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PERSPECTIVES THAT DRIVE ENTERPRISE SUCCESS

MARCH 3, 2022

Risk Allocation Study

City of San Jose Police and Fire Employees' Retirement System

P&F 3.3.22

Summary

Analyzing the mixes being considered, we observe:

- The proposed asset allocation changes are minor (1-3%) across asset classes

- All the mixes fall below the board limit for portfolio 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

- If the fed struggles with the timing of rate rises and tapering asset purchases, we could see the portfolio decline more than 10%

- We observe similar performance across asset mixes in most historic scenarios and stress tests
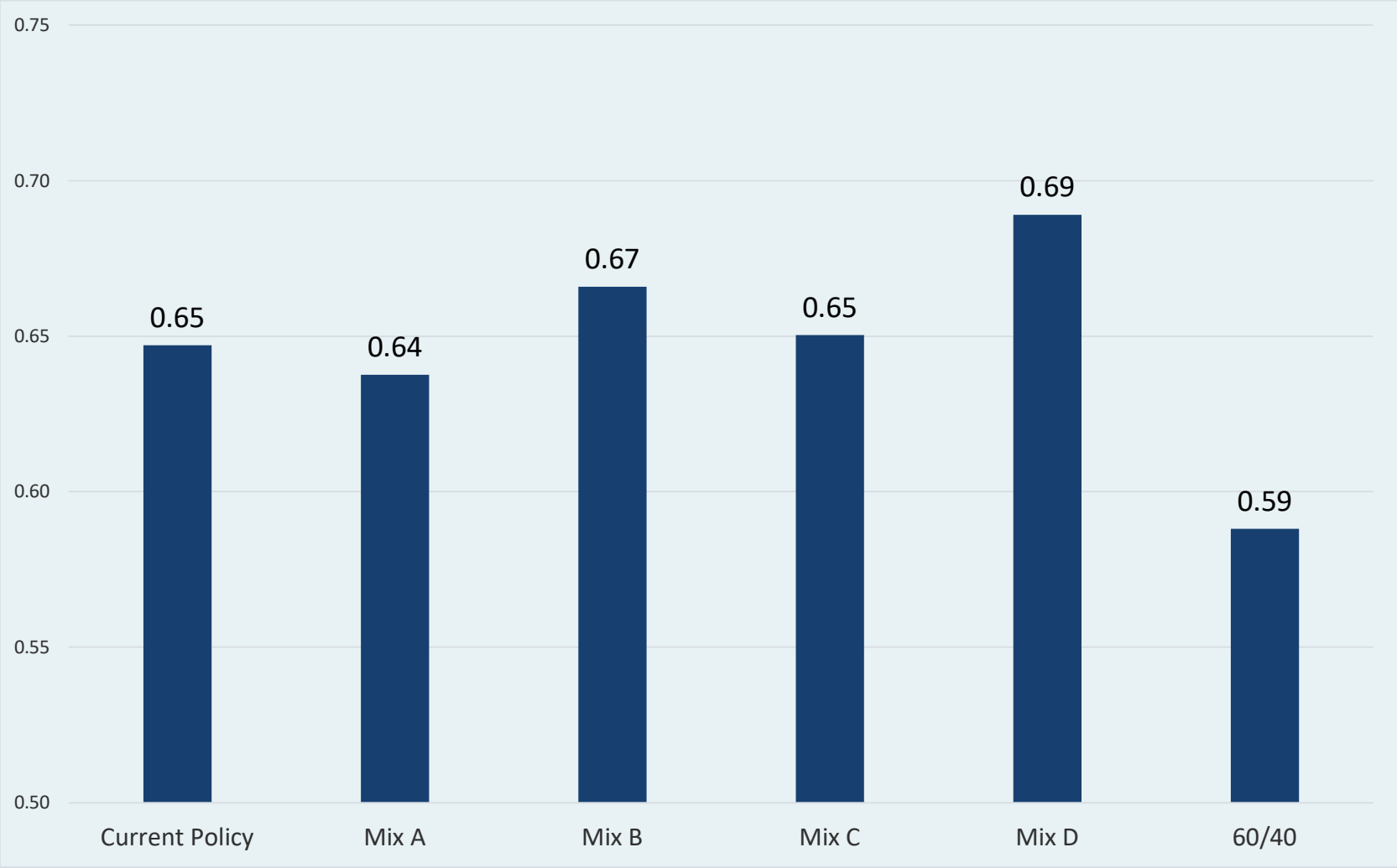
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Risk operating zones
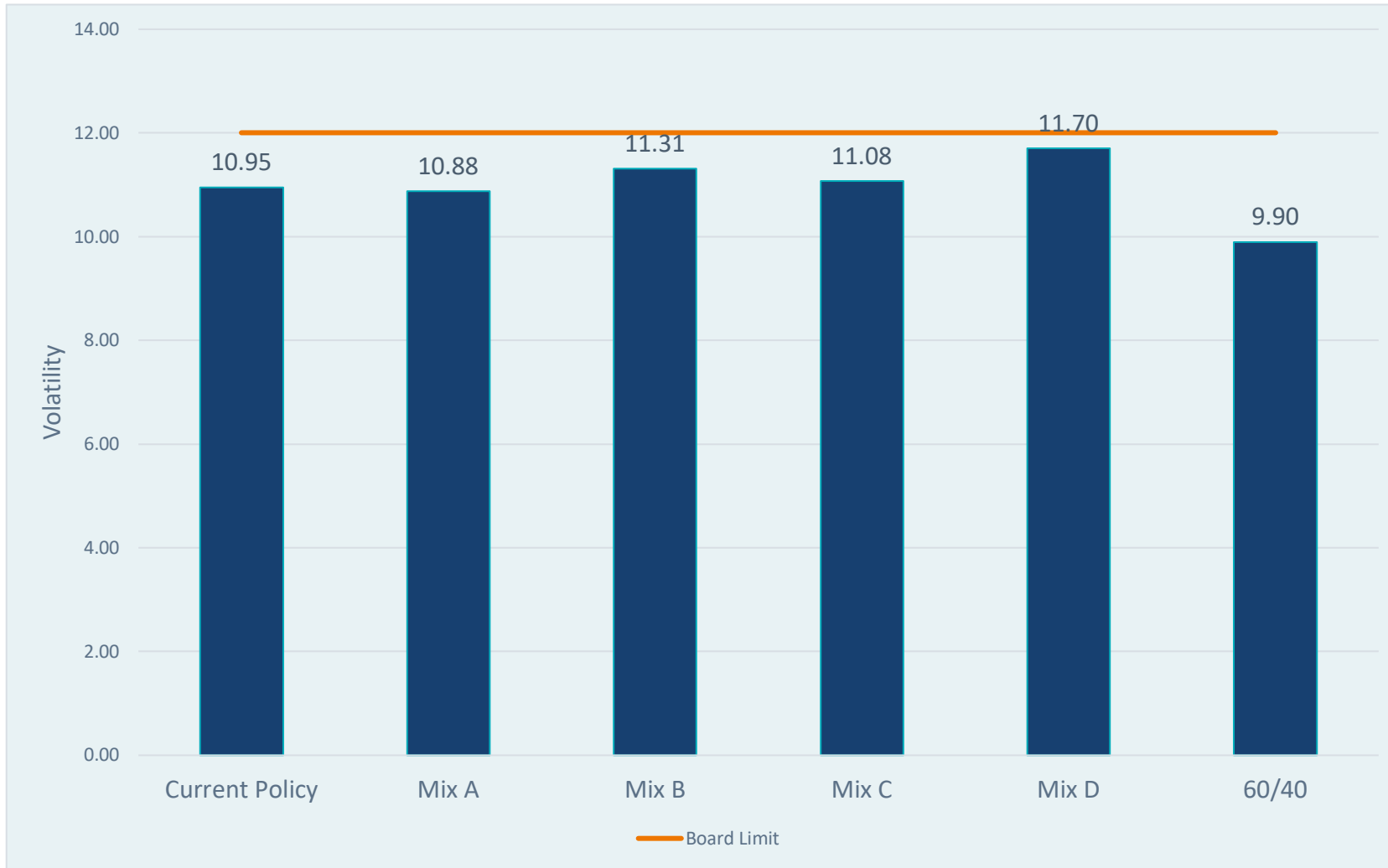
All mixes fall below the board limit for portfolio volatility

Operating zones are defined in appendix C of the Investment Policy Statement. Forecasted volatility using Barra's MAC.XL model.
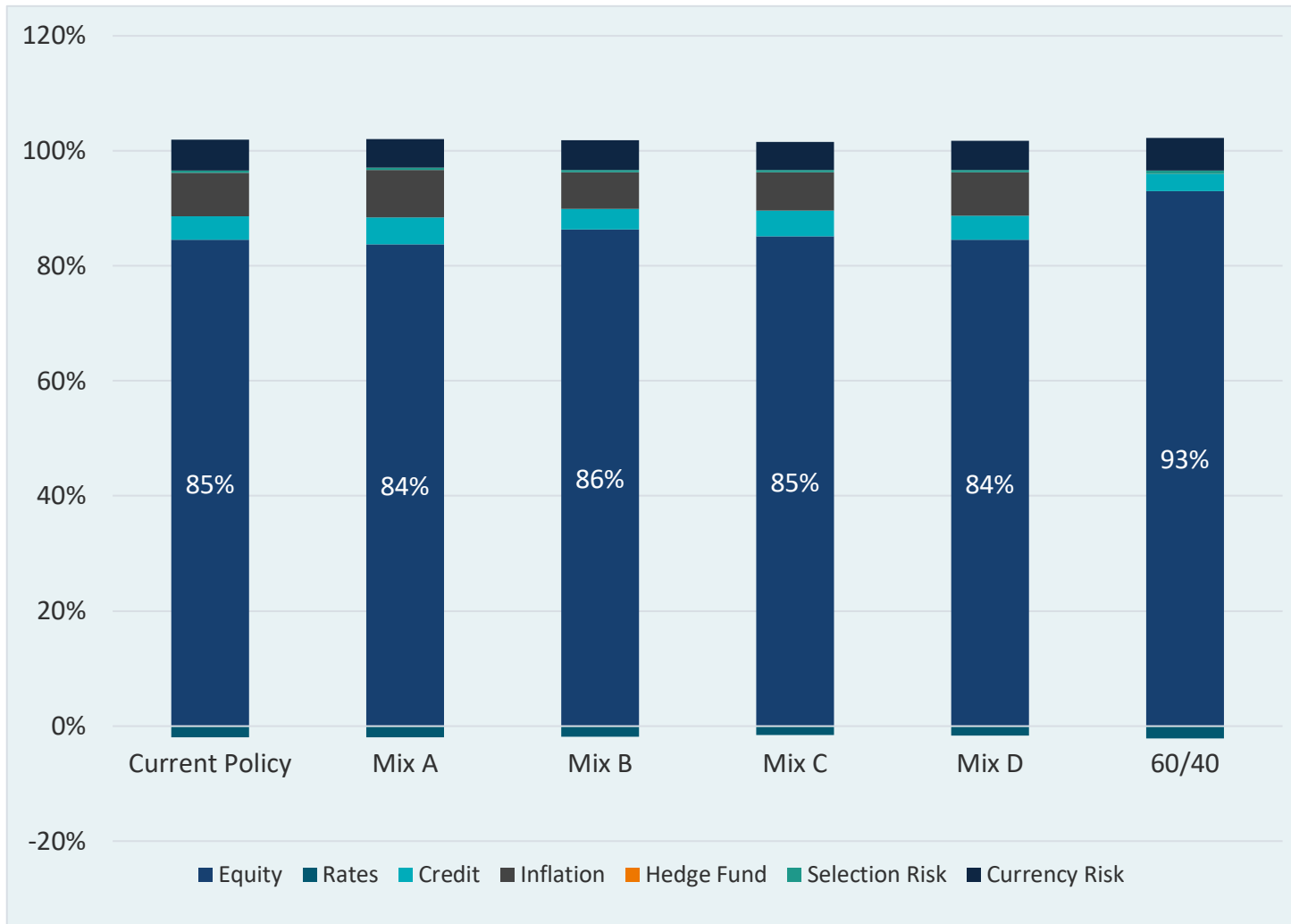
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Equity beta

Equity beta is lowest for the 60/40 mix and highest for Mix D.
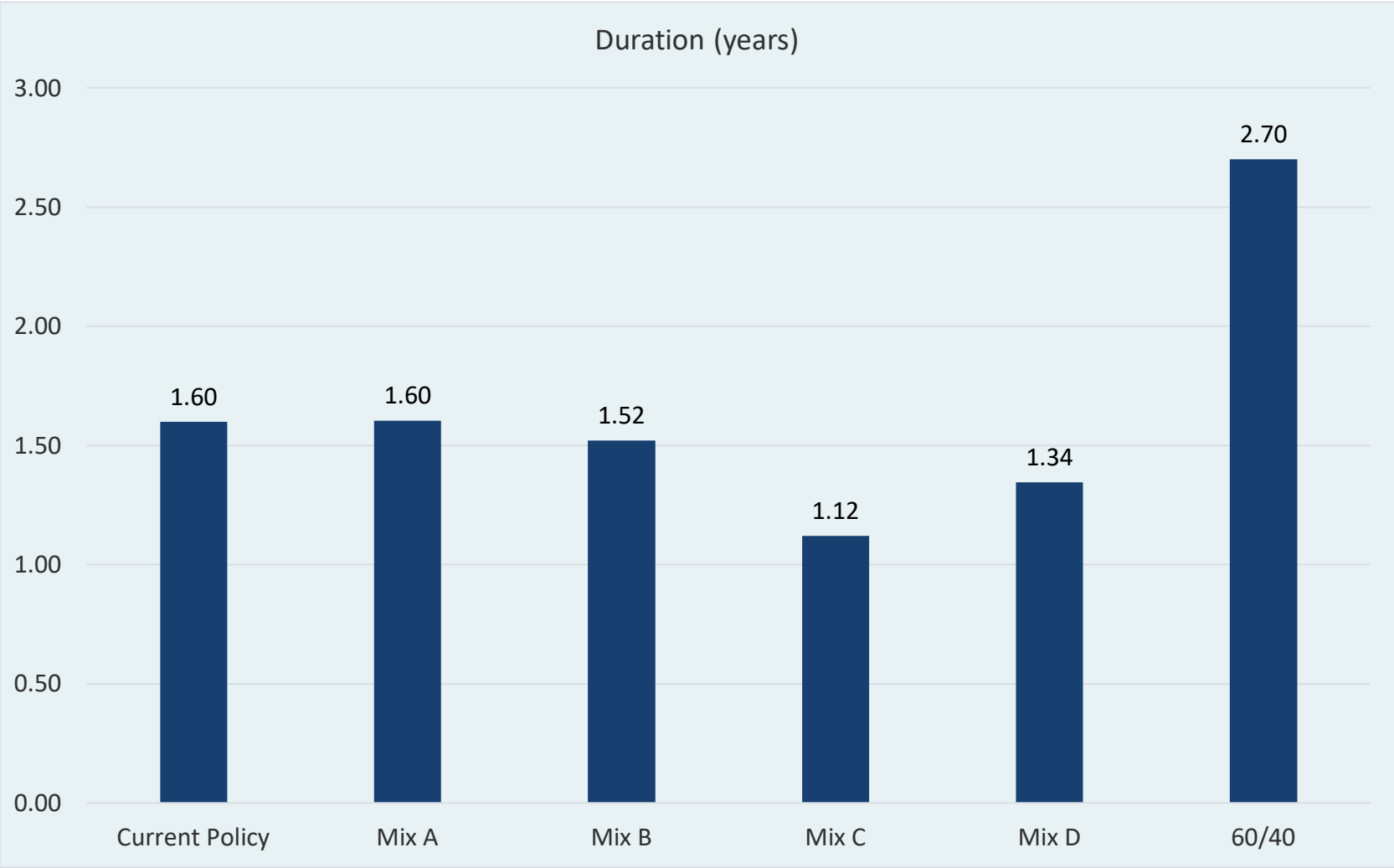
Data from MSCI BarraOne, MAC.XL model.

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 (years)

Duration risk remains low across all the mixes considered.

	Value
Current Policy	1.60
Mix A	1.60
Mix B	1.52
Mix C	1.12
Mix D	1.34
60/40	2.70

Data from MSCI BarraOne, MAC.XL model.

Fed rate hike scenarios
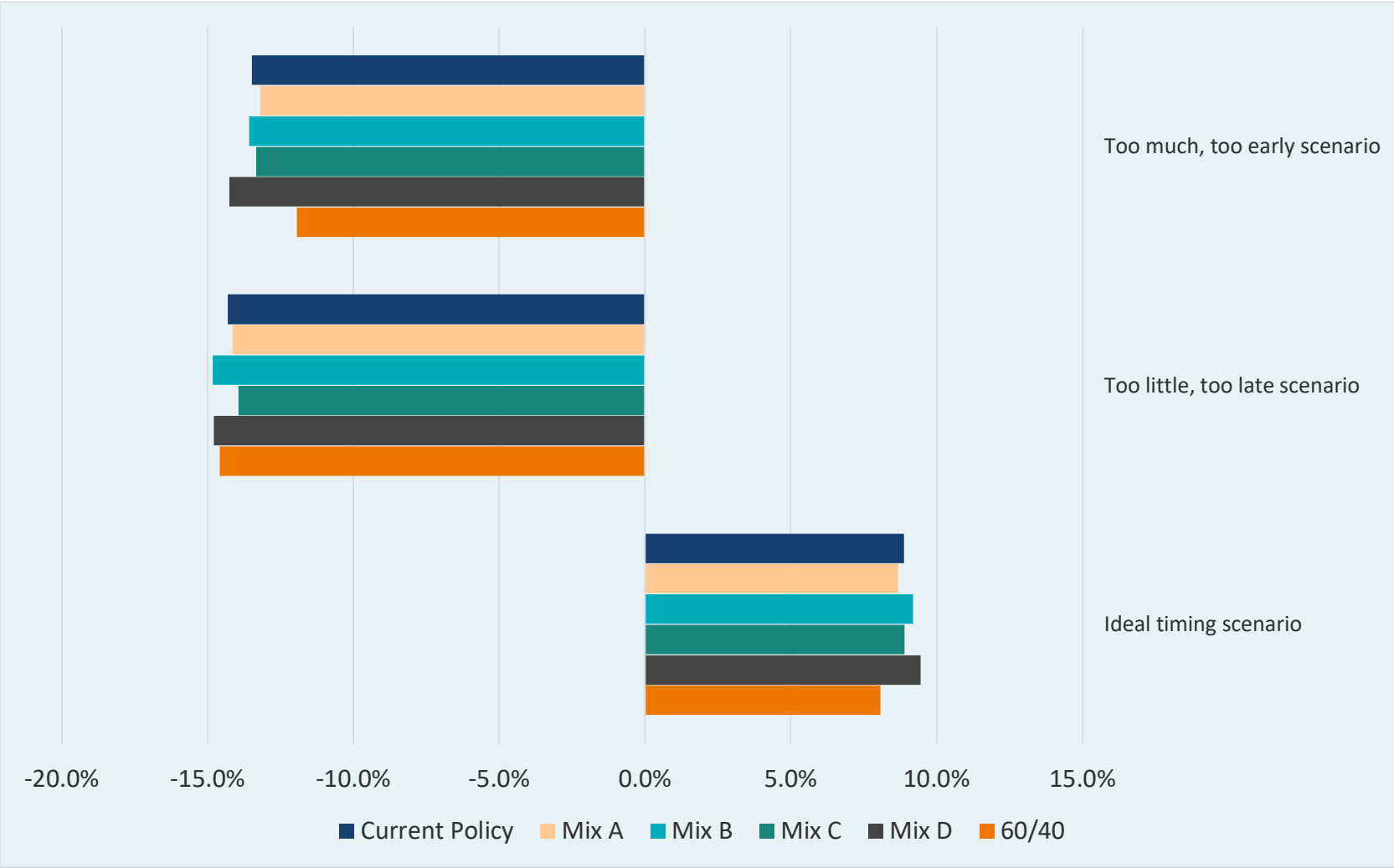
If the fed can successfully navigate the timing of raising rates and tapering asset purchases, we could experience positive returns.

Data from MSCI BarraOne, MAC.XL model.

Historic scenario analysis
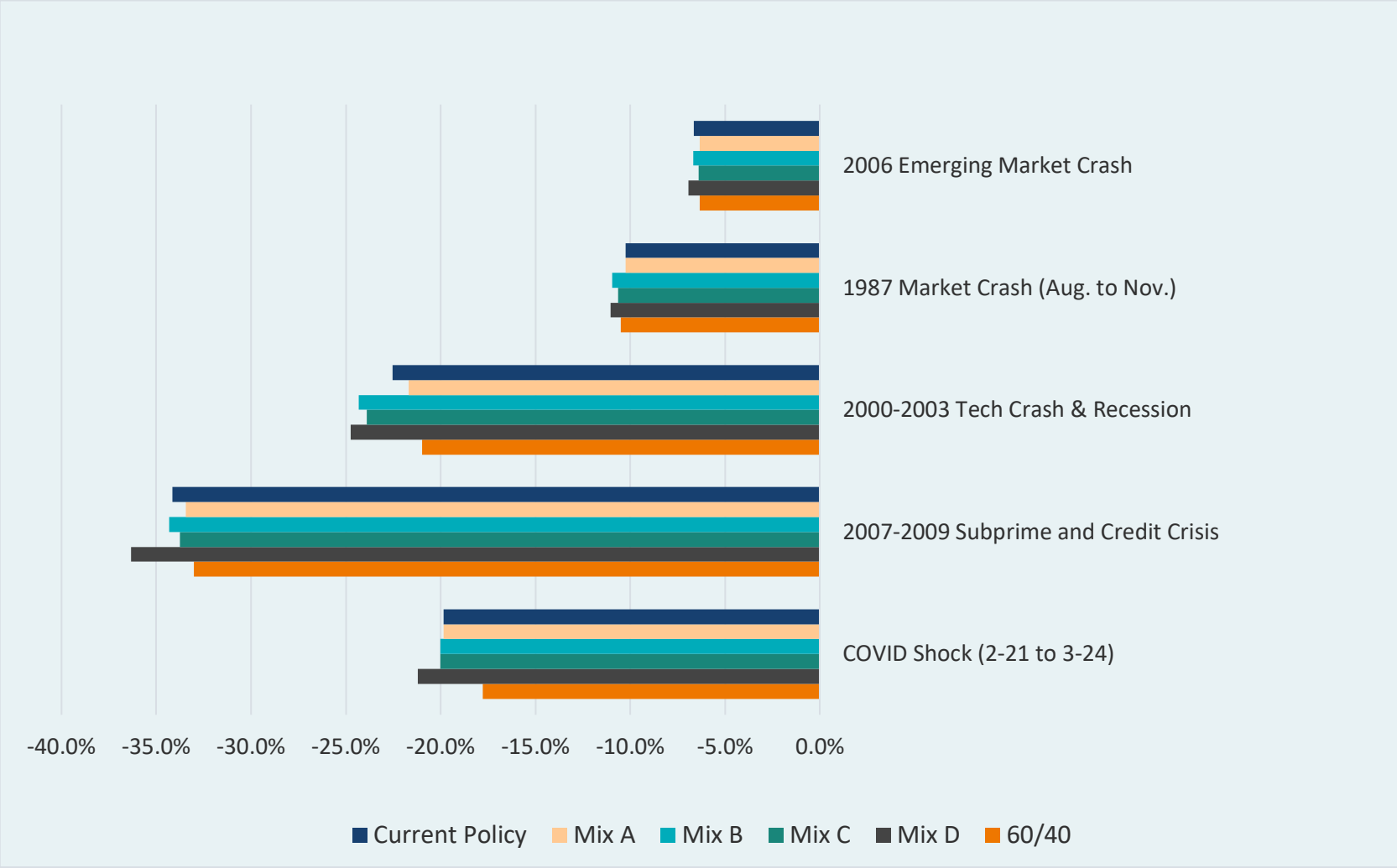
We observe similar performance in historic scenarios with Mix D performing the worst.

Data from MSCI BarraOne, MAC.XL model.

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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.

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Appendix

Rate hike scenarios

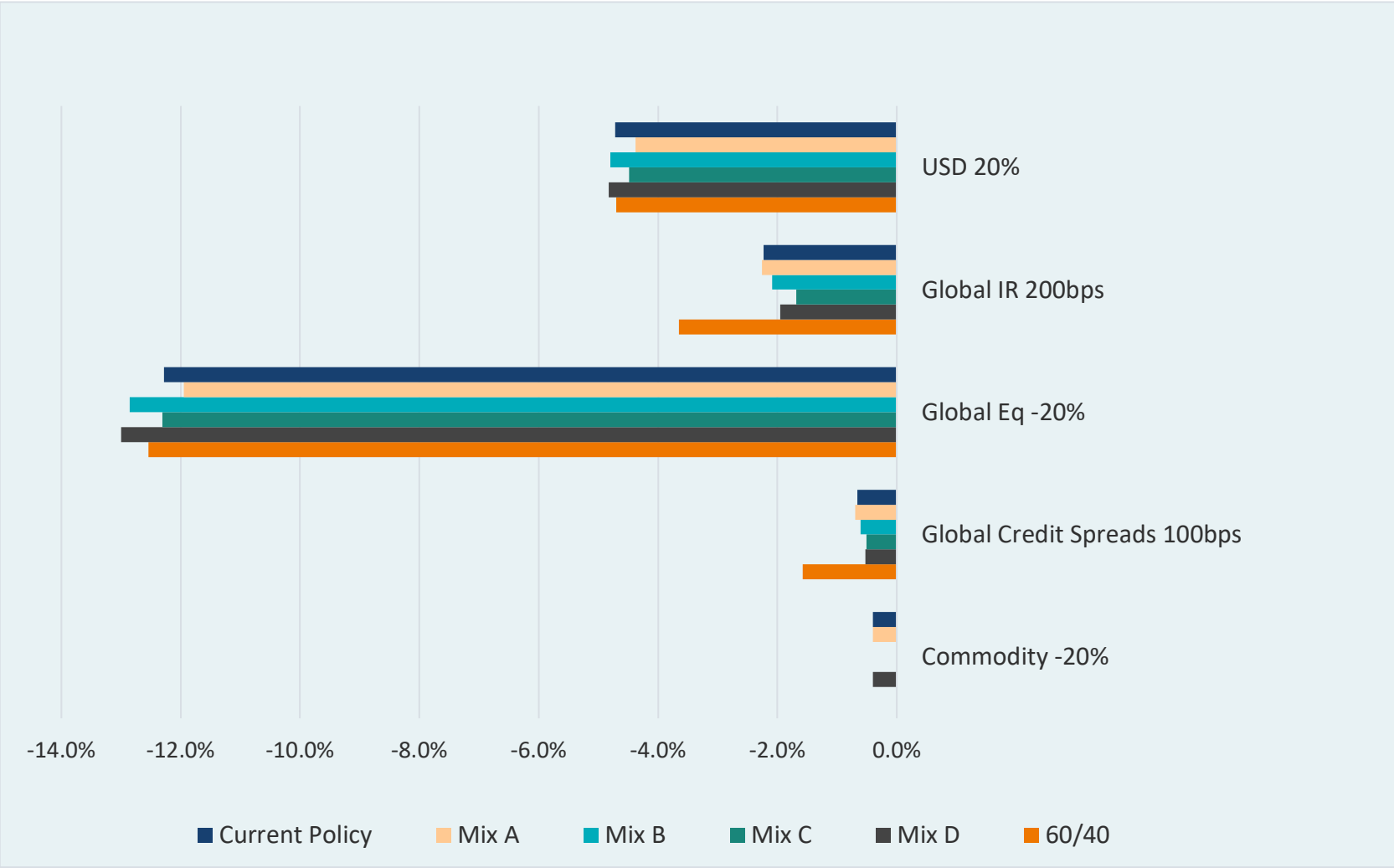**Ideal timing**: Markets perceive that the Fed tapers asset purchases and hikes rates at the right time to keep inflation controlled while helping economic growth remain stable and robust. Investors are confident, equities gain, and long-term rates increase slightly. Emerging markets benefit from strong U.S. growth.

Too much, too early: Markets believe that policy actions occur too early and are overaggressive. Short- and long-term economic growth are negatively impacted, and market-implied inflation expectations drop. Equities fall, the yield curve flattens and the slowdown in the U.S. growth hurts emerging markets.

Too little, too late: Markets perceive that the policy path is too slow, which brings inflation worries to the forefront. While short-term growth is steady, long-term forecasts are hit. Higher inflation and a diminished growth outlook increase equity risk premia. Equities decline, while long-term interest rates pick up, resulting in a positive bond-equity correlation.

Scenario	Ideal Timing	Too Much, Too Early	Too Little, Too Late
BEI-Rate Shocks (basis points)	Two-year: -15	Two-year: -85	Two-year: +165
	10-year: +5	10-year: -65	10-year: +115
Treasury-rate Shocks (basis points)	Two-year: +30	Two-year: +30	Two-year: +30
	10-year: +20	10-year: -40	10-year: +160
US Credit-Spread Shocks (basis points)	Investment Grade: -15	Investment Grade: +40	Investment Grade: +45
	High Yield: -40	High Yield: +150	High Yield: +190
US Equity Return (nominal)	13%	-17%	-18%
EM Equity Return (nominal, in local currency)	20%	-25%	-23%
EUR/USD Shocks	0%	-7%	10%

Source: MSCI

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Appendix – Asset mixes

	P&F Current (%)	Mix A (%)	Mix B (%)	Mix C (%)	Mix D (%)	60-40 (%)
Growth	**69**	**69**	**71**	**71**	**74**	**60**
US Equity	25	22	25	24	25	0
Dev. Market Equity (non-US)	12	12	12	11	12	0
Emerging Market Equity	9	7	9	7	9	0
Global Equity	0	0	0	0	0	60
Buyouts	7	9	7	9	9	0
Venture Capital	3	4	4	4	4	0
Private Debt	3	4	5	4	4	0
Private Real Estate	3	4	4	4	4	0
Private Real Assets	3	3	3	4	3	0
Emerging Market Bonds	2	2	2	2	2	0
High Yield Bonds	2	2	0	2	2	0
Low Beta	**8**	**8**	**8**	**16**	**8**	**0**
Absolute Return	3	3	3	3	3	0
Cash Equivalents (Immunized CFs)	5	5	5	13	5	0
Other	**23**	**23**	**21**	**13**	**18**	**40**
Core Real Estate	5	5	5	5	5	0
Commodities	2	2	0	0	2	0
TIPS	2	2	2	2	2	0
Investment Grade Bonds	11	11	11	4.5	6	40
Long-term Govt Bonds	3	3	3	1.5	3	0

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Determining risk limits

Relationship between volatility and drawdowns

Potential impact on financial condition/objectives
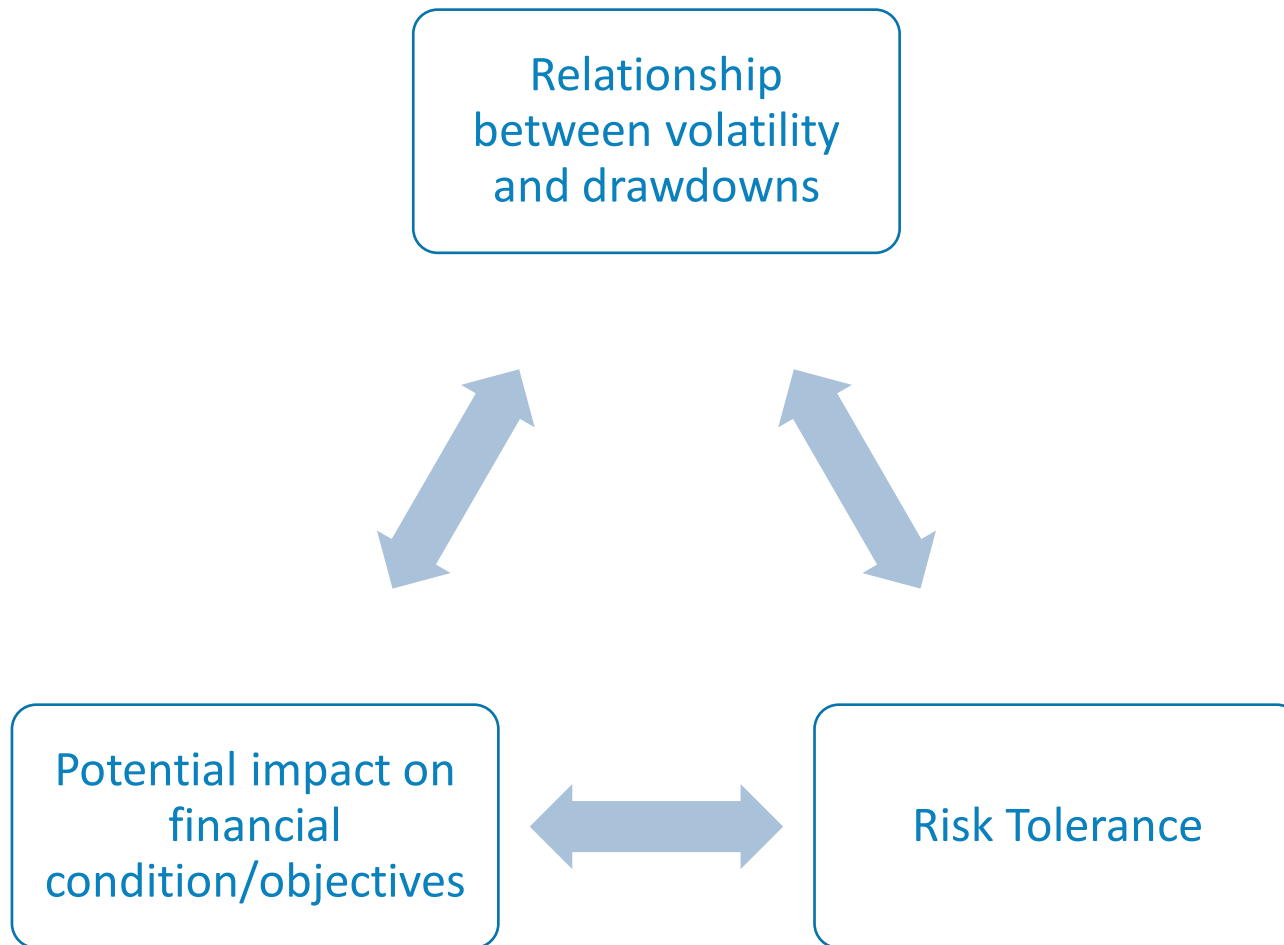
Risk Tolerance

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

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# Volatility, drawdowns and risk tolerance
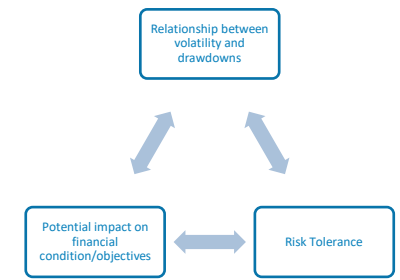
Risk Tolerance

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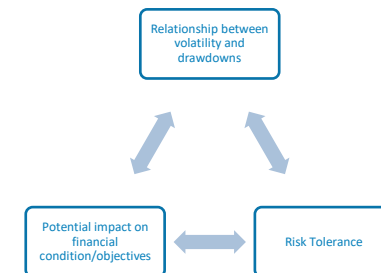
Based on discussions with Verus and Cheiron the board determined there were three actuarial metrics to include in the formulation of their risk limits: Funded Ratio, City Contributions, and Interest cost. Applying drawdowns in 5% increments ranging from 20% to 40%, we can determine the impact on the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

		Funded Ratio	City Contributions	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. 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

Relationship between volatility and drawdowns

Potential impact on financial condition/objectives

Risk Tolerance

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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.

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