Verus

PERSPECTIVES THAT DRIVE ENTERPRISE SUCCESS

MARCH 1, 2023

Risk Allocation Study

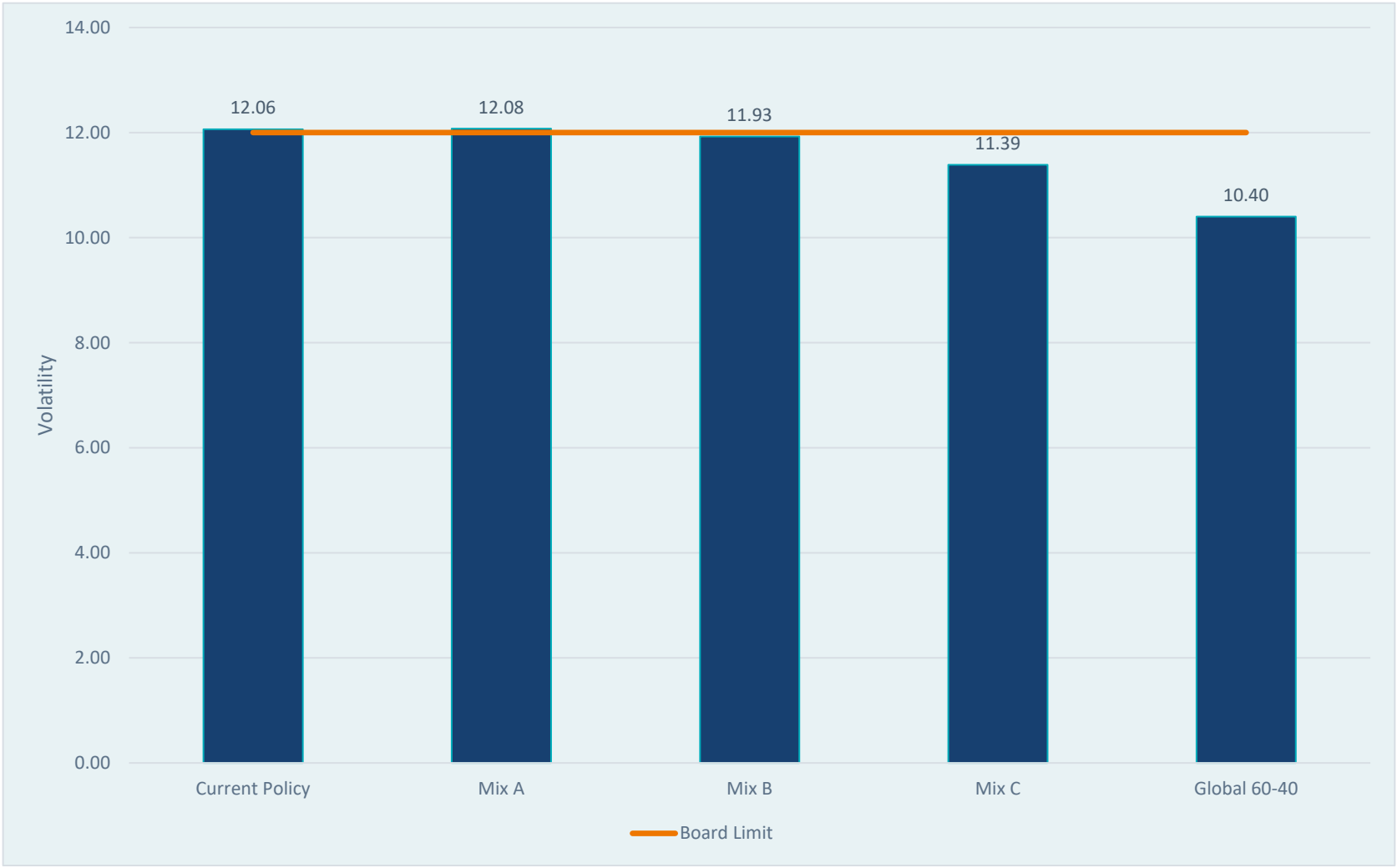
City of San Jose Federated Employees' Retirement System

Summary

Analyzing the mixes being considered, we observe:

- The proposed asset allocation changes are minor across asset classes
- 2 of the 5 mixes marginally fall outside the board limit for volatility as defined in IPS
- The mixes provide similar levels of equity market sensitivity (beta)
- Similar risk allocation profiles, with equity factors largely driving overall portfolio risk
- Duration risk is not significant risk among mixes considered as it is relatively short across all mixes
- With a high level of market uncertainty in 2023, a mild stagflation environment would be the worst for portfolio performance and a strong rebound would be the best.
- We observe similar performance across asset mixes in most historic scenarios and stress tests

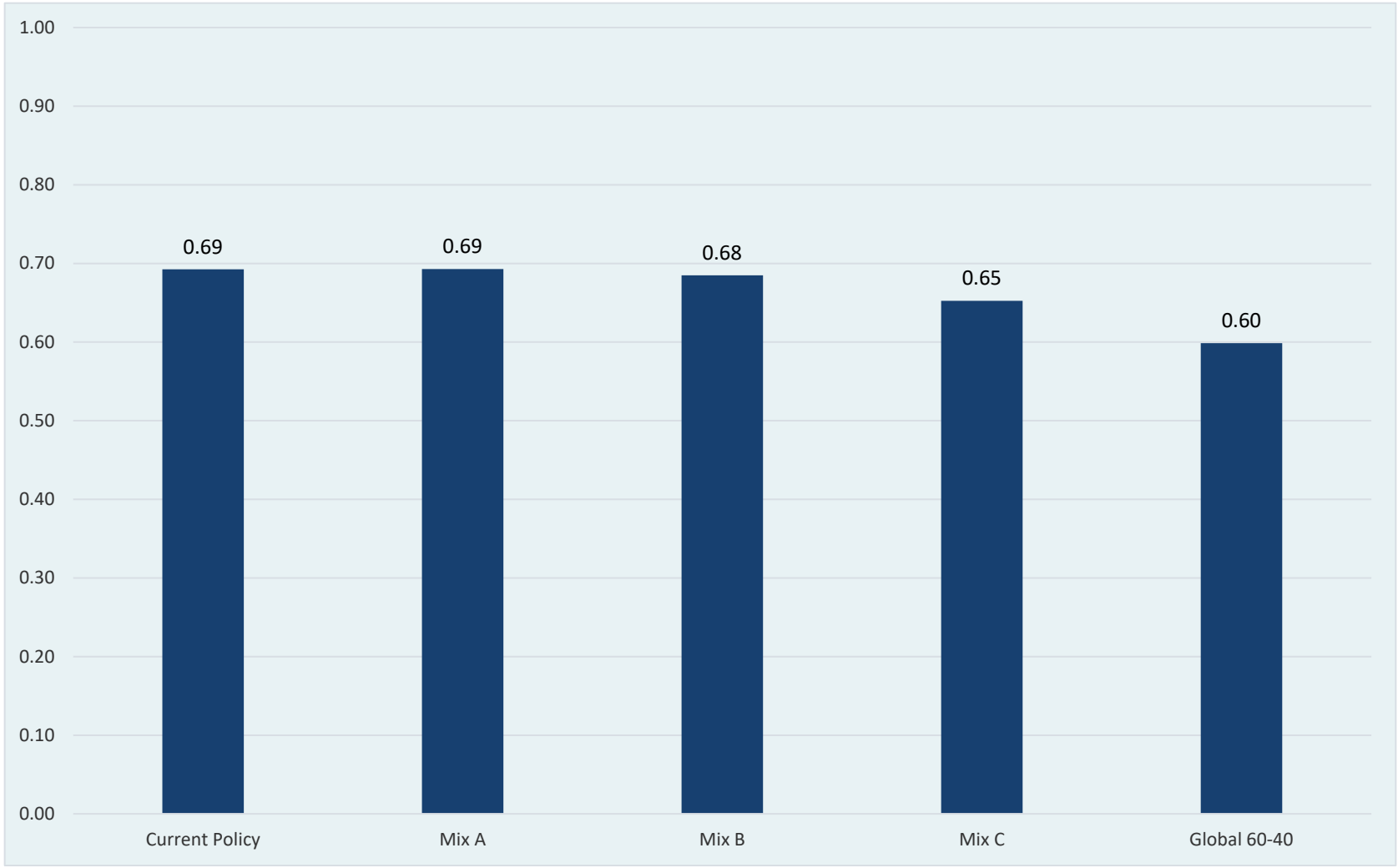
Risk operating zones



The Current Policy and Mix A are marginally higher than the board limit for portfolio volatility.

Operating zones are defined in appendix C of the Investment Policy Statement. Data from MSCI BarraOne, MAC.XL model.

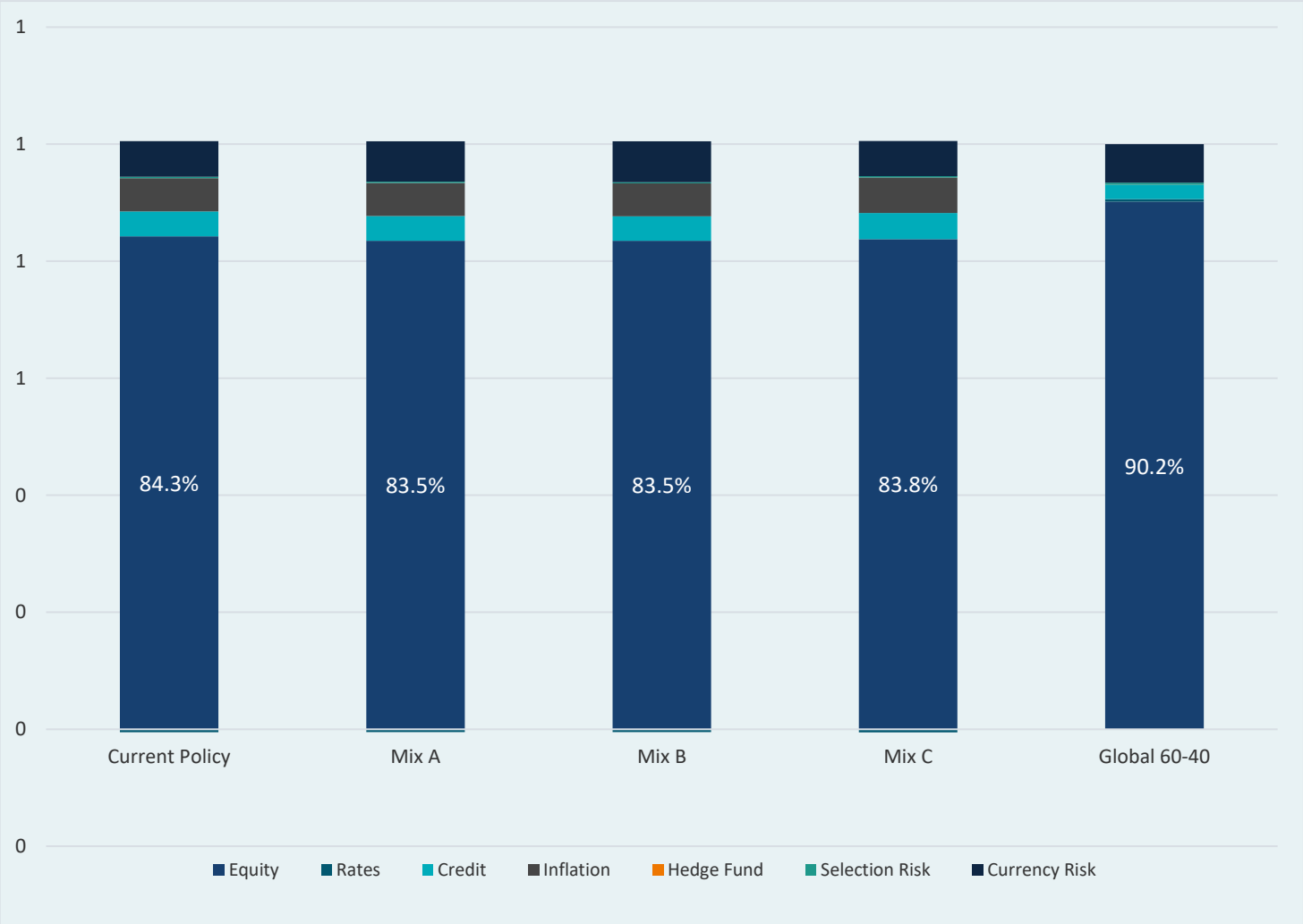
Equity beta



Equity beta is similar across the mixes, ranging from 0.60 to 0.69

Data from MSCI BarraOne, MAC.XL model.

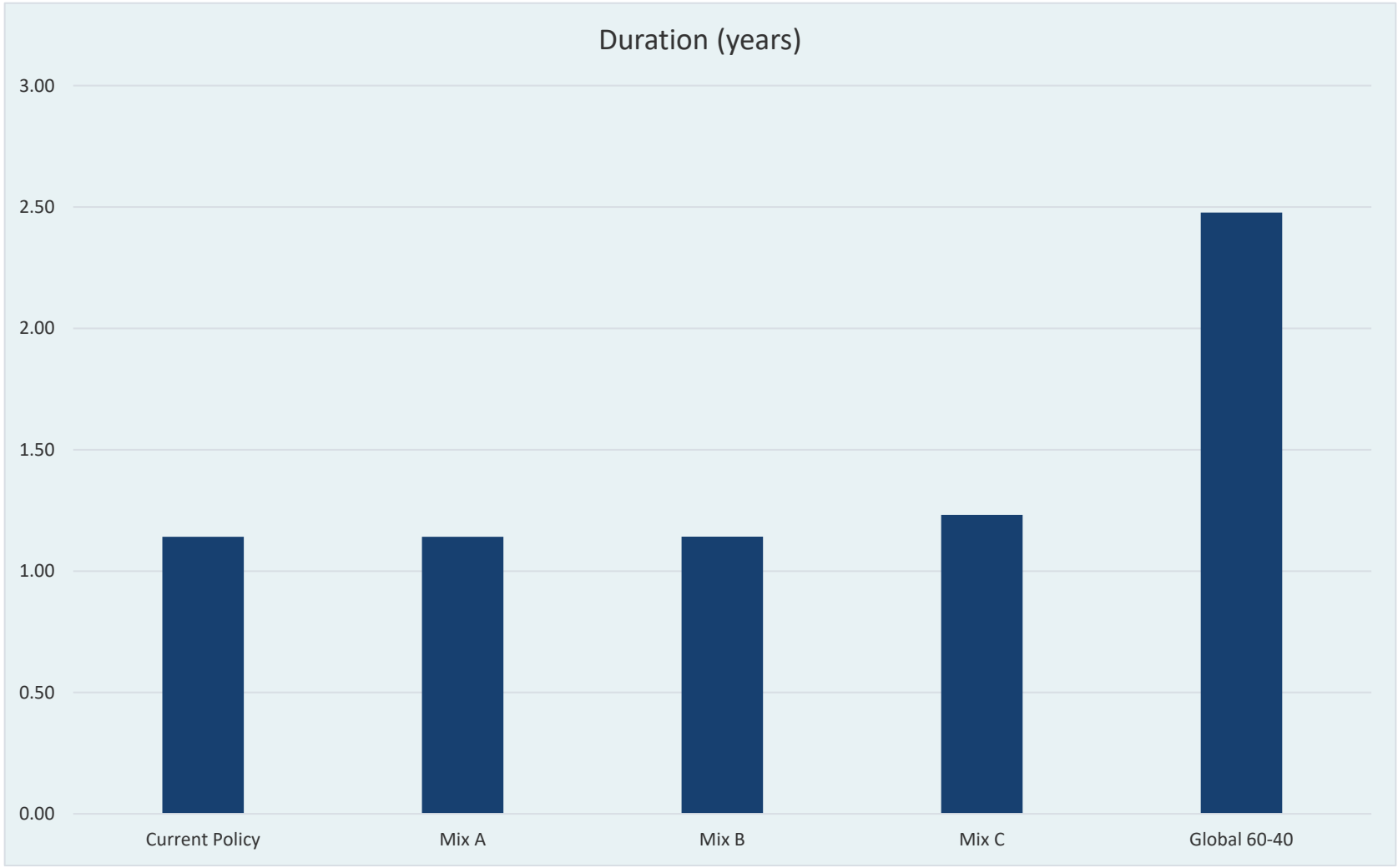
Risk decomposition



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, MAC.XL model.

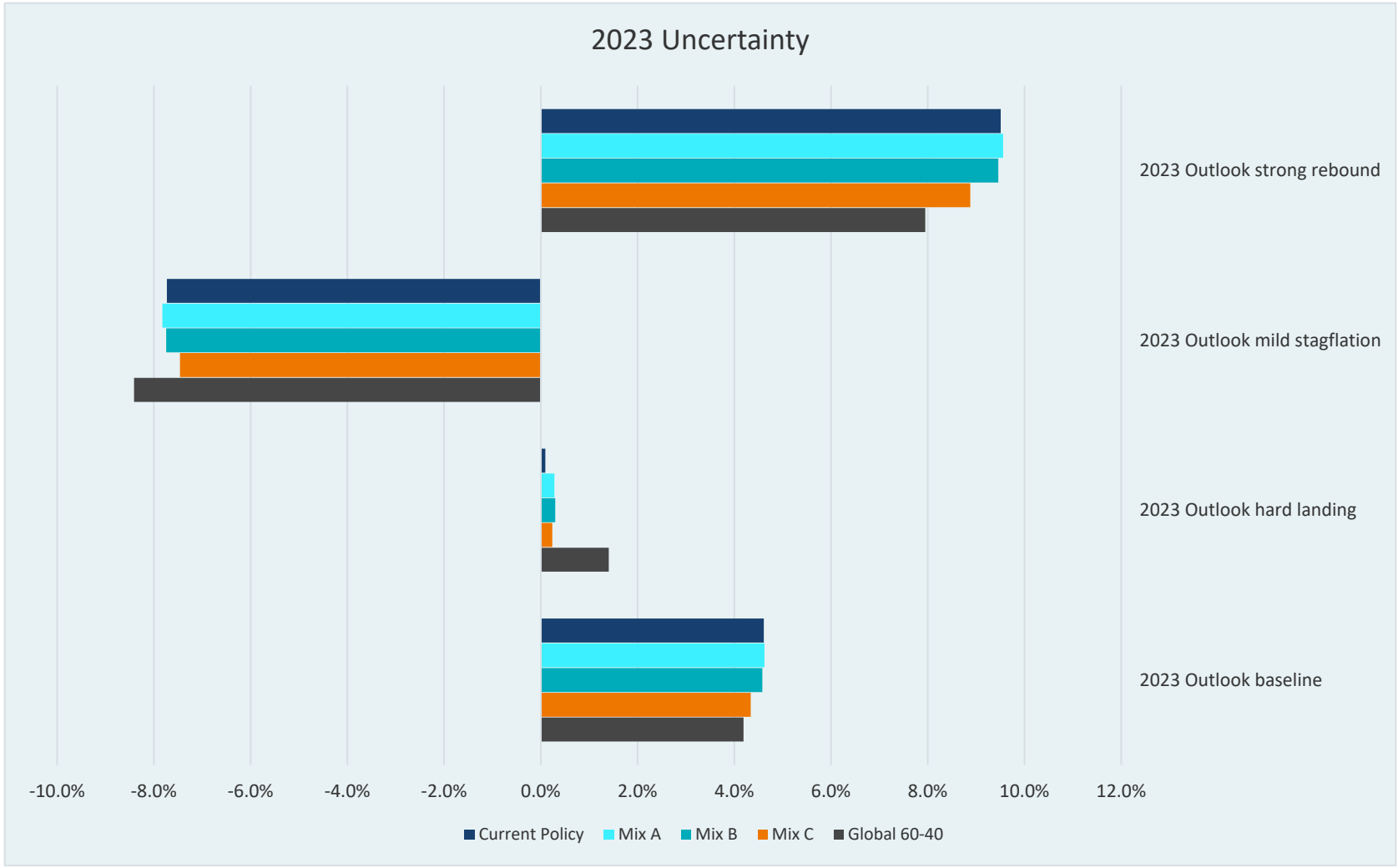
Effective duration



Duration risk remains low across all the mixes considered.

Data from MSCI BarraOne, MAC.XL model.

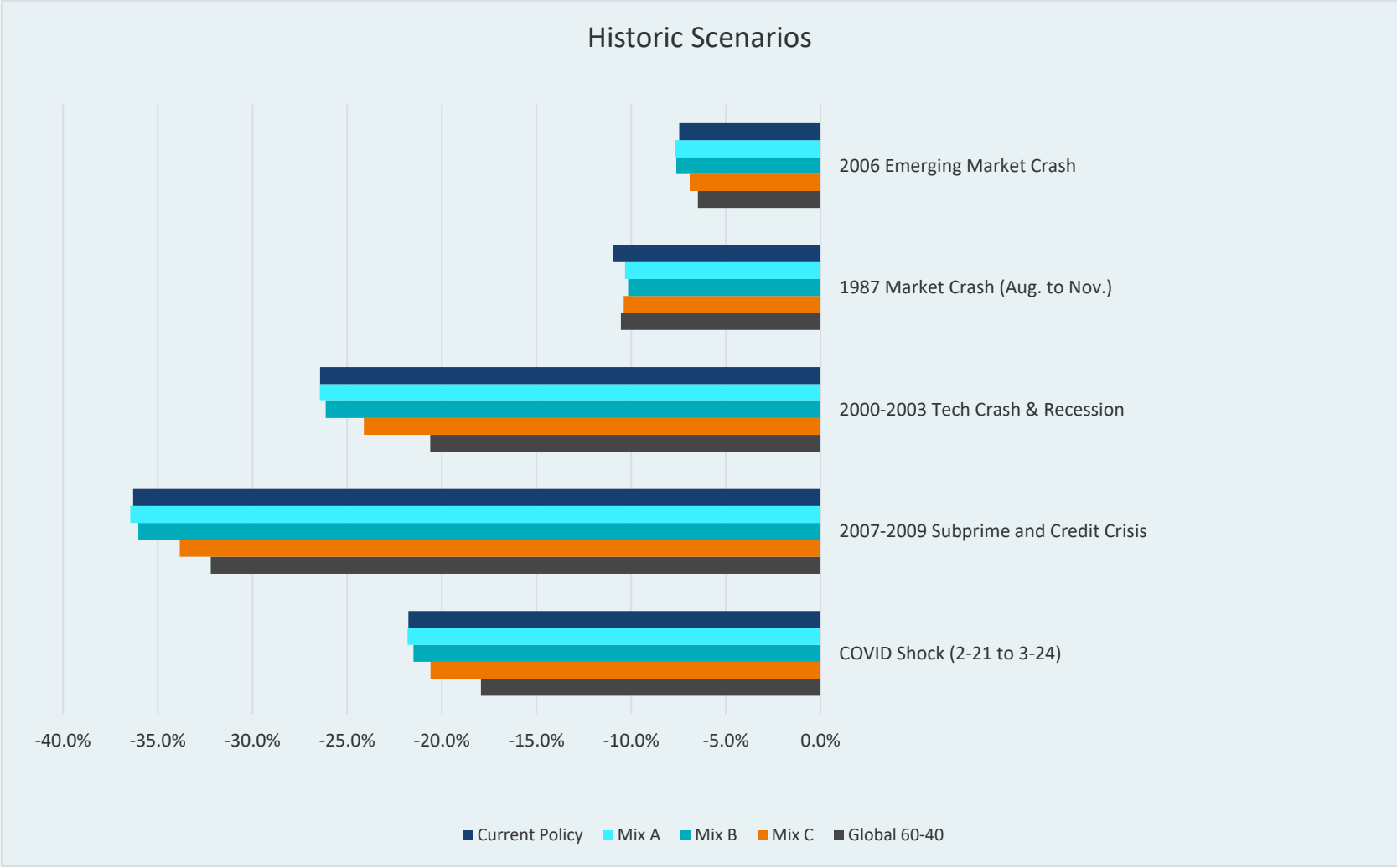
Prospective scenarios



If markets experience a strong rebound, coinciding with inflation coming under control and falling below economist expectations we could see portfolio returns exceeding the target return expectation.

Data from MSCI BarraOne, MAC.XL model.

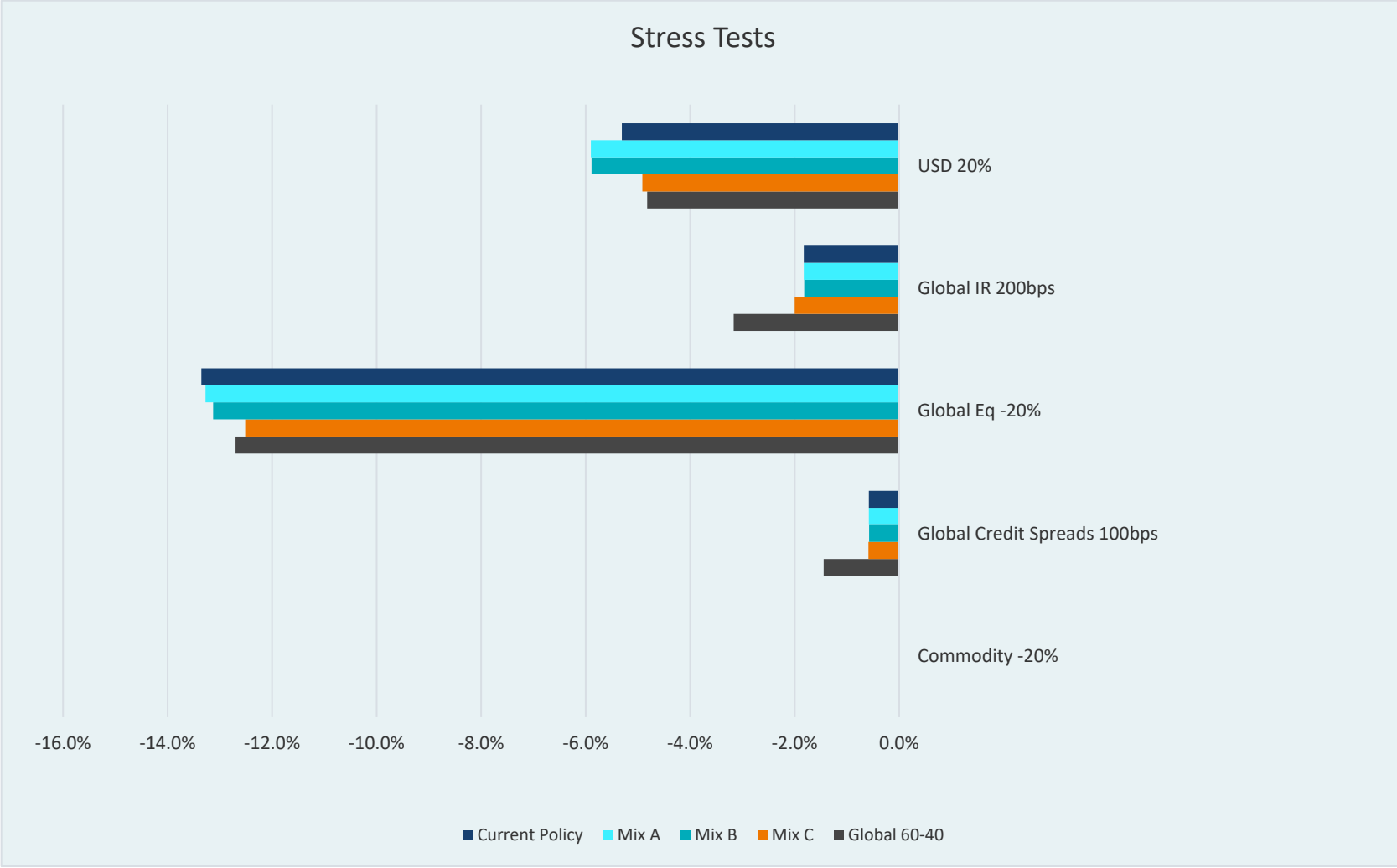
Historic scenarios



We observe similar performance in historic scenarios between the current policy and mixes A and B.

Data from MSCI BarraOne, MAC.XL model.

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, MAC.XL model.

Appendix

Navigating 2023 market uncertainty

The macroeconomic landscape for 2023 is shrouded in uncertainty following a tumultuous 2022. The path and influence of central banks' monetary tightening are unclear, and while energy prices have dropped, there are still questions about energy supply and geopolitical tensions. We have laid out four scenarios for investors to gauge the potential impact on their portfolios.

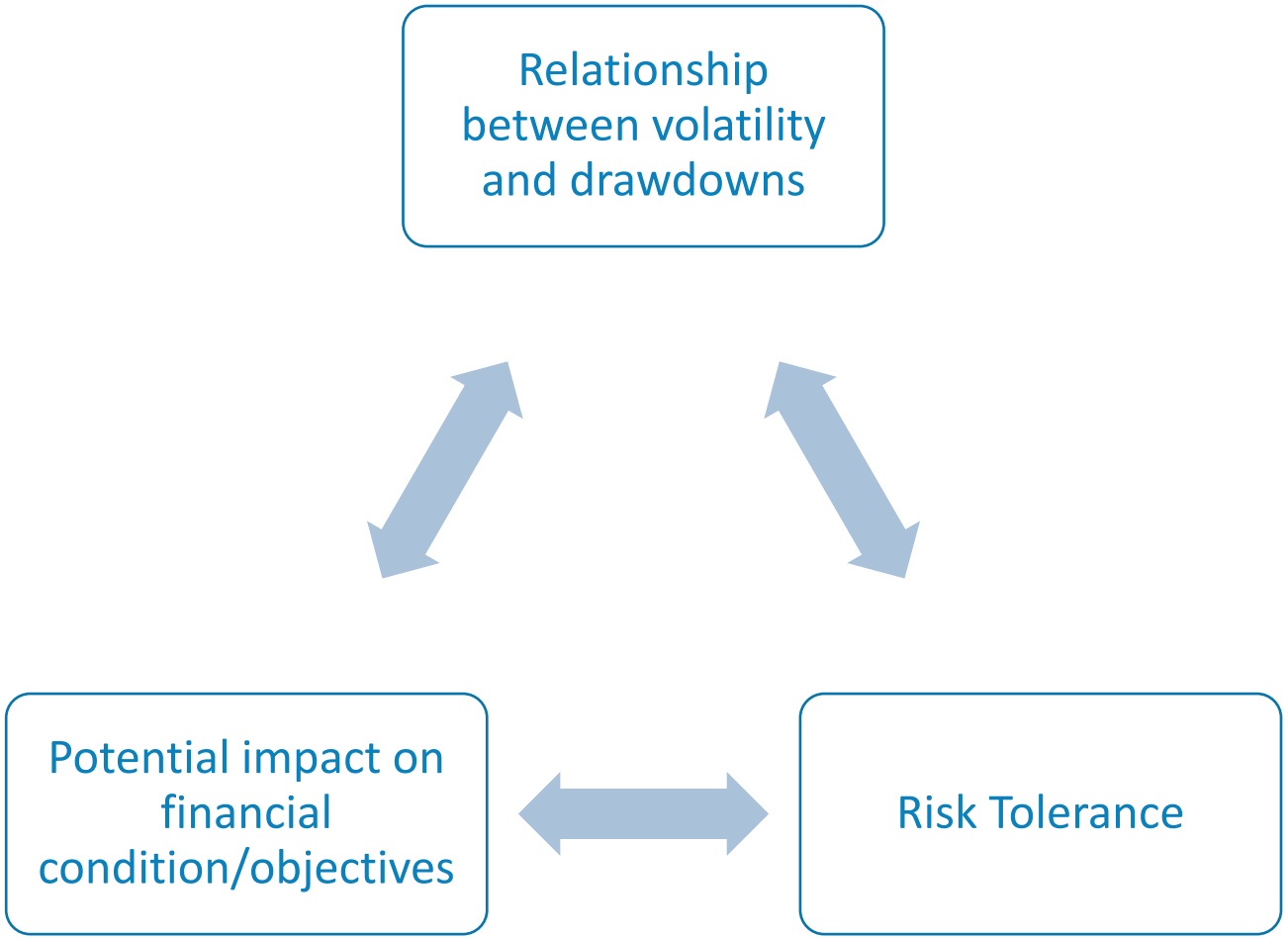
Baseline: Interest rates remain high as inflation stays elevated in 2023. Economic growth in the U.S. is weak but slightly positive, while there is a mild recession in Europe. No additional global downside risks materialize. The U.S. dollar slightly depreciates.
Hard landing: Monetary policy effectively curbs inflation, and the Federal Reserve maintains its credibility, at the cost of a U.S. recession in 2023. The Fed's pivot in response to the recession weakens the U.S. dollar significantly.
Mild stagflation: Central-bank policy does not efficiently tame inflation, eroding central banks' credibility, and inflation becomes entrenched. High prices and interest rates weigh on growth for an extended period. The U.S. dollar strengthens, putting pressure on emerging-market economies.
Strong rebound: Inflation is under control and falls more than economists' consensus expectation, while economic growth surprises on the upside. Current global headwinds get resolved and supply-chain issues ease.

Changes in market expectations have highlighted there is significant uncertainty surrounding portfolio outcomes in 2023

		Baseline	Hard landing	Mild stagflation	Strong rebound
Inflation	USD BEI 2Y	-15 bps	-50 bps	110 bps	0 bps
	EUR BEI 2Y	-20 bps	-55 bps	95 bps	-10 bps
Nominal yields	USD TSY 2Y	-25 bps	-90 bps	125 bps	0 bps
	USD TSY 10Y	-10 bps	-60 bps	80 bps	15 bps
	EUR TSY 2Y	-15 bps	-50 bps	100 bps	0 bps
	EUR TSY 10Y	-10 bps	-30 bps	60 bps	20 bps
Equity	US	6%	-2%	-10%	12%
	Europe	4%	-2%	-10%	8%
	China	10%	-5%	-10%	20%
	India	8%	-5%	-2.50%	20%
	US growth	6%	-5%	-25%	15%
Credit spreads	US IG	0 bps	20 bps	30 bps	-25 bps
Currency	EUR	2%	7%	-7%	5%
	JPY	5%	15%	-5%	10%

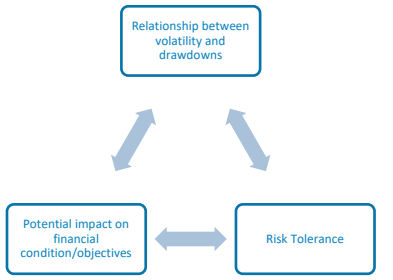
Source: MSCI

Determining risk limits



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

Volatility, drawdowns and risk tolerance



Risk Tolerance

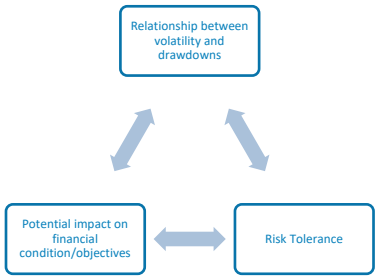
Aggressive ← → Conservative

Risk Tolerance: Conservative ↔ Aggressive

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	Interest Cost	Funded Ratio change	City Contributions change	Interest Cost Change
Single Year	Baseline	74%	$ 225	$ 75	0%	$ -	$ -
	-20%	63%	$ 341	$ 125	-11%	$ 116	$ 50
	-25%	60%	$ 362	$ 135	-14%	$ 137	$ 60
	-30%	57%	$ 382	$ 146	-17%	$ 157	$ 71
	-35%	54%	$ 402	$ 156	-21%	$ 177	$ 81
	-40%	49%	$ 422	$ 166	-25%	$ 197	$ 91

		Funded Ratio	City Contributions	Interest Cost	Funded Ratio change	City Contributions change	Interest Cost Change
10-year (cumulative)	Baseline	89%	$ 2,130	$ 597	0%	$ -	$ -
	-20%	75%	$ 2,815	$ 1,087	-14%	$ 685	$ 490
	-25%	73%	$ 2,961	$ 1,169	-16%	$ 831	$ 571
	-30%	71%	$ 3,107	$ 1,250	-18%	$ 978	$ 653
	-35%	69%	$ 3,261	$ 1,329	-20%	$ 1,131	$ 732
	-40%	67%	$ 3,415	$ 1,408	-22%	$ 1,285	$ 810

Source: Actuarial metrics provided by Cheiron based on 2021 Actuarial Valuation. Dollar amounts in millions

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

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

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.