



PERSPECTIVES THAT DRIVE ENTERPRISE SUCCESS



MARCH 18, 2021

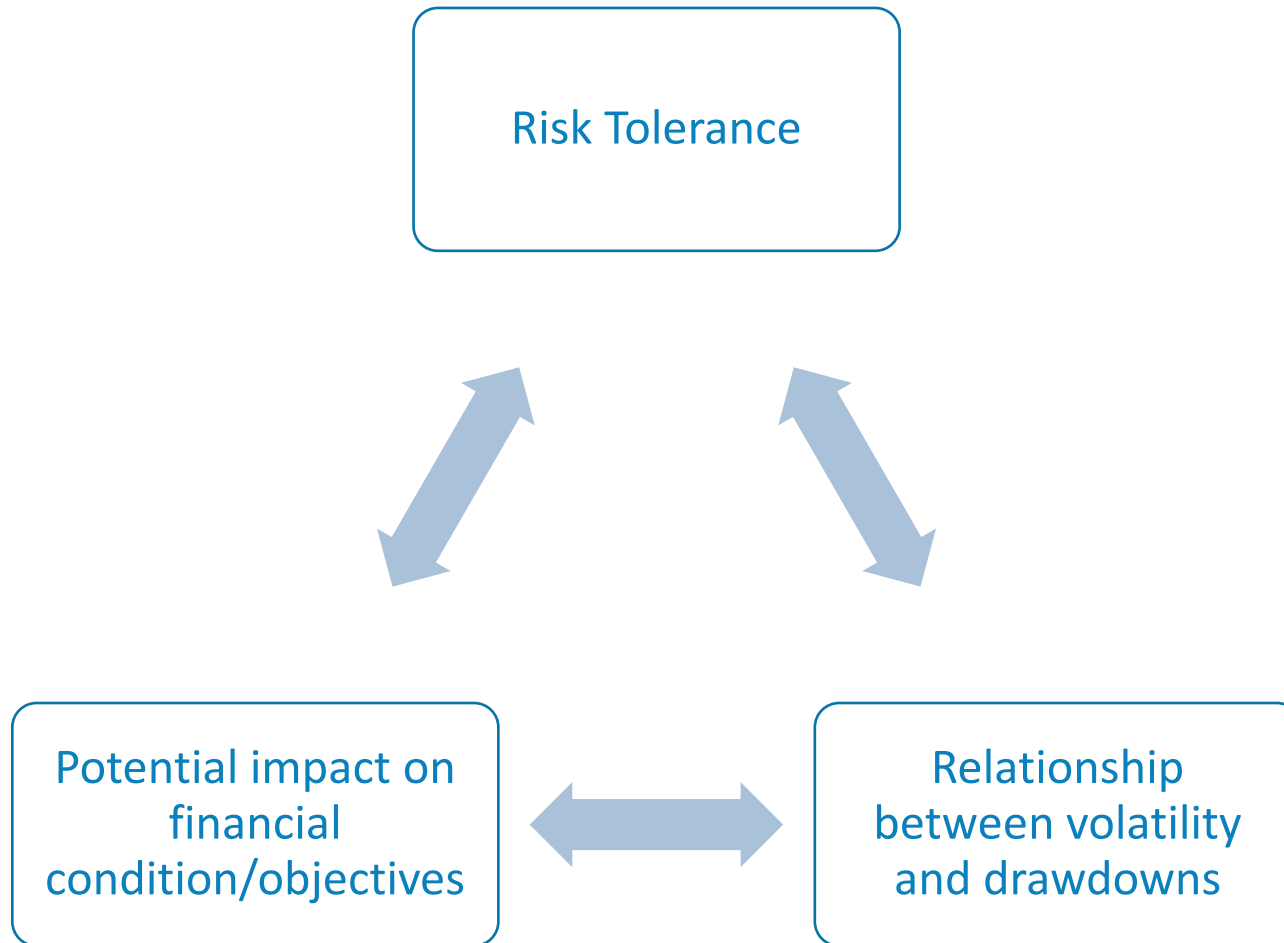
Risk Allocation Study

City of San Jose Federated Employees' Retirement System

Summary

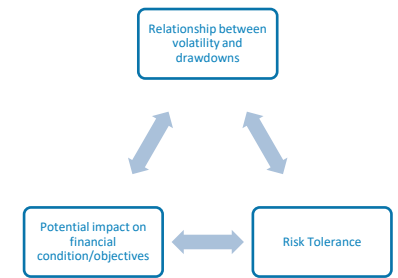
- Risk limits were established by the board by analyzing the relationship between:
 - Risk tolerance
 - Volatility and drawdowns
 - Potential impact on financial conditions and plan objectives
- Versus current strategic asset allocation, the set of asset allocation mixes being considered today:
 - Fall within the limit for Board risk as defined in IPS except for portfolio with higher growth allocation
 - Increases in volatility come from taking more equity risk as demonstrated by equity beta
 - Duration risk is not a significant risk among mixes considered as it is relatively short across all mixes
 - None of the mixes provide very different outcomes in stress scenarios or shocks

Risk limit framework



The board has used the following framework to determine the appropriate level of portfolio volatility

Volatility, drawdowns and risk tolerance

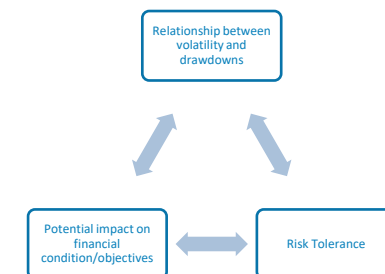


		Risk Tolerance				
		Aggressive		Conservative		
Risk Tolerance	Portfolio Volatility	95% VaR	95% CVaR	99% VaR	99% CVaR	Average 3 worst scenarios
	8% Risk	-14%	-17%	-18%	-20%	-19%
	9% Risk	-15%	-18%	-19%	-22%	-21%
	10% Risk	-16%	-19%	-21%	-24%	-23%
	11% Risk	-18%	-22%	-24%	-27%	-28%
	12% Risk	-20%	-25%	-27%	-31%	-32%
	13% Risk	-22%	-28%	-30%	-34%	-36%
	14% Risk	-24%	-29%	-31%	-36%	-39%
	15% Risk	-25%	-31%	-33%	-38%	-40%

The board's risk tolerance determines the appropriate level of risk and how expected drawdowns will be estimated

Actuarial projections

Potential impact on financial condition/objectives



Based on discussions with Verus and Cheiron the board determined there were three actuarial metrics to include in the formulation of their risk limits: Funded Ratio, City Contributions, and Interest cost. Applying drawdowns in 5% increments ranging from 20% to 40%, we can determine the impact on the three metrics.

		Funded Ratio	City Contributions	Funded Ratio change	City Contributions change
Single Year	Baseline	52%	\$ 254	0%	\$ -
	-20%	45%	\$ 312	-7%	\$ 58
	-25%	43%	\$ 323	-10%	\$ 68
	-30%	40%	\$ 333	-12%	\$ 79
	-35%	37%	\$ 344	-15%	\$ 90
	-40%	35%	\$ 355	-17%	\$ 101

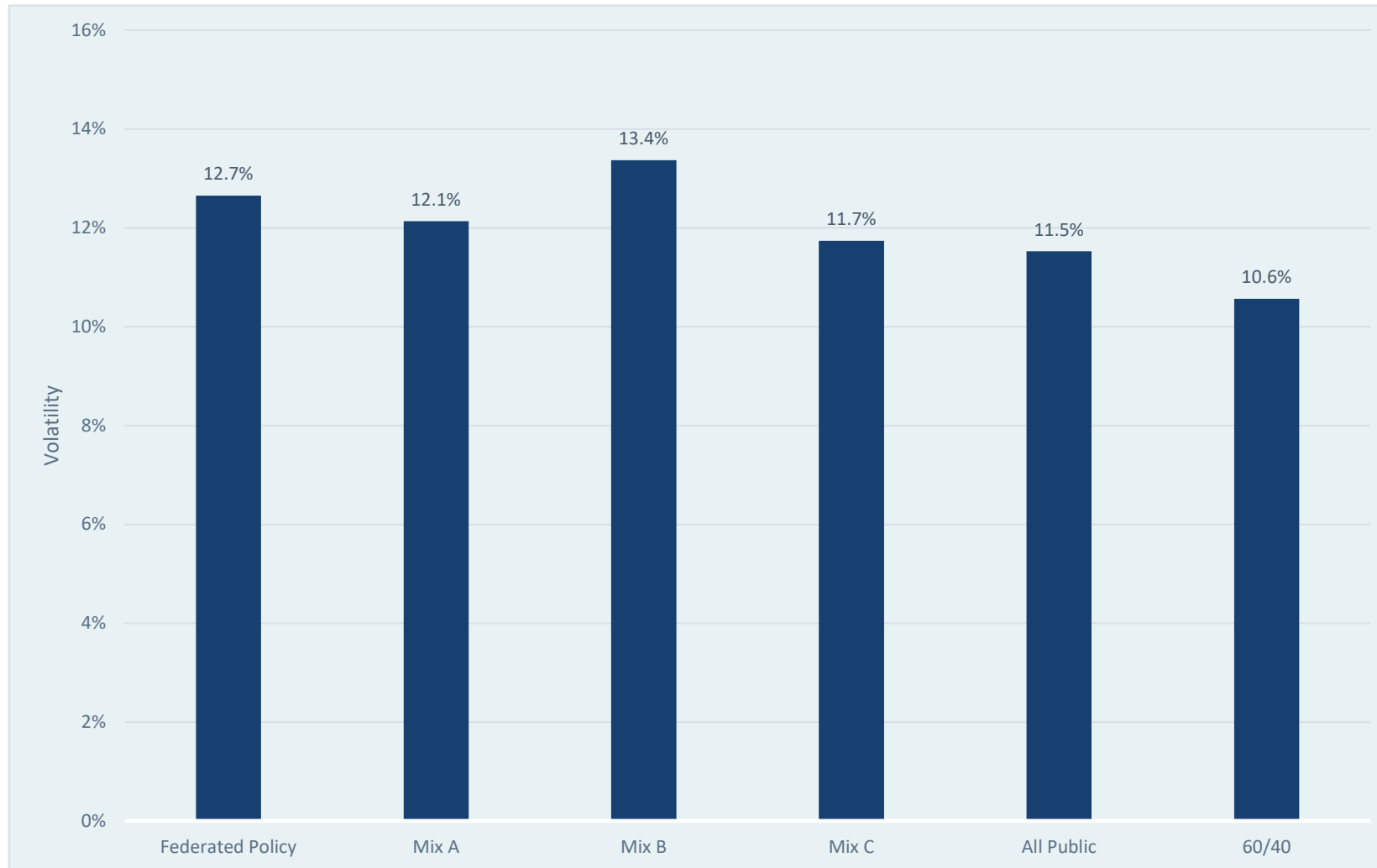
The Single Year table identifies the maximum or minimum for each category.

		Funded Ratio (end of period)	City Contributions	Funded Ratio change	City Contributions change
10-year (cumulative)	Baseline	68%	\$ 2,272	0%	\$ -
	-20%	56%	\$ 2,597	-12%	\$ 324
	-25%	54%	\$ 2,658	-14%	\$ 385
	-30%	51%	\$ 2,718	-16%	\$ 446
	-35%	49%	\$ 2,779	-19%	\$ 507
	-40%	47%	\$ 2,840	-21%	\$ 568

The 10-year Cumulative table identifies the end of period financial situation and total dollar amount for each category

Source: Actuarial metrics provided by Cheiron. Dollar amounts in millions

Board risk operating zone limit

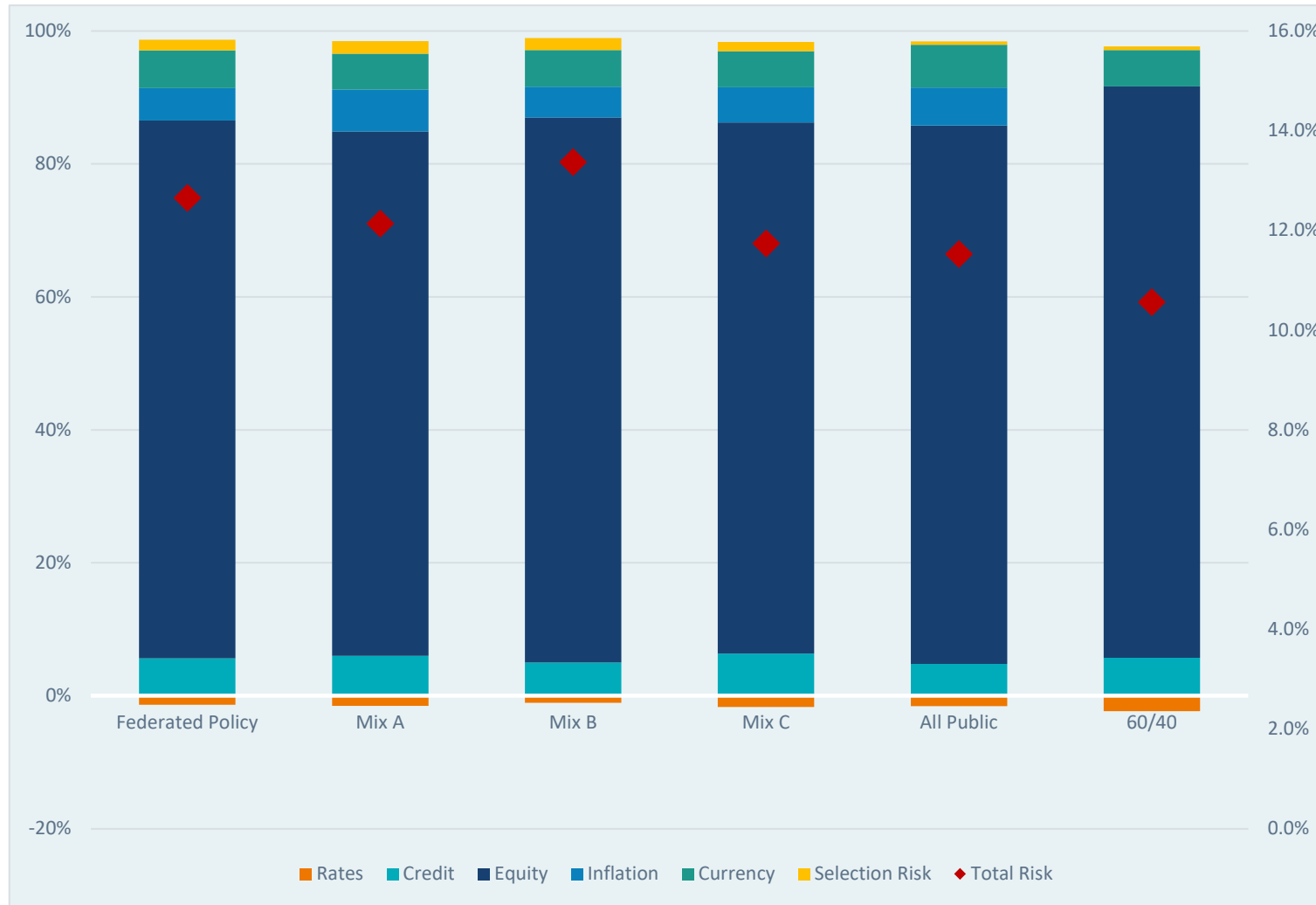


From IPS, Board risk operating zone limit is when portfolio forecast risk is >12%.

The current policy falls modestly outside of this limit as current volatility is elevated versus one year ago when the policy was adopted.

Data from MSCI BarraOne, 303XL model. All Public is based upon InvestorMetrics Public Funds >\$1B fund universe.

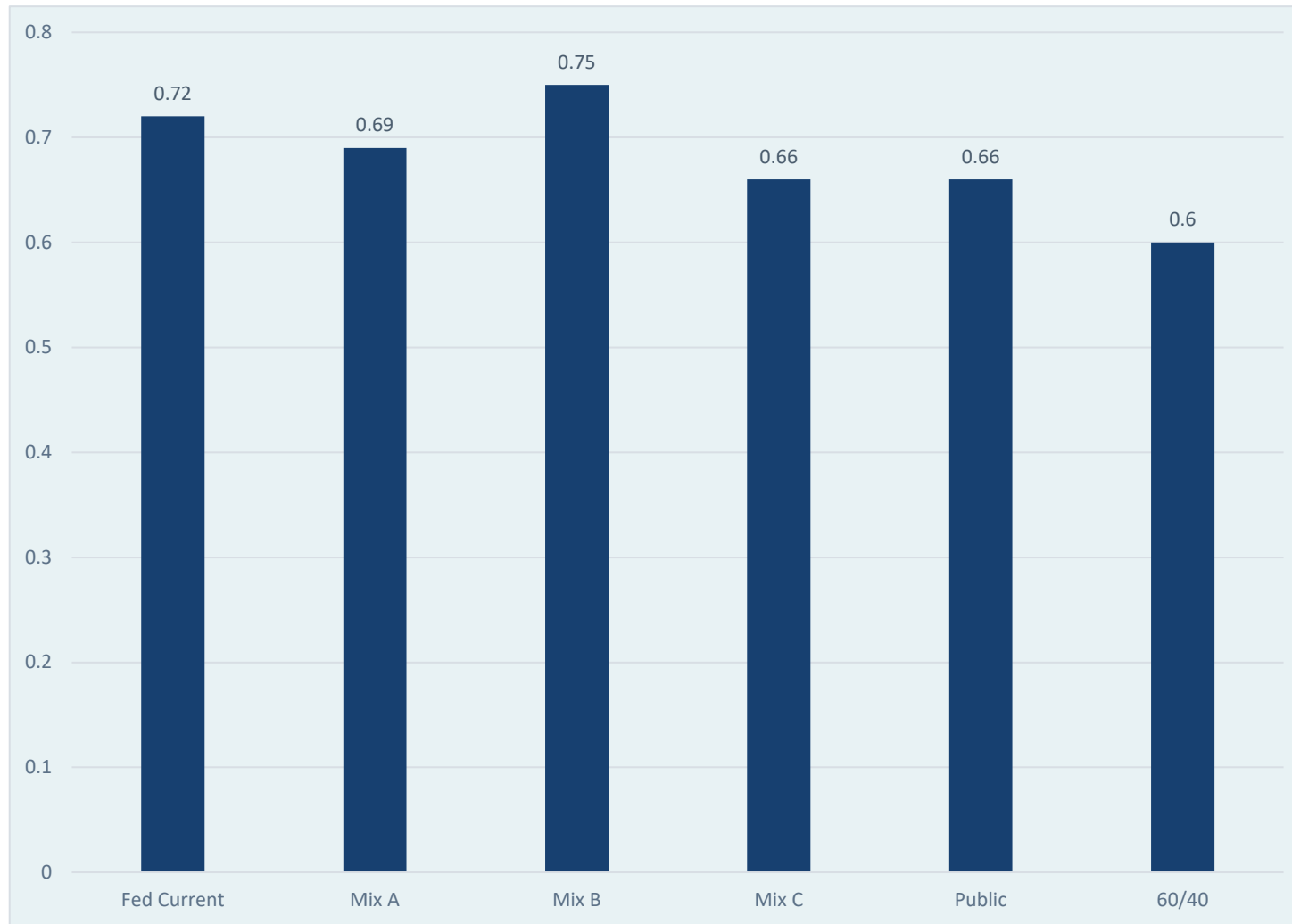
Risk decomposition



Equity factor risk remains the largest contributor to volatility across all the mixes considered. We see marginal differences in credit, inflation, and currency factors.

Data from MSCI BarraOne, 303XL model.

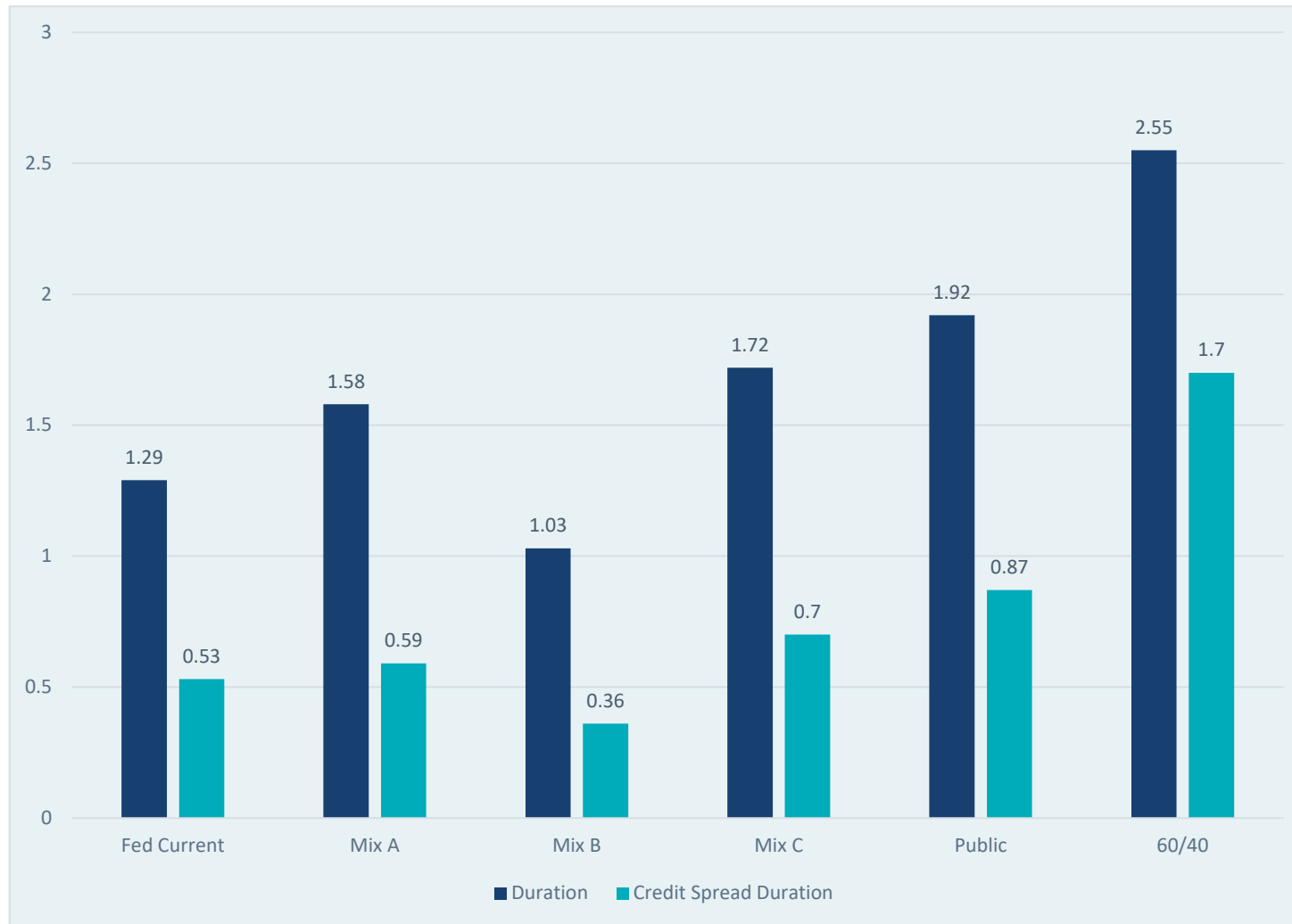
Equity Beta



The highest risk mix has slightly higher equity beta than the current Federated policy. The lower risk mixes would slightly reduce equity beta.

Equity beta is measured relative to the MSCI ACWI IMI index.

Duration

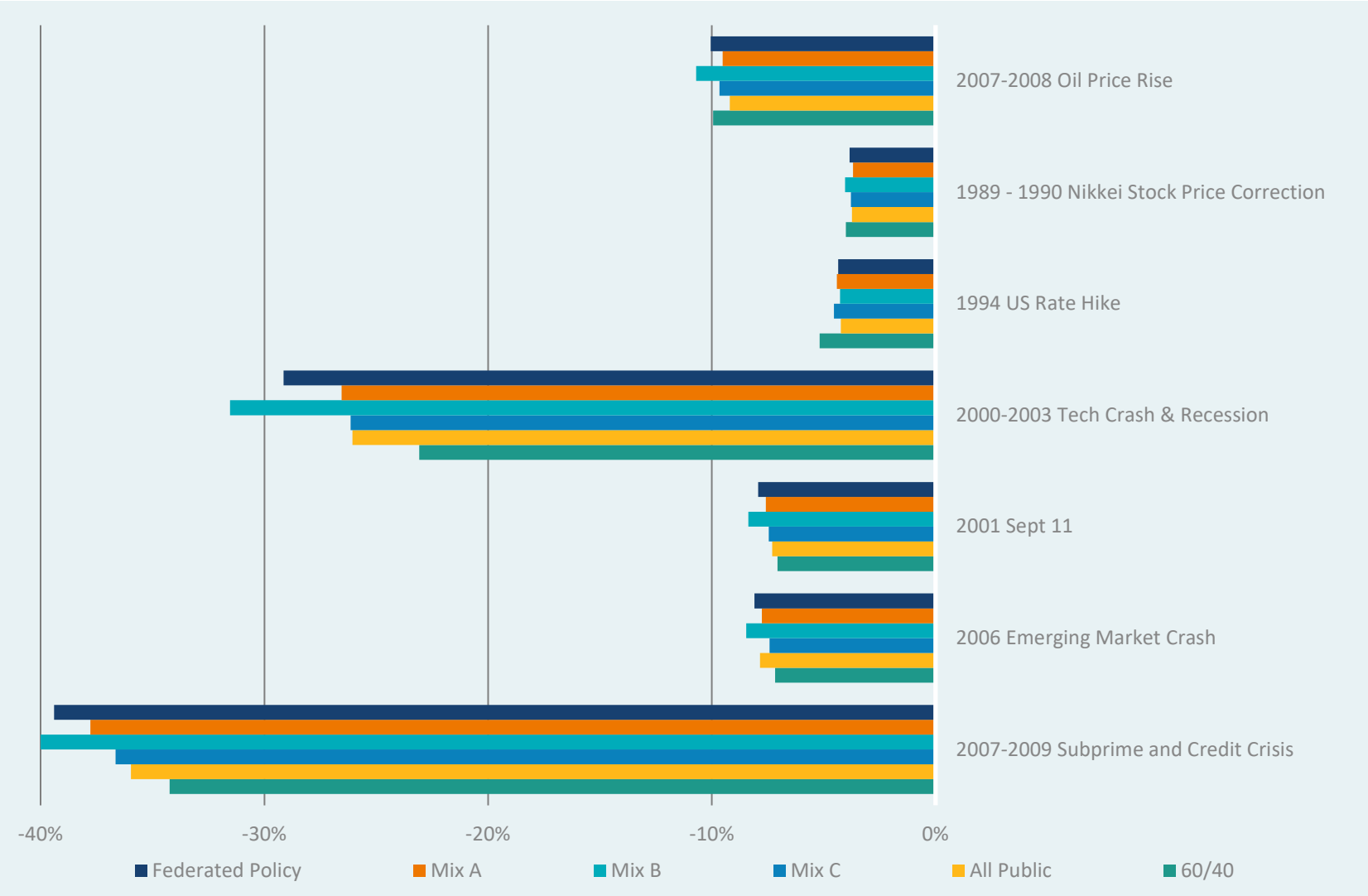


The 60/40 portfolio has the highest effective and credit spread duration among the mixes.

Mix B is expected to reduce portfolio duration by 0.25 years.

Source: MSCI BarraOne

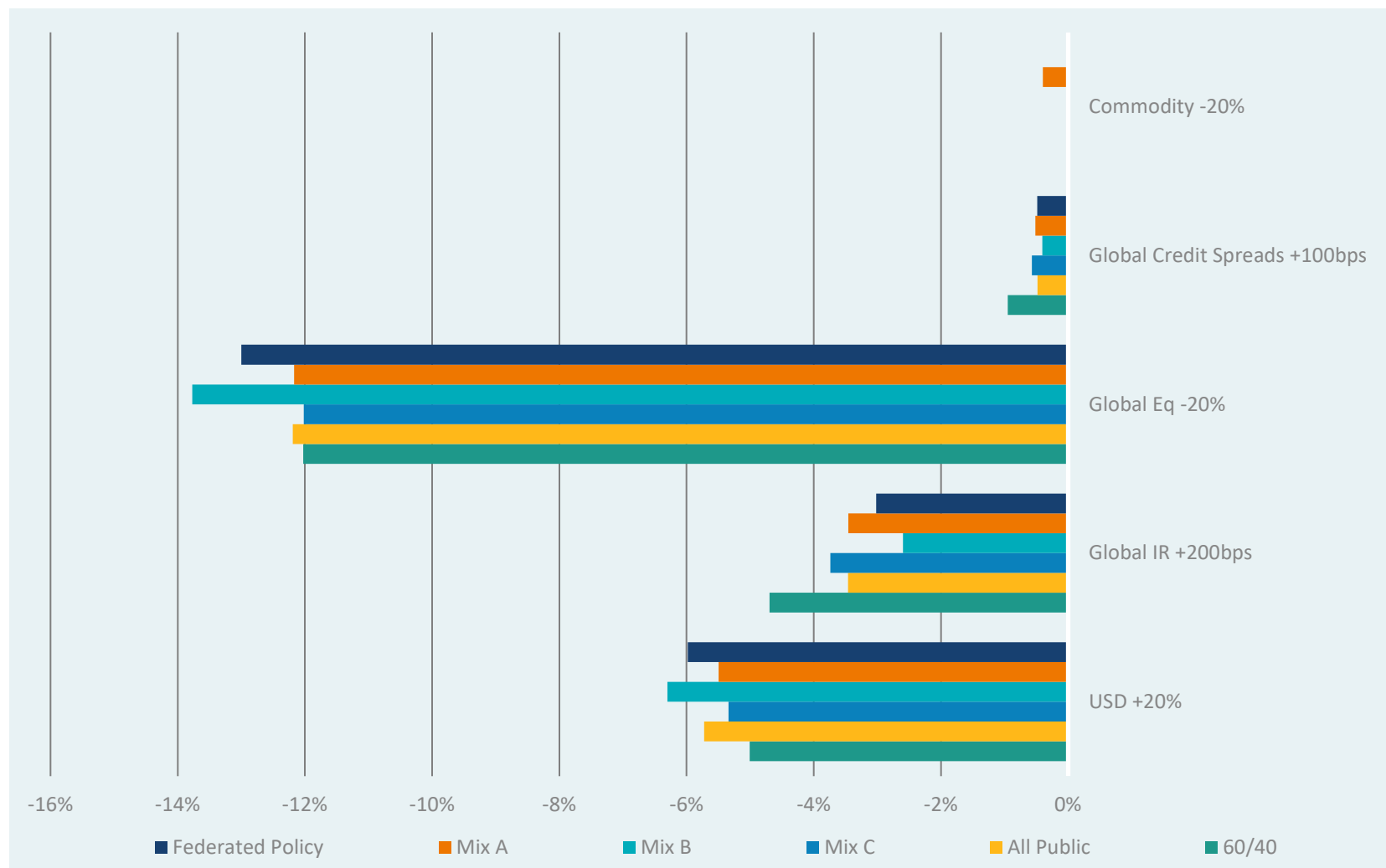
Scenario analysis



We see the largest differences in tail risk in the tech crash and subprime crisis.

Data from MSCI BarraOne.

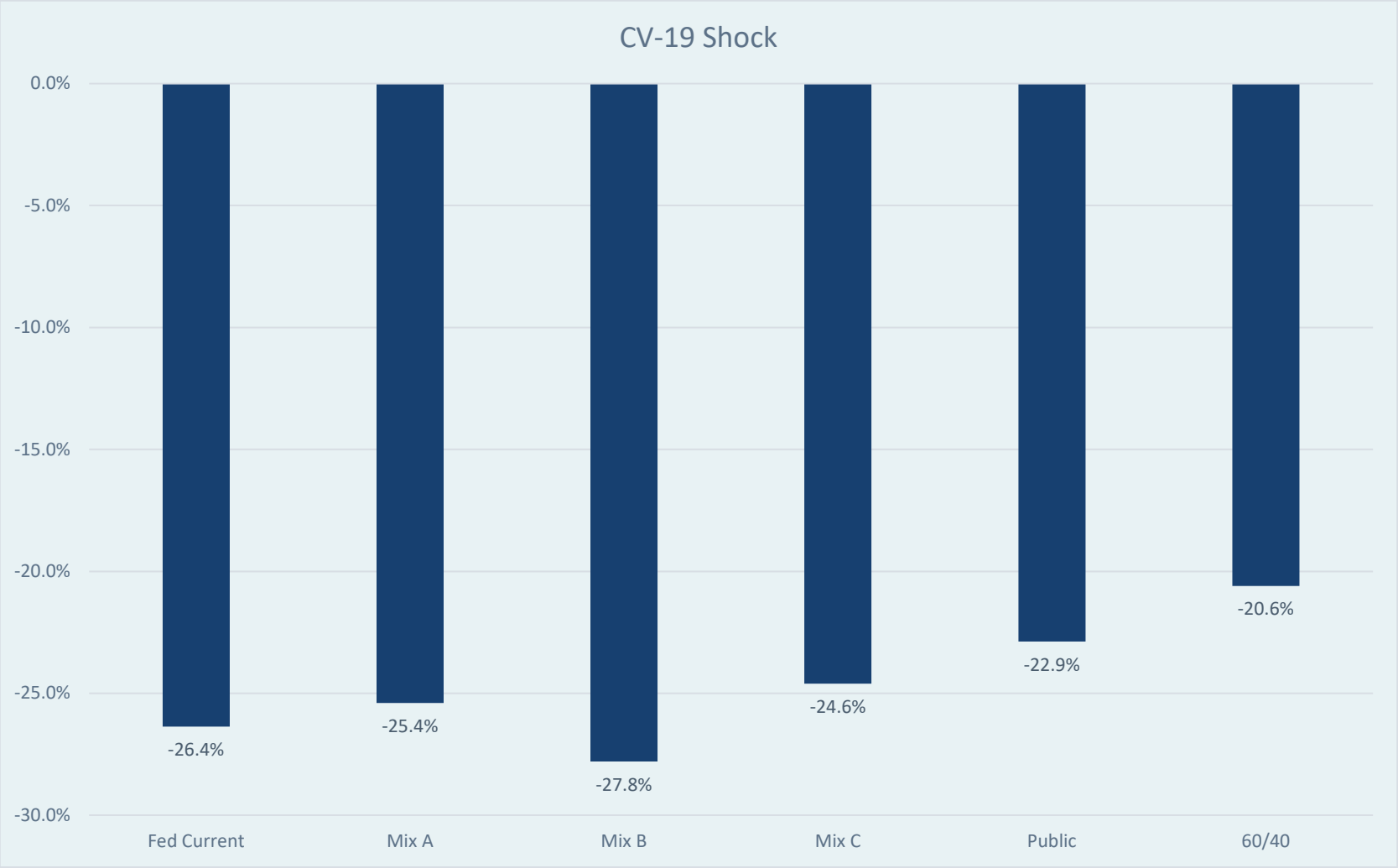
Stress tests



Of the stress tests considered, global equities falling 20% is the most severe, followed by the U.S. Dollar appreciating 20%.

Data from MSCI BarraOne.

COVID 19 Shock



If we experienced the COVID shock today, Mix B is expected to lose 1.4% more than the current Federated Policy.

COVID 19 shock represents the peak to trough return from 2/19/2020 to 3/23/2020.

Appendix – Asset mixes

							Verus 2021 CMA's (10 Yr)			
	Fed Current	Mix A	Mix B	Mix C	Public	60/40	Return (g)	Return (a)	Standard Deviation	Sharpe Ratio (a)
Growth	75	71	79	70	66	60				
US Equity	25.0	23.0	26.0	25.0	30.0	0.0	5.1	6.5	16.6	0.37
Dev. Market Equity (non-US)	12.0	11.0	13.0	12.0	15.0	0.0	5.2	6.7	17.9	0.36
Emerging Market Equity	12.0	10.0	12.0	9.0	12.0	0.0	5.4	8.3	25.5	0.32
Global Equity	0.0	0.0	0.0	0.0	0.0	60.0	5.2	6.6	17.3	0.37
Private Equity	12.0	13.0	14.0	10.0	0.0	0.0	9.3	12.1	28.1	0.46
Private Debt	3.0	3.0	3.0	3.0	0.0	0.0	4.6	5.2	11.2	0.45
Private Real Estate	3.0	3.0	3.0	3.0	0.0	0.0	8.5	10.0	18.6	0.53
Private Real Assets	3.0	3.0	3.0	3.0	0.0	0.0	7.8	9.4	18.8	0.49
Public Real Assets	0.0	0.0	0.0	0.0	3.0	0.0	7.8	9.4	18.8	0.49
Emerging Market Bonds	3.0	3.0	3.0	3.0	3.0	0.0	4.8	5.5	12.5	0.42
High Yield Bonds	2.0	2.0	2.0	2.0	3.0	0.0	3.4	4.0	11.3	0.34
Low Beta	8	8	8	8	5	0				
Absolute Return	3.0	3.0	3.0	3.0	0.0	0.0	3.8	4.1	7.8	0.49
Cash Equivalents (Immunized CFs)	5.0	5.0	5.0	5.0	5.0	0.0	0.2	0.2	1.2	-
Other	17	21	13	22	29	40				
Core Real Estate	5.0	5.0	5.0	5.0	8.0	0.0	5.8	6.5	12.6	0.50
Commodities	0.0	2.0	0.0	0.0	0.0	0.0	2.2	3.4	15.9	0.20
US TIPS	2.0	2.0	2.0	2.0	4.0	0.0	1.1	1.2	5.3	0.18
Investment Grade Bonds	8.0	9.0	4.0	12.0	15.0	40.0	1.1	1.3	6.1	0.17
Long-Term Gov't Bonds	2.0	3.0	2.0	3.0	2.0	0.0	0.7	0.9	6.7	0.10
Total Allocation	100	100	100	100	100	100				

	Fed Current	Mix A	Mix B	Mix C	Public	60/40
Mean Variance Analysis						
Forecast 10 Year Return	5.7	5.6	5.9	5.4	4.7	4.1
Standard Deviation	12.9	12.4	13.6	11.9	11.6	10.4
Return/Std. Deviation	0.4	0.5	0.4	0.5	0.4	0.4
1st percentile ret. 1 year	-20.2	-19.4	-21.2	-18.7	-18.8	-17.5
Sharpe Ratio	0.47	0.48	0.47	0.48	0.43	0.41

Verus/MPI

Appendix - Downside measures

We have discussed three methods of determining downside risk (or tail risk) for the investment portfolio.

Value at risk (VaR): VaR calculates the maximum loss expected over a 1-year period given a specified degree of confidence

Conditional Value at Risk (CVaR): CVaR measures the expected loss if VaR is exceeded. It takes the average of the tail observations

Average of three worst historical scenarios: We simulate the portfolio through historic scenarios to determine the three worst periods and take the average of those scenarios.

Risk Metric	Description
95% VaR	(95% Confidence) We don't expect the worst annual loss to exceed
99% VaR	(99% Confidence) we don't expect the worst annual loss to exceed
95% CVaR	(95% Confidence) If VaR is exceeded, the average expected loss
99% CVaR	(99% Confidence) If VaR is exceeded, the average expected loss
Avg. Scenario Drawdown	The average of the three worst historic scenarios measured in BarraOne

There are three methods to calculate VaR: Historic, Parametric, and Monte Carlo. VaR calculations are conducted in BarraOne using Monte Carlo VaR.

Actuarial Data

San Jose Federated - Baseline Projections

	Actuarial	Assets		Funded Ratio		Investment		Contribution Amounts		Contribution Rates		NC +	Interest	
June 30th	Liability	Market	Actuarial	Market	Actuarial	FYE	Return	Member	City	Member	City	Admin	Cost	ICaR
2020	4,401.1	2,208.0	2,301.5	50.2%	52.3%	2021	6.625%	25.2	190.9	7.7%	59.2%	20.7%	41.2%	11.3%
2021	4,517.4	2,329.3	2,395.9	51.6%	53.0%	2022	6.625%	27.9	206.0	7.9%	58.6%	20.3%	39.9%	11.6%
2022	4,636.2	2,470.9	2,507.8	53.3%	54.1%	2023	6.625%	28.9	212.8	8.0%	58.7%	19.8%	38.3%	11.9%
2023	4,753.0	2,619.9	2,631.6	55.1%	55.4%	2024	6.625%	30.0	219.8	8.0%	58.9%	19.4%	36.7%	12.3%
2024	4,867.8	2,776.5	2,776.5	57.0%	57.0%	2025	6.625%	31.1	226.6	8.1%	58.9%	19.1%	34.9%	12.6%
2025	4,980.3	2,940.9	2,940.9	59.0%	59.0%	2026	6.625%	32.2	232.5	8.1%	58.7%	18.7%	33.0%	13.0%
2026	5,090.6	3,112.7	3,112.7	61.1%	61.1%	2027	6.625%	33.3	237.8	8.2%	58.3%	18.5%	31.1%	13.3%
2027	5,198.1	3,291.2	3,291.2	63.3%	63.3%	2028	6.625%	34.4	243.2	8.2%	57.9%	18.2%	29.1%	13.7%
2028	5,303.2	3,477.5	3,477.5	65.6%	65.6%	2029	6.625%	34.9	248.3	8.1%	57.4%	18.0%	27.1%	14.0%
2029	5,405.1	3,670.4	3,670.4	67.9%	67.9%	2030	6.625%	36.2	254.2	8.1%	57.0%	17.8%	25.0%	14.4%

San Jose Federated - Minus 20% Projections

	Actuarial	Assets		Funded Ratio		Investment		Contribution Amounts		Contribution Rates		NC +	Interest	
June 30th	Liability	Market	Actuarial	Market	Actuarial	FYE	Return	Member	City	Member	City	Admin	Cost	ICaR
2020	4,401.1	2,208.0	2,301.5	50.2%	52.3%	2021	-20.000%	25.2	190.9	7.7%	59.2%	20.7%	41.2%	11.3%
2021	4,517.4	1,744.8	2,279.0	38.6%	50.5%	2022	6.625%	27.9	206.0	7.9%	58.6%	20.3%	50.6%	8.7%
2022	4,636.2	1,847.7	2,235.3	39.9%	48.2%	2023	6.625%	29.3	221.6	8.1%	61.2%	19.8%	49.4%	8.9%
2023	4,753.0	1,964.9	2,210.4	41.3%	46.5%	2024	6.625%	30.8	240.1	8.3%	64.3%	19.4%	47.9%	9.2%
2024	4,867.8	2,100.0	2,216.9	43.1%	45.5%	2025	6.625%	32.4	258.1	8.4%	67.1%	19.1%	46.2%	9.5%
2025	4,980.3	2,253.5	2,253.5	45.2%	45.2%	2026	6.625%	34.0	275.0	8.6%	69.5%	18.7%	44.2%	9.9%
2026	5,090.6	2,425.5	2,425.5	47.6%	47.6%	2027	6.625%	35.5	290.8	8.7%	71.3%	18.5%	41.9%	10.4%
2027	5,198.1	2,615.6	2,615.6	50.3%	50.3%	2028	6.625%	36.7	297.8	8.7%	70.9%	18.2%	39.4%	10.9%
2028	5,303.2	2,815.9	2,815.9	53.1%	53.1%	2029	6.625%	37.3	304.4	8.6%	70.3%	18.0%	36.9%	11.4%
2029	5,405.1	3,025.4	3,025.4	56.0%	56.0%	2030	6.625%	38.6	311.8	8.7%	70.0%	17.8%	34.3%	11.8%

Actuarial Data

San Jose Federated - Minus 25% Projections														
	Actuarial	Assets		Funded Ratio			Investment	Contribution Amounts		Contribution Rates		NC +	Interest	
June 30th	Liability	Market	Actuarial	Market	Actuarial	FYE	Return	Member	City	Member	City	Admin	Cost	ICaR
2020	4,401.1	2,208.0	2,301.5	50.2%	52.3%	2021	-25.000%	25.2	190.9	7.7%	59.2%	20.7%	41.2%	11.3%
2021	4,517.4	1,635.1	2,257.1	36.2%	50.0%	2022	6.625%	27.9	206.0	7.9%	58.6%	20.3%	52.6%	8.1%
2022	4,636.2	1,730.7	2,184.1	37.3%	47.1%	2023	6.625%	29.4	223.3	8.1%	61.6%	19.8%	51.4%	8.3%
2023	4,753.0	1,842.0	2,131.3	38.8%	44.8%	2024	6.625%	31.0	243.9	8.3%	65.4%	19.4%	50.0%	8.6%
2024	4,867.8	1,973.0	2,111.9	40.5%	43.4%	2025	6.625%	32.6	264.0	8.5%	68.7%	19.1%	48.3%	9.0%
2025	4,980.3	2,124.5	2,124.5	42.7%	42.7%	2026	6.625%	34.3	282.9	8.7%	71.5%	18.7%	46.3%	9.4%
2026	5,090.6	2,296.4	2,296.4	45.1%	45.1%	2027	6.625%	36.0	300.8	8.8%	73.8%	18.5%	44.0%	9.8%
2027	5,198.1	2,488.8	2,488.8	47.9%	47.9%	2028	6.625%	37.2	308.0	8.8%	73.3%	18.2%	41.4%	10.3%
2028	5,303.2	2,691.7	2,691.7	50.8%	50.8%	2029	6.625%	37.8	314.9	8.7%	72.8%	18.0%	38.7%	10.9%
2029	5,405.1	2,904.3	2,904.3	53.7%	53.7%	2030	6.625%	39.1	322.6	8.8%	72.4%	17.8%	36.0%	11.4%

San Jose Federated - Minus 30% Projections														
	Actuarial	Assets		Funded Ratio			Investment	Contribution Amounts		Contribution Rates		NC +	Interest	
June 30th	Liability	Market	Actuarial	Market	Actuarial	FYE	Return	Member	City	Member	City	Admin	Cost	ICaR
2020	4,401.1	2,208.0	2,301.5	50.2%	52.3%	2021	-30.000%	25.2	190.9	7.7%	59.2%	20.7%	41.2%	11.3%
2021	4,517.4	1,525.4	2,235.2	33.8%	49.5%	2022	6.625%	27.9	206.0	7.9%	58.6%	20.3%	54.6%	7.6%
2022	4,636.2	1,613.7	2,133.0	34.8%	46.0%	2023	6.625%	29.4	225.0	8.1%	62.1%	19.8%	53.5%	7.8%
2023	4,753.0	1,719.0	2,052.3	36.2%	43.2%	2024	6.625%	31.2	247.8	8.4%	66.4%	19.4%	52.2%	8.0%
2024	4,867.8	1,846.1	2,006.9	37.9%	41.2%	2025	6.625%	32.9	270.0	8.6%	70.2%	19.1%	50.4%	8.4%
2025	4,980.3	1,995.6	1,995.6	40.1%	40.1%	2026	6.625%	34.7	290.9	8.8%	73.5%	18.7%	48.4%	8.8%
2026	5,090.6	2,167.6	2,167.6	42.6%	42.6%	2027	6.625%	36.4	310.8	8.9%	76.2%	18.5%	46.0%	9.3%
2027	5,198.1	2,362.1	2,362.1	45.4%	45.4%	2028	6.625%	37.6	318.2	8.9%	75.8%	18.2%	43.3%	9.8%
2028	5,303.2	2,567.7	2,567.7	48.4%	48.4%	2029	6.625%	38.2	325.4	8.8%	75.2%	18.0%	40.6%	10.4%
2029	5,405.1	2,783.3	2,783.3	51.5%	51.5%	2030	6.625%	39.6	333.4	8.9%	74.8%	17.8%	37.7%	10.9%

Actuarial Data

San Jose Federated - Minus 35% Projections														
	Actuarial	Assets		Funded Ratio			Investment	Contribution Amounts		Contribution Rates		NC +	Interest	
June 30th	Liability	Market	Actuarial	Market	Actuarial	FYE	Return	Member	City	Member	City	Admin	Cost	ICaR
2020	4,401.1	2,208.0	2,301.5	50.2%	52.3%	2021	-35.000%	25.2	190.9	7.7%	59.2%	20.7%	41.2%	11.3%
2021	4,517.4	1,415.7	2,213.2	31.3%	49.0%	2022	6.625%	27.9	206.0	7.9%	58.6%	20.3%	56.6%	7.0%
2022	4,636.2	1,496.8	2,081.9	32.3%	44.9%	2023	6.625%	29.5	226.6	8.1%	62.5%	19.8%	55.6%	7.2%
2023	4,753.0	1,596.2	1,973.2	33.6%	41.5%	2024	6.625%	31.3	251.6	8.4%	67.4%	19.4%	54.3%	7.5%
2024	4,867.8	1,719.2	1,901.9	35.3%	39.1%	2025	6.625%	33.2	275.9	8.6%	71.8%	19.1%	52.6%	7.8%
2025	4,980.3	1,866.6	1,866.6	37.5%	37.5%	2026	6.625%	35.0	298.9	8.8%	75.5%	18.7%	50.5%	8.2%
2026	5,090.6	2,038.6	2,038.6	40.0%	40.0%	2027	6.625%	36.8	320.7	9.0%	78.6%	18.5%	48.0%	8.7%
2027	5,198.1	2,235.4	2,235.4	43.0%	43.0%	2028	6.625%	38.0	328.5	9.1%	78.2%	18.2%	45.3%	9.3%
2028	5,303.2	2,443.5	2,443.5	46.1%	46.1%	2029	6.625%	38.7	335.9	8.9%	77.6%	18.0%	42.4%	9.9%
2029	5,405.1	2,662.3	2,662.3	49.3%	49.3%	2030	6.625%	40.0	344.2	9.0%	77.2%	17.8%	39.5%	10.4%

San Jose Federated - Minus 40% Projections														
	Actuarial	Assets		Funded Ratio			Investment	Contribution Amounts		Contribution Rates		NC +	Interest	
June 30th	Liability	Market	Actuarial	Market	Actuarial	FYE	Return	Member	City	Member	City	Admin	Cost	ICaR
2020	4,401.1	2,208.0	2,301.5	50.2%	52.3%	2021	-40.000%	25.2	190.9	7.7%	59.2%	20.7%	41.2%	11.3%
2021	4,517.4	1,306.1	2,191.3	28.9%	48.5%	2022	6.625%	27.9	206.0	7.9%	58.6%	20.3%	58.6%	6.5%
2022	4,636.2	1,379.9	2,030.7	29.8%	43.8%	2023	6.625%	29.5	228.4	8.2%	63.0%	19.8%	57.7%	6.6%
2023	4,753.0	1,473.3	1,894.3	31.0%	39.9%	2024	6.625%	31.5	255.4	8.4%	68.4%	19.4%	56.4%	6.9%
2024	4,867.8	1,592.4	1,797.0	32.7%	36.9%	2025	6.625%	33.4	281.8	8.7%	73.3%	19.1%	54.7%	7.2%
2025	4,980.3	1,737.7	1,737.7	34.9%	34.9%	2026	6.625%	35.3	306.8	8.9%	77.5%	18.7%	52.5%	7.7%
2026	5,090.6	1,909.8	1,909.8	37.5%	37.5%	2027	6.625%	37.2	330.7	9.1%	81.1%	18.5%	50.0%	8.2%
2027	5,198.1	2,108.7	2,108.7	40.6%	40.6%	2028	6.625%	38.5	338.7	9.2%	80.6%	18.2%	47.2%	8.8%
2028	5,303.2	2,319.5	2,319.5	43.7%	43.7%	2029	6.625%	39.2	346.4	9.1%	80.1%	18.0%	44.2%	9.4%
2029	5,405.1	2,541.4	2,541.4	47.0%	47.0%	2030	6.625%	40.5	355.0	9.1%	79.7%	17.8%	41.2%	10.0%