MEKETA
INVESTMENT GROUP

San Jose Federated City Employees' Retirement System

March 16, 2021

Asset Allocation Analysis

FCERS 3-18-21

Introduction

- This document evaluates the current asset allocation policy and presents alternative asset allocation options for the San Jose Federated City Employees' Retirement System and Health Care Trust.

- 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 Federated Retirement System's long-term (20-year) expected return remains above the actuarial assumed rate of return of 6.625%. However, the current allocation's expected standard deviation, calculated by risk advisor Verus, has risen slightly above the 12% threshold defined as the upper limit in the Retirement System's Investment Policy Statement (to 12.3%).

- 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 to develop and analyze a wide variety of potential alternative asset allocation policies, and provides three alterative options for comparison in this document, along with a 60% global equity/40% global bond allocation and an "all public markets" allocation, 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.
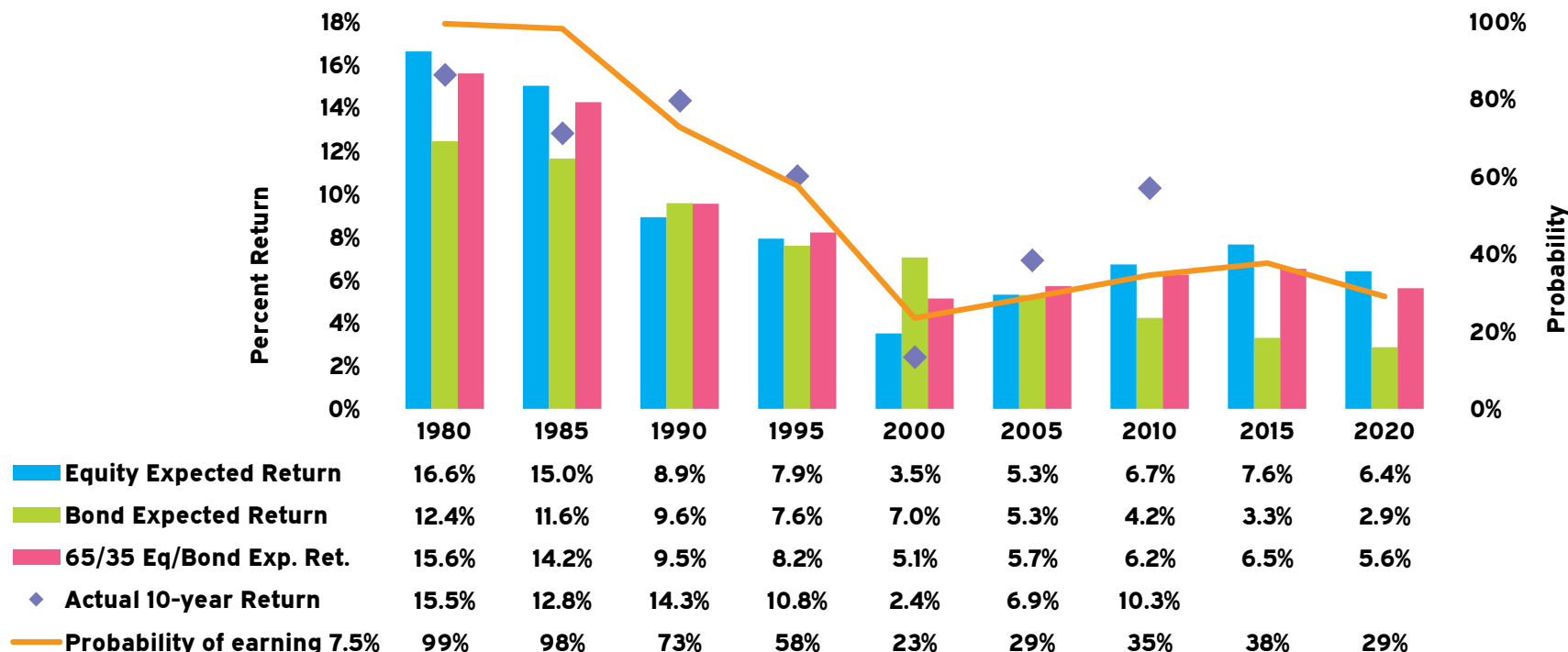
San Jose Federated Investment Policy Statement Asset Allocation Policy

- According to the Retirement System's Investment Policy Statement:

"The Board recognizes that establishing an appropriate strategic asset allocation (SAA) portfolio is critical to the long-term success of the investment program, as asset allocation is the single biggest determinant of the expected risk and return of the System."

- The IPS also includes the following process:

"The (asset allocation) will be re-evaluated annually following the results of the annual actuarial study. (It) shall be established and modified based on the results of formal asset allocation studies performed approximately every three years or when a significant market correction occurs. The capital market assumptions (CMAs) used in such studies shall be reviewed and updated annually or when the S&P 500 experiences a decrease of more than 20% from peak. The Board shall consult with the general investment consultant in connection with such asset allocation studies and CMA reviews."

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.

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[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]
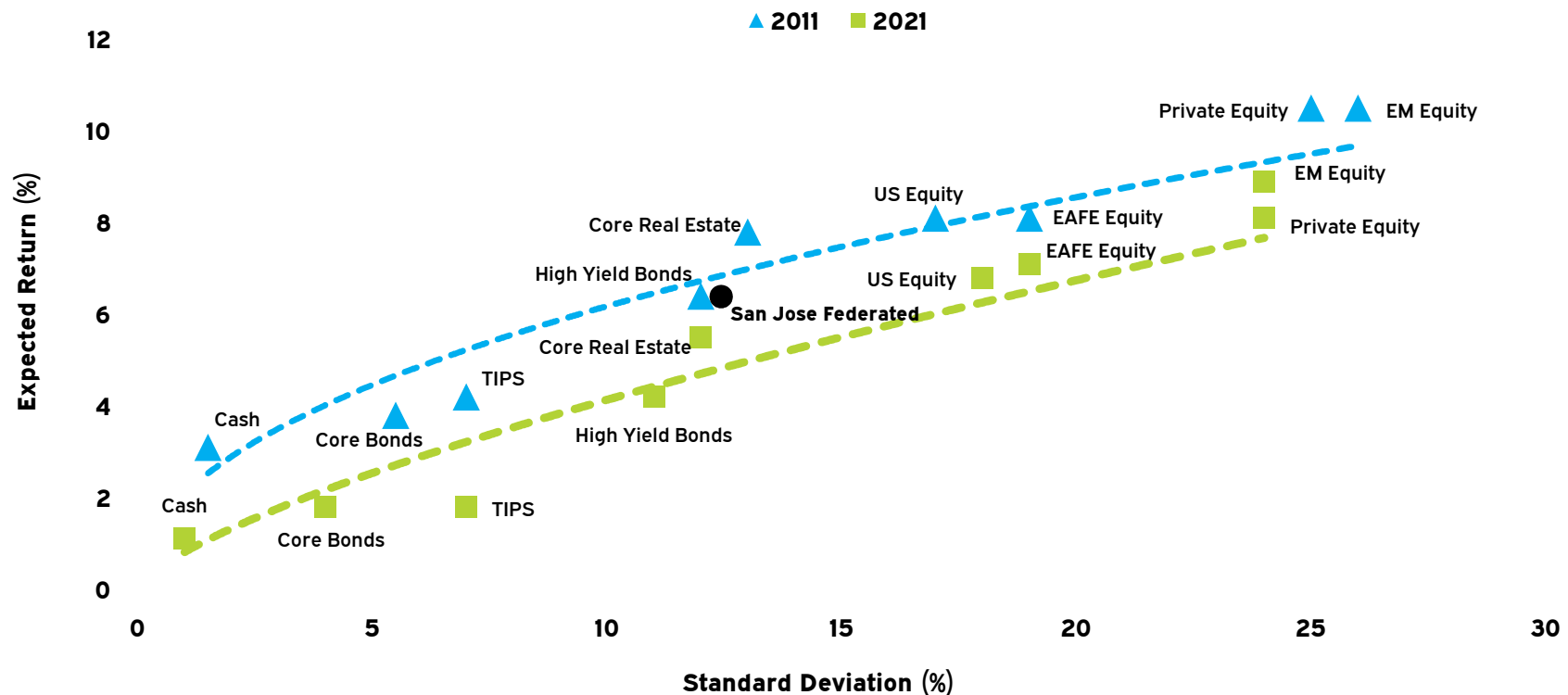
- Generally, the more risk an investor takes on, the more one can expect in return.

- However, this relationship is not static. Different decades have delivered very different total return results.

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

Asset Allocation Policy Comparison[1]

	Fed Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	Public (%)	60-40 (%)
Split between Growth/Income & Diversification[2]	*75/25*	*71/29*	*79/21*	*70/30*	*65/35*	*60/40*
Growth	**75**	**71**	**79**	**70**	**66**	**60**
US Equity	25	23	26	25	30	0
Dev. Market Equity (non-US)	12	11	13	12	15	0
Emerging Market Equity	12	10	12	9	12	0
Global Equity	NA	NA	NA	NA	NA	60
Buyouts	8	10	10	7	0	0
Venture Capital	4	3	4	3	0	0
Private Debt	3	3	3	3	0	0
Private Real Estate	3	3	3	3	0	0
Private Real Assets	3	3	3	3	0	0
Public Real Assets	0	0	0	0	3	0
Emerging Market Bonds	3	3	3	3	3	0
High Yield Bonds	2	2	2	2	3	0
Low Beta	**8**	**8**	**8**	**8**	**5**	**0**
Absolute Return	3	3	3	3	0	0
Cash Equivalents (Immunized CFs)	5	5	5	5	5	0
Other	**17**	**21**	**13**	**22**	**29**	**40**
Core Real Estate	5	5	5	5	8	0
Commodities	0	2	0	0	0	0
TIPS	2	2	2	2	4	0
Investment Grade Bonds	8	9	4	12	15	40
Long-term Govt Bonds	2	3	2	3	2	0
Meketa Expected Return (10 years)	*6.3*	*6.1*	*6.5*	*5.9*	*5.3*	*4.6*
Meketa Expected Return (20 years)	*7.1*	*6.9*	*7.3*	*6.7*	*6.1*	*5.4*
Verus Standard Deviation	*12.7*	*12.4*	*13.4*	*11.7*	*11.5*	*10.6*

[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.

Review of Proposed Asset Allocation Policies

- San Jose Staff and Meketa Investment Group discussed several alternative policies.

- We show the following allocations:

  – The Federated Current Policy

  – Then we show three alternative options.

    ▪ Mix A shows a portfolio with less equity and a lower return expectation than the current policy. The expected standard deviation is above 12%.

    ▪ Mix B shows a portfolio with more equity and a higher return expectation than the current policy. The expected standard deviation is above 12%.

    ▪ Mix C shows a portfolio with less equity, and low enough risk to meet the current Investment Policy Statement threshold of 12%.

  – Lastly, we show an "all public" option that does not use illiquid assets (beyond core real estate, which has quarterly liquidity), and then we also show a 60% global equity/40% global investment grade bond allocation, for comparison purposes.

  – In Mixes A and C, the Venture Capital Weight is lowered by 1% (from 4 to 3). In Mix A, a small Commodities weight (2%) is added as a potential diversifier and for inflation protection. Mixes A and C include lower emerging markets equity weights than the current allocation.

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

Total Plan Allocation vs. InvMetrics Public DB > $1B Net
As of December 31, 2020
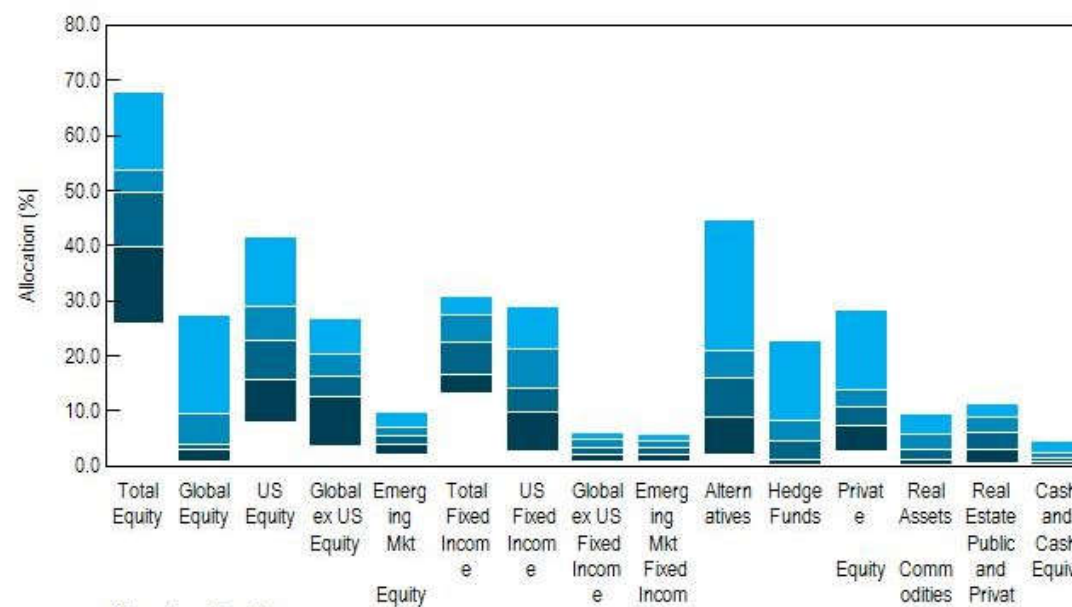
Allocation (Rank)	Total Equity	Global Equity	US Equity	Global ex US Equity	Emerging Mkt Equity	Total Fixed Income	US Fixed Income	Global ex US Fixed Income	Emerg ing Mkt Fixed Income	Altern atives	Hedge Funds	Private Equity	Real Assets Comm odities	Real Estate Public and Private	Cash and Cash Equiv.
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	Current Fed Mix (%)	MIx A (%)	Mix B (%)	Mix C (%)	Public (%)	60/40 (%)
Worst Case Returns (1)						
One Year	-20.9	-20.1	-22.0	-19.4	-18.6	-17.2
Three Years (annualized)	-10.1	-9.7	-10.8	-9.2	-9.0	-8.3
Five Years (annualized)	-6.5	-6.2	-7.0	-5.9	-5.8	-5.4
Ten Years (annualized)	-2.7	-2.5	-3.0	-2.4	-2.5	-2.3
Twenty Years (annualized)	0.0	0.1	-0.1	0.2	-0.1	-0.1
Probability of Experiencing Negative Returns						
One Year	30.1	29.7	30.4	29.6	30.3	30.6
Three Years	18.3	17.9	18.7	17.6	18.6	19.0
Five Years	12.1	11.7	12.6	11.5	12.4	12.8
Ten Years	4.9	4.6	5.2	4.5	5.2	5.4
Twenty Years	1.0	0.9	1.1	0.8	1.1	1.2
Probability of Achieving at least a 6.625% Return						
One Year	51.2	50.8	51.8	50.2	48.1	45.6
Three Years	52.1	51.3	53.1	50.3	46.7	42.4
Five Years	52.7	51.7	54.0	50.4	45.7	40.3
Ten Years	53.8	52.4	55.7	50.5	44.0	36.4
Twenty Years	55.4	53.4	58.0	50.7	41.5	31.1

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

Scenario	Current Fed Mix (%)	MIx A (%)	Mix B (%)	Mix C (%)	Public (%)	60/40 (%)
Taper Tantrum (May - Aug 2013)	-0.5	-0.5	-0.2	-0.6	-2.0	-1.9
Global Financial Crisis (Oct 2007 - Mar 2009)	-29.1	-27.4	-31.0	-26.5	-28.4	-26.2
Popping of the TMT Bubble (Apr 2000 - Sep 2002)	-16.5	-13.2	-19.0	-12.9	-17.5	-16.6
LTCM (Jul - Aug 1998)	-10.0	-9.3	-10.5	-9.1	-10.4	-7.7
Rate spike (1994 Calendar Year)	2.4	2.7	2.8	2.1	0.0	1.8
Crash of 1987 (Sep - Nov 1987)	-12.5	-11.2	-13.1	-11.6	-14.2	-12.0
Strong dollar (Jan 1981 - Sep 1982)	2.4	3.0	0.9	4.2	3.7	5.3
Volcker Recession (Jan - Mar 1980)	-3.8	-4.0	-3.6	-4.1	-4.8	-7.0
Stagflation (Jan 1973 - Sep 1974)	-23.1	-18.3	-24.6	-21.1	-23.0	-20.4
COVID-19 Market Shock (Feb 2020-Mar 2020)	-19.1	-17.9	-20.0	-18.0	-21.3	-20.6

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[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	Current Fed Mix (%)	MIx A (%)	Mix B (%)	Mix C (%)	Public (%)	60/40 (%)
Global Financial Crisis Recovery (Mar 2009 - Nov 2009)	37.5	35.0	38.6	34.8	40.9	39.5
Best of Great Moderation (Apr 2003 - Feb 2004)	32.5	30.8	33.8	30.1	33.8	29.5
Peak of the TMT Bubble (Oct 1998 - Mar 2000)	61.6	55.1	63.9	53.3	40.2	33.6
Plummeting Dollar (Jan 1986 - Aug 1987)	58.5	54.4	60.5	55.1	64.7	70.8
Volcker Recovery (Aug 1982 - Apr 1983)	32.7	31.1	32.8	32.3	36.8	36.3
Bretton Wood Recovery (Oct 1974 - Jun 1975)	30.6	28.1	31.5	29.1	32.4	30.5

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[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	Current Fed Mix (%)	MIx A (%)	Mix B (%)	Mix C (%)	Public (%)	60/40 (%)
10-year Treasury Bond rates rise 100 bps	4.9	4.6	5.3	4.2	4.0	2.9
10-year Treasury Bond rates rise 200 bps	1.4	0.9	1.9	0.4	0.2	-1.4
10-year Treasury Bond rates rise 300 bps	-1.3	-2.1	-0.7	-2.5	-2.4	-5.1
Baa Spreads widen by 50 bps, High Yield by 200 bps	0.0	0.2	-0.1	0.3	0.1	0.5
Baa Spreads widen by 300 bps, High Yield by 1000 bps	-22.5	-21.3	-23.6	-20.7	-21.9	-20.0
Trade Weighted Dollar gains 10%	-2.9	-2.6	-3.2	-2.3	-2.9	-2.7
Trade Weighted Dollar gains 20%	-2.4	-2.4	-2.7	-1.6	-2.2	-2.0
US Equities decline 10%	-6.3	-5.6	-6.7	-5.6	-5.6	-4.9
US Equities decline 25%	-17.4	-16.3	-18.3	-15.9	-16.4	-14.6
US Equities decline 40%	-27.6	-26.3	-28.9	-25.6	-27.7	-25.0

[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
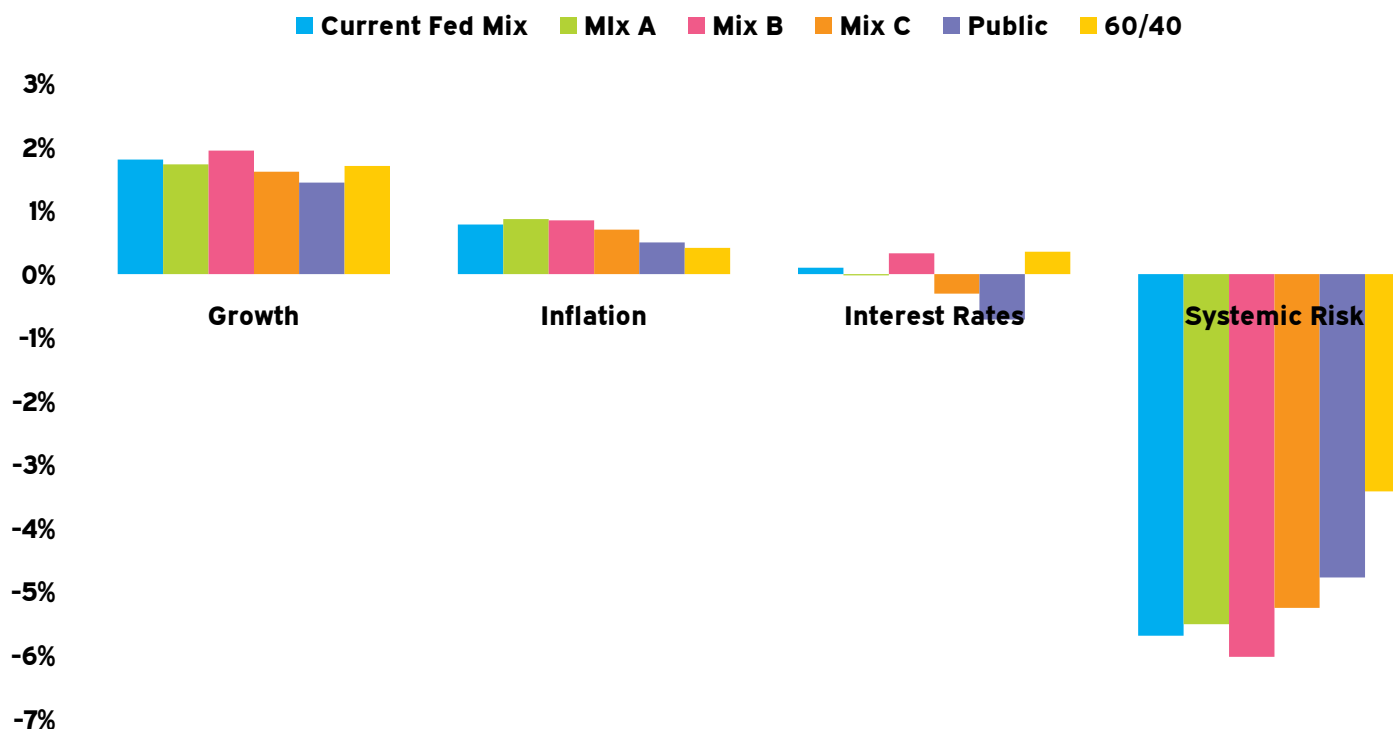## (Expected Return under Stressed Conditions)[1]

Scenario	Current Fed Mix (%)	Mix A (%)	Mix B (%)	Mix C (%)	Public (%)	60/40 (%)
10-year Treasury Bond rates drop 100 bps	4.1	4.3	3.9	4.5	4.3	4.9
10-year Treasury Bond rates drop 200 bps	13.9	13.5	13.8	14.1	15.2	16.3
Baa Spreads narrow by 30bps, High Yield by 100 bps	8.1	7.8	8.5	7.7	7.6	6.8
Baa Spreads narrow by 100bps, High Yield by 300 bps	15.5	14.5	15.9	14.3	15.6	14.0
Trade Weighted Dollar drops 10%	8.0	7.7	8.2	7.4	8.1	7.7
Trade Weighted Dollar drops 20%	22.1	20.9	22.8	20.9	22.5	22.9
US Equities rise 10%	7.4	7.1	7.7	7.0	6.6	6.1
US Equities rise 30%	18.2	17.1	18.9	17.2	18.0	17.0

[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."

Portfolio Sensitivity Comparison

■ Current Fed Mix　■ MIx A　■ Mix B　■ Mix C　■ Public　■ 60/40

- 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

Summary

- Meketa Investment Group believes that the current Federated allocation, adopted in March 2020, remains reasonable, if the Investment Committee and Board are comfortable with the updated standard deviation.

- We recommend that the Investment Committee and Board consider updating the Health Care Trust asset allocation to make it more in line with the general strategy of the Retirement System asset allocation.

- We also look forward to discussing this analysis with the members of the Investment Committee.

Health Care Trust Asset Allocation Analysis

Asset Allocation Policy Comparison[1]

	Fed 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 invetsment 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

Total Plan Allocation vs. InvMetrics Health & Welfare Net
As of December 31, 2020
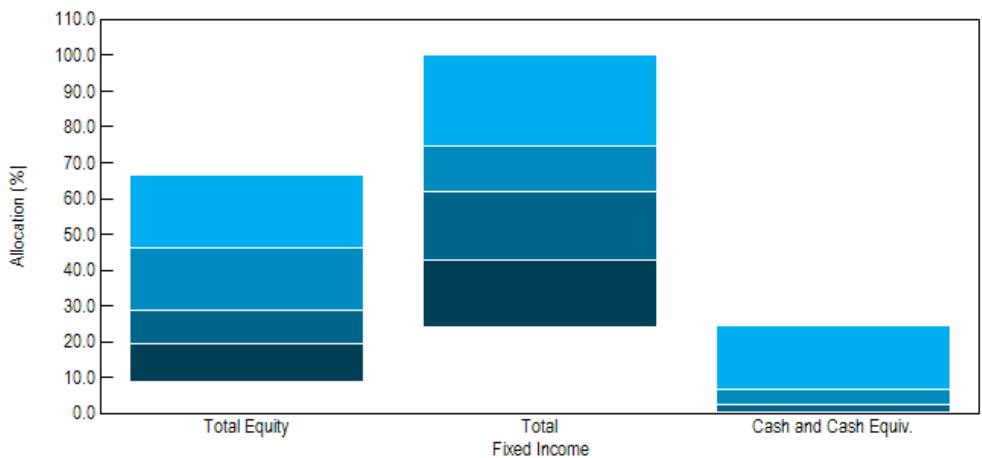
Allocation (Rank)			
5th Percentile	66.5	100.0	24.5
25th Percentile	46.0	74.6	6.8
Median	28.6	62.0	2.5
75th Percentile	19.6	42.7	0.5
95th Percentile	9.0	24.1	0.0
# of Portfolios	183	232	157

MVO-Based Risk Analysis

Scenario	Fed 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	Fed 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.

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[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	Fed 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.

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[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	Fed 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.

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[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]

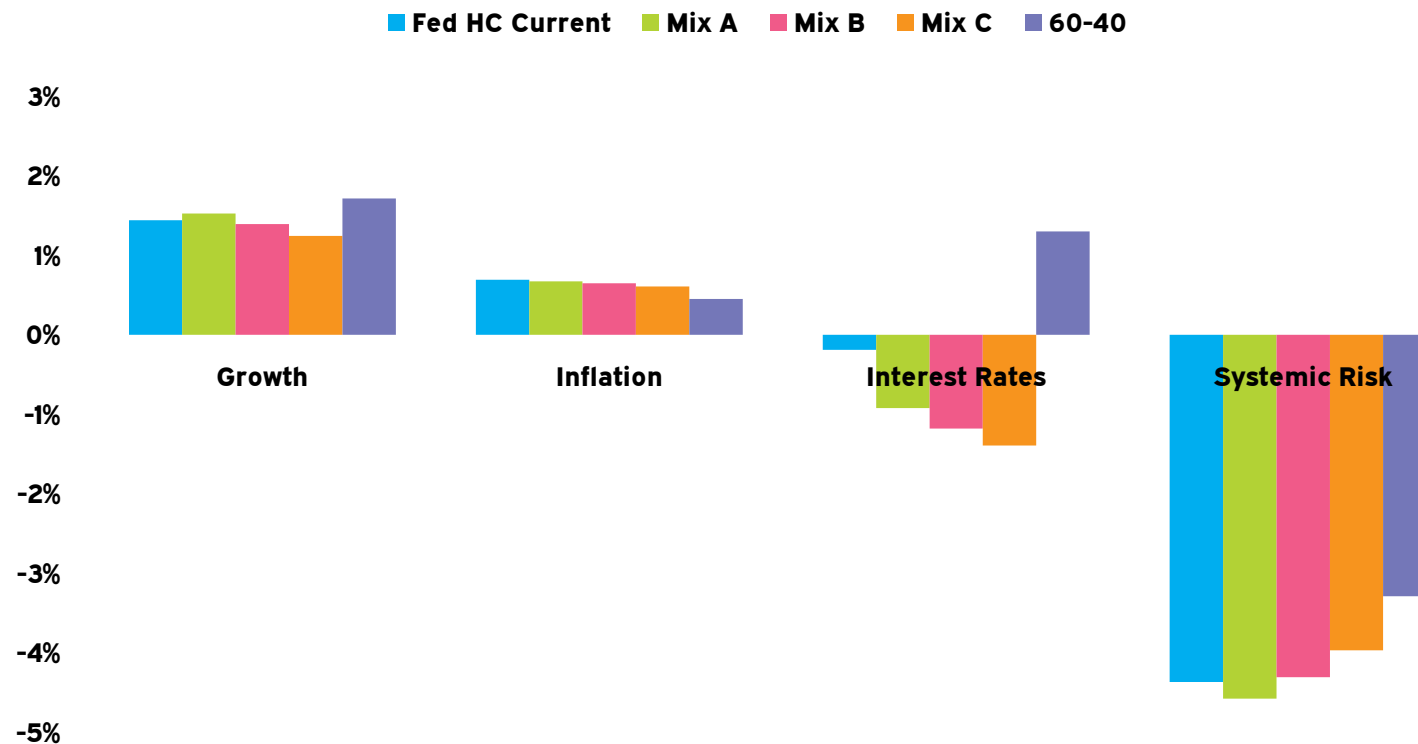| Scenario	Fed HC Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	60-40 (%)
10-year Treasury Bond rates drop 100 bps	2.9	4.3	4.7	5.0	2.9
10-year Treasury Bond rates drop 200 bps	12.1	15.3	15.4	15.2	12.7
Baa Spreads narrow by 30bps, High Yield by 100 bps	6.8	7.4	7.0	6.6	6.4
Baa Spreads narrow by 100bps, High 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.

Appendix

Overview of Annual Asset Study Methodology

- In order to construct an optimal portfolio from a risk-return standpoint, conventional financial wisdom dictates that one develop return, volatility, and correlation expectations over the relevant investing horizon.

- Given the uncertainty surrounding financial and economic forecasts, expectations development is challenging, and any of several methodological approaches may meaningfully contribute to this complex task.

- Meketa Investment Group's process relies on both quantitative and qualitative methodologies.

- First, we employ a large set of quantitative models to arrive at a set of baseline expected ten-year annualized returns for major asset classes.

- These models attempt to forecast a gross "beta" return for each *public market* asset class; that is, we specifically do not model "alpha," nor do we apply an estimate for management fees or other operational expenses.[1]

- Our models are fundamentally based (based on some theoretically defined return relationship with current observable factors).

- Some of these models are more predictive than others. For this reason, we next overlay a qualitative analysis, which takes the form of a data-driven deliberation among the research team and our Investment Policy Committee.

- Return assumptions for hard-to-predict asset classes as well as those with limited data will be influenced more heavily by our qualitative analysis.

- As a result of this process, we form our ten-year annualized return expectations, which serve as the primary foundation of our longer-term, twenty-year expectations.

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[1] Our expectations are net of fees where passive management is not available (e.g., private markets and hedge funds).

Overview of Annual Asset Study Methodology (continued)

- We form our twenty-year annualized return expectations by systematically considering historical returns on an asset class by asset class level. Specifically, we construct a weighted average of our ten-year expectations and average historical returns in each asset class.

- The weights are determined by a qualitative assessment of the value of the historical data. Generally, if we have little confidence that the historical average return is representative of what an investor can expect,[1] we will weight our ten-year forecast more heavily. Therefore, the weight on our ten-year forecasts ranges from 0.5 to 0.9.

- We develop our twenty-year volatility and correlation expectations differently. We rely primarily on historical averages, with an emphasis given to the experience of the trailing ten years.

- Qualitative adjustments, when applied, usually serve to increase the correlations and volatility over and above the historical estimates (e.g., using the higher correlations usually observed during a volatile market).

- We also make adjustments to the volatility based on the historical skewness of each asset class (e.g., increasing the volatility for an asset class that has been negatively skewed).

- In the case of private markets and other illiquid asset classes where historical volatility and correlations have been artificially dampened, we seek public market equivalents on which to base our estimates before applying any qualitative adjustments.

- These volatility and correlation expectations are then combined with our twenty-year return expectations to assist us in subsequent asset allocation work, including mean-variance optimization and scenario analyses.

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[1] For example, we have less confidence in historical data that do not capture many possible market scenarios or that are overly polluted by survivorship bias.

Overview of Annual Asset Study Methodology (continued)

- Each year, we review and set our capital market expectations via our Asset Study.

- This involves setting long-term expectations for a variety of asset classes for:

  – Returns.

  – Standard Deviation.

  – Correlations.

- Our process relies on both quantitative and qualitative methodologies.

Asset Class Definitions

- We identify asset classes and strategies that are appropriate for long-term allocation of funds, and that also are investable.

- Several considerations influence this process:

    – Unique return behavior,

    – Observable historical track record,

    – A robust market,

    – And client requests.

- We then make forecasts for each asset class.

    – We created inputs for 81 "asset classes" in 2020.

Our Process

- The first step is to build our 10-year forecasts.

  – Our fundamental models are primarily valuation based.

- Each model falls in one of eight groups, based on the most important factors that drive their returns:

Asset Class Category	Major Factors
Equities	Dividend Yield, GDP Growth, Valuation
Bonds	Yield to Worst, Default Rate, Recovery Rate
Commodities	Collateral Yield, Roll Yield, Inflation
Infrastructure	Public IS Valuation, Income, Growth
Natural Resources	Price per Acre, Income, Public Market Valuation
Real Estate	Cap Rate, Yield, Growth
Private Equity	EBITDA Multiple, Debt Multiple, Public VC Valuation
Hedge Funds and Other	Leverage, Alternative Betas

  – The common components are income, growth, and valuation.

Some factors are naturally more predictive than others.

Investment Grade Bonds
Yield to Worst vs. Forward 10-Year Returns
R² = 0.8552

Cash (90-day T-Bill)
Yield vs. Forward 10-Year Returns
R² = 0.6579

Core Real Estate
Cap Rates vs. Forward 10-Year Returns
R² = 0.1819

US Equities
Shiller CAPE vs. Forward 10-Year Returns
R² = 0.5406
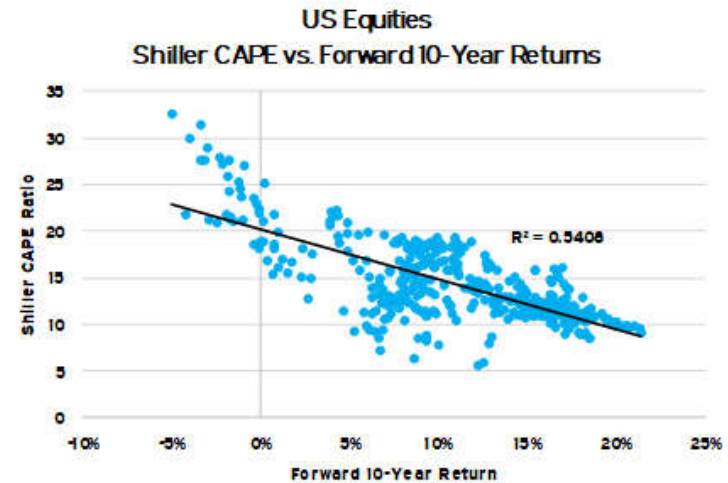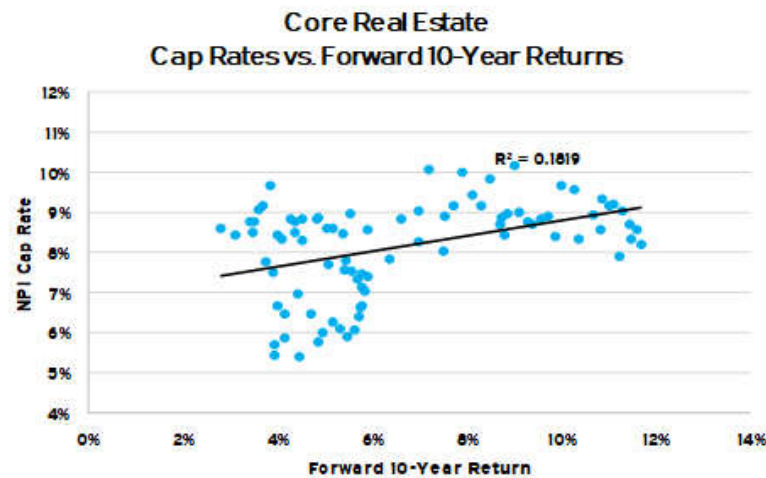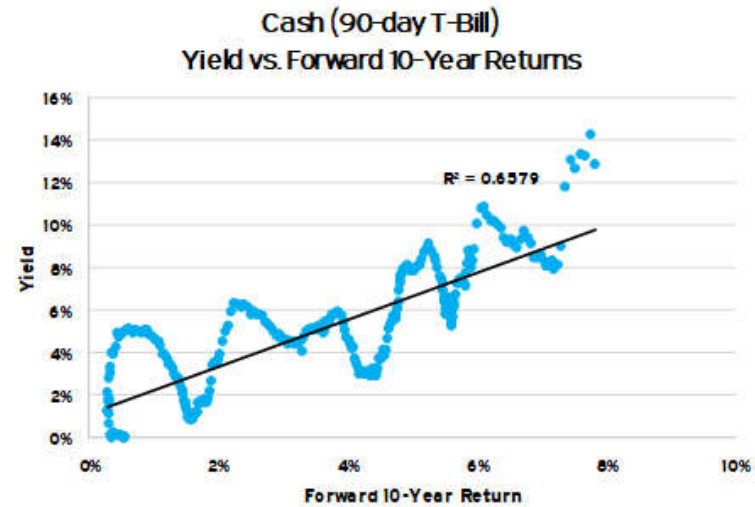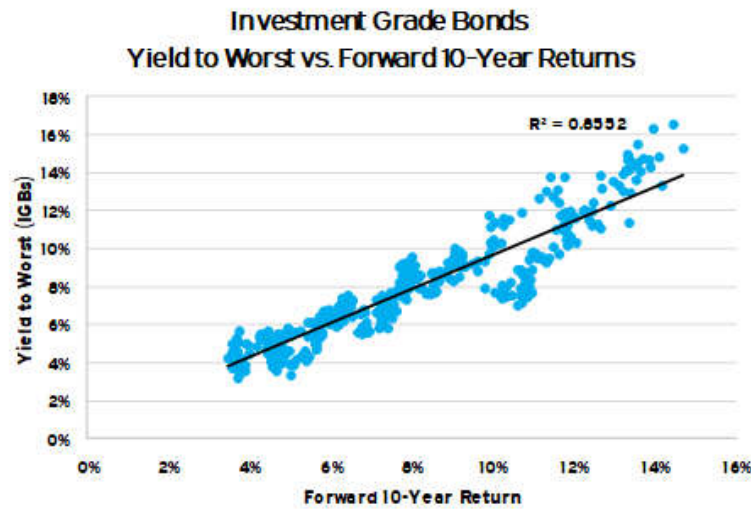
The next step is to move from ten-year to our twenty-year forecasts.

- We do this by combining our ten-year forecasts with the historical returns for each asset class.

    - How much we apply to each depends on our confidence in them (both the model and the data).

- The ten-year model weighting varies between 50% and 100%.

- It only hits 100% when there is a lack of reliable historical data.

- We then infer a forecast of ten-year returns in ten years (i.e., years 11-20).

    - This allows us to test our assumptions with finance theory.

    - Essentially, we assume mean-reversion over the first ten years, then consistency with CAPM thereafter.

The final step is to make any qualitative adjustments.

- The Investment Committee reviews the output and may make adjustments due to:

  – Quality of the underlying data.

  – Confidence in the model.

  – External inputs (e.g., perceived risks).

Capital Market Assumption Development Example

Equities

- We use a fundamental model for equities that combines income and capital appreciation.

$$E(R) = Dividend\ Yield + Expected\ Earnings\ Growth + Multiple\ Effect + Currency\ Effect$$

- Meketa Investment Group evaluates historical data statistically to develop expectations for dividend yield, earnings growth, the multiple effect, and currency effect.

- Our models assume that there is a reversion to the mean over long time periods.

Bonds

- The short version for investment grade bond models is:

$$E(R) = Current\ YTW\ (yield\ to\ worst)$$

- Our models assume that there is a reversion to the mean for spreads (though not yields).

- For TIPS, we add the real yield of the TIPS index to the breakeven inflation rate.

- As with equities, we make currency adjustments when necessary for foreign bonds.

- For bonds with credit risk, Meketa Investment Group estimates default rates and loss rates, in order to project an expected return:

$$E(R) = YTW - (Annual\ Default\ Rate * Loss\ Rate)$$

The other inputs: standard deviation and correlation.

- Standard Deviation:

  - We review the trailing ten-year standard deviation, as well as the trailing ten-year skewness.

  - Historical standard deviation serves as the base for our assumptions.

  - We increase or decrease the assumptions based on the size and sign of the historical skewness.

Asset Class	Standard Deviation	Skewness	Assumption
Bank Loans	6.6%	-2.3	9.0%

  - We consider performance during the GFC to see if further changes are warranted (e.g., hedge funds).

  - We also adjust for private market asset classes with "smoothed" return streams.

- Correlation:

  - We use trailing ten-year correlations as our guide.

  - Again, we make adjustments for performance during the GFC and "smoothed" return streams.

- Most of our adjustments are conservative in nature (i.e., they increase the standard deviation and correlation).

Horizon Study

- Annually, Horizon Actuarial Services, LLC publishes a survey of capital market assumptions that they collect from various investment advisors.

  - In the 2019[1] survey there were 34 respondents.

- The Horizon survey is a useful tool for Board members to determine whether their consultant's expectations for returns (and risk) are reasonable.

Asset Class	10-Year Average (%)	20-Year Average (%)	MIG 20-Year (%)
US Equity (large cap)	6.0	7.1	8.1
Non-US – Developed	6.8	7.7	8.5
Non-US – Emerging	7.8	8.7	10.4
US Corporate Bonds – Core	3.6	4.3	4.6
US Corporate Bonds – High Yield	5.1	5.8	6.5
Non-US Debt – Developed	2.6	3.4	2.3
Non-US Debt – Emerging	5.6	6.1	5.3
US Treasuries (cash)	2.7	3.0	2.9
TIPS	3.1	3.5	3.6
Real Estate	5.8	6.8	7.0
Hedge Funds	5.3	6.2	5.4
Commodities	3.9	4.7	5.0
Infrastructure	6.8	7.2	6.5
Private Equity	9.0	10.1	10.1
Private Debt	7.4	7.8	7.3
Inflation	2.2	2.3	2.6

[1] The 10-year horizon includes all 34 respondents and the 20-year horizon includes 16 respondents.

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

Asset Class Detailed Breakdown and Comparison to 2020 Expectations

	Fed Current (%)	Global 60/40 (%)
Growth	75	60
US Equity	25	0
Dev. Market Equity (non-US)	12	0
Emerging Market Equity	12	0
Global Equity	0	60
Buyouts	8	0
Venture Capital	4	0
Private Real Estate	3	0
Natural Resources (Private)	2	0
Infrastructure (Core Private)	1	0
Private Debt	3	0
Emerging Market Bonds	3	0
High Yield Bonds	2	0
Low Beta	8	0
Cash Equivalents	5	0
Hedge Funds	3	0
Other	17	40
Investment Grade Bonds	8	40
TIPS	2	0
Core Private Real Estate	5	0
Long-Term Government Bonds	2	0
2020 Meketa Expected Return (20 years)	*7.8*	*6.3*
2021 Meketa Expected Return (20 years)	*7.1*	*5.4*
2020 Meketa Standard Deviation	*13.6*	*10.4*
2021 Meketa Standard Deviation	*14.1*	*11.0*

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.

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

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