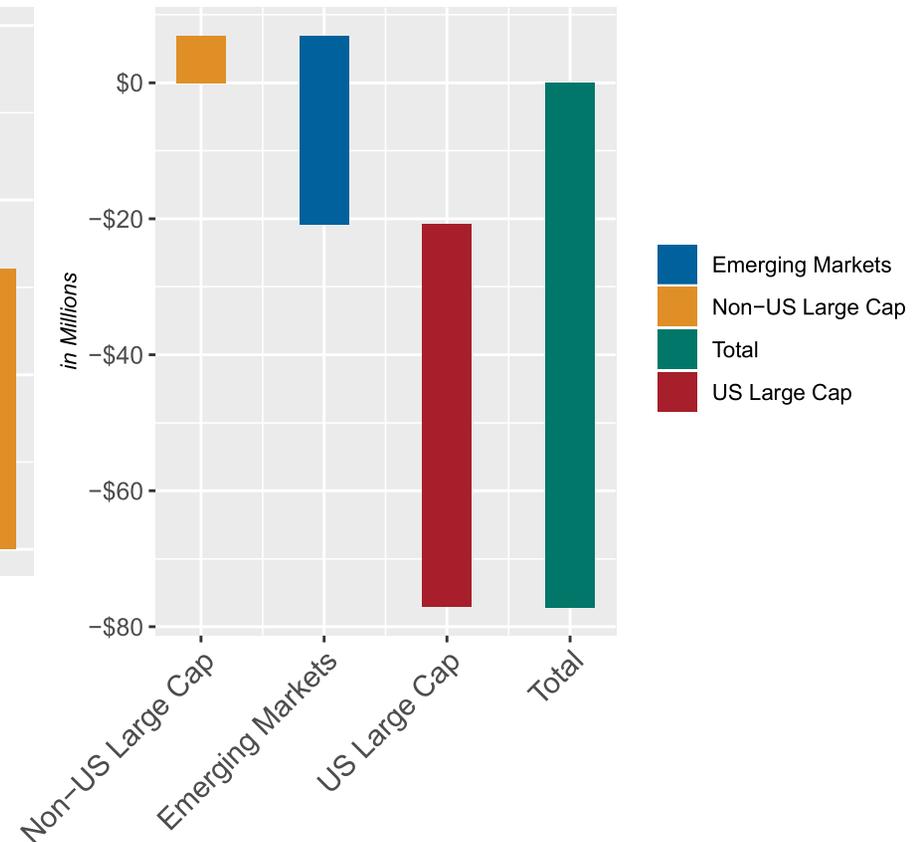
**Factor Portfolios and Benchmark**

Fiscal Year to Date



**Factor Portfolio Dollar Value Add**

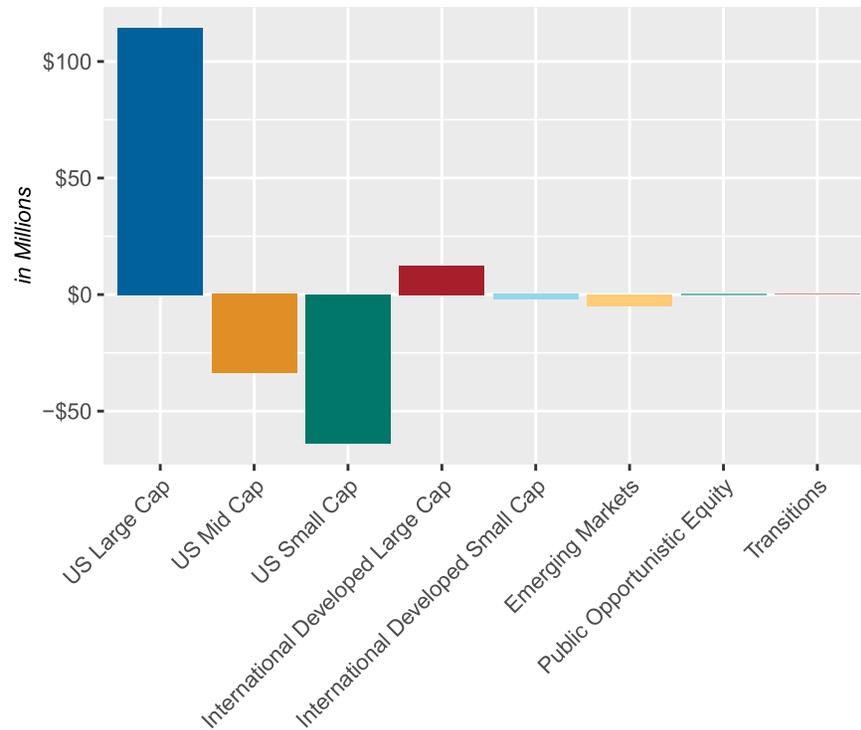
Fiscal Year to Date Dollar Value Add



# Public Equity Allocation through 1/21/2020

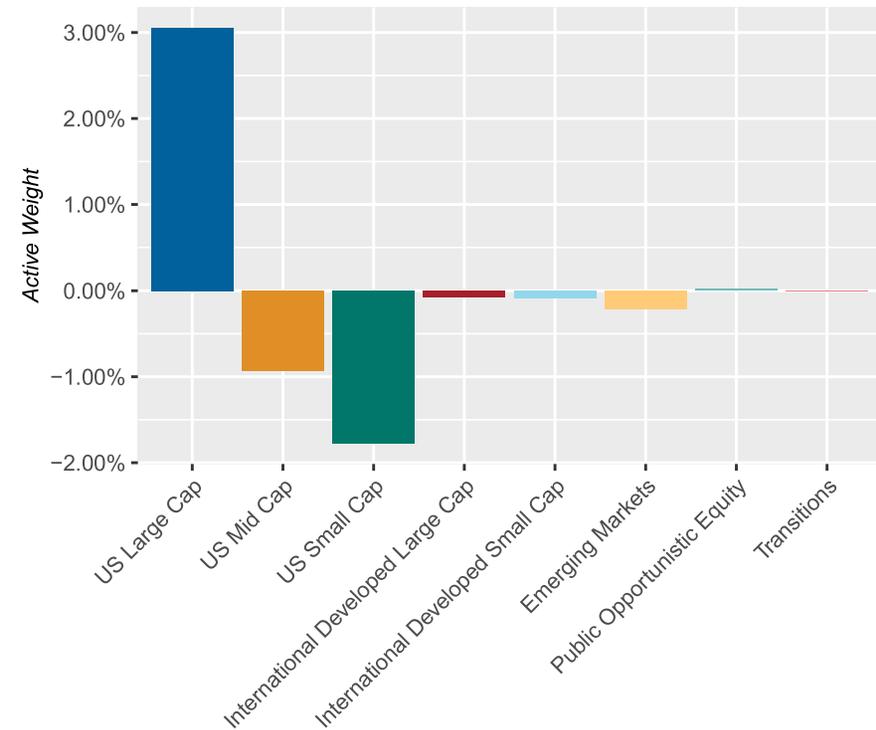
**Allocation Effect by ACWI Subcomponents**

Relative to ACWI IMI



**Composite Average Active Weights**

Relative to ACWI IMI



# Quarterly Performance

December 31, 2019 Estimated  
Fiscal Year to Date  
Quarterly Performance  
Quarterly Performance  
Equity  
Private Equity  
Real Estate  
Credit  
MSCI Risk Report

External Reports

## External Reports

# State Street Performance Summary for the period ended September 30, 2019

ARIZONA STATE RETIREMENT SYSTEM  
 Investment Management Division  
 Sep-30-2019  
 Net Returns  
 Final

ASRS Performance Summary



	Benchmark	Market Value (\$mil.)	1 Mth	3 Mth	FYTD	1 Year	3 Year	5 Year	ITD	Inception Date
<b>TOTAL PLAN</b>	<b>INTERIM SAA POLICY</b>	41,401	1.16	1.23	1.23	4.89	9.13	7.17	9.63	07-01-1975
Excess			-0.54	0.06	0.06	1.07	1.99	1.72	0.42	
<b>TOTAL EQUITY</b>	<b>LEGACY Total Equity BM</b>	22,248	2.17	0.58	0.58	2.30	10.21	7.66	9.31	07-01-2013
Excess			-0.74	0.06	0.06	0.91	-0.13	0.07	-0.03	
US EQUITY	COMBINED DOMESTIC EQUITY INDEX	10,118	2.77	1.45	1.45	2.18	11.92	10.13	11.18	07-01-1975
Excess			0.99	0.22	0.22	-0.83	-1.08	-0.81	-0.15	
INTERNATIONAL EQUITY	INTERNATIONAL EQUITY INDEX	8,023	2.60	-1.71	-1.71	-2.20	6.28	3.19	5.83	04-01-1987
Excess			0.05	0.00	0.00	-0.35	0.01	-0.10	0.24	
PRIVATE EQUITY	MSCI ACWI IMI w/USA GROSS (NET) LAGGED	4,107	-0.05	3.04	3.04	12.83	14.99	11.75	7.73	09-01-2007
<b>INTEREST RATE SENSITIVE</b>	<b>BBG BARC Agg (Dly)</b>	4,254	-0.53	2.31	2.31	10.21	3.00	3.66	7.88	07-01-1975
Excess			0.00	0.04	0.04	-0.09	0.08	0.28		
<b>CREDIT</b>	<b>LEGACY Total Credit BM</b>	8,114	-0.02	2.35	2.35	8.21	9.93	7.65	7.56	07-01-2013
Excess			-0.47	0.05	0.05	1.65	2.51	2.57		
PRIVATE DEBT	S&P LEVERAGED LOAN INDEX LAGGED + 250BPS	5,684	-0.02	2.30	2.30	8.65	10.70	10.02	11.76	10-01-2012
Excess			-0.47	-0.01	-0.01	2.09	2.84	3.75	4.69	
DISTRESSED DEBT	S&P LEVERAGED LOAN INDEX LAGGED + 250BPS	1,757	-0.00	2.77	2.77	7.93			9.21	07-01-2018
Excess			-0.45	0.46	0.46	1.37			2.89	
OTHER CREDIT	S&P LEVERAGED LOAN INDEX LAGGED + 250BPS	671	0.00	1.10	1.10	8.85			11.96	07-01-2018
Excess			-0.45	-1.20	-1.20	2.29			5.64	
<b>REAL ESTATE</b>	<b>Custom ASRS ODCE (Net)</b>	6,297	0.37	1.55	1.55	7.66	8.52	10.92	6.48	12-01-2005
<b>CASH</b>	<b>CASH CUSTOM INDEX</b>	488	0.25	1.25	1.25	2.76	6.30	3.00	4.03	04-01-1990
Excess			0.08	0.68	0.68	0.37	0.35	-0.66	0.68	
<b>OTHER</b>	<b>ICE BofA US 3-Month Treasury Bill</b>	0	28.34	14.16	14.16	13.20	8.70	2.97	4.37	07-01-2013
Excess			28.16	13.60	13.60	10.82	7.16	1.99	3.58	

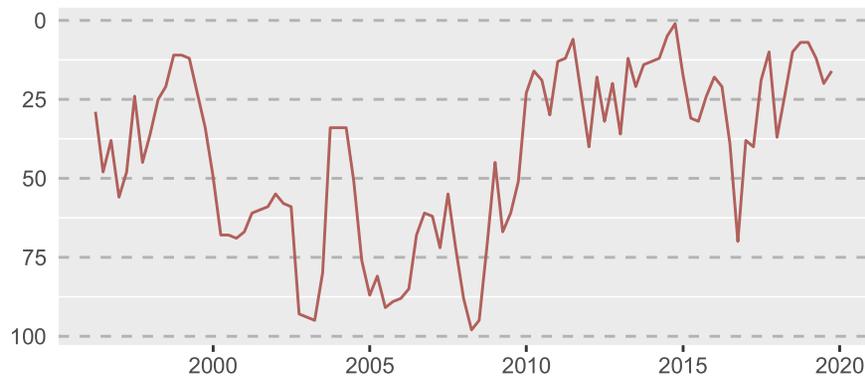
# ASRS Returns Compared to Public Fund Universe for the period ended September 30, 2019

## UNIVERSE COMPARISON

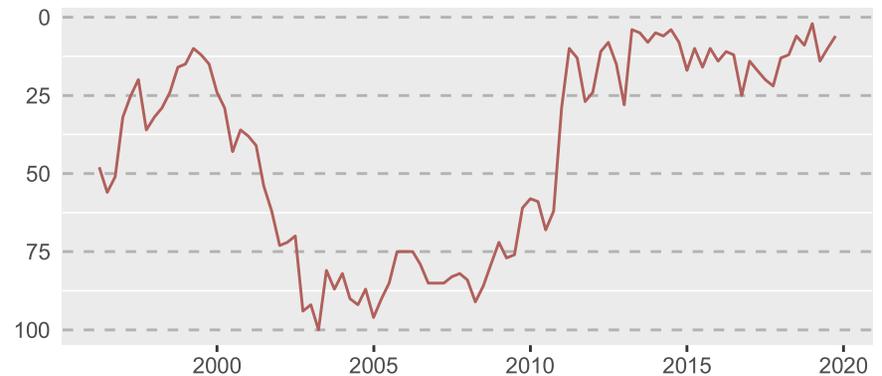


# Total Fund Rolling Percentile Rankings for the period ended 9/30/2019

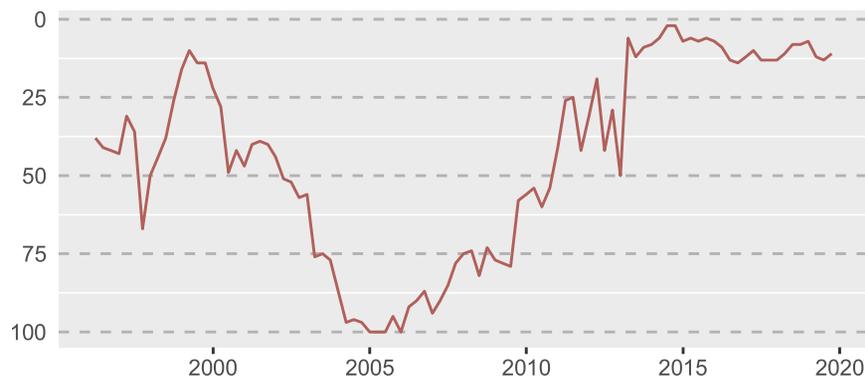
Total Fund One Year Rolling Percentile Rankings



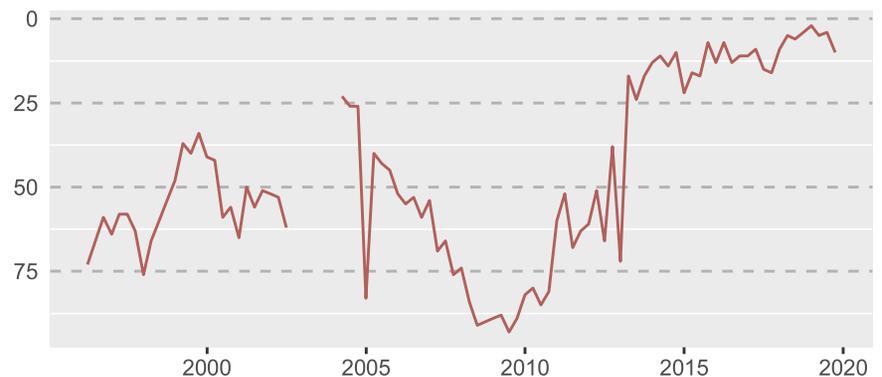
Total Fund Three Year Rolling Percentile Rankings



Total Fund Five Year Rolling Percentile Rankings



Total Fund Ten Year Rolling Percentile Rankings



# Annual returns for years ended September 30

ASRS Asset Class Net Returns  
 1-Year Returns ending September 30

RE SMA 27.9	RE SMA 17.8	US Equity 15.5	Emerging Market: Equity 23.7	US Equity 16.7	Core Bonds 10.2
Private Equity 17.0	Real Estate 13.6	Emerging Market Equity 14.8	non-US Developed Equity 19.5	Private Equity 15.9	Private Debt 9.0
US Equity 16.7	Private Debt 8.8	RE SMA 13.0	Public Equity 19.0	Private Debt 11.0	Credit 8.6
Real Estate 15.2	Private Equity 5.2	Public Equity 11.7	US Equity 17.6	Credit 10.3	Private Equity 8.6
Dist Debt 12.9	Credit 4.9	Private Equity 11.3	RE SMA 14.5	Public Equity 9.4	Dist Debt 8.0
Public Equity 11.6	Core Bonds 3.2	Real Estate 11.1	Total Fund 14.0	Total Fund 8.7	RE SMA 7.5
Credit 11.6	US Equity 0.1	Private Debt 10.8	Dist Debt 12.3	Dist Debt 8.5	Real Estate 6.4
Private Debt 11.6	Total Fund -0.2	Total Fund 9.0	Private Equity 12.0	Real Estate 8.2	Total Fund 4.9
Total Fund 10.8	Dist Debt -0.5	Credit 8.3	Credit 11.4	RE SMA 8.1	US Equity 2.3
Emerging Market Equity 6.7	Public Equity -4.0	non-US Developed Equity 6.2	Private Debt 11.2	non-US Developed Equity 3.3	Public Equity 0.2
Core Bonds 4.0	non-US Developed Equity -7.4	Core Bonds 6.1	Real Estate 10.9	Core Bonds -1.1	non-US Developed Equity -1.4
non-US Developed Equity 3.8	Emerging Market Equity -20.0	Dist Debt 2.4	Core Bonds 0.2	Emerging Market Equity -1.9	Emerging Market Equity -3.4
2014	2015	2016	2017	2018	2019

- Asset Class:
- Core Bonds
  - Credit
  - Dist Debt
  - Emerging Market
  - Equity
  - non-US Developed
  - Private Debt
  - Private Equity
  - Public Equity
  - RE SMA
  - Real Estate
  - Total Fund
  - US Equity

# Annual excess returns for years ended September 30

ASRS Asset Class Excess Returns  
 1-Year Excess Returns ending September 30

RE SMA 17.1	Private Debt 5.2	RE SMA 2.8	RE SMA 7.5	Private Equity 8.9	Private Equity 8.1
Private Equity 13.2	RE SMA 4.9	Private Debt 2.0	Dist Debt 4.3	Private Debt 3.2	RE SMA 3.4
Private Debt 5.1	Private Equity 4.4	Total Fund 1.3	Real Estate 4.2	Credit 2.4	Private Debt 3.3
Dist Debt 4.9	Real Estate 1.6	Real Estate 1.3	Credit 3.5	Total Fund 1.3	Credit 2.9
Credit 4.5	Total Fund 1.3	Core Bonds 0.9	Private Debt 3.3	Real Estate 1.3	Real Estate 2.3
Real Estate 4.4	non-US Developed Equity 1.3	Credit -0.2	Total Fund 3.2	RE SMA 1.4	Dist Debt 2.3
Emerging Market Equity 2.4	Core Bonds 0.3	US Equity -0.3	Emerging Marke: Equity 1.2	Dist Debt 0.5	Total Fund 1.1
Total Fund 1.2	Public Equity 0.1	non-US Developed Equity -0.3	non-US Developed Equity 0.4	non-US Developed Equity 0.5	Core Bonds -0.1
Public Equity 0.3	Credit -0.5	Public Equity -0.9	Core Bonds 0.2	Core Bonds 0.2	non-US Developed Equity -0.4
US Equity 0.3	US Equity -0.5	Emerging Market Equity -1.9	Public Equity -0.6	Public Equity -0.7	Public Equity -0.6
Core Bonds 0.0	Emerging Market Equity -0.7	Private Equity -4.1	US Equity -1.2	Emerging Market Equity -0.7	US Equity -0.8
non-US Developed Equity -0.5	Dist Debt -8.5	Dist Debt -5.6	Private Equity -8.2	US Equity -1.2	Emerging Market Equity -1.0
2014	2015	2016	2017	2018	2019

- Asset Class:
- Core Bonds
  - Credit
  - Dist Debt
  - Emerging Market Equity
  - non-US Developed Equity
  - Private Debt
  - Private Equity
  - Public Equity
  - RE SMA
  - Real Estate
  - Total Fund
  - US Equity

# ASRS Goals Met for the period ended September 30, 2019

## ASRS INVESTMENT OBJECTIVES

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

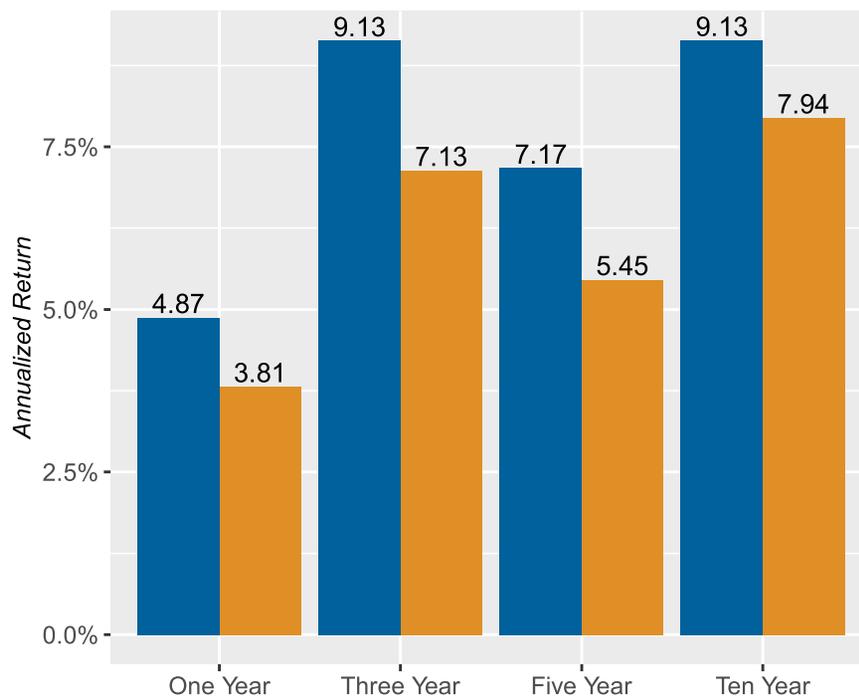
- a) Develop, approve and implement an Asset Allocation program that is expected to achieve a 20-year rolling average annual return at or above the actuarial assumed return  
**Goal met: Yes**
- b) Achieve a total fund net return in the top quartile of the peer universe  
**Goal met: Yes**
- c) Achieve a 1 year total fund net return greater than the Strategic Asset Allocation Benchmark  
**Goal met: Yes**
- 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: Yes**
- g) Sufficient cash will be maintained to meet all payment requirements  
**Goal met: Yes**

## Quarterly Performance

# Total Fund

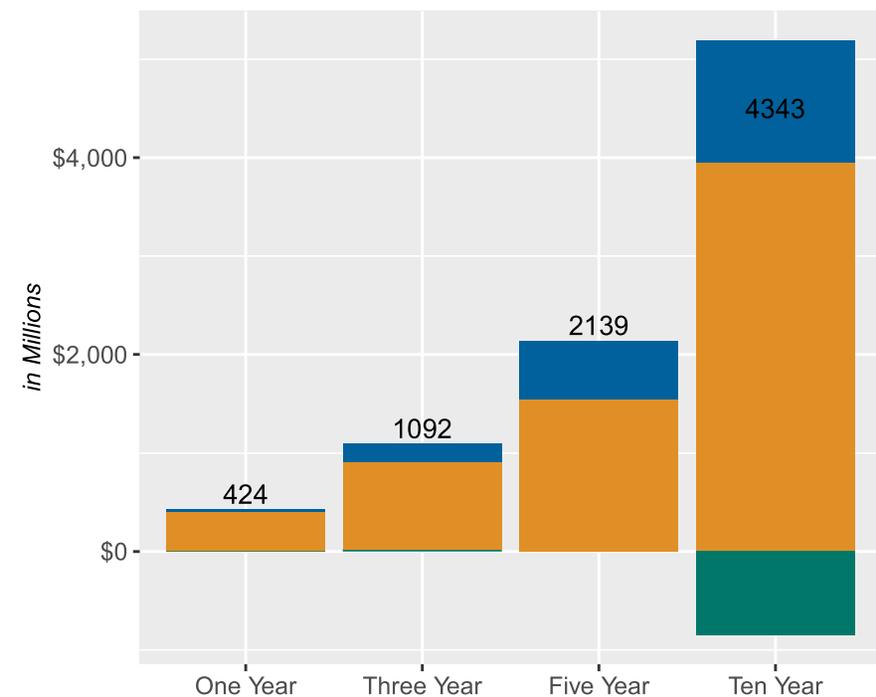
# Trailing Returns & Dollar Value Add for the period ended 9/30/2019

**Total Fund and Strategic Asset Allocation Benchmark**  
 Trailing Period Returns



■ Total Fund ■ Strategic Asset Allocation Benchmark

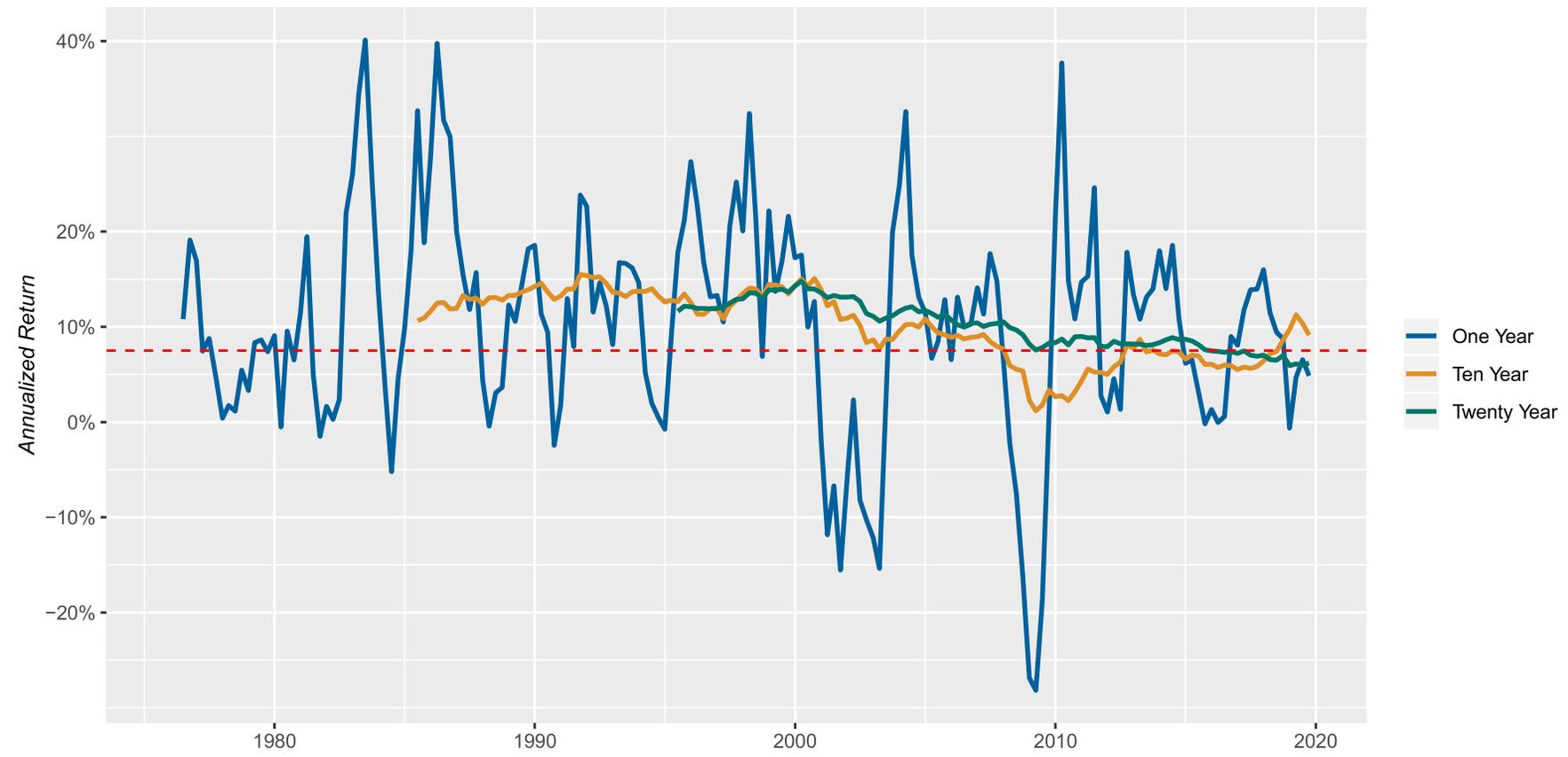
**Total Fund Dollar Value Add**  
 Relative to Strategic Asset Allocation Benchmark



■ Allocation ■ Excess Return ■ Residual

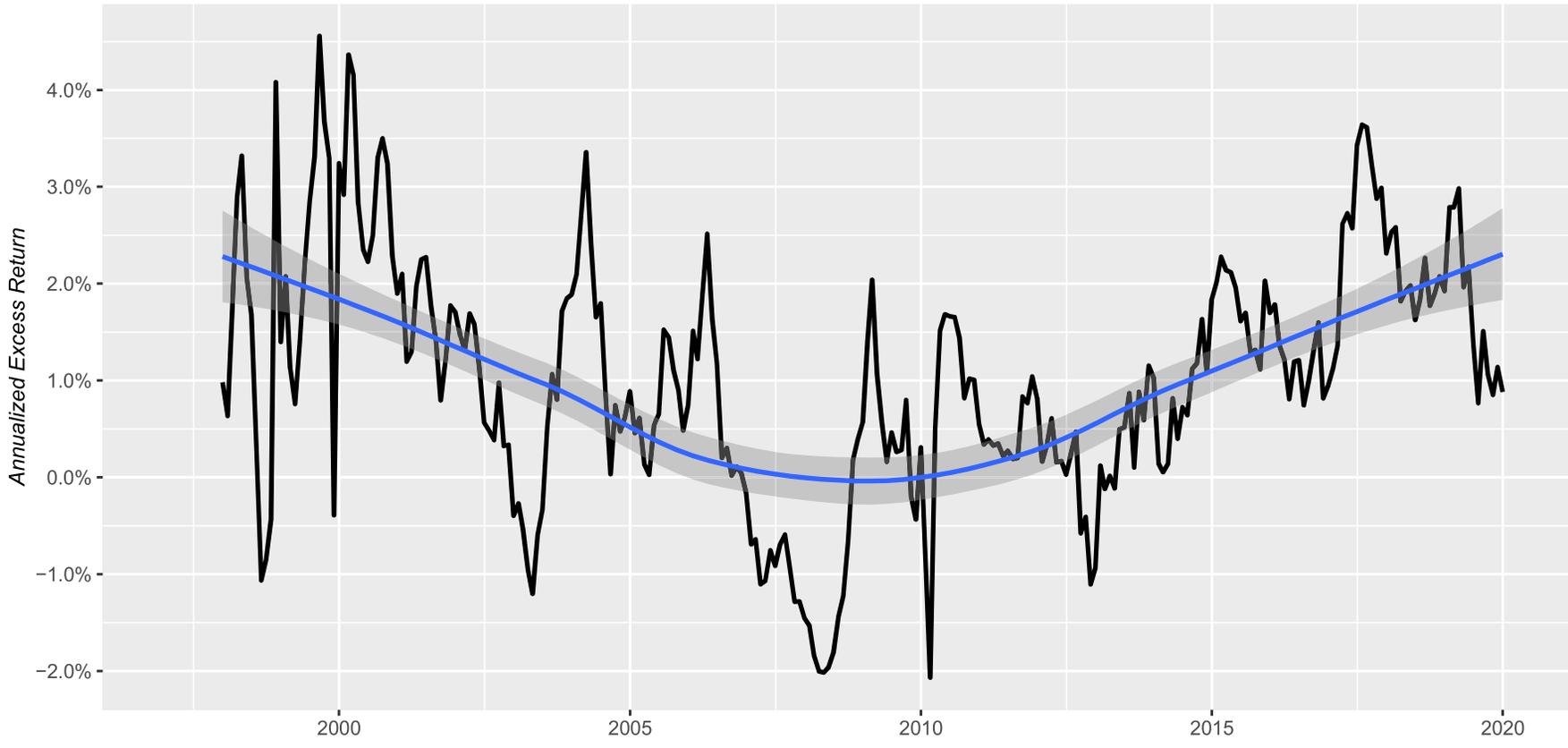
# Total Fund Returns for the period ended 9/30/2019

**Total Fund Rolling Returns**  
Trailing Period Returns



# Total Fund Rolling 1 Year Excess Return for the period ended 9/30/2019

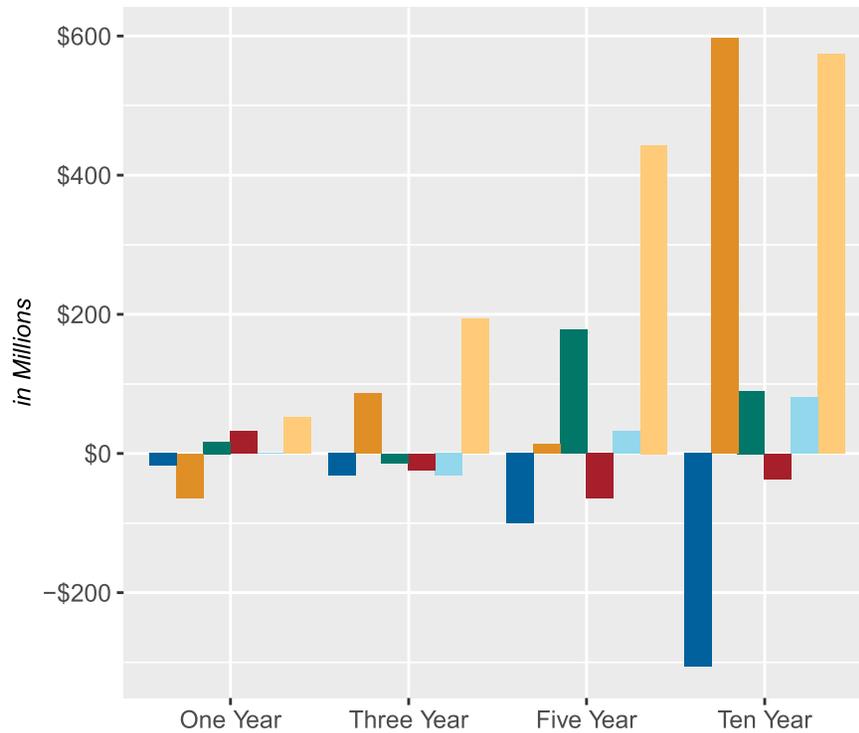
Total Fund Rolling 1 Year Excess



# Allocation Effect for the period ended 9/30/2019

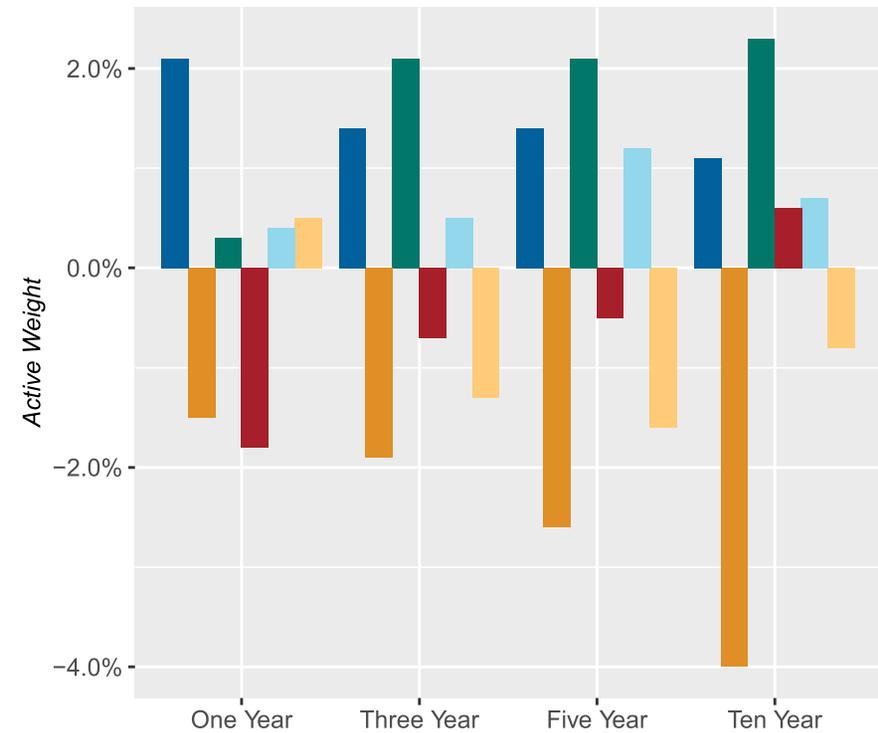
## Allocation Effect by Asset Class

Relative to Strategic Asset Allocation Benchmark



## Asset Class Average Active Weights

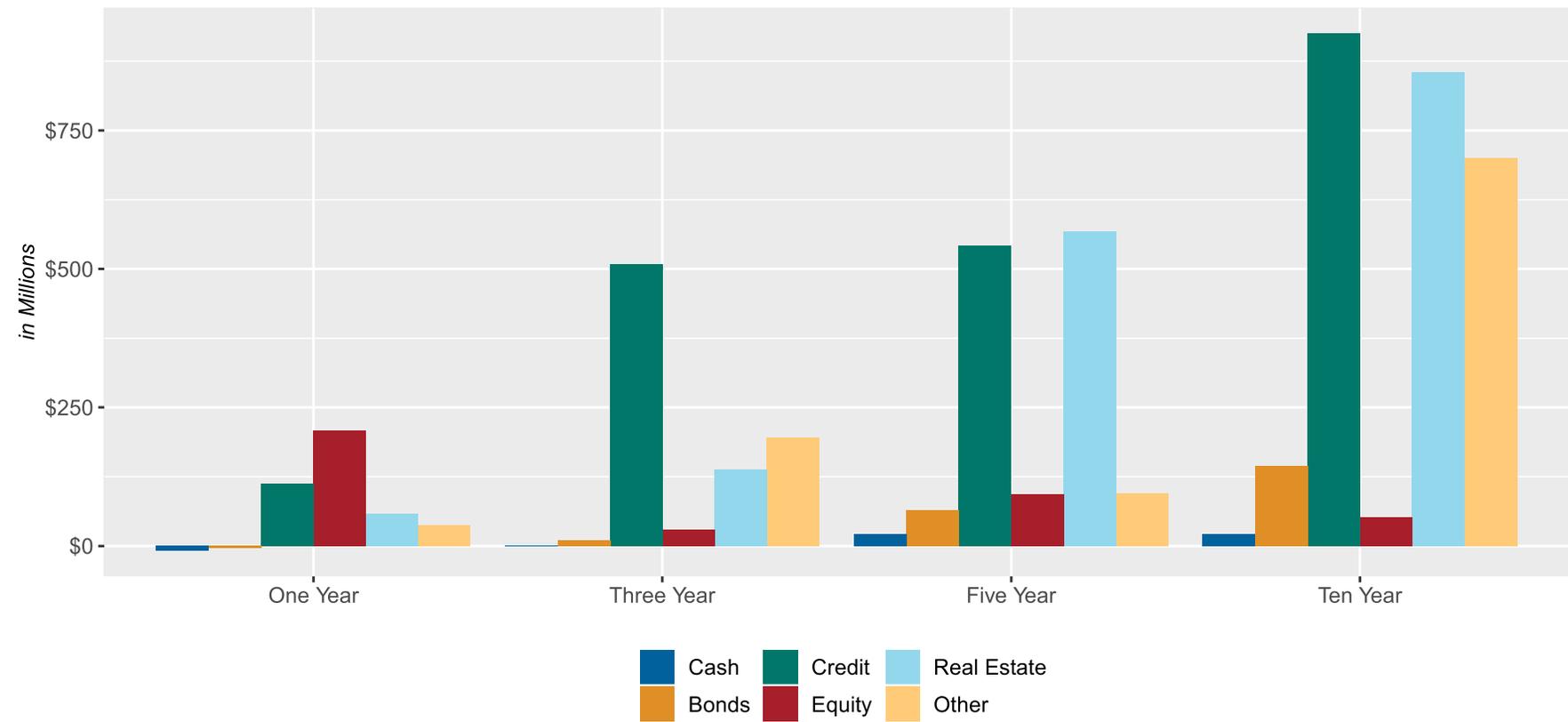
Relative to Strategic Asset Allocation Policy



# Excess Return by Asset Class for the period ended 9/30/2019

## Excess Return by Asset Class

Relative to Strategic Asset Allocation Benchmark



# Equity

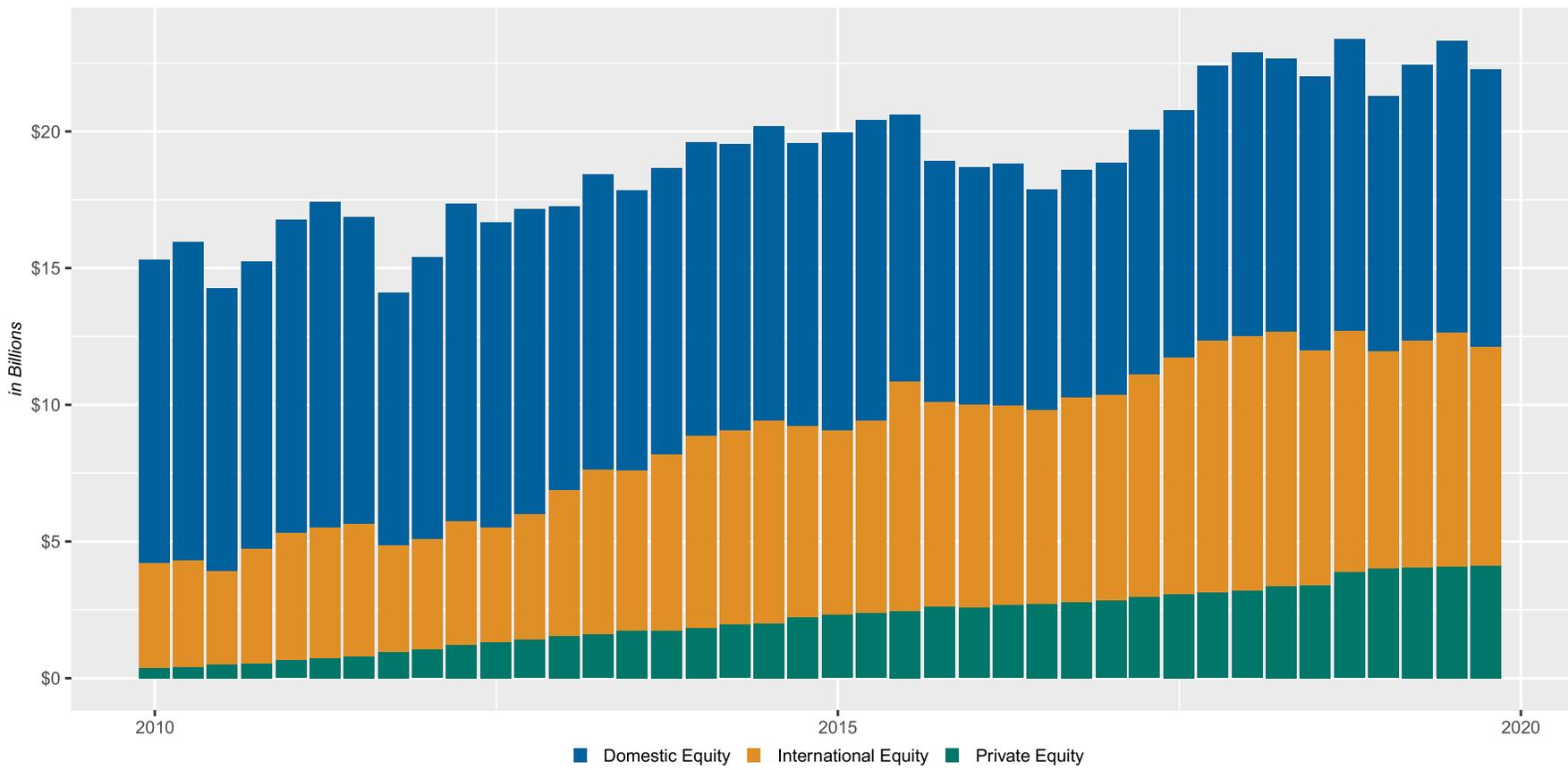
# Total Equities for the period ended 9/30/2019

## Returns for the period ended 9/30/2019

	Composite	Quarter	One Year	Three Year	Five Year
Equity		0.58%	2.28%	10.2%	7.65%
Benchmark		0.52%	1.37%	10.33%	7.57%
Excess		0.06%	0.9%	-0.13%	0.08%
Public Equity		0.03%	0.16%	9.24%	6.93%
Benchmark		-0.1%	0.8%	9.88%	7.44%
Excess		0.12%	-0.64%	-0.64%	-0.51%
US Equity		1.45%	2.26%	11.95%	10.15%
Benchmark		1.23%	3.01%	12.99%	10.94%
Excess		0.22%	-0.75%	-1.05%	-0.79%
International Equity		-1.71%	-2.28%	6.25%	3.17%
Benchmark		-1.72%	-1.85%	6.27%	3.29%
Excess		0.01%	-0.43%	-0.02%	-0.12%
Private Equity		3.28%	12.85%	14.82%	11.6%
Benchmark		3.12%	5.26%	12.43%	7.4%
Excess		0.16%	7.58%	2.38%	4.2%

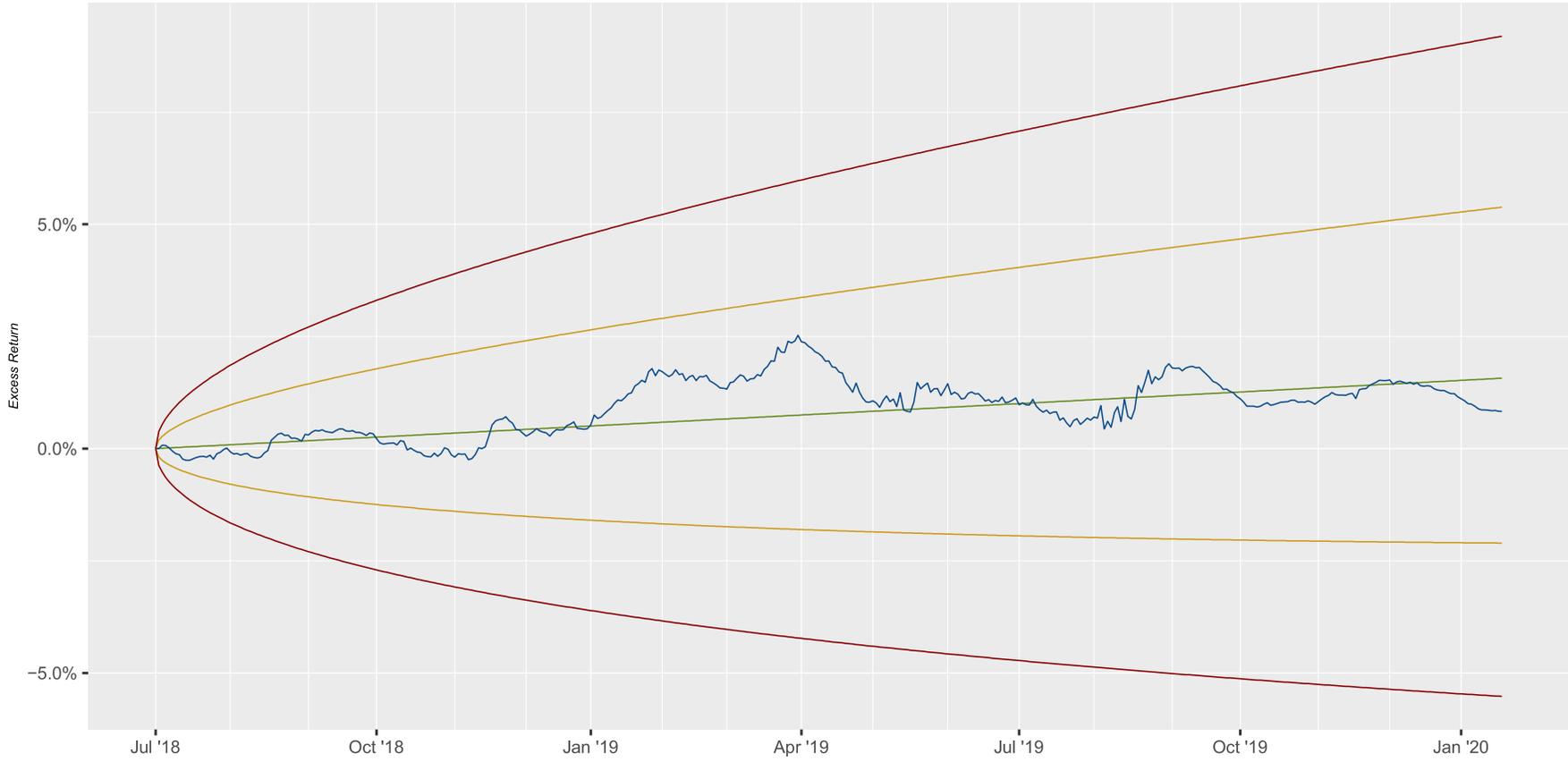
# Total Equity Market Values for the period ended 9/30/2019

Market Values

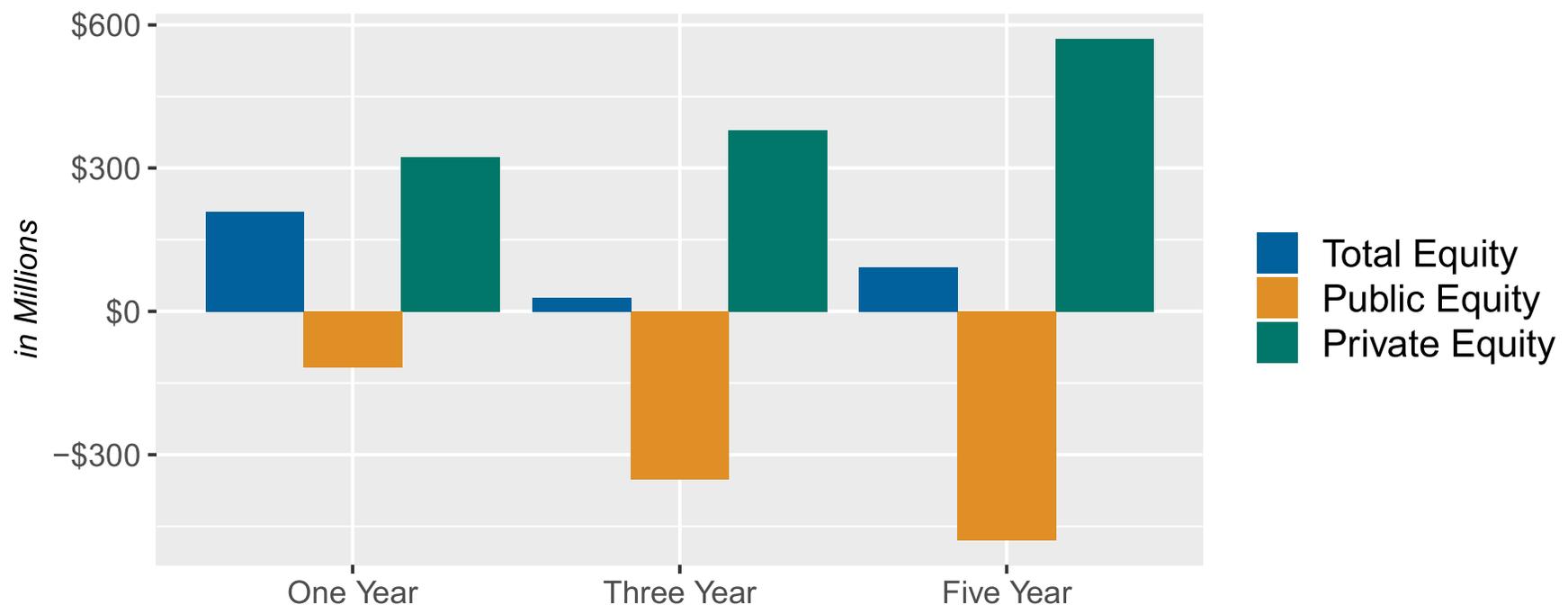


# Total Equity Performance for the period ended 9/30/2019

**Total Equity Portfolio Performance versus Expectations**  
100 Basis Points Expected Excess Return with 300 Basis Points Tracking Error



# Total Equity Dollar Value Add for the period ended 9/30/2019

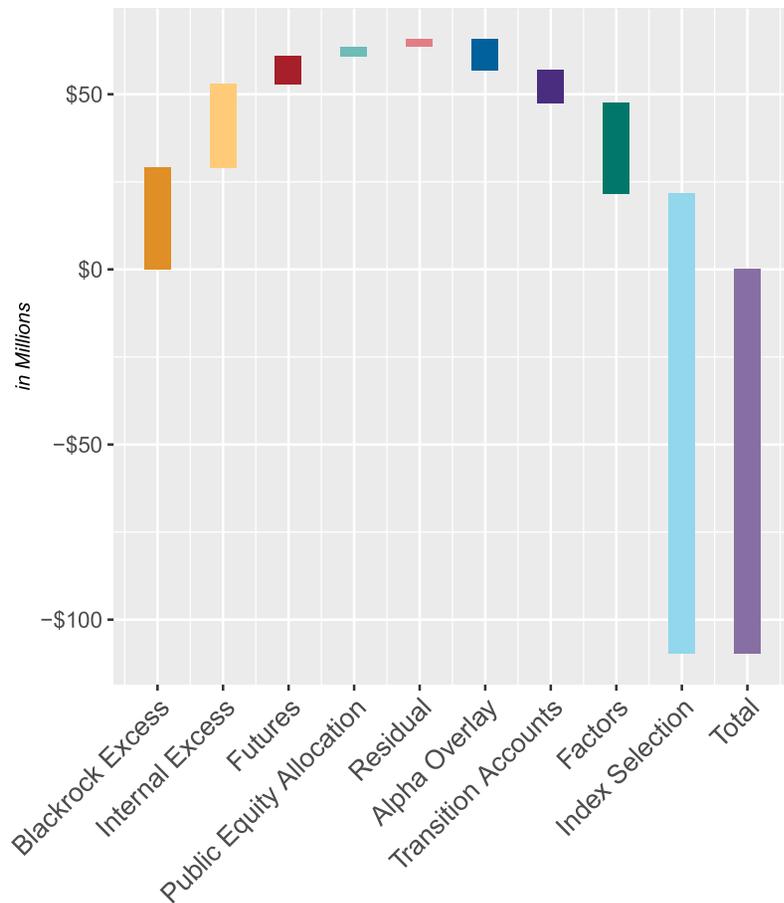


## Public Equity

# Public Equity "Levers" for the period ended 9/30/2019

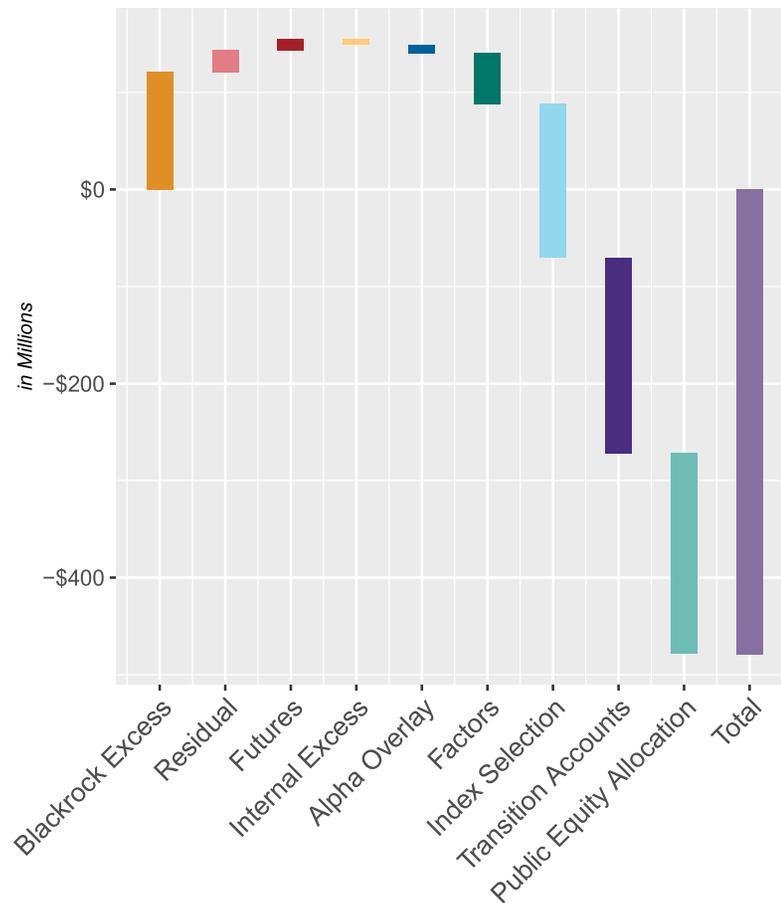
**Public Equity Dollar Value Add**

One Year



**Public Equity Dollar Value Add**

Trailing 5 Years



# Private Equity

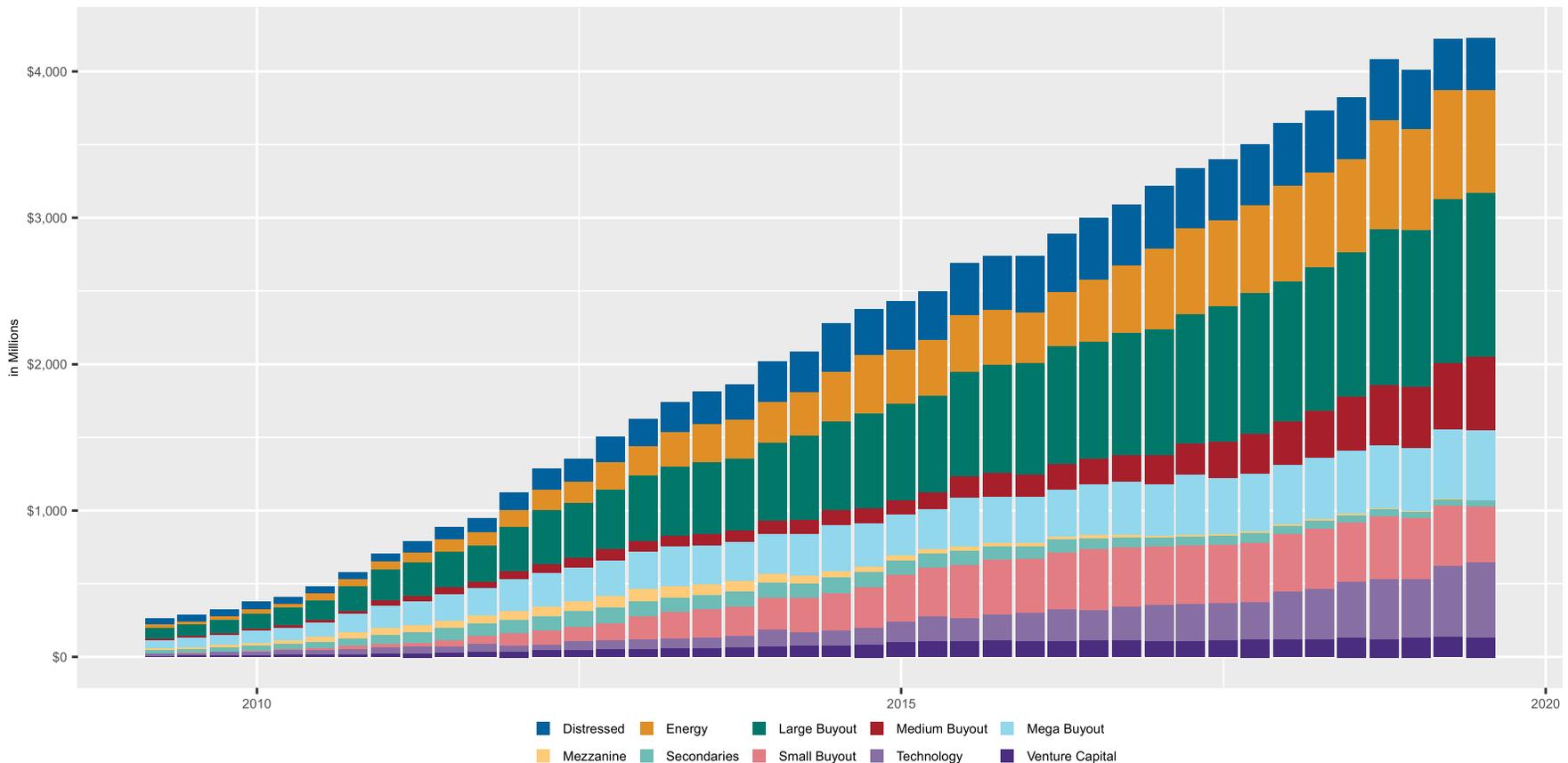
# Private Equity Performance Overview & Allocation for the period ended 6/30/2019

## Private Equity Internal Rate of Return

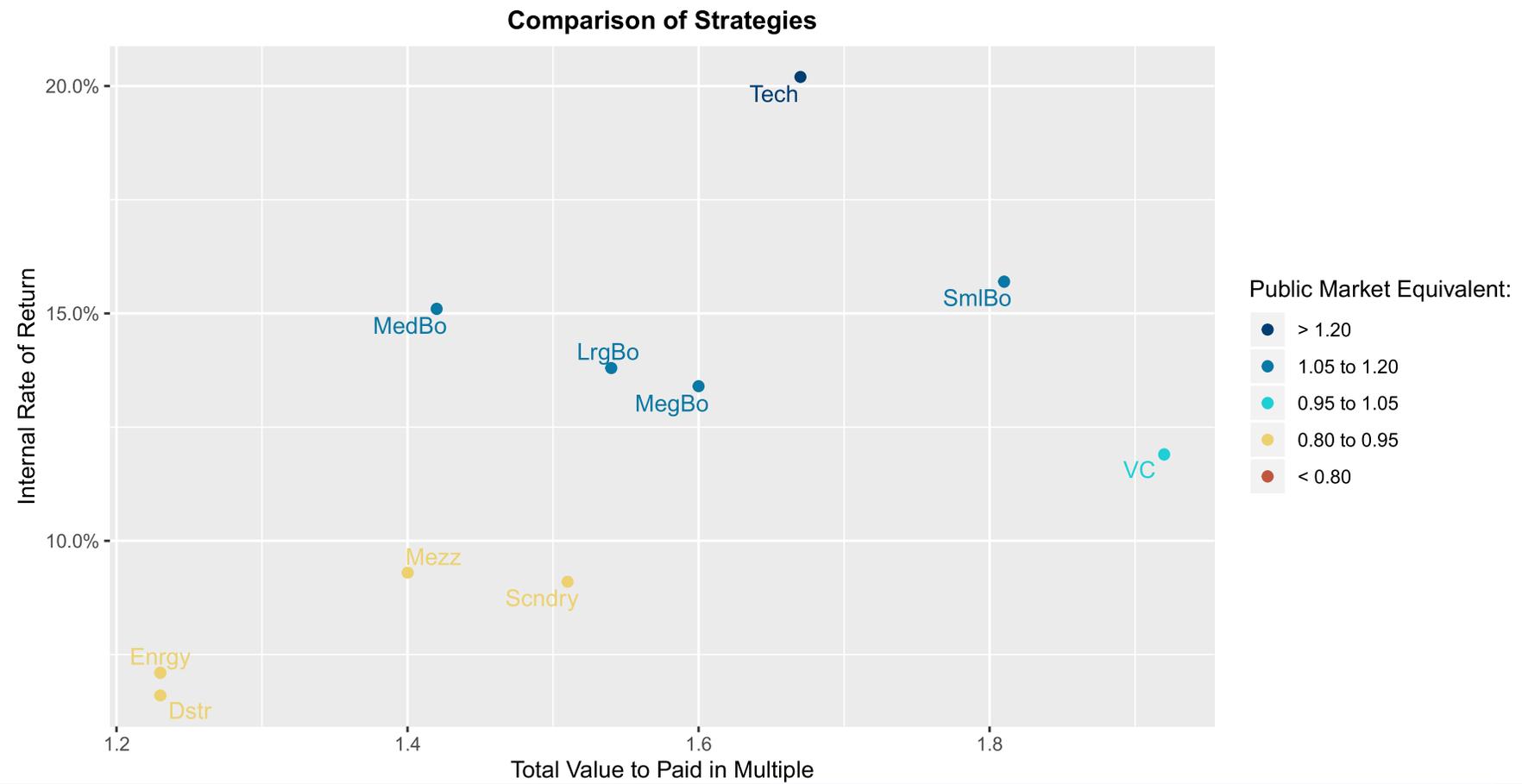
Category	Quarter	One Year	Three Year	Five Year	Ten Year	Inception
Private Equity	3.3%	12.8%	14.8%	11.6%	13.6%	12.5%
Benchmark	3.1%	5.3%	12.4%	7.4%	11.9%	11.2%
Excess	0.2%	7.6%	2.4%	4.2%	1.8%	1.2%
Burgiss	3.1%	5.3%	12.4%	7.4%	11.9%	11.2%
Burgiss Excess	0.4%	3.1%	1.2%	0.5%	1.1%	0%
Distressed	2.5%	-5.4%	3.2%	1.5%	6.8%	6.6%
Energy	-3.6%	1.4%	8.4%	2.8%	7.5%	7.1%
Large Buyout	6%	15.6%	16.2%	12.7%	14.9%	13.8%
Medium Buyout	3%	16%	16.3%	18.5%	16.5%	15.1%
Mega Buyout	3.2%	11.5%	18.6%	14%	15.7%	13.4%
Mezzanine	3.2%	-11.8%	5.9%	8.4%	9.9%	9.3%
Secondaries	-4%	-0.3%	6.9%	4%	11.4%	9.1%
Small Buyout	5.4%	26.5%	21.6%	20.3%	16.9%	15.7%
Technology	6.9%	31.4%	24.5%	22.7%	22.1%	20.2%
Venture Capital	5.2%	17%	15.5%	15.1%	13%	11.9%

# Private Equity Decomposition for the period ended 6/30/2019

Net Asset Value by Strategy



# Private Equity Performance by Category for the period ended 6/30/2019



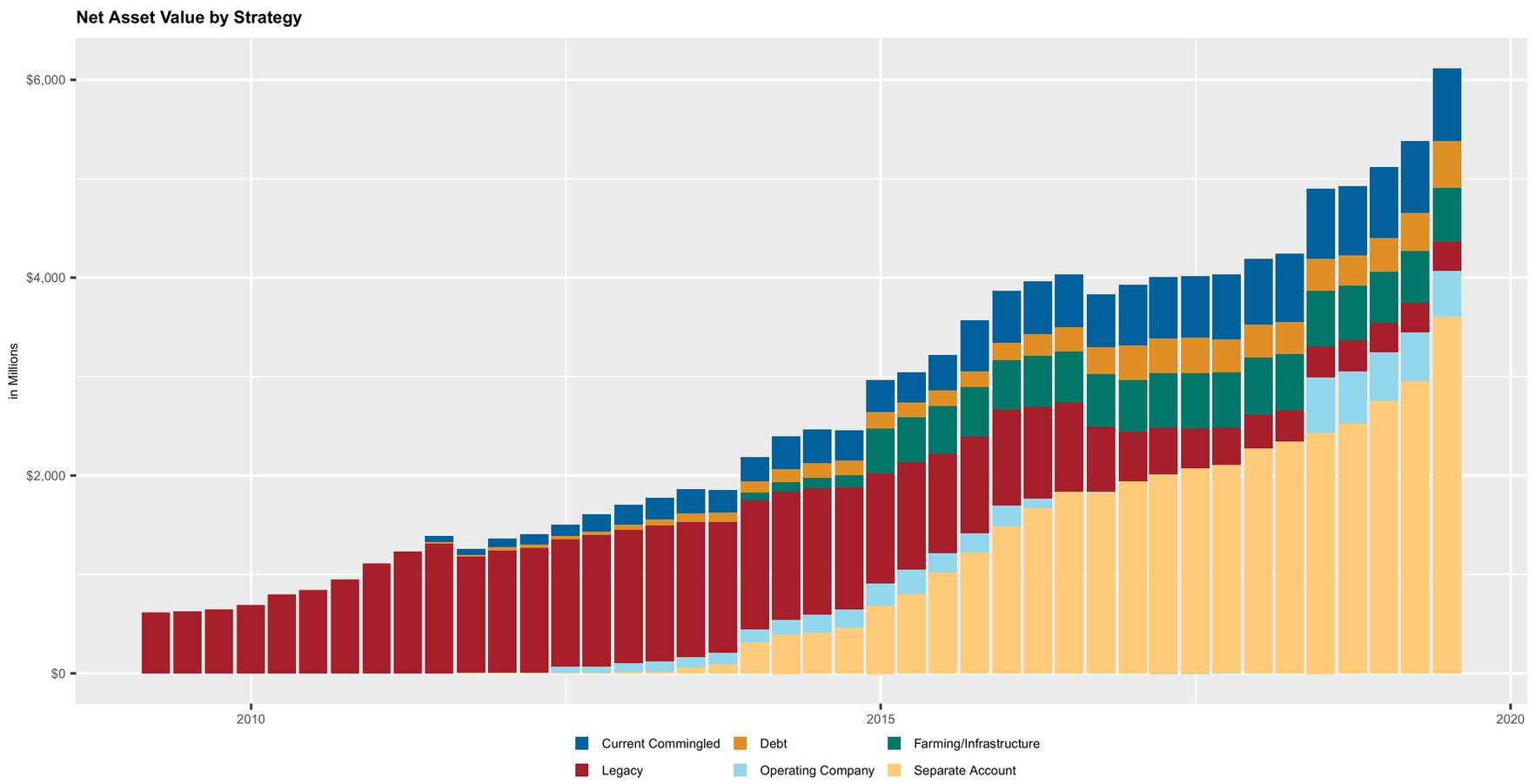
# Real Estate

# Real Estate Performance Overview & Allocation for the period ended 6/30/2019

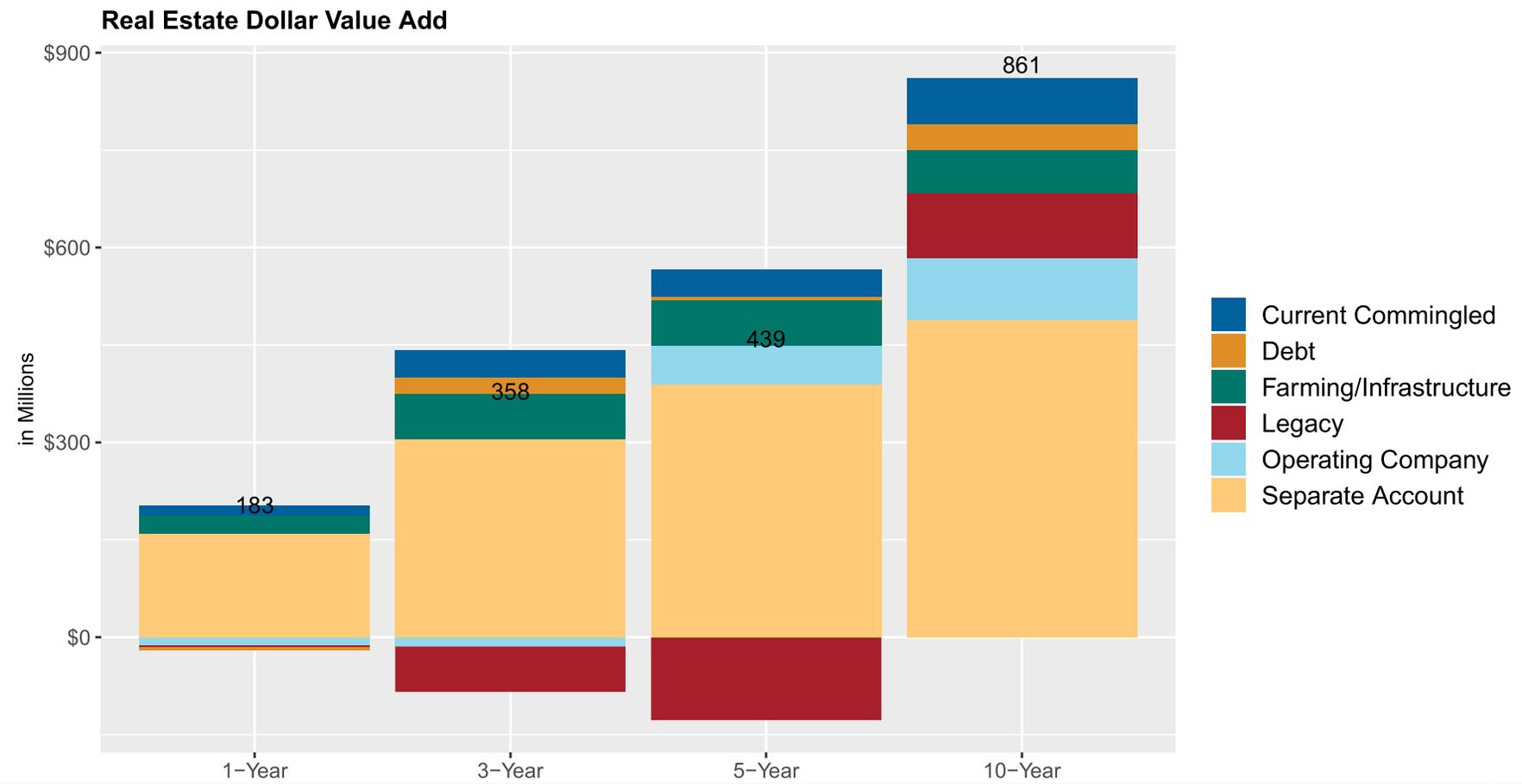
## Real Estate Internal Rate of Return

Category	Quarter	One Year	Three Year	Five Year	Ten Year	Inception
Real Estate	1.8%	8.1%	8.8%	10.2%	11.5%	8.7%
Benchmark	1.2%	4.4%	6.1%	8.1%	8.9%	6.8%
Excess	0.61%	3.7%	2.6%	2%	2.6%	1.9%
Separate Account	2.41%	10.5%	10.6%	12%	13.1%	13.1%
Operating Company	-1.59%	1.8%	2.7%	13.2%	15.2%	15.2%
Farming/Infrastructure	2.38%	9.9%	9.7%	8.1%	7.9%	7.9%
Legacy	1.48%	3.6%	1.4%	7.5%	11.1%	5.8%
Current Commingled	1.52%	6.6%	8.4%	9.9%	11%	11%
Debt	1.17%	3.2%	8.9%	8.6%	11.3%	11.3%

# Real Estate Net Asset Value by Strategy for the period ended 6/30/2019

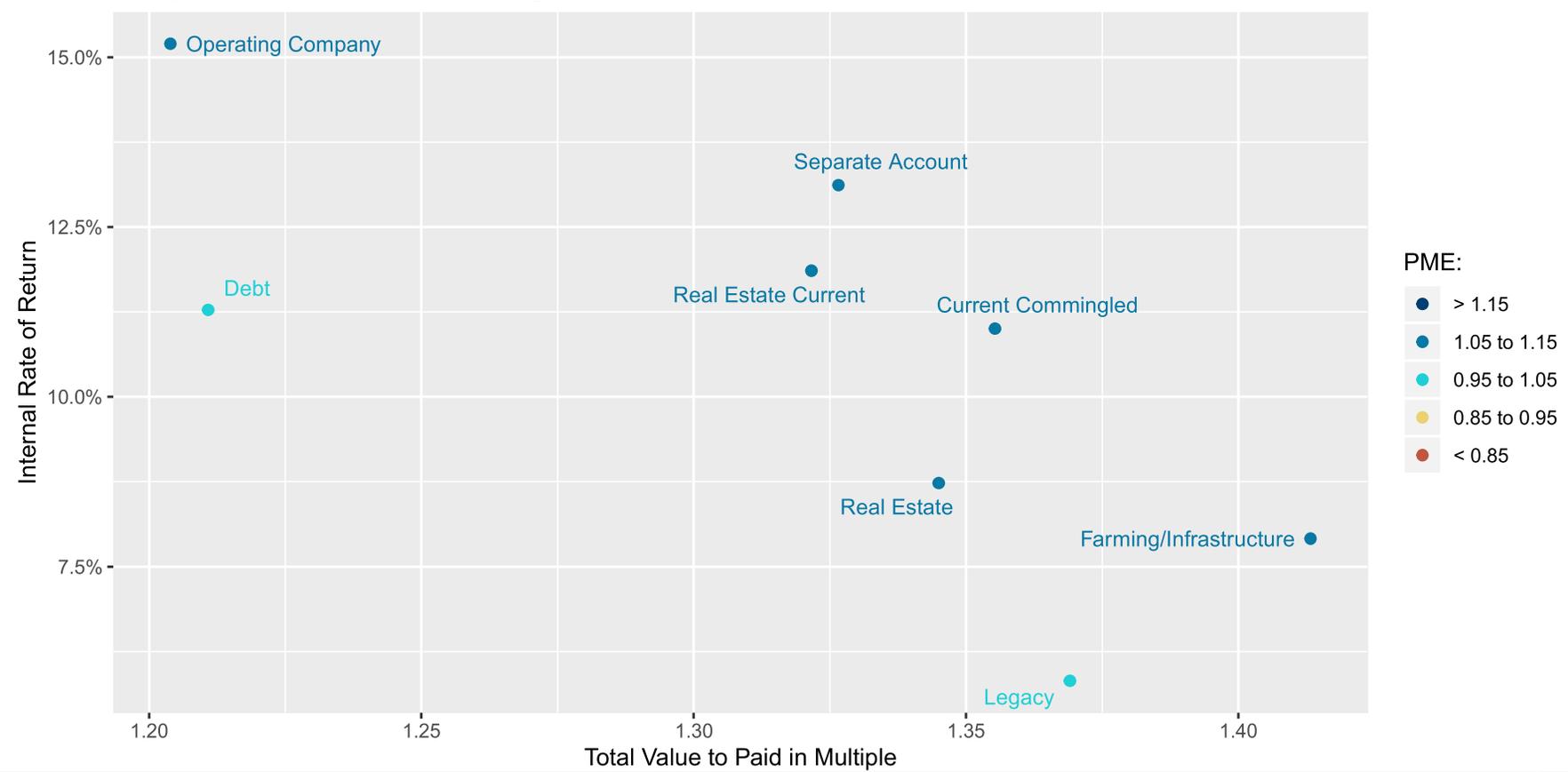


# Real Estate Dollar Value Add for the period ended 6/30/2019



# Real Estate Performance Summary for the period ended 6/30/2019

Comparison of Real Estate Strategies



# Credit

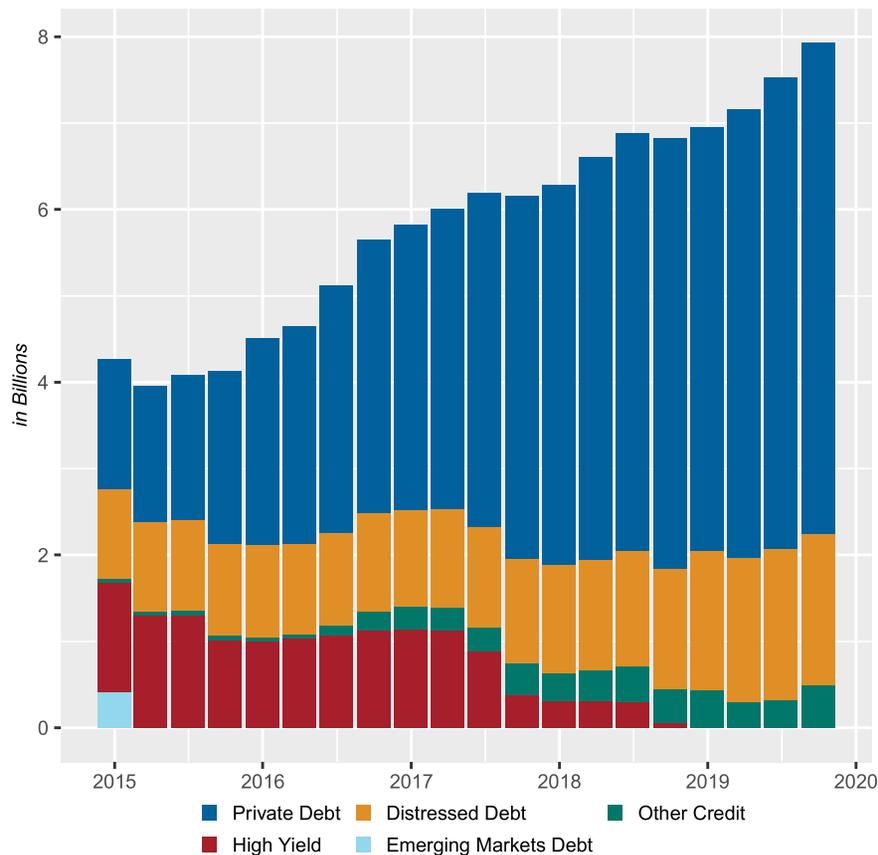
## Total Credit for the period ended 9/30/2019

### Credit Internal Rate of Return

	Quarter	One Year	Three Year	Five Year
Total Credit (TWR)	2.35	8.21	9.93	7.65
Blended Benchmark	2.31	6.57	7.42	5.08
Total Credit Excess	0.04	1.65	2.51	2.57
Private Debt (IRR)	2.39	9.26	10.79	10.31
S&P/LSTA Leveraged Loan + 250 Basis Points	2.30	6.58	7.68	6.87
Private Debt Excess	0.09	2.68	3.11	3.44
Distressed Debt (IRR)	2.76	8.26	10.87	6.36
Fixed 8% Return/LSTA Blend	2.28	6.50	7.24	7.53
Distressed Debt Excess	0.48	1.76	3.63	-1.17
Other Credit (IRR)	1.40	6.19	8.10	7.69
Fixed 8% Return/LSTA Blend	2.32	6.71	7.27	7.37
Other Credit Excess	-0.92	-0.52	0.83	0.32

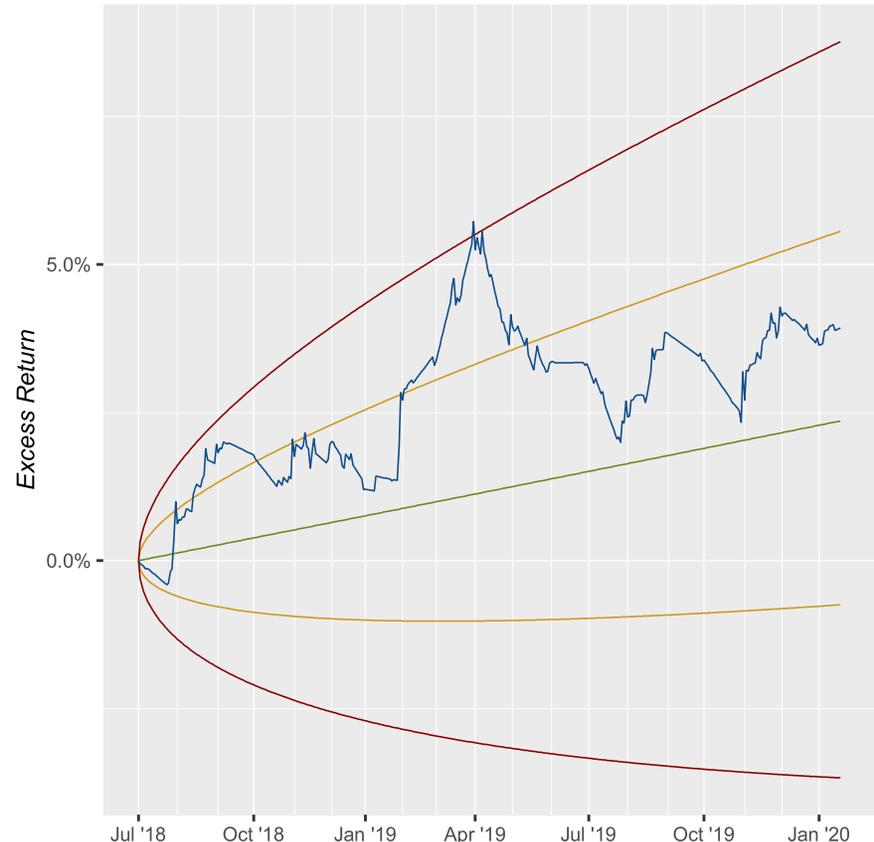
# Credit Market Values and Performance for the period ended 9/30/2019

**Total Credit Market Values**



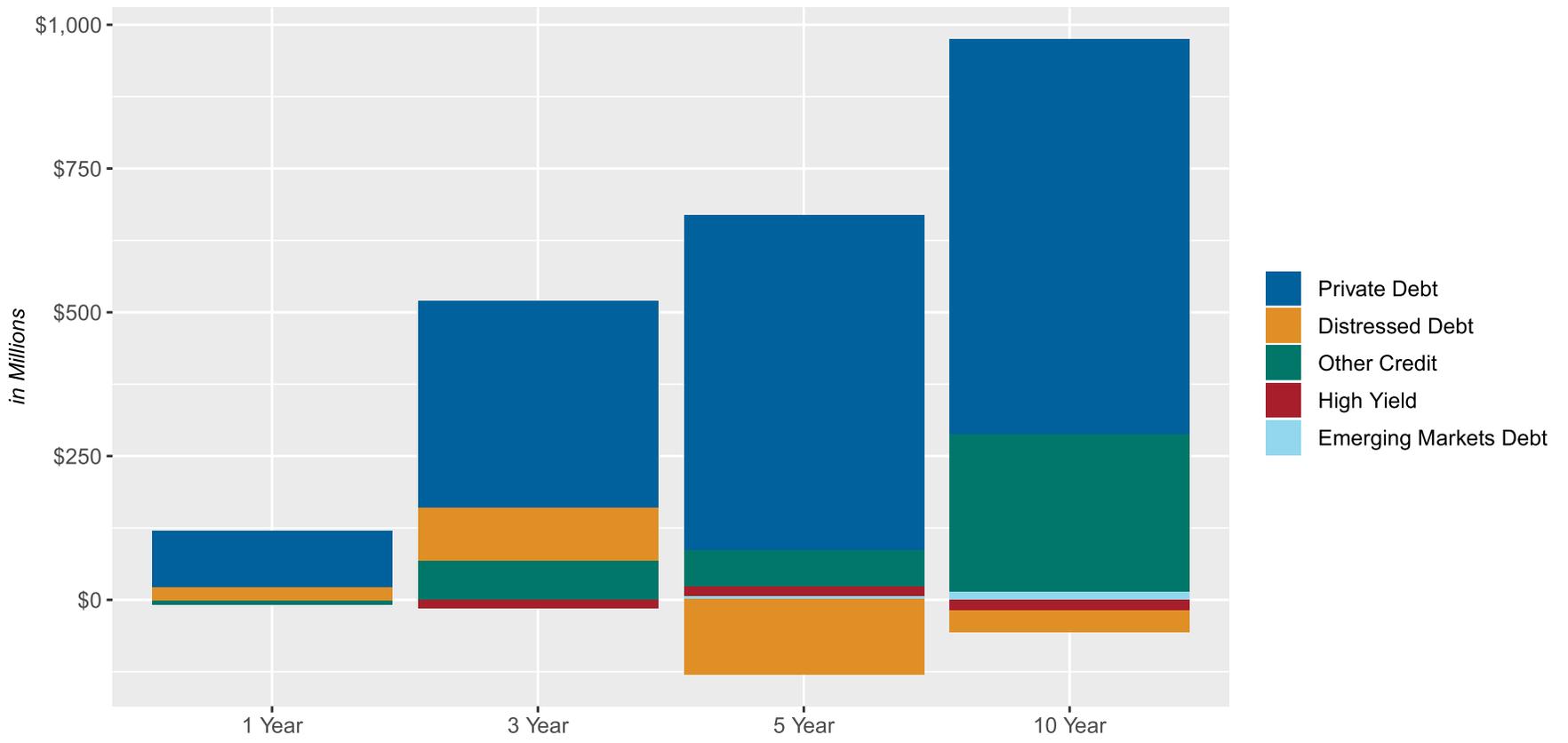
**Total Credit Portfolio Performance versus Expectations**

150 Basis Points Expected Excess Return with 250 Basis Points Tracking Error



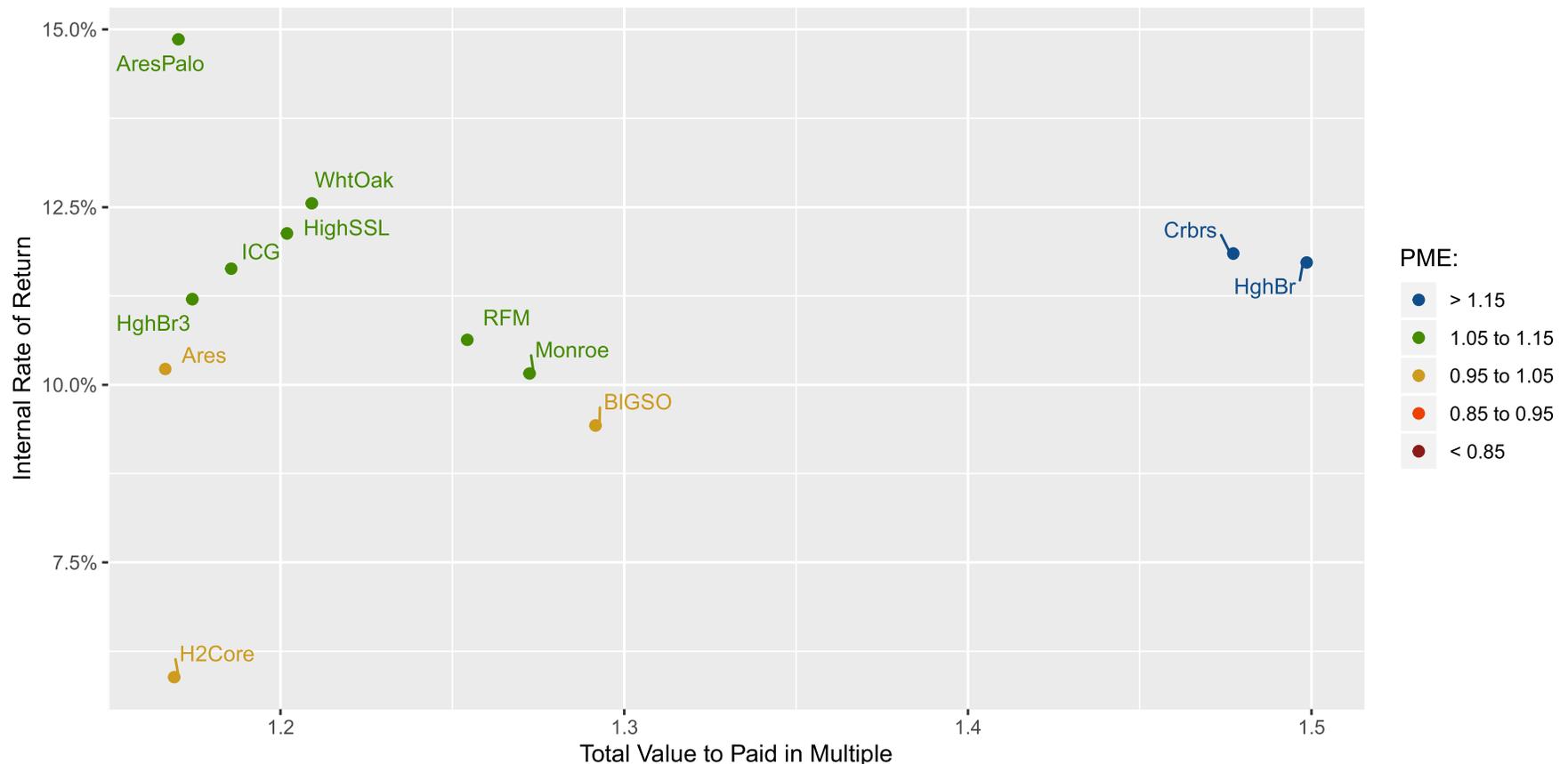
# Credit Dollar Value Add for the period ended 6/30/2019

**Credit Dollar Value Add versus Benchmark**



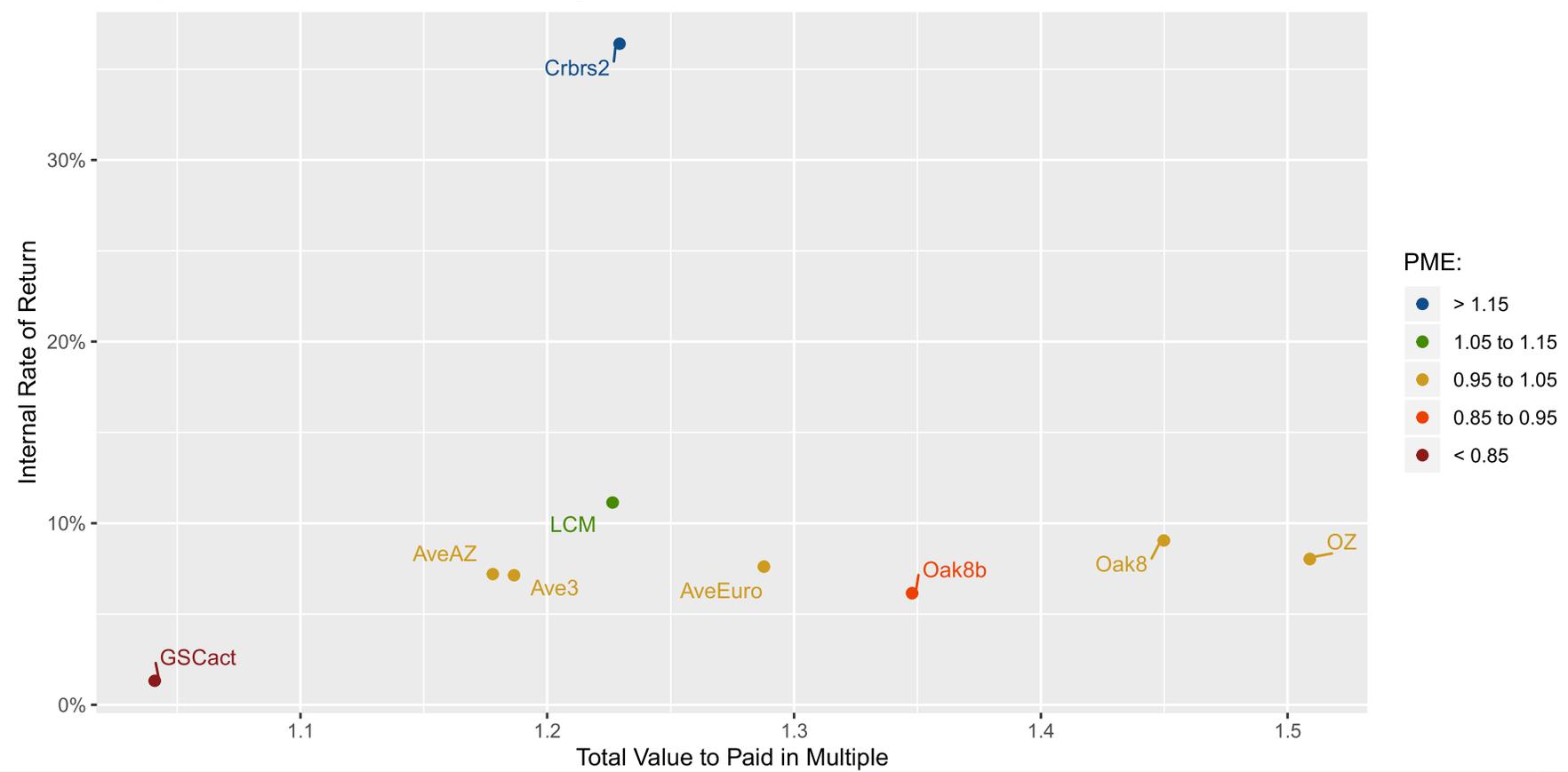
# Private Debt: Total Value to Paid in Multiple & Public Market Equivalent for the period ended 6/30/2019

Comparison of Private Debt Strategies

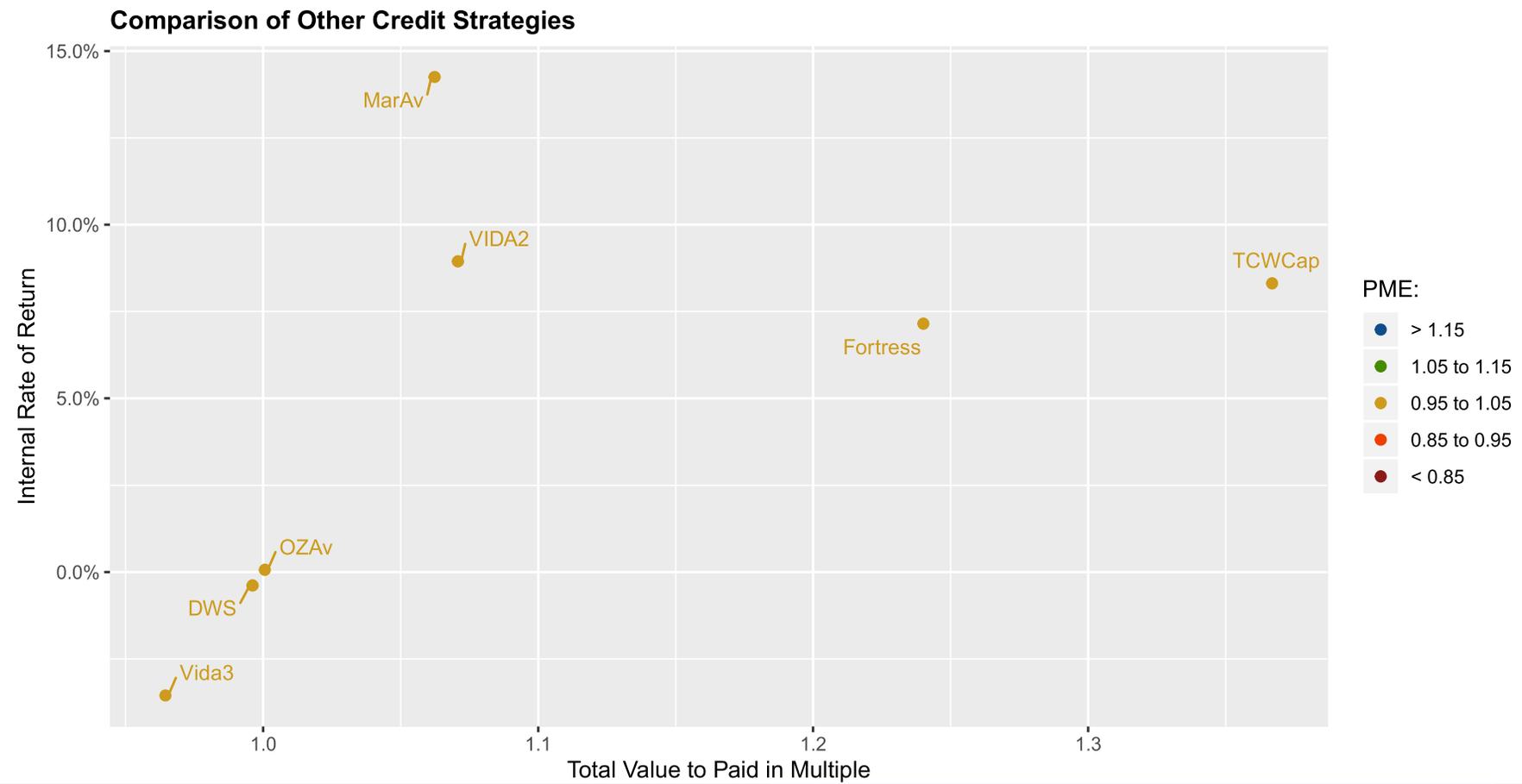


# Distressed Debt: Total Value to Paid in Multiple & Public Market Equivalent for the period ended 6/30/2019

Comparison of Distressed Debt Strategies



# Other Credit: Total Value to Paid in Multiple & Public Market Equivalent for the period ended 6/30/2019



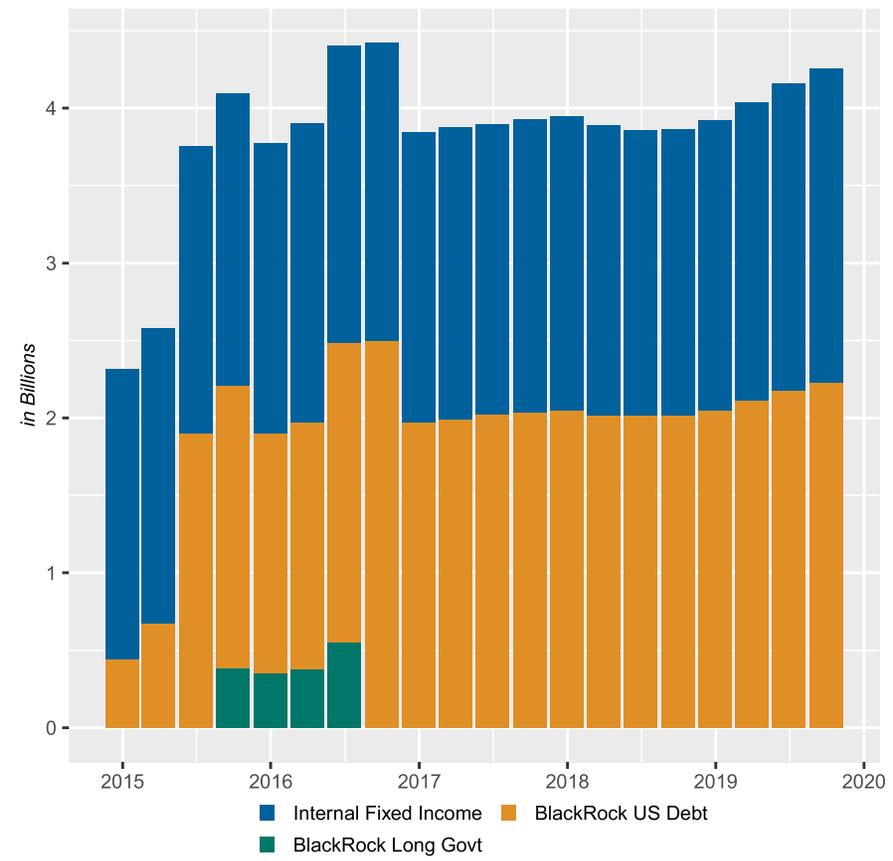
## Core Fixed Income for the period ended 9/30/2019

### Annualized Time-Weighted Returns

	Quarter	One Year	Three Year	Five Year
Core Bond Composite	2.31	10.21	3.00	3.66
Barclay's Aggregate	2.27	10.30	2.92	3.38
Core Composite Excess	0.04	-0.09	0.08	0.28
Internal Fixed Income	2.35	10.05	3.01	3.51
Barclay's Aggregate	2.27	10.30	2.92	3.38
Internal Fixed Income Excess	0.08	-0.24	0.08	0.14
BlackRock US Debt Fund	2.27	10.35	3.01	3.47
Barclay's Aggregate	2.27	10.30	2.92	3.38
BlackRock Excess	0.00	0.06	0.08	0.09

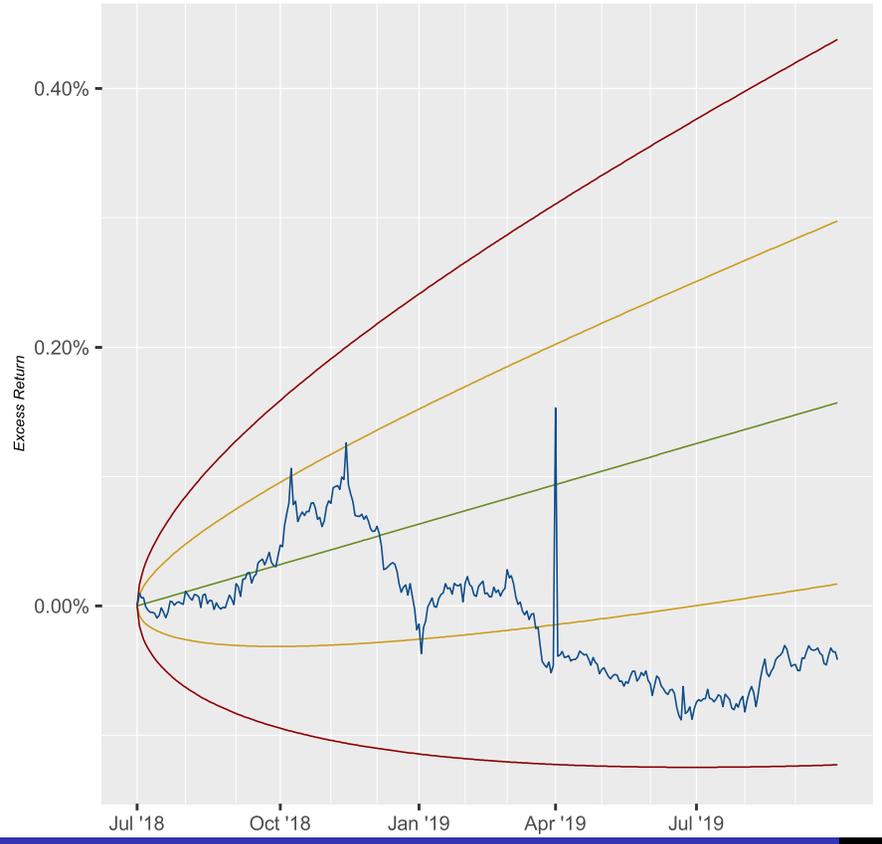
# Core Fixed Income Decomposition for the period ended 9/30/2019

**Core Bonds Market Values**



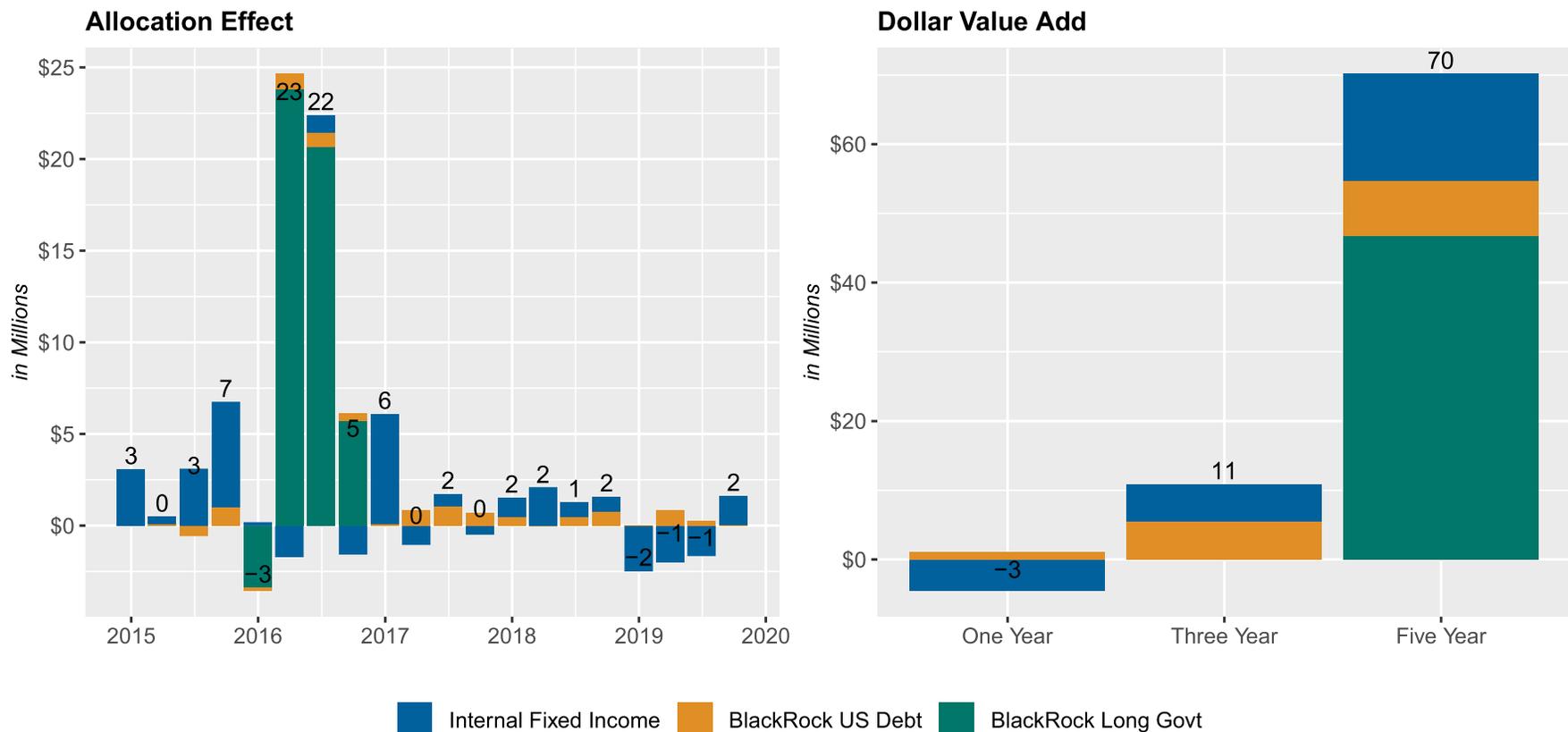
**Core Bond Performance versus Expectations**

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



# Core Fixed Income Dollar Value Added for the period ended 9/30/2019

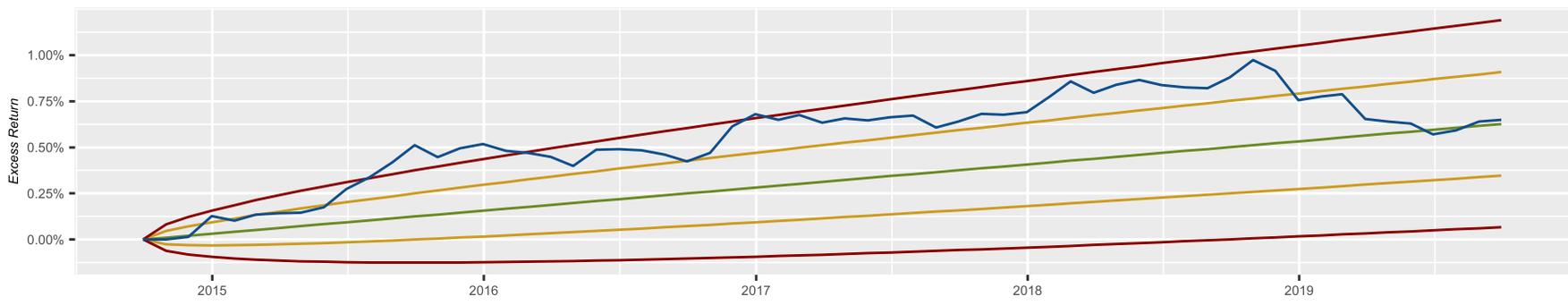
**Core Fixed Income Dollar Value Added  
 Relative to Barclay's Aggregate Benchmark**



# Core Fixed Income Performance for the period ended 9/30/2019

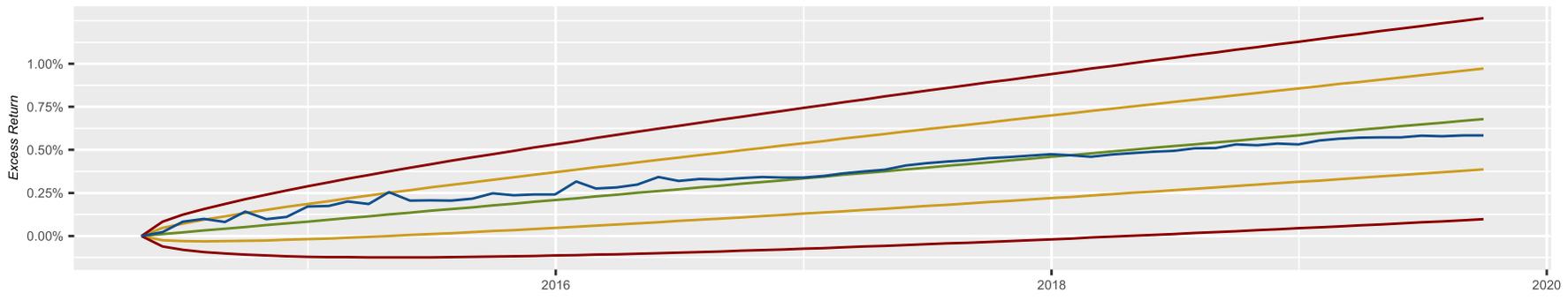
## Internal Fixed Income Portfolio Performance versus Expectations

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



# MSCI Risk Report

# Total Portfolio Value-at-Risk at 11/30/2019

## ▀ Total Portfolio Value-At-Risk (VAR)

As of November 30th, 2019 Total VaR for ASRS Portfolio was 13.15%, indicating that there is a 5% chance that portfolio could lose ~\$5.34B in a given year. Note that a 5% event is expected to occur every 20 years

