MEKETA
INVESTMENT GROUP

City of San Jose Police and Fire Department Retirement Plan

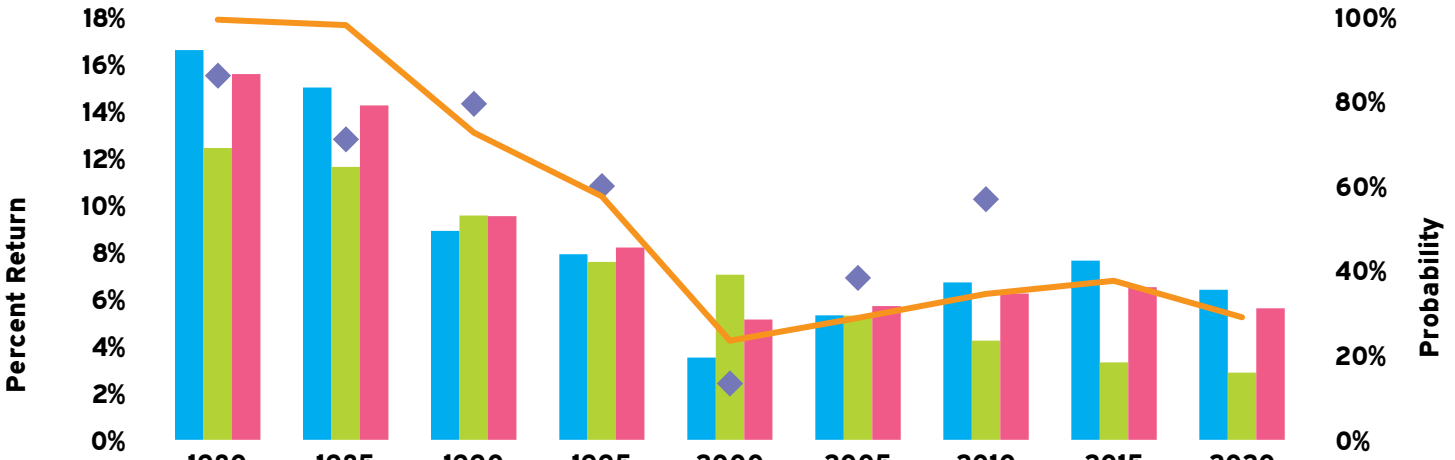
April 1, 2021

Asset Allocation Analysis

Introduction

- This document reviews updated capital market expectations, evaluates the current asset allocation policy, and presents alternative asset allocation options for the Retirement Plan and Health Care Plan.
- In the current market environment characterized by historically high equity valuations, low interest rates, and heightened uncertainty, expectations for asset class returns have declined, and expectations for volatility/standard deviation have increased. Meketa Investment Group expects that the Retirement Plan's long-term (20-year) expected return remains above the actuarial assumed rate of return of 6.625%, and the standard deviation, as calculated by risk advisor Verus, remains below the 12% threshold defined as the upper limit in the Retirement System's Investment Policy Statement.
- The asset allocation review process highlights the natural tension between long-term goals and short-term risks, and should allow the Plan's decision-makers to make more informed decisions regarding portfolio positioning. Meketa Investment Group has worked with San Jose Staff and Investment Committee members to develop and analyze a wide variety of potential alternative asset allocation policies, and provides four alterative options for comparison in this document, along with a 60% global equity/40% bond allocation and unconstrained allocation from our optimizer, for the Board's information.
- Throughout the following slides, we provide various approaches to assessing risk in order to provide a "mosaic" of the risks faced by the Plan, including mean-variance analysis using Meketa's capital markets expectations, historical scenario analysis, and forward-looking stress testing and Economic Regime Management® analysis. The goal of this review is not to declare one portfolio the "right" choice or the only prudent choice, but to highlight the risk and return tradeoffs of different policy portfolios.

The Secular Decline in Investment Returns[1]



	1980	1985	1990	1995	2000	2005	2010	2015	2020
Equity Expected Return	16.6%	15.0%	8.9%	7.9%	3.5%	5.3%	6.7%	7.6%	6.4%
Bond Expected Return	12.4%	11.6%	9.6%	7.6%	7.0%	5.3%	4.2%	3.3%	2.9%
65/35 Eq/Bond Exp. Ret.	15.6%	14.2%	9.5%	8.2%	5.1%	5.7%	6.2%	6.5%	5.6%
Actual 10-year Return	15.5%	12.8%	14.3%	10.8%	2.4%	6.9%	10.3%		
Probability of earning 7.5%	99%	98%	73%	58%	23%	29%	35%	38%	29%

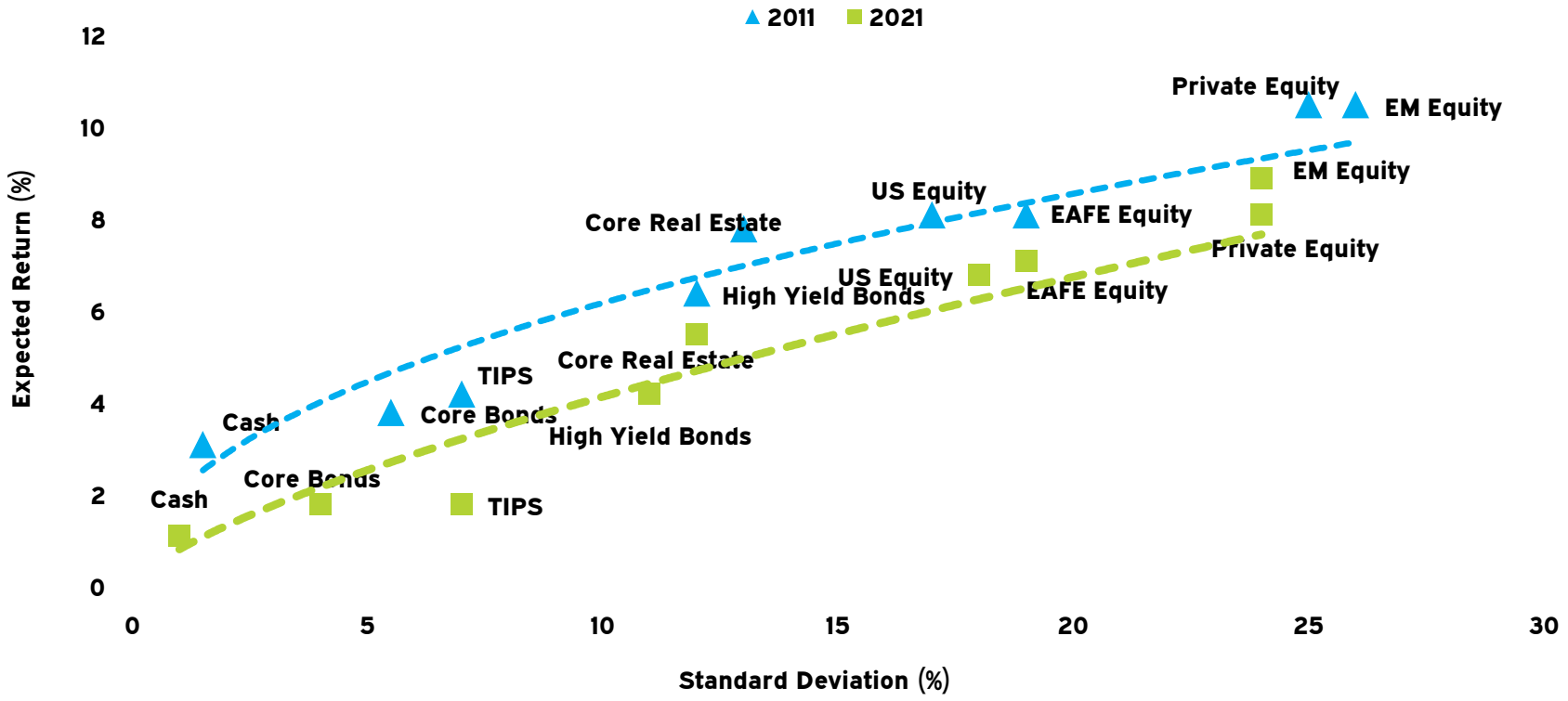
- The chart above illustrates that a portfolio made up of 65% domestic stocks and 35% investment grade bonds has produced diminishing expected as well as actual returns over the past 30 years.

[1] Expected return assumptions for 1) Bonds equals the yield of the ten-year Treasury plus 100 basis points, and 2) Equities equals the dividend yield plus the earnings yield of the S&P 500 index (using the inflation-adjusted trailing 10-year earnings). Probability calculation is for the subsequent ten years.

Mean Variance Optimization

- MVO is the traditional starting point for determining asset allocation.
- MVO mathematically determines an "efficient frontier" of policy portfolios with the highest risk-adjusted returns.
- All asset classes exhibit only three characteristics, which serve as inputs to the model:
  - Expected return
  - Expected volatility
  - Expected covariance with all other assets
- The model assumes:
  - Normal return distribution
  - Stable volatility and covariances over time
  - Returns are not serially correlated
- The MVO model tends to underestimate the risks of large negative events.

Investable Universe over Time: Less Return for the Same or More Risk[1]



- A positive relationship exists between long-term return expectations and the level of risk accepted.
- However, this relationship is not static.

[1] Expected return and standard deviation are based upon Meketa Investment Group's Annual Asset Study.

Asset Allocation Policy Comparison (%)[1]

	P&F Current	Mix A	Mix B	Mix C	Mix D	60-40	Unconstrained
Growth	**70**	**75**	**69**	**67**	**70**	**60**	**72**
US Equity	23	25	25	26	23	0	0
Dev. Market Equity (non-US)	11	12	12	12	11	0	0
Emerging Market Equity	12	12	9	6	8	0	0
Global Equity	0	0	0	0	0	60	0
Buyouts	6	9	7	6	8	0	0
Venture Capital	4	3	3	3	4	0	14
Private Debt	3	3	3	3	3	0	7
Private Real Estate	3	3	3	2	4	0	13
Private Real Assets	3	3	3	3	4	0	38
Emerging Market Bonds	3	3	2	4	3	0	0
High Yield Bonds	2	2	2	2	2	0	0
Low Beta	**8**	**8**	**8**	**8**	**8**	**0**	**0**
Absolute Return	3	3	3	3	3	0	0
Cash Equivalents (Immunized CFs)	5	5	5	5	5	0	0
Other	**22**	**17**	**23**	**25**	**22**	**40**	**28**
Core Real Estate	5	5	5	4	5	0	0
Commodities	0	2	2	2	0	0	7
TIPS	2	2	2	2	2	0	0
Investment Grade Bonds	12	6	11	14	12	40	0
Long-term Govt Bonds	3	2	3	3	3	0	21
Meketa Expected Return (10 years)	*6.0*	*6.5*	*5.9*	*5.5*	*6.0*	*4.6*	*7.6*
Meketa Expected Return (20 years)	*6.8*	*7.1*	*6.8*	*6.4*	*6.8*	*5.4*	*8.1*
Verus Standard Deviation	*11.7*	*12.8*	*11.8*	*11.3*	*11.7*	*10.6*	*12.3*
Split between Growth/Income & Diversification[2]	*70/30*	*75/25*	*70/30*	*65/35*	*70/30*	*60/40*	*72/28*
Illiquid Asset Allocation[3]	*19*	*21*	*19*	*17*	*23*	*0*	*72*
Fees Relative to Current Policy	*NA*	*Higher*	*Lower*	*Lower*	*Higher*	*Lower*	*Higher*

[1] Expected return and standard deviation are based upon Meketa Investment Group's 2021 Annual Asset Study. Throughout this document, returns for periods longer than one year are annualized.

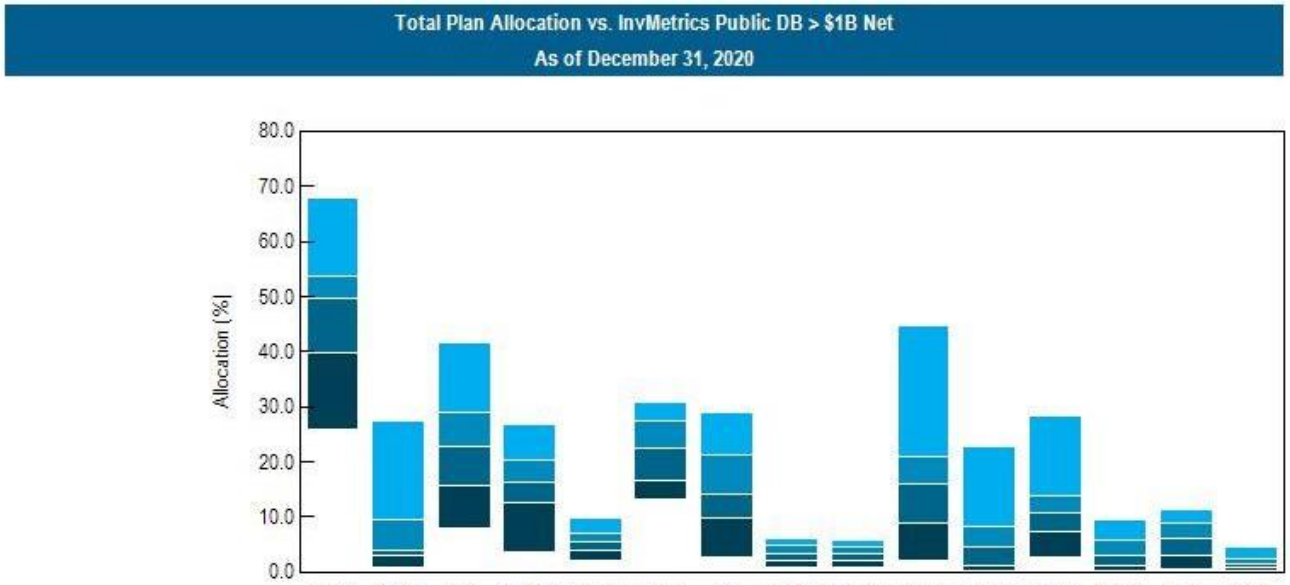
[2] Growth includes all asset classes listed under "Growth" except emerging markets bonds and high yield bonds, plus core real estate.

[3] Illiquid assets includes Buyouts, Venture Capital, Private Debt, Private Real Estate, and Private Real Assets. Quarterly/biannual liquid asset classes (Absolute Return and Core Real Estate) not included.

Review of Proposed Asset Allocation Policies

- San Jose Staff and Meketa Investment Group discussed several alternative policies.
- We show the following allocations:
  - The Police & Fire Current Policy, and then:
    - Mix A shows a portfolio with more risk and a higher return expectation than the current policy.
    - Mix B shows a portfolio with less risk and a lower return expectation than the current policy.
    - Mix C shows a portfolio with low enough risk to meet the current Investment Policy Statement threshold of 12%.
    - Mix D was added to the analysis based on feedback from the Police & Fire Investment Committee. It shows a portfolio with the same risk and return expectation as the current policy, with a lower weight to emerging markets equity and additional allocations to private assets. Private real assets and private real estate are used for inflation hedging instead of commodities (as in Mixes A-C), and there is a lower weight to emerging markets equity than the current allocation.
  - In Mixes A-C, the Venture Capital Weight is lowered by 1% (from 4 to 3). A small Commodities weight (2%) is added to Mixes A-C as a potential diversifier and for inflation protection. Mixes B and C include lower emerging markets equity weights than the current allocation. Mix B has a similar emerging markets equity weight as the MSCI ACWI Index (12.9% of the 70% in Growth assets), while Mix C has an emerging markets equity weight that is more similar to peer-reported allocations.

Peer Information - InvestorForce Public DB > $1B Net Peer Universe



Allocation (Rank)																
5th Percentile	68	27	41	26	9.	31	29	6.	5.	44	22	28	9.	11	4.	--
25th Percentile	53	9.	28	20	7.	27	21	5.	4.	20	8.	13	5.	8.	2.	--
Median	49	3.	22	16	5.	22	14	3.	3.	15	4.	10	3.	6.	1.	--
75th Percentile	39	2.	15	12	4.	16	9.	2.	2.	9.	1.	7.	1.	3.	0.	--
95th Percentile	26	0.	7.	3.	2.	13	2.	1.	0.	2.	0.	2.	0.	0.	0.	--
# of Portfolios	58	27	42	54	42	58	41	29	28	56	40	51	31	53	58	--

MVO-Based Risk Analysis

Scenario	P&F Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	Mix D (%)	60/40 (%)	Unconstrained (%)
Worst Case Returns (1)							
One Year	-19.6	-21.1	-19.5	-18.6	-19.3	-17.2	-16.5
Three Years (annualized)	-9.3	-10.3	-9.3	-8.9	-9.2	-8.3	-6.9
Five Years (annualized)	-5.9	-6.6	-5.9	-5.6	-5.8	-5.4	-3.7
Ten Years (annualized)	-2.4	-2.8	-2.4	-2.2	-2.3	-2.3	-0.4
Twenty Years (annualized)	0.2	0.0	0.2	0.2	0.3	-0.1	2.0
Probability of Experiencing Negative Returns							
One Year	29.5	30.2	29.6	29.5	29.3	30.6	24.1
Three Years	17.6	18.5	17.7	17.6	17.2	19.0	11.2
Five Years	11.4	12.3	11.5	11.4	11.1	12.8	5.8
Ten Years	4.4	5.0	4.5	4.4	4.2	5.4	1.3
Twenty Years	0.8	1.0	0.8	0.8	0.7	1.2	0.1
Probability of Achieving at least a 6.62% Return							
One Year	50.4	51.2	50.3	49.3	50.5	45.6	54.9
Three Years	50.8	52.1	50.4	48.8	50.9	42.4	58.5
Five Years	51.0	52.7	50.6	48.4	51.2	40.3	60.9
Ten Years	51.4	53.9	50.8	47.7	51.7	36.4	65.2
Twenty Years	52.0	55.4	51.1	46.8	52.4	31.1	70.9

Historical Negative Scenario Analysis[1] (*Cumulative* Return)

Scenario	P&F Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	Mix D (%)	60/40 (%)	Unconstrained (%)
Taper Tantrum (May - Aug 2013)	-0.9	-0.5	-0.5	-0.7	-0.4	-1.9	0.6
Global Financial Crisis (Oct 2007 - Mar 2009)	-26.5	-30.1	-27.3	-25.4	-25.5	-26.2	-7.6
Popping of the TMT Bubble (Apr 2000 - Sep 2002)	-13.3	-16.4	-12.9	-12.8	-10.2	-16.6	10.3
LTCM (Jul - Aug 1998)	-9.4	-10.3	-9.0	-8.9	-8.6	-7.7	-1.7
Rate spike (1994 Calendar Year)	1.8	2.7	2.6	2.1	2.6	1.8	2.4
Crash of 1987 (Sep - Nov 1987)	-11.7	-12.5	-11.5	-11.3	-10.7	-12.0	-0.1
Strong dollar (Jan 1981 - Sep 1982)	4.2	1.4	3.6	4.2	5.0	5.3	8.8
Volcker Recession (Jan - Mar 1980)	-4.1	-3.8	-4.1	-4.4	-3.9	-7.0	-3.9
Stagflation (Jan 1973 - Sep 1974)	-21.2	-20.4	-18.1	-17.1	-19.7	-20.4	7.2
COVID-19 Market Shock (Feb 2020-Mar 2020)	-17.8	-19.5	-18.2	-17.8	-17.0	-20.6	-3.1

[1] See the Appendix for our scenario inputs. In periods where the ideal benchmark was not yet available we used the next closest benchmark(s) as a proxy.

Historical Positive Scenario Analysis[1] (*Cumulative* Return)

Scenario	P&F Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	Mix D (%)	60/40 (%)	Unconstrained (%)
Global Financial Crisis Recovery (Mar 2009 - Nov 2009)	35.9	38.1	35.0	33.8	32.8	39.5	10.1
Best of Great Moderation (Apr 2003 - Feb 2004)	30.9	33.3	30.4	28.5	28.7	29.5	12.1
Peak of the TMT Bubble (Oct 1998 - Mar 2000)	58.7	58.0	53.1	50.7	56.5	33.6	81.9
Plummeting Dollar (Jan 1986 - Aug 1987)	56.1	58.9	55.1	52.6	52.5	70.8	17.2
Volcker Recovery (Aug 1982 - Apr 1983)	32.3	32.3	31.9	31.8	30.9	36.3	13.3
Bretton Wood Recovery (Oct 1974 - Jun 1975)	29.2	30.0	28.3	27.7	27.7	30.5	6.7

[1] See the Appendix for our scenario inputs. In periods where the ideal benchmark was not yet available we used the next closest benchmark(s) as a proxy.

Stress Testing: Impact of Market Movements (Expected Return under Stressed Conditions)[1]

Scenario	P&F Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	Mix D (%)	60/40 (%)	Unconstrained (%)
10-year Treasury Bond rates rise 100 bps	4.3	5.1	4.4	4.0	3.4	2.9	2.0
10-year Treasury Bond rates rise 200 bps	0.5	1.7	0.7	-0.1	-1.1	-1.4	-3.9
10-year Treasury Bond rates rise 300 bps	-2.5	-1.0	-2.3	-3.0	-4.3	-5.1	-9.2
Baa Spreads widen by 50 bps, High Yield by 200 bps	0.3	-0.1	0.2	0.3	0.8	0.5	2.1
Baa Spreads widen by 300 bps, High Yield by 1000 bps	-21.0	-23.0	-21.1	-20.0	-20.6	-20.0	-9.2
Trade Weighted Dollar gains 10%	-2.5	-3.1	-2.4	-2.1	-3.0	-2.7	0.3
Trade Weighted Dollar gains 20%	-2.0	-3.0	-2.1	-1.8	-1.4	-2.0	1.7
US Equities decline 10%	-5.7	-6.2	-5.5	-5.1	-5.6	-4.9	-1.9
US Equities decline 25%	-16.1	-17.5	-16.0	-15.2	-16.4	-14.6	-7.8
US Equities decline 40%	-25.8	-28.3	-26.1	-24.8	-25.2	-25.0	-12.7

[1] Assumes that assets not directly exposed to the factor are affected nonetheless. See the Appendix for further details.

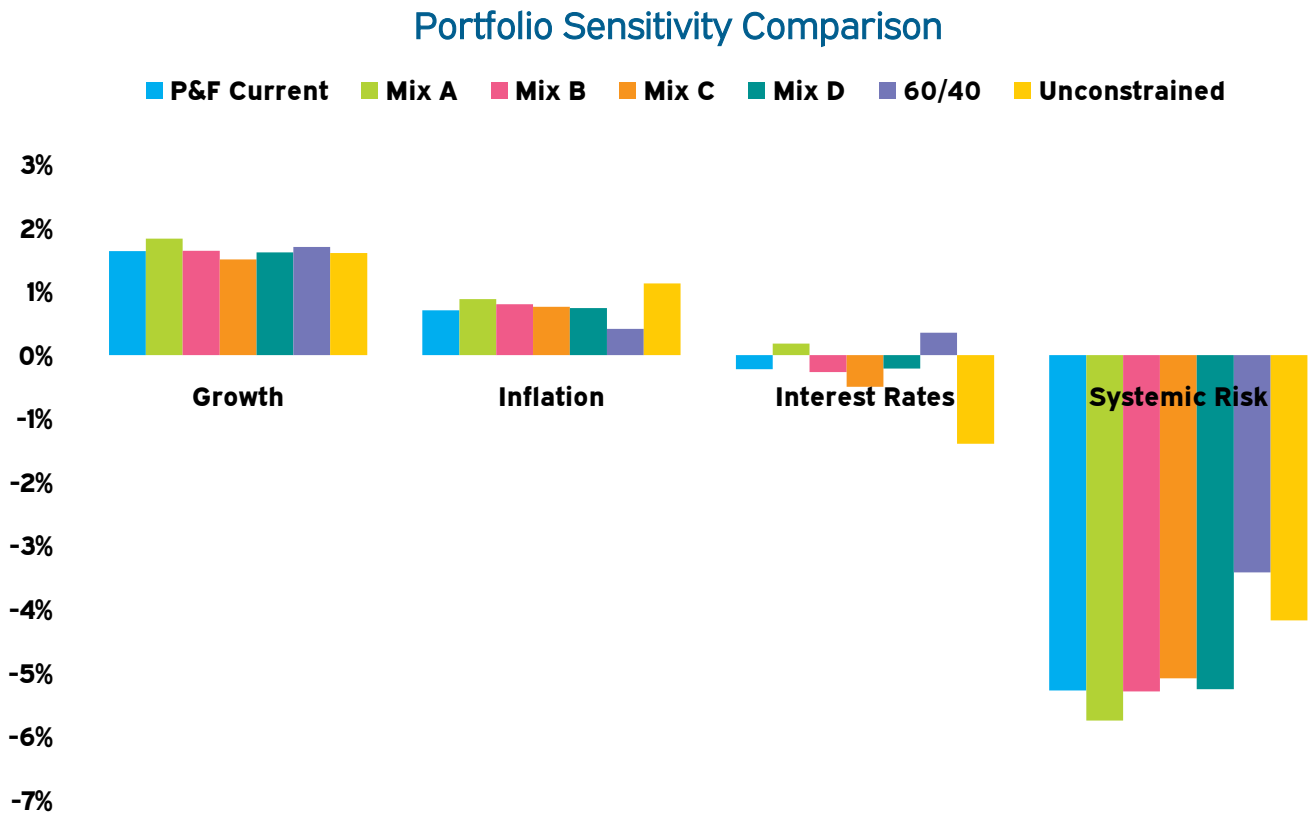
Stress Testing: Impact of Positive Market Movements (Expected Return under Stressed Conditions)[1]

Scenario	P&F Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	Mix D (%)	60/40 (%)	Unconstrained (%)
10-year Treasury Bond rates drop 100 bps	4.5	3.9	4.3	4.6	3.2	4.9	6.9
10-year Treasury Bond rates drop 200 bps	14.2	13.5	13.8	13.9	11.7	16.3	13.0
Baa Spreads narrow by 30bps, High Yield by 100 bps	7.7	8.1	7.7	7.4	7.2	6.8	6.0
Baa Spreads narrow by 100bps, High Yield by 300 bps	14.9	15.5	14.3	13.7	12.7	14.0	7.0
Trade Weighted Dollar drops 10%	7.7	8.2	7.5	7.2	7.3	7.7	4.9
Trade Weighted Dollar drops 20%	21.3	22.0	20.7	19.9	21.3	22.9	12.7
US Equities rise 10%	7.1	7.4	7.0	6.7	6.8	6.1	5.3
US Equities rise 30%	17.3	18.1	17.0	16.6	15.8	17.0	9.0

[1] Assumes that assets not directly exposed to the factor are affected nonetheless. See the Appendix for further details.

Economic Regime Management®

- The Economic Regime Management® ("ERM") approach focuses on understanding the dynamics of the most important macro level forces that drive returns across asset classes.
- We find the most important factors to be:
  - Interest Rate Surprise — Unexpected changes in the 10 year interest rate (related to Duration).
  - Inflation Surprise — Unexpected changes in the CPI growth rate.
  - Growth Surprise — Unexpected changes in the Real GDP growth rate.
  - Systemic Risk — "System-wide" risk that propagates through all asset classes (e.g., 2008).
- We focus on surprises because expectations matter.
  - What was considered "low" inflation in the 1970s would be considered "high" today.
- These factors explain the majority of volatility across asset classes.
- Understanding these dynamics explain the "why" not just the "what."



- The chart above shows the resulting change in portfolio return given a one standard deviation event in the respective risk factor.
- There is more concentration in Growth and Systematic Risk because these sources of risk tend to pay better (have higher expected returns) than the other risk factors.

Recommended Benchmark Components

Asset Class	Strategic Asset Allocation Portfolio (SAAP) Benchmark	Low Cost Passive Portfolio (LCPP) Benchmark
Public Equity	Weighted Blend of MSCI US IMI, MSCI World ex US IMI Net, MSCI EM IMI Net	Weighted Blend of MSCI US IMI, MSCI World ex US IMI Net, MSCI EM IMI Net
Total Private Markets	Actual Return	
Private Equity		Russell 3000
Venture Capital		Russell 3000
Private Debt		Bloomberg Barclays Aggregate
Growth Real Estate		Global NAREIT
Private Real Assets		S&P Global Natural Resources
Emerging Market Debt	50% JPM EMBI Global Diversified (USD)/ 50% JPM GBI-EM Global Diversified (Local)	50% JPM EMBI Global Diversified (USD)/ 50% JPM GBI-EM Global Diversified (Local)
High Yield Bonds	Bloomberg Barclays High Yield	Bloomberg Barclays High Yield
Market Neutral Strategies	3-Month LIBOR + 1.5%	3-Month LIBOR
Immunized Cash Flows	Actual Return	Bloomberg Barclays Gov/Credit 1-3 Year
TIPS	Bloomberg Barclays 0-5 Year TIPS	Bloomberg Barclays 0-5 Year TIPS
Core Real Estate	NCREIF ODCE Cap Weighted - Net (Lagged 1 quarter)	Global NAREIT
Investment Grade Bonds	Blend of BBarc 1-3 Yr Gov/Credit, US Aggregate, US Securitized	Blend of BBarc 1-3 Yr Gov/Credit, US Aggregate, US Securitized
Long-Term Government Bonds	Bloomberg Barclays US Long Treasury	Bloomberg Barclays US Long Treasury

- Liability Benchmark Portfolio: Bloomberg Barclays U.S. Long Treasury Index.

Recommended Benchmark Updates

- San Jose Investment Staff and Meketa recommend updating the Core Real Estate benchmark component for the SAAP to the market capitalization-weighted version of the NCREIF, which is more widely used by institutional investors. We also recommend lagging it one quarter, to align with receipt of manager statements.

Benchmark Returns (%)	1 Year	3 Years (annualized)	5 years (annualized)
Old - NCREIF ODCE Equal Weighted - Net	0.8	4.4	5.7
New - NCREIF ODCE Cap Weighted	0.3	4.0	5.3

- For the Market Neutral Strategies benchmark, we recommend updating the SAAP to T-Bills (cash) + 1.5%, and the LCCP to 3-month T-Bills, to acknowledge that the LCCP is supposed to be investable.

Benchmark Returns (%)	1 Year	3 Years (annualized)	5 years (annualized)
Old – 3-month T-Bills + 1%	1.7	2.6	2.2
New – 3-month T-Bills + 1.5%	2.2	3.1	2.7

- For the Immunized Cash Flows LCCP benchmark, we recommend updating the LCCP to Bloomberg Barclays Gov/Credit 1-3 Year from T-Bills (cash) + 1.5%, to align with underlying asset class investments.

Benchmark Returns (%)	1 Year	3 Years (annualized)	5 years (annualized)
Old – 3-month T-Bills	0.7	1.6	1.2
New – Bloomberg Barclays G/C 1-3 Yr	3.3	3.0	2.2

- For the Long-Term Government Bonds, we recommend updating both the SAAP and LCCP to Bloomberg Barclays US Long Treasury, which is very close to the Treasury 10+ benchmark, but more widely available.

Benchmark Returns (%)	1 Year	3 Years (annualized)	5 years (annualized)
Old – Bloomberg Barclays Treasury 10+	17.7	9.9	7.8
New – Bloomberg Barclays US Long Treasury	17.7	9.9	7.8

Health Care Trust Asset Allocation Analysis

Asset Allocation Policy Comparison[1]

	P&F HC Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	60-40 (%)
Growth	**56**	**59**	**55**	**50**	**60**
US Equity	28	30	29	27	0
Developed Market Equity (non-US)	13	14	13	12	0
Emerging Market Equity	15	15	13	11	0
Global Equity	0	0	0	0	60
Low Beta	**29**	**5**	**5**	**5**	**40**
Short-Term Investment Grade Bonds	29	5	5	5	40
Other	**15**	**36**	**40**	**45**	**0**
Investment Grade Bonds	0	14	20	25	0
Long-term Government Bonds	0	5	5	5	0
Core Real Estate	10	12	10	10	0
Commodities	5	5	5	5	0
Meketa Expected Return (20 years)	*5.8*	*6.3*	*6.0*	*5.7*	*5.2*
Meketa Expected Return (10 years)	*5.1*	*5.4*	*5.1*	*4.8*	*4.5*
Meketa Standard Deviation	*11.6*	*12.1*	*11.3*	*10.4*	*10.8*
Split between Growth/Income & Diversification[2]	*66/34*	*71/29*	*65/35*	*60/40*	*60/40*

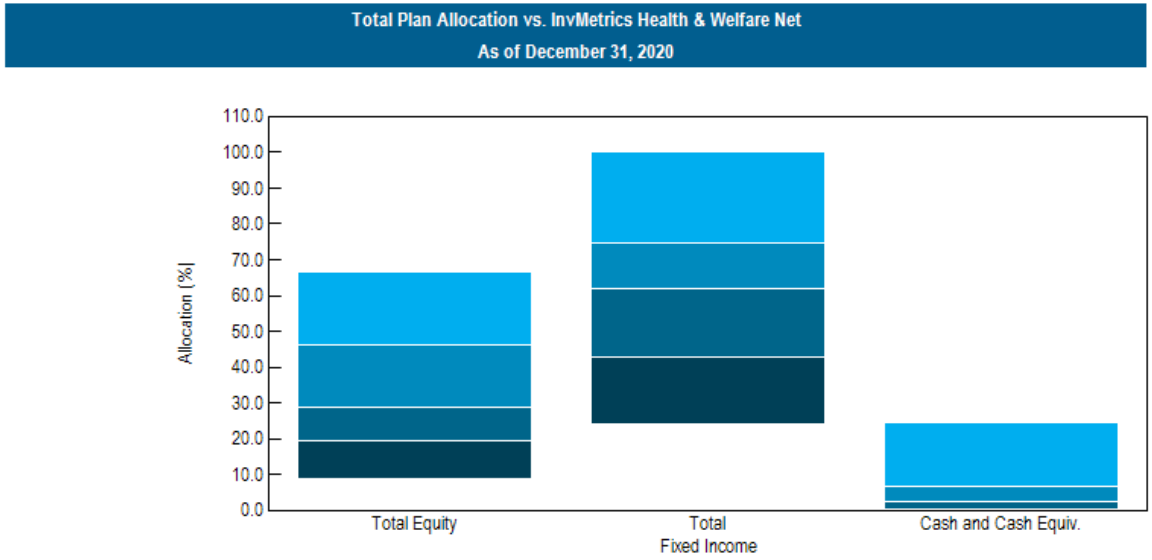
[1] Expected return and standard deviation are based upon Meketa Investment Group's 2021 Annual Asset Study. Throughout this document, returns for periods longer than one year are annualized.

[2] Growth Includes all asset classes listed under growth, plus core real estate.

Review of Proposed Asset Allocation Policies

- The recently adopted actuarial assumed rate of return for the Health Care Trust is 6.25%.
- Mixes A, B, and C present 3 options that are more in line with the Pension portfolio. They shift some short-term investment grade bonds to investment grade bonds, and add long-term government bonds as a diversifier.
- Mix A would meet the current target return, while Mixes B and C are lower risk option that would have a lower probability of meeting the 6.25% target.

Comparison to Peers



	Allocation (Rank)		
5th Percentile	66.5	100.0	24.5
25th Percentile	46.0	74.6	6.8
Median	28.6	62.0	2.5
75th Percentile	19.6	42.7	0.5
95th Percentile	9.0	24.1	0.0
# of Portfolios	183	232	157

MVO-Based Risk Analysis

Scenario	P&F HC Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	60-40 (%)
Worst Case Returns (1)					
One Year	-17.7	-18.3	-17.1	-15.8	-17.0
Three Years (annualized)	-8.5	-8.7	-8.1	-7.3	-8.2
Five Years (annualized)	-5.5	-5.6	-5.1	-4.6	-5.4
Ten Years (annualized)	-2.3	-2.2	-2.0	-1.7	-2.4
Twenty Years (annualized)	0.0	0.2	0.3	0.4	-0.2
Probability of Experiencing Negative Returns					
One Year	30.1	29.6	29.3	28.7	30.9
Three Years	18.3	17.7	17.3	16.5	19.4
Five Years	12.2	11.6	11.2	10.5	13.3
Ten Years	5.0	4.5	4.3	3.8	5.8
Twenty Years	1.0	0.8	0.7	0.6	1.3
Probability of Achieving at least a 6.25% Return					
One Year	48.4	49.9	48.8	47.6	46.1
Three Years	47.3	49.9	47.9	45.8	43.3
Five Years	46.5	49.9	47.3	44.6	41.4
Ten Years	45.0	49.8	46.3	42.4	38.0
Twenty Years	43.0	49.7	44.7	39.3	33.2

Historical Negative Scenario Analysis[1] (*Cumulative* Return)

Scenario	P&F HC Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	60-40 (%)
Taper Tantrum (May - Aug 2013)	-0.7	-1.6	-1.7	-1.7	-0.5
Global Financial Crisis (Oct 2007 - Mar 2009)	-27.9	-29.0	-26.3	-23.4	-26.4
Popping of the TMT Bubble (Apr 2000 - Sep 2002)	-15.3	-15.6	-12.6	-9.0	-19.3
LTCM (Jul - Aug 1998)	-9.7	-10.0	-9.1	-8.1	-7.7
Rate spike (1994 Calendar Year)	1.9	1.2	1.0	0.9	3.2
Crash of 1987 (Sep - Nov 1987)	-12.9	-13.8	-12.7	-11.4	-12.0
Strong dollar (Jan 1981 - Sep 1982)	5.5	4.2	5.9	7.9	5.2
Volcker Recession (Jan - Mar 1980)	-3.7	-5.0	-5.4	-5.6	-4.5
Stagflation (Jan 1973 - Sep 1974)	-15.5	-16.8	-14.6	-12.1	-21.9
COVID-19 Market Shock (Feb 2020-Mar 2020)	-19.5	-20.1	-18.8	-17.2	-20.0

- Mix C would have performed the best in environments of declining equity markets, due to its more conservative positioning.

[1] See the Appendix for our scenario inputs. In periods where the ideal benchmark was not yet available we used the next closest benchmark(s) as a proxy.

Historical Positive Scenario Analysis[1] (*Cumulative* Return)

Scenario	P&F HC Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	60-40 (%)
Global Financial Crisis Recovery (Mar 2009 - Nov 2009)	38.0	39.7	37.5	34.4	37.7
Best of Great Moderation (Apr 2003 - Feb 2004)	32.9	34.6	32.2	29.5	28.8
Peak of the TMT Bubble (Oct 1998 - Mar 2000)	40.3	41.1	37.8	34.3	35.0
Plummeting Dollar (Jan 1986 - Aug 1987)	61.8	64.4	60.4	55.9	70.3
Volcker Recovery (Aug 1982 - Apr 1983)	33.7	37.0	36.5	35.3	31.9
Bretton Wood Recovery (Oct 1974 - Jun 1975)	28.8	31.0	29.5	27.5	28.8

- Mix A would have been the best option for capturing most of the upside in strongly positive markets.

[1] See the Appendix for our scenario inputs. In periods where the ideal benchmark was not yet available we used the next closest benchmark(s) as a proxy.

Stress Testing: Impact of Market Movements (Expected Return under Stressed Conditions)[1]

Scenario	P&F HC Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	60-40 (%)
10-year Treasury Bond rates rise 100 bps	5.1	4.2	3.6	3.0	4.2
10-year Treasury Bond rates rise 200 bps	2.7	0.4	-0.5	-1.2	1.6
10-year Treasury Bond rates rise 300 bps	0.8	-2.7	-3.9	-4.8	-0.4
Baa Spreads widen by 50 bps, High Yield by 200 bps	-0.3	0.0	0.3	0.6	-0.1
Baa Spreads widen by 300 bps, High Yield by 1000 bps	-20.8	-22.0	-20.4	-18.6	-19.1
Trade Weighted Dollar gains 10%	-2.9	-2.9	-2.4	-1.9	-3.0
Trade Weighted Dollar gains 20%	-3.2	-2.2	-1.8	-1.2	-3.0
US Equities decline 10%	-5.1	-5.2	-4.7	-4.0	-5.3
US Equities decline 25%	-15.4	-16.0	-14.8	-13.4	-14.6
US Equities decline 40%	-26.8	-27.9	-25.8	-23.7	-24.6

- Each policy portfolio has a different sensitivity to four major risk factors: interest rates, credit spreads, currency fluctuations, and equity values.
- The Trust's primary risk factors would continue to be an equity market decline and a widening of credit spreads, no matter the policy.

[1] Assumes that assets not directly exposed to the factor are affected nonetheless. See the Appendix for further details.

Stress Testing: Impact of Positive Market Movements (Expected Return under Stressed Conditions)[1]

Scenario	P&F HC Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	60-40 (%)
10-year Treasury Bond rates drop 100 bps	2.9	4.3	4.7	5.0	2.9
10-year Treasury Bond rates drop 200 bps	12.1	15.3	15.4	15.2	12.7
Baa Spreads narrow by 30bps, High Yield by 100 bps	6.8	7.4	7.0	6.6	6.4
Baa Spreads narrow by 100bps, High Yield by 300 bps	14.4	15.1	14.2	13.1	13.1
Trade Weighted Dollar drops 10%	7.8	8.2	7.7	7.2	7.3
Trade Weighted Dollar drops 20%	20.2	22.6	21.4	20.1	20.9
US Equities rise 10%	6.0	6.5	6.2	5.8	5.7
US Equities rise 30%	16.4	17.6	16.8	15.6	16.2

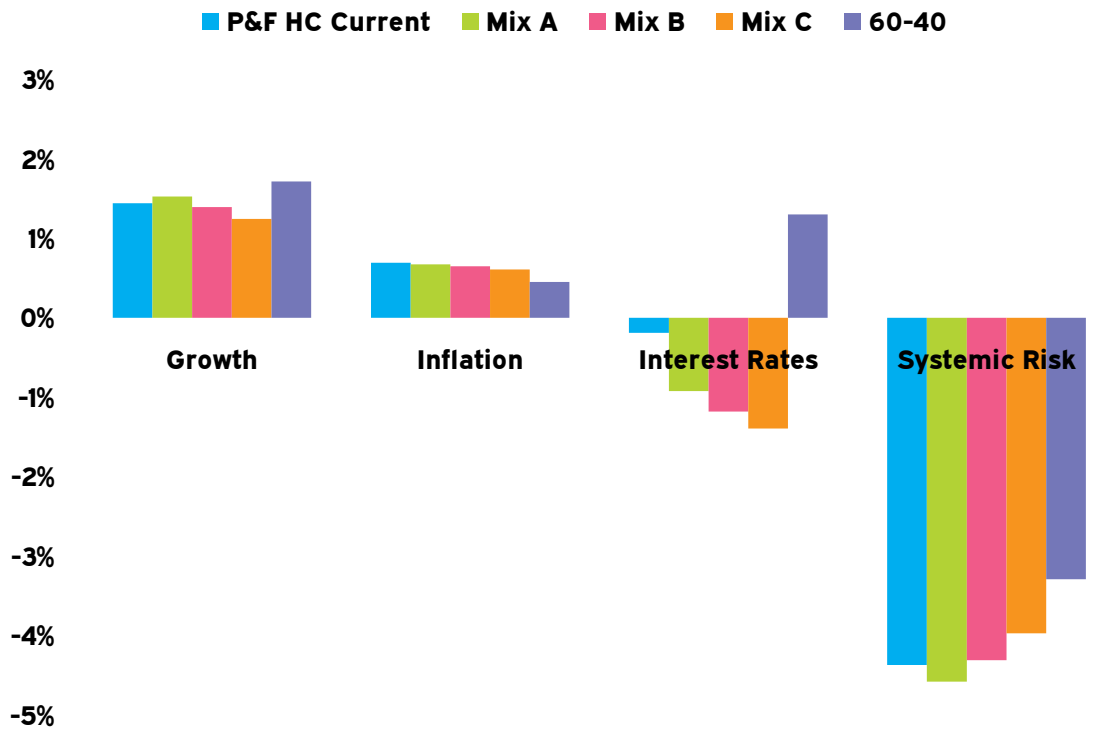
- The portfolio with the least downside risk is likewise the portfolio that participates least in upside scenarios.

[1] Assumes that assets not directly exposed to the factor are affected nonetheless. See the Appendix for further details.

Economic Regime Management

- The Economic Regime Management ("ERM") approach focuses on understanding the dynamics of the most important macro level forces that drive returns across asset classes.
- We find the most important factors to be:
  - Interest Rate Surprise — Unexpected changes in the 10 year interest rate (related to Duration).
  - Inflation Surprise — Unexpected changes in the CPI growth rate.
  - Growth Surprise — Unexpected changes in the Real GDP growth rate.
  - Systemic Risk — "System-wide" risk that propagates through all asset classes (e.g., 2008).
- We focus on surprises because expectations matter.
  - What was considered "low" inflation in the 1970s would be considered "high" today.
- These factors explain the majority of volatility across asset classes.
  - Understanding these dynamics explain the "why" not just the "what."

Portfolio Sensitivity Comparison



- The chart above shows the resulting change in portfolio return given a one standard deviation event in the respective risk factor.
- There is more concentration in Growth and Systematic Risk because these sources of risk tend to pay better (have higher expected returns) than the other risk factors.

Summary

- Meketa Investment Group believes that the current Plan allocation, adopted in March 2020, remains reasonable. The Board could also consider the other mixes presented.
- We recommend that the Board consider updating the Health Care Trust asset allocation to make it more in line with the general strategy of the Retirement Plan asset allocation.
- We also look forward to discussing this analysis with the members of the Board.

Appendix

Notes and Disclaimers

1 The returns shown in the Policy Options and Risk Analysis sections rely on estimates of expected return, standard deviation, and correlation developed by Meketa Investment Group. To the extent that actual return patterns to the asset classes differ from our expectations, the results in the table will be incorrect. However, our inputs represent our best unbiased estimates of these simple parameters.

2 The returns shown in the Policy Options and Risk Analysis sections use a lognormal distribution, which may or may not be an accurate representation of each asset classes' future return distribution. To the extent that it is not accurate in whole or in part, the probabilities listed in the table will be incorrect. As an example, if some asset classes' actual distributions are even more right-skewed than the lognormal distribution (i.e., more frequent low returns and less frequent high returns), then the probability of the portfolio hitting a given annual return will be lower than that stated in the table.

3 The standard deviation bars in the chart in the Risk Analysis section do not indicate the likelihood of a 1, 2, or 3 standard deviation event—they simply indicate the return we expect if such an event occurs. Since the likelihood of such an event is the same across allocations regardless of the underlying distribution, a relative comparison across policy choices remains valid.

Scenario Return Inputs

Asset Class	Benchmark Used
Investment Grade Bonds	Barclays Aggregate
TIPS	Barclays US TIPS
Intermediate-term Government Bonds	Barclays Treasury Intermediate
Long-term Government Bonds	Barclays Long US Treasury
EM Bonds (local)	JPM GBI-EM Global Diversified Composite
Bank Loans	CSFB Leveraged Loan
High Yield Bonds	Barclays High Yield
Direct Lending - First Lien	Cliffwater Direct Lending Index
Direct Lending - Second Lien	Cliffwater Direct Lending Index
Mezzanine Debt	Cambridge Associates Mezzanine
Distressed Debt	Cambridge Associates Distressed Debt Index
Core Real Estate	NCREIF Property
Value-Added RE	NCREIF Townsend Value Added
Opportunistic RE	NCREIF Townsend Opportunistic
REITs	NAREIT Equity
Infrastructure (private)	S&P Global Infrastructure
Natural Resources (private)	S&P Global Natural Resources
Timber	NCREIF Timberland
Commodities	Bloomberg Commodity Index
US Equity	Russell 3000
Public Foreign Equity (Developed)	MSCI EAFE
Public Foreign Equity (Emerging)	MSCI Emerging Markets
Private Equity	Cambridge Associates Private Equity Composite
Long-short Equity	HFRI Equity Hedge
Global Macro	HFRI Macro
Hedge Funds	HFRI Fund Weighted Composite
Private Debt	Weighted average of Distressed Debt, Mezzanine Debt and Direct Lending (2nd Lien)

Negative Historical Scenario Returns - Sample Inputs

	Taper Tantrum (May - Aug 2013)	Global Financial Crisis (Oct 2007 - Mar 2009)	2008 Calendar Year	Popping of the TMT Bubble (Apr 2000 - Sep 2002)	LTCM (Jul - Aug 1998)	Asian Financial Crisis (Aug 1997 - Jan 1998)	Rate spike (1994 Calendar Year)	Crash of 1987 (Sep - Nov 1987)	Strong dollar (Jan 1981 - Sep 1982)	Stagflation (Jan - Mar 1980)	Stagflation (Jan 1973 - Sep 1974)
Cash Equivalents	0.0	3.1	1.7	9.9	0.8	2.4	3.9	1.4	24.4	2.9	13.5
Short-term Investment Grade Bonds	-0.1	8.7	5.0	21.9	1.6	3.5	0.5	2.3	29.9	-2.6	4.3
Investment Grade Bonds	-3.7	9.3	5.2	28.6	1.8	4.9	-2.9	2.2	29.9	-8.7	7.9
Long-term Corporate Bonds	-9.3	-9.4	-5.2	26.9	-0.6	5.4	-5.8	1.5	29.6	-14.1	-12.0
Long-term Government Bonds	-11.6	24.5	24.0	35.5	4.1	8.6	-7.6	2.6	28.4	-13.6	-1.8
TIPS	-8.5	9.6	-2.4	37.4	0.7	2.0	-7.5	2.8	15.6	-7.8	4.3
Global ILBs	-7.4	-1.5	-7.7	39.7	0.7	2.2	-7.9	2.9	16.5	-8.3	4.5
High Yield Bonds	-2.0	-20.7	-26.2	-6.3	-5.0	5.6	-1.0	-3.6	6.9	-2.3	-15.5
Bank Loans	0.8	-22.5	-28.8	6.3	0.7	3.3	10.3	-1.7	3.3	-1.1	-7.5
Direct Lending - First Lien	3.4	-2.1	-5.8	-0.7	-0.7	1.7	0.7	-0.2	2.0	-0.6	-4.4
Direct Lending - Second Lien	4.6	-2.9	-7.8	-1.0	-0.9	2.3	1.0	-0.3	2.6	-0.8	-5.9
Foreign Bonds	-3.2	5.3	4.4	8.5	3.5	3.3	5.3	-0.3	34.8	-6.5	-1.4
Mezzanine Debt	4.6	-25.5	-25.9	-2.0	-2.6	10.3	7.6	0.4	3.2	-1.0	-7.2
Distressed Debt	4.6	-25.5	-25.9	-2.0	-2.6	10.3	7.6	0.4	3.2	-1.0	-7.2
Emerging Market Bonds (major)	-11.5	-2.7	-9.7	6.3	-28.2	-1.8	-18.9	-9.2	-1.6	-2.6	-20.2
Emerging Market Bonds (local)	-14.3	-2.3	-5.2	7.2	-34.1	-2.4	-22.8	-11.0	-2.0	-3.2	-23.9
US Equity	3.0	-43.8	-37.0	-43.8	-15.4	3.6	1.3	-29.5	-2.3	-4.1	-42.6
Developed Market Equity (non-US)	-2.2	-49.6	-43.4	-46.7	-11.5	-5.8	7.8	-14.5	-18.0	-7.0	-36.3
Emerging Market Equity	-9.4	-45.8	-53.3	-43.9	-26.7	-31.8	-7.3	-25.3	-12.1	-6.6	-44.2
Global Equity	-0.7	-46.6	-42.2	-46.7	-14.0	-3.2	5.0	-21.5	-11.2	-5.8	-39.3
Private Equity/Debt	5.7	-25.6	-27.2	-23.4	-3.2	15.7	13.2	0.6	-2.7	-2.5	-18.2
Private Equity	5.8	-25.8	-27.6	-26.0	-3.3	16.7	14.2	0.6	-3.9	-2.7	-20.1
Private Debt Composite	4.6	-21.3	-22.5	-1.7	-2.3	8.7	6.2	0.2	3.0	-1.0	-6.9
REITs	-13.3	-61.3	-37.7	45.4	-15.3	9.8	-3.5	-19.5	2.5	-3.6	-33.9
Core Private Real Estate	3.6	-7.3	-6.5	23.6	2.3	8.5	6.4	0.7	23.9	5.5	-4.4
Value-Added Real Estate	3.8	-18.0	-13.4	177.0	1.8	11.4	11.2	1.2	44.2	9.6	-7.6
Opportunistic Real Estate	4.0	-24.7	-21.8	21.4	1.5	20.0	18.8	0.9	30.7	7.0	-5.6
Natural Resources (Private)	2.5	-26.2	-34.1	-3.9	-16.9	-7.8	12.6	-10.8	-9.4	-9.2	19.3
Timberland	1.3	25.4	9.5	-1.5	0.5	12.0	15.4	3.8	23.6	-7.4	5.5
Farmland	3.3	30.2	15.8	11.4	0.8	3.9	9.4	2.2	13.3	-4.2	3.1
Commodities (naïve)	-2.4	-31.8	-35.6	18.5	-12.0	-6.2	16.6	1.8	-16.0	-9.6	139.5
Core Infrastructure	3.7	0.2	-0.6	24.8	-0.3	6.1	-11.5	0.0	-0.2	-0.1	-0.5
Hedge Funds	-0.4	-15.6	-19.0	-2.1	-9.4	1.7	4.1	-7.8	-3.8	-1.9	-15.7
Long-Short	1.0	-24.0	-26.6	-8.8	-8.3	7.9	2.6	-10.0	-4.9	-2.5	-19.8
Hedge Fund of Funds	-0.5	-17.8	-21.4	-0.4	-7.7	0.5	-3.5	-5.7	-2.7	-1.4	-11.5

Positive Historical Scenario Returns - Sample Inputs

	Global Financial Crisis Recovery (Mar 2009 - Nov 2009)	Best of Great Moderation (Apr 2003 - Feb 2004)	Peak of the TMT Bubble (Oct 1998 - Mar 2000)	Pre-Recession (Jun - Oct 1990)	Plummeting Dollar (Jan 1986 - Aug 1987)	Volcker Recovery (Aug 1982 - Apr 1983)	Bretton Wood Recovery (Oct 1974 - Jun 1975)
Cash Equivalents	0.1	0.9	6.7	3.3	10.0	6.0	4.5
Short-term Investment Grade Bonds	4.3	2.8	5.3	4.5	13.2	15.4	5.0
Investment Grade Bonds	9.0	4.6	1.7	3.8	14.4	26.4	9.2
Long-term Corporate Bonds	28.8	11.3	-3.1	1.5	15.9	42.1	17.5
Long-term Government Bonds	2.0	4.9	-2.3	2.4	15.4	33.6	11.8
TIPS	14.3	9.1	6.3	2.2	10.2	11.5	4.1
Global ILBs	24.7	9.6	6.6	2.3	10.8	12.1	4.3
High Yield Bonds	49.1	21.8	2.1	-12.9	24.9	23.3	19.3
Bank Loans	32.9	10.1	6.1	-6.1	11.1	10.4	8.7
Direct Lending - First Lien	10.6	5.7	1.1	-1.9	5.8	5.0	5.1
Direct Lending - Second Lien	14.3	7.7	1.4	-2.5	7.8	6.7	6.8
Foreign Bonds	23.4	15.2	-7.0	15.8	44.5	32.3	17.9
Mezzanine Debt	30.8	23.7	26.8	0.7	5.4	8.2	8.3
Distressed Debt	30.8	23.7	26.8	0.7	5.4	8.2	8.3
Emerging Market Bonds (major)	27.0	20.6	49.0	-8.7	38.9	21.6	21.0
Emerging Market Bonds (local)	37.5	25.2	61.0	-10.5	48.4	26.5	25.7
US Equity	51.6	37.2	50.2	-14.7	64.8	59.3	55.1
Developed Market Equity (non-US)	60.5	56.7	53.0	-9.7	140.0	29.6	34.6
Emerging Market Equity	94.6	79.4	101.3	-15.9	126.5	52.1	53.4
Global Equity	59.9	46.2	54.8	-11.1	108.4	43.0	44.6
Private Equity/Debt	15.4	23.3	84.6	4.6	19.1	13.7	18.4
Private Equity	13.0	23.7	92.1	5.5	21.7	14.8	20.2
Private Debt Composite	27.5	20.4	21.4	0.1	5.9	7.9	8.0
REITs	82.5	44.6	-5.2	-15.6	51.8	47.4	42.5
Core Private Real Estate	-16.4	9.0	18.1	1.9	13.1	6.8	4.5
Value-Added Real Estate	-32.7	11.4	19.6	3.2	23.6	11.9	7.8
Opportunistic Real Estate	-19.0	13.6	27.9	0.4	16.7	8.6	5.7
Natural Resources (Private)	57.8	36.1	22.2	6.0	78.3	30.2	14.8
Timberland	-3.3	8.5	20.5	5.7	28.6	20.0	8.7
Farmland	5.4	9.6	10.4	3.3	15.9	11.3	5.0
Commodities (naïve)	28.9	30.6	17.1	43.5	27.6	6.2	-20.2
Core Infrastructure	2.1	8.5	33.0	0.0	1.4	0.6	0.6
Hedge Funds	20.1	22.4	52.8	-1.9	30.6	13.8	14.5
Long-Short	25.9	25.3	81.4	5.1	40.8	18.0	18.9
Hedge Fund of Funds	10.3	13.3	36.8	11.9	21.3	9.7	10.3

'Anti' Stress Test Return Assumptions - Sample Inputs[1]

	10-year Treasury Bond rates drop 100 bps	10-year Treasury Bond rates drop 200 bps	Baa Spreads narrow by 30bps, High Yield by 100 bps	Baa Spreads narrow by 100bps, High Yield by 300 bps	Trade Weighted Dollar drops 10%	Trade Weighted Dollar drops 20%	US Equities rise 10%	US Equities rise 30%
Cash Equivalents	1.6	1.8	0.5	0.2	1.8	3.9	2.0	2.9
Short-term Investment Grade Bonds	3.7	5.6	0.7	2.2	1.8	3.4	1.0	2.2
Investment Grade Bonds	8.7	14.7	1.8	4.3	2.8	8.5	1.8	4.3
Long-term Corporate Bonds	18.3	32.6	5.0	15.1	5.7	13.9	3.3	7.9
Long-term Government Bonds	20.3	38.1	1.6	-0.3	2.9	19.2	3.0	6.8
TIPS	8.8	15.4	1.8	6.2	4.0	6.5	1.6	2.6
Global ILBs	3.0	5.3	2.8	7.7	6.0	6.9	1.9	3.8
High Yield Bonds	5.0	10.2	7.6	26.3	6.6	7.5	5.3	11.7
Bank Loans	1.4	2.1	4.3	16.7	3.3	1.0	2.7	5.5
Direct Lending - First Lien	0.7	0.5	5.7	6.9	1.3	4.5	2.1	3.3
Direct Lending - Second Lien	1.4	1.8	7.6	9.2	2.1	7.4	3.3	5.4
Foreign Bonds	7.2	13.9	2.6	7.9	10.3	18.4	2.6	7.6
Mezzanine Debt	3.0	3.8	9.0	17.2	5.7	8.2	6.4	7.9
Distressed Debt	2.8	4.2	9.2	17.6	5.8	10.0	6.7	9.1
Emerging Market Bonds (major)	4.7	8.8	6.3	16.2	7.0	14.2	5.6	11.8
Emerging Market Bonds (local)	5.6	10.0	6.2	18.3	10.1	18.2	6.6	15.2
US Equity	4.8	17.6	11.0	18.1	6.7	23.5	10.0	30.0
Developed Market Equity (non-US)	-0.6	18.0	10.2	18.8	13.9	41.3	6.8	18.9
Emerging Market Equity	2.0	18.9	10.7	35.4	18.6	43.2	10.4	29.1
Global Equity	2.3	17.3	10.2	20.4	10.9	32.6	8.9	25.5
Private Equity/Debt	3.9	6.9	10.0	10.7	6.7	17.3	10.2	16.6
Private Equity	4.1	7.5	10.2	9.8	6.7	18.1	10.8	18.4
Private Debt Composite	2.4	3.2	8.3	14.3	4.4	8.1	5.2	7.1
REITs	5.2	16.4	10.7	27.2	6.6	25.0	11.1	25.6
Core Private Real Estate	2.5	3.8	4.7	4.2	1.9	6.9	3.1	3.4
Value-Added Real Estate	4.8	9.1	5.1	3.4	2.0	13.4	5.7	6.9
Opportunistic Real Estate	3.0	7.4	4.9	3.8	0.7	13.2	4.7	5.6
Natural Resources (Private)	1.4	13.3	10.1	19.7	14.6	22.9	9.5	18.0
Timberland	6.9	11.2	4.5	3.3	4.2	13.4	6.1	5.9
Farmland	4.0	5.9	7.0	6.6	3.7	9.6	5.2	4.8
Commodities (naïve)	-1.0	-0.9	3.1	9.6	11.6	2.6	3.6	3.3
Core Infrastructure	3.5	2.4	6.9	4.6	3.7	6.5	2.2	3.4
Hedge Funds	5.1	7.0	5.7	11.5	5.3	8.7	5.9	10.1
Long-Short	4.9	8.1	6.5	12.5	6.7	14.0	7.1	13.1
Hedge Fund of Funds	4.0	5.9	4.6	10.2	4.2	7.5	4.8	8.8

[1] Assumptions are based on performance for each asset class during historical periods that resembled these situations.

Stress Test Return Assumptions - Sample Inputs[1]

	10-year Treasury Bond rates rise 100 bps	10-year Treasury Bond rates rise 200 bps	10-year Treasury Bond rates rise 300 bps	Baa Spreads widen by 50 bps, High Yield by 200 bps	Baa Spreads widen by 300 bps, High Yield by 1000 bps	Trade Weighted Dollar gains 10%	Trade Weighted Dollar gains 20%	US Equities decline 10%	US Equities decline 25%	US Equities decline 40%
Cash Equivalents	1.1	0.9	0.6	2.5	1.0	4.2	0.9	2.6	1.9	0.3
Short-term Investment Grade Bonds	-0.1	-2.0	-3.9	2.5	1.8	2.7	1.2	1.5	1.0	0.7
Investment Grade Bonds	-3.5	-9.6	-15.6	3.8	-0.4	3.3	3.7	2.3	1.0	-0.3
Long-term Corporate Bonds	-10.0	-24.0	-37.9	2.2	-12.6	2.3	5.8	0.4	-7.1	-12.3
Long-term Government Bonds	-14.9	-32.4	-49.9	7.0	7.5	5.4	12.7	4.0	6.4	12.0
TIPS	-4.4	-10.9	-17.5	2.7	-1.5	-0.5	-1.0	2.3	-1.4	-8.8
Global ILBs	-1.8	-6.6	-12.0	2.2	-11.2	-1.6	-5.4	2.3	-4.2	-15.7
High Yield Bonds	2.0	-3.0	-4.4	-2.0	-23.0	-2.3	-2.3	-4.3	-13.8	-21.0
Bank Loans	3.8	3.4	3.1	-2.2	-19.8	-2.2	-1.0	-3.1	-10.7	-15.9
Direct Lending - First Lien	3.1	2.7	2.7	-1.0	-7.8	-2.3	1.2	-3.1	-6.1	-5.1
Direct Lending - Second Lien	4.1	3.4	3.7	-0.7	-10.5	-2.3	1.7	-3.6	-7.9	-6.9
Foreign Bonds	-5.8	-12.3	-19.1	5.5	-2.9	-4.8	-11.1	1.6	-3.8	-8.9
Mezzanine Debt	4.4	1.7	-1.5	-1.4	-19.5	-2.1	-4.4	-4.5	-13.9	-18.9
Distressed Debt	4.3	1.5	-1.0	-1.6	-21.5	-2.8	-6.4	-5.1	-15.6	-20.5
Emerging Market Bonds (major)	0.9	-3.7	-3.5	0.3	-14.0	0.2	-4.3	-3.0	-11.1	-15.6
Emerging Market Bonds (local)	0.7	-4.1	-3.3	0.0	-13.1	-4.1	-14.7	-3.0	-13.0	-21.7
US Equity	6.7	2.7	4.3	-1.3	-30.6	-1.5	2.0	-10.0	-25.0	-40.0
Developed Market Equity (non-US)	8.0	4.9	-1.8	-1.5	-34.6	-10.9	-9.3	-8.9	-23.5	-42.1
Emerging Market Equity	8.9	7.3	2.3	-3.1	-42.0	-12.6	-16.6	-11.7	-30.5	-48.0
Global Equity	7.1	4.0	1.9	-1.7	-33.1	-6.7	-5.9	-9.7	-25.0	-41.5
Private Equity/Debt	6.5	2.6	-2.4	0.4	-22.3	-3.0	-4.9	-8.8	-20.1	-23.6
Private Equity	6.9	2.7	-2.5	0.7	-22.6	-2.8	-4.6	-9.5	-20.9	-24.1
Private Debt Composite	3.5	1.0	-1.3	-1.3	-16.7	-2.5	-2.8	-4.4	-12.0	-14.9
REITs	3.7	-0.9	2.5	-4.0	-37.9	-0.9	8.3	-7.4	-30.8	-55.8
Core Private Real Estate	3.9	4.4	6.2	2.4	-7.0	3.0	8.6	0.0	-6.2	-13.7
Value-Added Real Estate	5.6	8.5	12.5	6.7	-13.1	7.5	8.8	0.9	-10.0	-22.1
Opportunistic Real Estate	5.1	8.0	9.7	2.5	-20.3	1.8	15.8	-1.4	-13.2	-25.2
Natural Resources (Private)	13.3	7.6	-0.2	-1.2	-25.0	-5.6	-19.1	-4.9	-18.2	-32.7
Timberland	3.3	2.9	-0.8	5.1	6.7	2.7	8.9	0.7	2.7	3.2
Farmland	3.8	1.1	-1.3	4.6	10.4	1.5	9.1	1.1	4.4	9.0
Commodities (naïve)	10.0	6.7	0.3	-4.0	-24.3	-6.1	-25.7	3.5	-9.1	-34.5
Core Infrastructure	3.9	1.0	0.5	2.4	-0.1	-0.7	3.0	-0.8	-4.3	-8.4
Hedge Funds	3.4	0.7	-2.5	-0.1	-13.7	-1.0	-1.3	-3.8	-10.7	-14.7
Long-Short	4.4	1.2	-1.9	0.5	-19.9	-1.6	-3.6	-6.3	-15.6	-22.1
Hedge Fund of Funds	2.4	-0.2	-3.3	-1.0	-14.3	-1.8	-2.2	-4.5	-11.5	-15.7

[1] Assumptions are based on performance for each asset class during historical periods that resembled these situations.

Meketa Investment Group 2021 Annual Asset Study
Twenty-Year Annualized Return and Volatility Expectations for Major Asset Classes

Asset Class	Expected Return (%)	Volatility (%)
Fixed Income		
Cash Equivalents	2.9	1.0
Investment Grade Bonds	3.0	4.0
Long-term Government Bonds	3.2	12.0
TIPS	2.9	7.0
High Yield Bonds	5.2	11.0
Emerging Market Bonds (major)	4.5	11.0
Emerging Market Bonds (local)	4.8	14.0
Equities		
US Equity	7.4	17.0
Developed Market Equity	7.9	19.0
Emerging Market Equity	9.1	24.0
Global Equity	7.8	17.0
Buyouts	9.4	24.0
Venture Capital	9.3	34.0
Mezzanine Debt	7.0	15.0
Real Assets		
Real Estate	7.5	15.0
REITs	7.0	26.0
Core Private Real Estate	6.3	11.0
Value Added Real Estate	8.4	18.0
Opportunistic Real Estate	9.9	24.0
Natural Resources (Public)	8.3	22.0
Natural Resources (Private)	8.8	21.0
Commodities (naïve)	4.3	17.0
Infrastructure (Public)	7.5	17.0
Core Infrastructure (Private)	6.7	14.0
Non-Core Infrastructure (Private)	9.1	22.0
Other		
Hedge Funds	4.9	7.0
Long-Short	4.3	9.0
Event-Driven	5.8	8.0
Global Macro	4.6	5.0

Other Firm Long-Term Capital Markets Expectations

Expected Return	BlackRock 20 Yr (%)	GMO[1] 7 Yr (%)	Morgan Stanley 10 Yr (%)	Verus[2] 10 Yr (%)	Meketa 10 Yr (%)	Meketa 20 Yr (%)
Global Equity	N/A	N/A	5.2	5.2	5.5	7.1
US Equity	6.3	-4.4	2.6	5.1	4.9	6.8
Emerging Markets Equity	8.0	0.9	6.7	5.4	7.2	8.1
Private Equity	15.4	N/A	6.0	9.3	8.0	9.1
US Fixed Income	2.0	-1.1	N/A	1.5	1.0	1.8
Emerging Markets Debt	4.7	0.9	5.5	5.2	2.8	3.7
TIPS	2.7	-1.6	1.9	1.1	0.6	1.8
Real Estate	6.2	N/A	N/A	5.8	5.0	6.9
Hedge Funds	6.1	N/A	2.9	3.8	3.4	4.3
Commodities	N/A	N/A	2.6	2.2	3.4	3.7

- The table above compares recently released capital markets assumptions (expected returns per year) from a variety of investment firms. Unsurprisingly, the short-term return expectations for most asset classes tend to be lower than the long-term expectations.

[1] Inflation estimate has been added to real return expectation assumptions.

[2] Source: Verus' 2021 10-year geometric capital markets assumptions.