



RETIREMENT BOARD CALENDAR SHEET
Retirement Board Meeting of October 14, 2020

To: The Retirement Board

Through: Jay Huish 
Executive Director

From: William Coaker, Jr. – CFA
Chief Investment Officer

Anna Langs - CFA, FRM
Managing Director, Asset Allocation
Risk Management, Innovative Solutions

Date: October 14, 2020

Agenda Item:

Risk Review for SFERS Total Plan

Background:

SFERS Investment Staff presents its annual update for Risk Management. The update provides an overview of SFERS Risk Management Framework, evaluates key risk drivers for the Total Plan and each asset class, highlights current and historical exposures and concentrations, examines risk adjusted performance and whether SFERS was paid for taking these risks, and concludes with a review of relevant stress tests and scenario analysis.

Over the past 5 years SFERS increased its concentration in the following 4 areas:

- Technology
- Health Care
- China
- Active Management

SFERS benefited substantially from taking those risks.

Recommendation:

This item for discussion only

Attachments:

- Staff's Memorandum on Risk Review for SFERS Total Plan
- Staff's Presentation "Risk Review for SFERS Total Plan"




SFERS

San Francisco Employees' Retirement System

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DATE: October 14, 2020

TO: Members of the Retirement Board

THROUGH: Jay Huish 
Executive Director

FROM: William J. Coaker Jr., CFA, MBA
Chief Investment Officer

Anna Langs, CFA
Managing Director – Asset Allocation, Risk Management,
and Innovative Solutions

SUBJECT: Risk Review for SFERS Total Plan

Overview

This memo provides a synopsis of the document titled "Risk Review for SFERS Total Plan." The memo is summarized according to the documents three sections: 1 – Risk and Performance; 2 – Exposure Analysis; 3 – Stress Tests and Scenarios. The memo then summarizes the documents findings.

1 – Risk and Performance

A – Asset Allocation

Page 5 shows that SFERS current allocation to Public Equity is at an all-time low since 1996. That has occurred even as bond yields have dropped to unprecedented levels, which has led SFERS to significantly reduce its allocation to Fixed Income. SFERS allocation to Private Markets has jumped from about 15% in 1996 and 28% as recently as 2014 to 45% today. SFERS also has a strategic allocation of 15% to Absolute Return, resulting in a total of 60% to Alternative Investments (meaning, Private Markets plus Absolute Return).

In sum, SFERS allocation to Public Markets is at all-time lows and its weight to Private Markets and Alternative Investments is at historic highs. That has helped reduce the volatility of Plan returns but it has also reduced liquidity.

B – Allocation of Risk

The graph on the upper right of Page 7 shows that 73.0% of SFERS total risk is from Equities, meaning the combination of Public and Private Equity. Both asset classes contribute more to total plan risk than their strategic weight. Public Equity has a strategic weight of 31.0% but contributes 46.9% to the Plan's total risk. Private Equity has a strategic allocation of 18.0% but it contributes 23.1% to total risk.

SFERS other asset classes – Real Assets, Absolute Return, Private Credit, Liquid Credit, and Treasuries – all contribute less to total plan risk than their strategic weight.

The most diversifying asset class is Treasuries. Treasuries have an allocation of 6% but it reduces total plan risk by 1%.

The next most diversifying asset class – meaning, the proportion of its strategic allocation to total plan risk – is Real Assets. Real Assets have an allocation of 17.0% while contributing about half of its weight, or 8.7%, to total risk.

The third most diversifying asset class – again, as measured by the proportion of its strategic weight to its contribution to total plan risk – is Absolute Return. Absolute Return has a strategic weight of 15% while contributing just over half of its weight, or 9%, to total plan risk.

The fourth most diversifying asset class is Liquid Credit. Liquid Credit has a strategic weight of 3% while it contributes 2/3rds of its weight, or 2%, to total risk.

The fifth most diversifying asset class is Private Credit. Private Credit has a strategic weight of 10% while it contributes slightly less than that, 8.2%, to the plan's total risk.

If the Retirement Board sought to reduce plan risk, then among these five asset classes, it would first increase the allocation to Treasuries, which has been by far the most risk-reducing asset class. Treasuries are also liquid, which is desirable as SFERS payments for pension benefits will begin rising significantly over the next 5 to 10 years. However, since yields are ultra-low, in normal markets the return on Treasuries will be exceedingly low, and in periods marked by higher interest rates intermediate and long-term Treasuries could post negative returns.

If the Retirement Board sought to pursue higher returns, it would consider increasing the allocation to Public Equity, Private Equity, Real Assets, and Private Credit. Boosting Public Equity, however, increases volatility, while increasing Private Equity would increase volatility and reduce liquidity. Increasing Real Assets and Private Credit would also reduce liquidity and could increase plan volatility, depending on what asset classes were reduced.

Liquidity will become more important, given our high allocation to illiquids while our annual payout for pension benefits will rise from \$500 million today to \$900 million in the next four years to \$1.3 billion before the end of the decade.

C - Total Plan Volatility

Pages 12 to 14 show that SFERS Annualized Volatility is considerably lower than our peers. Over the past one year, which was quite volatile, SFERS incurred volatility of 8.2% versus our median peers' volatility of 12.8%. That means SFERS experienced 35.9% less volatility over the past one year than the median public pension plan with assets over \$1 billion. SFERS also incurred 28.3% and 21.0% less volatility over the past 3 and 5 years, respectively, than our peers.

SFERS has solidly outperformed the median public pension plan – by 1.1% over the past one year and a cumulative total of 7.4% and 12.1% over the past 3 and 5 years, respectively. SFERS solidly outperformed over the past 1, 3 and 5 years, even as we incurred considerably less volatility than our peers.

Time Frame	SFERS Volatility	Median Peer Volatility	SFERS Volatility Above (Below) Median Peer
1 Year	8.2%	12.8%	-35.9%
3 Years	6.6%	9.2%	-28.3%
5 Years	6.4%	8.1%	-21.0%

In recent years, SFERS total plan volatility has come down sharply compared to our peers. Per page 16 of the attached, SFERS long-term volatility has been about 10% higher than our peers, with an annualized volatility of 9.0% versus our peers of 8.2%. Over the past one through five years, SFERS volatility has been 21.0% to 35.9% lower than our peers. SFERS annual volatility has also been consistently lower than the projected 12.2% estimate on Page 7.

D – Strong Downside Protection and High-Risk Adjusted Returns

As shown on pages 12-14 of the attached and summed in the table below, SFERS has achieved strong downside protection versus our peers. We have recorded a Sortino Ratio about twice as high as our median peer over the past 1, 3 and 5 years. We have also posted a greater percentage of positive months than our peers, and in the worst month over the past 5 years when our median peer lost -9.2%, SFERS lost -6.0%.

SFERS has also achieved high risk-adjusted returns, with a Sharpe Ratio about twice as high as our peers across the past 1, 3 and 5 years. SFERS has also posted fewer months of negative returns than our peers.

Note: The Sharpe Ratio measures risk-adjusted returns. The Sortino Ratio measures risk-adjusted returns in down months.

Time Frame	Description	Sharpe Ratio	Downside Deviation	Sortino Ratio	Worst Month	% of Positive Months
1 Year	SFERS	0.33	6.3%	0.43	-6.0%	75.0%
	Median Peer	0.16	10.0%	0.20	-9.2%	66.7%
3 Years	SFERS	1.09	4.5%	1.58	-6.0%	77.8%
	Median Peer	0.57	6.8%	0.77	-9.2%	72.2%
5 Years	SFERS	1.44	4.2%	1.74	-6.0%	75.0%
	Median Peer	0.69	5.8%	0.97	-9.2%	70.0%

E – Rolling 20-Year Returns Have Declined Sharply

Page 17 shows that SFERS rolling 20-year returns have been declining for some time. Over the past 20 years, from July 2000 to June 2020 SFERS returned 6.4% annualized, which has been much lower than the Trust's very long-term return of 8.1%.

Importantly, 20 years ago the assumed rate of return for SFERS was 8.5%, but our actual return the past 20 years has been 6.4%. For approximately the past three years, our rolling 20-year return has been less than 7.4%, which is SFERS current long-term assumed rate of return. With bond yields at historic lows and amid lofty equity valuations, most investors expect modest investment returns over the next decade.

2 – Exposure Analysis

A – Exposures by Region and Country

Page 20 shows that SFERS has 66.9% of its assets invested in the U.S. SFERS has 9.9% invested in China, while a 68/32 mix of global stocks and U.S. bonds has 2.8% invested in China.

B – Exposures by Sector

Per Page 21, SFERS has 22.9% invested in Technology versus a 68/32 stock/bond mix of 14.2%. The tech sector is broad and includes software, hardware, services, networks, semiconductors, and more. Many of the industries in the tech sector are also quite broad. Software and Services, for example, includes human resources, payroll, and benefits; financial planning and reporting; financial analysis; internet security; applications management; procurement; payments; data aggregation, storage, organization and analysis, customer service; and more.

SFERS second largest sector weight is in Real Estate at 16.4% while 68/32 has just 2.1% invested in the sector. About 10% of our Real Estate exposure is due to our separate allocation to Real Assets. The remaining 6% of our Real Estate exposure is in our Public Equity, Private Credit, Fixed Income, and Absolute Return portfolios.

SFERS third largest sector weight is in Health Care at 11.7%, while 68/32 has 8.9% invested in the sector.

Compared to a 68/32 stock/bond portfolio, SFERS is underweight Financials (8.3% v. 9.5%), Consumer Discretionary (6.6% v. 8.1%), Industrials (5.7% v. 6.5%), Consumer Staples (3.1% v. 5.5%), Materials (1.7% v. 3.2%), and Utilities (1.3% v. 3.2%). SFERS has a large underweight to Sovereign Bonds (8.1% v. 25.9%). The latter has a large benchmark weight because most of the bond exposure of a 68/32 stock/bond portfolio is in government bonds.

C – Performance Attribution

SFERS has three meaningful overweight's in its portfolio: to Technology, Health Care, and China.

Per page 23, in its Public Equity portfolio SFERS has posted very strong returns in Health Care and Technology. Sector Allocation is the Public Equity portfolios returns attributable to its sector weight multiplied by the sector return. Stock Selection is the return attributable to the specific stocks in each sector. Over the past 5 years, the average weight to Health Care and Technology has been about 32% while the two sectors have generated more than 50% of Public Equity's active returns. Indeed, over every time period these two sectors have been responsible for more than half of the portfolio's excess returns, even as they have ranged from 23% to 45% of the portfolios weight.

Page 24 shows that Technology and Health Care have also significantly outperformed the other sectors in SFERS Private Equity portfolio. SFERS has 51% of its Private Equity portfolio in Technology and 16% in Health Care versus the Cambridge Associates benchmark weights of 37% and 18%, respectively, as per page 39.

Page 25 shows that more than 82% of our China exposure is in our Public Equity and Private Equity portfolios. Page 26 shows that the returns of our China-centric managers have substantially outperformed in both our Public Equity and Private Equity portfolios.

Since our hiring of China-centric managers in our Public Equity portfolio about four years ago, those managers have posted annualized returns of 17.6% versus the MSCI ACWI's return of 8.5%, an outperformance of 9.1% annualized.

In Private Equity, our China-centric managers have also significantly outperformed, posting a 5-year IRR of 19.3% while the rest of our Private Equity portfolio has returned 14.2%. Our Private Equity managers with a focus on China have also topped Cambridge Associates Private Equity China benchmark return the past 5 years, 19.3% to 17.4%.

Pages 27 and 28 show that in recent years SFERS Public Equity portfolio significantly increased its exposure to active management. The Public Equity portfolio ex-ante tracking error increased from 57bps in 2015 to 300bps in June 2020. Ex-ante tracking error measures the annual variability of active returns from the benchmark. Another measure of active management is Active Share. Active Share measures how much the portfolio's position weights in individual stocks differ from the benchmark index. The Active Share for SFERS Public Equity Portfolio increased from 32% to 52% over the past 5 years. Hence, more than half of Public Equity portfolio is different from the MSCI ACWI benchmark now vs. less than a third 5 years ago.

In sum, our investments in Technology, Health Care, and China have significantly outperformed in both our Public Equity and Private Equity portfolios. SFERS also benefited from increasing its allocation to active managers, i.e. managers that are significantly different than the benchmark.

D – Leverage

Per Pages 29-30, SFERS has gross exposures of about 195% and a net long position of 106%. SFERS net long position exceeds 100% because Buyout and Real Estate utilize leverage averaging approximately 50-60% of Net Asset Value while Private Credit managers use leverage of about 30% of NAV.

SFERS gross exposures are further increased due to our 15% allocation to Absolute Return, but our net long position is reduced by investing in this asset class because Absolute Return is only about 70% net long. Further, our total plan risk is reduced by including Absolute Return because the managers in the portfolio have an aggregate beta, meaning, systematic risk to the global equity market, of only about 20%.

SFERS does not utilize leverage at the plan level. Rather, the leverage described herein is used by some managers that SFERS has hired. Utilization of leverage at the plan level is being used by numerous public pension plans. Staff and NEPC are currently evaluating whether to recommend leverage at the plan level in our Asset Allocation recommendation which is scheduled for next month's Board meeting.

E – Public Equity

Page 32 shows that SFERS Public Equity portfolio largest country exposure is in the U.S. at 63.7%. The MSCI ACWI has 56.2% in the U.S.; hence, SFERS is overweight the U.S. in Public Equity by 7.5%. SFERS is also overweight China, with a weight of 11.4% versus the index exposure of 3.7%. SFERS is underweight Japan, with an exposure of 2.5% versus the index' 7.4%.

F – Fixed Income

Page 36 shows that SFERS Liquid Credit book has a lower average credit quality (BB+ v. AA-) than the Bloomberg Barclays U.S. Aggregate Bond Index, a much higher yield (6.0% v. 1.3%) and higher coupon (4.9% v. 3.0%). These traits suggest our Liquid Credit portfolio has greater economic sensitivity than the index. This is partially offset by our lower duration (4.9 years v. 5.8) and our separate 6% allocation to U.S. Treasuries.

G – Private Equity

Page 39 shows that SFERS has 63% of its Private Equity book invested in North America. We have a considerable overweight to Asia, with 26% of our Private Equity portfolio invested in Asia compared to the Cambridge Associates benchmark weight of 15%. We are underweight Europe, with just 4% invested in the region versus the benchmark weight of 20%.

Page 39 also shows our allocation to Technology within our Private Equity portfolio is 51%, which is significantly overweight the benchmark's position of 37%. SFERS allocation to Utilities is just 7% compared to the benchmark's weight of 17%. Our sector weights have been driven by both manager selection and our expectation that Tech will post strong returns while prospects for Utilities are much lower.

H – Private Credit

Per page 40, SFERS is overweight Global strategies (listed as "Other") with an allocation of 30% versus the Cambridge Associates benchmark weight of 15%. We are overweight Asia, with an allocation of 16% v. 6%. Global strategies provide managers with flexibility, and private credit is a developing opportunity in Asia. We are underweight Europe at 9% v. 20%. SFERS Private Credit book is balanced with six sector weights between 10% and 20%.

I – Real Estate and Natural Resources

By region, page 41 shows that SFERS Real Estate portfolio is overweight Europe at 24% versus the Cambridge Benchmark weight of 17%. By property type, SFERS has 30% in Office properties, which is in line with the benchmark weight of 34%.

Page 42 shows that SFERS Natural Resources book has 67% in North America, but that is less than the Cambridge Associates benchmark weight, which is heavily North American centric at 85%. By Resource type, SFERS is underweight Upstream projects at 31% versus the benchmark weight of 49% and underweight Downstream projects at 2% v. 15%. These two underweights are mostly offset by our 24% allocation to Diversified Oil & Gas, for which the benchmark does not separately allocate. We are overweight Metals & Mining at 17% v. 7%.

J – Absolute Return

Page 43 shows that SFERS has 29% of its Absolute Returns portfolio invested in Credit strategies vs. 20% of the HFRI Composite benchmark, 18% allocation to Equity Long/Short strategies vs. 49% of the HFRI benchmark, 18% vs. 12% to Multi-Strategy managers, 11% vs 13% to Global Macro managers, 11% vs 3% in Quantitative strategies, and 12% vs 3% to Special Situations. Absolute Return underweight in Equity strategies is by design in order to improve diversification benefits vs SFERS Total Plan. The overweights in Credit, Multi-Strategy, Global Macro, Quantitative, and Special Situations and Other strategies have the potential for differentiated alpha with low correlation to Global Equities.

3 – Stress Test and Scenario Analysis

In all scenarios in this section, the timing of Private Markets pricing has been aligned to match that of Public Markets. This approach captures the full effect of a negative scenario by restating the lag in Private Markets pricing to the same timing of Public Markets.

A – Single Market Factor Stress Test

Page 45 summarizes SFERS estimated returns in 16 different scenarios. Hypothetical scenarios involve estimates using historical betas and correlations, both of which sometimes have significant variability. Hence, these scenarios should be viewed in the context of an estimated result given average betas and correlations. They should not be viewed as predictive or specific. Nevertheless, Staff finds it useful to evaluate our portfolios sensitivity to a range of potential events. Sixteen such scenarios for which each asset price movement is correlated with respective stress market factor are summarized here. The correlations are estimated using daily returns data over the past fiscal year.

The worst impact on SFERS returns of the 16 scenarios is if the MSCI ACWI were to decline -40%, SFERS is estimated to lose -25%. The estimates are based on projected portfolio betas and correlations. They do not account for manager alpha, and betas and correlations can oftentimes prove to be unpredictable.

B – Historical Stress Test Summary

Pages 52-55 summarize SFERS projected returns for our current portfolio and a repeat of five different historical market stress events including the most recent three significant negative market scenarios of the past 20 years. The three major events are the Tech Meltdown from March 2000 to October 2002, the Global Financial Crisis from August 2007 to March 2009, and the COVID-19 experience in February-March 2020. The exact dates of each scenario are found in the notes accompanying each scenario.

The least impact of these three major historical events is projected to be a repeat of the Tech Meltdown of 2000-02. In that scenario, SFERS is estimated to lose -11.2%. It is worth noting in this scenario that our Private Equity book loses more than our Public Equity portfolio, -31.2% to -26.3% due to its large allocation to IT. Real Assets, Private Credit, and Absolute Return all post positive mid-single digit returns in the Tech Meltdown scenario.

In a repeat of the COVID-19 market movement, SFERS is estimated to lose -19.8%, with the timing of private markets pricing adjusted to align with the timing of public markets. In this event, Public Equity loses -28.2% while Real Assets decline -23.5%. Private Equity loses -17.8% in this scenario, while Private Credit and Absolute Return fall -13.8% and -13.1%, respectively. Fixed Income also declines, losing -4.2%.

In a repeat of the Global Financial Crisis, SFERS is projected to lose -30.5%. In this scenario, Public Equity falls the most, losing -47.2%. Real Assets and Private Equity also get pummeled, falling -34.8% and -32.2%, respectively. Private Credit and Absolute Return also decline, losing -17.1% and -14.5%, respectively. In this scenario, only our Fixed Income portfolio posts a positive projected return, gaining 7.3%. (Cash edges out a positive return of 1.5% since we currently hold Treasury future in the cash overlay account.)

A summary of the estimated impact of each of these three historical scenarios is below.

Description	Tech Meltdown	Global Financial Crisis	COVID-19
	Mar 2000-Oct 2002	Aug 2007-Mar 2009	Feb-Mar 2020
Public Equity	-26.3%	-47.1%	-28.2%
Private Equity	-31.1%	-32.2%	-17.8%
Real Assets	7.3%	-34.8%	-23.5%
Private Credit	4.6%	-14.5%	-13.8%
Absolute Return	6.8%	-17.1%	-13.1%
Fixed Income	28.8%	7.3%	-4.2%
Estimated SFERS Portfolio	-11.2%	-30.5%	-19.8%

There are a few important takeaways from each scenario:

1 – Diversification Reduces Volatility, But its Impact Can Vary

In the Tech Meltdown from March 2000 to October 2002, diversification worked very well. While Public Equity and Private Equity lost -26.3% and -31.1%, respectively, all of the other four asset classes – Real Assets, Private Credit, Absolute Return, and Fixed Income – posted positive returns.

On the other hand, in the Global Financial Crisis, only Fixed Income posted positive returns, and during COVID-19 none of these six asset classes generated a positive return. In these two events, diversification did help, but it did not help nearly as much as an investor would hope. That is because the GFC and COVID-19 were systemic shocks with broad and immense economic impact, whereas the Tech Meltdown did not have a severe impact on other asset classes.

It is also important to keep in mind that betas, correlations, and alphas are all variable and can behave differently than their historical averages nor behave as predicted. That said, diversification still did help during the GFC and COVID-19. In the Global Financial Crisis, Private Credit and Absolute Return lost only about 1/3rd compared to the decline in Public Equity and during COVID-19 they both lost less than half.

2 – Absolute Asset Class Performance, and Their Relation to One Another, Differs in Each Scenario

In the Tech Meltdown, Private Equity was the worst performing asset class, losing -31.1%. But under COVID-19 scenario, it was only the third worst performer, falling -17.8%. During COVID-19 Private Equity provided some diversification benefits, by incurring less of a loss than Public Equity, but in the Tech Meltdown Private Equity did not enhance diversification, losing more than Public Equity.

Real Assets posted positive returns of 7.3% during the Tech Meltdown, providing excellent diversification and generating the second-best asset class performance behind only Fixed Income. However, Real Assets lost -34.8% and -23.5% during the GFC and COVID-19, respectively. In the first scenario Real Assets provided excellent diversification benefits, but in the latter two scenarios it provided much less.

Private Credit and Absolute Return also provided excellent diversification in the Tech Meltdown during which they both posted positive returns. However, both suffered double digit losses during the GFC and COVID-19. In all three scenarios both asset classes boosted diversification and helped reduce the loss compared to all-equity portfolio. However, how much these two asset classes helped varied in each scenario.

Overall, diversification helps reduce volatility, but how much it helps has varied considerably.

Summary:

Staff seeks to earn high excess returns versus our peers. To achieve our objective, a key tenet to our investment philosophy is to be thoughtful about where the world is going and then to invest in the leaders in where the world will be. Staff believes the world is evolving from the Industrial Revolution to an era of Science, Technology, and Innovation. That has led Staff to its overweight's in Technology and Health Care as well as to China and Asia. Staff also believes that manager selection in every asset class of our book can boost excess returns.

SFERS has 22.9% invested in Technology, which is an 8.7% overweight compared to a 14.2% allocation for a 68/32 mix of stocks and bonds. We have 11.7% invested in Health Care versus a 68/32 allocation of 8.9% to the sector. Lastly, we have 9.9% invested in China while 68/32 has 2.8% invested in the country. All three of these overweight's have added significant value to the SFERS Trust.

There are several exposures SFERS will need to consider going forward.

1 – Determine Return Objectives and Risk Tolerance. Currently, SFERS protects capital through its allocation to Treasuries, Core Bonds, Absolute Return, and Cash. The strategic weights to these assets total 24%. Increasing their allocation further protects capital, but their projected 10- and 30-year returns are considerably lower than Public and Private Equity, Real Assets, and Private Credit.

Our total plan volatility is in the lowest 10% versus our peers. It is important to make sure SFERS is taking sufficient risk to achieve its long-term return objective.

Protecting capital in down markets while taking sufficient risk to achieve a long-term objective can be in conflict with one another. Further, while Treasuries have historically provided the strongest protection in down markets, their yields are currently at historic lows, indicating their future returns will also be very low, and intermediate and long-term Treasuries can post negative returns in periods of rising interest rates or amid a dollar selloff.

2 – Real Estate. SFERS has 16.4% in Real Estate sector. Approximately 10% of our Real Estate exposure is in our Real Assets portfolio, with another 6% invested in Real Estate in our Public Equity, Private Credit, and Absolute Return portfolios. SFERS will need to determine the appropriate allocation to Real Estate in a total portfolio context and consider the lasting impact that the COVID-19 human health crisis may have on the industry's future.

3 – Natural Resources. NEPC projects that Natural Resources will return 9.4% annualized and be among the three best performing asset classes over the next 10 years. Natural Resources consist of more than 2/3rds oil and gas, and NEPC's projected return would argue for a lofty weight to oil and gas. On the other hand, for 90 years oil did not have competition. Now it faces an abundant supply of natural gas, increasing supply of solar and wind, and an urgent need to reduce carbon emissions. Further, many countries and businesses are making a commitment to be carbon neutral within the next several decades. Meanwhile, electric vehicles are likely to take significant market share from combustion engines. Lastly, COVID-19 may have a lasting impact on demand for oil. In sum, there is a large degree of uncertainty about the return prospects for oil and gas.

4 – How Much to Allocate to Illiquid Investments. SFERS has a current allocation of 45% to illiquid assets, which include Private Equity, Real Assets, and Private Credit. Comparatively, our peers average about 28%. SFERS will need to determine how much to allocate to private investments, considering that our annual benefit payments will increase from \$500 million in 2000 to \$900 million within 4-5 years and to \$1.3 billion at the end of this decade.

5 – Whether to Utilize Plan Leverage. SFERS does not utilize leverage at the plan level. It makes sense to be a borrower when interest rates are low and to be a lender when rates are high. Since interest rates are currently at historic lows, it may make sense to utilize leverage at the Plan level.

Staff will be evaluating each of these exposures, as well as other important considerations, such as equity valuations, bond yields, government deficits and prospects for higher inflation, and manager selection through our asset allocation recommendation, scheduled for next month.

Meanwhile, over the past 1, 3, and 5 years, SFERS has significantly reduced total portfolio volatility, while still outperforming our peers and posting high risk-adjusted returns.



SFERS
San Francisco Employees' Retirement System

San Francisco Employees' Retirement System

Risk Review for SFERS Total Plan

Retirement Board Meeting, October 14, 2020

SFERS Risk Review | Overview

- Comprehensive risk management framework includes Strategic Asset Allocation, Liquidity Management, and measurement and monitoring of key risk drivers for SFERS Total Fund and each asset class
- SFERS uses risk analytics and reporting from multiple sources and vendors

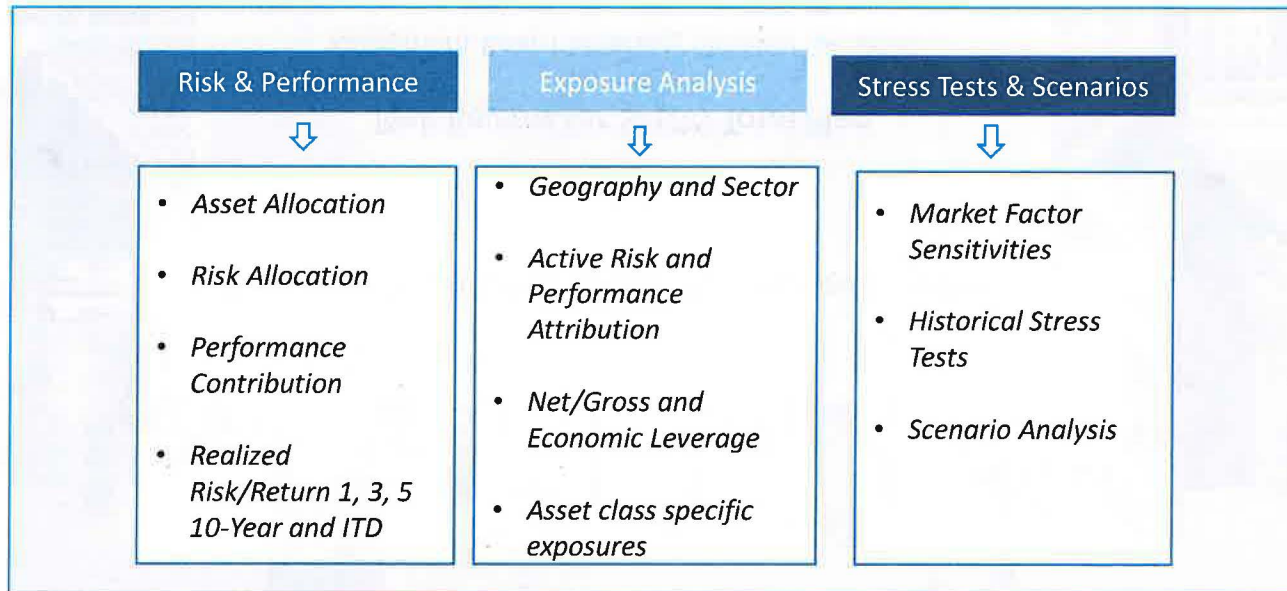
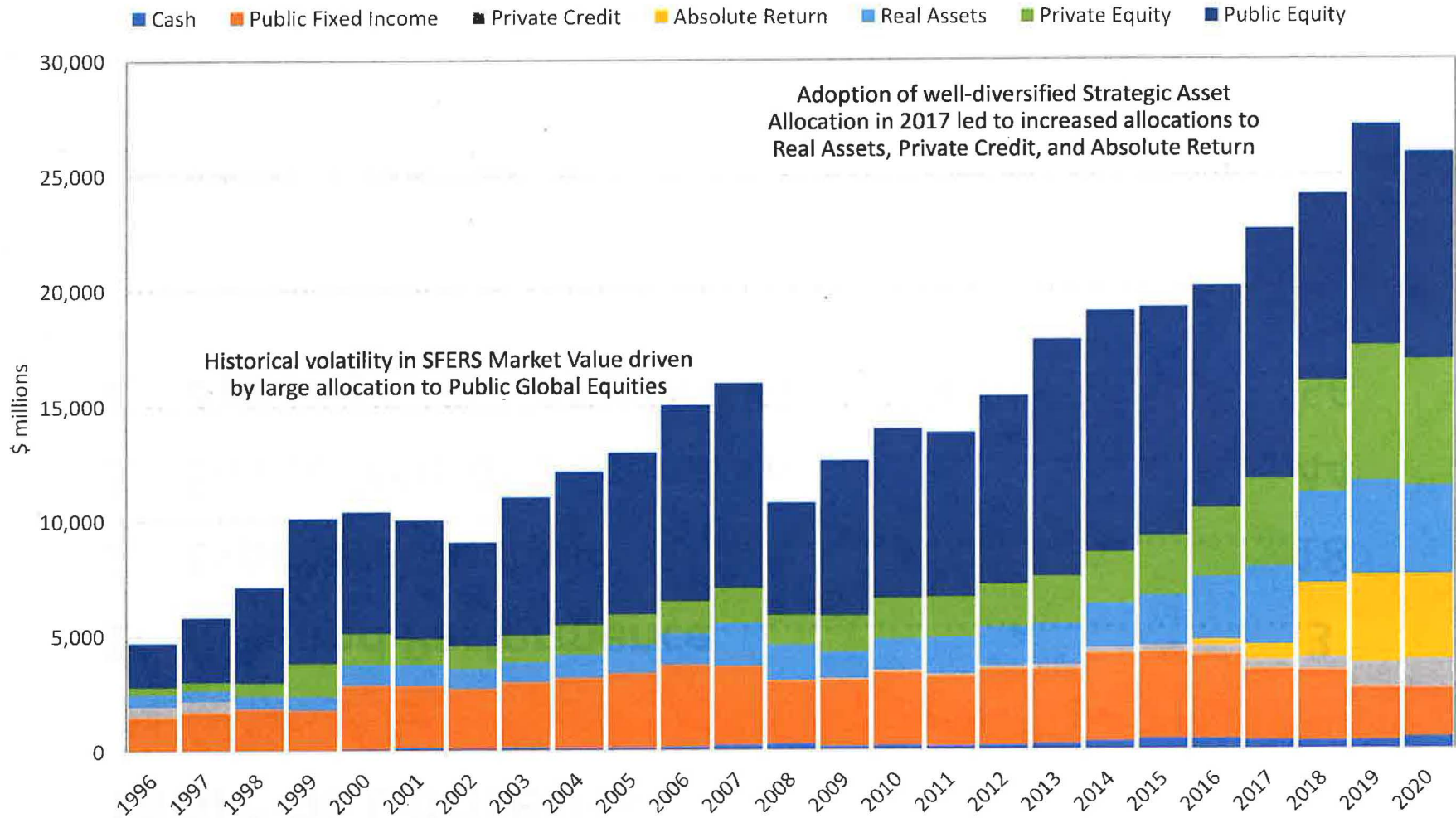


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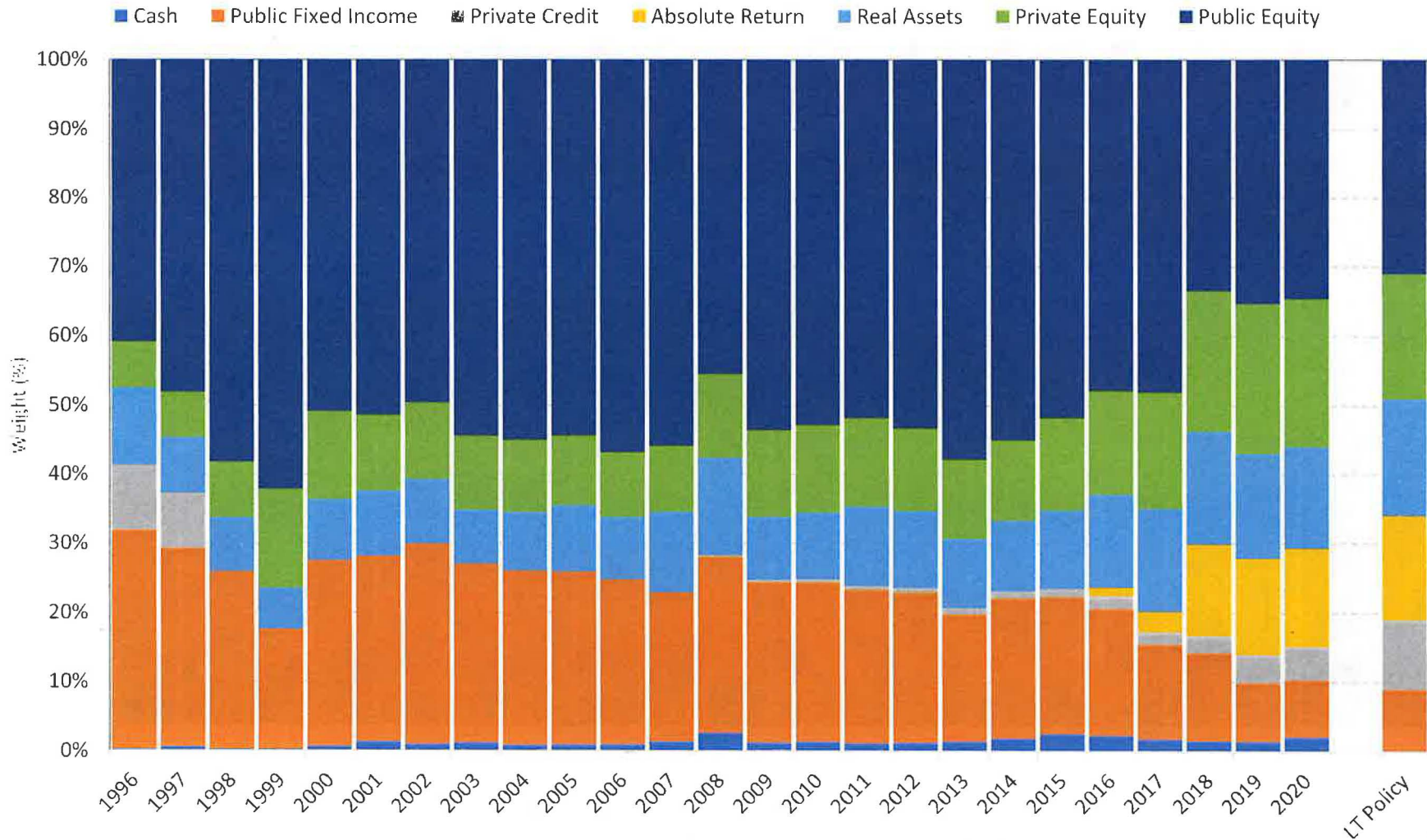
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SFERS Historical Asset Allocation | Long-Term Annual by Market Value



Source: Caissa and Custodian (NT and BNY Mellon) valuations from January 1996 through December 2019. Valuations as of December 31 for each year except 2020 which is as of June 30.

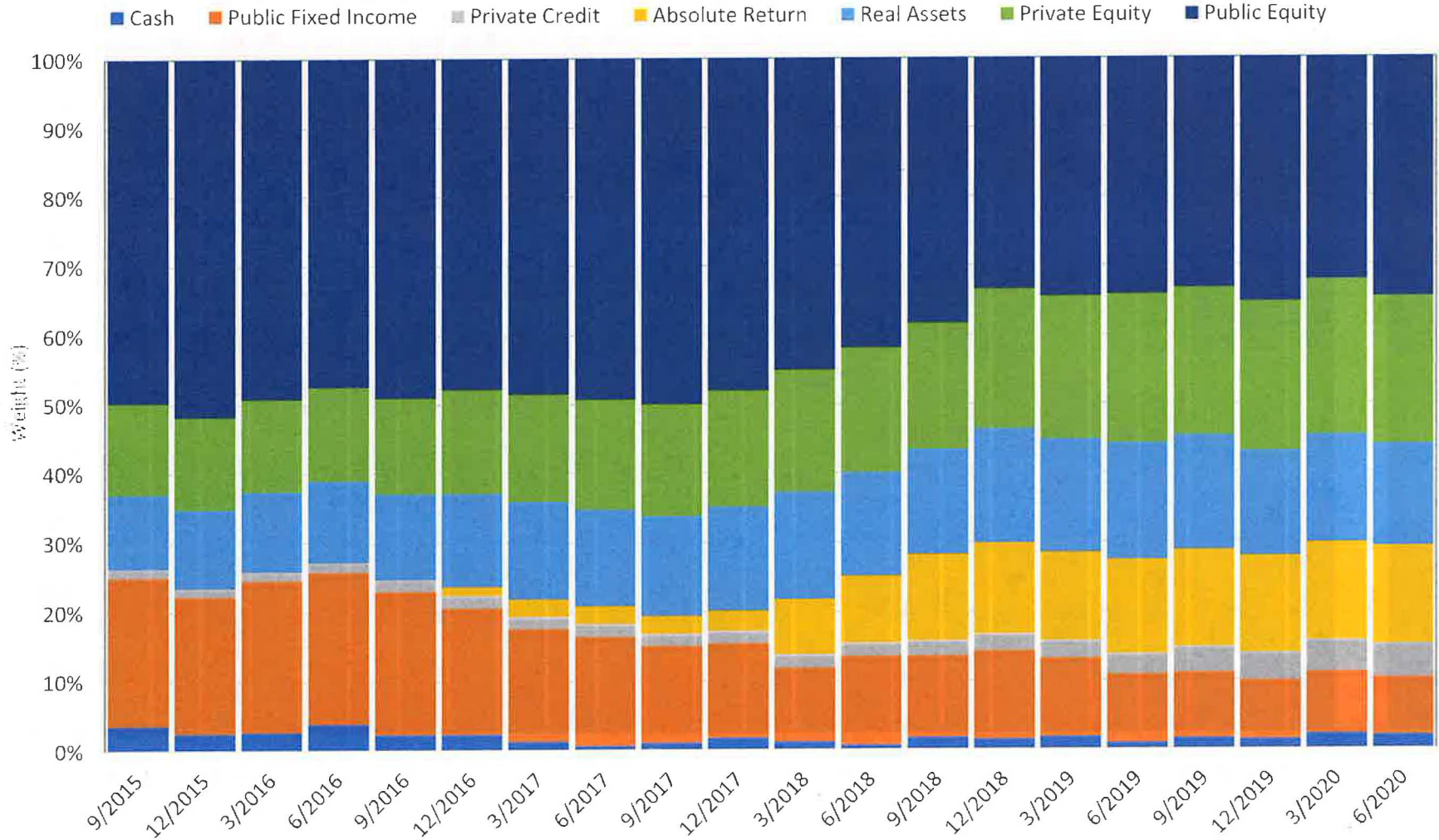
SFERS Historical Asset Allocation | Long-Term Annual by Weight



Source: Caissa and Custodian (NT and BNY Mellon) valuations from January 1996 through December 2019. Valuations as of December 31 for each year except 2020 which is as of June 30.

SFERS Historical Asset Allocation by Weight | 5-Year Quarterly

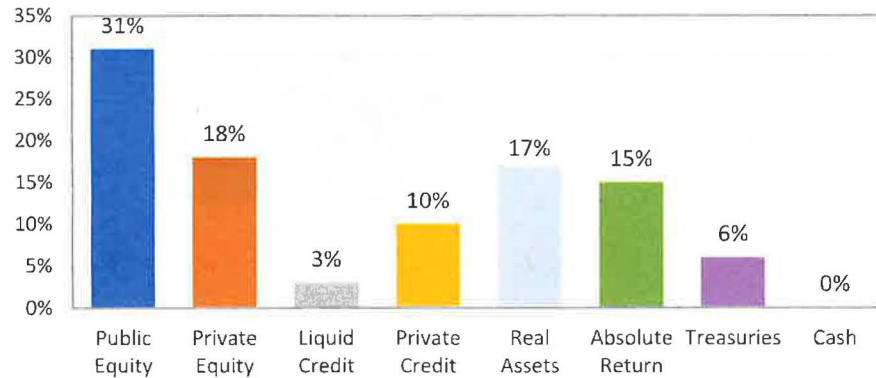
Over the last 5 years SFERS has been reducing allocations to Public Equity, and Public Fixed Income while increasing allocations to Private Equity, Private Credit, and Absolute Return



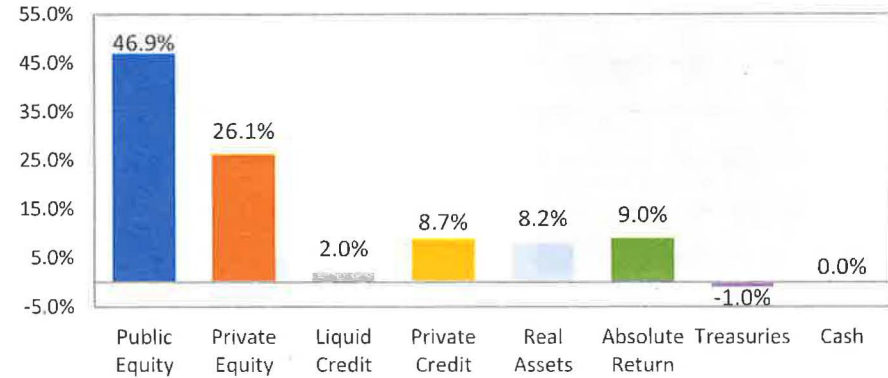
Source: Caissa and Custodian (NT and BNY Mellon) valuations from July 2015 through June 2020.

Systematic Risk of Strategic Asset Allocation¹

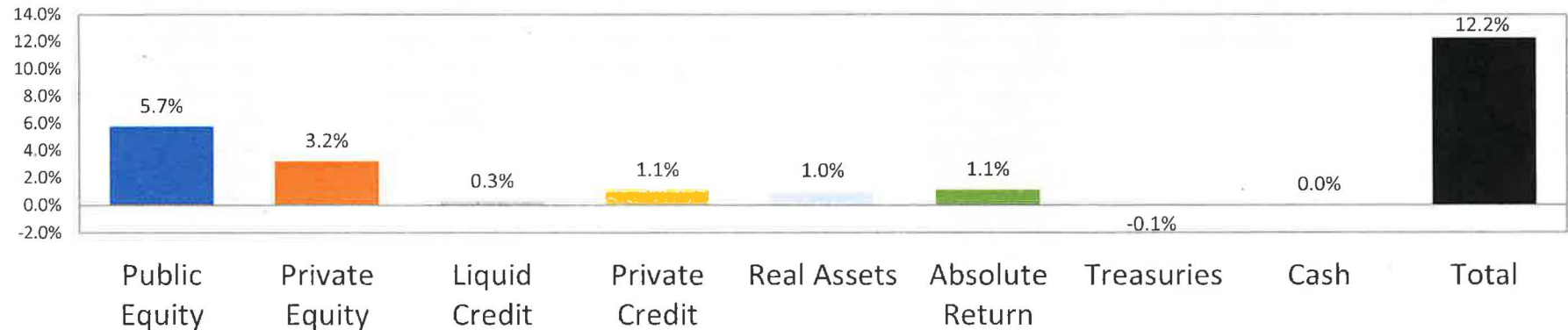
Investment Policy Weights



Contribution to Policy Risk

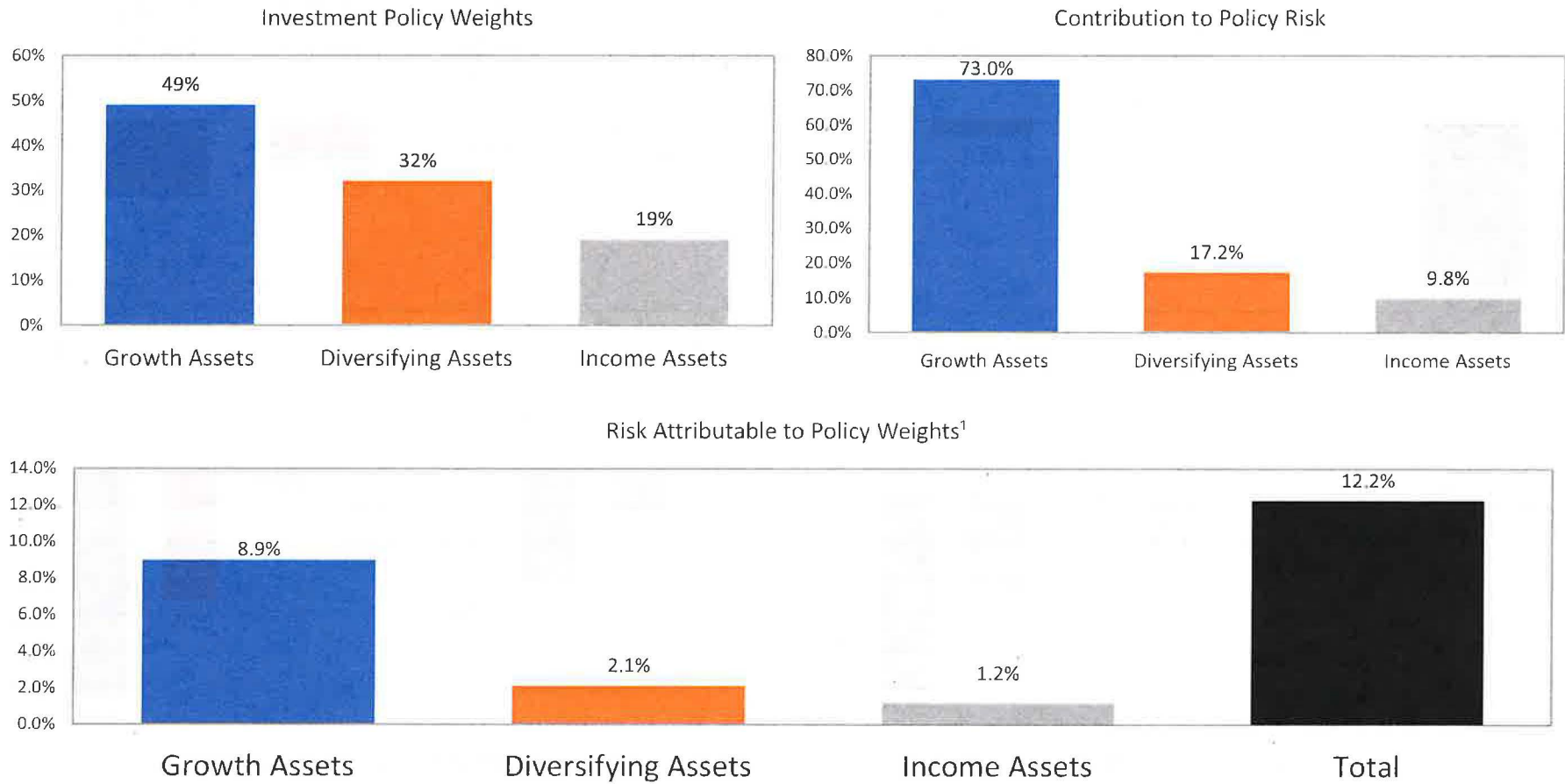


Risk Attributable to Policy Weights¹



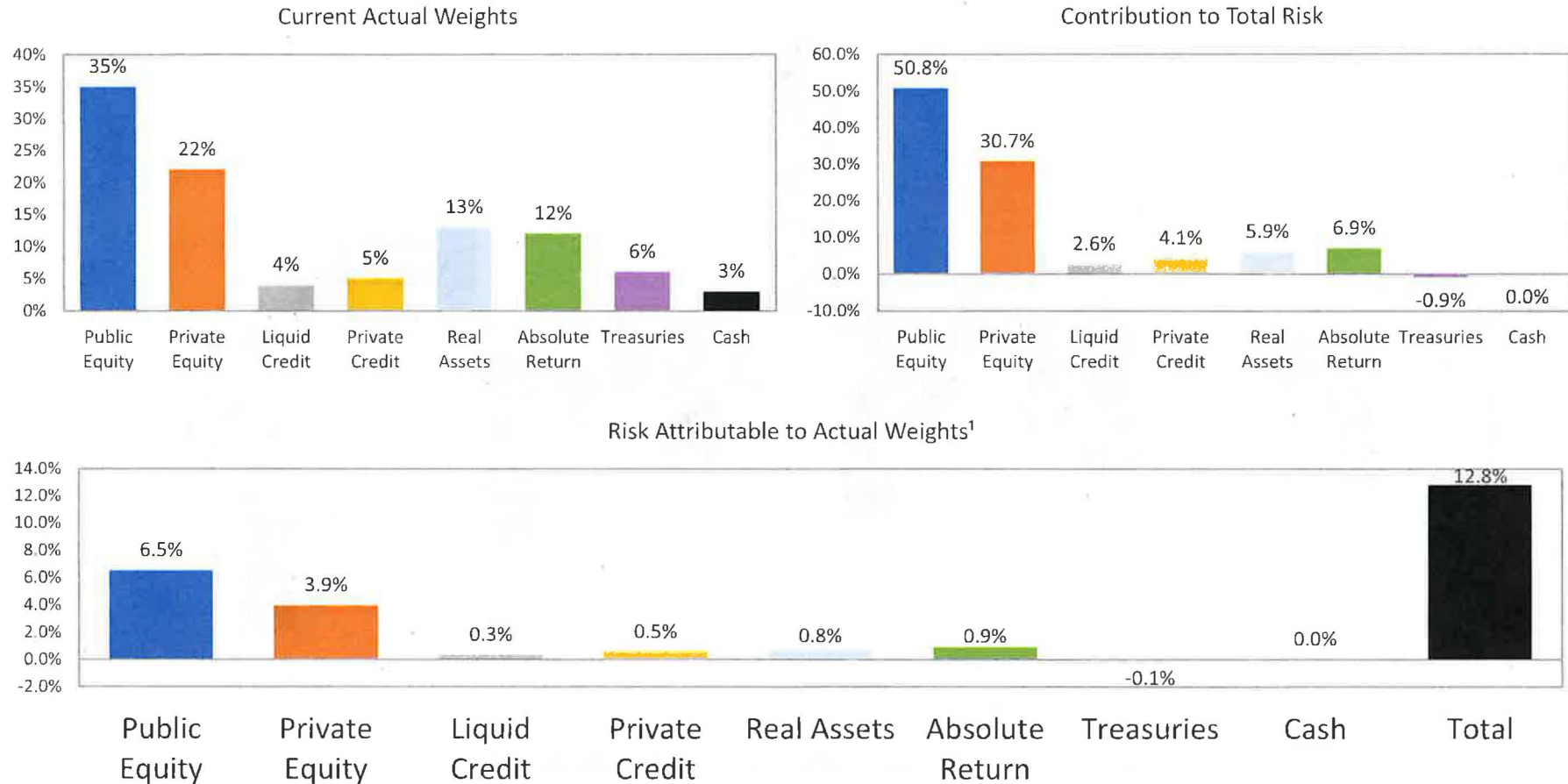
¹Risk and Tracking Error represent annualized standard deviation adjusted for correlation using realized quarterly returns from June 2006 to June 2020 and Wilshire Compass methodology.

Systematic Risk by Macro Asset Class Groups¹



¹Risk and Tracking Error represent annualized standard deviation adjusted for correlation using realized quarterly returns from June 2006 to June 2020 and Wilshire Compass methodology.

Systematic Risk of Current Actual Asset Allocation¹

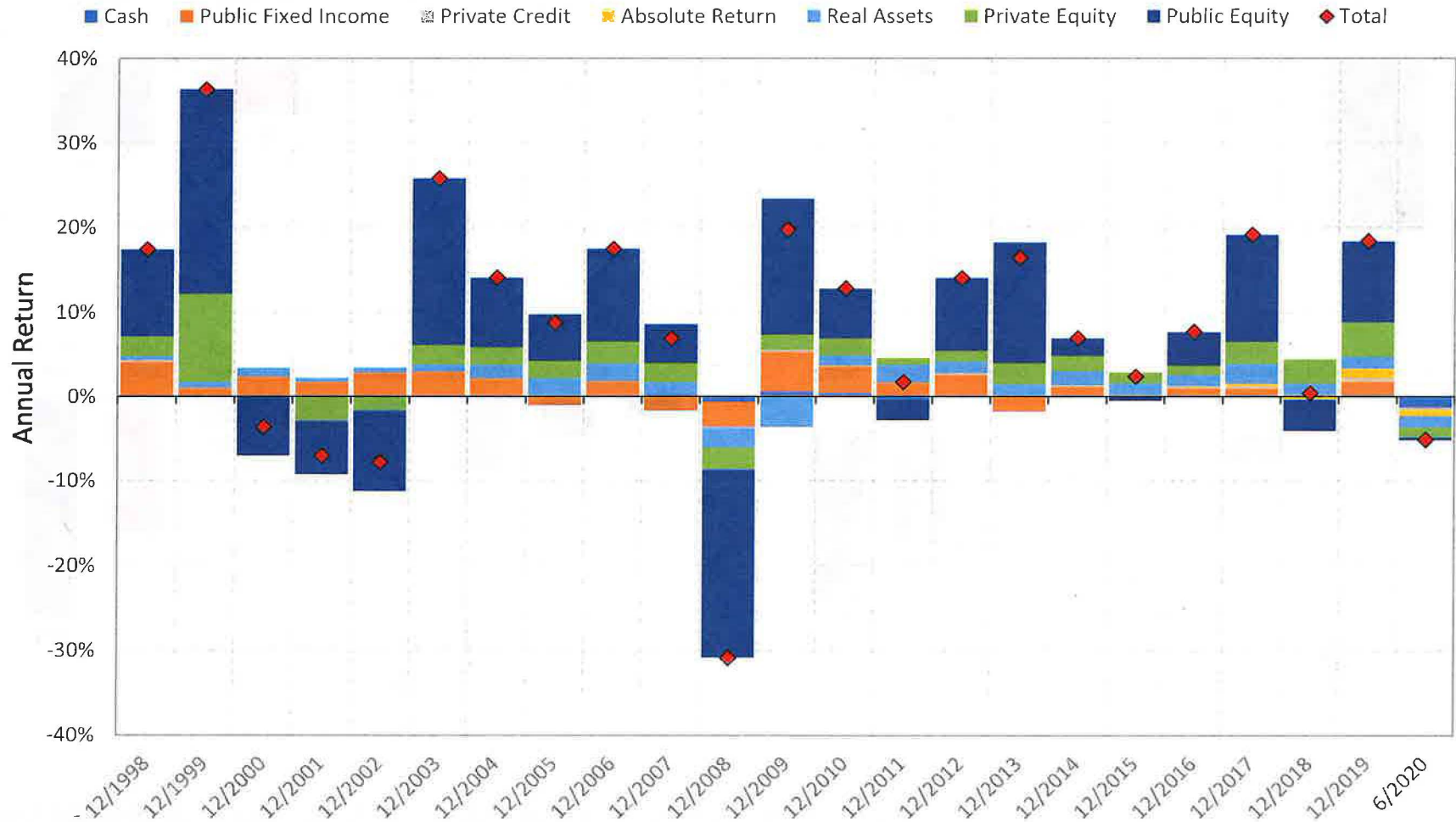


¹Risk and Tracking Error represent annualized standard deviation adjusted for correlation using realized quarterly returns from June 2006 to June 2020 and Wilshire Compass methodology.

SFERS Historical Return Contribution by Asset Class | Long-Term Annual

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

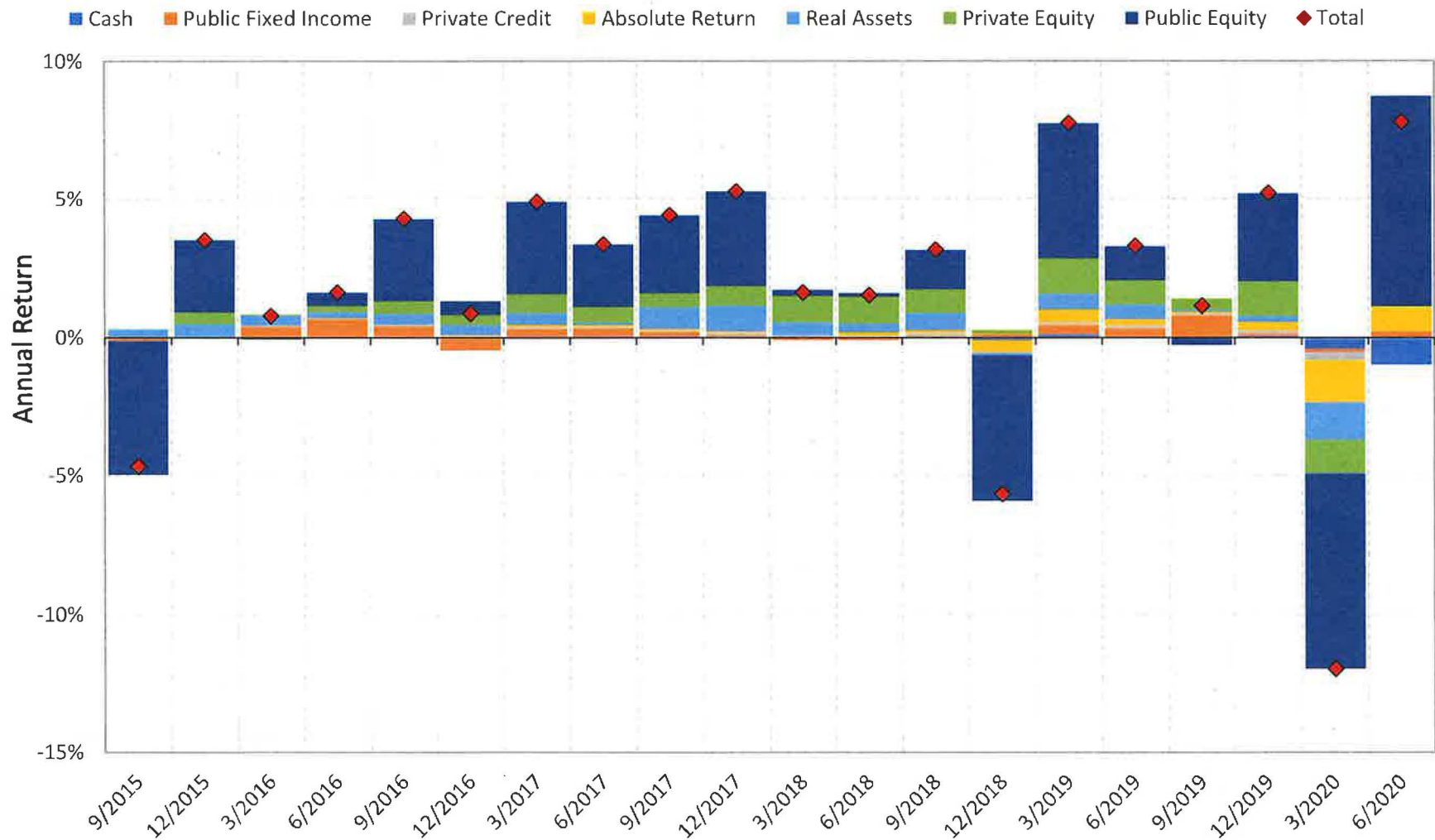
Contribution to Annual Return from Each Asset Class



Source: Caissa and Custodian (NT and BNY Mellon) valuations from January 1998 through June 2020. Performance for 2020 is the first 6 months. Private Equity, Real Assets, and Private Credit performance as of 03/31/2020.

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

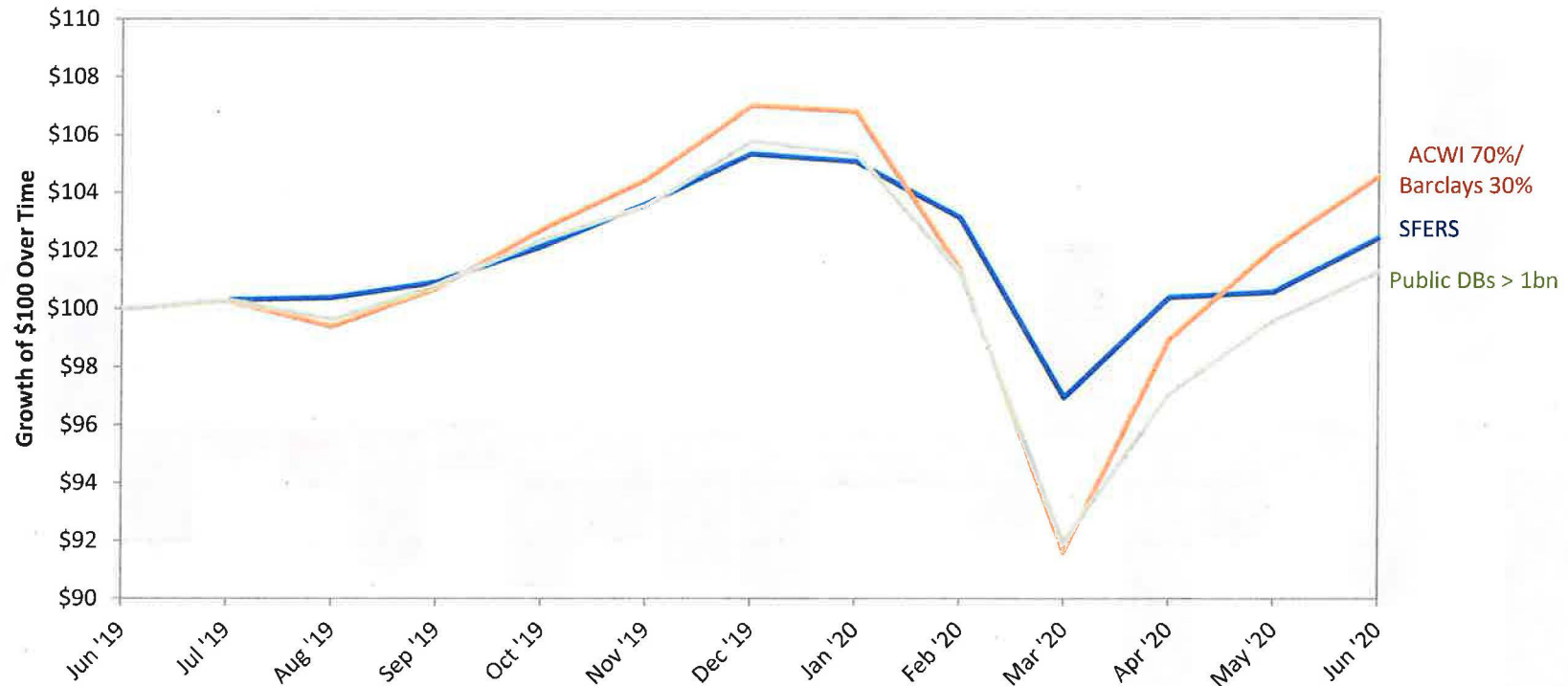
Public and Private Equity drive most of SFERS performance and volatility



SFERS Performance Analysis | 1 Year (July 2019 to June 2020)

SFERS underperformed 70/30 benchmark by 2.1% albeit with 46% less risk¹

Compounded Cumulative Returns



Realized Risk/Return Analytics

	Total Return	Annlzd. Return	Annlzd. Volatility	Sharpe Ratio	Downside Deviation	Sortino Ratio	Gain Deviation	Semi Deviation	Loss Deviation	Correlation	Worst Return %	Worst Return Month	% of Positive Months	VaR (99 %)
SFERS	2.4%	2.4%	8.2%	0.33	6.3%	0.43	3.8%	11.4%	10.2%	1.00	-6.0%	Mar. 20	75.0%	5.5%
70/30 Equity/Bond	4.6%	4.6%	15.2%	0.36	10.9%	0.51	8.1%	20.1%	15.1%	0.96	-9.6%	Mar. 20	66.7%	10.2%
Public DBs > 1bn	1.3%	1.3%	12.8%	0.16	10.0%	0.20	5.5%	20.5%	14.1%	0.97	-9.2%	Mar. 20	66.7%	8.6%

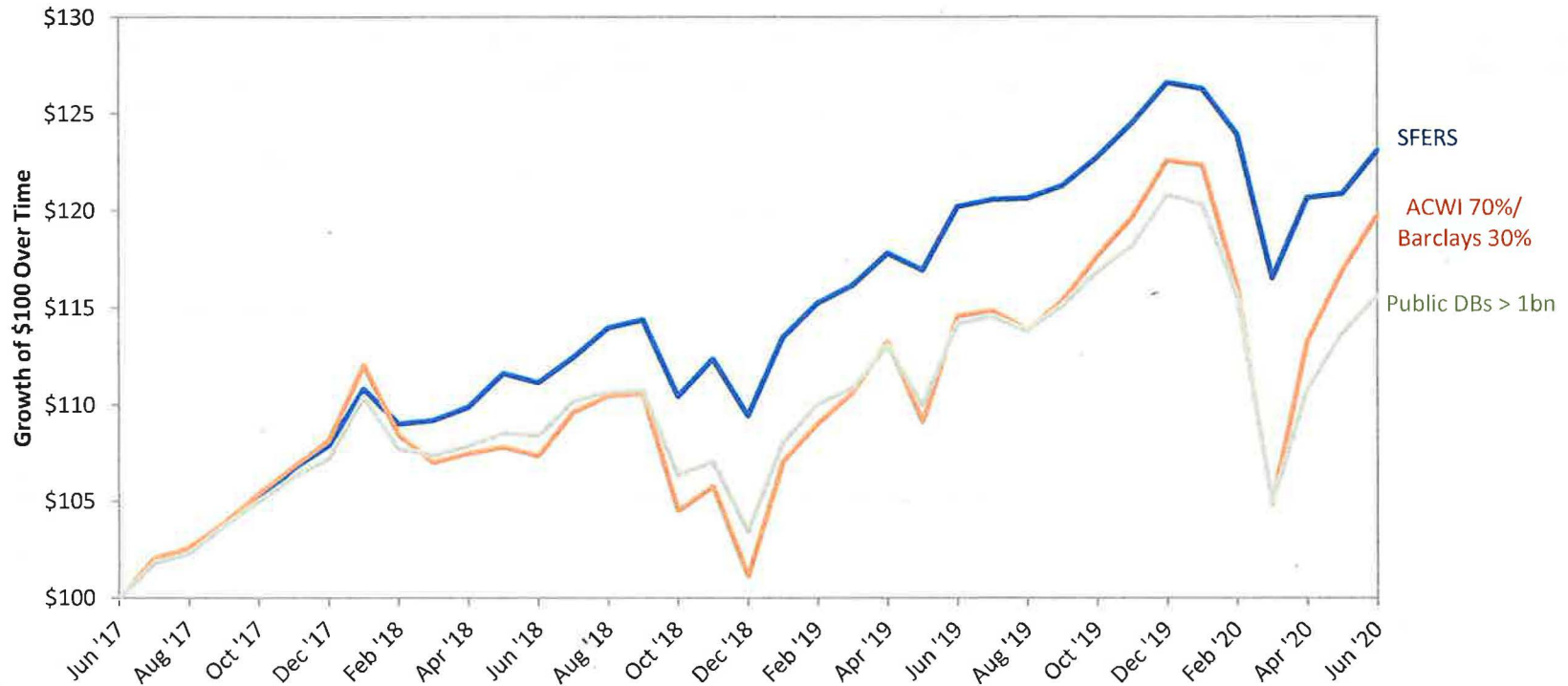
* See Appendix for definitions of risk and return analytics

Notes: SFERS data sourced from NEPC and BNY Mellon. 70/30 Equity/Bond returns sourced from Evestment – represents 70% MSCI ACWI Net Dividends (prior to 1999 uses Gross Dividends) + 30% Bloomberg Barclays US Aggregate Index. Public DBs > 1bn sourced from NEPC and represents the Investment Metrics Public DB > \$1 Billion Net universe. ¹Risk is defined as Annualized Volatility Data Period: July 1, 2019 through June 30, 2020. Private Equity, Real Assets, and Private Credit performance as of 3/31/2020

SFERS Performance Analysis | 3 Year (July 2017 to June 2020)

SFERS delivered superior risk-adjusted returns outperforming 70/30 benchmark by 3.3% with 43% less risk¹

Compounded Cumulative Returns



Realized Risk/Return Analytics

	Total Return	Annld. Return	Annld. Volatility	Sharpe Ratio	Downside Deviation	Sortino Ratio	Gain Deviation	Semi Deviation	Loss Deviation	Correlation	Worst Return %	Worst Return Month	% of Positive Months	VaR (99%)
SFERS	23.1%	7.2%	6.6%	1.09	4.5%	1.58	3.3%	8.5%	6.6%	1.00	-6.0%	Mar. 20	77.8%	4.4%
70/30 Equity/Bond	19.8%	6.2%	11.4%	0.58	8.0%	0.83	6.3%	14.2%	10.1%	0.95	-9.6%	Mar. 20	72.2%	7.7%
Public DBs > 1bn	15.7%	5.0%	9.2%	0.57	6.8%	0.77	4.6%	12.9%	9.5%	0.96	-9.2%	Mar. 20	72.2%	6.2%

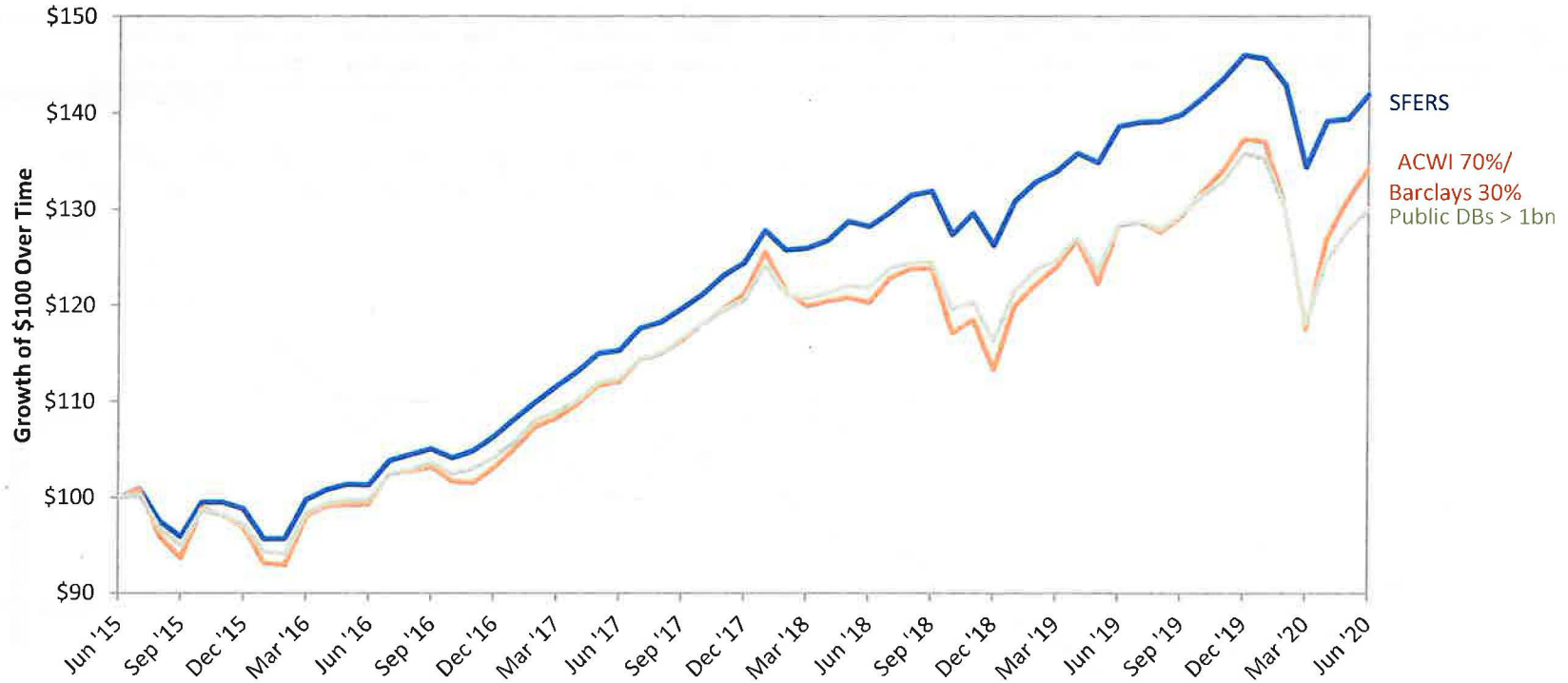
* See Appendix for definitions of risk and return analytics

Notes: SFERS data sourced from NEPC and BNY Mellon. 70/30 Equity/Bond returns sourced from Evestment – represents 70% MSCI ACWI Net Dividends (prior to 1999 uses Gross Dividends) + 30% Bloomberg Barclays US Aggregate Index. Public DBs > 1bn sourced from NEPC and represents the Investment Metrics Public DB > \$1 Billion Net universe. ¹Risk is defined as Annualized Volatility Data Period: July 1, 2017 through June 30, 2020. Private Equity, Real Assets, and Private Credit performance as of 3/31/2020

SFERS Performance Analysis | 5 Year (July 2015 to June 2020)

SFERS delivered superior risk-adjusted returns outperforming 70/30 benchmark by 7.9% with 38% less risk¹

Compounded Cumulative Returns



Realized Risk/Return Analytics

	Total Return	Annlzd. Return	Annlzd. Volatility	Sharpe Ratio	Downside Deviation	Sortino Ratio	Gain Deviation	Semi Deviation	Loss Deviation	Correlation	Worst Return %	Worst Return Month	% of Positive Months	VaR (99%)
SFERS	42.1%	7.3%	6.4%	1.14	4.2%	1.74	3.5%	7.8%	5.8%	1.00	-6.0%	Mar. 20	75.0%	4.3%
70/30 Equity/Bond	34.2%	6.1%	10.2%	0.63	7.0%	0.92	6.1%	11.8%	8.7%	0.95	-9.6%	Mar. 20	70.0%	6.8%
Public DBs > 1bn	30.0%	5.4%	8.1%	0.69	5.8%	0.97	4.5%	10.2%	7.8%	0.96	-9.2%	Mar. 20	70.0%	5.5%

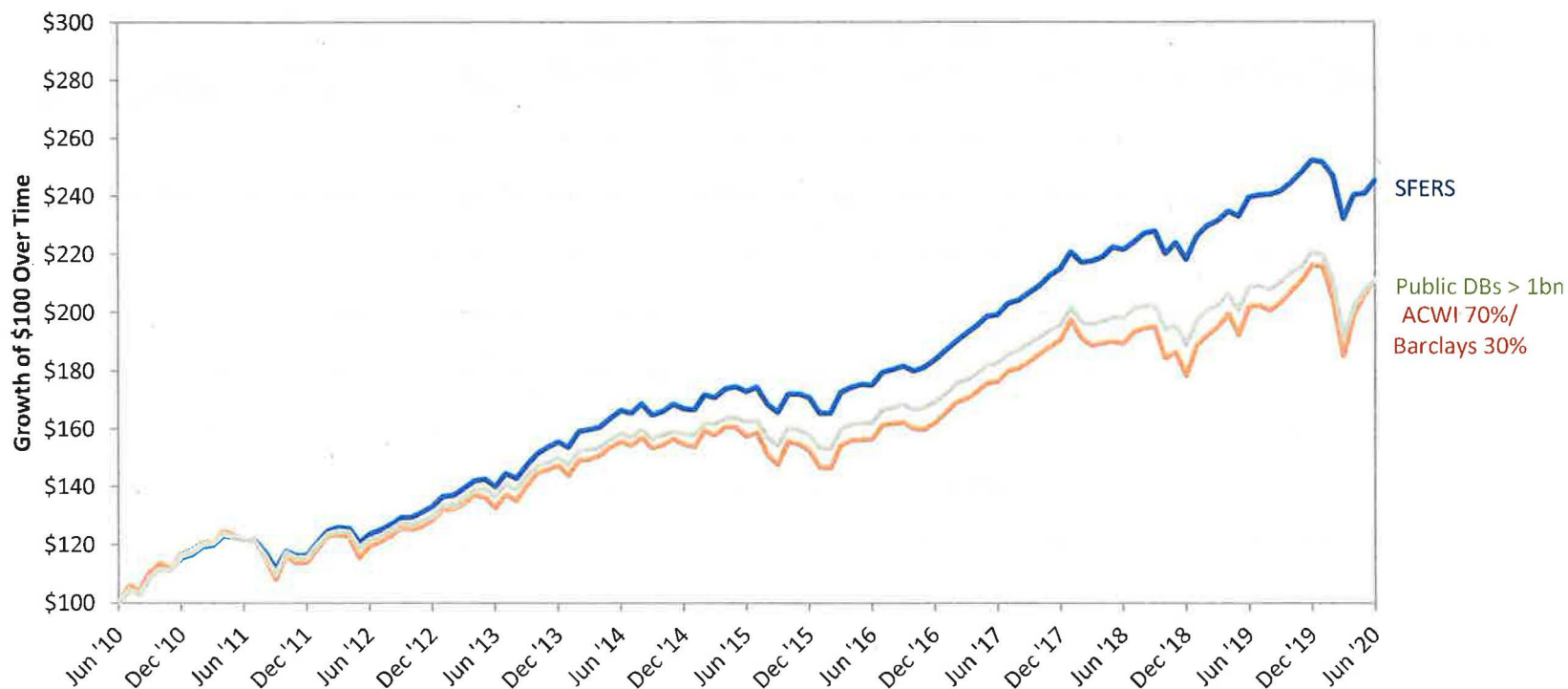
* See Appendix for definitions of risk and return analytics

Notes: SFERS data sourced from NEPC and BNY Mellon. 70/30 Equity/Bond returns sourced from Evestment – represents 70% MSCI ACWI Net Dividends (prior to 1999 uses Gross Dividends) + 30% Bloomberg Barclays US Aggregate Index. Public DBs > 1bn sourced from NEPC and represents the Investment Metrics Public DB > \$1 Billion Net universe. ¹Risk is defined as Annualized Volatility Data Period: July 1, 2017 through June 30, 2020. Private Equity, Real Assets, and Private Credit performance as of 3/31/2020

SFERS Performance Analysis | 10 Year (July 2010 to June 2020)

SFERS delivered superior risk-adjusted returns outperforming 70/30 benchmark by 37% with 30% less risk¹

Compounded Cumulative Returns



Realized Risk/Return Analytics

	Total Return	Annld. Return	Annld. Volatility	Sharpe Ratio	Downside Deviation	Sortino Ratio	Gain Deviation	Semi Deviation	Loss Deviation	Correlation	Worst Return %	Return Month	% of Positive Months	VaR (99 %)
SFERS	148.5%	9.5%	6.8%	1.37	3.9%	2.38	4.3%	7.6%	5.1%	1.00	-6.0%	Mar. 20	71.7%	4.6%
70/30 Equity/Bond	111.3%	7.8%	9.8%	0.81	6.2%	1.29	6.2%	10.8%	7.4%	0.97	-9.6%	Mar. 20	65.8%	6.6%
Public DBs > 1bn	111.5%	7.8%	8.0%	0.98	5.0%	1.56	4.9%	8.8%	6.5%	0.97	-9.2%	Mar. 20	68.3%	5.3%

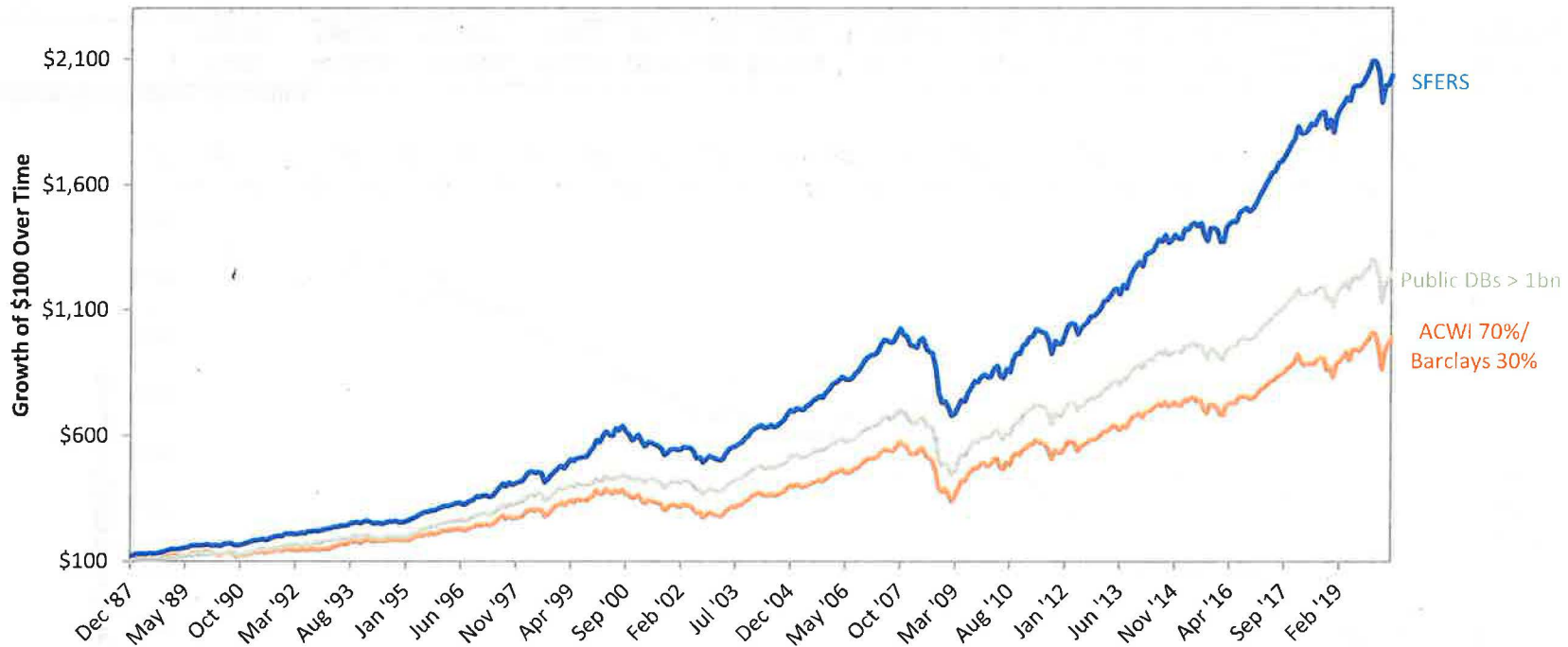
* See Appendix for definitions of risk and return analytics

Notes: SFERS data sourced from NEPC and BNY Mellon. 70/30 Equity/Bond returns sourced from Evestment – represents 70% MSCI ACWI Net Dividends (prior to 1999 uses Gross Dividends) + 30% Bloomberg Barclays US Aggregate Index. Public DBs > 1bn sourced from NEPC and represents the Investment Metrics Public DB > \$1 Billion Net universe. ¹Risk is defined as Annualized Volatility Data Period: July 1, 2017 through June 30, 2020. Private Equity, Real Assets, and Private Credit performance as of 3/31/2020

SFERS Performance Analysis | Long Term

SFERS delivered superior risk-adjusted returns outperforming 70/30 benchmark by 1155% with 16% less risk¹

Compounded Cumulative Returns



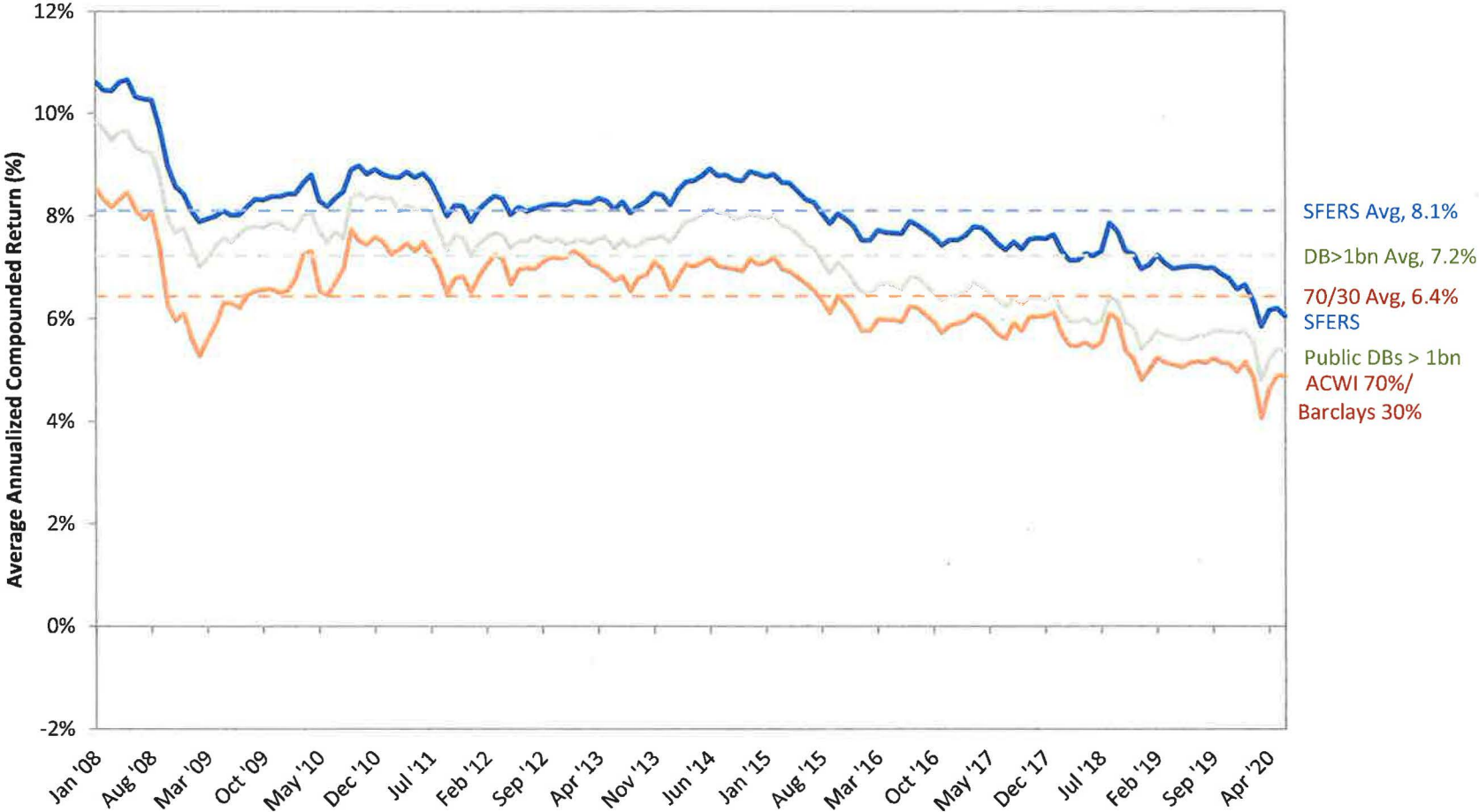
Realized Risk/Return Analytics

	Total Return	Annlzd. Return	Annlzd. Volatility	Sharpe Ratio	Downside Deviation	Sortino Ratio	Gain Deviation	Semi Deviation	Loss Deviation	Correlation	Worst Return %	Return Month	% of Positive Months	VaR (99 %)
SFERS	2042.1%	9.9%	9.0%	1.10	4.8%	2.03	6.9%	8.9%	6.3%	1.00	-11.0%	Oct. 08	69.0%	6.0%
70/30 Equity/Bond	887.3%	7.3%	10.7%	0.71	7.1%	1.08	6.2%	12.3%	8.1%	0.81	-14.6%	Oct. 08	64.1%	7.2%
Public DBs > 1bn	1145.7%	8.1%	8.2%	0.99	5.4%	1.49	4.7%	9.3%	7.4%	0.77	-13.6%	Oct. 08	67.9%	5.5%

* See Appendix for definitions of risk and return analytics

Notes: SFERS data sourced from NEPC and BNY Mellon. 70/30 Equity/Bond returns sourced from Evestment – represents 70% MSCI ACWI Net Dividends (prior to 1999 uses Gross Dividends) + 30% Bloomberg Barclays US Aggregate Index. Public DBs > 1bn sourced from NEPC and represents the Investment Metrics Public DB > \$1 Billion Net universe. ¹Risk is defined as Annualized Volatility Data Period: July 1, 2017 through June 30, 2020. Private Equity, Real Assets, and Private Credit performance as of 3/31/2020

SFERS Performance Analysis | Annualized Rolling 20-Year Returns

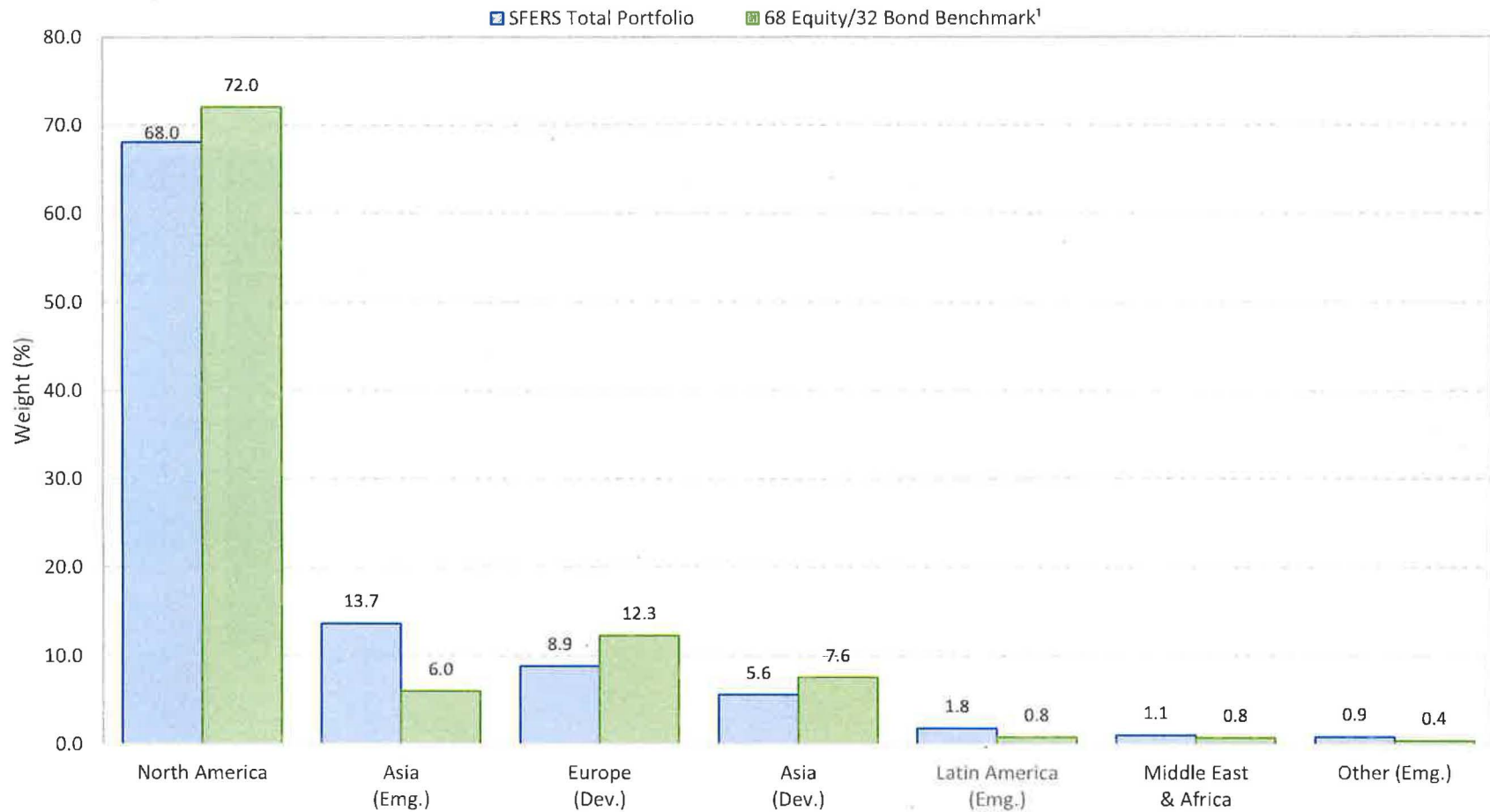


Notes: SFERS data sourced from NEPC and BNY Mellon. 70/30 Equity/Bond returns sourced from Evestment – represents 70% MSCI ACWI Net Dividends (prior to 1999 uses Gross Dividends) + 30% Bloomberg Barclays US Aggregate Index. Public DBs > 1bn sourced from NEPC and represents the Investment Metrics Public DB > \$1 Billion Net universe. ¹Risk is defined as Annualized Volatility Data Period: July 1, 2017 through June 30, 2020. Private Equity, Real Assets, and Private Credit performance as of 3/31/2020

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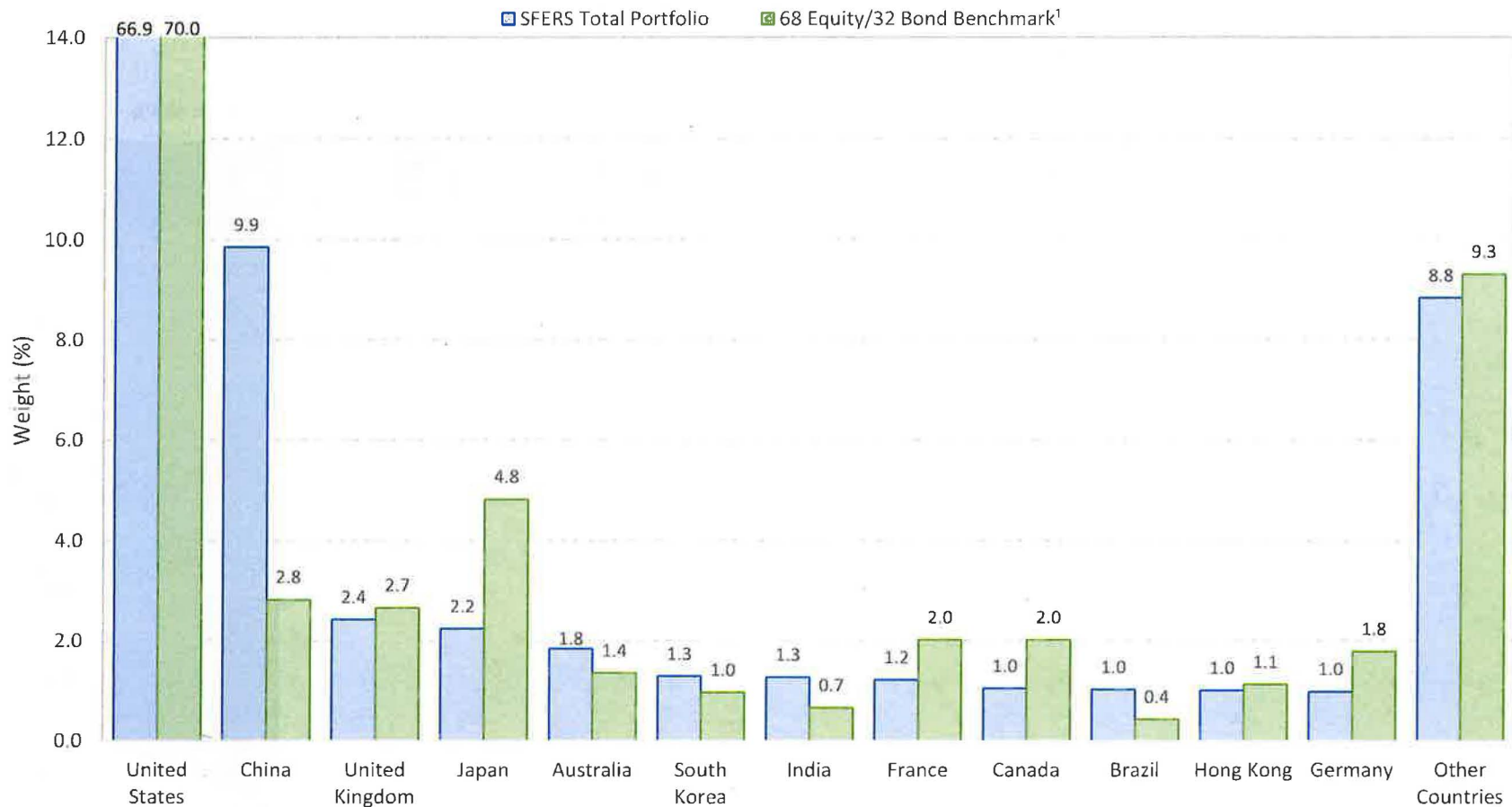
SFERS Total Fund | Exposures by Region



Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020. Shown as a % of net exposure. **Regional** exposures exclude commodities and supranational exposures (0.3%). Europe emerging and General emerging exposures (0.9%) are bucketed under Other Emerging. General developed exposure and undefined exposures (0.1%) bucketed as North America.

¹68 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)

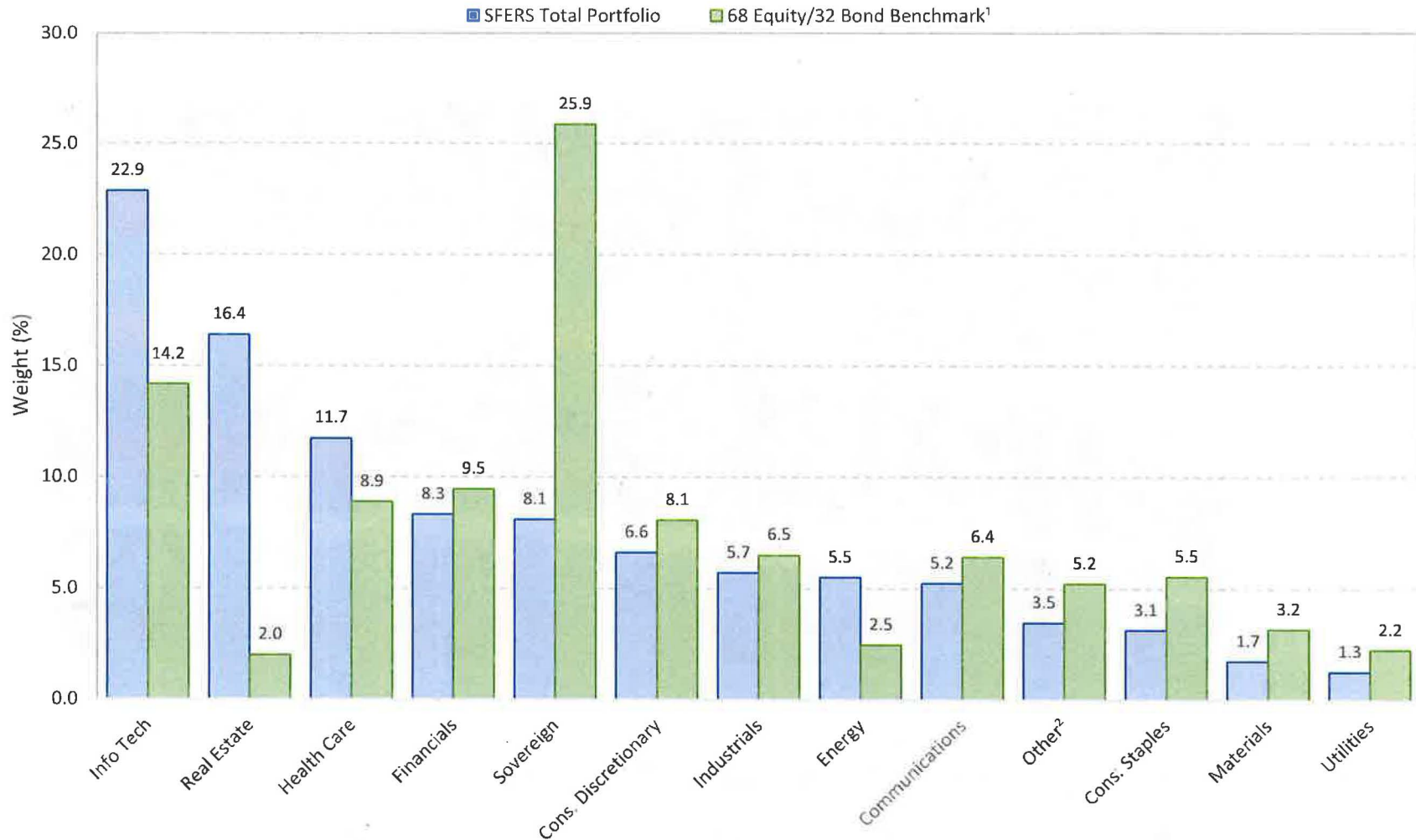
SFERS Total Fund | Exposure by Country



Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020. Shown as a % of net exposure. **Country** exposures exclude Commodities exposure (0.2%). North America undefined, General and Undefined exposures (4.2%) bucketed as United States. Europe undefined exposure (0.4%) split evenly between UK, France and Germany. Asia Developed undefined exposure (0.4%) split evenly between South Korea and Hong Kong. Asia Emerging undefined exposure (0.3%) split 2/3 to China and 1/3 to India. Middle East undefined exposure (0.1%) bucketed as Saudi Arabia. South America undefined exposure (0.1%) bucketed as Brazil.

¹68 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. 20 Aggregate).

SFERS Total Fund | Exposure by Sector



Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020. Shown as a % of net exposure.

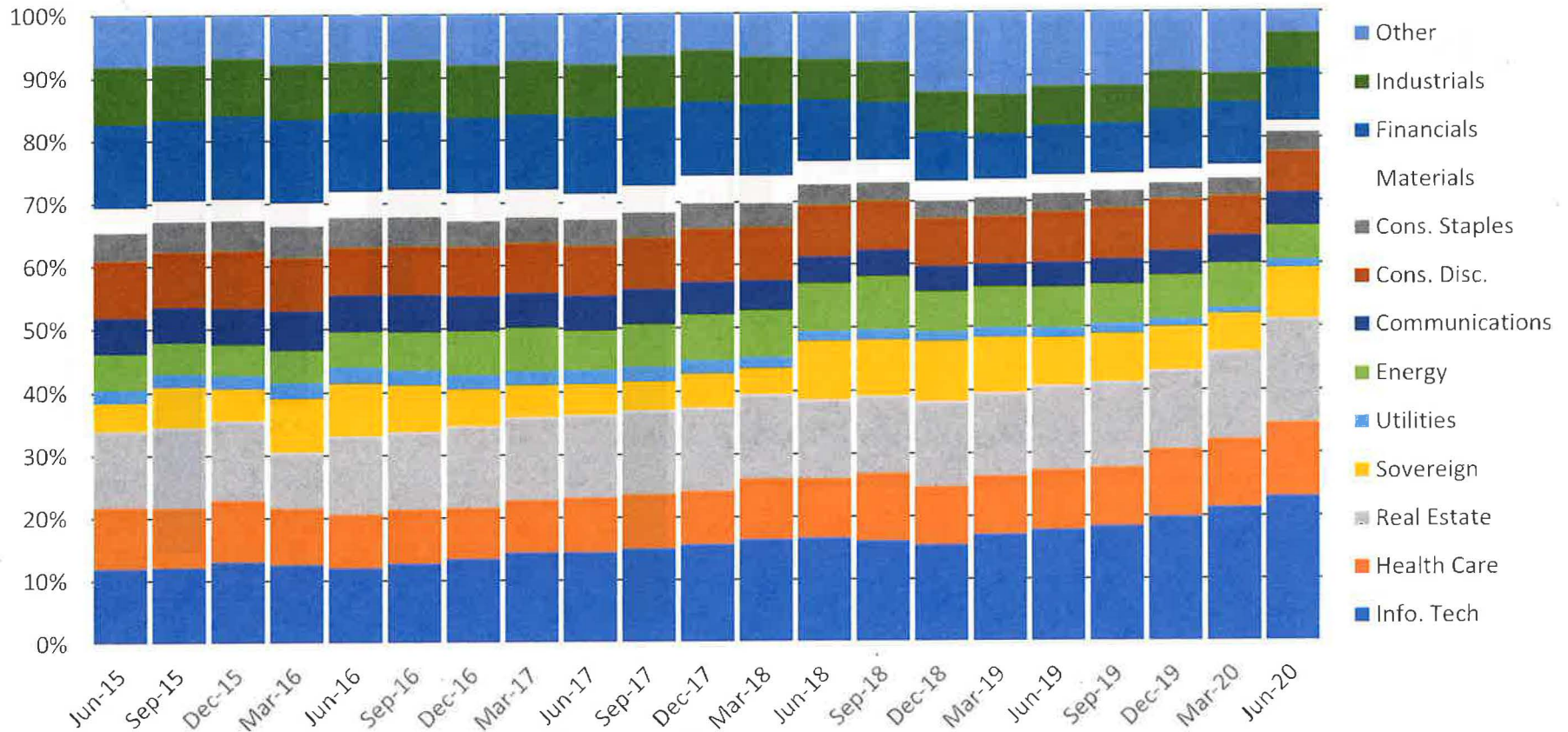
Sector exposures exclude cash and FX.

¹68 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).

²Other consists of ABS, CMBS, Municipal bonds, investment grade bonds, structured credit and commodities.

SFERS Total Fund | Exposure by Sector Over Last 5 Years

- SFERS doubled IT exposure over the last 5 years while decreasing Industrials and Credit
- SFERS increased allocation to Sovereign by introducing direct allocation to U.S. Treasuries



Notes: Private market asset class exposures are one quarter lagged. Shown as a % of net exposure. **Sector** exposures exclude cash and FX.
²Other consists of ABS, CMBS, Municipal bonds, investment grade bonds, structured credit, commodities and unknown exposures

SFERS Public Equity | Sector Performance Attribution for Public Equity

- Over half of active outperformance comes from Health Care and IT
- SFERS benefited from both sector tilt and stock selection within Health Care and IT allocations

Cumulative Active Return Attribution for SFERS Public Equities vs MSCI ACWI in Percent

	1 YEAR			3 YEARS			5 YEARS			7 YEARS		
	Sector Allocation	Stock Selection	Total	Sector Allocation	Stock Selection	Total	Sector Allocation	Stock Selection	Total	Sector Allocation	Stock Selection	Total
Health Care	0.60	1.13	1.66	0.78	1.30	1.95	0.87	1.65	2.43	1.44	2.32	3.57
Information Technology	1.38	0.87	2.23	1.94	1.61	3.46	2.56	1.28	3.80	3.48	2.34	5.36
Other Sectors (incl. Cash)	2.45	1.65	4.19	2.91	1.79	4.92	3.59	1.41	5.13	5.14	2.95	8.74
Total	4.43	3.65	8.08	5.63	4.70	10.33	7.02	4.34	11.36	10.06	7.61	17.67

SFERS Total Fund | Sector Performance Attribution for Private Equity

- SFERS investment in Health Care and IT private companies outperformed the rest of portfolio by a wide margin
- SFERS Health Care and Technology investment outperformed respective Cambridge benchmarks

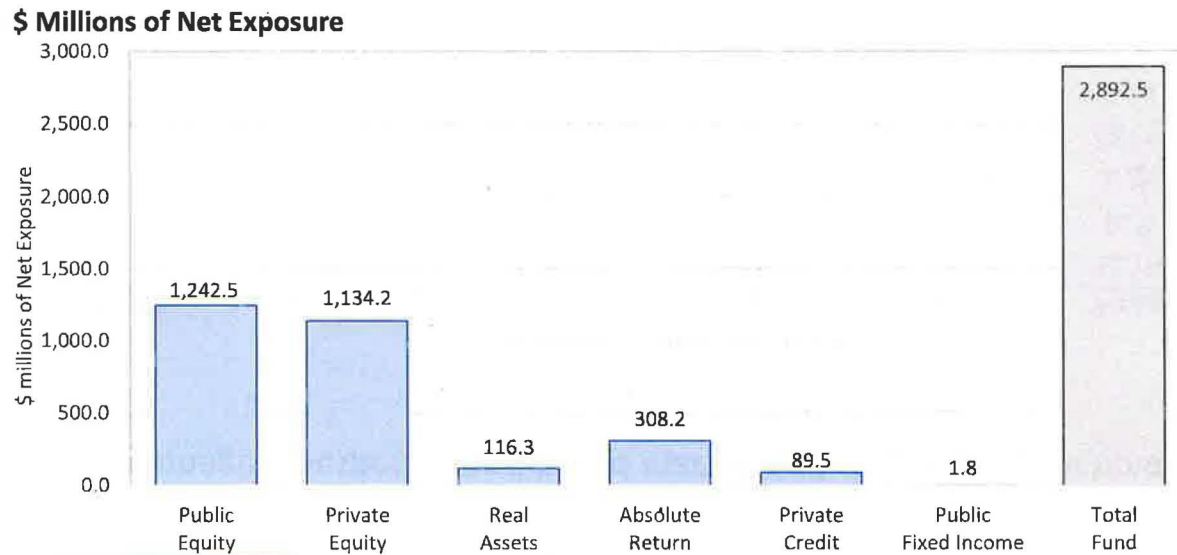
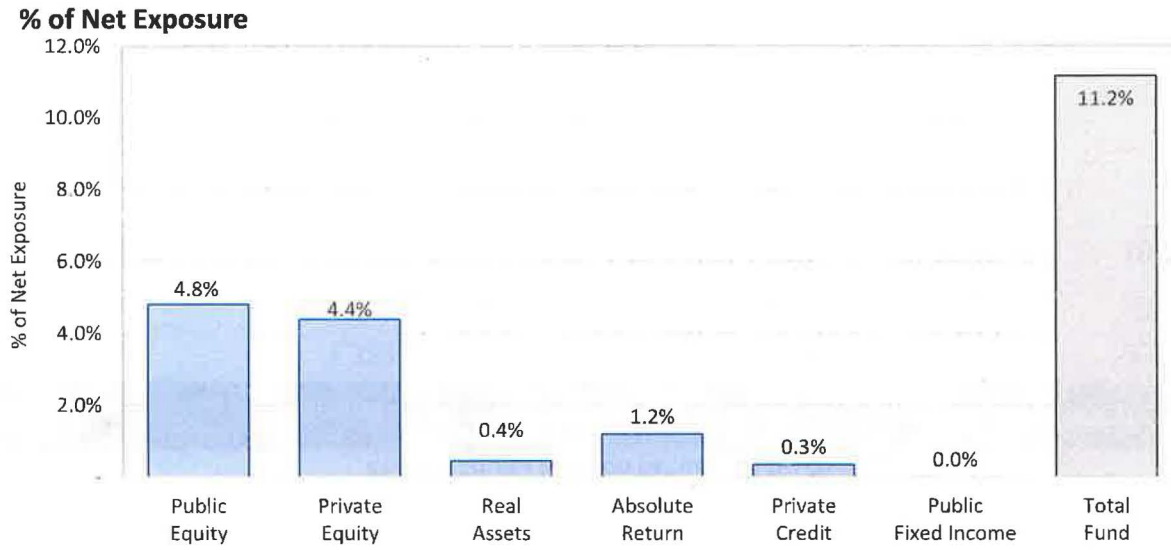
Sector	Commitment	Horizon Returns 6/30/2020 ¹					IRR ITD	DPI	TVPI
		IRR 1 year	IRR 3 year	IRR 5 year	IRR 10 year				
Health Care	706,116,204	41.9%	28.5%	22.5%	22.8%	19.8%	0.42x	1.75x	
Cambridge Health Care Benchmark ^{1, 2}		19.6%	21.0%	14.6%	17.1%	14.0%	0.86x	1.73x	
<i>Difference</i>		22.3%	7.5%	7.9%	5.7%	5.8%	(0.43x)	0.02x	
Information Technology	3,192,087,206	16.8%	20.0%	16.3%	19.6%	45.0%	0.49x	1.72x	
Cambridge Technology Benchmark ^{1, 2}		15.4%	21.5%	16.1%	19.1%	14.6%	0.87x	1.75x	
<i>Difference</i>		1.4%	(1.5%)	0.2%	0.4%	30.4%	(0.38x)	(0.03x)	
Other Sectors	9,080,458,059	6.1%	12.9%	12.3%	13.2%	15.0%	1.16x	1.61x	
PE Total Portfolio³	12,978,661,469	12.9%	16.5%	14.2%	15.0%	16.0%	0.98x	1.64x	

Source: Askia data as of June 30th, 2020

Note ¹Data is preliminary, ²Benchmarks are generated with similar vintage years for the respective sectors across buyout, growth equity, and venture capital strategies

³~90% of 6/30/20 valuations reported

SFERS Total Fund | Greater China Exposure



Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020. Greater China includes China, Hong Kong, Taiwan and Macau Undefined Asia Developed exposure for Private Equity are assumed to be a mix of 90% Greater China countries and 10% other countries.

SFERS Total Fund | China Performance Attribution

SFERS China managers outperformed broad market and respective benchmarks

Public Equity (6/30/20)	NAV (\$MM)	% of SFERS Portfolio	% of SFERS Public Equity	1-Year	3-Year	5-Year	ITD
SFERS China Managers	\$806	3.1%	9.0%	12.9%	12.3%	-	17.6%
MSCI ACWI				2.1%	6.1%	-	8.5%
<i>Excess Returns v. MSCI ACWI</i>				10.8%	6.2%	-	9.1%
S&P 500				7.5%	10.7%	-	11.5%
<i>Excess Returns v. S&P 500</i>				5.4%	1.6%	-	6.1%

Private Equity Horizon Returns 6/30/2020 ¹							
Portfolio/Benchmark	Commitment	IRR 1 year	IRR 3 year	IRR 5 year	IRR ITD	DPI	TVPI
China Managers ²	1,382,000,000	18.3%	23.1%	19.3%	20.0%	0.18x	1.55x
PE Portfolio ³	12,978,661,469	12.9%	16.5%	14.2%	16.0%	0.98x	1.64x
Cambridge China Benchmark ⁴		20.2%	19.6%	17.4%	19.0%	0.29x	1.75x

Source: BNY Mellon, Askia

Notes: Note ¹Data is preliminary, ²Benchmarks are generated with similar vintage years for the respective sectors across buyout, growth equity, and venture capital strategies

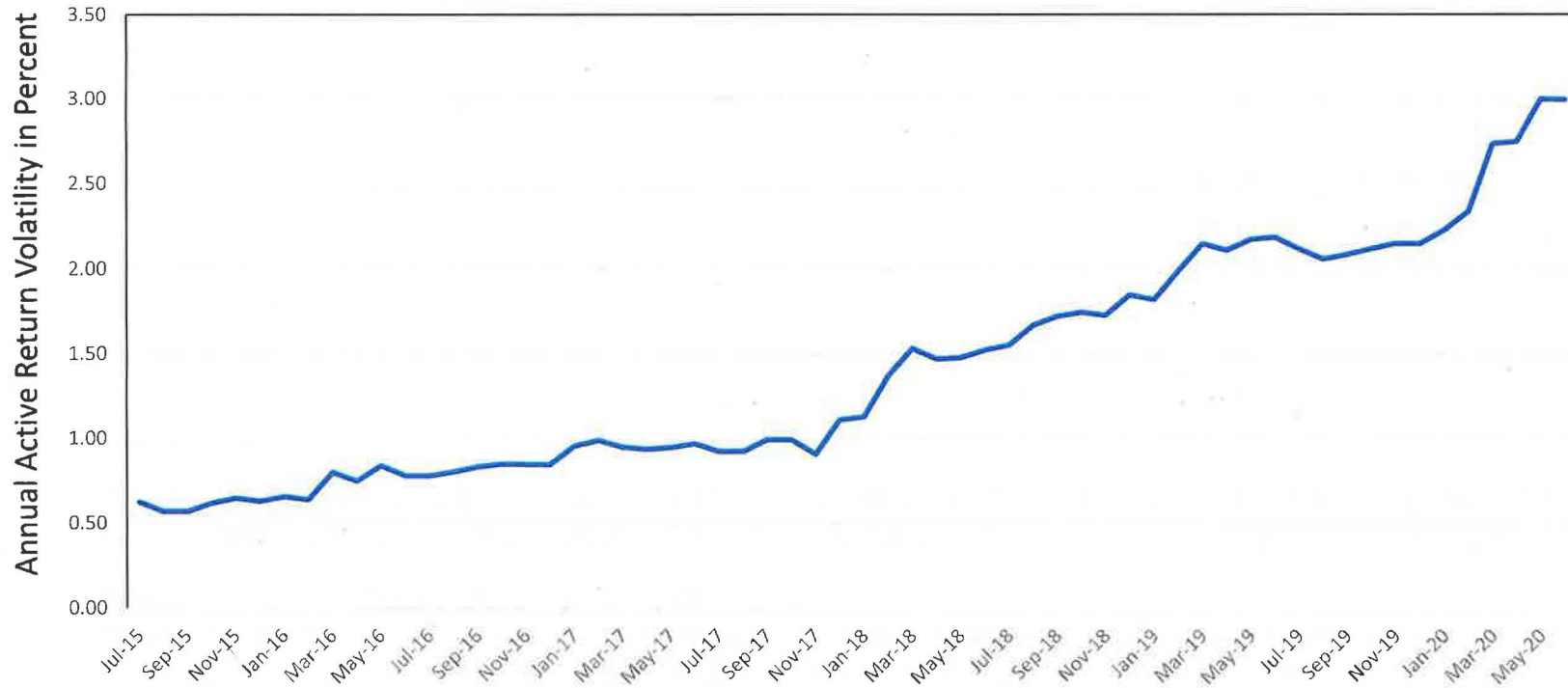
³~90% of 6/30/20 valuations reported

⁴Data is preliminary. Benchmark created includes China-focused buyout, growth, and venture managers with vintage years 2011 and 2013-2020

SFERS Public Equity | Tracking Error Over Last 5 Years

- Ex-Ante Tracking error measures portfolio's annual volatility away from the benchmark index
- **SFERS Public Equity portfolio active risk increased 5 times over past 5 years**
- Portfolio Ex-Ante Tracking Error estimate increased from 57bps in 2015 to 300bps in 2020

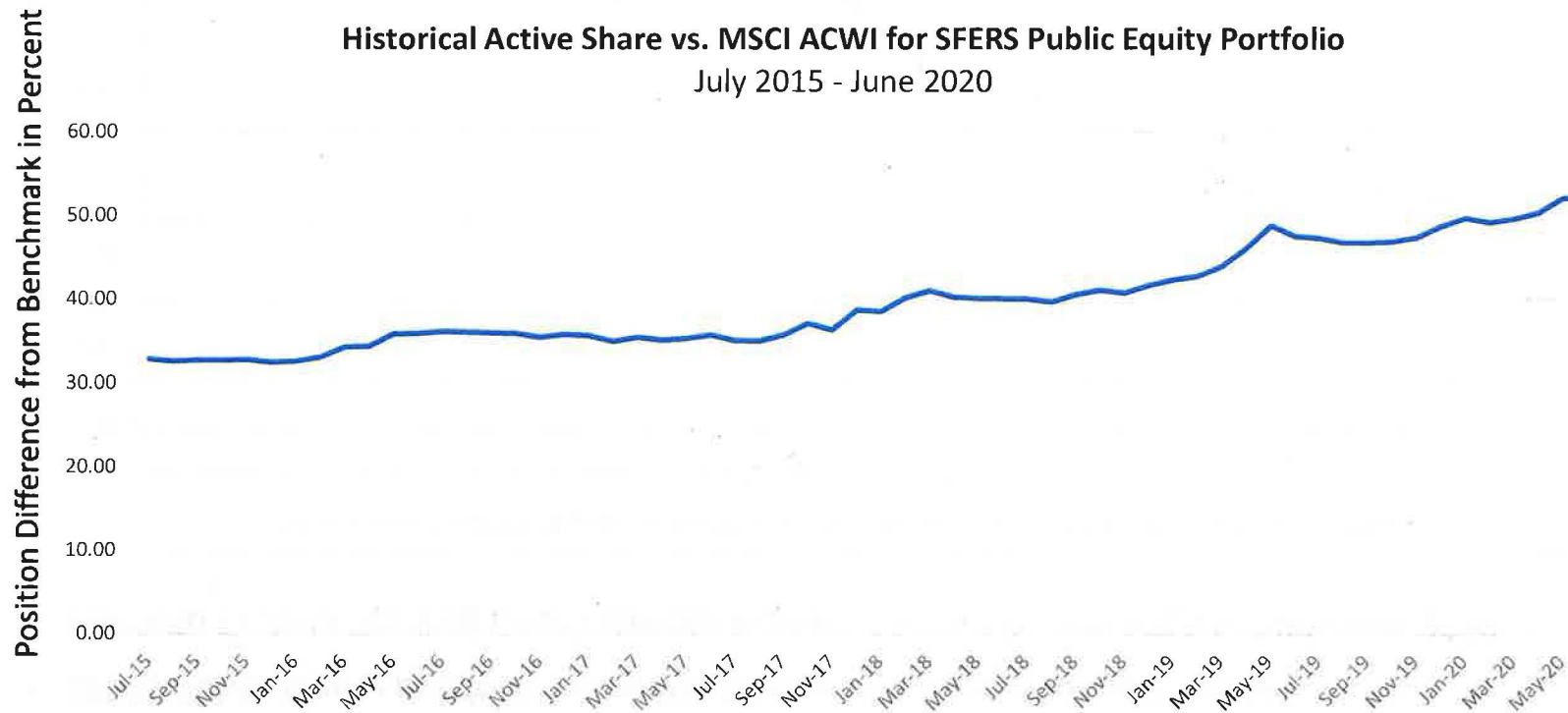
Historical Ex-Ante Tracking Error vs. MSCI ACWI for SFERS Public Equity Portfolio
July 2015-June 2020



Source: StyleAnalytics.

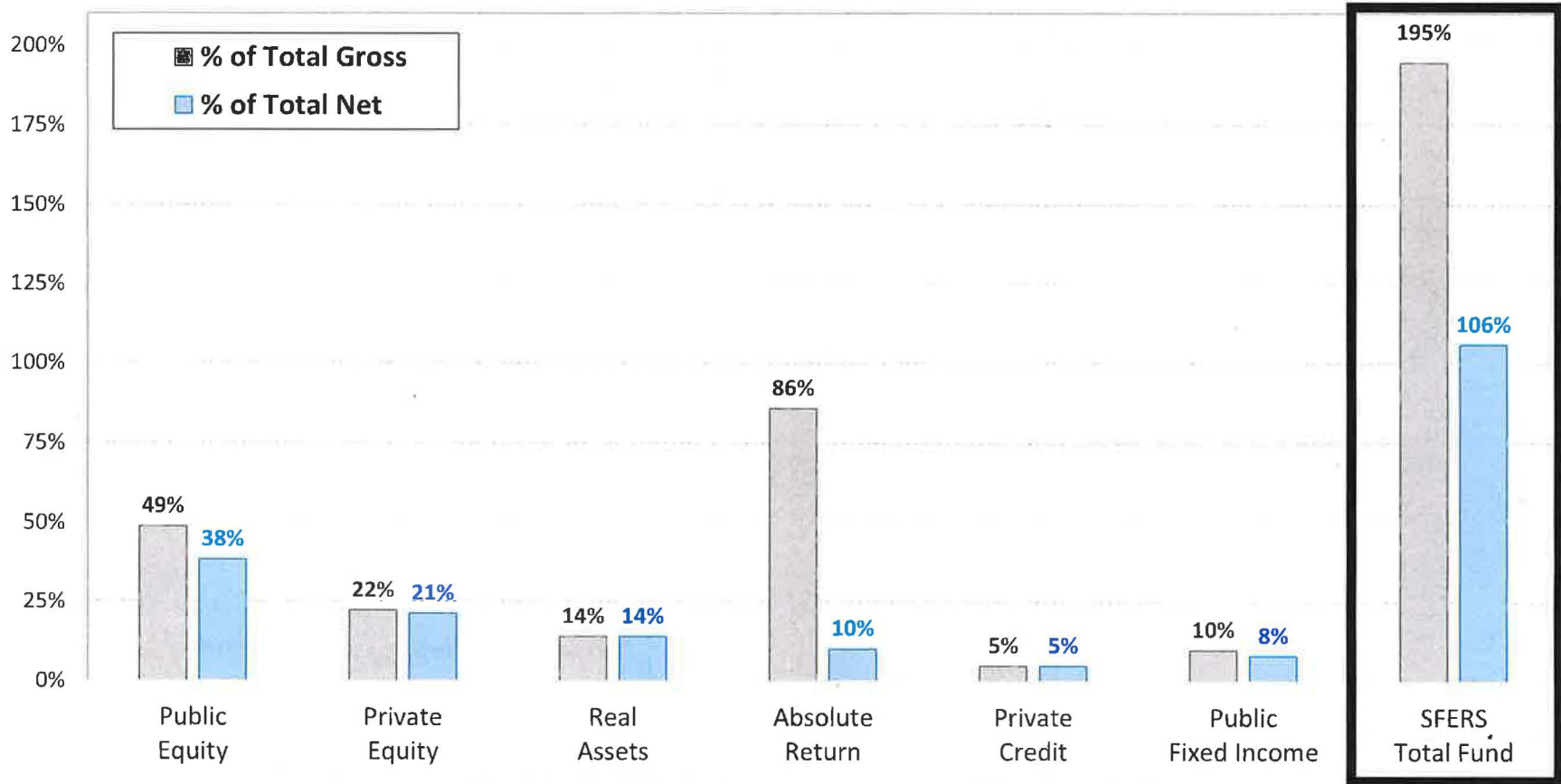
SFERS Public Equity | Active Share Over Last 5 Years

- “Active Share” measures how portfolio is different from the benchmark quantifying the degree of active management. Active Share measures the fraction of portfolio’s position weights that differs from the benchmark index, MSCI ACWI in the analysis below
- Active Share for SFERS Public Equity Portfolio increased from 32% to 52% over the past 5 years, i.e. more than half of Public Equity portfolio is different from MSCI ACWI benchmark now vs. less than a third 5 years ago



SFERS Exposure Analysis | Gross and Net Exposures By Asset Class

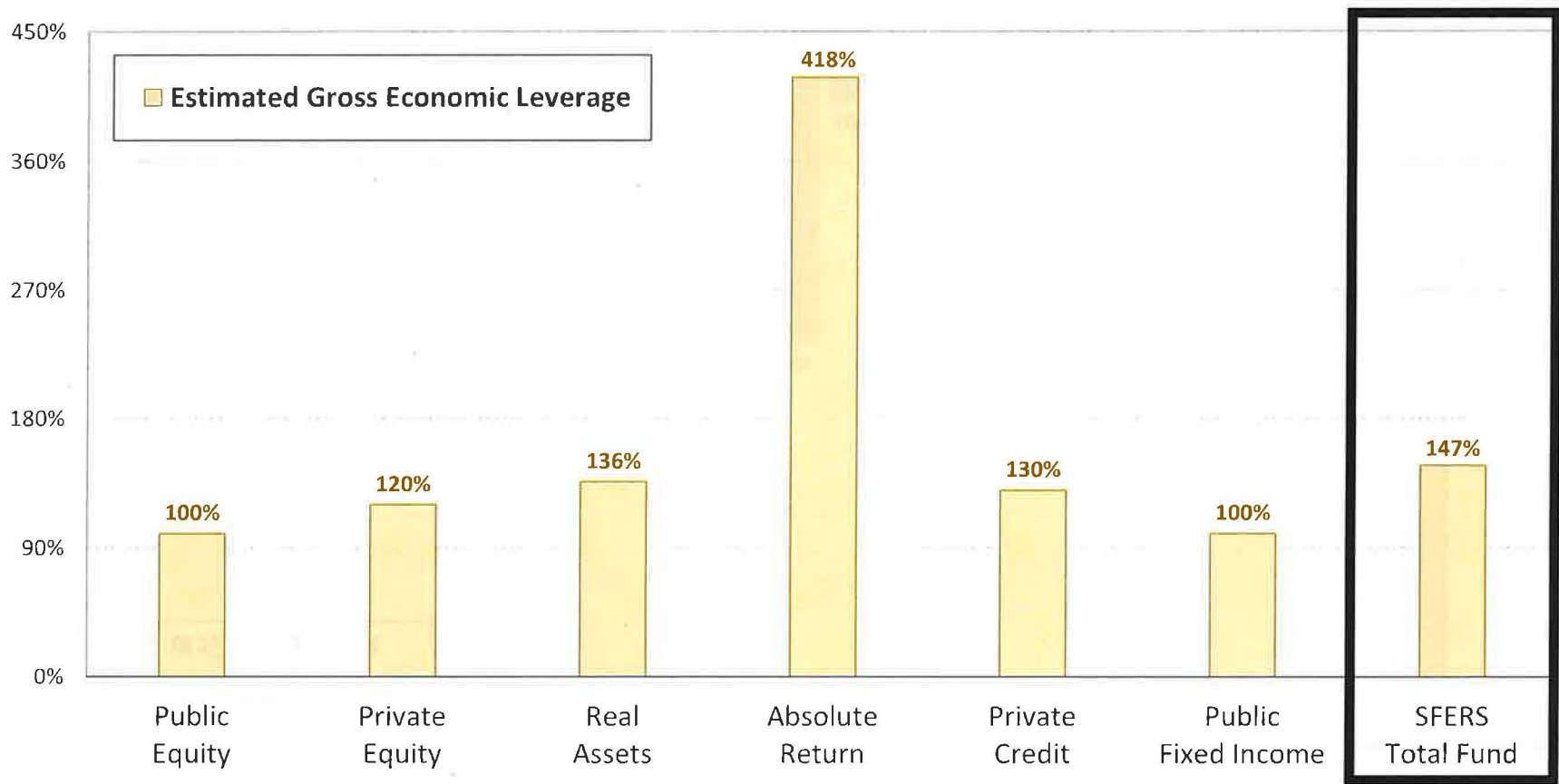
Gross and Net Exposures as Percent of Total Fund's NAV



Note: Exposures as of June 30, 2020. Gross exposures do not net similar positions and do not risk/volatility adjust positions.
 Source: Caissa, Blackstone Alternative Asset Management.

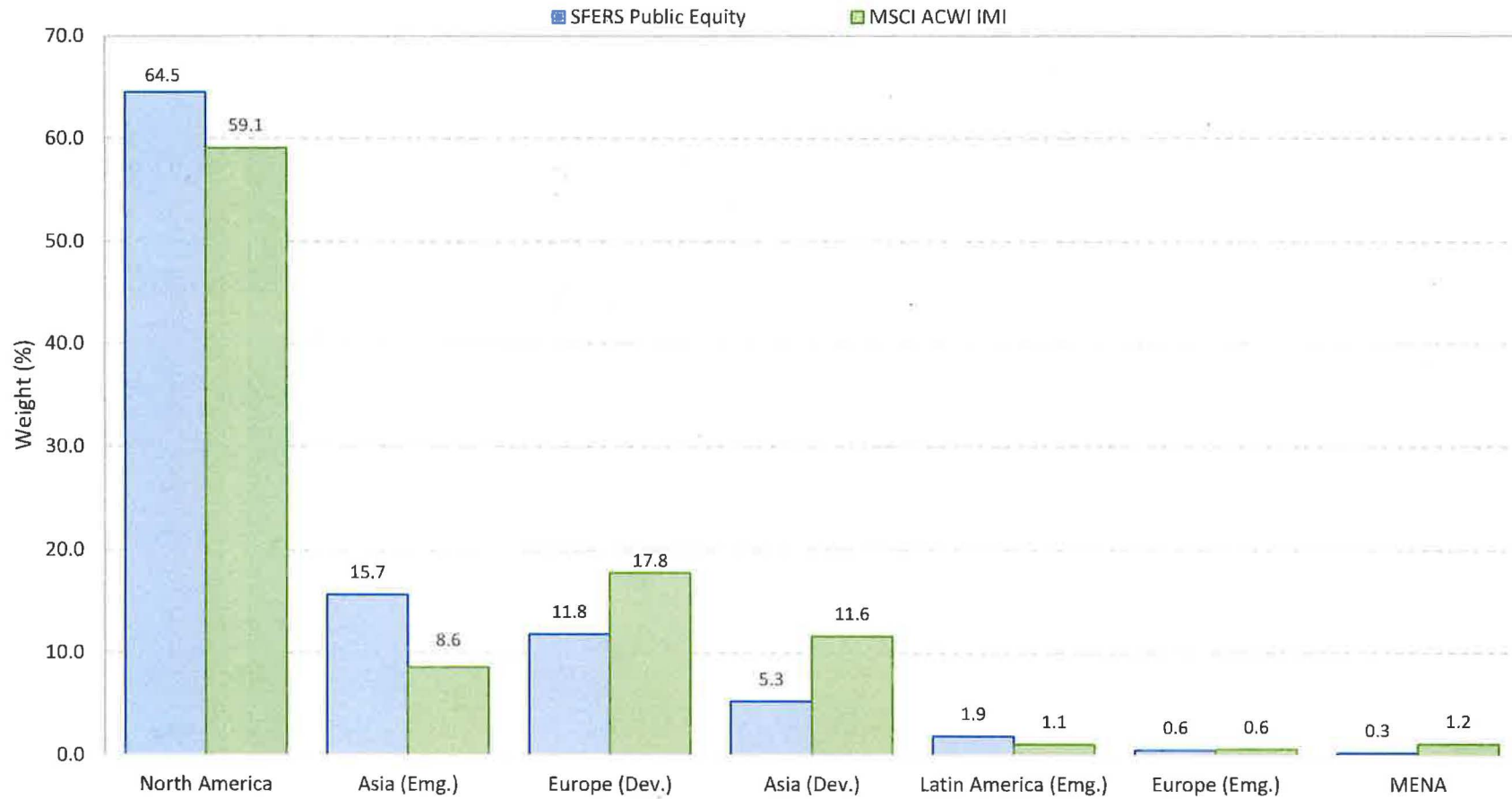
SFERS Exposure Analysis | Economic Leverage By Asset Class

Estimated Economic Exposures as Percent of Total Fund's NAV



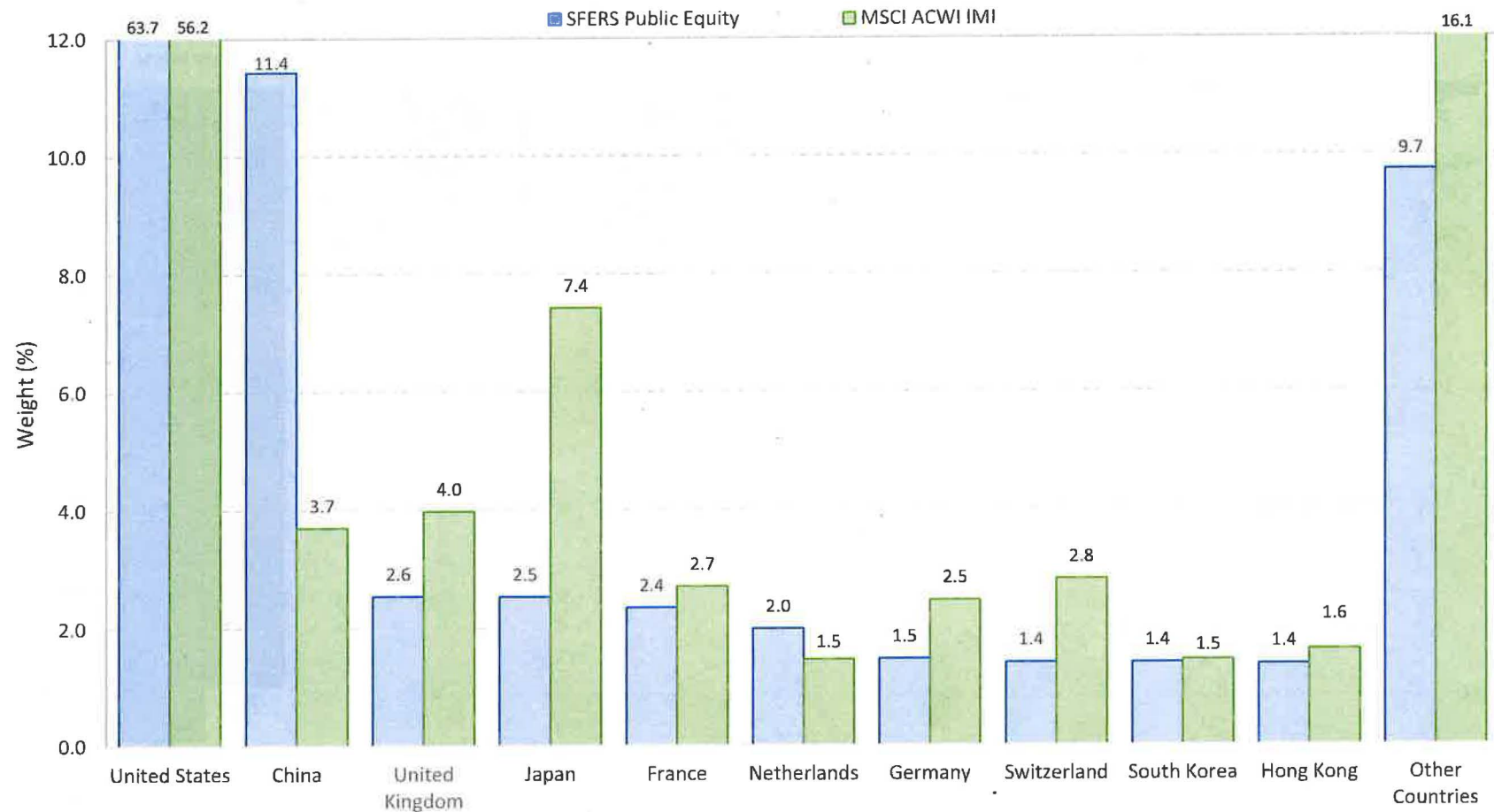
Note: Exposures as of June 30, 2020. The following assumptions are made: Private Equity's 120% leverage as the result of 50% assumed leverage of Buyout, which is 40% of total PE exposure, Venture Capital and Growth exposures are at zero leverage; Real Assets' 136% leverage as the result of 60% leverage (LTV) of Real Estate which is 60% of total RA exposure, Natural Resources are assumed to have zero leverage; Private Credit is conservatively estimated at 130% leverage, and Absolute Return's balancesheet leverage is calculated by Blackstone Alternative Asset Management.

Public Equity | Exposure by Region



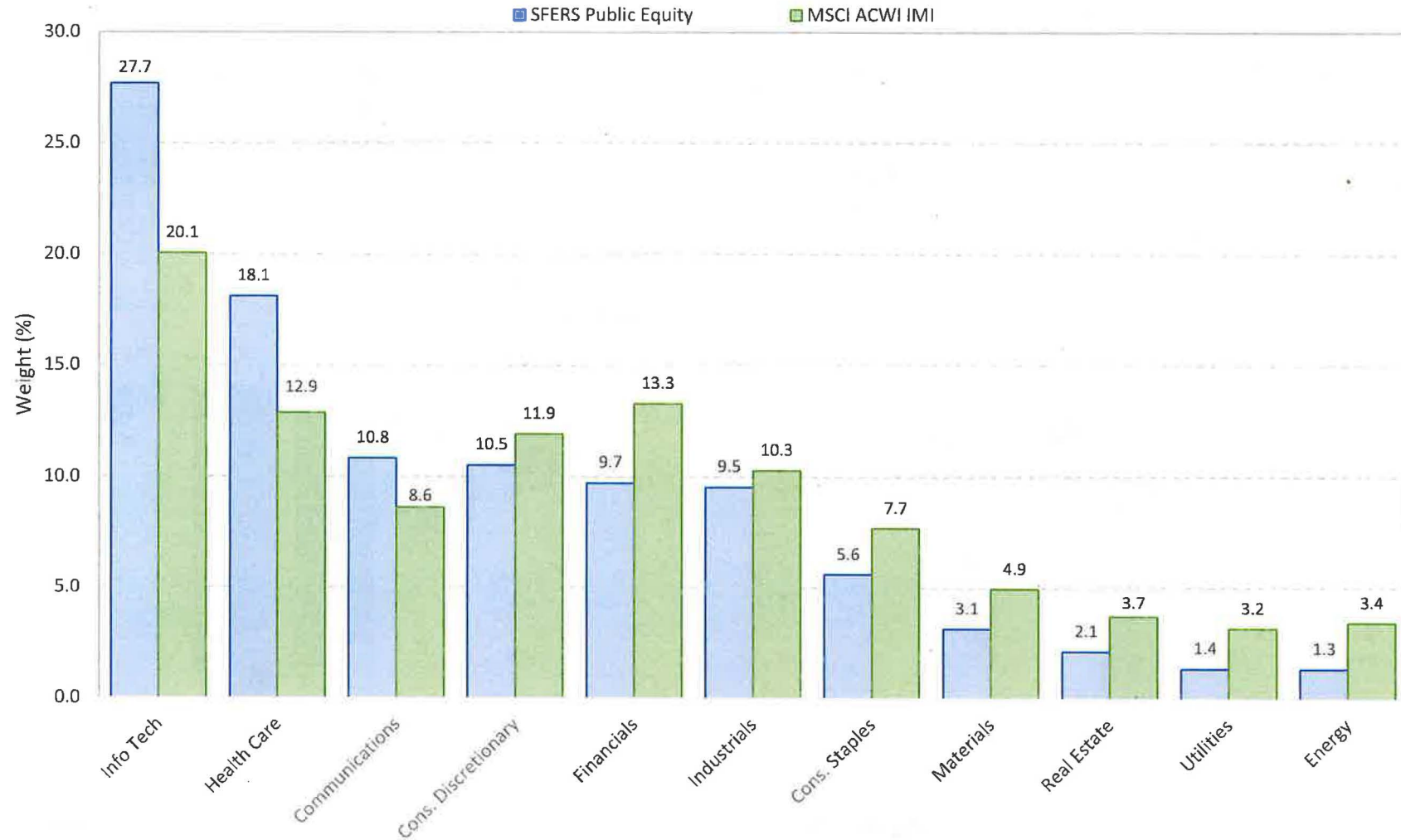
Notes: Exposures as of June 30, 2020. Shown as a % of net exposure.
 Undefined exposure (0.1%) bucketed as North America.

Public Equity | Exposure by Country



Notes: Exposures as of June 30, 2020. Shown as a % of net exposure. Undefined exposure (0.1%) bucketed as United States.

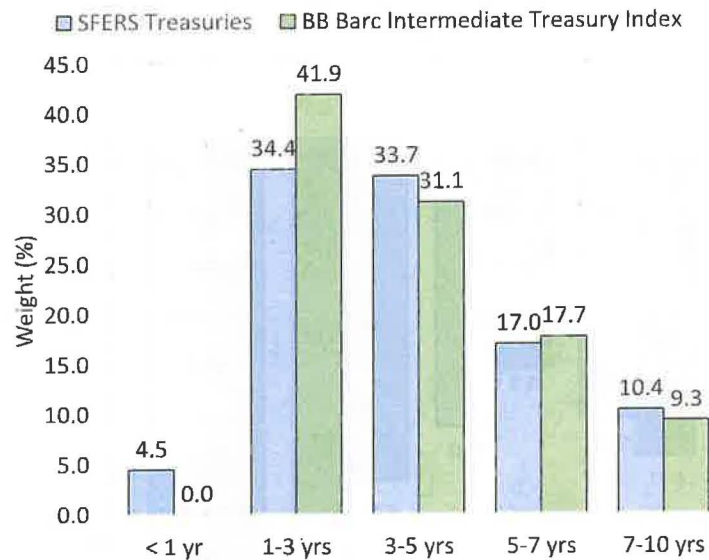
Public Equity | Exposure by Sector



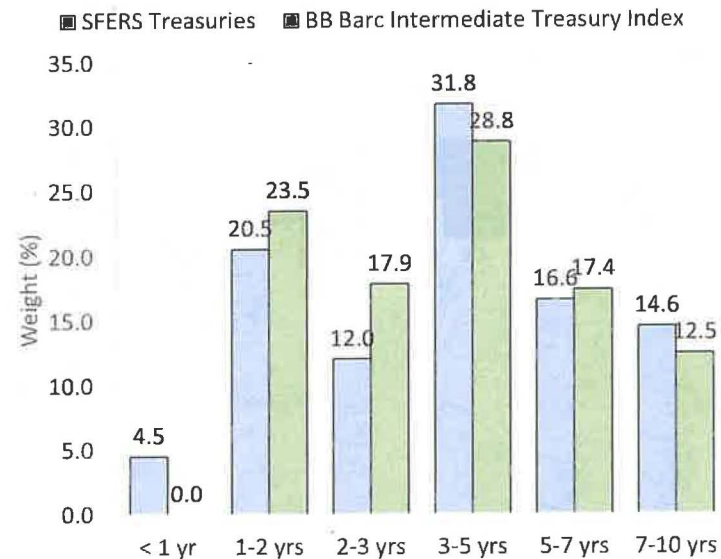
Notes: Exposures as of June 30, 2020. Shown as a % of net exposure.
Sector exposures exclude cash and FX.

Treasuries | Duration, Maturity and Risk Characteristics

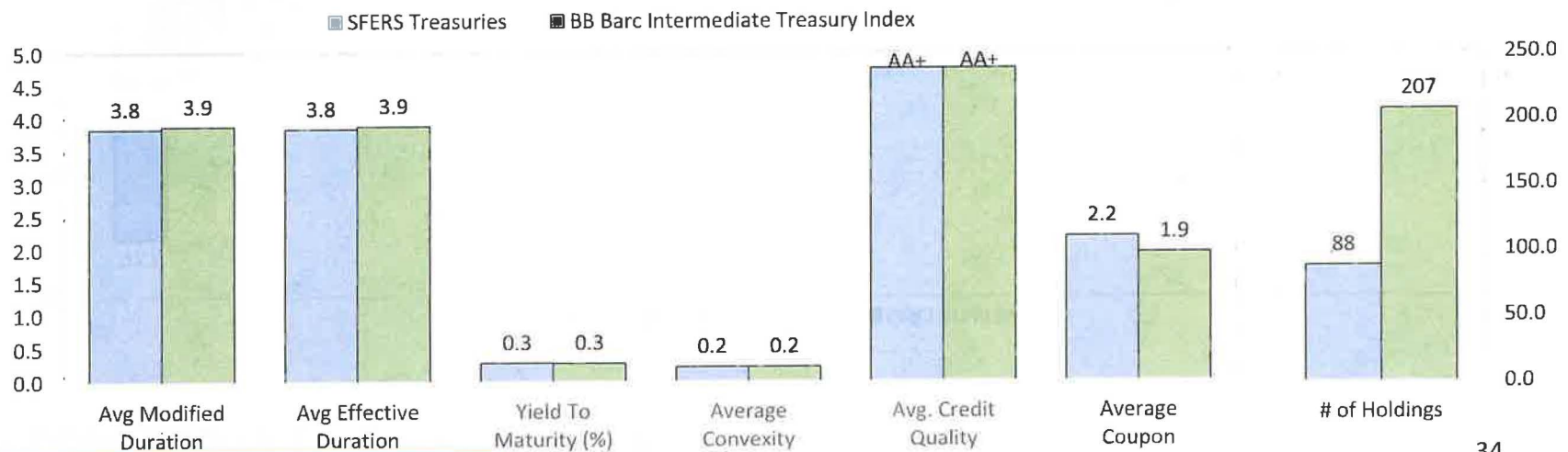
Duration Buckets



Maturity Buckets



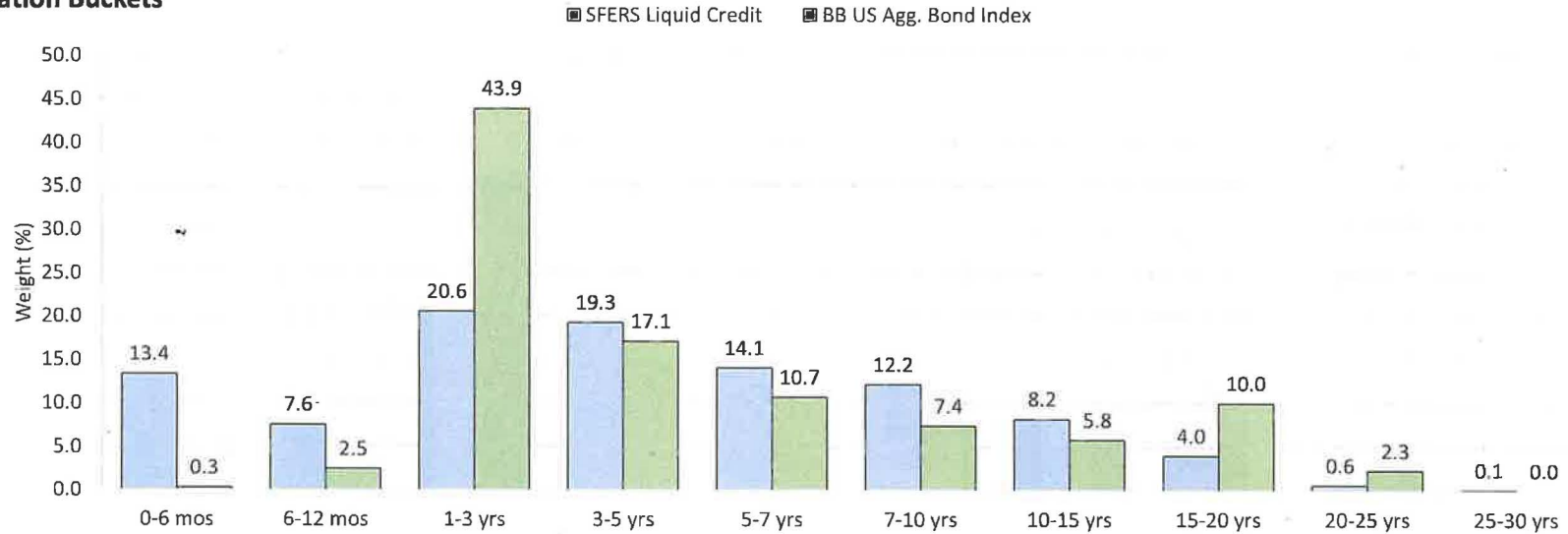
Risk Characteristics



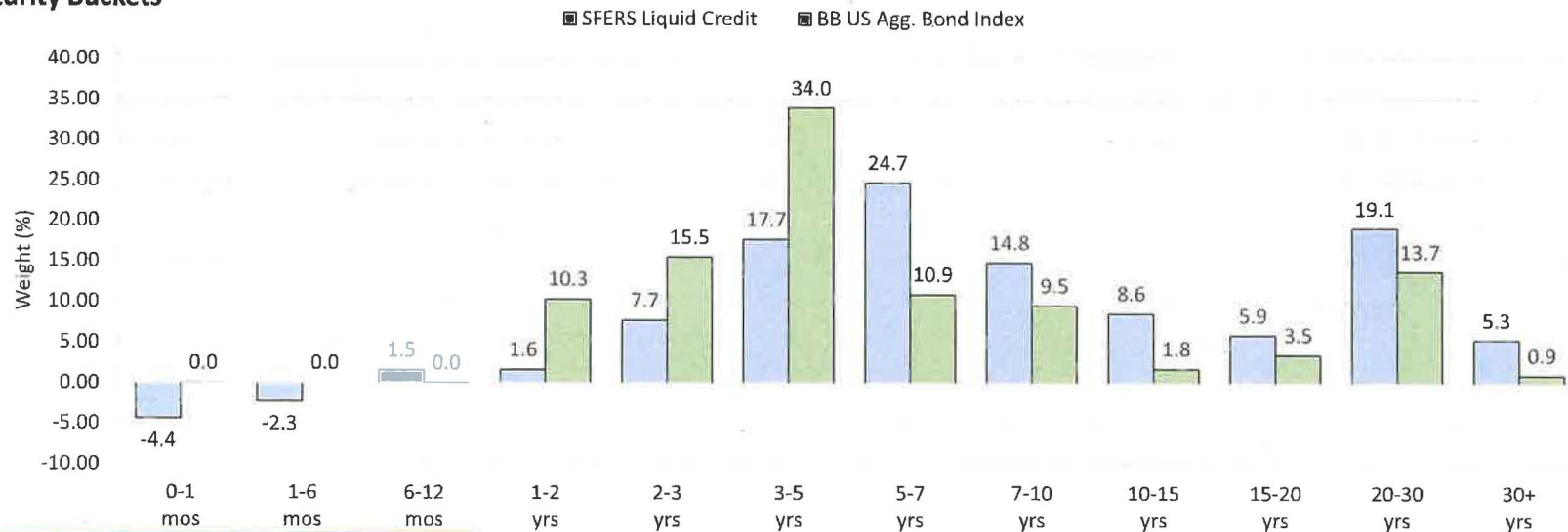
Notes: Exposures as of June 30, 2020.

Liquid Credit | Duration and Maturity Characteristics

Duration Buckets

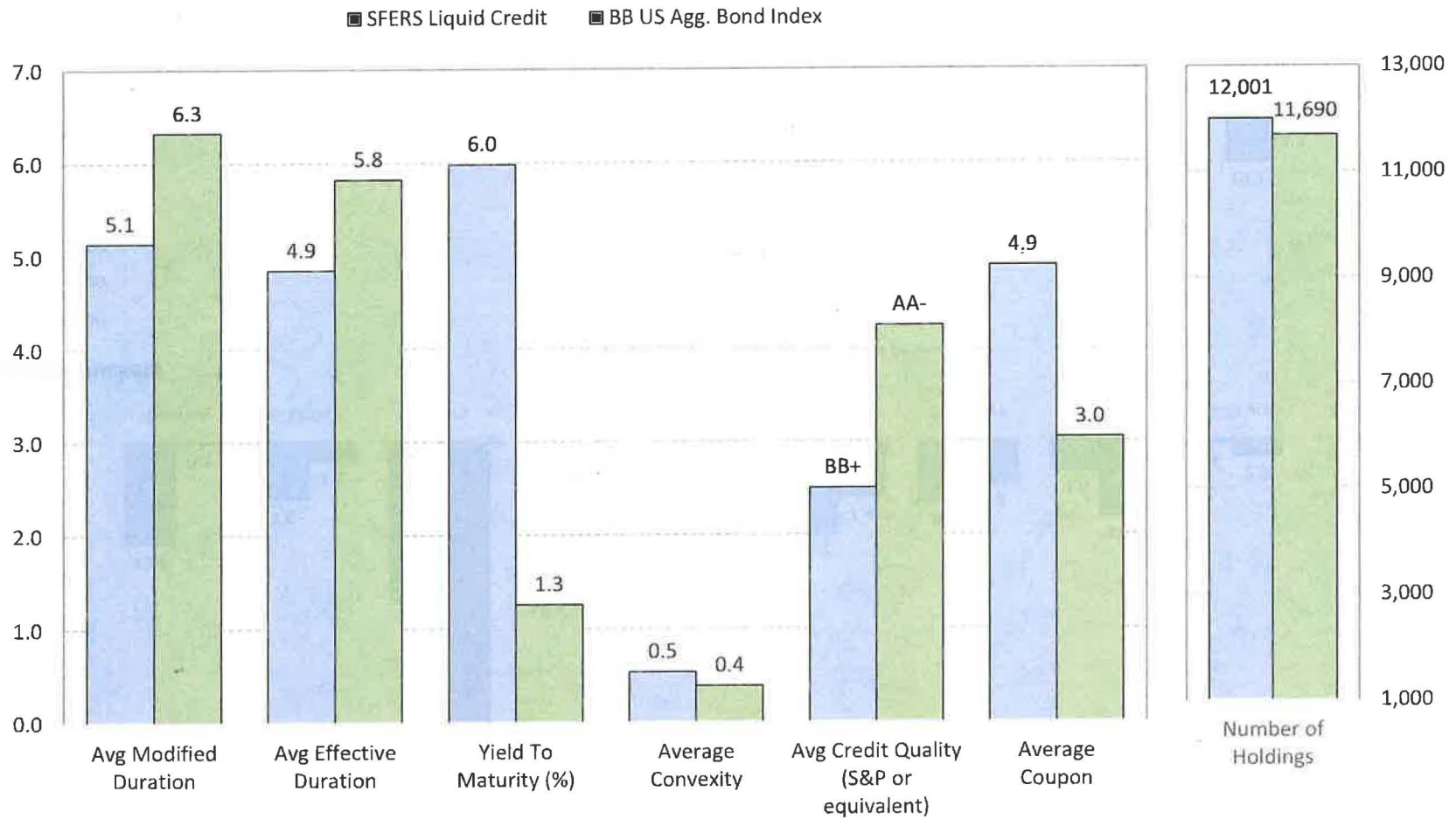


Maturity Buckets



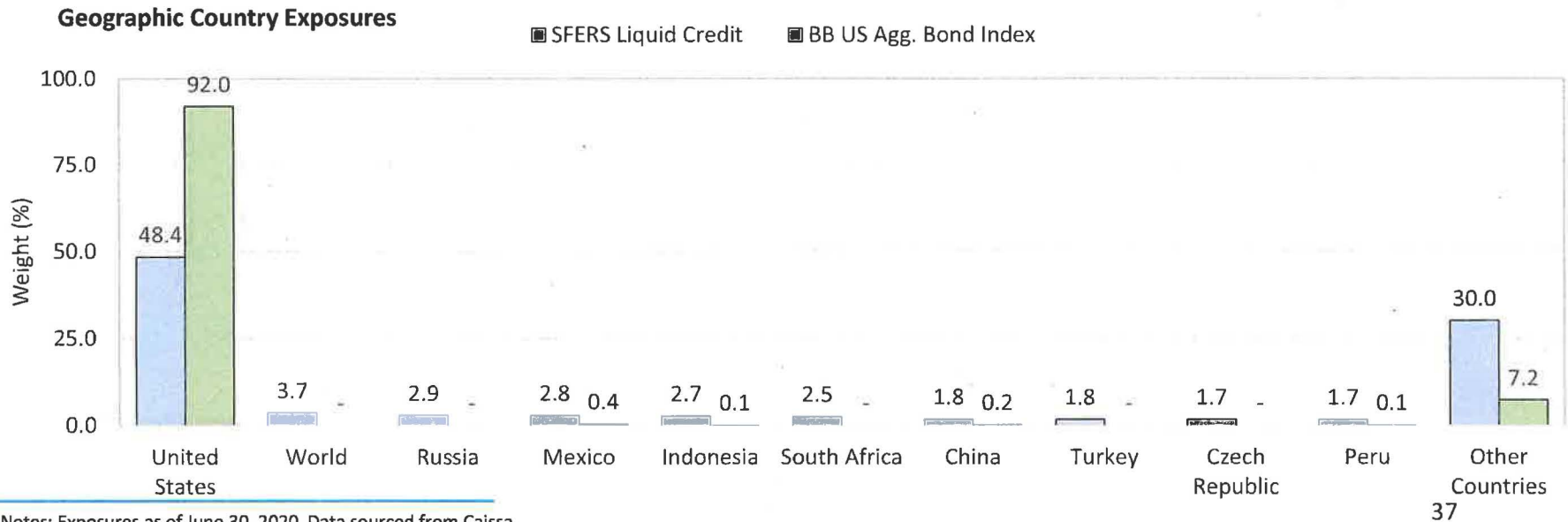
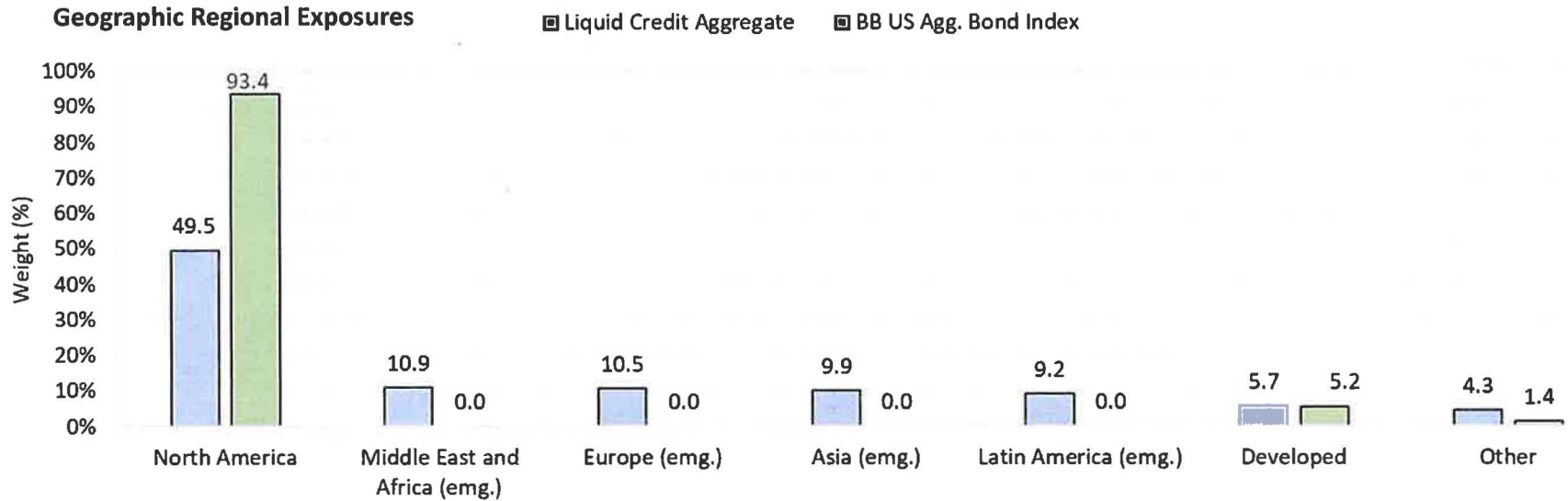
Notes: Exposures as of June 30, 2020.
Data sourced from managers.

Liquid Credit | Risk Characteristics



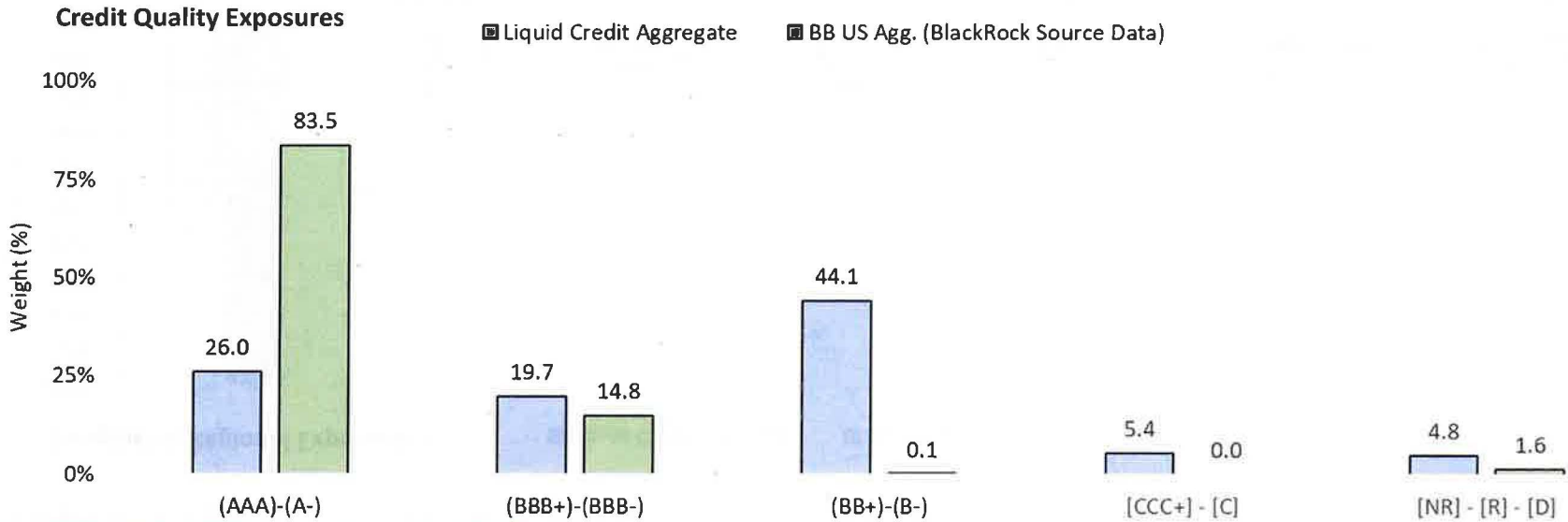
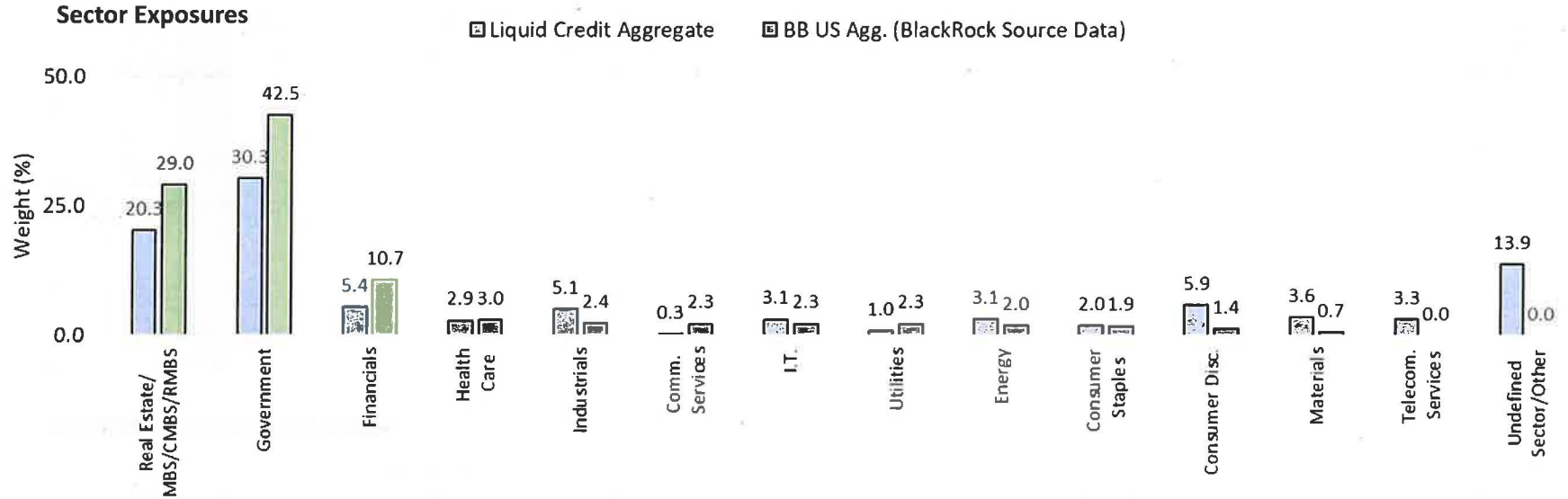
Notes: Exposures as of June 30, 2020.
Data sourced from managers.

Liquid Credit | Exposure by Region and Country



Notes: Exposures as of June 30, 2020. Data sourced from Caissa.
 Undefined Region and Country excluded. Region and Country weights are re-weighted to a base of 100%.

Liquid Credit | Exposure by Sector and Credit Quality



Notes: Exposures as of June 30, 2020. Data sourced from managers.

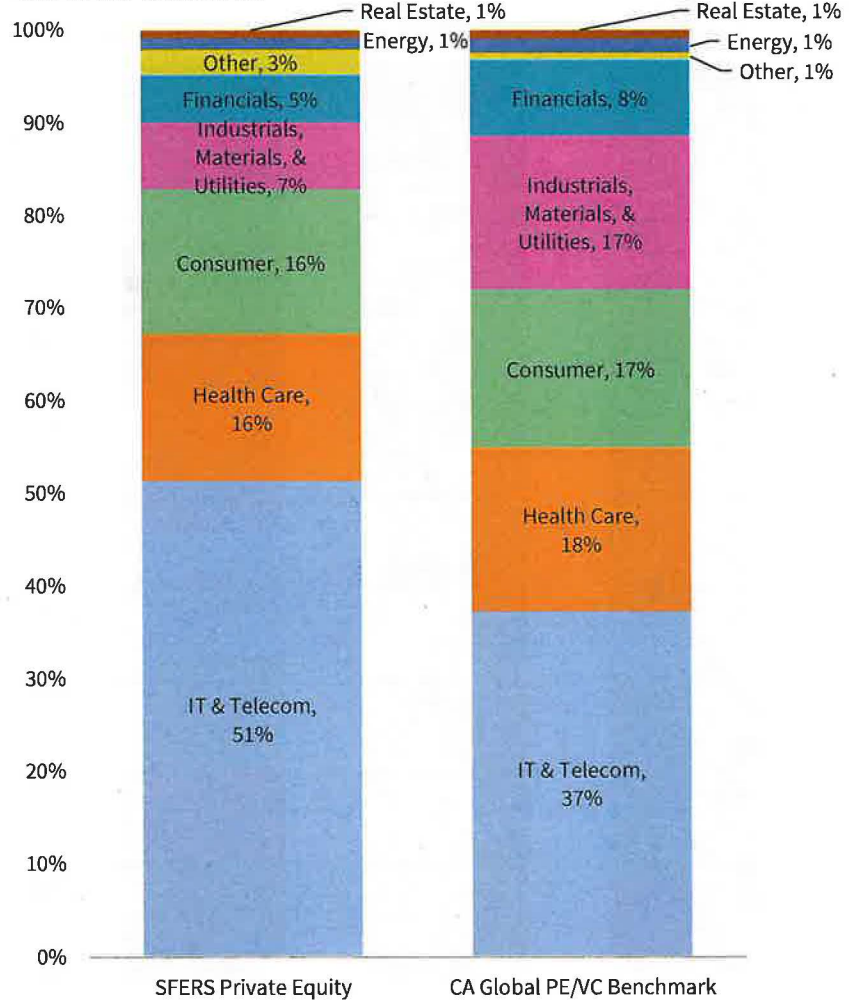
Gov. weighting as reported in Security Type exposure (Caissa reporting). RMBS/CMBS/MBS is summed from Security type (Securitized) section of Caissa reporting.

Private Equity | Exposure by Geography and Sector

GEOGRAPHIC NAV BREAKDOWN



SECTOR NAV BREAKDOWN

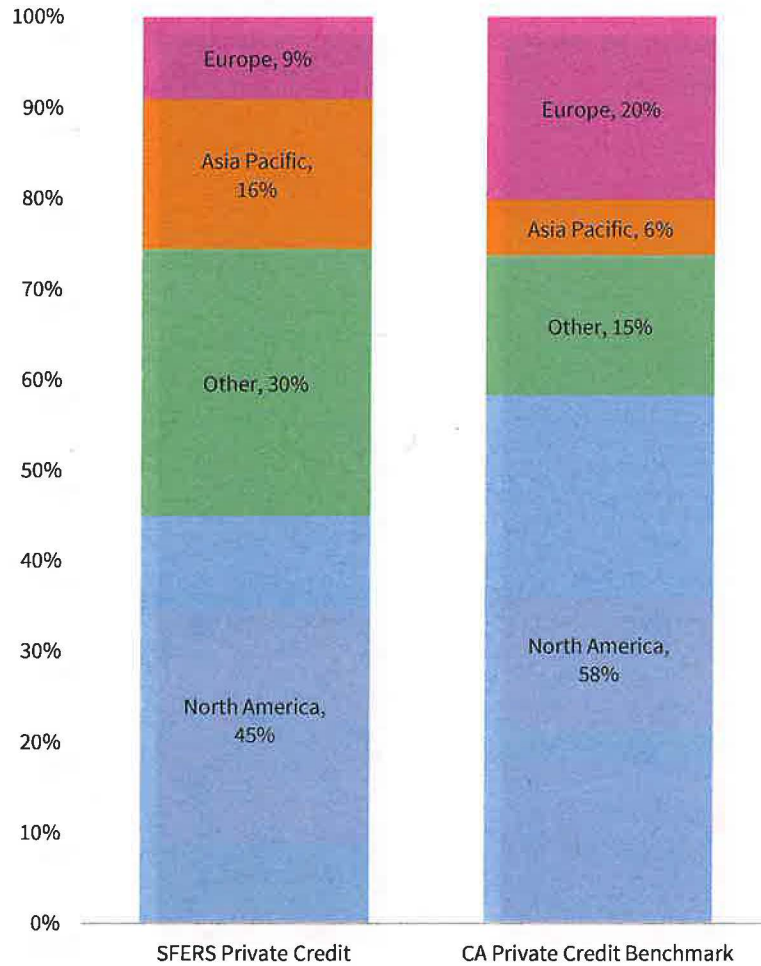


Sources: Aksia and Cambridge Associates LLC.

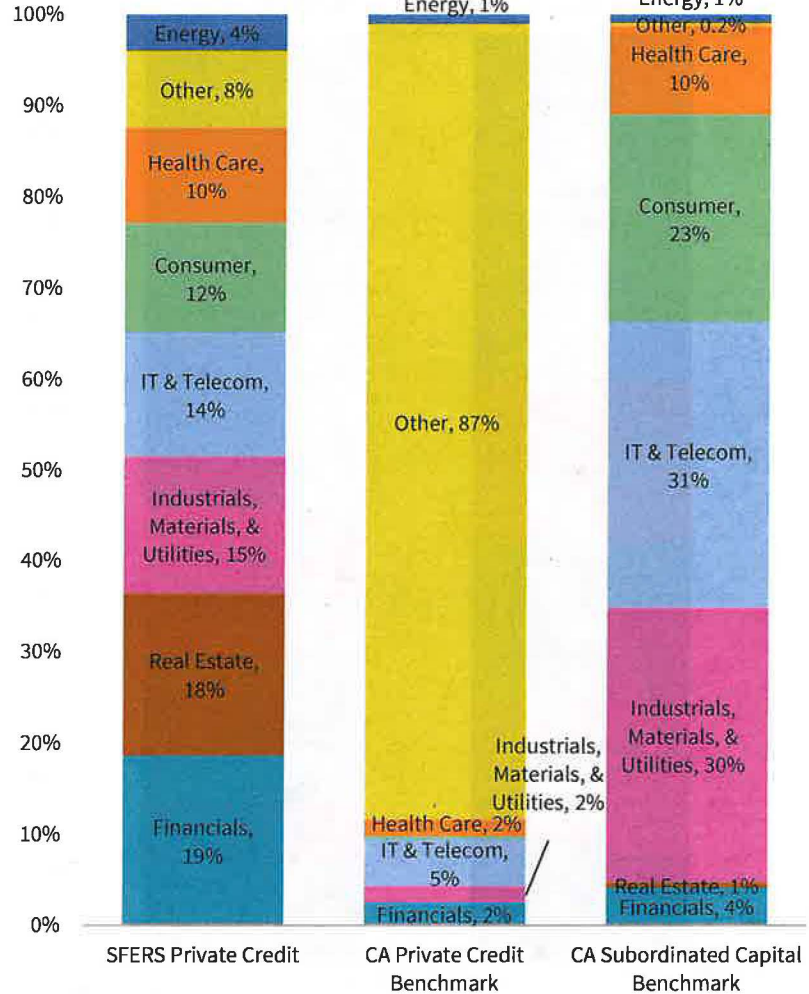
Notes: Breakdown based on NAV as of March 31, 2020. Analysis based on Aksia company-level data and Cambridge Associates Global PE/VC Benchmark investment-level data. Analysis excludes some investments in which exposure is unknown or not provided by the General Partner. Other for geographic exposures includes Global, Latin America, Caribbean, Africa, and Middle East. Other for sector exposures include Not Provided.

Private Credit | Exposure by Geography and Sector

GEOGRAPHIC NAV BREAKDOWN



SECTOR NAV BREAKDOWN

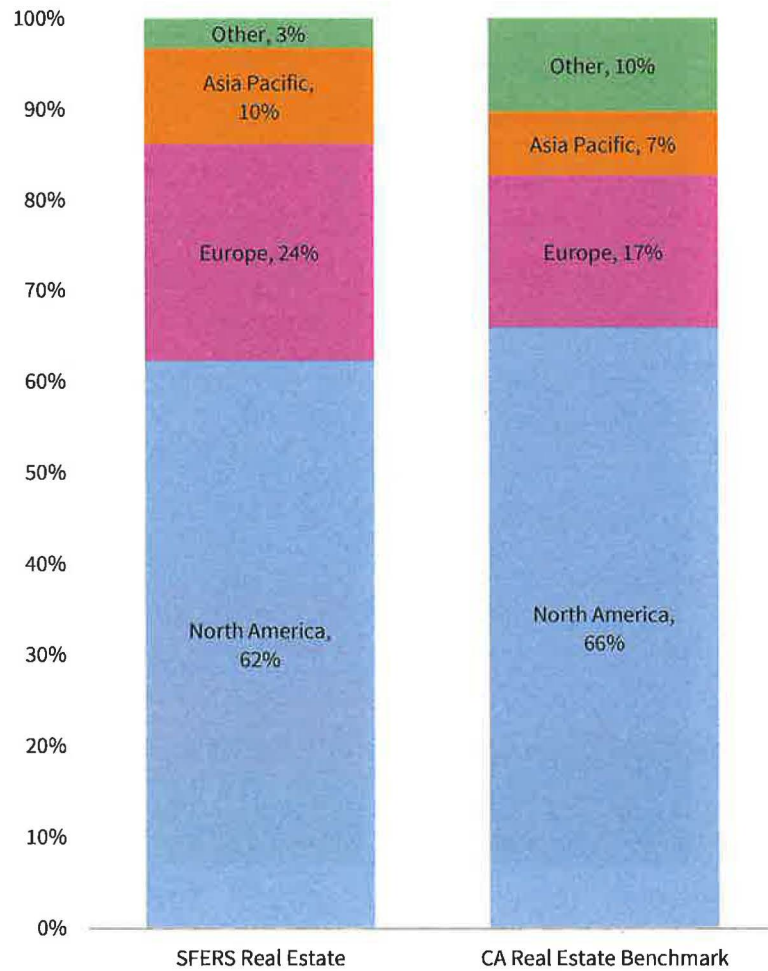


Sources: Aksia and Cambridge Associates LLC.

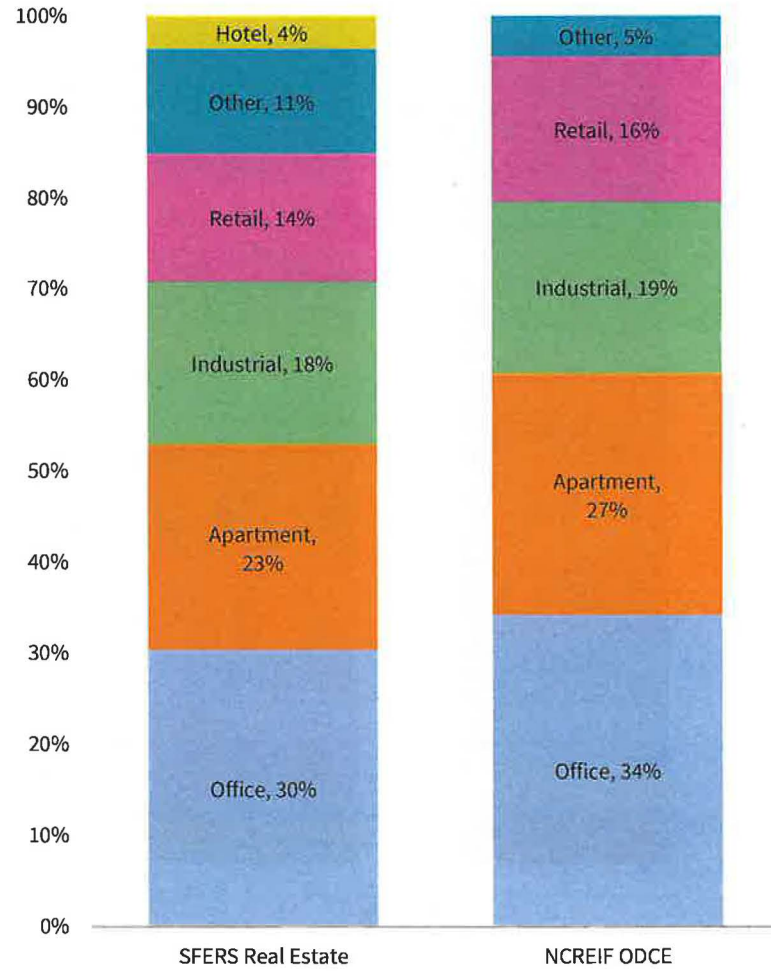
Notes: Breakdown based on NAV as of March 31, 2020. Analysis based on Aksia company-level data, Cambridge Associates Private Credit Benchmark fund-level data, and Cambridge Associates Subordinated Capital Benchmark investment-level data. Analysis excludes some investments in which exposure is unknown or not provided by the General Partner. For the Cambridge Associates Subordinated Capital Benchmark, the investment-level sector and geographic exposures as of March 31, 2020 above capture ~43% (74 out of 173 funds) of the funds tracked in the broader benchmark. Other for geographic exposures includes Global, Latin America, Caribbean, Africa, and Middle East. Other for sector exposures includes not provided and multi-industry.

Real Estate | Exposure by Geography and Property Type

GEOGRAPHIC NAV BREAKDOWN



PROPERTY TYPE NAV BREAKDOWN

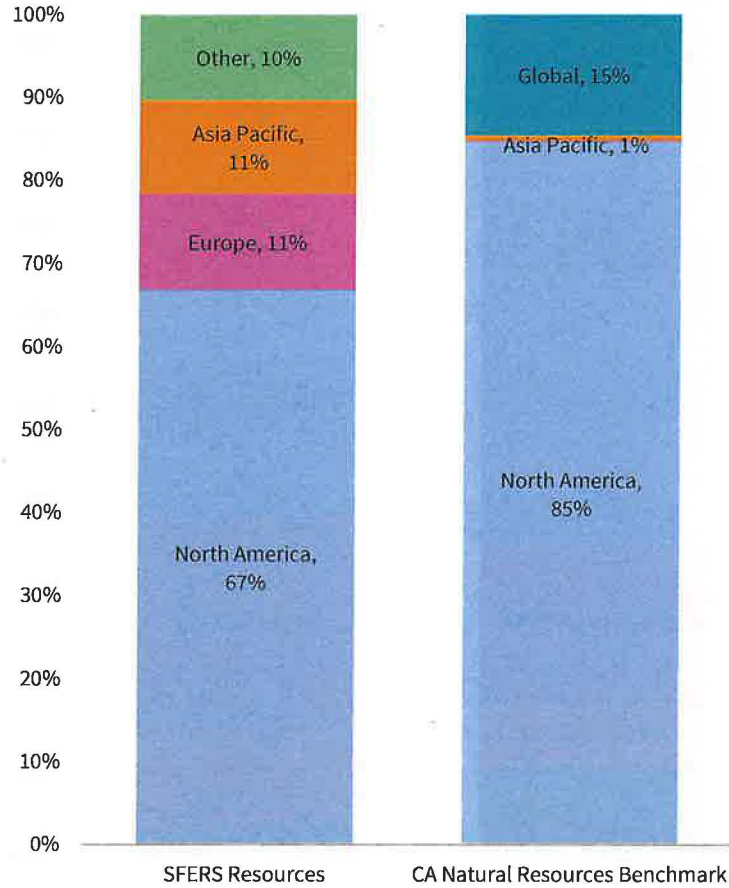


Sources: Aksia, Cambridge Associates LLC, and NCREIF.

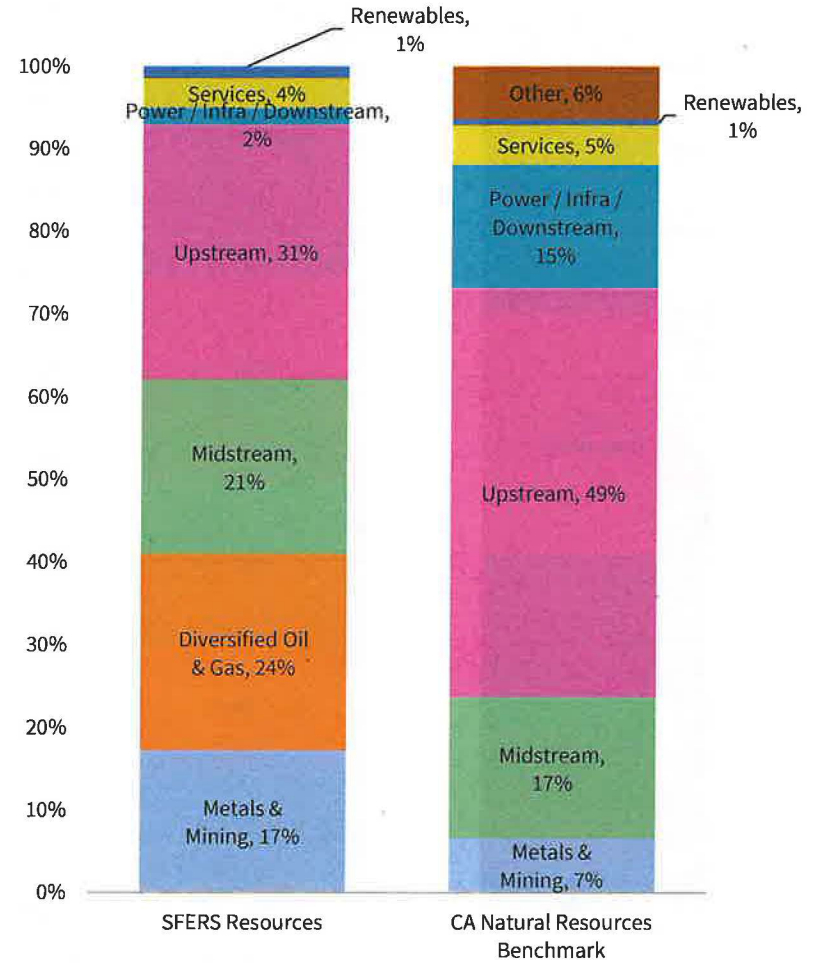
Notes: Breakdown based on NAV as of March 31, 2020. Analysis accounts for Prologis redemption and includes SFERS' infrastructure funds. Analysis based on Aksia asset-level data, Cambridge Associates Real Estate Benchmark fund-level data, and NCREIF ODCE index data. Analysis excludes some investments in which exposure is unknown or not provided by the General Partner. Other for geographic exposures includes Global, Latin America, Caribbean, and Africa. Other for property-type exposures includes self-storage and infrastructure.

Natural Resources | Exposure by Geography and Resource Type

GEOGRAPHIC NAV BREAKDOWN



RESOURCE TYPE NAV BREAKDOWN

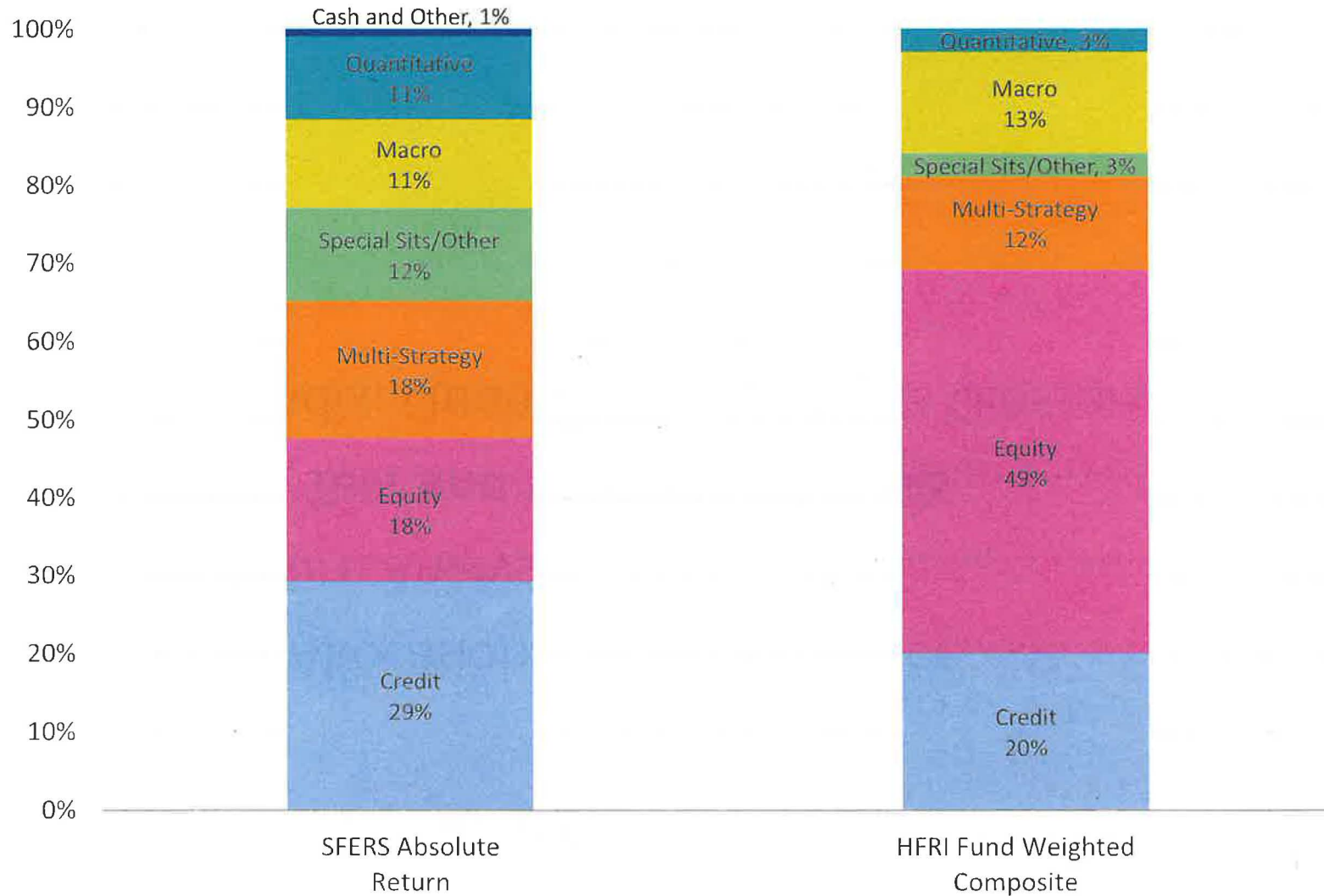


Sources: Aksia and Cambridge Associates LLC.

Notes: Breakdown based on NAV as of March 31, 2020. Analysis based on Aksia asset-level data and Cambridge Associates Natural Resources Benchmark fund-level data.

Analysis excludes some investments in which exposure is unknown or not provided by the General Partner. Other for geographic exposures includes Latin America, Caribbean, Africa, Multi-Region, and N/A. Other for resource-type exposures include royalty interests and timber.

Absolute Return | Exposure by Strategy Type



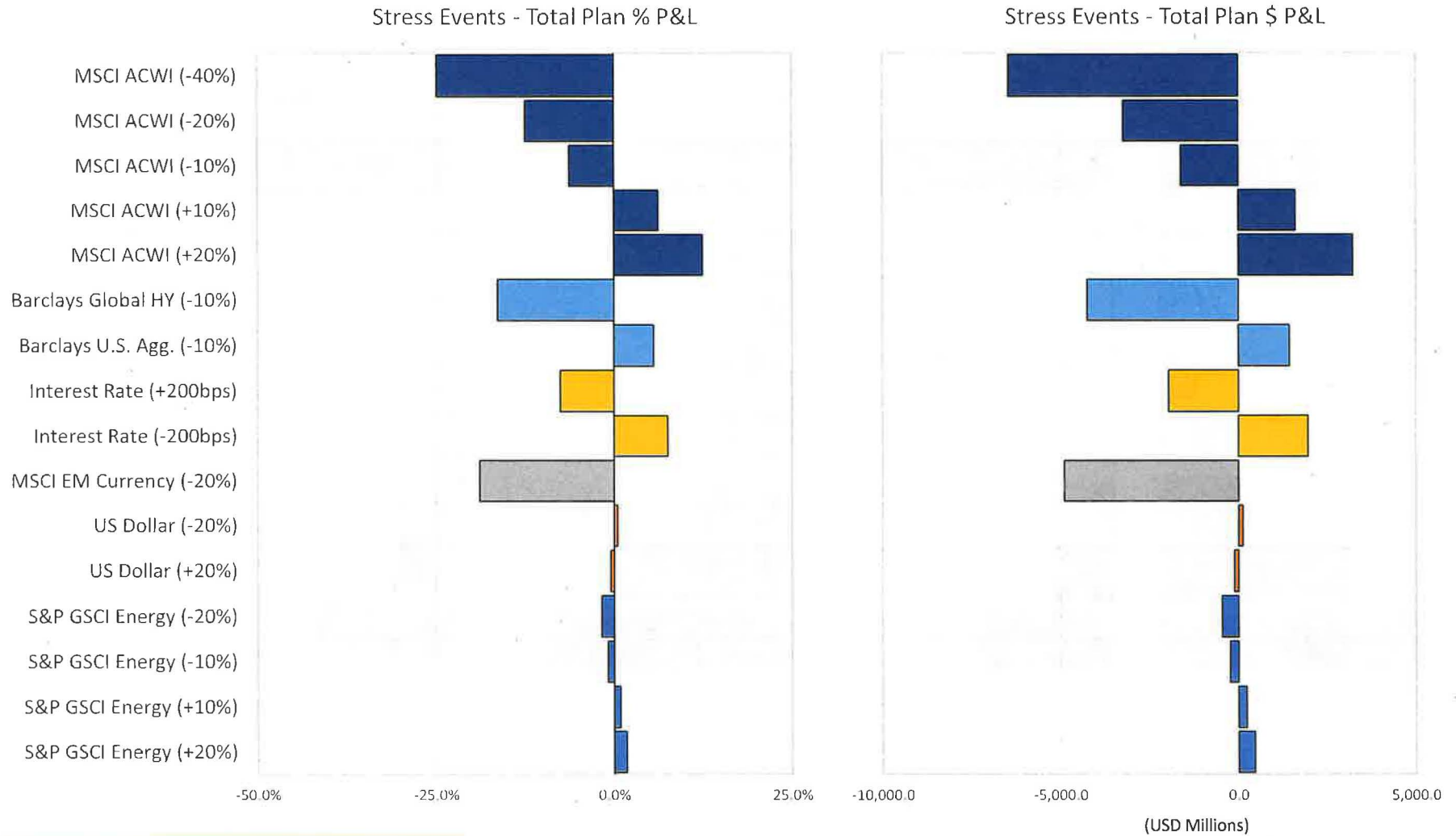
Sources: BAAM and HFRI

Notes: Breakdown as of June 30, 2020. The sub-strategy category definitions used have been qualified to meaningfully distinguish among various investment strategies and styles. BAAM's underlying managers have been categorized based on the category definitions to the best of BAAM's knowledge.

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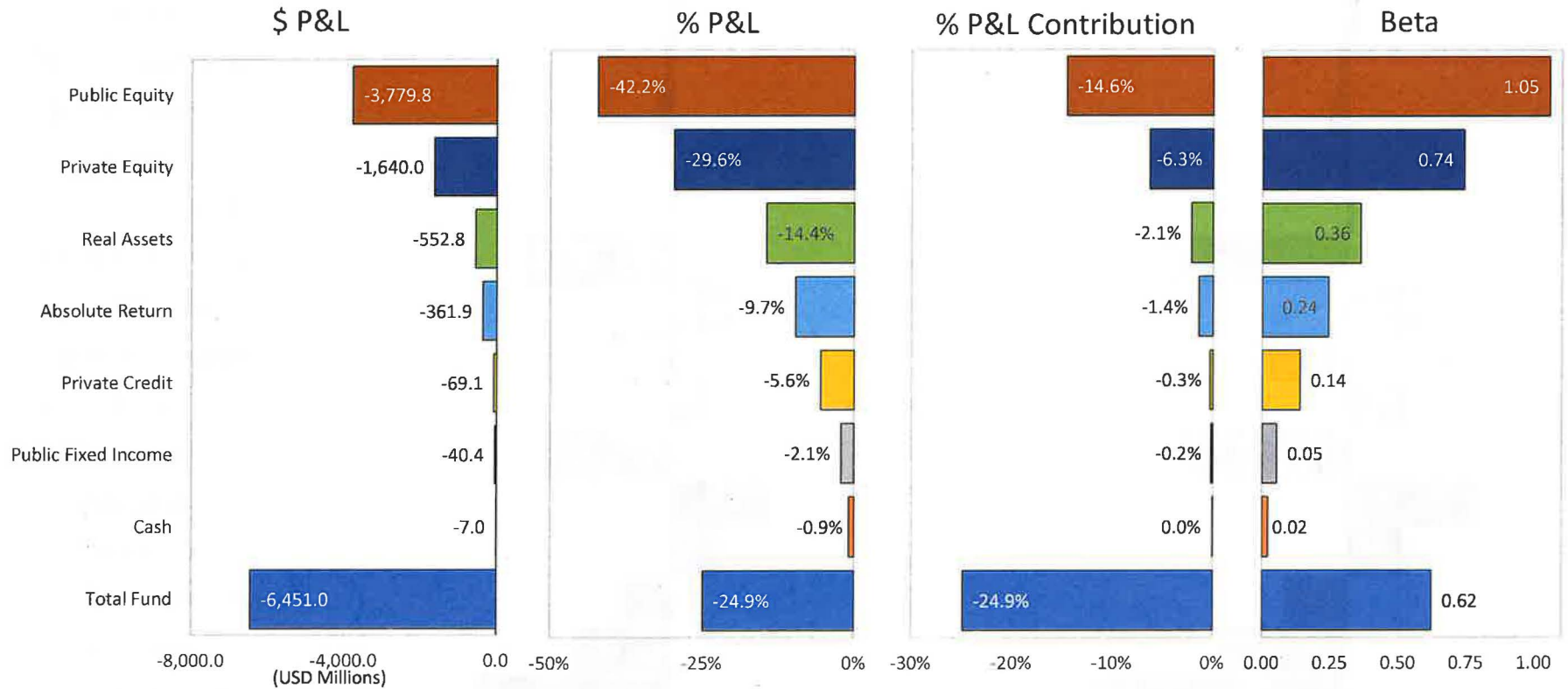
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SFERS Stress Test | Single Market Factor Stress Test Summary



Source: Caissa. Each Stress Test shocks a single market factor and deducts the impact on all other assets using correlation matrix calculated based on daily price movements from July 1st, 2019 till June 30th 2020. Adjustment factors of 0.6x for Private Equity, 0.55x for Real Assets and 0.75x for Private Credit are applied
 Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020.

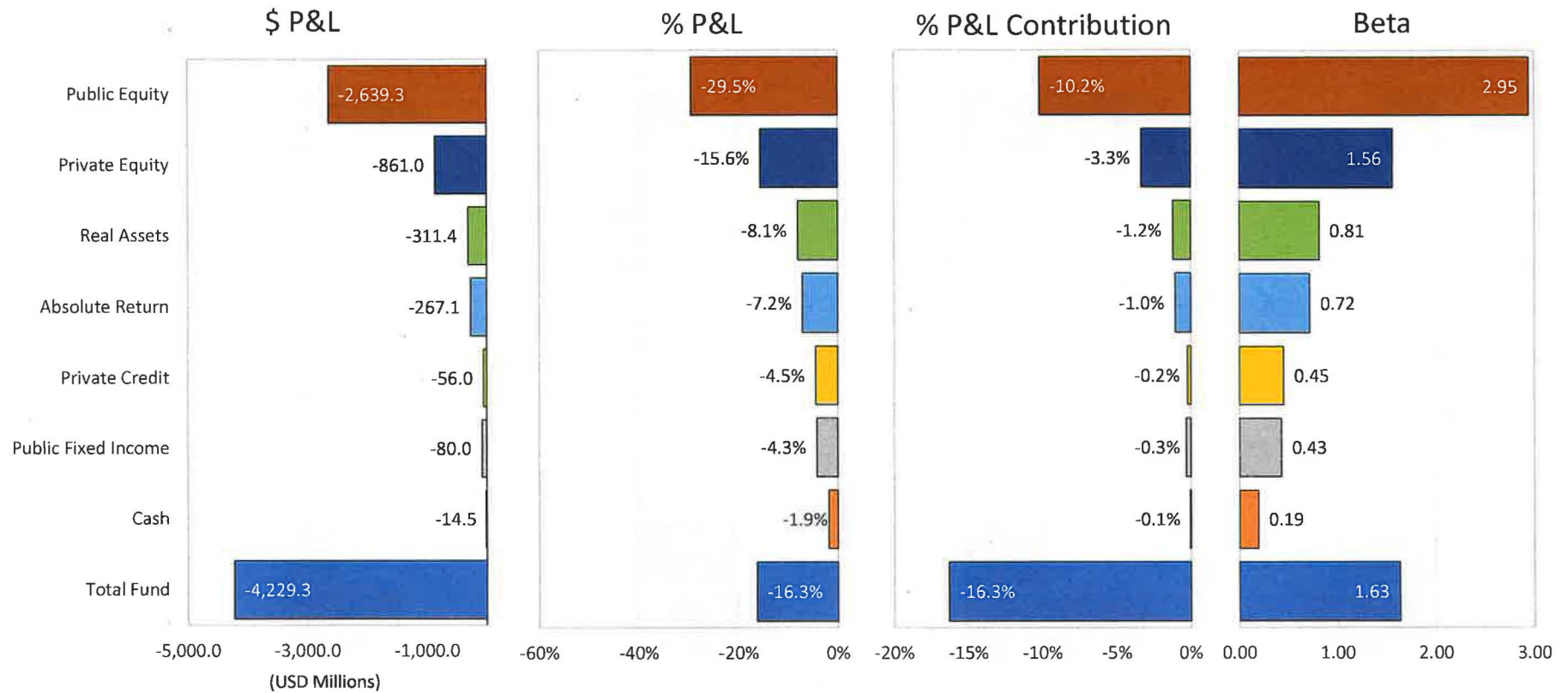
SFERS Factor Sensitivity Analysis | MSCI ACWI -40%



* Beta is calculated vs. shock market factor, i.e. MSCI ACWI

Source: Caissa. Uses adjustment factors of 0.6x for Private Equity, 0.55x for Real Assets and 0.75x for Private Credit.
 Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020.

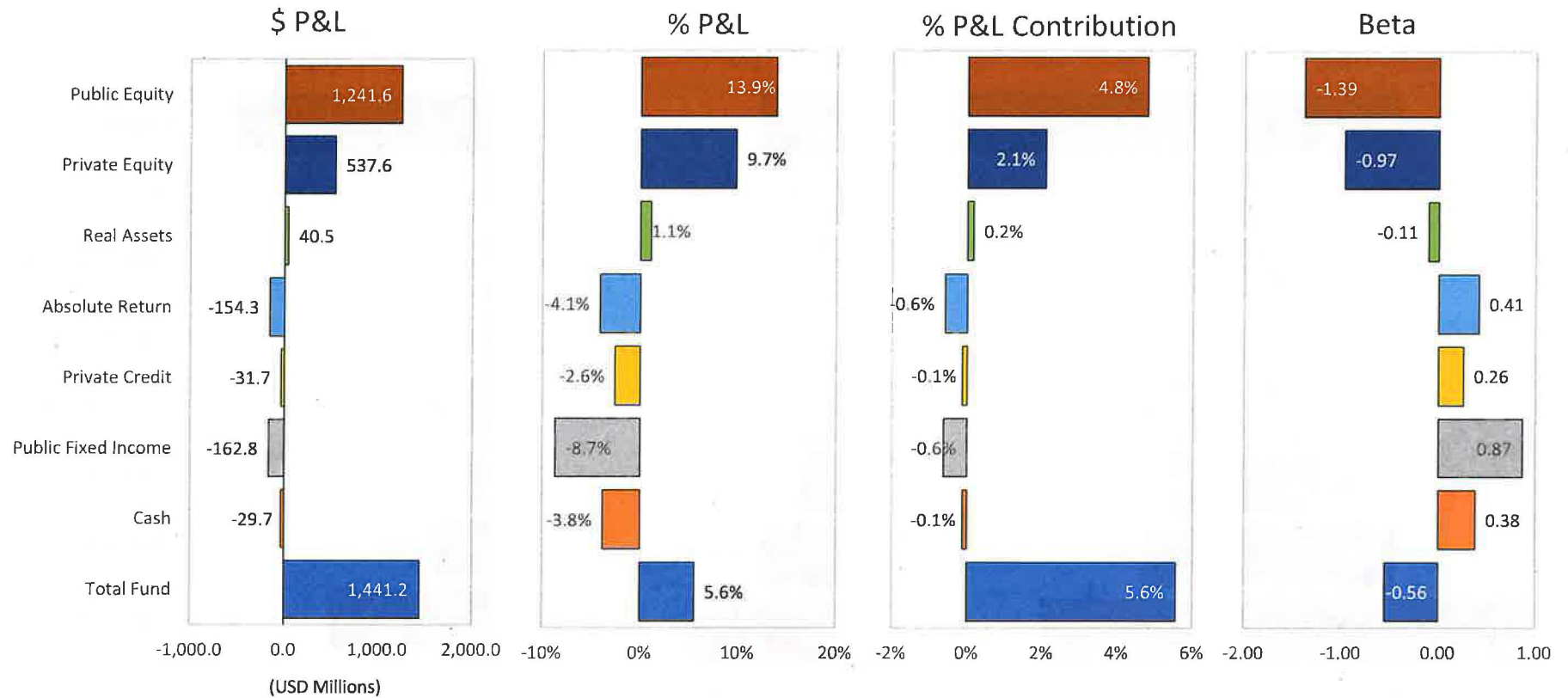
SFERS Factor Sensitivity Analysis | Barclays Global HY -10%



* Beta is calculated vs. shock market factor, i.e. Bloomberg Barclays Global High Yield Index

Source: Caissa. Uses adjustment factors of 0.6x for Private Equity, 0.55x for Real Assets and 0.75x for Private Credit.
 Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020.

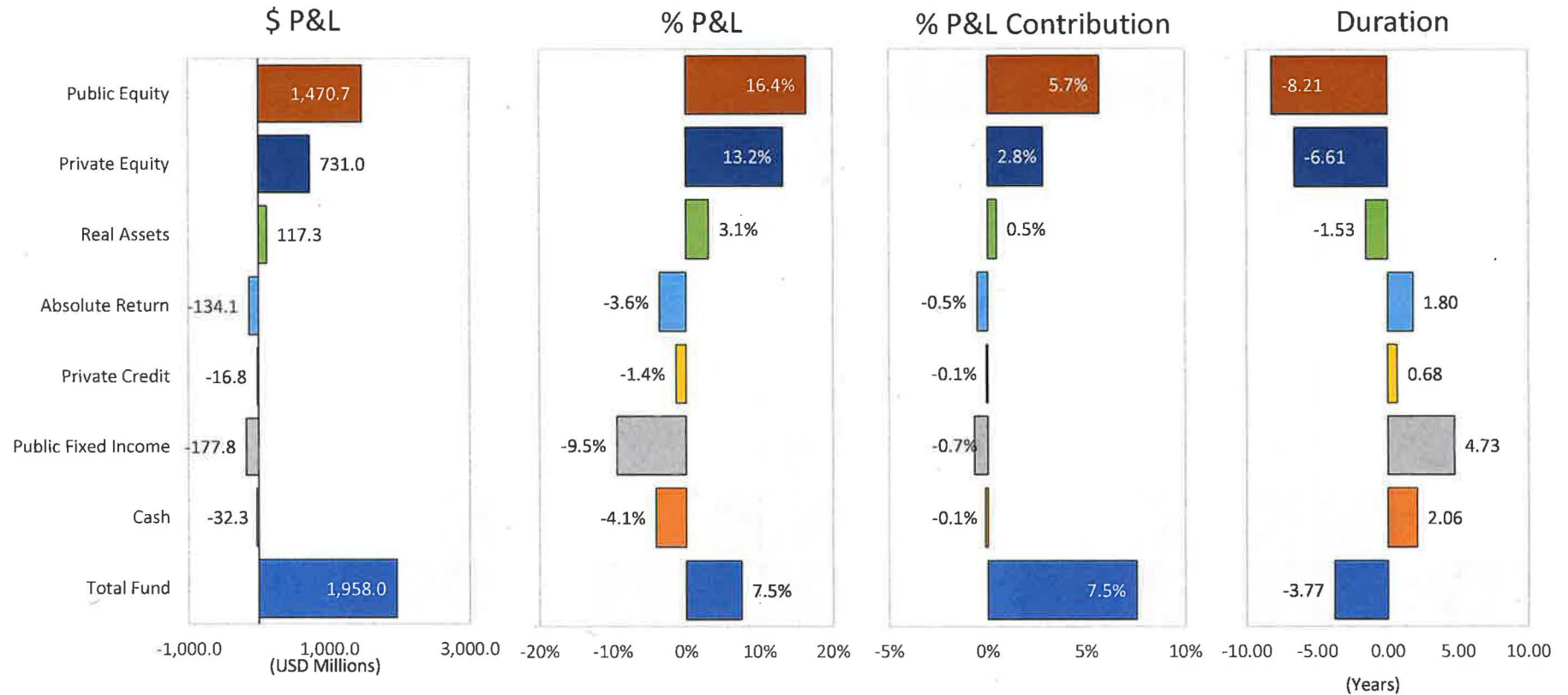
SFERS Factor Sensitivity Analysis | Barclays US Aggregate -10%



* Beta is calculated vs. shock market factor, i.e. Bloomberg Barclays U.S. Aggregate Debt Index

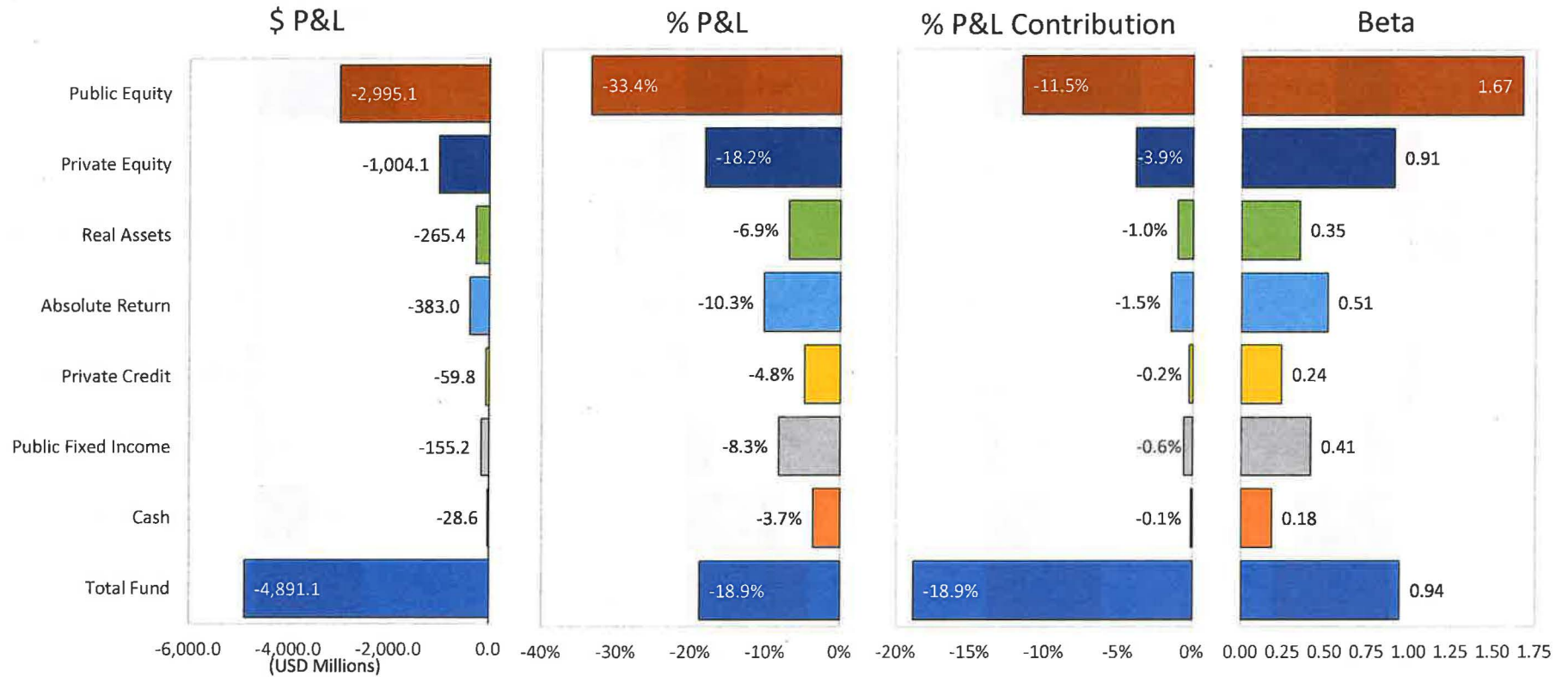
Source: Caissa. Uses adjustment factors of 0.6x for Private Equity, 0.55x for Real Assets and 0.75x for Private Credit.
 Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020.

SFERS Factor Sensitivity Analysis | Interest Rates +200bps



Source: Caissa. Uses adjustment factors of 0.6x for Private Equity, 0.55x for Real Assets and 0.75x for Private Credit.
 Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020.

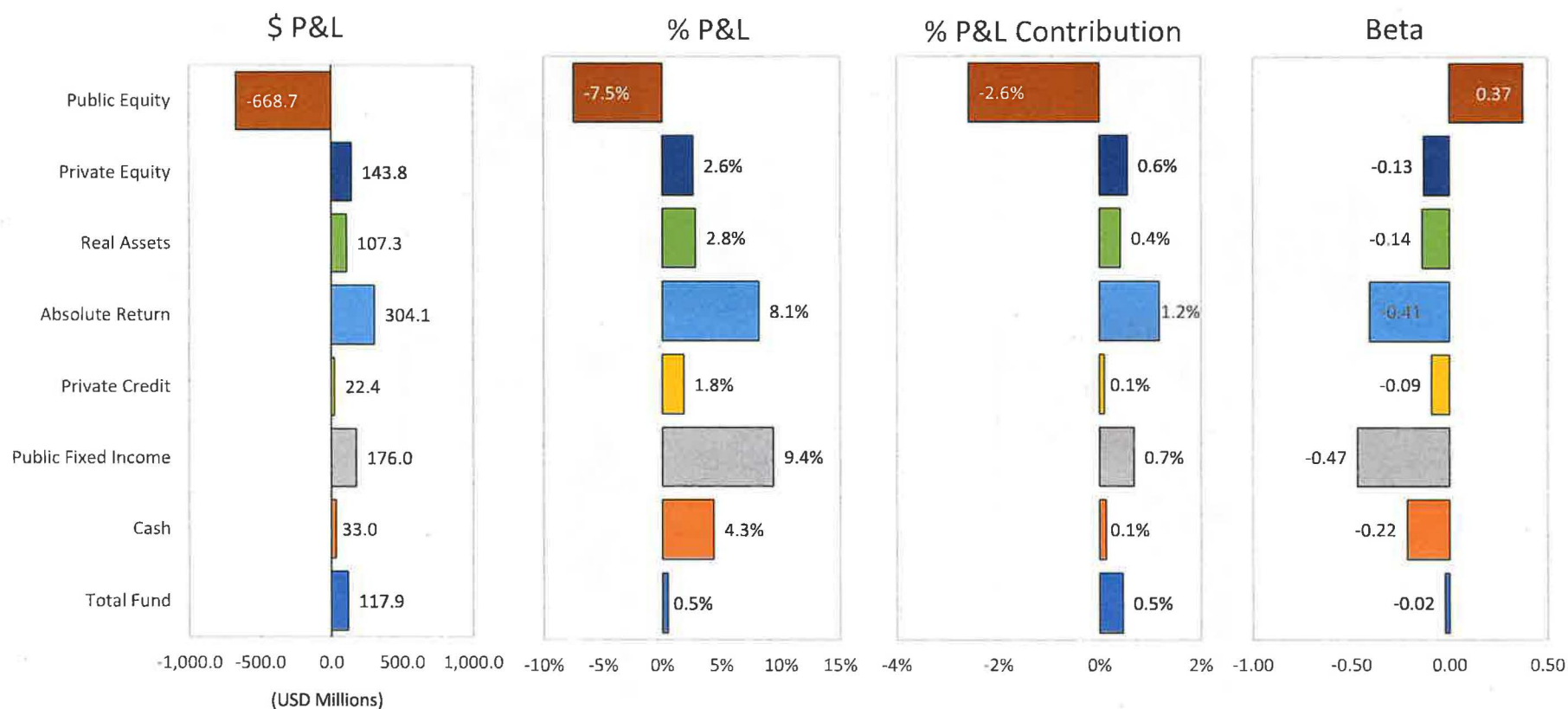
SFERS Factor Sensitivity Analysis | MSCI EM Currency Index -20%



* Beta is calculated vs. shock market factor, i.e. MSCI Emerging Market Currency Index

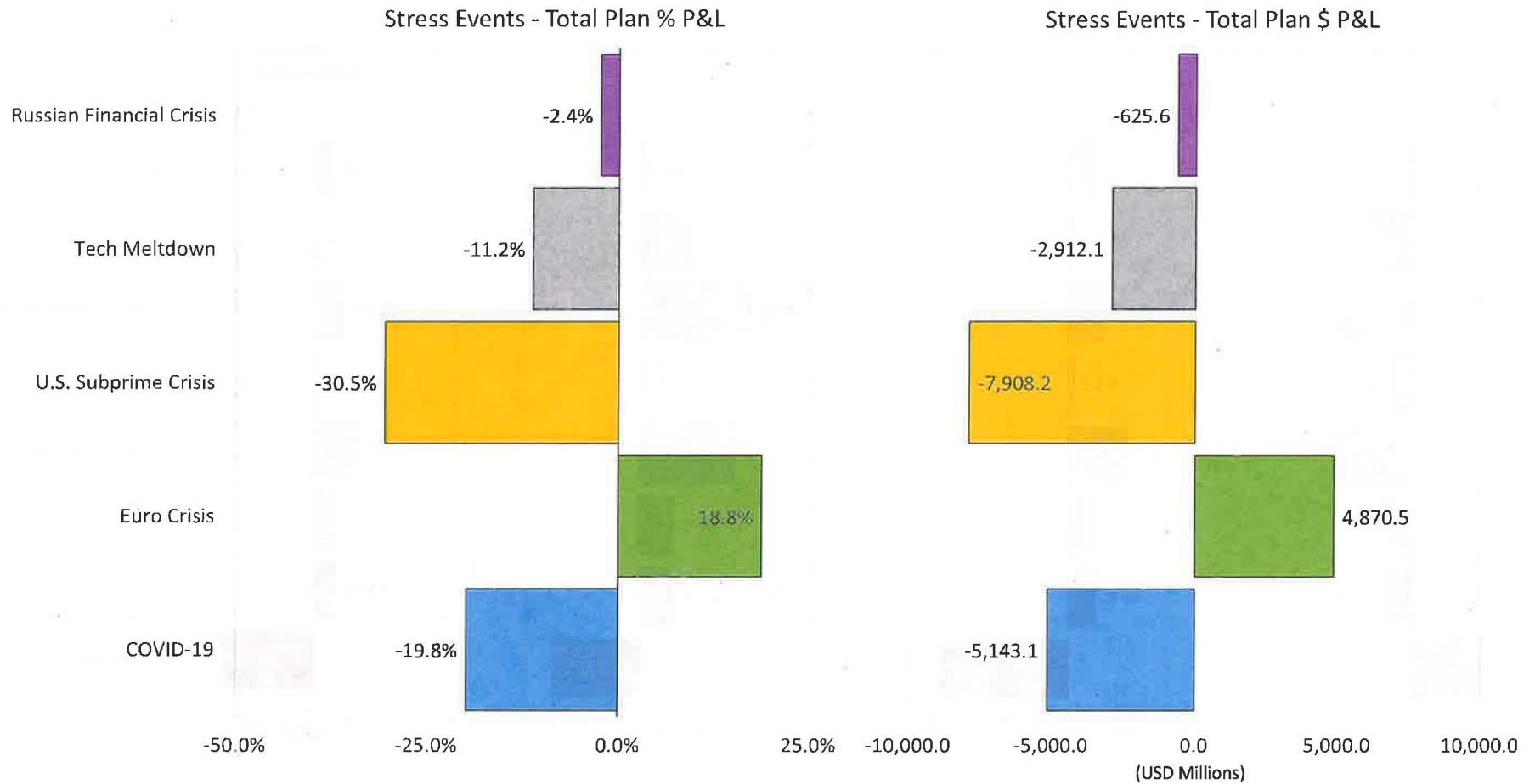
Source: Caissa. Uses adjustment factors of 0.6x for Private Equity, 0.55x for Real Assets and 0.75x for Private Credit.
 Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020.

SFERS Factor Sensitivity Analysis | US Dollar -20%



* Beta is calculated vs. shock market factor, i.e. DXY U.S. Dollar Index, an index of USD vs. a basket of foreign currencies

SFERS Stress Test | Historical Stress Test Summary

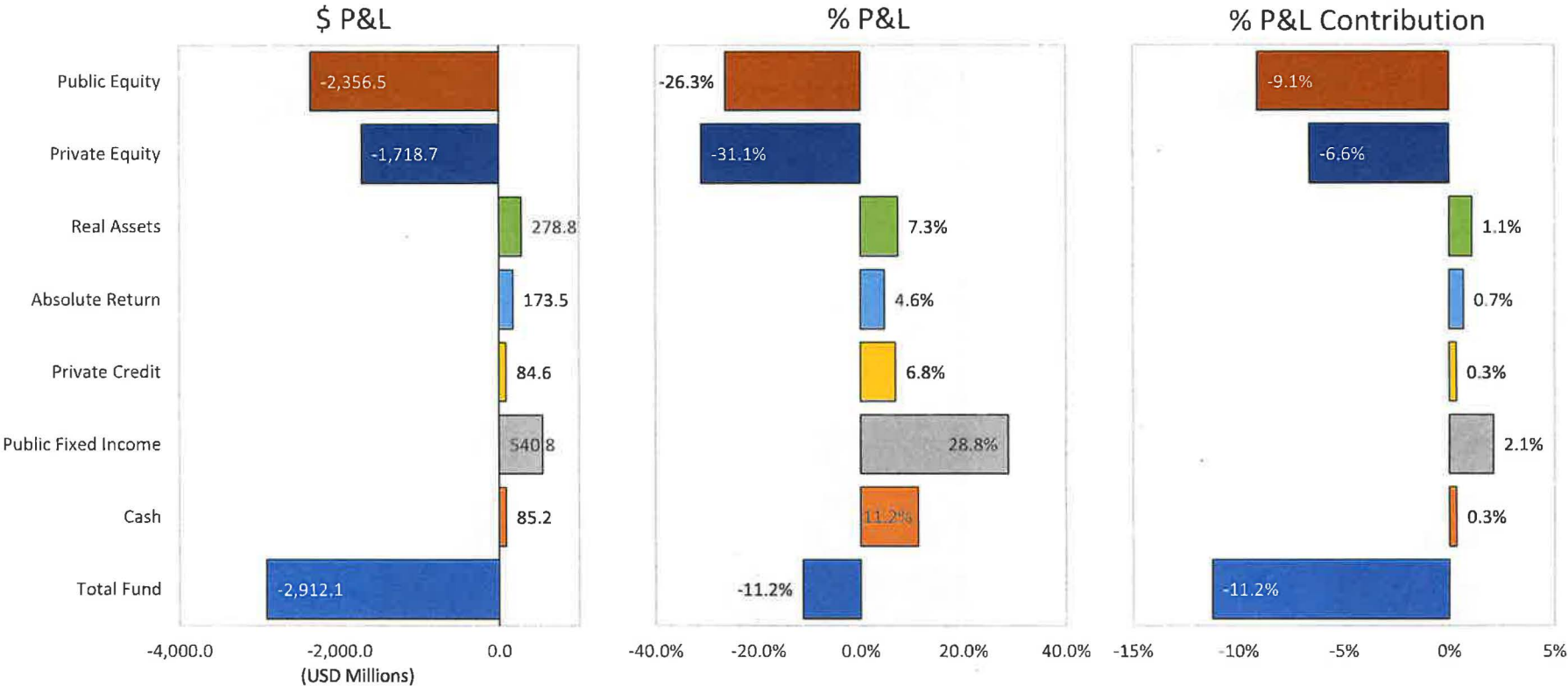


Source: Caissa. Uses adjustment factors of 0.6x for Private Equity, 0.55x for Real Assets and 0.75x for Private Credit.

Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020.

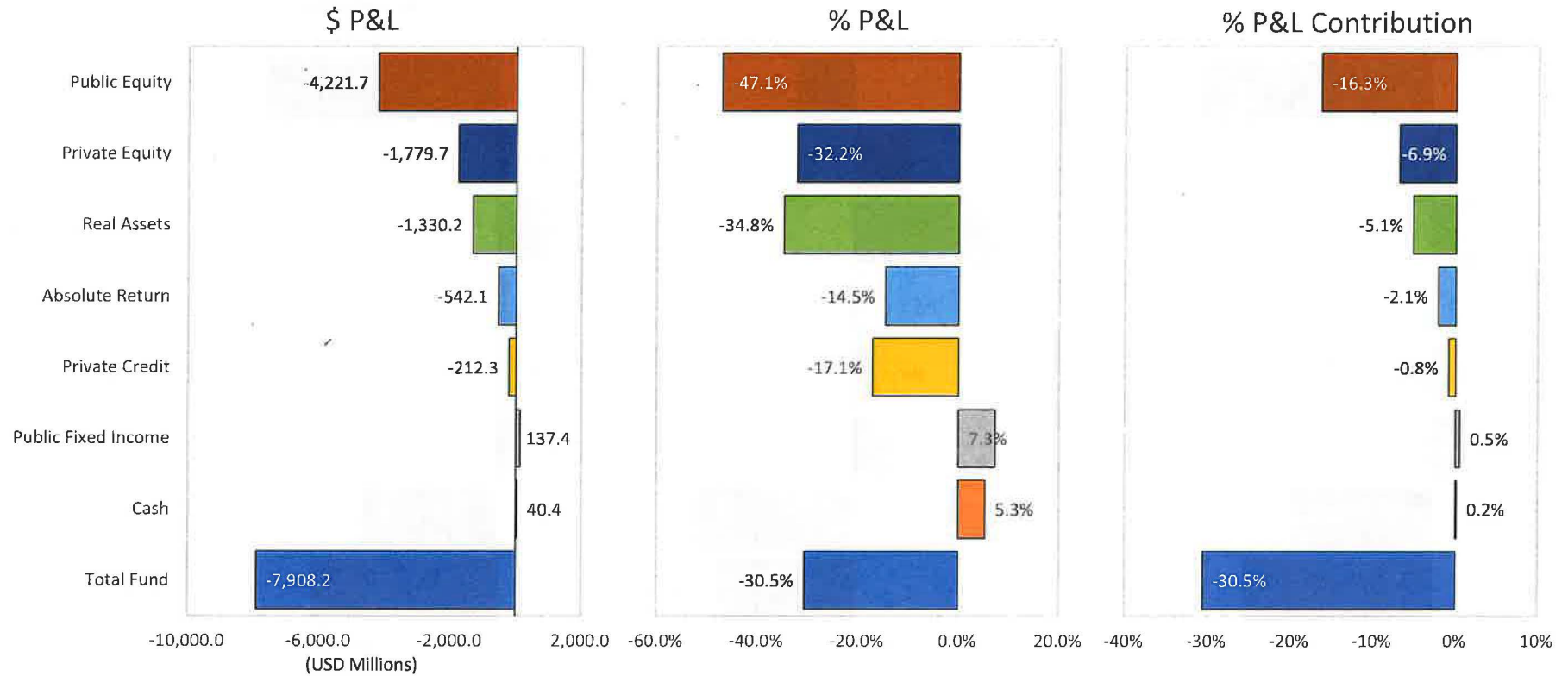
Russian Financial Crisis dates are October 6, 1997 through October 5, 1998. Tech Meltdown dates are March 10, 2000 through October 9, 2002. US Subprime Crisis dates are October 8, 2007 through March 9, 2009. Euro Crisis dates are April 1, 2010 through July 31, 2012. COVID-19 dates are February 12, 2020 through March 23, 2020.

SFERS Historical Stress Test | Tech Meltdown '00-'02 Scenario



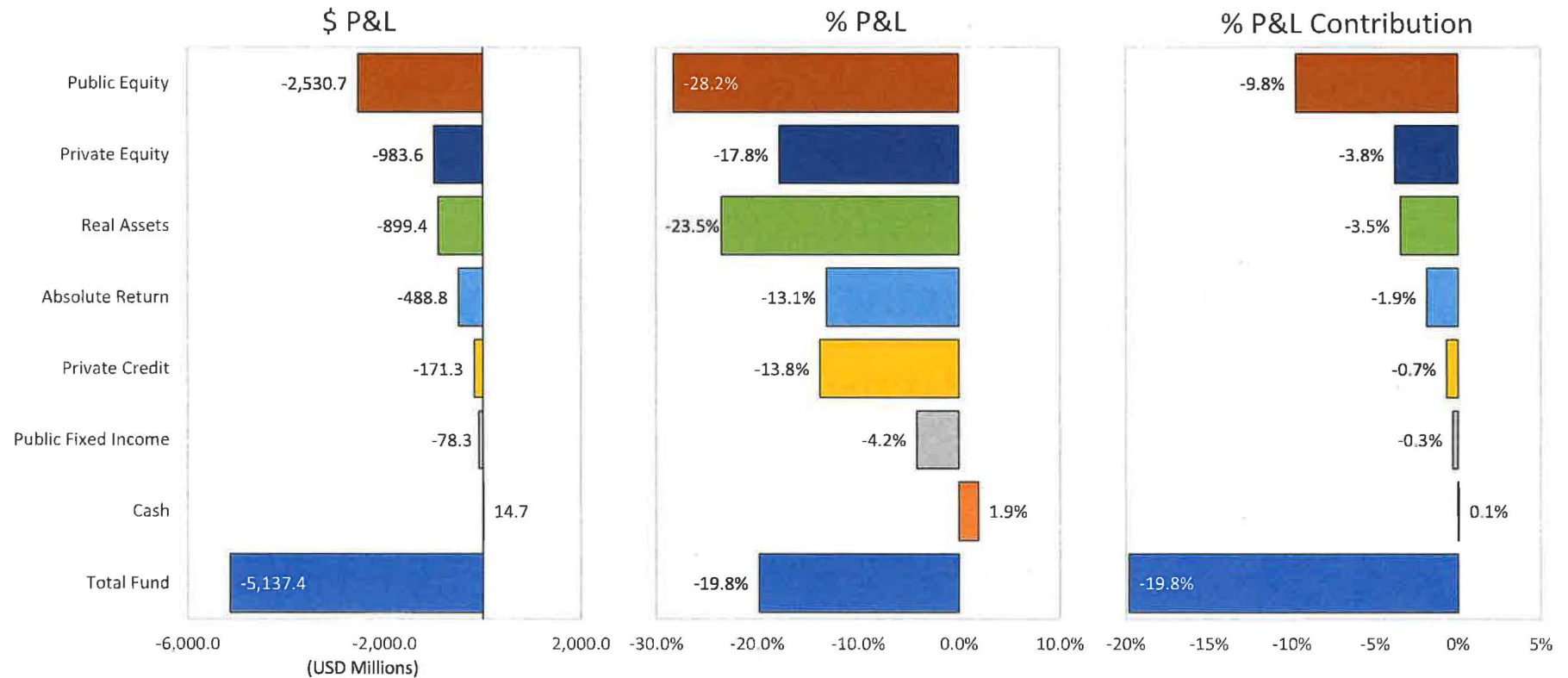
Source: Caissa. Uses adjustment factors of 0.6x for Private Equity, 0.55x for Real Assets and 0.75x for Private Credit.
 Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020.
 Tech Meltdown 2000-2002 scenario is based on asset price movements from 03/10/2000 to 10/09/2002.

SFERS Historical Stress Test | U.S. Subprime Crisis '07-'09 Scenario



Source: Caissa. Uses adjustment factors of 0.6x for Private Equity, 0.55x for Real Assets and 0.75x for Private Credit.
 Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020.
 U.S. Subprime Crisis 07-09 scenario is based on asset price movements from 10/08/2007 to 03/09/2009.

SFERS Historical Stress Test | COVID-19 Scenario



Source: Caissa. Uses adjustment factors of 0.6x for Private Equity, 0.55x for Real Assets and 0.75x for Private Credit.
 Notes: Total Plan exposures as of June 30, 2020 except for private market asset class exposures which are as of March 31, 2020.
 COVID-19 scenario is based on asset price movements from 02/12/2020 to 03/23/2020.

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APPENDIX: 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



APPENDIX: 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.

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



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Source: Caissa

APPENDIX: Quantitative Analytics Glossary

Annualized Downside Deviation

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

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

N = Number of months in the defined time period

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.

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

MAR = Minimum Acceptable Return

N = Number of months in the defined time period



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Source: Caissa

APPENDIX: 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 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



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Source: Caissa

APPENDIX: 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 $\text{Return}_t \geq 0$

$\text{Mean Loss Return} = \text{Sum of Loss Return}_t$ 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



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Source: Caissa

APPENDIX: 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



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Source: Caissa