




**RETIREMENT BOARD CALENDAR SHEET**  
**Board Meeting of May 8th, 2019**

**To:** Retirement Board

**Through:** Jay Huish   
Executive Director

**From:** Anna Langs, CFA, FRM   
Managing Director, Asset Allocation,  
Risk Management, Innovative Solutions

William J. Coaker, Jr. – CFA, MBA   
Chief Investment Officer

**Date:** May 8th, 2019

**Agenda Item:**

Risk Review for SFERS Total Plan: Risk-Adjusted Returns and Exposure Analysis

**Background:**

We present a Risk Review for SFERS Total Plan using risk aggregation and analytics from Caissa platform. SFERS collaborates with Caissa to measure, monitor, and manage Total Plan risk exposures and performance.

This review covers 1) Performance Contribution and Performance Analytics and 2) Exposure Analysis for the Total Plan and Each Asset Class.

**Recommendation**

This is a discussion only item.

**Attachments**

Risk Review for SFERS Total Plan: Risk-Adjusted Returns and Exposure Analysis

San Francisco Employee's Retirement System

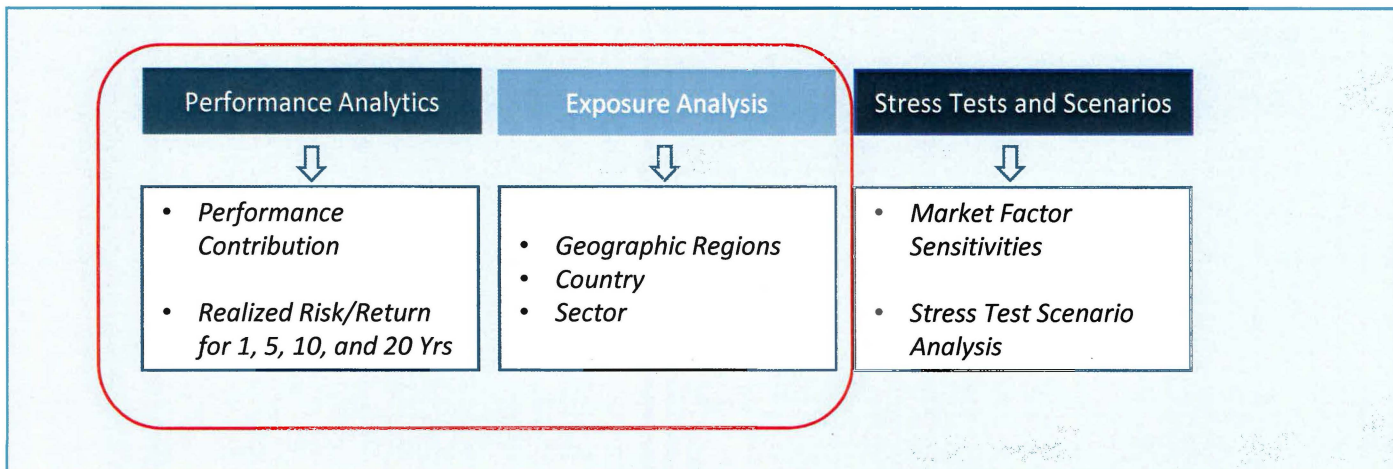
Risk Review for SFERS Total Plan

Risk-Adjusted Returns and Exposure Analysis

Board Meeting, May 8th 2019

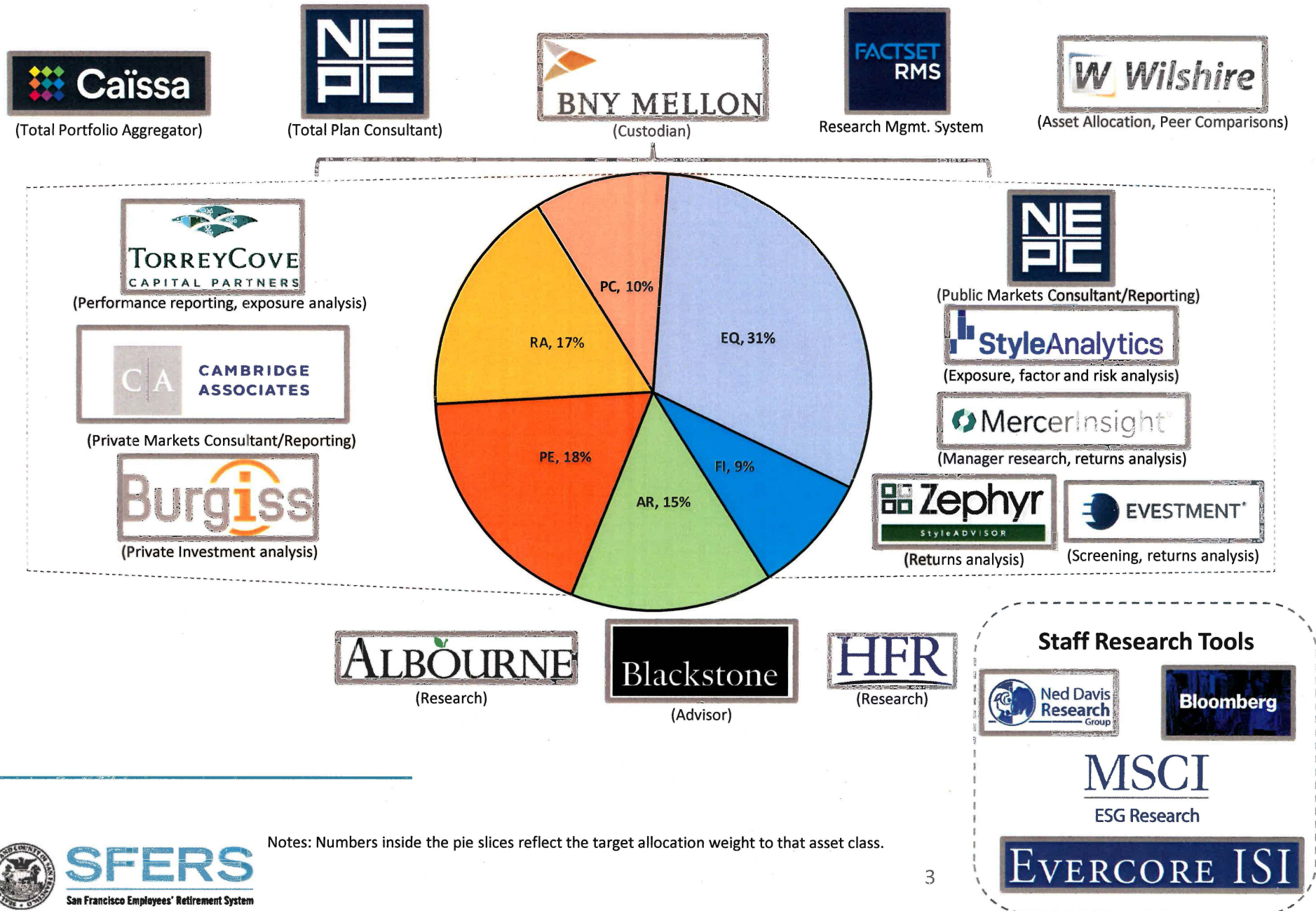
## SFERS Risk Review | Overview

- Comprehensive risk management framework includes Strategic Asset Allocation, Liquidity Management, and measurement, monitoring, and management of key risk drivers for SFERS Total Fund and each asset class
- SFERS Staff continues to invest in and build best-in-class risk management practices
- SFERS uses risk analytics and reporting from multiple sources and vendors
- SFERS collaborates with Caissa to measure, monitor, and manage Total Plan risk





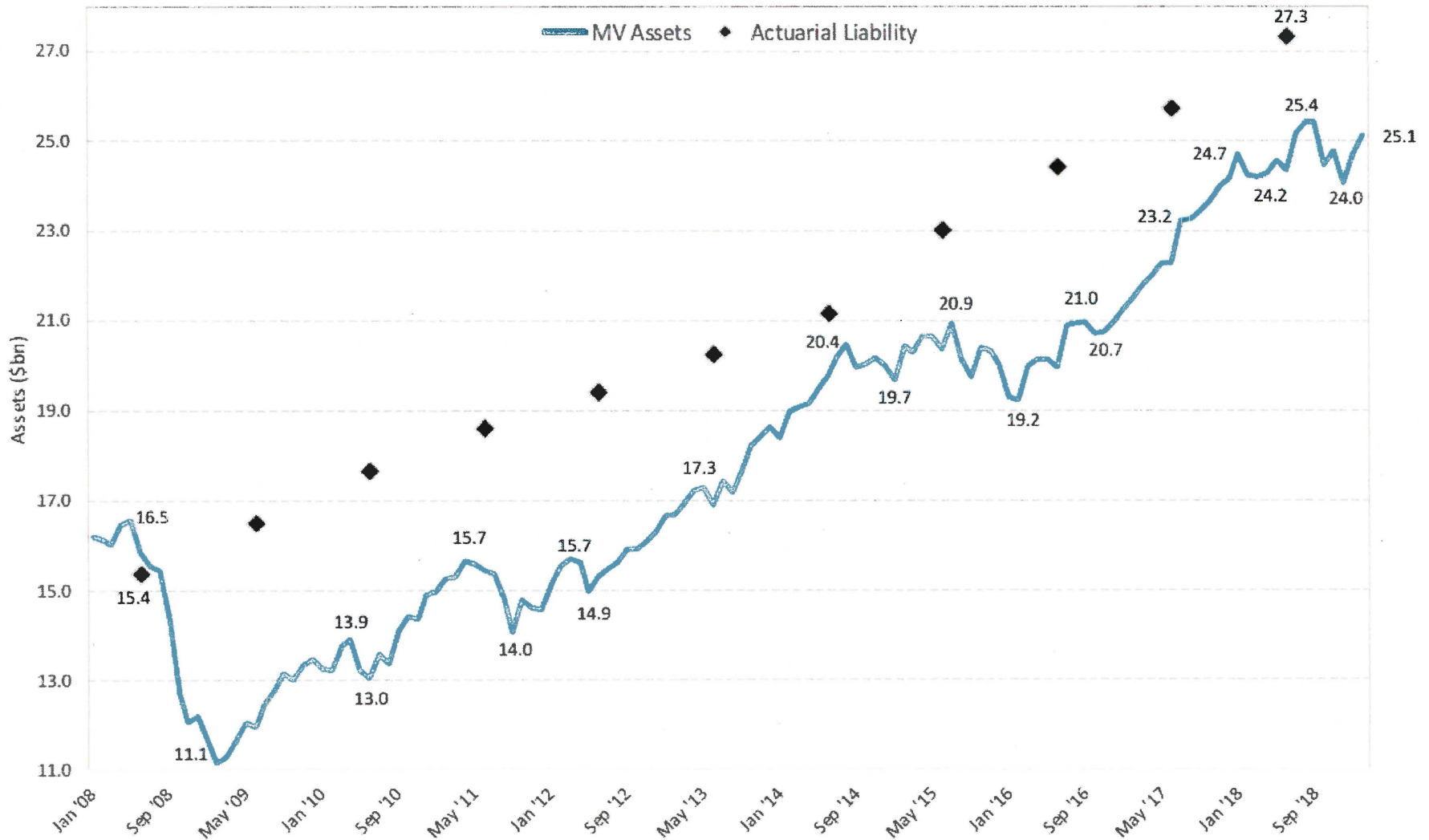
# SFERS' Consultants, Advisors, Vendors and Analytics Platforms



Notes: Numbers inside the pie slices reflect the target allocation weight to that asset class.

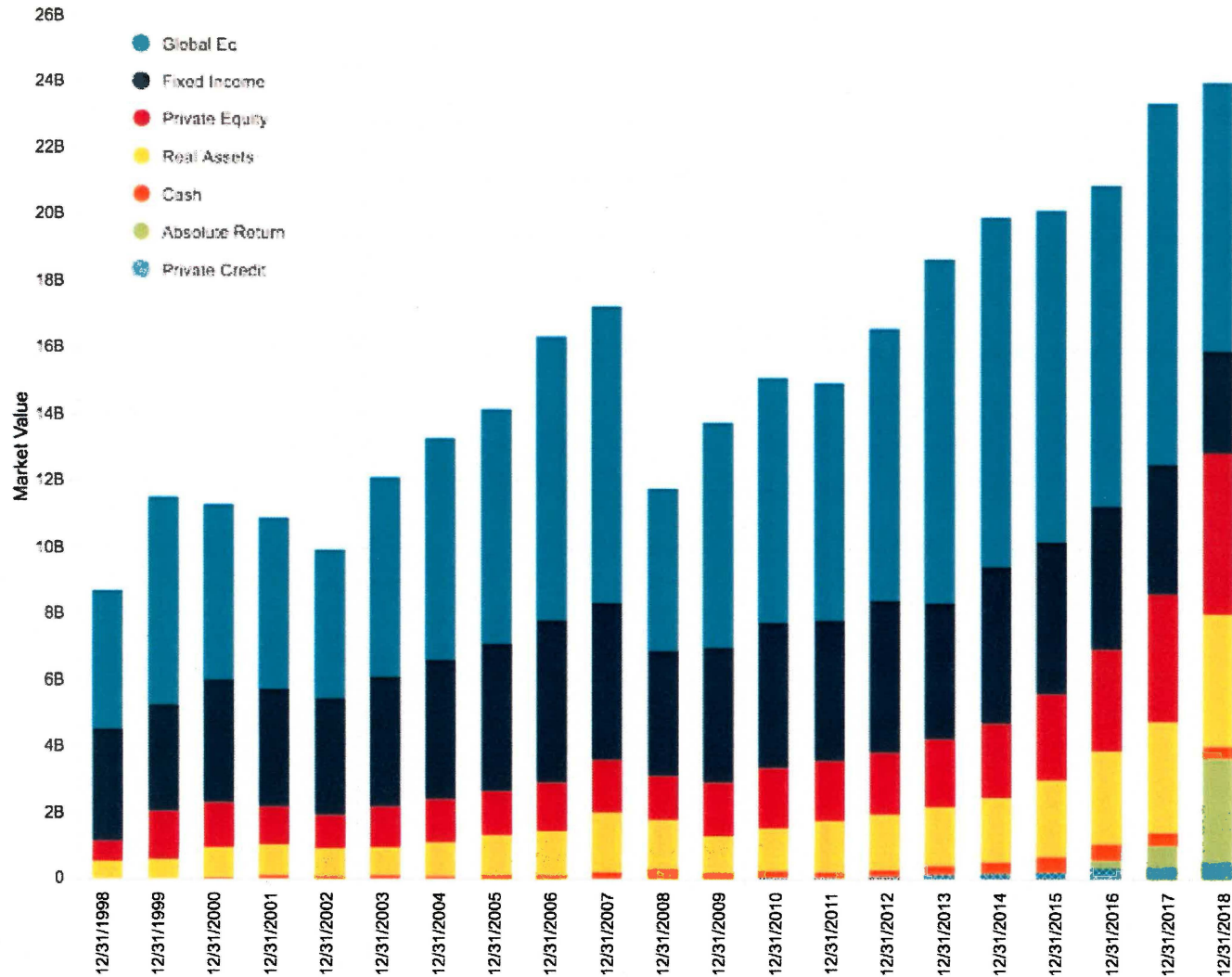


# SFERS Assets and Liabilities



Notes: Data from January 31, 2008 through November 30, 2018. Total Plan market values through September 2018 is provided by NEPC. October and November data is provided by BNY Mellon and should be considered preliminary.

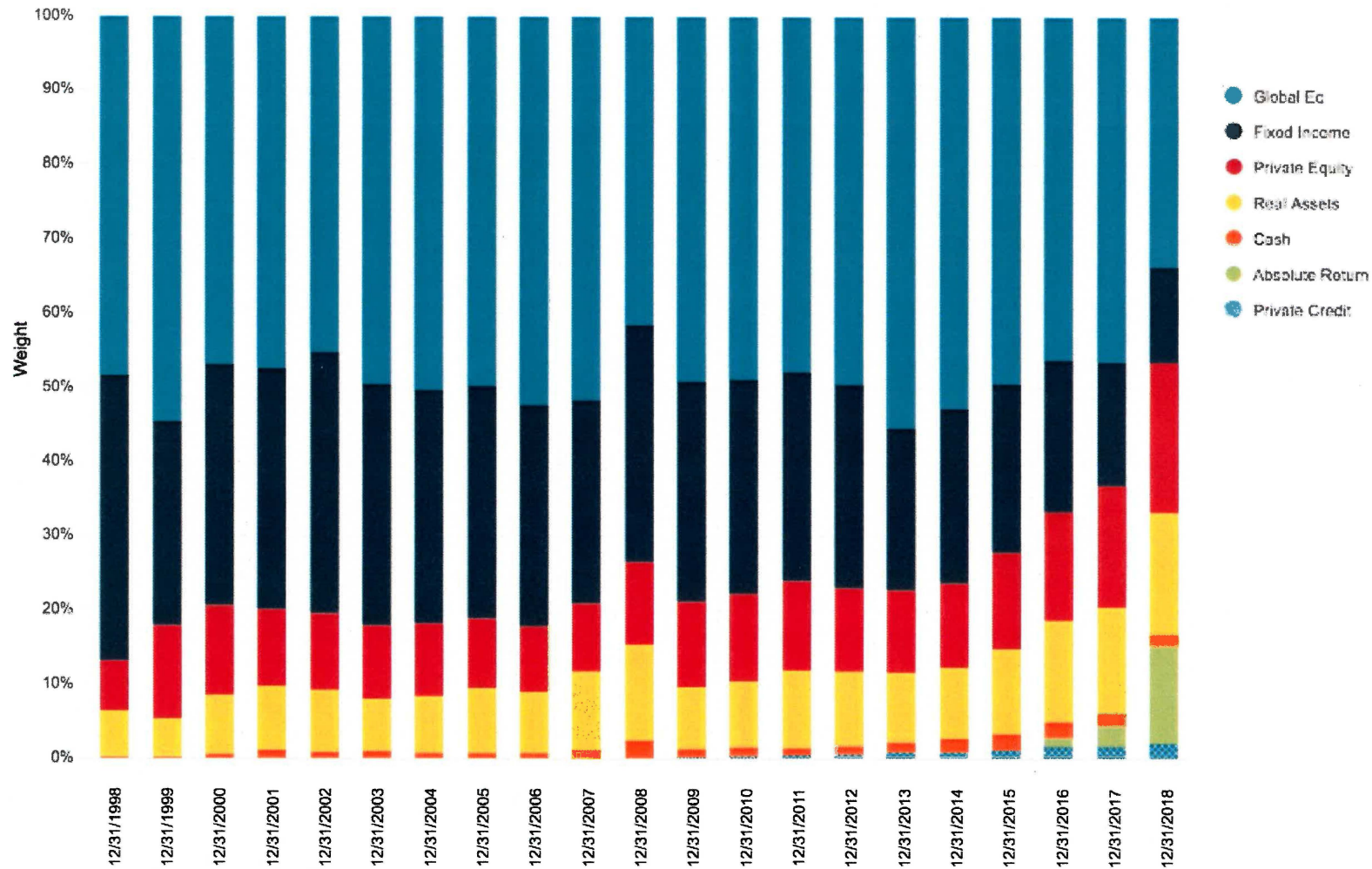
# SFERS Historical Asset Allocation by Market Value



Historical volatility in SFERS Market Value driven by large allocation to Public Global Equities

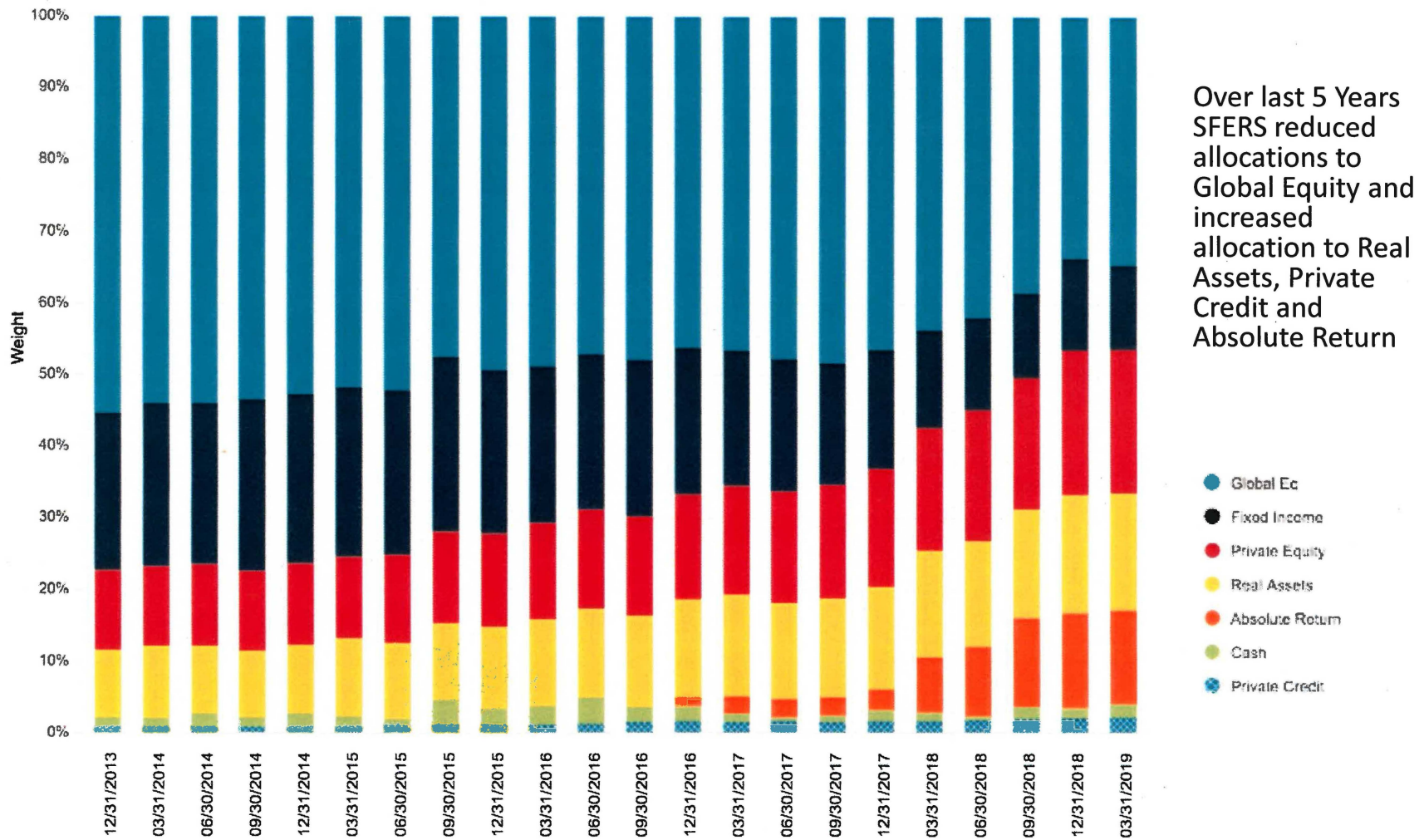
Adoption of well-diversified Strategic Asset Allocation in 2017 led to increased allocations to Real Assets, Private Credit, and Absolute Return

# SFERS Historical Asset Allocation by Weight | 20 Year Annual





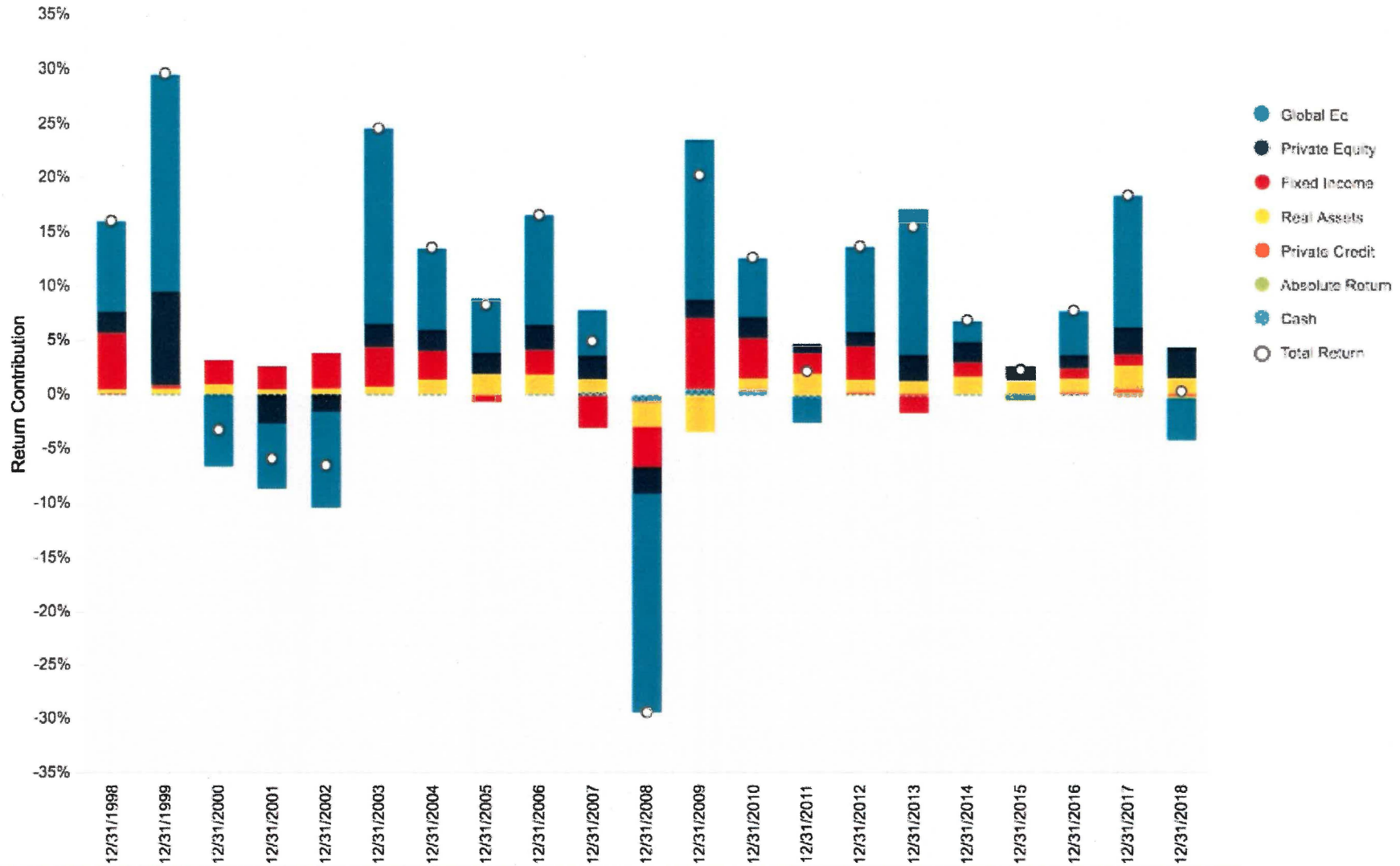
# SFERS Historical Asset Allocation by Weight | 5-Year Quarterly



Source: Caissa and Custodian (NT and BNY Mellon) valuations from December 2013 till March 2019. March, 2019 data is provided by BNY Mellon and should be considered preliminary.

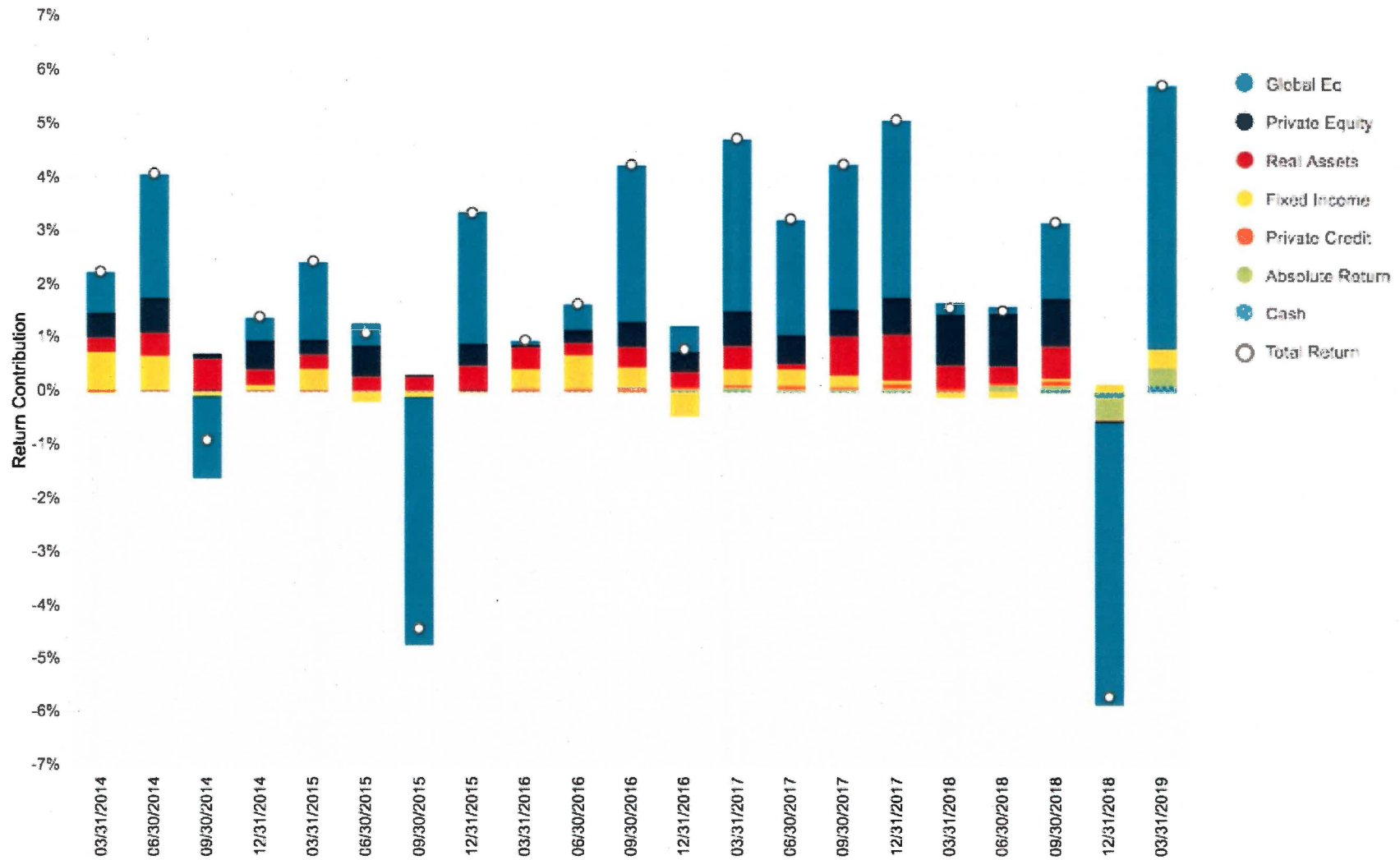
# SFERS Historical Return Contribution by Asset Class | 20-Year Annual

Fixed Income and Real Assets historically provided diversification for equity volatility except in 2008



# SFERS Historical Return Contribution by Asset Class | 5-Year Quarterly

Public and Private Equity drove performance and volatility of SFERS returns



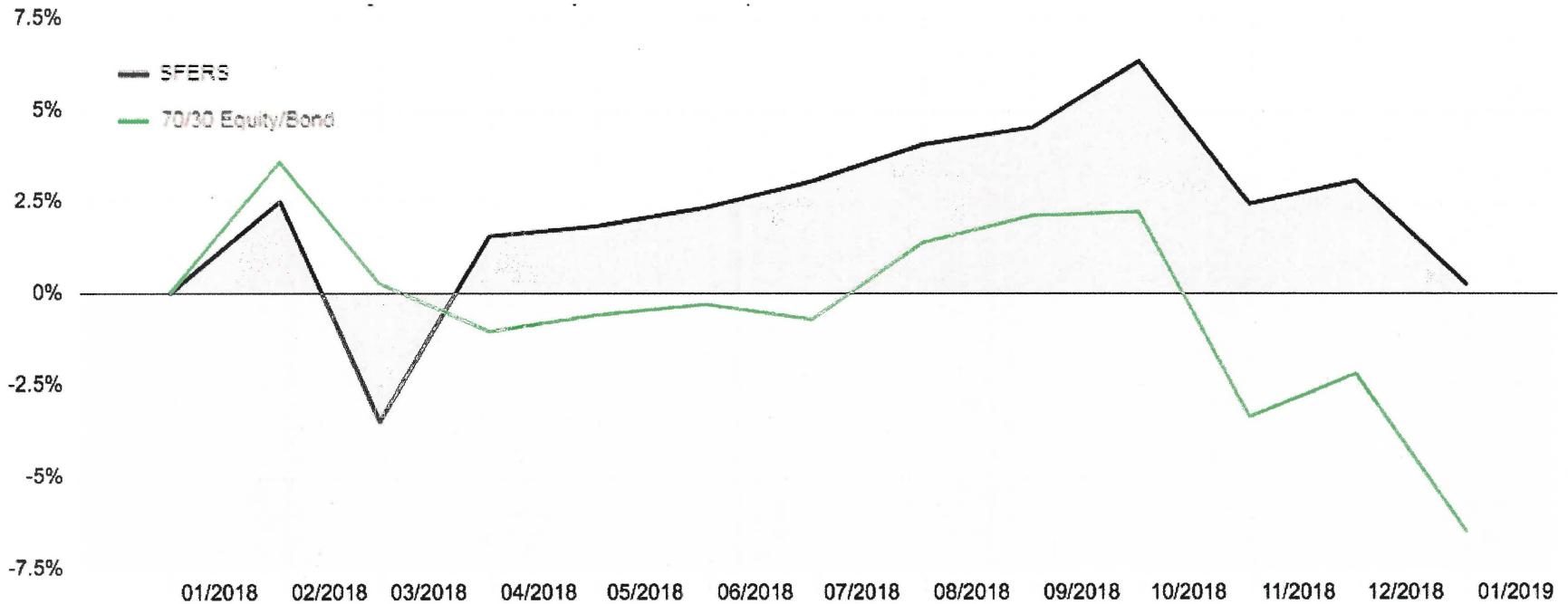
Source: Caissa and Custodian (NT and BNY Mellon) valuations from January 2014 till March 2019. March, 2019 data is provided by BNY Mellon and should be considered preliminary.



# SFERS Performance Analysis | 1 Year (12/31/2017 - 12/31/2018)

SFERS delivered superior risk-adjusted returns outperforming 70/30 benchmark by 6.73% with less downside volatility

Compounded Cumulative Returns



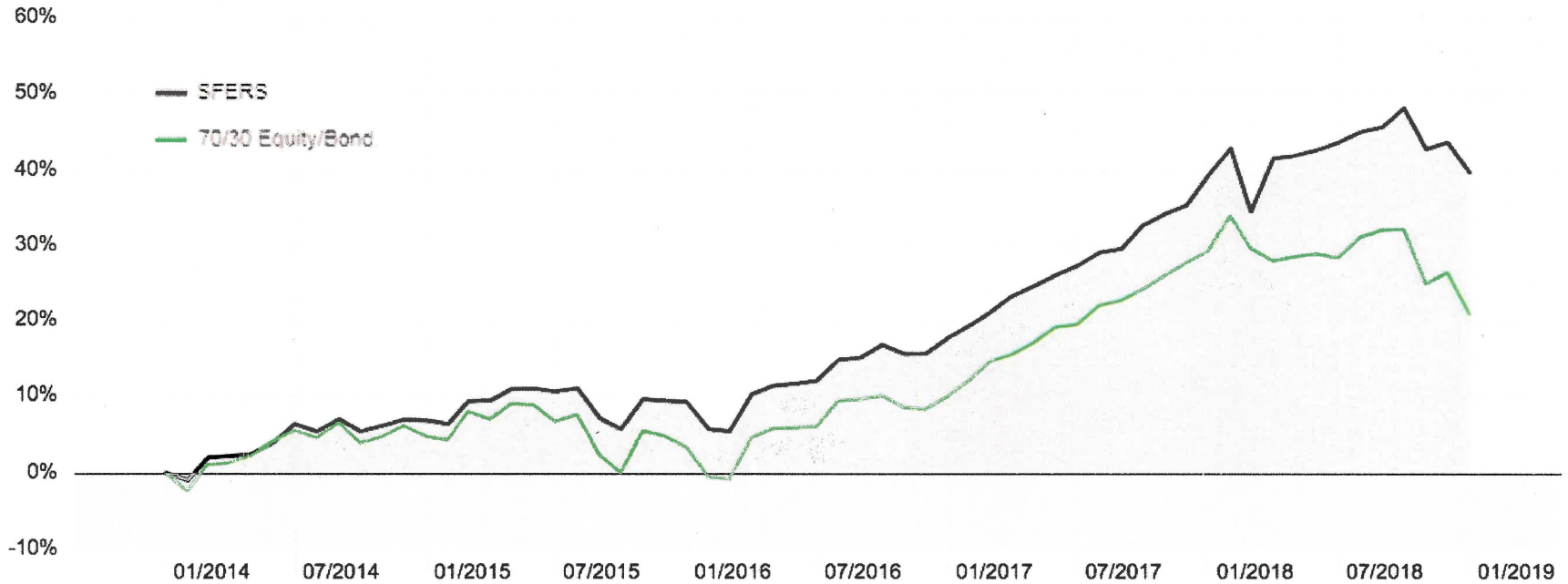
Realized Risk/Return Analytics

	Total Return	Annualized Return	Annualized Volatility	Sharpe Ratio	Downside Deviation	Sortino Ratio	Gain Deviation	Semi Deviation	Loss Deviation	Correlation	Worst Return	Worst Return Date	% of Positive Months	VaR99
SFERS	0.25%	0.25%	10.15%	0.07	7.44%	0.03	5.51%	18.48%	5.52%	1	-5.86%	2/28/2018	75.00%	6.82%
70/30	-6.48%	-6.48%	9.22%	-0.7	7.84%	-0.9	4.33%	13.76%	7.27%	0.66	-5.48%	10/31/2018	58.33%	6.19%



# SFERS Performance Analysis | 5 Years (12/31/2013 – 12/31/2018)

SFERS delivered superior risk-adjusted returns outperforming 70/30 by 18.9% (3.06% annualized) with 16% less risk\*



## Realized Risk/Return Analytics

	Total Return	Annualized Return	Annualized Volatility	Sharpe Ratio	Downside Deviation	Sortino Ratio	Gain Deviation	Semi Deviation	Loss Deviation	Correlation	Worst Return	Worst Return Date	% of Positive Months	VaR99
SFERS	39.80%	6.93%	6.57%	1.06	4.14%	1.62	4.15%	7.26%	5.81%	1	-5.86%	2/28/2018	73.33%	4.41%
70/30	20.94%	3.87%	7.60%	0.54	5.07%	0.75	4.61%	8.40%	5.54%	0.83	-5.48%	10/31/2018	65.00%	5.10%

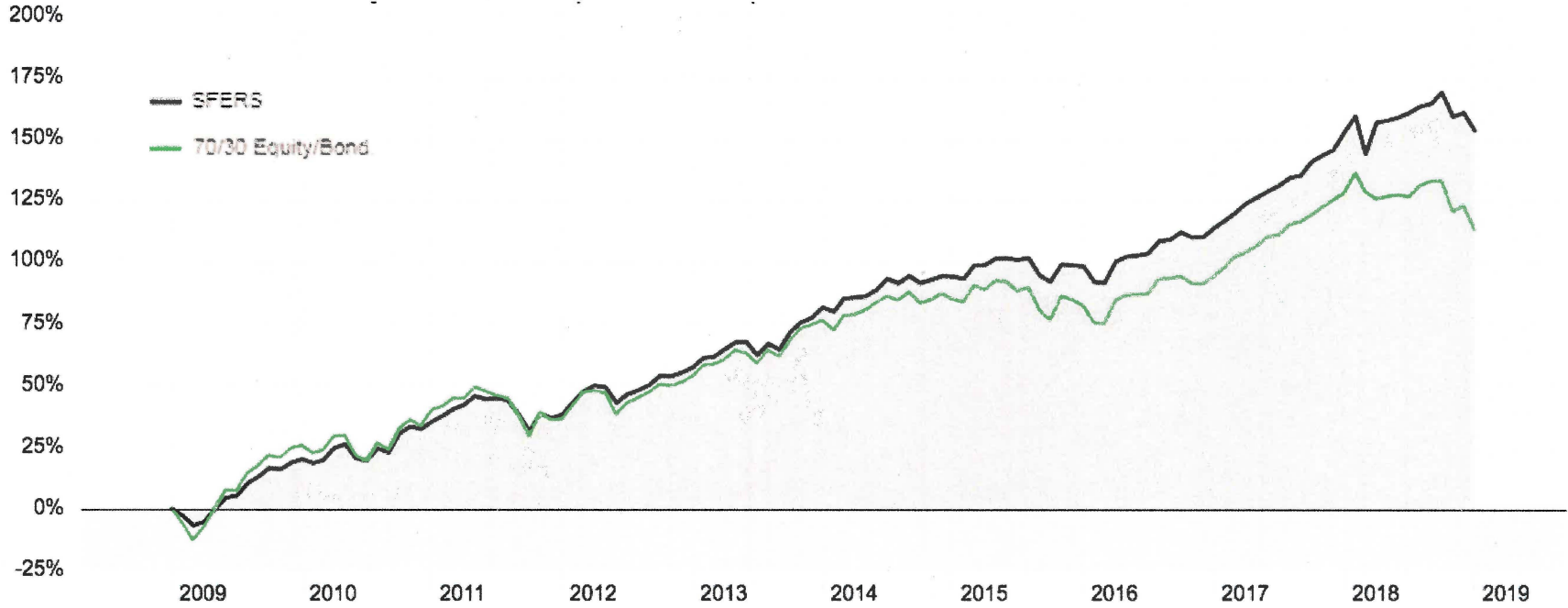


Source: Caissa and Custodian (NT and BNY Mellon) valuations from 12/31/2013 till 12/31/2018  
 70/30 Benchmark is 70% MSCI ACWI Net + 30% Bloomberg Barclays US Aggregate  
 risk is defined as Annualized Volatility

# SFERS Performance Analysis | 10 Years (12/31/2008 – 12/31/2018)

SFERS delivered superior risk-adjusted returns outperforming 70/30 by 40.45% (1.89% annualized) with 32% less risk\*

Compounded Cumulative Returns



Realized Risk/Return Analytics

	Total Return	Annualized Return	Annualized Volatility	Sharpe Ratio	Downside Deviation Ratio	Sortino Ratio	Gain Deviation	Semi Deviation	Loss Deviation	Correlation	Worst Return	Worst Date	Return Positive Months	% of Positive	Var99
SFERS	153.95%	9.77%	7.82%	1.24	4.58%	2.04	4.97%	8.68%	5.74%	1	-5.86%	2/28/2018	71.67%	5.25%	
70/30	113.50%	7.88%	10.29%	0.79	6.25%	1.22	6.90%	10.80%	7.00%	0.92	-6.97%	2/28/2009	64.17%	6.91%	



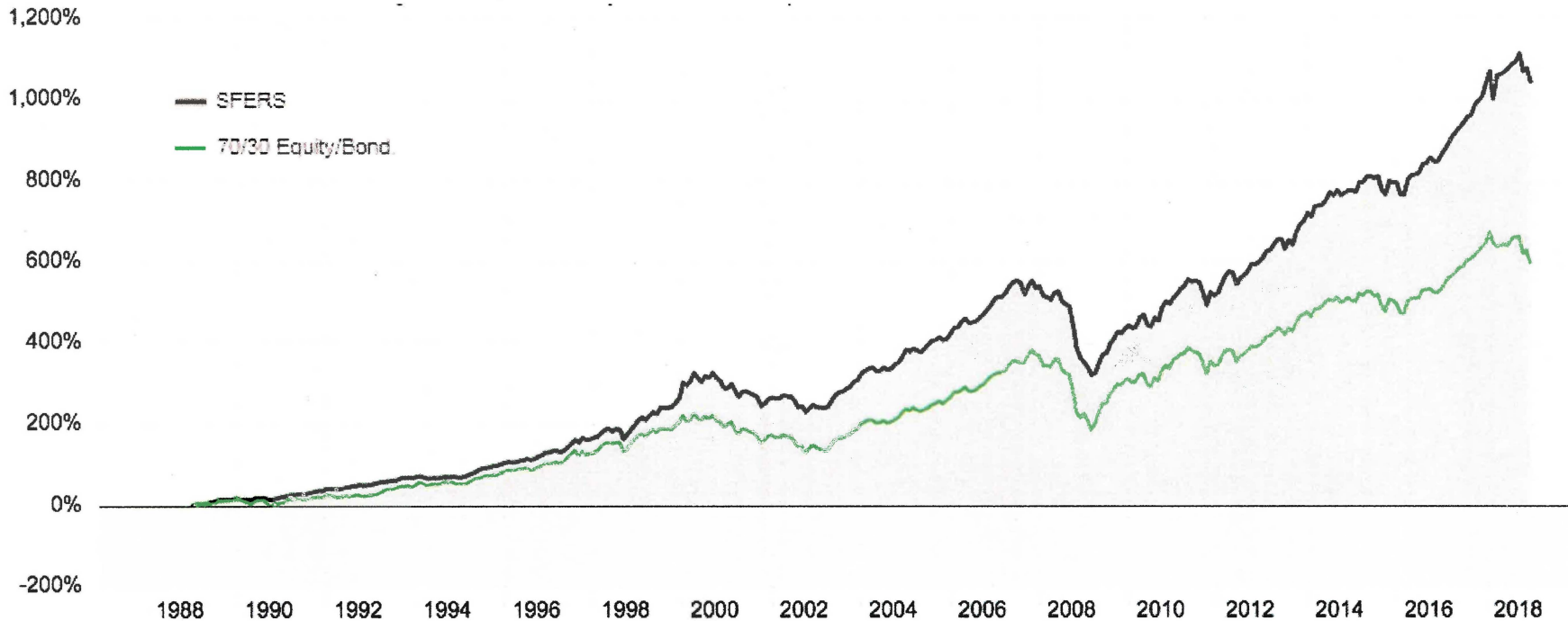
Source: Caissa and Custodian (NT and BNY Mellon) valuations from 12/31/2008 till 12/31/2018  
 70/30 Benchmark is 70% MSCI ACWI Net + 30% Bloomberg Barclays US Aggregate  
 risk is defined as Annualized Volatility



# SFERS Performance Analysis | 30 Years (12/31/1988 – 12/31/2018)

SFERS delivered superior risk-adjusted returns outperforming 70/30 by 449% (1.78% annualized) with 32% less risk\*

Compounded Cumulative Returns



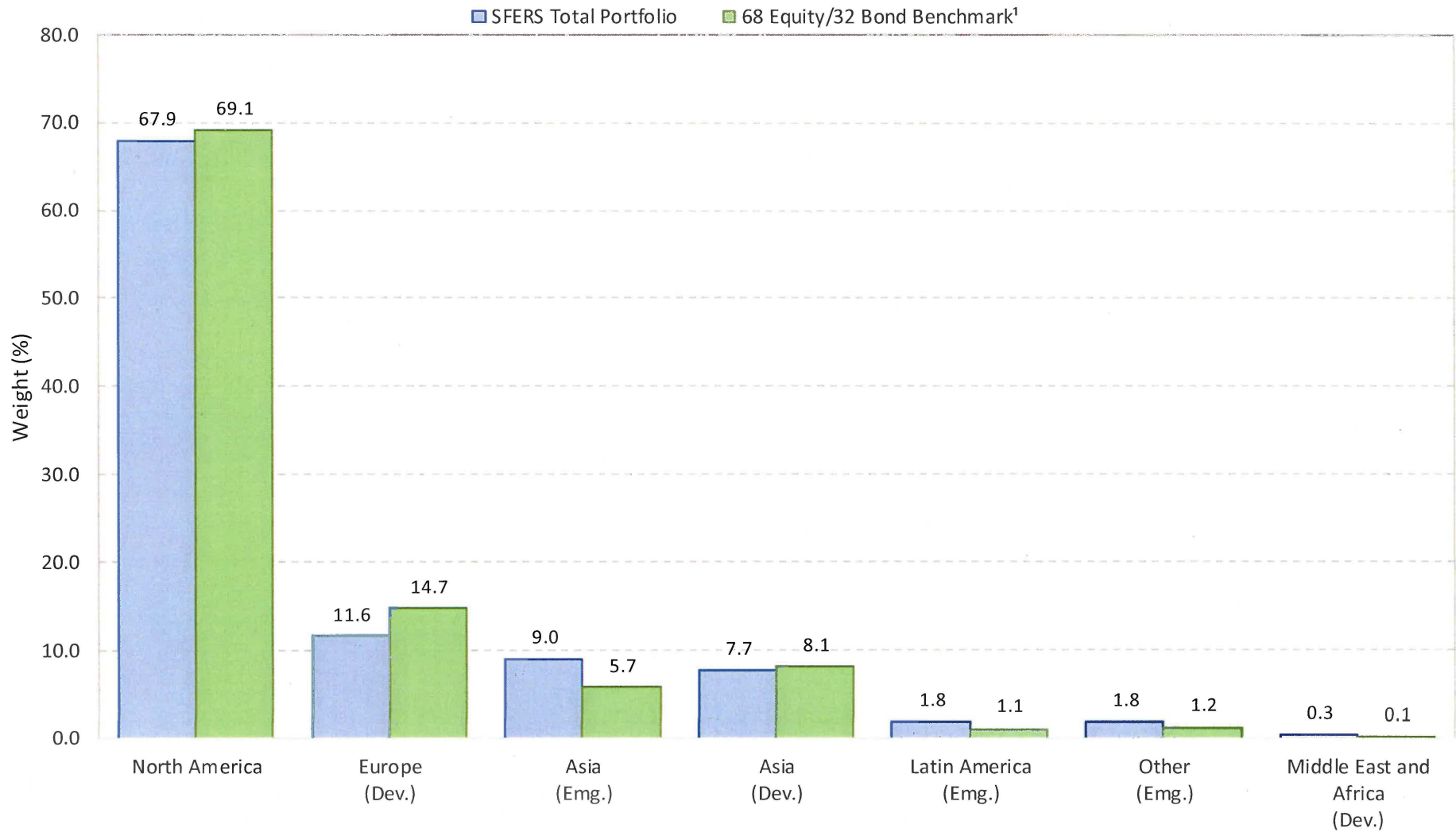
Realized Risk/Return Analytics

	Total Return	Annualized Return	Annualized Volatility	Sharpe Ratio	Downside Deviation Ratio	Sortino Gain	Semi Deviation	Loss Deviation	Correlation	Worst Return	Worst Date	Return Positive Months	% of Positive Return	Var99
SFERS	1046.17%	8.47%	8.06%	1.05	5.11%	1.6	4.78%	9.27%	6.41%	1 -10.74%	10/31/2008	70.00%	70.00%	5.42%
70/30	597.64%	6.69%	10.59%	0.67	7.04%	0.92	6.19%	11.93%	7.89%	0.88 -14.58%	10/31/2008	63.33%	63.33%	7.11%



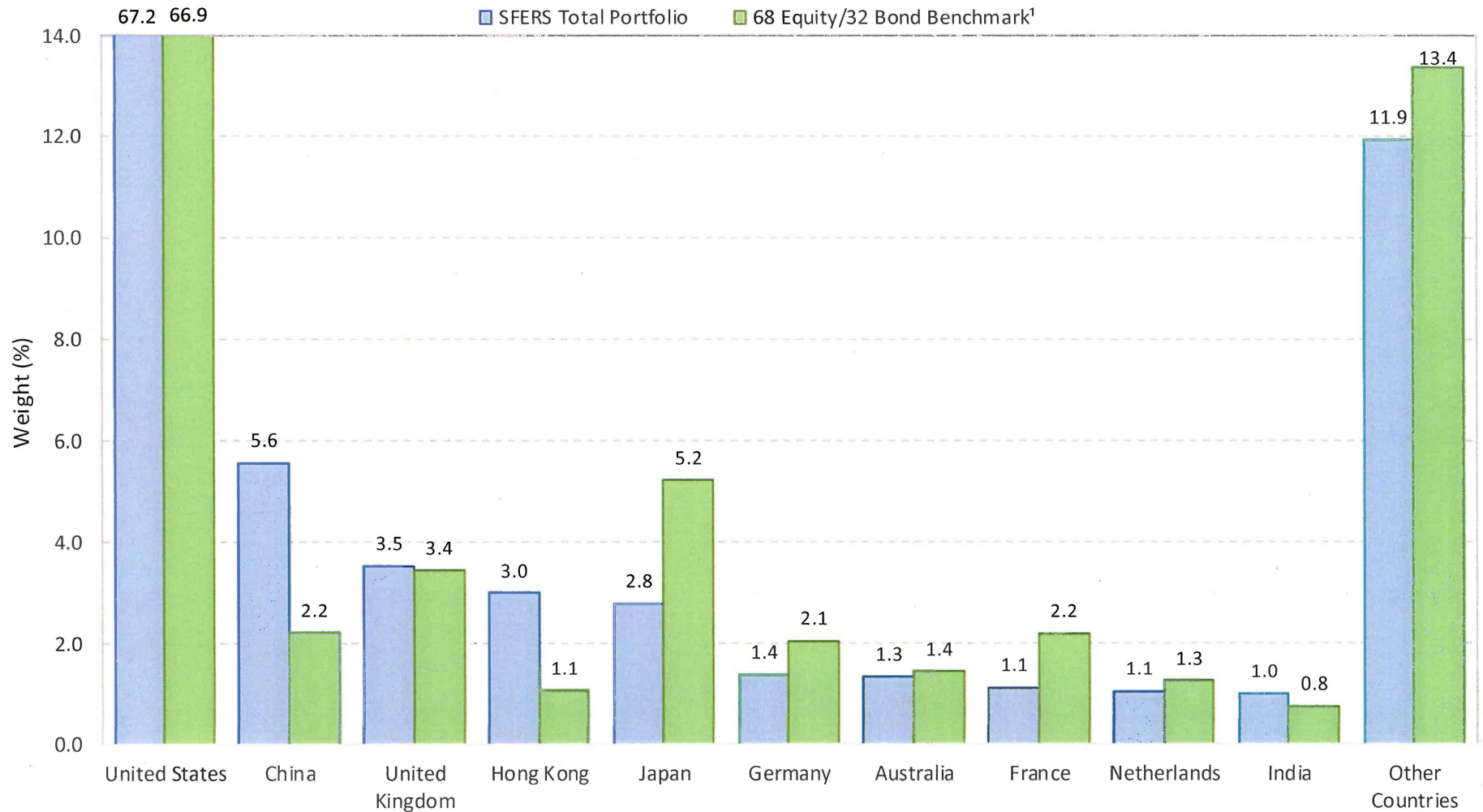
Source: Caissa and Custodian (NT and BNY Mellon) valuations from 12/31/1988 till 12/31/2018  
 70/30 Benchmark is 70% MSCI ACWI Net + 30% Bloomberg Barclays US Aggregate  
 risk is defined as Annualized Volatility

# SFERS Total Fund | Regional Exposures



Notes: Exposures as of December 31, 2018. Shown as a % of net exposure. Regional exposure exclude commodities, supranational and undefined exposures. Europe emerging, MENA emerging and General emerging exposures are bucketed under Other Emerging. FX and Cash are included. <sup>1</sup>68 Equity/32 Bond Benchmark is defined as 68% Global Equity (MSCI ACWI) and 32% Fixed Income (2/3 Bloomberg Barclays Intermediate Treasuries + 1/3 Bloomberg Barclays U.S. Aggregate).

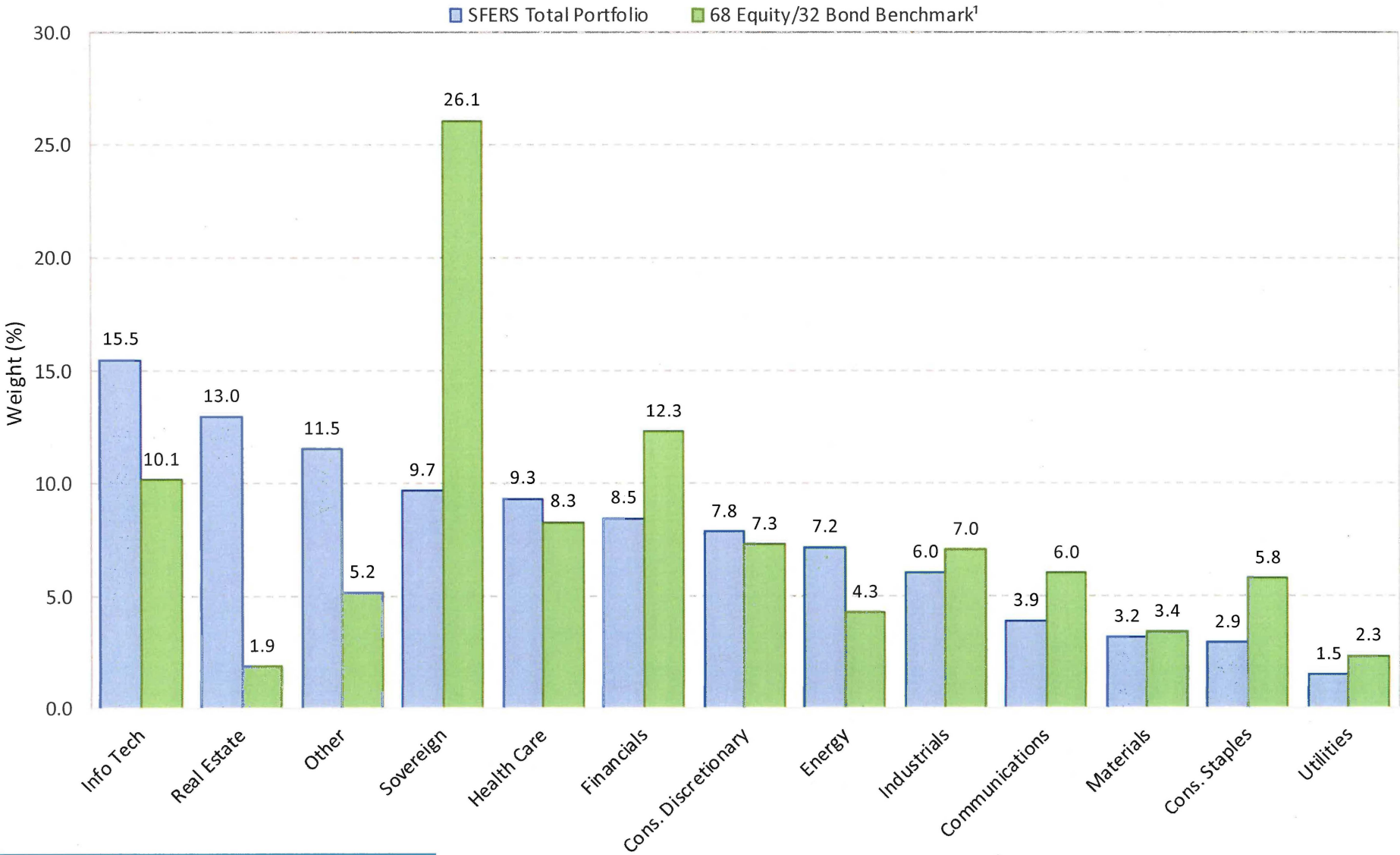
# SFERS Total Fund | Country Exposures



Notes: Exposures as of December 31, 2018. Shown as a % of net exposure. Country exposures exclude Commodities, Supranational and generic undefined exposures. Asia Dev. undefined exposure bucketed as Hong Kong, Asia Emg. undefined exposure bucketed as China, Europe undefined exposure split between UK, France and Germany, and North America undefined exposure bucketed as US. FX and Cash are included. <sup>1</sup>68 Equity/32 Bond Benchmark is defined as 68% Global Equity (MSCI ACWI) and 32% Fixed Income (2/3 Bloomberg Barclays Intermediate Treasuries + 1/3 Bloomberg Barclays U.S. Aggregate).



# SFERS Total Fund | Sector Exposures

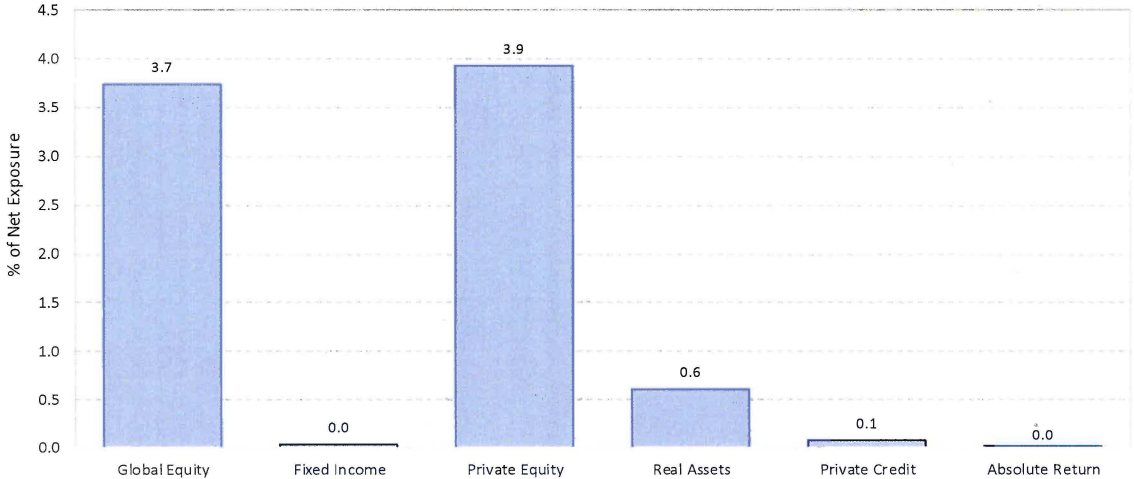


**SFERS**  
San Francisco Employees' Retirement System

Notes: Exposures as of December 31, 2018. Shown as a % of net exposure. FX and Cash are excluded.  
 '68 Equity/32 Bond Benchmark is defined as 68% Global Equity (MSCI ACWI) and 32% Fixed Income (2/3 Bloomberg Barclays Intermediate Treasuries + 1/3 Bloomberg Barclays U.S. Aggregate).

# SFERS Total Fund | Greater China Exposure

**% of Net Exposure**



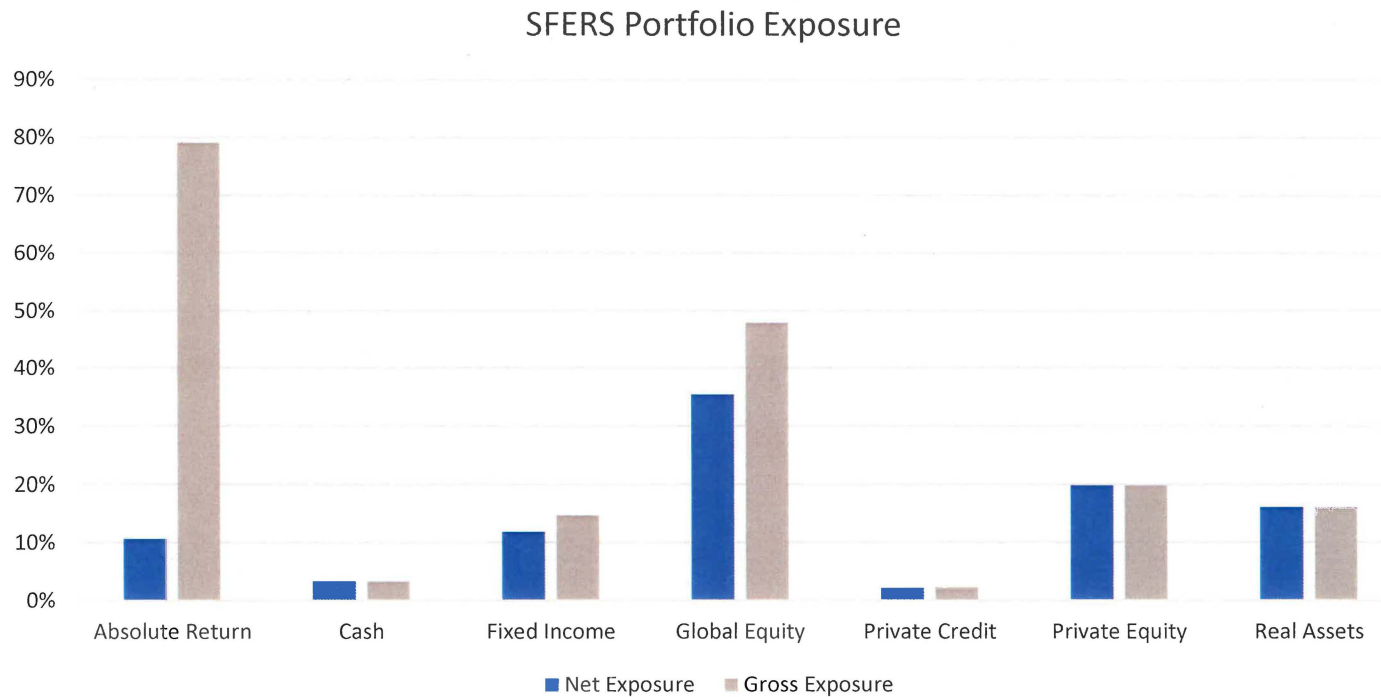
**\$ of Net Exposure**



Notes: Exposures as of December 31, 2018. Greater China includes China, Hong Kong, Taiwan, Singapore and exposures classified as Undefined Asia. Undefined Asia Developed exposures for Absolute Return are assumed to be Japan and excluded from this analysis. Undefined Asia Developed exposure for Private Equity are assumed to be a mix of 90% Greater China countries and 10% other countries.

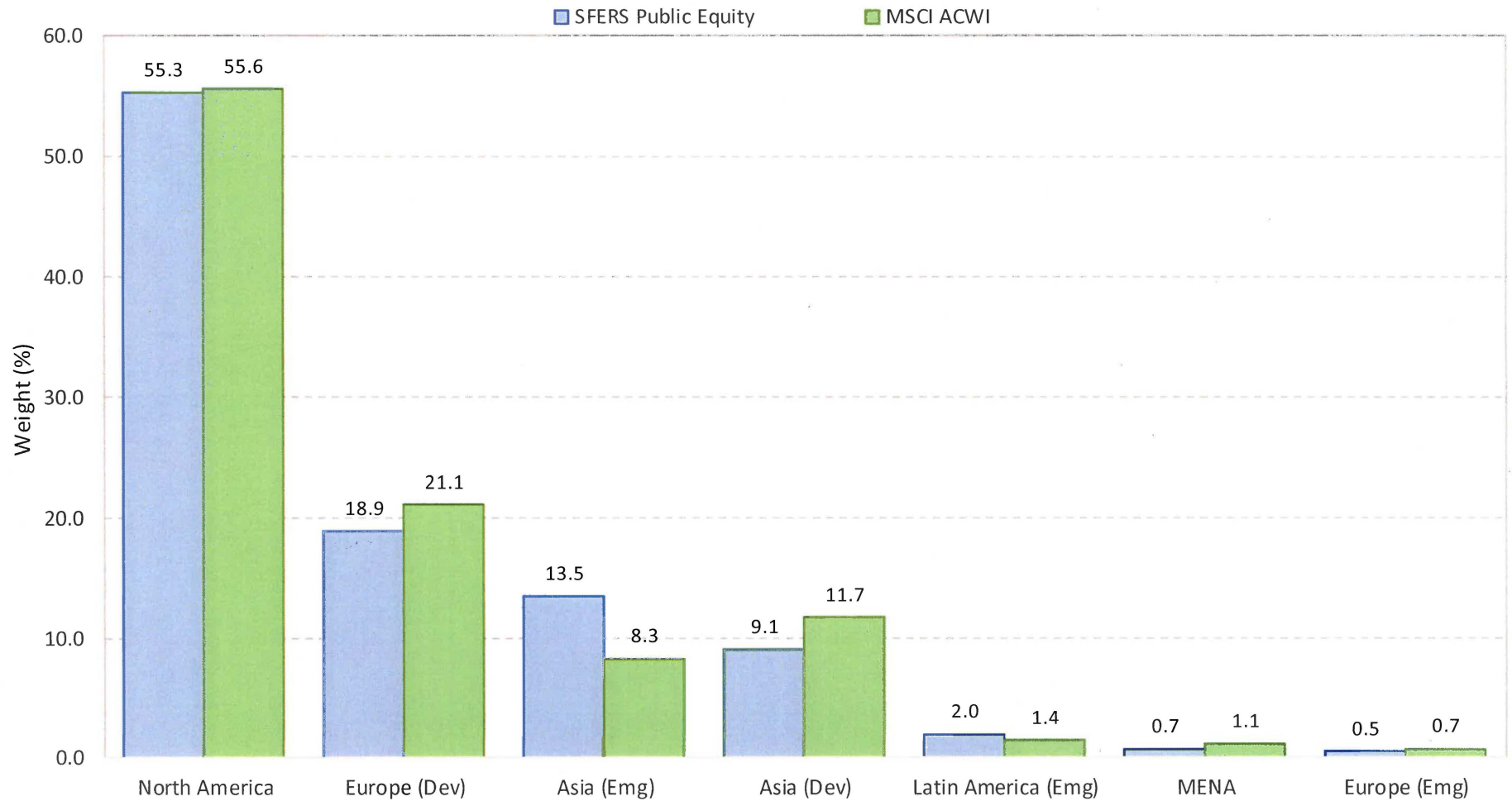
# SFERS Exposure Analysis | Gross and Net Exposures

## Net and Gross Exposures by Asset Class





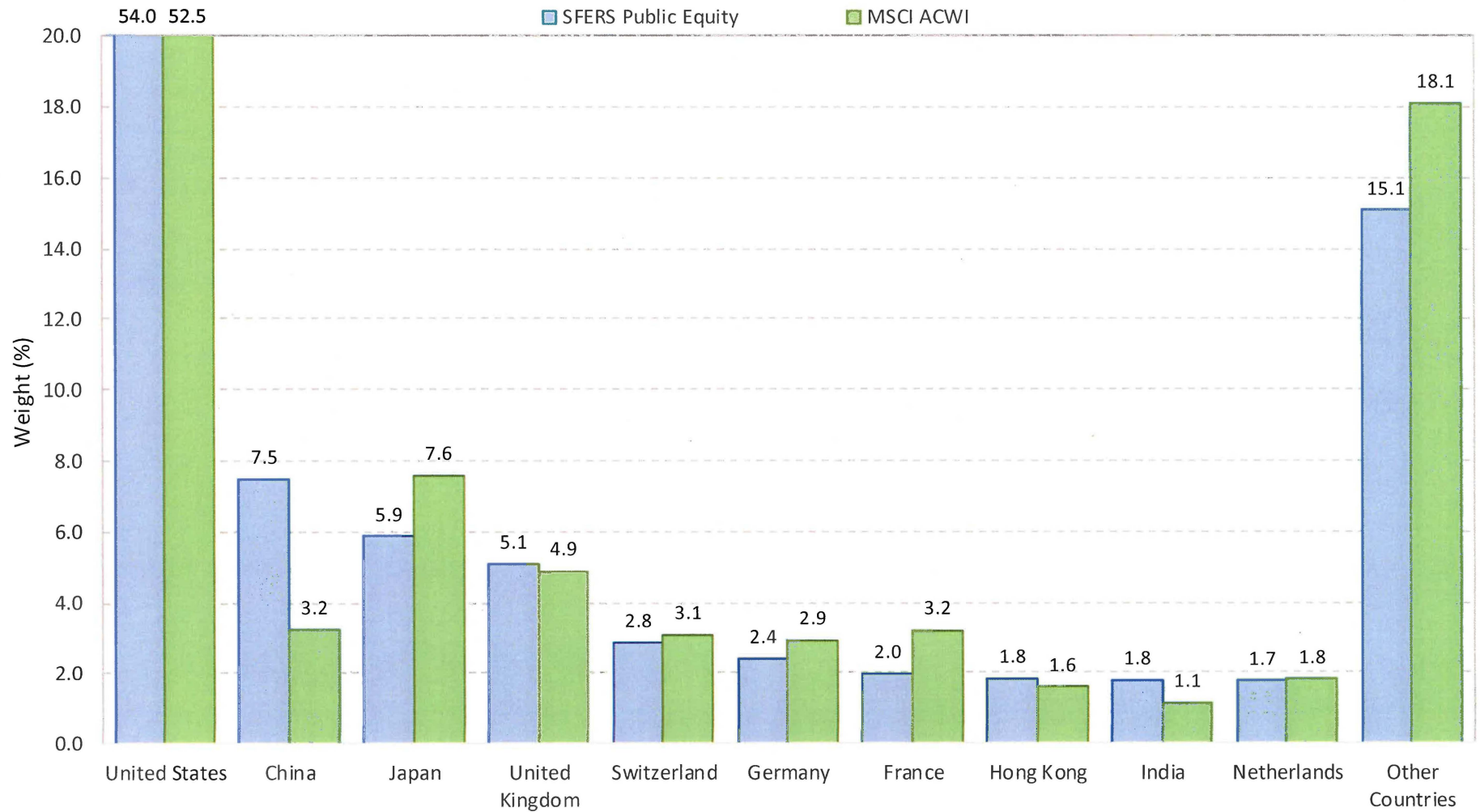
# SFERS Public Equity | Regional Exposures



**SFERS**  
San Francisco Employees' Retirement System

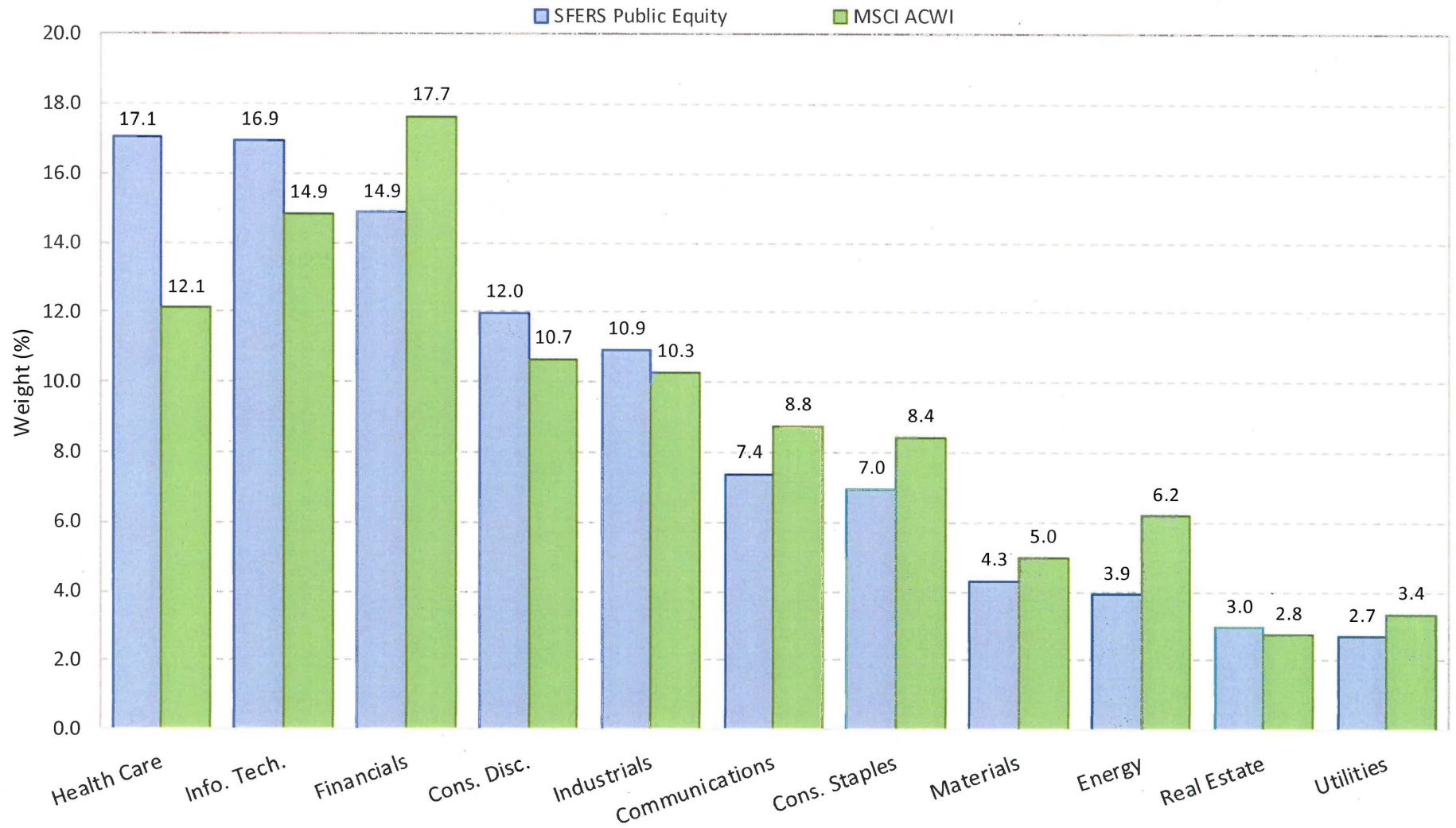
Notes: Exposures as of December 31, 2018. Shown as a % of net exposure. **Regional** exposures exclude undefined exposures, cash and FX. MENA developed and emerging exposures are combined.

# SFERS Public Equity | Country Exposures



Notes: Exposures as of December 31, 2018. Shown as a % of net exposure. **Country** exposures exclude undefined exposures, cash and FX.

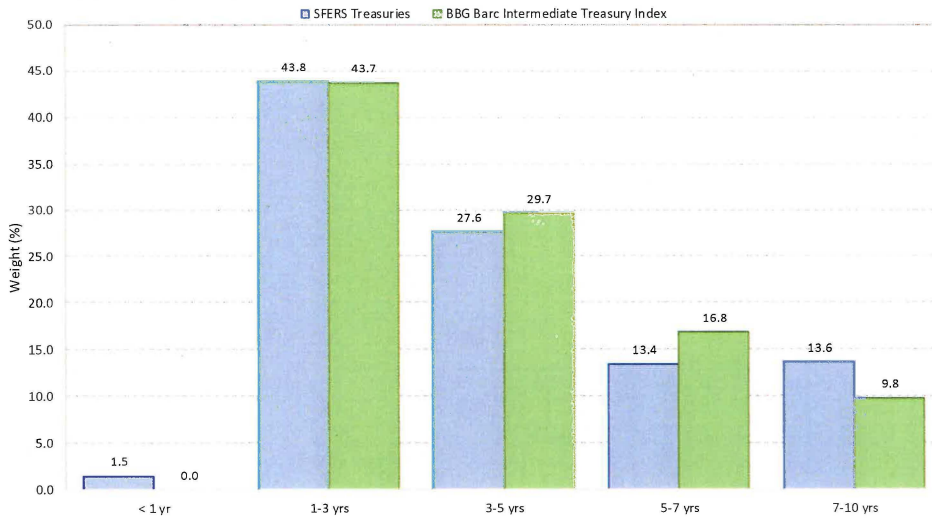
# SFERS Public Equity | Sector Exposures



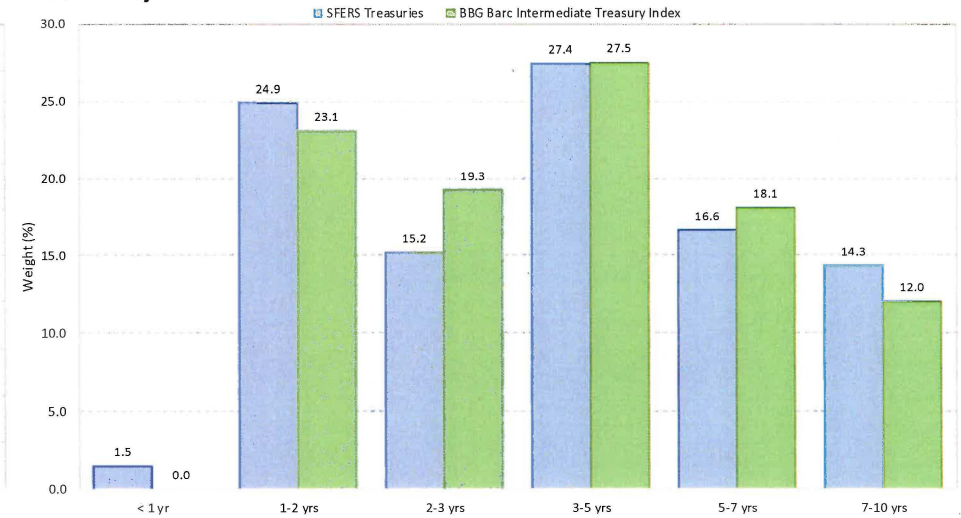


# SFERS Treasuries | Exposures: Duration, Maturity and Risk

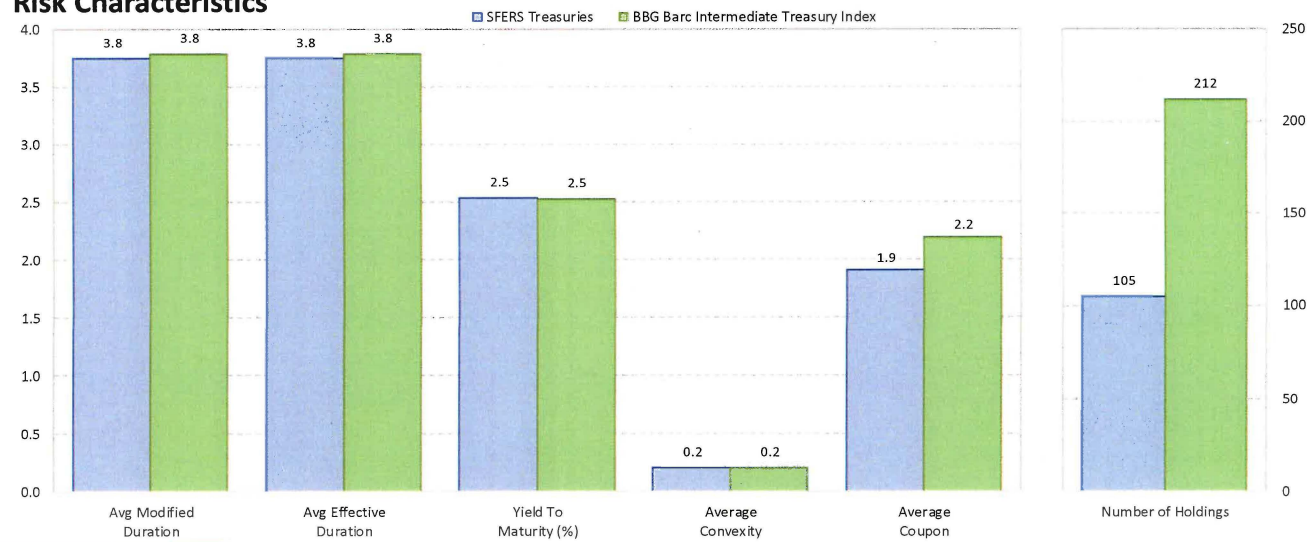
## Duration Buckets



## Maturity Buckets



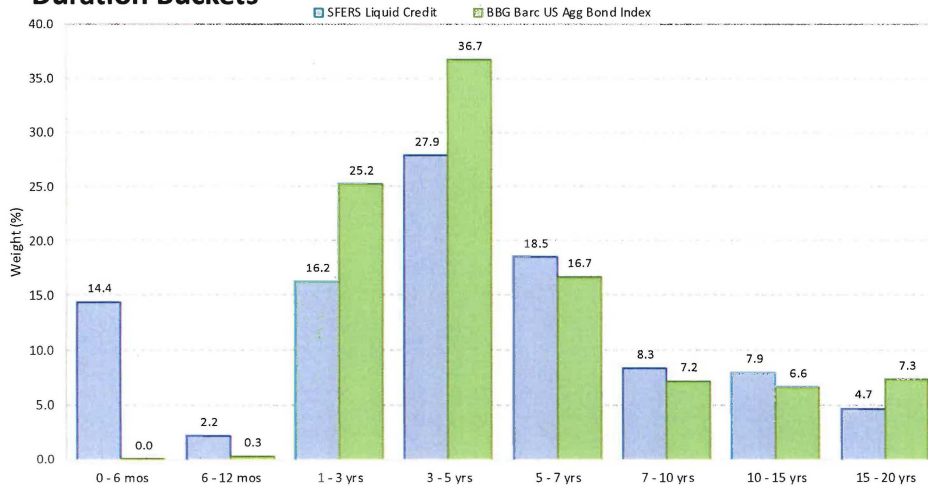
## Risk Characteristics



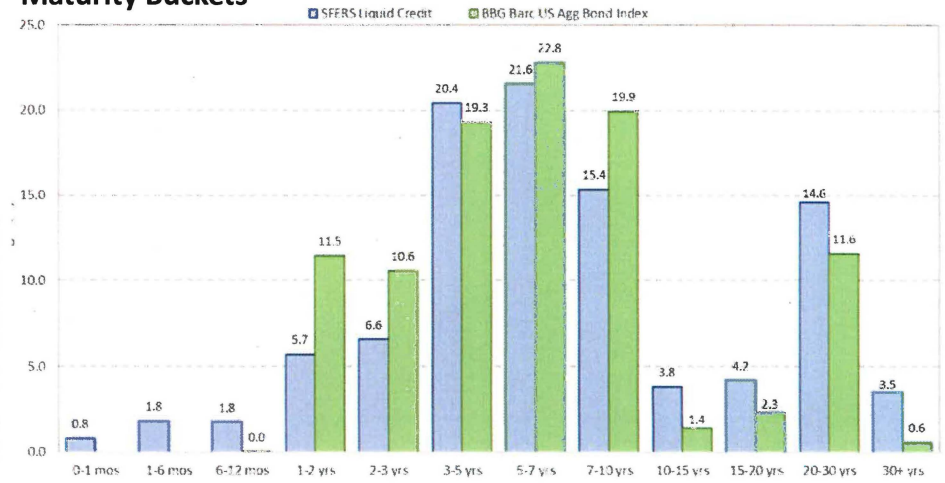
Notes: Exposures as of December 31, 2018.

# SFERS Liquid Credit | Exposures: Duration, Maturity and Risk

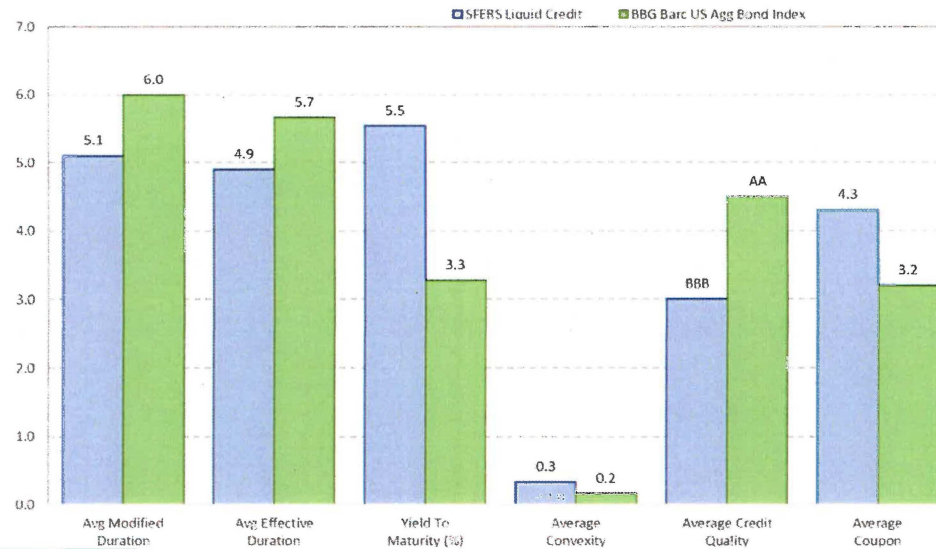
## Duration Buckets



## Maturity Buckets



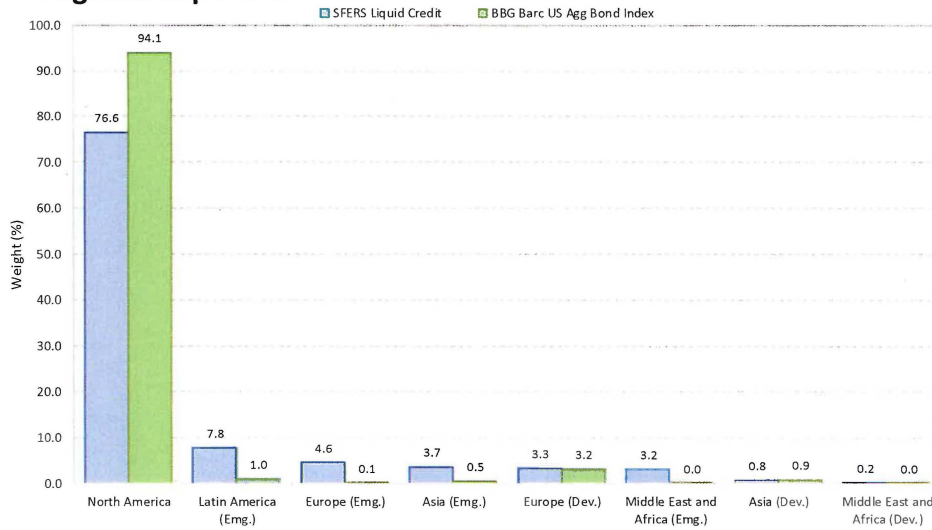
## Risk Characteristics



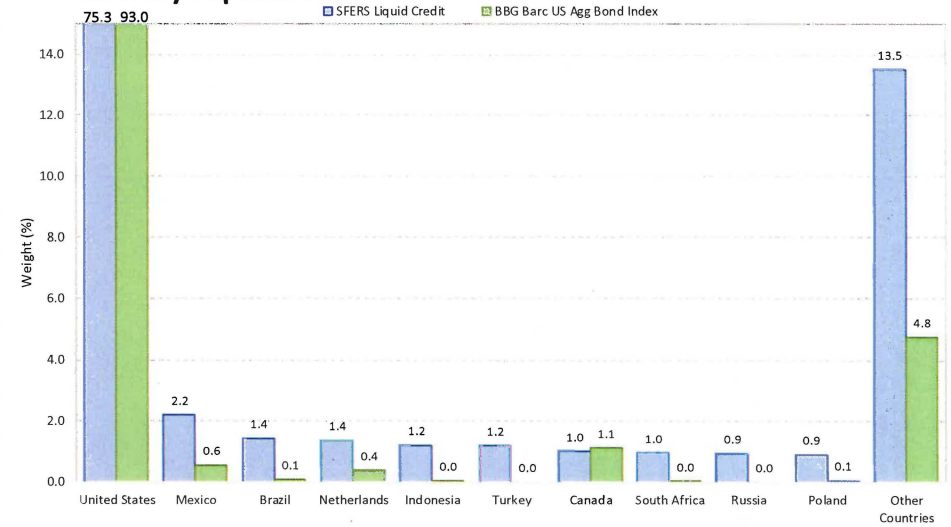
Notes: Exposures as of December 31, 2018.

# SFERS Liquid Credit | Exposures: Regional, Country and Industry

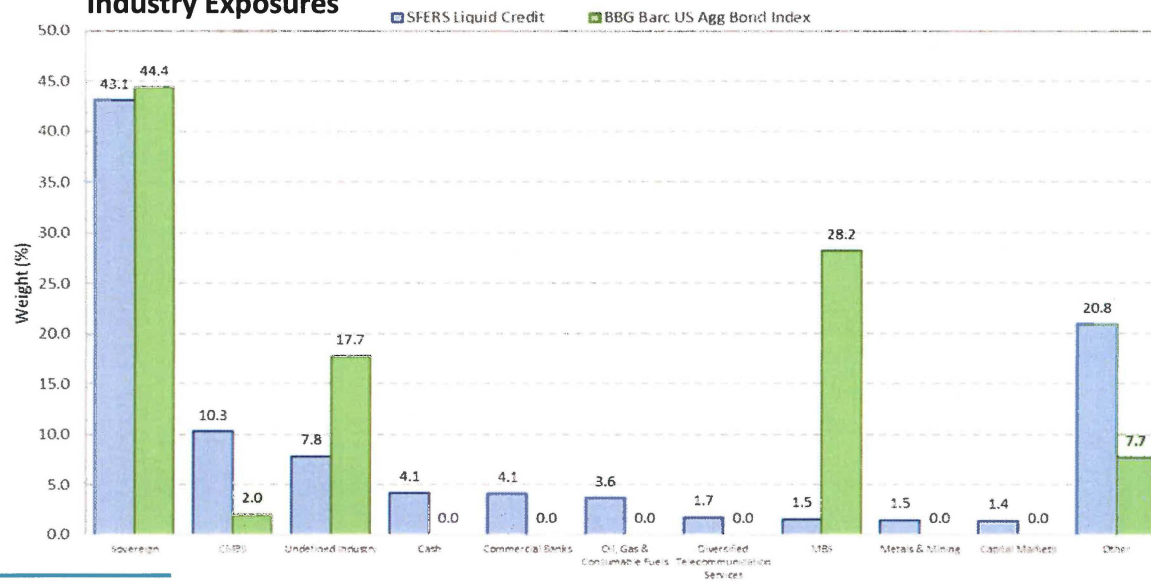
## Regional Exposures



## Country Exposures



## Industry Exposures

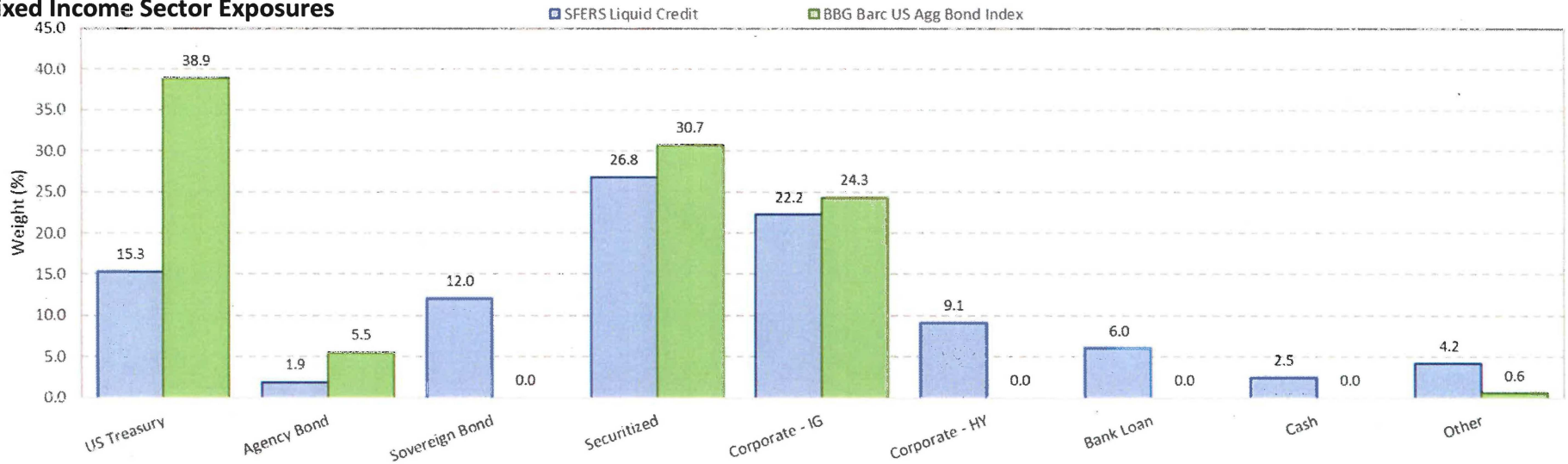


Notes: Exposures as of December 31, 2018. Data from Caissa provided metrics.  
For Country exposures, Undefined Europe Developed exposures bucketed evenly between UK, Germany and France

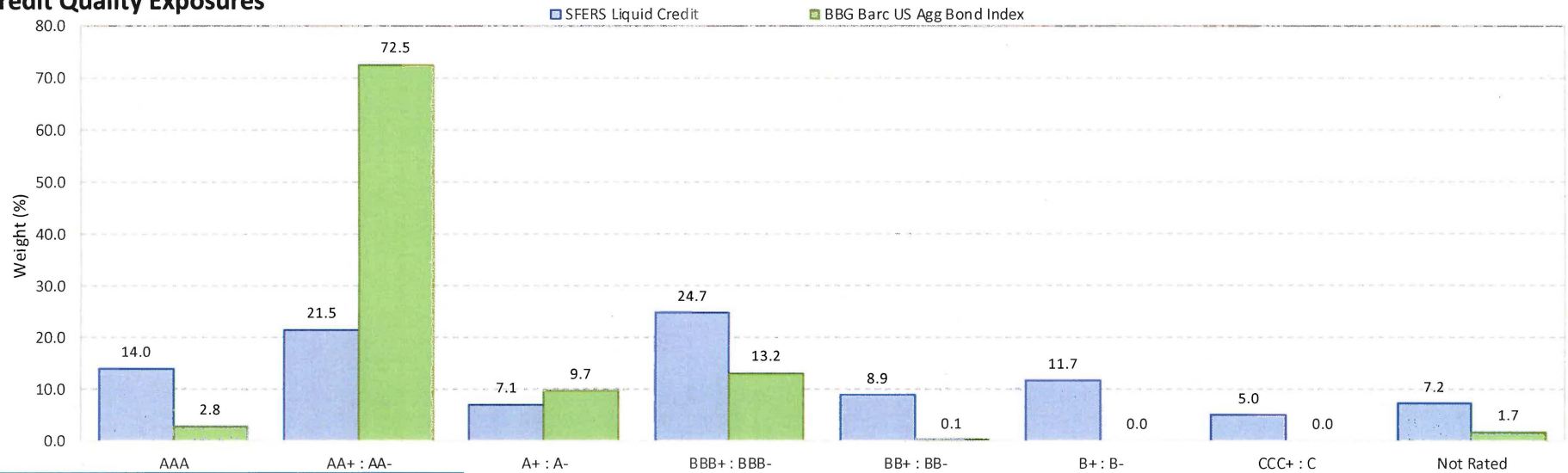


# SFERS Liquid Credit | Exposures: Sector and Quality

## Fixed Income Sector Exposures



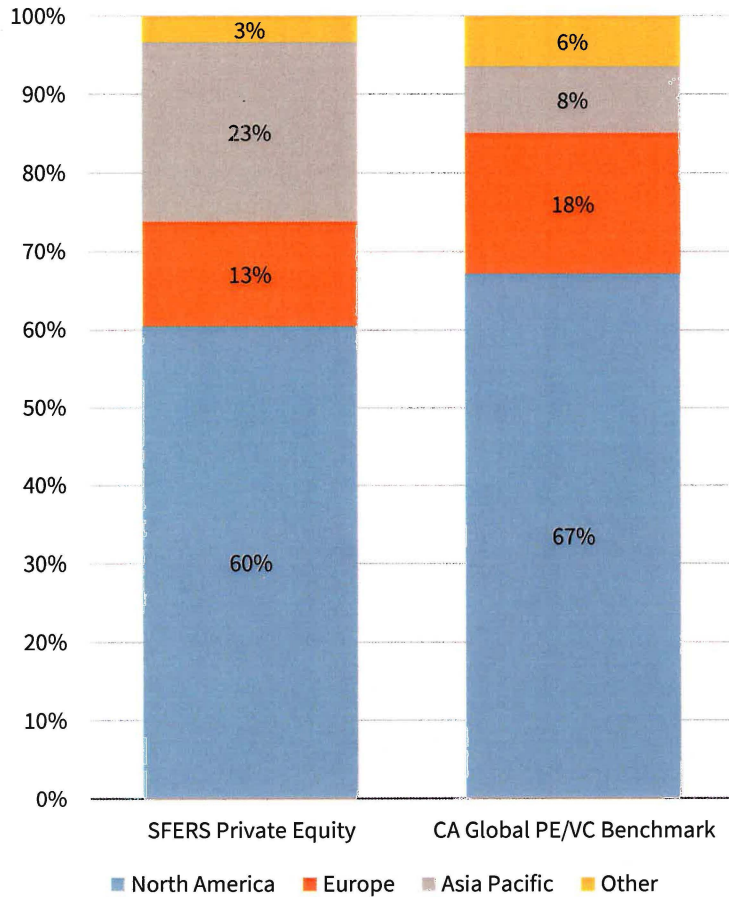
## Credit Quality Exposures



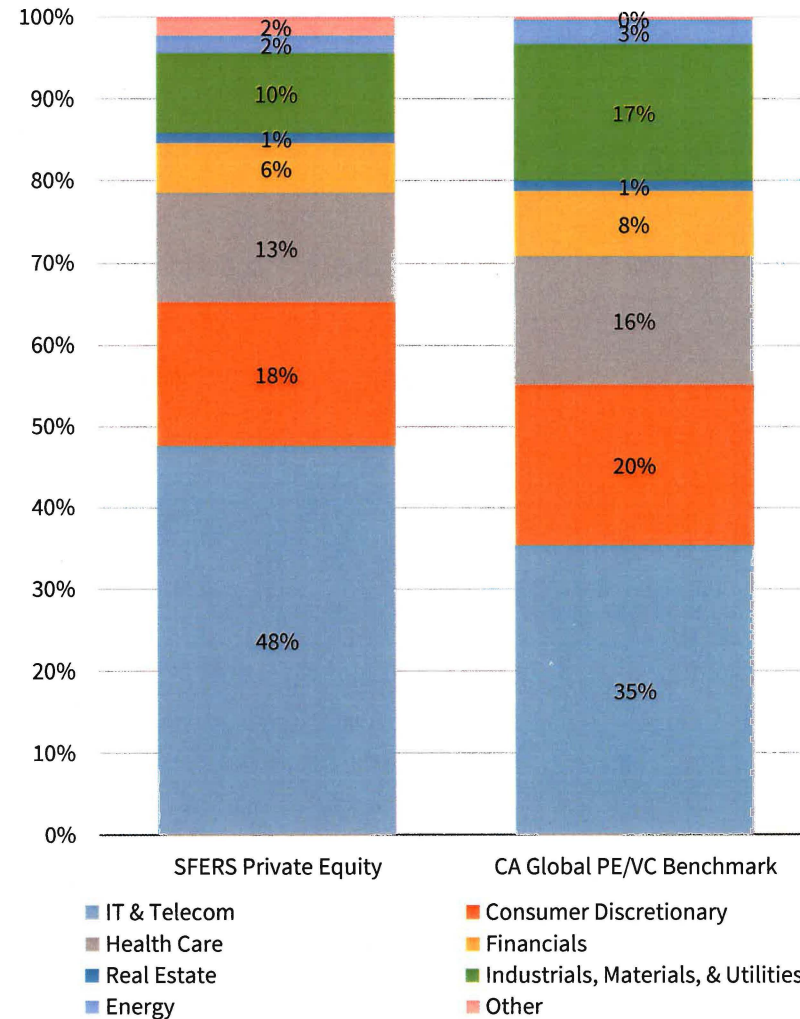
Notes: Exposures as of December 31, 2018.

# SFERS Exposure Analysis | Private Equity

GEOGRAPHIC EXPOSURES



SECTOR EXPOSURES

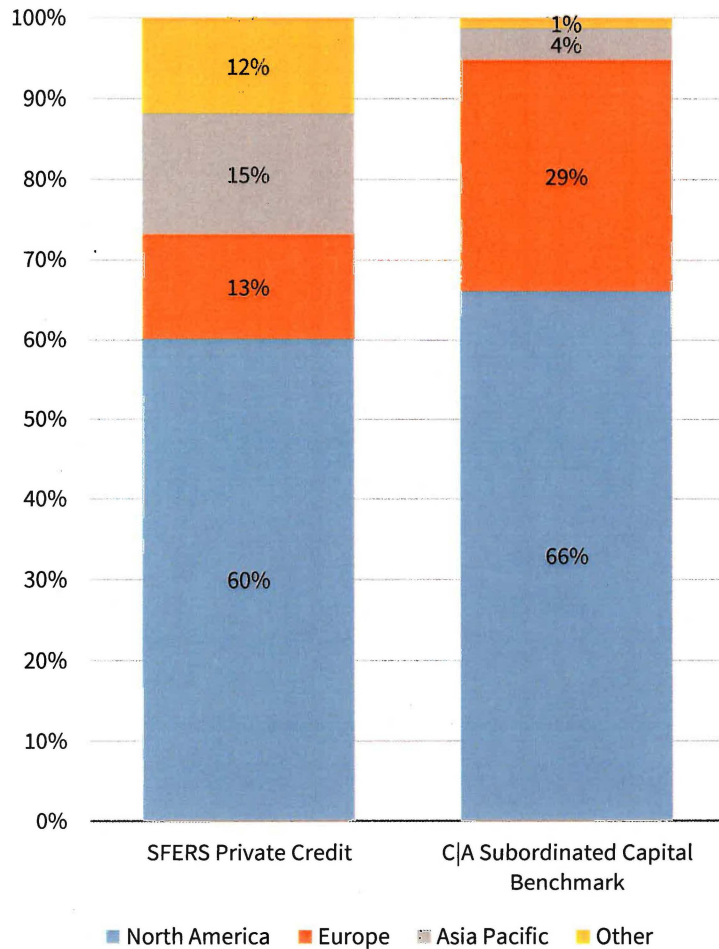


Source: TorreyCove and Cambridge Analytics SFERS and Cambridge Analytics benchmark data as of September 30, 2018. Exposure to Consumer Discretionary includes Consumer Staples exposure. CA benchmark exposures are based on the aggregated CA Global Private Equity and Venture Capital Benchmark NAV and are as of September 30, 2018. Sector exposures for the benchmark are at the investment level. Geographic exposures for the benchmark are at the fund level. Private Equity Energy Funds were removed from the CJA Global Private Equity and Venture Capital Benchmark in the sector breakdown analysis..

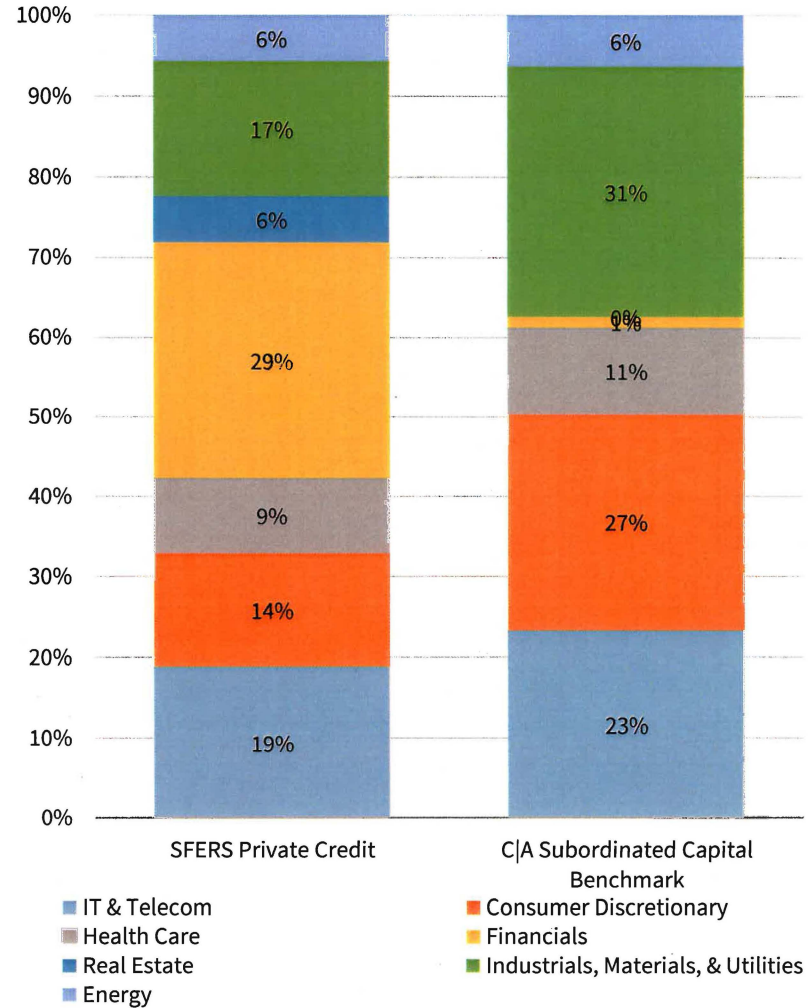


# SFERS Exposure Analysis | Private Credit

GEOGRAPHIC EXPOSURES



SECTOR EXPOSURES

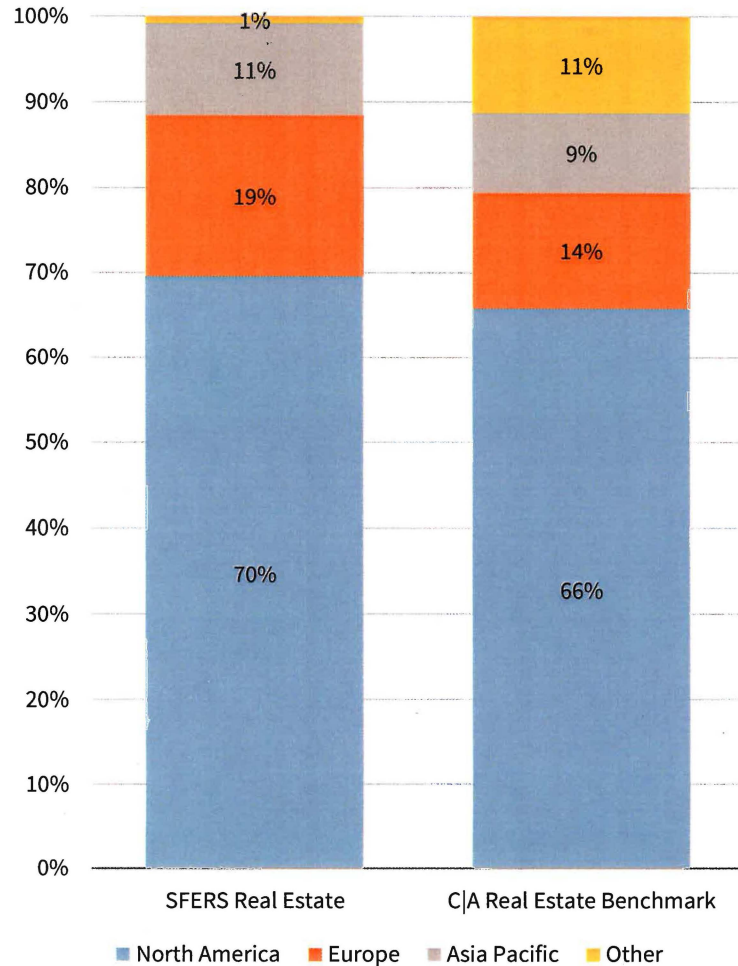


Source: TorreyCove and Cambridge Analytics Both SFERS and Cambridge Analytics benchmark data as of September 30, 2018. Other includes Multi-Region, Latin America, Africa, Middle East, and investments for which geography was not provided. Exposure to Consumer Discretionary includes Consumer Staples exposure. CA benchmark exposures are based on the aggregated CA Subordinated Capital NAV and are as of September 30, 2018. Benchmark exposures are provided at the investment-level.

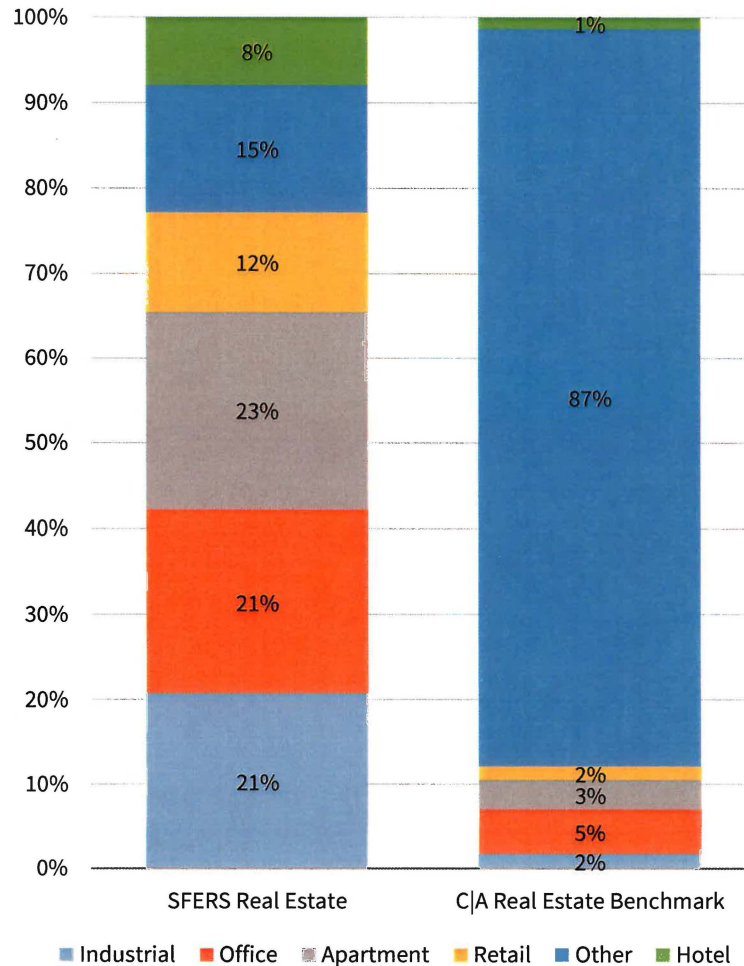


# SFERS Exposure Analysis | Private Real Estate

GEOGRAPHIC EXPOSURES



PROPERTY TYPE EXPOSURES

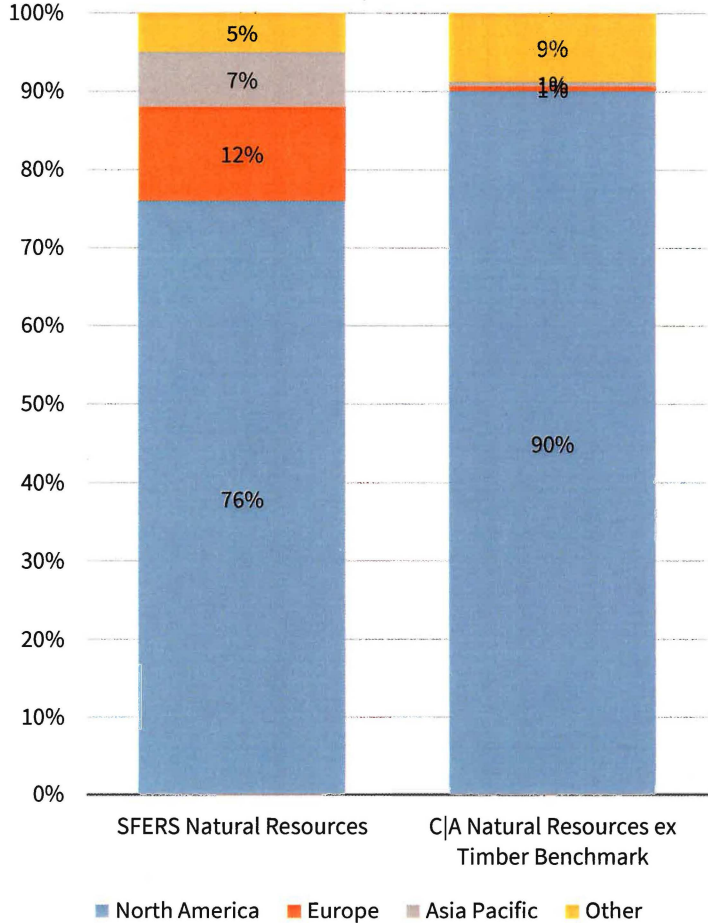


Source: TorreyCove, SFERS Data and Cambridge Benchmark Data as of September 30, 2018. Exposure based on NAV at quarter-end. Data provided by Cambridge Associates. CA Benchmark exposures are based on the aggregated CA Global Real Estate Capitalization and are as of September 30, 2018. Exposures for the benchmark are at the fund level. Other includes data centers, loan pools, manufacturing, storage, and parking garages.

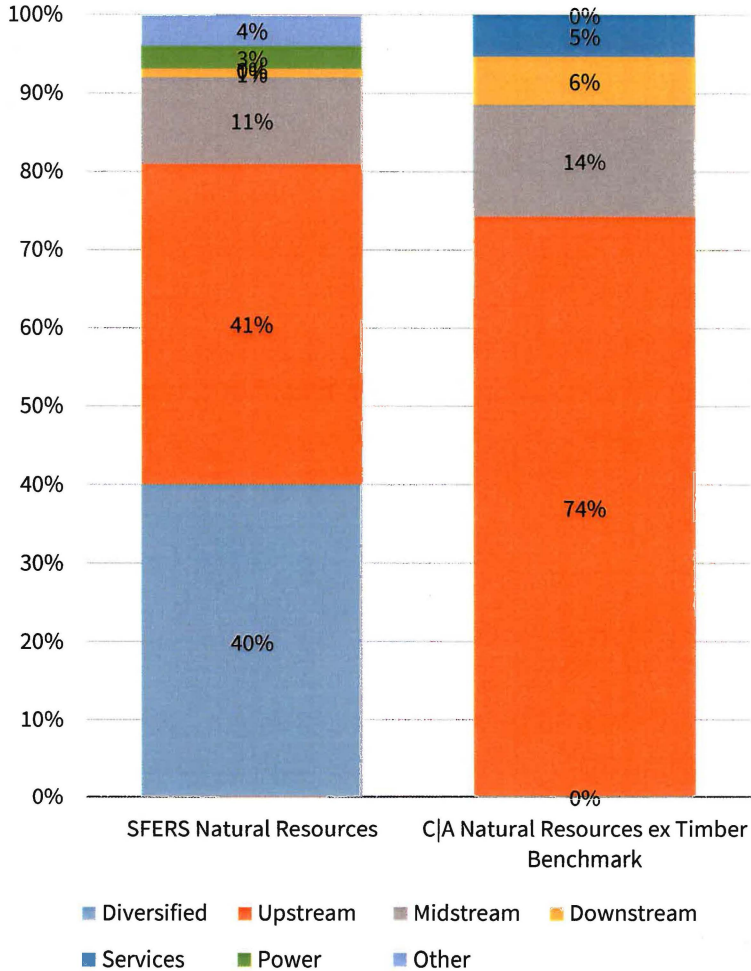


# SFERS Exposure Analysis | Private Natural Resources

GEOGRAPHIC EXPOSURES



VALUE CHAIN EXPOSURES



Source: TorreyCove and Cambridge Analytics Benchmark Data as of September 30, 2018. CA Benchmark exposures are based on the aggregated CA Global Natural Resources Capitalization and are as of September 30, 2018. Exposures for the benchmark are at the fund level. Other includes construction, engineering, services, acquisition company, chemical manufacturer, and other miscellaneous companies.

# Quantitative Analytics Glossary

## **Total Return**

Total time-weighted rate of return earned during the defined time period.

$$\text{Total Return}_t = (1 + \text{Return}_t) \times (1 + \text{Total Return}_{t-1}) - 1$$

## **Annualized Return**

Average annual compounded rate of return earned during the defined time period.

$$\text{Annualized Return} = (1 + \text{Total Return})^{12/N} - 1$$

*N = Number of months in the defined time period*



# Quantitative Analytics Glossary

## Annualized Volatility

Annualized standard deviation (volatility) of monthly returns. Volatility measures the dispersion of return around the average return.

$$\text{Monthly Volatility} = \sqrt{\frac{1}{N-1} \sum_{t=1}^N (\text{Return}_t - \text{Average Monthly Return})^2}$$

$$\text{Annualized Volatility} = \text{Monthly Volatility} \times \sqrt{12}$$

$N$  = Number of months in the defined time period

## Sharpe Ratio

Return in excess of the risk-free rate per unit of risk.

$$\text{Sharpe Ratio} = \frac{\text{Average Monthly Return} - \text{Period Risk Free Rate}}{\text{Monthly Volatility}} \times \sqrt{12}$$



# Quantitative Analytics Glossary

## Annualized Downside Deviation

Volatility of returns below a specified minimum acceptable return (MAR).

$$\text{Downside Deviation} = \sqrt{\frac{1}{N} \sum_{r_t < \text{MAR}}^N (r_t - \text{MAR})^2} \times \sqrt{12}$$

$N$  = Number of months in the defined time period

$\text{MAR}$  = Minimum Acceptable Return

## Sortino Ratio

An alternative to the Sharpe Ratio, the Sortino Ratio measures the compound average return in excess of the minimum acceptable return (MAR) per unit of downside deviation below the MAR.

$$\text{Sortino Ratio} = \frac{\text{Compound Average Monthly Return} - \text{MAR}}{\text{Monthly Downside Deviation}} \times \sqrt{12}$$

$\text{MAR}$  = Minimum Acceptable Return

$N$  = Number of months in the defined time period





# Quantitative Analytics Glossary

## Annualized Gain Deviation

Volatility of returns at or above 0%.

$$\text{Gain Deviation} = \sqrt{\frac{1}{N-1} \sum_{\text{Return}_t \geq 0}^N (\text{Gain Return}_t - \text{Mean Gain Return})^2 \times \sqrt{12}}$$

$N$  = Number of months in the defined time period where return is greater than or equal to 0%

$\text{Gain Return}_t = \text{Return}_t$  if  $\text{Return}_t \geq 0$  and 0 if  $\text{Return}_t < 0$

$\text{Mean Gain Return} = \text{Sum of Gain Return}_t$  for defined time period divided by  $N$

## Annualized Semi Deviation

Volatility of returns below the average return.

$$\text{Semi Deviation} = \sqrt{\frac{1}{N-1} \sum_{\text{Return}_t < \text{Average Return}}^N (\text{Semi Return}_t - \text{Average Return})^2 \times \sqrt{12}}$$

$N$  = Number of months in the defined time period where return is less than the Average Return for the period

$\text{Semi Return}_t = \text{Return}_t$  if  $\text{Return}_t < \text{Average Return}$  and  $\text{Average Return}$  if  $\text{Return}_t \geq \text{Average Return}$

$\text{Average Return} = \text{Mean return}$  for all return observations in the defined time period



# Quantitative Analytics Glossary

## Annualized Loss Deviation

Volatility of returns below 0%.

$$\text{Loss Deviation} = \sqrt{\frac{1}{N-1} \sum_{\text{Return}_t < 0}^N (\text{Loss Return}_t - \text{Mean Loss Return})^2 \times \sqrt{12}}$$

$N$  = Number of months in the defined time period where return is less than 0%

$\text{Loss Return}_t$  =  $\text{Return}_t$  if  $\text{Return}_t < 0$  and 0 if  $\text{Return}_t \geq 0$

$\text{Mean Loss Return}$  = Sum of  $\text{Loss Return}_t$  for defined time period divided by  $N$

## Correlation

Indicates the extent two return series fluctuate together. Positive correlation indicates the extent to which the two return series increase or decrease in parallel. Negative correlation indicates the extent to which one return series moves in the opposite direction as the other return series.

$$\text{Correlation}_{x,y} = \frac{\sum_{t=1}^N (\text{Return}_{x,t} - \text{Average Return}_x)(\text{Return}_{y,t} - \text{Average Return}_y)}{(N-1) \times \text{Monthly Volatility}_x \times \text{Monthly Volatility}_y}$$

$N$  = Number of months in the defined time period

$x$  = One of the two return series

$y$  = The other one of the two return series

# Quantitative Analytics Glossary

## **Worst Return**

Lowest periodic return within an entity's return series associated with the defined time period.

## **Worst Return Date**

Date of the lowest periodic return within an entity's return series associated with the defined time period.

## **% of Positive Months**

Percent of periodic returns within an entity's return series that are greater than zero within the defined time period.

## **VaR**

Value at Risk expressed in %.

$$VaR = Z \text{ Score} \times \text{Standard Deviation of Returns}$$

*Z Score = Z Score at the specified confidence level*

<u>Confidence Level</u>	<u>Z Score</u>
90%	1.28155
95%	1.64485
99%	2.32635

