



AGENDA

RETIREMENT BOARD MEETING

SECOND MONTHLY MEETING
March 27, 2019
9:00 a.m.

Retirement Board Conference Room
The Willows Office Park
1355 Willow Way, Suite 221
Concord, California

THE RETIREMENT BOARD MAY DISCUSS AND TAKE ACTION ON THE FOLLOWING:

1. Pledge of Allegiance.
2. Accept comments from the public.
3. Approve minutes from the February 27, 2019 meeting.

CLOSED SESSION

4. CONFERENCE WITH LABOR NEGOTIATORS
(Government Code Section 54957.6)

Agency designated representative:
Gail Strohl, Chief Executive Officer

Unrepresented Employees: All CCCERA unrepresented positions

OPEN SESSION

5. Presentation from Chief Investment Officer and Verus on updated capital market assumptions and suggested revisions to strategic asset allocation.
6. Miscellaneous
 - a. Staff Report
 - b. Outside Professionals' Report
 - c. Trustees' comments

The Retirement Board will provide reasonable accommodations for persons with disabilities planning to attend Board meetings who contact the Retirement Office at least 24 hours before a meeting.



Meeting Date
03/27/19
Agenda Item
#3

MINUTES

RETIREMENT BOARD MEETING MINUTES

REGULAR MEETING
February 27, 2019
9:00 a.m.

Retirement Board Conference Room
The Willows Office Park
1355 Willow Way, Suite 221
Concord, California

Present: Candace Andersen, Scott Gordon, Jerry Holcombe, Jay Kwon, Louie Kroll, David MacDonald, John Phillips, William Pigeon, Todd Smithey, Jerry Telles and Russell Watts

Absent: None

Staff: Gail Strohl, Chief Executive Officer; Christina Dunn, Deputy Chief Executive Officer; Timothy Price, Chief Investment Officer; Karen Levy, General Counsel; Wrally Dutkiewicz, Compliance Officer; Anne Sommers, Administrative/HR Manager; Henry Gudino, Accounting Manager; Tim Hoppe, Retirement Services Manager; and Colin Bishop, Member Services Manager

Outside Professional Support:	Representing:
Harvey Leiderman	Reed Smith LLP
Ed Hoffman	Verus Investments
John Botsford	Milliman

1. Pledge of Allegiance

The Board, staff and audience joined in the *Pledge of Allegiance*.

2. Accept comments from the public

No member of the public offered comment.

3. Approval of Minutes

It was **M/S/C** to approve the minutes from the January 23, 2019 meeting. (Yes: Andersen, Gordon, Holcombe, Kwon, Phillips, Pigeon, Smithey, Telles and Watts)

It was the consensus of the Board to move to Item 8.

MacDonald was present for subsequent discussion and voting.

8. Review of total portfolio performance for period ending December 31, 2018

a. Presentation from Verus

Hoffman reviewed the fourth quarter summary highlighting the changes that have taken place since September 30, 2018. He also reviewed the Federal Reserve's position on interest rates and their effect on the market in the fourth quarter.

He reviewed CCCERA's investment fund performance for the period ending December 31, 2018 noting the ending market value of the total fund portfolio is \$8,255,878,307. He reviewed the total fund executive summary net of fees and the total fund performance summary gross of fees. He also reviewed total fund closed end funds investment summary and total fund closed end funds IRR summary.

b. Presentation from staff

Price reported this report is a supplement to Verus' quarterly report. He stated in this report everything is measured against a simple target index and noted everything is working as it should and is in line with long term expectations.

He reviewed each sub-portfolio and reported CCCERA is meeting expectations in each of the three portfolios except Positive Real Returns in the Risk Diversifying sub-portfolio. He noted CCCERA is still building out the Risk Diversifying sub-portfolio.

He reviewed the Total Fund performance vs. the Simple Target Index noting the Total Fund has produced a better Sharpe ratio relative to the Simple Target Index. He also reviewed the performance of the managers noting CCCERA will be meeting with the portfolio managers at William Blair and Wellington regarding their performance.

On a total fund basis relative to the simple target index, CCCERA is capturing more of the upside and less of the downside on a 3-year rolling basis.

It was the consensus of the Board to move to Item 7.

7. Consider and take possible action to adopt the actuarial valuation report of Other Post-Employment Benefits as of December 31, 2018

Dunn reviewed the background on Other Post-Employment Benefits and the irrevocable IRC 115 Trust that was established in 2018 to fund those benefits.

Botsford briefly reviewed the terminology associated with the report and noted CCCERA's OPEB liability has to be accounted for the same as our pension liability but is funded differently. He reviewed the information used to prepare the accounting disclosures required by GASB 74 and 75 including assumptions for the investment rate of return, discount rate, health cost trends, demographic rates, and coverage election rates and spouse age differences.

He reported the Total OPEB Liability as of 12/31/18 is \$4.7 million and the Net OPEB Liability as of 12/31/18 is \$2.17 million. He reported that as of 12/31/18 the trust is 54% funded.

He reported they used a discount rate of 6.75% in the valuation to reflect CCCERA's current investment policy for funding its OPEB liabilities. There was a discussion on making higher contributions to bring the percentage of funding up and/or possibly shortening the amortization period from 30 years to 15 years.

Botsford reported changes in assumptions and any differences between actual and expected experiences will be included in the next valuation. He also reported the Actuarially Determined Contribution (ADC) in the report is for 2018 and noted the ADC for 2019 would be slightly different, especially if the amortization period is shortened.

It was **M/S/C** to adopt the actuarial valuation report of Other Post-Employment Benefits as of December 31, 2018. (Yes: Andersen, Gordon, Holcombe, MacDonald, Phillips, Pigeon, Smithey, Telles and Watts)

It was the consensus of the Board to move into Closed Session for Items 5 and 6.

CLOSED SESSION

The Board moved into closed session pursuant to Govt. Code Section 54956.9(d)(1) and 54956.9(d)(4).

The Board moved into open session.

5. a. There was no reportable action related to Govt. Code Section 54956.9(d)(1).
- b. MacDonald recused himself from this item and was not present for subsequent discussion and voting. There was no reportable action related to Govt. Code Section 54956.9(d)(1).

Telles was no longer present for subsequent discussion and voting.

6. There was no reportable action related to Govt. Code Section 54956.9(d)(4).

It was the consensus of the Board to move to Item 9.

9. Information session on retirement process

Dunn reported this is an informational session on CCCERA's processes throughout employment and retirement, noting it provides additional information beyond the presentation at the last Board meeting.

Hoppe reviewed the steps in the retirement process and timeline including informational sessions, pre-retirement workshops, retirement estimates, and one-on-one counseling. He reviewed the information that is covered during the informational sessions and the pre-retirement workshops. He also reviewed the process and timing on preparing estimates. He noted two estimates are prepared for legacy members, one with on-call or standby pay differentials included and one without if applicable.

He reviewed the retirement application and calculation process including the responsibilities of CCCERA, the employer, and the member and the average timing of the process. He also reviewed the items reviewed during the calculation process. He stated the calculations are initially prepared manually, then reviewed by the supervisor and then verified in the pension administration software system. Members then meet with a counselor to discuss final calculations and payment choices. Once the options are signed and returned the member is placed on the next available pension payroll.

He reviewed the documentation required and what can affect the timing of an initial pension check by the member, the employer, and by CCCERA. He also reviewed the steps CCCERA is currently taking to shorten the timeline.

Dunn provided statistical information on the average retirement estimates completed each year and the average number of service retirements process each year. She also provided member survey results on the Informational Sessions, Pre-Retirement Workshops, and In Office surveys.

10. Information regarding fire standby pay for Contra Costa County Fire Protection District

Andersen stated she had to leave the meeting but hoped that the Board will direct staff to go ahead and relook at the MOU language and then request that ConFire provide data regarding fire standby pay so as it pertains to the inclusion or exclusion of standby pay for Contra Costa County Fire Protection District across the board in any classification. Data showing hours of on-call actually performed would show whether it is pay for on call work that is mandatory or whether it is voluntary.

Andersen was no longer present for subsequent discussion and voting.

Dunn reviewed the background on this item and gave an overview of CCCERA's review process when employees retire, including reviewing pay codes regarding on call or standby pay. She noted the fire standby pay for Contra Costa County Fire Protection District is currently being reported to CCCERA as pensionable. She reported members are put on payroll without including those pay codes until the review process is complete. She reviewed the Board's policy, which was approved by the court, on determining compensation earnable under AB 197 for purposes of calculating retirement benefits for Legacy (pre-PEPRA) members. Dunn stated that to be pensionable, the standby pay must be for work (1) within be the normal working hours set forth in the applicable employment agreement, (2) must be required by the employer to be worked by the employee (as distinguished from voluntarily worked), and (3) must be ordinarily worked by all others in the same grade or classification at the same rate of pay during the FAS period. Employers must report to CCCERA as pensionable only that pay for work that is required of and ordinarily served by everyone in the same grade or classification.

In Public Comment, Jeff Carman, Fire Chief, Contra Costa County Fire Protection District, spoke on his concerns about the way CCCERA determines if the standby pay code is pensionable or not at the time of retirement and specifically whether the standby time is within the employee's normal work hours. The position in question is the assistant chief level. The MOU language may not be as specific as it should be, but they are more than willing to provide the documentation and information that this board would like to see to verify that all three of the policy standards have been met and that it was the employer's intent that the standby pay be pensionable. He noted in the next round of negotiations they will change the language in the MOU to meet CCCERA's policy standards. He also stated that the statement he made at the November 28, 2018 meeting may have offended some Board members and stated he didn't feel the Board was unethical, he felt that it was unethical to take retirement deductions from employee paychecks and to lead them to believe that they would be compensated for their time, and then at the finish line pull that away from them. He apologized if any Board member was offended.

There was a discussion on what is legally required to meet the standard to include standby and on-call pay, the language in the MOU, and what the current practice is and how long it has been going on.

The Board directed staff to request additional information from the District regarding how the employment agreements in question are applied in practice by the respective parties.

11. Annual Statement of Compliance with Board Resolutions

Price reported one of the components required by the Investment Policy Statement is the Annual Statement of Compliance with Board Resolutions. He reported the Board adopted one investment-related resolution in 2018 and one resolution from 2017 remained in effect at the beginning of 2018.

He also reviewed the Asset Allocation Summary for the calendar year 2018.

12. Consider authorizing the attendance of Board:

- a. It was **M/S/C** to authorize the attendance of 2 Board members at the CRCEA Spring 2019 Conference, April 14-17, 2019, San Diego, CA. (Yes: Gordon, Holcombe, Kroll, Kwon, MacDonald, Phillips, Pigeon, Smithey and Watts)
- b. There was no action taken on this item. Advanced Investments Management, IFEBP, April 29-May 2, 2019, Philadelphia, PA.
- c. It was **M/S/C** to authorize the attendance of all Board members at the SACRS 2019 Spring Conference, May 7-10, 2019, Lake Tahoe, CA. (Yes: Gordon, Holcombe, Kroll, Kwon, MacDonald, Phillips, Pigeon, Smithey and Watts)

- d. It was **M/S/C** to authorize the attendance of 1 Board member at the Annual Conference and Exhibition, NCPERS, May 18-22, 2019, Austin, TX. (Yes: Gordon, Holcombe, Kroll, Kwon, MacDonald, Phillips, Pigeon, Smithey and Watts)

13. Miscellaneous

- (a) Staff Report –

Strohl reported staff is working on the custodian bank conversion from State Street to Northern Trust; and staff is continuing discussions on the new building lease.

Levy reported the 2019 Retirement Law Book is now available and to see Luz Casas if any Board member would like a hard copy. She noted it is also available on CCCERA's website.

- (b) Outside Professionals' Report -

None

- (c) Trustees' comments –

None

It was the consensus of the Board to move into Closed Session for Item 4.

CLOSED SESSION

The Board moved into closed session pursuant to Govt. Code Section 54957.

The Board moved into open session.

- 4.** There was no reportable action related to Govt. Code Section 54957.

It was **M/S/C** to adjourn the meeting. (Yes: Gordon, Holcombe, Kroll, Kwon, MacDonald, Phillips, Pigeon, Smithey and Watts)

Todd Smithey, Chairman

David MacDonald, Secretary



<i>Meeting Date</i> 03/27/19 <i>Agenda Item</i> #5

MEMORANDUM

Date: March 27, 2019
To: CCCERA Board of Retirement
From: Timothy Price, Chief Investment Officer
Subject: Annual Asset Allocation and Capital Market Assumption Review

Overview

Every year CCCERA Investment Staff and Verus review capital market assumptions and seek to incrementally adjust CCCERA's asset allocation to capture the most promising opportunities in the prevailing market. As part of this annual exercise, CCCERA Investment Staff and Verus review the size and allocation of each of CCCERA's functional sub-portfolios; liquidity, growth, and risk diversifying. The first step of this annual exercise is to adjust the size of the liquidity sub-portfolio to add a new fourth year of expected benefit payments to our liquidity model and fund that fourth year during the Annual Funding Plan in July. Assets not allocated to the liquidity portfolio are available for the growth and risk diversifying portfolios.

This memo outlines this annual asset allocation process, with specific detail on the sizing of the liquidity program.

Liquidity Sub-portfolio Sizing

CCCERA's liquidity sub-portfolio has the mandate of storing and disbursing four years' worth of benefit payments on a rolling basis. The liquidity portfolio is fully funded every July through the Annual Funding Plan, which incorporates the receipt of the employer pre-payments. Over the subsequent year the liquidity portfolio disburses benefit payments until the program is replenished again the following July.

The size of the liquidity program is measured in dollars; CCCERA knows the dollar value of expected benefit payments, as projected by CCCERA's actuaries, for the next four years. This is the dollar value targeted every year during the annual review of the asset allocation and capital market assumptions. This dollar value is then converted into a percentage of CCCERA's Total Fund. The current present value of the liquidity program is approximately \$1.75bn, and this will fund benefits through June of 2022.

The next tranche of benefit payments (the new "year four," to be funded this upcoming July) has a present value of \$530 mm. In order to determine the impact on this year's asset allocation, we discount this tranche at the liquidity sub-portfolio's current yield of 3.2% (by discounting the value of future benefit payments CCCERA harvests the growth of the assets). This gives us an indication of the dollars that we will need to add to the liquidity sub-portfolio in July 2019. The discounted sum of the projected benefit payments totals \$2.07 bn for the next four years (July 2019 through June 2023).

Details of the calculation for the size of the liquidity program is shown below:

February 2019 Liquidity Program Size (\$)	\$1.75 bn
Less March – July 2019 Benefit Payments	\$207 mm
Plus Discounted Year 4	\$530 mm
Expected Liquidity Program Size	\$2.07 bn

Estimating the Total Fund balance by taking the current value and adjusting for future cash flows, we project an expected allocation of 24% for the liquidity sub-portfolio, up slightly from a 23% allocation last year. Details of the calculation for the percentage of total fund assets required to fund the liquidity program is shown below:

February 2019 Total Fund Market Value	\$8.62 bn
Less March – July 2019 Benefit Payments	\$207 mm
Plus Estimated Employer Pre-Payments	\$290 mm
Projected Total Fund Market Value as of July 2019	\$8.71 bn
Expected Liquidity Program Size as of July 2019	\$2.07 bn
Liquidity Program as a % of Total Fund Assets	23.8%

This expected percentage allocation was used for the asset allocation exercise that will be presented by Verus. Please note that we will fine tune these allocations in the Annual Funding Plan, to be presented in advance of the mid-year rebalancing.

Expected Allocations

The incremental 1% of assets will be drawn from the growth sub-portfolio. CCCERA Investment Staff and Verus are recommending a slight decrease to value-add real estate.

Summary

This memo is meant to outline the process for the annual asset allocation and capital market review undertaken by CCCERA Investment Staff and Verus. The liquidity program is sized in dollars because the liability is known and stable, while the growth and risk diversifying portfolios are sized in percentages of Total Fund assets. The conversion of the dollar size of the liquidity portfolio to a percentage of total fund assets may at times give the optics of shrinking or expanding the liquidity portfolio, however the percentage is simply adjusted to match the dollar liability.

This memo is for information purposes only, and no action is required.



**PERSPECTIVES
THAT DRIVE
ENTERPRISE
SUCCESS**



MARCH 27, 2019

Asset Allocation Analysis

Contra Costa County Employees' Retirement Association

Meeting Date
03/27/19
Agenda Item
#5

Table of Contents



VERUSINVESTMENTS.COM

SEATTLE 206-622-3700

LOS ANGELES 310-297-1777

SAN FRANCISCO 415-362-3484

Executive Summary 3

Liquidity Sub-Portfolio 4

Asset Allocation Analysis 6

Appendix 14

Past performance is no guarantee of future results. This document is provided for informational purposes only and is directed to institutional clients and eligible institutional counterparties only and is not intended for retail investors. Nothing herein constitutes investment, legal, accounting or tax advice, or a recommendation to buy, sell or hold a security or pursue a particular investment vehicle or any trading strategy. This document may include or imply estimates, outlooks, projections and other "forward-looking statements." No assurance can be given that future results described or implied by any forward looking information will be achieved. Investing entails risks, including possible loss of principal. Verus Advisory Inc. and Verus Investors, LLC ("Verus") file a single form ADV under the United States Investment Advisors Act of 1940, as amended. Additional information about Verus Advisory, Inc. and Verus Investors, LLC is available on the SEC's website at www.adviserinfo.sec.gov. Verus – also known as Verus Advisory™ or Verus Investors™.

Executive summary

- When the FFP 4-Yr asset allocation was initially adopted in December 2015, it was agreed that the Plan’s asset allocation would be reviewed annually.
- The objective of the annual review process is not to make large changes to the asset allocation, but rather to:
 1. Adjust the size of the Liquidity sub-portfolio based on projected benefit payments; and
 2. Make small adjustments to the components of the Growth & Risk Diversifying sub-portfolios based on updated CMAs.
- Based on this year’s review, the following changes are being recommended:
 1. Increase the Liquidity sub-portfolio from 23% to 24% based on current projections; and
 2. Decrease the Growth sub-portfolio from 67% to 66%.
- If approved, these allocations will become the Plan’s new long-term targets and will result in a revised implementation plan being presented to the Board at a future meeting.

Proposal: Adopt “Alt. Mix 1” as the investment program’s new long-term asset allocation.

Liquidity Sub-Portfolio

Sizing the allocation

The size of the Liquidity sub-portfolio is estimated to be 24% of total plan assets based on the discounted projected benefit payments as a percent of the Total Fund:

A	Total Fund Market Value (2/28/18)	\$8,624,322,229
B	Less March – July benefit payments	(207,000,000)
C	Plus estimated employer pre-payments	290,000,000
D	Projected Total Fund Market Value in July 2018	\$8,707,322,229
E	Yield of Liquidity sub-portfolio ¹	3.17%
F	Discounted projected monthly benefit payments ²	\$2,068,930,476
G	Size of the Liquidity sub-portfolio = (F) / (D)	23.8%

The precision of this exercise implies a level of accuracy that is higher than can actually be expected given market fluctuations across the total portfolio and time over which the benefits are paid (i.e. 48 months)

1: As of December 31, 2018
2: From July 2019 through June 2023

Asset Allocation Analysis

Portfolio analysis

	Phase 3 Long-Term Alt. Mix 1		Phase 3 Long-Term Alt. Mix 1		
			Return (10-Yr)	Standard Deviation	Sharpe Ratio
Growth					
US Large	8.8	5	5.8	15.6	0.31
US Small	2.2	-	5.4	21.3	0.25
International Developed	14.2	13	7.7	17.8	0.39
Emerging Markets	4.8	11	8.6	26.1	0.36
Global Equity	11	-	6.8	17.1	0.36
High Yield Corp. Credit	2	-	5.7	11.5	0.37
Private Equity	10	11	8.8	25.6	0.37
Private Credit	4	12	7.7	10.2	0.60
Private Real Estate	9	9			
Value Add Real Estate	5	5	8.1	19.4	0.40
Opportunistic Real Estate	4	4	10.1	25.9	0.42
REITs	1	1	6.1	19.3	0.30
Risk Parity	-	5	7.1	9.5	0.55
	67	67			
Liquidity					
Short-Term Gov't/Credit	23	23	2.8	3.6	0.22
	23	23			
Risk Diversifying					
US Treasury	5.5	3	2.7	6.7	0.12
Hedge Fund	4.5	7	4.4	7.8	0.33
	10	10			
Total	100	100			

Mean Variance Analysis

Forecast 10 Year Return	6.7	7.1	7.1
Standard Deviation	11.0	10.4	10.3
Sharpe Ratio	0.46	0.52	0.51
Exp. Return less 1 Stnd. Dev.	-4.3	-3.3	-3.3
Exp. Return less 2 Stnd. Dev.	-15.3	-13.7	-13.6

Based on Verus' 2019 Capital Market Assumptions

Asset allocation



Risk contribution

RISK CONTRIBUTION BY ASSET CLASS

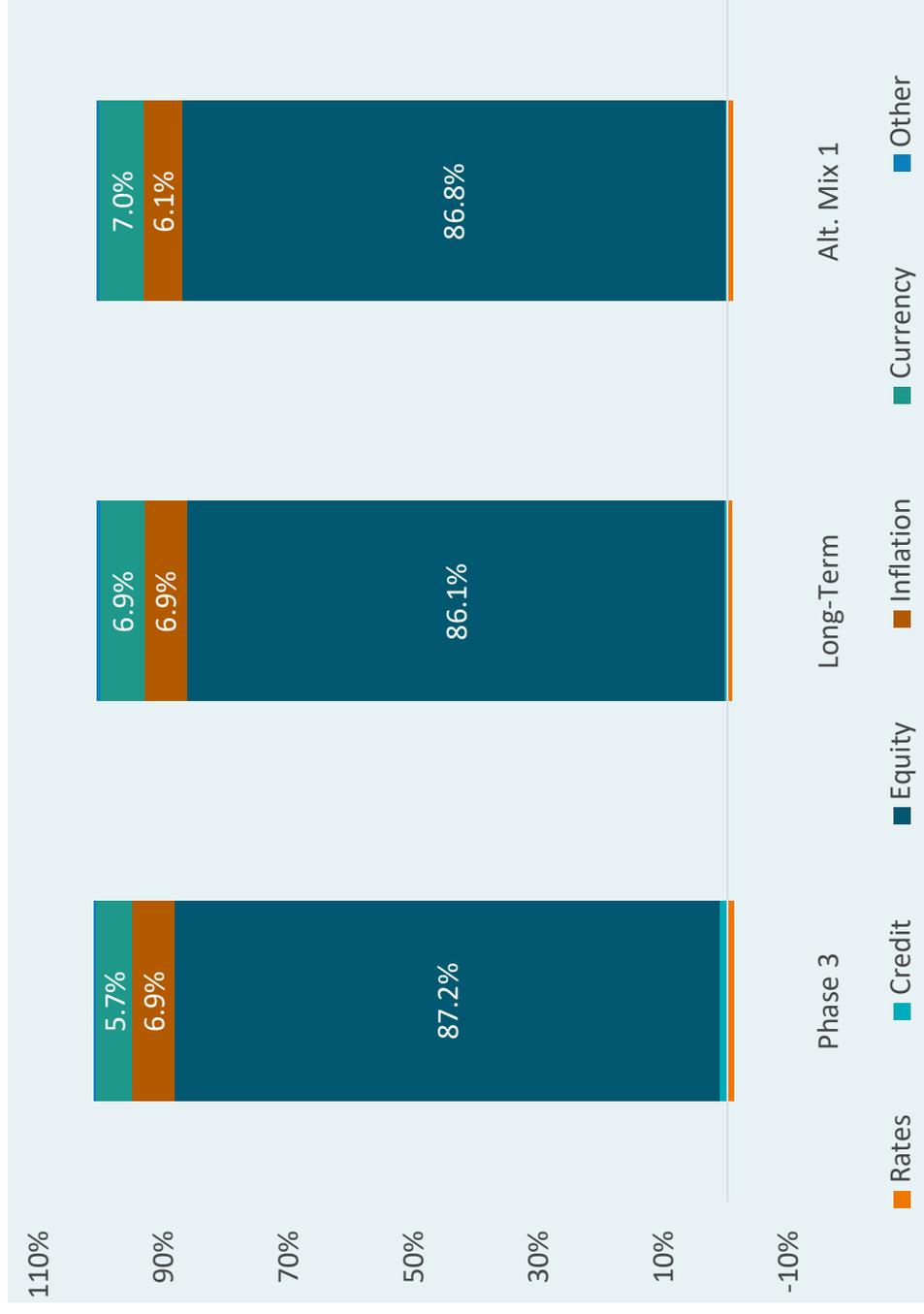


Public Equity remains the largest contributor to risk across all portfolios.

Based on Verus' 2019 Capital Market Assumptions

Risk contribution

RISK CONTRIBUTION BY RISK FACTOR



The main drivers behind the notable risk factors are:

- Equity: Public and Private Equity
- Inflation: Real Estate
- Currency: International Equity

Based on MSCI BarraOne's 2019 Capital Market Assumptions

Historical scenario analysis

TAIL RISK – SCENARIO ANALYSIS



Scenario analysis based on risk factors in current policy index and computed as hypothetical scenarios using MSCI Barra One

Historical scenario analysis

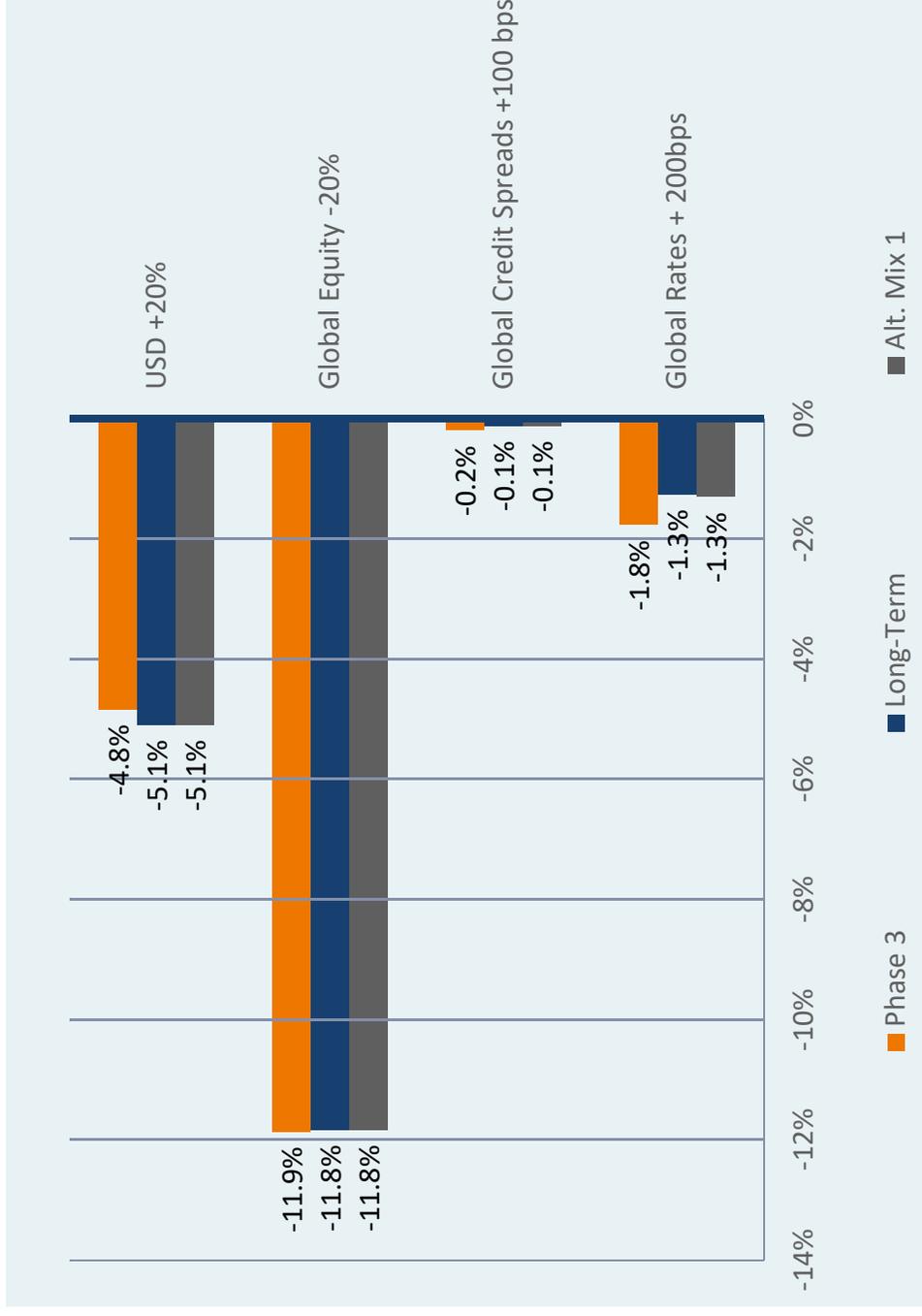
TAIL RISK – SCENARIO ANALYSIS



Scenario analysis based on risk factors in current policy index and computed as hypothetical scenarios using MSCI Barra One

Stress test

TAIL RISK – STRESS TEST



BarraOne’s risk decomposition analysis can hypothesize how the different portfolios would have performed in certain hypothetical stress tests or historical environments.

This analysis is based on how the risk factors inherent in the current index holdings reacted in those environments.

Scenario analysis based on risk factors in current policy index and computed as hypothetical scenarios using MSCI Barra One

Appendix

10-year return & risk assumptions

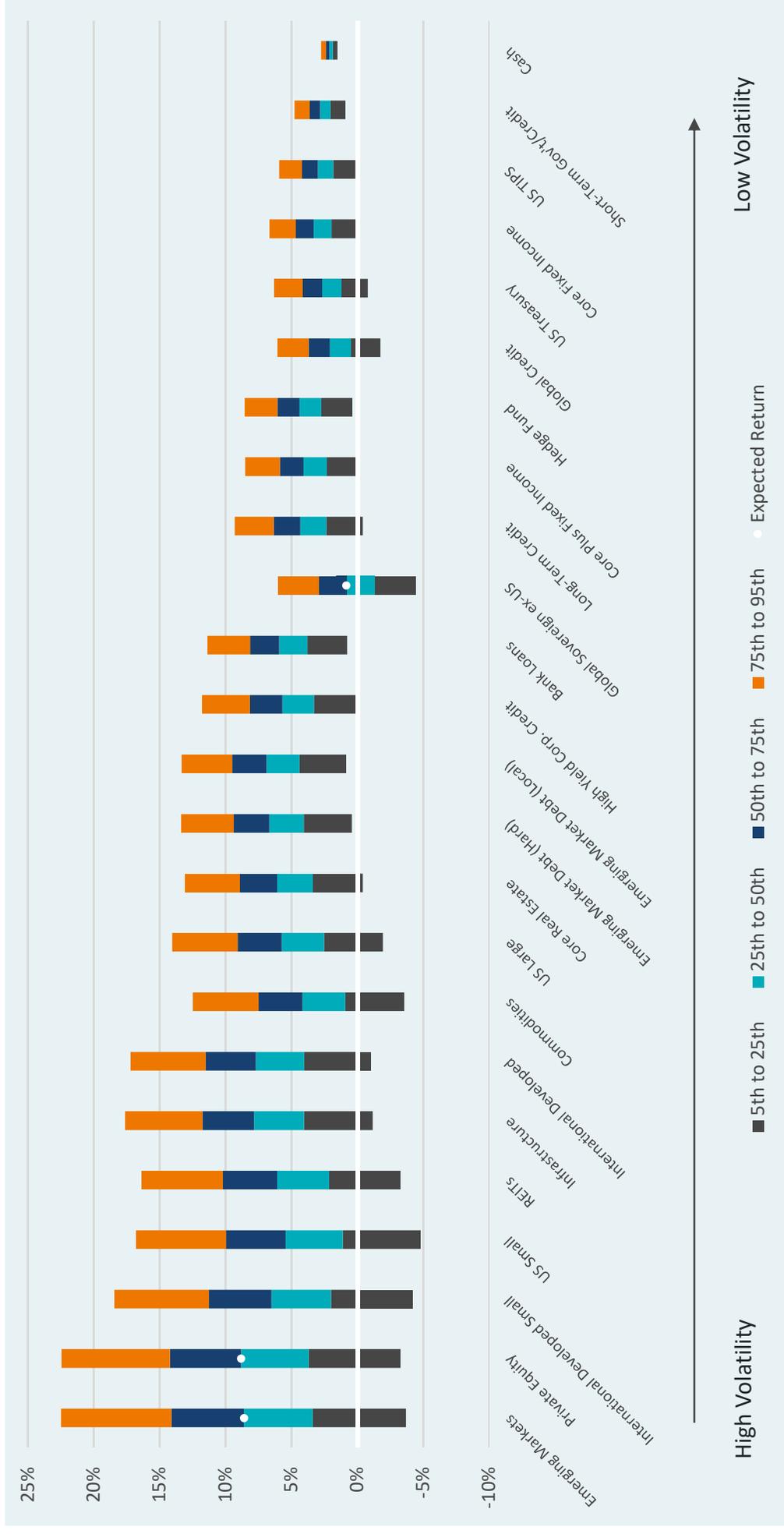
Asset Class	Index Proxy	Ten Year Return Forecast		Standard Deviation Forecast	Sharpe Ratio		10-Year Historical		
		Geometric	Arithmetic		Forecast (g)	Forecast (a)	Sharpe Ratio (g)	Sharpe Ratio (a)	
Equities									
U.S. Large	S&P 500	5.8%	6.9%	15.6%	0.24	0.31	0.94	0.95	
U.S. Small	Russell 2000	5.4%	7.5%	21.3%	0.15	0.25	0.63	0.69	
International Developed	MSCI EAFE	7.7%	9.1%	17.8%	0.31	0.39	0.37	0.43	
International Small	MSCI EAFE Small Cap	6.5%	8.8%	22.4%	0.20	0.30	0.61	0.66	
Emerging Markets	MSCI EM	8.6%	11.6%	26.1%	0.25	0.36	0.40	0.48	
Global Equity	MSCI ACWI	8.8%	8.2%	17.1%	0.27	0.36	0.62	0.67	
Private Equity*	Cambridge Private Equity	8.8%	11.7%	25.6%	0.26	0.37	-	-	
Fixed Income									
Cash	30 Day T-Bills	2.1%	2.1%	1.2%	-	-	-	-	
U.S. TIPS	BBGBarc U.S. TIPS 5-10	3.0%	3.1%	5.5%	0.16	0.18	0.67	0.68	
U.S. Treasury	BBGBarc Treasury 7-10 Year	2.7%	2.9%	6.7%	0.09	0.12	0.46	0.48	
Global Sovereign ex U.S.	BBGBarc Global Treasury ex U.S.	0.8%	1.3%	9.8%	-0.13	-0.08	0.14	0.18	
Core Fixed Income	BBGBarc U.S. Aggregate Bond	3.3%	3.5%	6.4%	0.19	0.22	1.09	1.08	
Core Plus Fixed Income	BBGBarc U.S. Corporate IG	4.1%	4.4%	8.4%	0.24	0.27	1.23	1.22	
Short-Term Gov't/Credit	BBGBarc U.S. Gov't/Credit 1-3 Year	2.8%	2.9%	3.6%	0.19	0.22	1.38	1.37	
Short-Term Credit	BBGBarc Credit 1-3 Year	3.2%	3.2%	3.7%	0.30	0.30	1.66	1.64	
Long-Term Credit	BBGBarc Long U.S. Corporate	4.3%	4.7%	9.4%	0.23	0.28	0.88	0.89	
High Yield Corp. Credit	BBGBarc U.S. Corporate High Yield	5.7%	6.3%	11.5%	0.31	0.37	1.39	1.36	
Bank Loans	S&P/LSTA Leveraged Loan	5.9%	6.4%	10.2%	0.37	0.42	1.50	1.47	
Global Credit	BBGBarc Global Credit	2.1%	2.4%	7.5%	0.00	0.04	0.88	0.89	
Emerging Markets Debt (Hard)	JPMI EMBI Global Diversified	6.7%	7.4%	12.6%	0.37	0.42	1.19	1.18	
Emerging Markets Debt (Local)	JPMI GBI-EM Global Diversified	6.9%	7.6%	12.1%	0.40	0.45	0.26	0.31	
Private Credit	Bank Loans + 175bps	7.7%	8.2%	10.2%	0.55	0.60	-	-	
Other									
Commodities	Bloomberg Commodity	4.2%	5.3%	15.7%	0.13	0.20	-0.29	-0.22	
Hedge Funds*	HFRI Fund Weighted Composite	4.4%	4.7%	7.8%	0.29	0.33	0.76	0.76	
Core Real Estate	NCREIF Property	6.1%	6.9%	12.9%	0.31	0.37	1.28	1.26	
Value-Add Real Estate	NCREIF Property + 200bps	8.1%	9.8%	19.4%	0.31	0.40	-	-	
Opportunistic Real Estate	NCREIF Property + 400bps	10.1%	13.0%	25.9%	0.31	0.42	-	-	
REITs	Wilshire REIT	6.1%	7.8%	19.3%	0.21	0.30	0.55	0.63	
Global Infrastructure	S&P Global Infrastructure	7.9%	9.3%	18.2%	0.32	0.40	0.52	0.57	
Risk Parity	Risk Parity	7.1%	7.6%	10.0%	0.50	0.55	-	-	
Currency Beta	Russell Conscious Currency	2.1%	2.2%	4.1%	0.02	0.02	0.25	0.26	
Inflation		2.0%	-	-	-	-	-	-	

Investors wishing to produce expected geometric return forecasts for their portfolios should use the arithmetic return forecasts provided here as inputs into that calculation, rather than the single-asset-class geometric return forecasts. This is the industry standard approach, but requires a complex explanation only a heavy quant could love, so we have chosen not to provide further details in this document – we will happily provide those details to any readers of this who are interested.

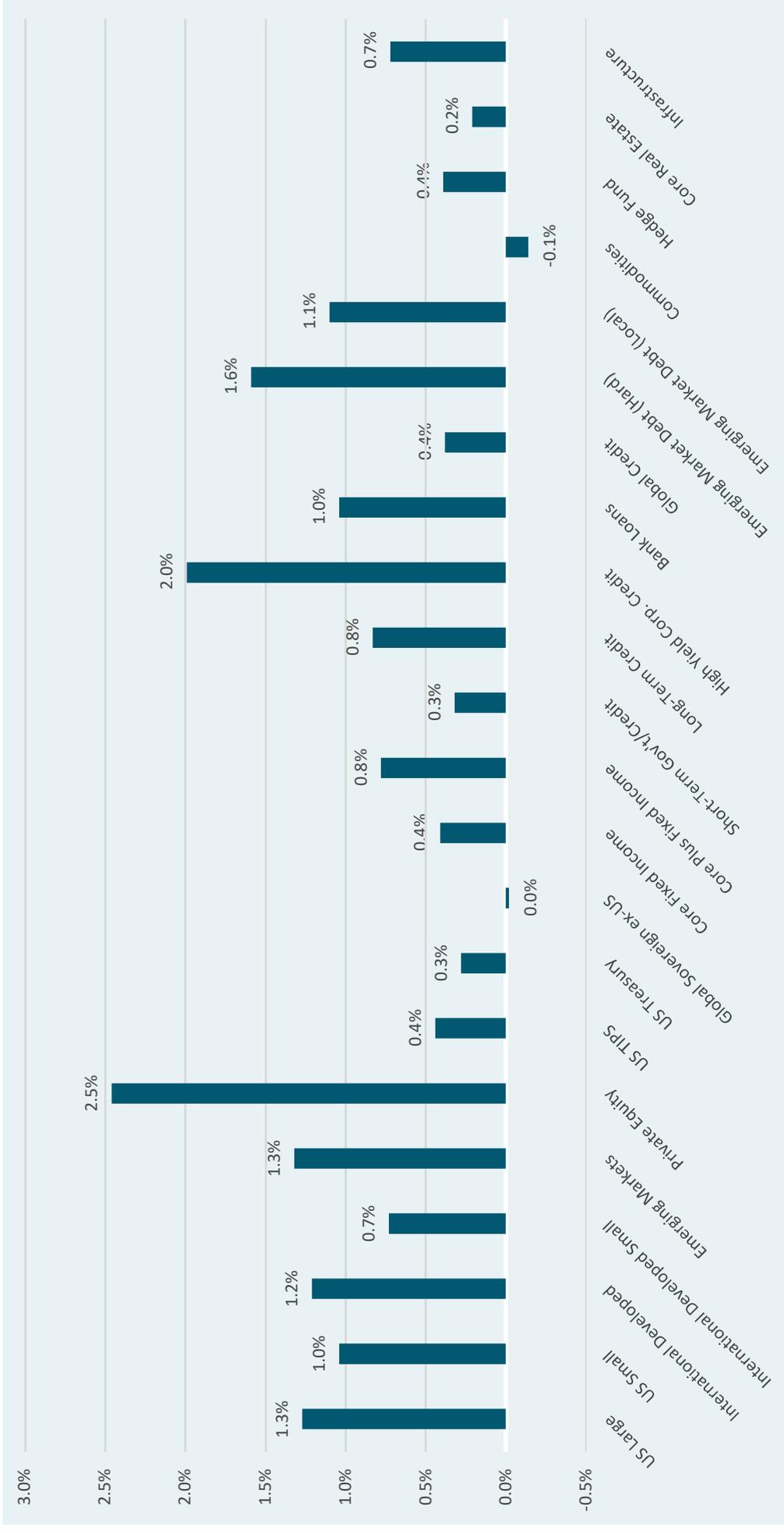
*Return expectations differ depending on method of implementation

Range of likely 10 year outcomes

10-YEAR RETURN 90% CONFIDENCE INTERVAL



2019 vs. 2018 10-yr return forecast



Note: the year-over-year change is based on the 2019 methodology

Correlation assumptions

	Cash	US Large	US Small	Intl Large	Intl Small	Intl Large Hdg	Intl Small Hdg	EM	Global Equity	PE	US TIPS	US Treasury	Global Sovereign ex US	Global Sovereign ex US Hdg	US Core Plus	US Core	ST Govt/Credit	Short-Term Credit	Long-Term Credit	US HY	Bank Loans	Global Credit	Global Credit Hdg	EMD USD	EMD Local	Commodities	Hedge Funds	Real Estate	REITs	Global Intra	Risk Parity	Currency Beta	Inflation		
Cash	1.0																																		
US Large	-0.1	1.0																																	
US Small	-0.1	0.9	1.0																																
Intl Large	-0.1	0.9	0.7	1.0																															
Intl Large Hdg	-0.1	0.8	0.8	0.9	1.0																														
Intl Small	-0.1	0.8	0.7	1.0	0.8	1.0																													
Intl Small Hdg	-0.1	0.8	0.8	0.9	0.9	0.9	1.0																												
EM	0.0	0.8	0.7	0.8	0.7	0.8	0.7	1.0																											
Global Equity	-0.1	1.0	0.8	1.0	0.9	0.9	0.9	0.9	1.0																										
PE	-0.2	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	1.0																									
US TIPS	-0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.3	0.2	0.1	1.0																								
US Treasury	0.0	-0.3	-0.3	-0.3	-0.3	-0.3	-0.4	-0.2	-0.3	-0.2	0.7	1.0																							
Global Sovereign ex US	0.1	0.3	0.1	0.4	0.1	0.5	0.1	0.5	0.4	0.0	0.5	0.4	1.0																						
Global Sovereign ex US Hdg	-0.1	-0.1	-0.2	-0.1	-0.2	-0.2	-0.2	-0.1	-0.1	0.0	0.5	0.7	0.3	1.0																					
US Core	-0.1	-0.1	0.0	0.0	-0.1	0.0	-0.1	0.1	0.0	-0.1	0.7	0.9	0.5	0.7	1.0																				
US Core Plus	-0.1	0.2	0.1	0.4	0.3	0.4	0.3	0.4	0.3	0.0	0.6	0.5	0.5	0.5	0.8	1.0																			
ST Govt/Credit	0.1	0.0	0.0	0.2	0.0	0.2	0.0	0.3	0.1	-0.1	0.6	0.5	0.6	0.3	0.8	0.7	1.0																		
Short-Term Credit	0.0	0.3	0.2	0.4	0.3	0.5	0.4	0.5	0.4	0.0	0.4	0.0	0.4	0.0	0.4	0.7	0.8	1.0																	
Long-Term Credit	-0.1	0.2	0.1	0.3	0.2	0.3	0.2	0.3	0.2	0.0	0.5	0.5	0.5	0.5	0.8	0.9	0.5	0.5	1.0																
US HY	-0.1	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.4	0.3	-0.2	0.3	-0.1	0.1	0.6	0.4	0.7	0.4	1.0															
Bank Loans	-0.2	0.4	0.4	0.5	0.5	0.6	0.6	0.5	0.5	0.4	0.1	-0.4	0.1	0.8	-0.2	0.0	0.4	0.2	0.7	0.2	0.9	1.0													
Global Credit	0.0	0.6	0.4	0.8	0.5	0.7	0.5	0.8	0.7	0.2	0.5	0.1	0.8	0.2	0.5	0.8	0.6	0.7	0.7	0.5	1.0														
Global Credit Hdg	0.0	0.4	0.3	0.5	0.4	0.6	0.5	0.6	0.5	0.2	0.5	0.3	0.5	0.4	0.7	0.9	0.6	0.7	0.9	0.7	0.5	0.8	1.0												
EMD USD	-0.1	0.5	0.3	0.6	0.5	0.6	0.4	0.7	0.6	0.2	0.5	0.2	0.6	0.3	0.5	0.7	0.5	0.6	0.6	0.6	0.7	0.4	0.8	1.0											
EMD Local	0.0	0.6	0.4	0.7	0.5	0.7	0.5	0.8	0.7	0.3	0.4	0.1	0.7	0.1	0.3	0.5	0.4	0.5	0.4	0.6	0.7	0.4	0.8	0.8	1.0										
Commodities	0.0	0.5	0.5	0.6	0.4	0.6	0.4	0.6	0.6	0.2	0.2	-0.2	0.5	-0.2	0.0	0.2	0.2	0.3	0.1	0.5	0.3	0.6	0.3	0.4	0.6	1.0									
Hedge Funds	-0.1	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.6	0.1	-0.3	0.2	-0.2	-0.1	0.3	0.0	0.3	0.2	0.6	0.5	0.4	0.4	0.4	0.5	1.0								
Real Estate	-0.1	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.5	0.4	0.1	0.0	0.1	0.0	0.0	0.2	0.0	0.1	0.1	0.3	0.3	0.3	0.2	0.3	0.3	0.2	0.4	1.0							
REITs	-0.1	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.4	0.2	0.1	0.3	0.2	0.3	0.5	0.3	0.4	0.4	0.6	0.4	0.5	0.5	0.5	0.5	0.3	0.4	0.7	1.0						
Global Intra	0.0	0.8	0.6	0.9	0.8	0.8	0.7	0.8	0.8	0.2	0.3	-0.1	0.6	0.0	0.2	0.5	0.3	0.5	0.4	0.7	0.4	0.8	0.6	0.7	0.8	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	
Risk Parity	-0.1	0.5	0.4	0.5	0.4	0.5	0.4	0.6	0.5	0.3	0.5	0.3	0.6	0.3	0.5	0.6	0.5	0.4	0.5	0.5	0.2	0.7	0.7	0.6	0.6	0.5	0.4	-0.1	0.4	0.6	1.0				
Currency Beta	0.0	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.2	-0.1	-0.2	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.0
Inflation	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	-0.1	0.1	-0.2	-0.1	-0.1	0.0	0.1	-0.1	0.1	0.1	0.2	0.1	0.0	0.0	0.1	0.2	0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	1.0

Note: Correlation assumptions are based on the last ten years. Private Equity and Real Estate correlations are especially difficult to model – we have therefore used BarraOne correlation data to strengthen these correlation estimates.

Notices & disclosures

Past performance is no guarantee of future results. *The information presented in this report is provided pursuant to the contractual agreement (the "Contract") by and between the entity named and to which this report or presentation deck is being presented ("Client") and Verus Advisory, Inc. ("Company"). Client is an institutional counter-party and in no event should the information presented be relied upon by a retail investor.*

The information presented has been prepared by the Company from sources that it believes to be reliable and the Company has exercised all reasonable professional care in preparing the information presented. However, the Company cannot guarantee the accuracy of the information contained therein. The Company shall not be liable to Client or any third party for inaccuracy or in-authenticity of information obtained or received from third parties in the analysis or for any errors or omissions in content.

The information presented does not purport to be all-inclusive nor does it contain all information that the Client may desire for its purposes. The information presented should be read in conjunction with any other material furnished by the Company. The Company will be available, upon request, to discuss the information presented in the report that Client may consider necessary, as well as any information needed to verify the accuracy of the information set forth therein, to the extent Company possesses the same or can acquire it without unreasonable effort or expense. Nothing contained therein is, or should be relied on as, a promise, representation, or guarantee as to future performance or a particular outcome. Even with portfolio diversification, asset allocation, and a long-term approach, investing involves risk of loss that the client should be prepared to bear.

The material may include estimates, outlooks, projections and other "forward-looking statements." Such statements can be identified by the use of terminology such as "believes," "expects," "may," "will," "should," "anticipates," or the negative of any of the foregoing or comparable terminology, or by discussion of strategy, or assumptions such as economic conditions underlying other statements. No assurance can be given that future results described or implied by any forward-looking information will be achieved. Actual events may differ significantly from those presented. Investing entails risks, including possible loss of principal. Risk controls and models do not promise any level of performance or guarantee against loss of principal.

Verus – also known as Verus Advisory™.