

Asset Liability Management: Discussion of Candidate Portfolios

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Investment Committee
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Summary

- For discussion purposes today, for the Public Employees' Retirement Fund (PERF), we present several sample candidate portfolio strategies with a wide range of characteristics to illustrate the pros and cons of different strategies. Feedback from this discussion will be considered in the options and recommendation presented in November.
- The portfolios were developed in alignment with CalPERS' objectives of minimizing costs, maximizing projected returns, minimizing potential losses, and maintaining sufficient liquidity.
- Three of the portfolios have a projected return of 6.8%: an unlevered but diversified portfolio, a levered and diversified portfolio, and a levered but undiversified portfolio. In general, diversification reduces potential for loss and leverage improves diversification.
- The risk assessment is multi-faceted, with potential for losses (drawdown), contribution volatility, funding ratio, and return volatility. All the candidates have sufficient liquidity, but the cost of liquidity will vary based on market conditions.
- Private assets and emerging markets are the most promising in terms of projected returns. Scaling up private assets remains challenging, and allocations are limited to feasible levels.
- Scenarios are used to consider the range of outcomes for each portfolio.
- Portfolio choice requires balancing risk and returns. If projected returns are too low, projected costs will be too high, creating unacceptable financial hardship. If return variability is too high, risk of funding ratio dropping too low is unacceptable.

Portfolio Construction

- The portfolio construction is aligned with CalPERS objectives.
- Our CMAs indicate near-term returns (5-year), compared to long-term returns (20-year), are lower. Risks are also higher in the near-term horizon.
- Each candidate is a two-part strategy to balance the elevated risks and lower projected returns of the current market against the longer-term market projections.
- This two-part strategy is consistent with our ALM process, which we use to update portfolio allocations if and when market conditions change.
- The projected returns use 5 years as the near-term horizon. Market uncertainty means the near-term projection may change in advance of 5 years. Our ongoing review of market conditions mitigates some of this risk.
- Each portfolio strategy is designed to achieve a projected return while minimizing potential losses over any three-year period during the next twenty years.
- Our process includes use of investment analysis tools and technology from leading industry providers.

Glossary

Term	Definition	CalPERS Implementation
Downside Risk	An estimate of potential for losses (compare with Volatility)	<p>CalPERS 2021 Asset Liability Management modelling estimates the size of large losses that could occur over any three-year period. This estimate is called conditional drawdown at risk. To estimate it, start with the range of outcomes for returns. Then focus on only the losses, the part of the range where returns are negative. Conditional drawdown is based on the larger losses.</p> <p>CalPERS has a constitutional objective to 'minimize the risk of loss.'</p>
Leverage	Borrowing to acquire additional assets	<p>CalPERS has leverage in its policy benchmarks, accompanied by a limit of 20% on additional but discretionary leverage.</p> <p>A leverage allocation in the strategic asset allocation would improve diversification.</p>
Portfolio Strategy	A plan for managing assets to achieve financial objectives	<p>CalPERS portfolio strategy balances the desire for higher returns (leading to lower employer costs) against potential risk of portfolio losses (leading to higher contributions and lower funding ratios).</p> <p>The CalPERS portfolio strategy includes the ALM process to regularly review and, if need be, revise Capital Market Assumptions and portfolio allocations.</p>
Return Term Structure	A return projection that includes estimates for different investment horizons	CalPERS CMAs survey results include return projections for 5-year and 20-year investment horizons.
Volatility	An estimate of the width of a return distribution (compare with Downside Risk)	<p>CalPERS 2021 Asset Liability Management uses volatility when estimating the range of return outcomes.</p> <p>As an example, the width of a Bell curve is measured using both the upside and the downside. Risk is related to loss, which involves only downside, which is why we use conditional drawdown to measure downside risk.</p>

Pros and Cons of Key Decisions

If we choose	Pros	Cons
Higher discount rate	Lower projected contributions	Increased contribution risk Increased funding ratio risk
Higher projected returns	Increased discount rate	Increased portfolio risk
Managing near-term risk	Avoid excessive risk taking in near-term horizon	Lower projected returns in near-term horizon
Leverage	Increased diversification Strategic options	Losses (and gains) may be amplified Increased complexity
Increasing private asset allocations	Increased diversification Increased projected returns	Challenging to scale, even with policy changes Potential increase in some ESG related issues Policy changes required Increased complexity
Increasing exposure to emerging markets	Improved projected returns	Potential increase in some ESG related issues Increased complexity
New asset classes	Increased diversification	Policy changes required Increased complexity

Current Portfolio: status quo

Discount rate: 6.25%, Projected Return: 6.2%

Time Horizon	Projected Return	Drawdown Risk	Volatility
20 Years	6.2%	22.6%	11.2%
Near-term	5.2%	23.6%	10.9%
Long-term	6.6%	22.3%	11.3%

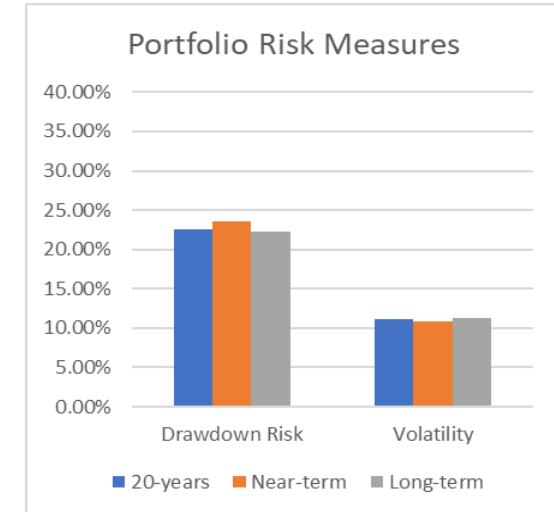
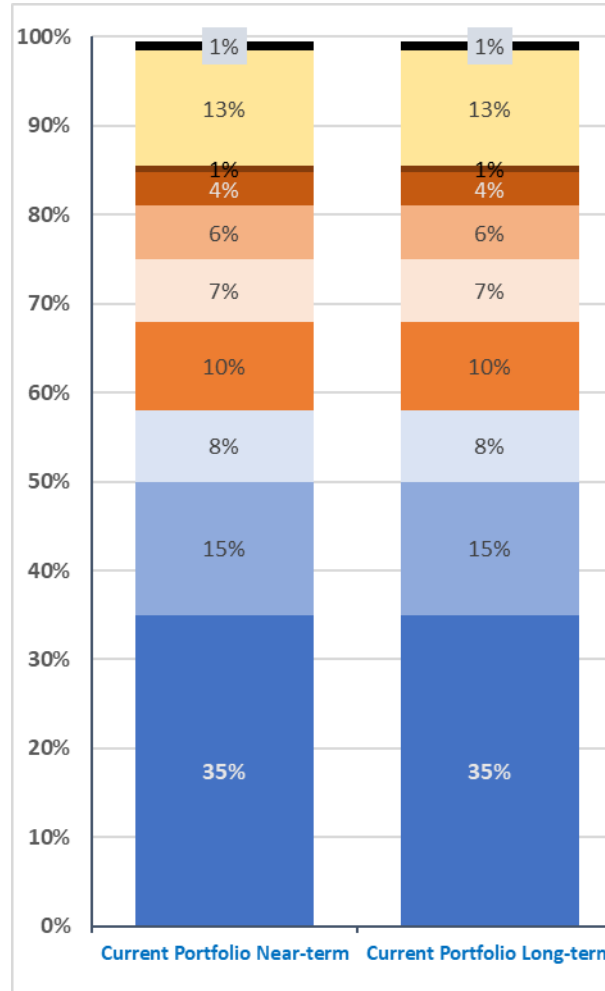
In comparison to other candidate portfolios:

Pros

- No changes, no added complexity
- No policy changes required

Cons

- Lowest return for similar risk levels
- Lower projected returns in near-term horizon
- Lower diversification
- Higher projected contributions



- Liquidity
- Real Assets
- Private Debt
- Emerging Market Sovereign Bonds
- High Yield
- Investment Grade Corporates
- Mortgage-backed Securities
- Treasury
- Private Equity
- Global Equity_Non-Cap-weighted
- Global Equity_Cap-weighted

Candidate Portfolio A: lower risk/return

Discount rate: 6.375%, Projected Return: 6.4%

Time Horizon	Projected Return	Drawdown Risk	Volatility
20 Years	6.4%	18.7%	10.3%
Near-term	5.7%	22.6%	11.1%
Long-term	6.7%	17.7%	10.0%

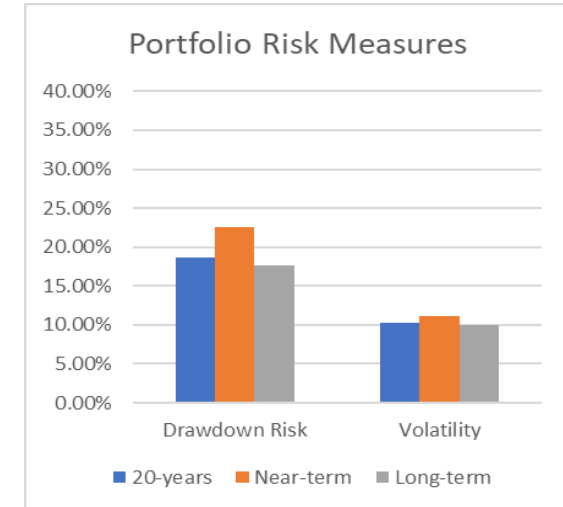
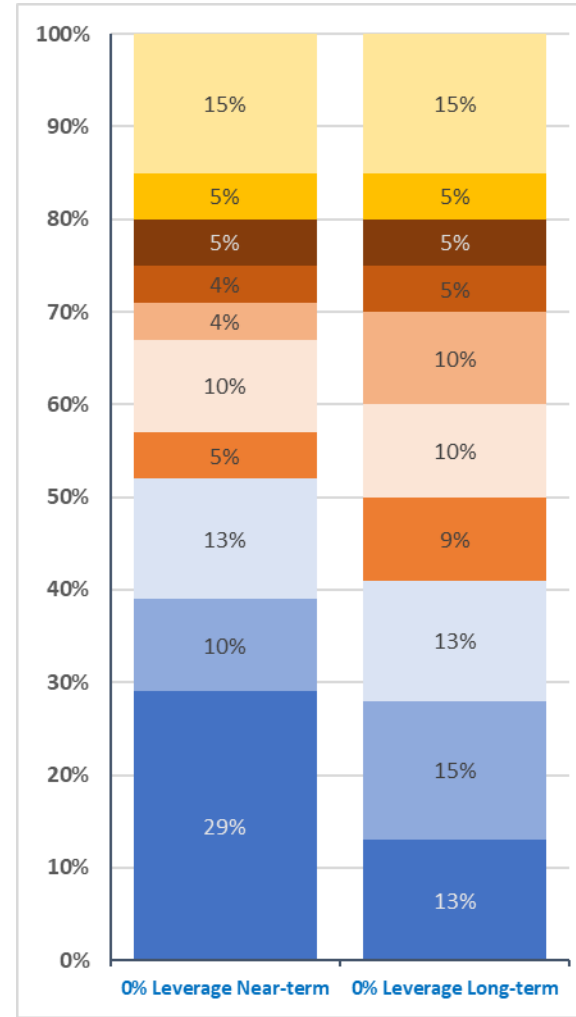
In comparison to other candidate portfolios:

Pros

- Better returns, and lower risk, than current portfolio
- Lower contribution risk and funding ratio risk

Cons

- Lower projected returns
- Less strategic diversification
- Increased exposures to PE and EM bonds likely
- Potential increased exposure to ESG issues
- Higher projected contributions



Candidate Portfolio B: higher risk/return, public assets, 10% leverage

Discount rate: 6.75%, Projected Return: 6.8%

Time Horizon	Projected Return	Drawdown Risk	Volatility
20 Years	6.8%	37.4%	16.7%
Near-term	6.8%	39.8%	17.5%
Long-term	6.9%	36.9%	16.5%

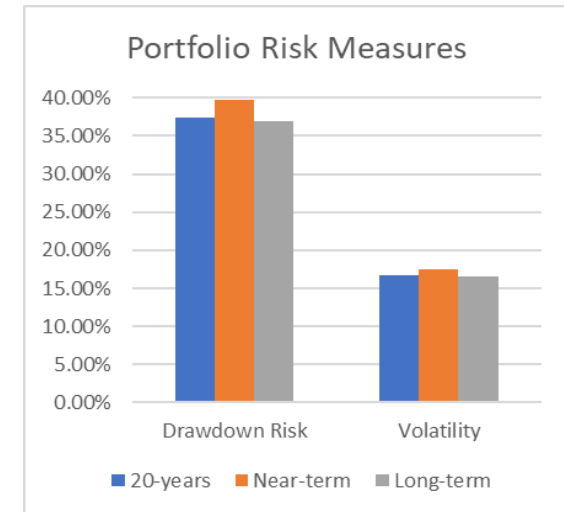
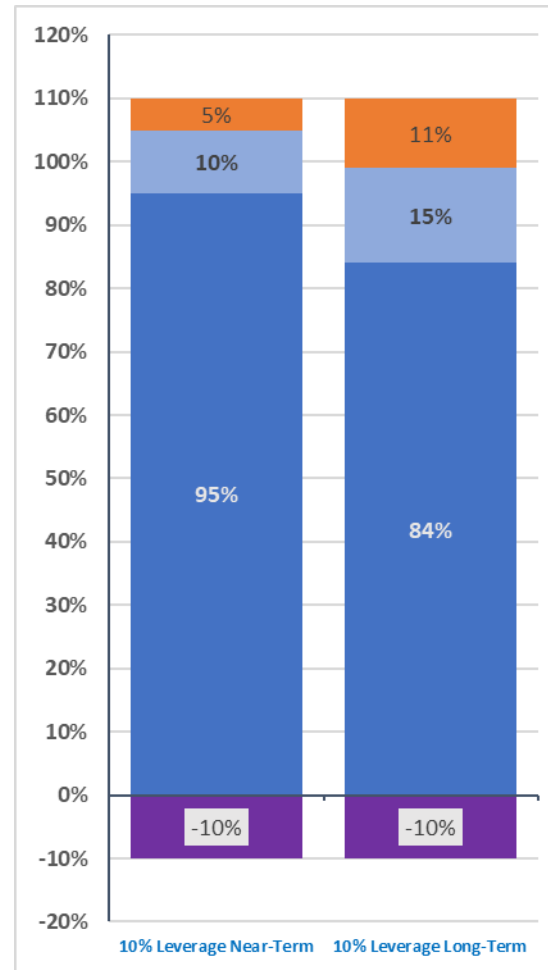
In comparison to other candidate portfolios:

Pros

- Less complexity
- Avoids possible ESG issues associated with private assets and emerging market debt

Cons

- 6.8% return not feasible without 10% leverage
- Highest drawdown risk, close to 40%
- Lowest diversification with public asset classes only
- Higher contribution risk and funding ratio risk



Candidate Portfolio C: higher risk/return, diversified

Discount rate: 6.75%, Projected Return: 6.8%

Time Horizon	Projected Return	Drawdown Risk	Volatility
20 Years	6.8%	22.9%	11.8%
Near-term	6.2%	26.3%	12.6%
Long-term	7.0%	22.0%	11.6%

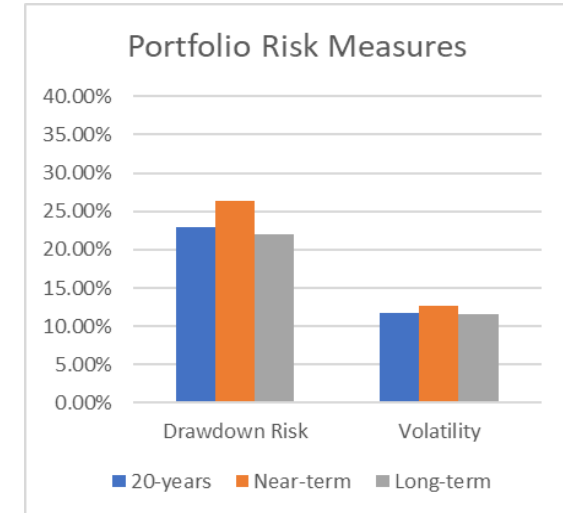
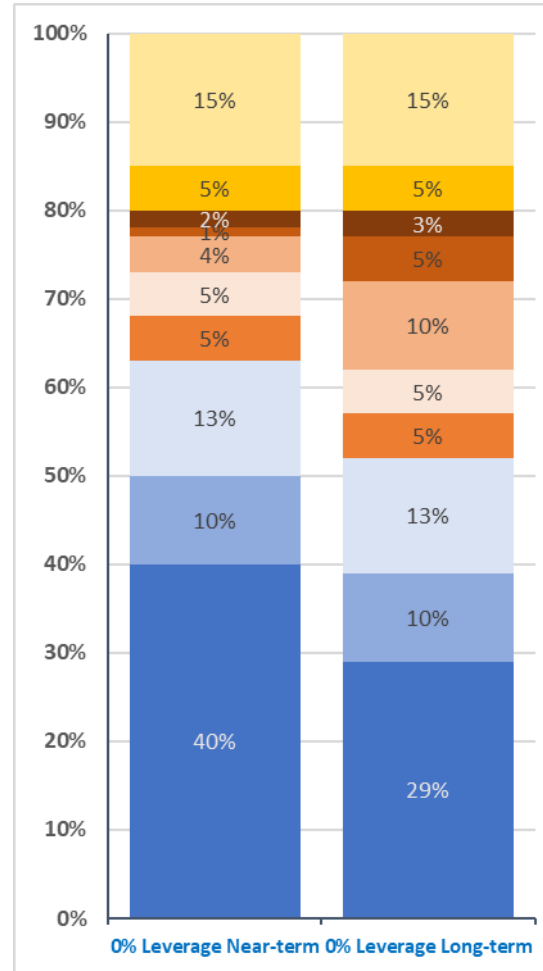
In comparison to other candidate portfolios:

Pros

- Higher returns than current portfolio
- Lower contributions

Cons

- Private asset deployment requires policy changes.
- Potential increased exposure to ESG issues
- Higher contribution and funding risk compared to portfolio A and current portfolio



- Real Assets
- Private Debt
- Emerging Market Sovereign Bonds
- High Yield
- Investment Grade Corporates
- Mortgage-backed Securities
- Treasury
- Private Equity
- Global Equity_Non-Cap-weighted
- Global Equity_Cap-weighted

Candidate Portfolio D: higher risk/return, diversified, 5% leverage

Discount rate: 6.75%, Projected Return: 6.8%

Time Horizon	Projected Return	Drawdown Risk	Volatility
20 Years	6.8%	22.1%	11.6%
Near-term	6.4%	27.2%	13.0%
Long-term	7.0%	20.8%	11.1%

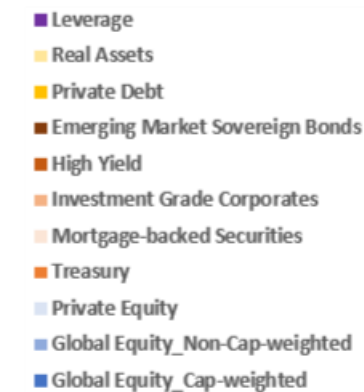
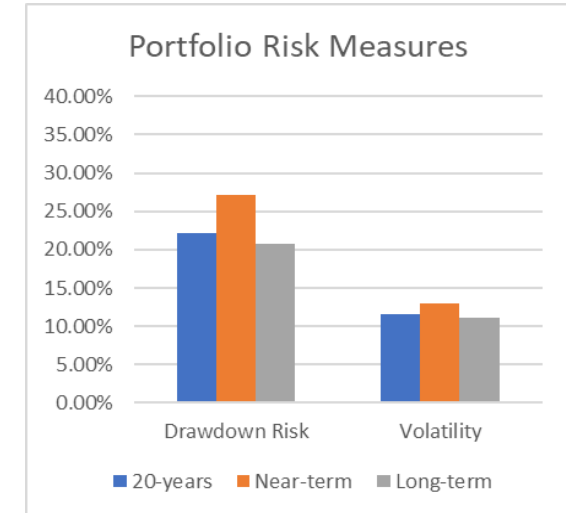
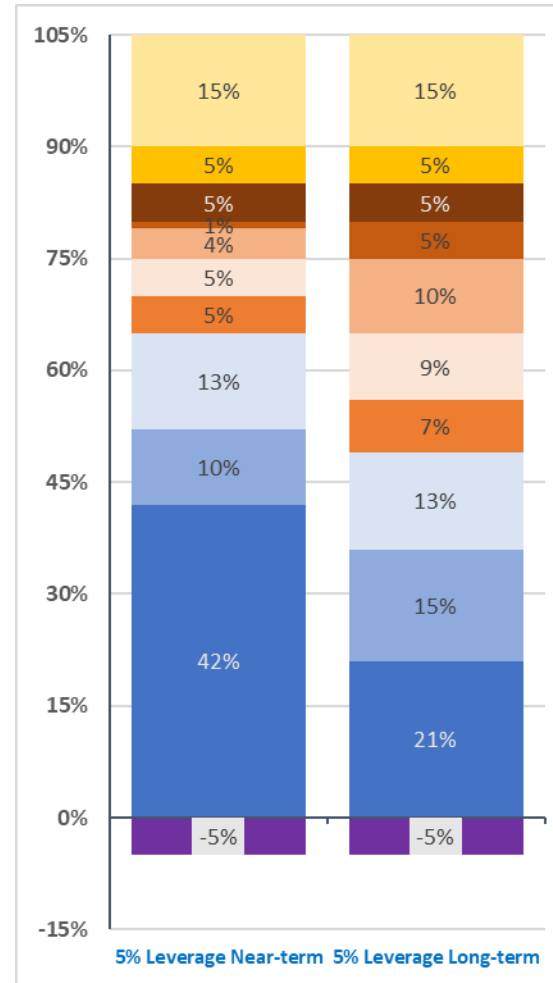
In comparison to other candidate portfolios:

Pros

- Higher returns than current portfolio
- In the long-term, more diversification than unlevered
- Lower contributions

Cons

- More complexity with leverage
- Private asset deployment requires policy changes
- Potential increased exposure to ESG issues
- Higher contribution and funding risk compared to portfolio A and current portfolio



Candidate Portfolio E: highest risk/return, diversified, 5% leverage

Discount rate: 7.0%, Projected Return: 7.0%

Time Horizon	Projected Return	Drawdown Risk	Volatility
20 Years	7.0%	24.5%	12.5%
Near-term	6.4%	28.2%	13.4%
Long-term	7.2%	23.6%	12.2%

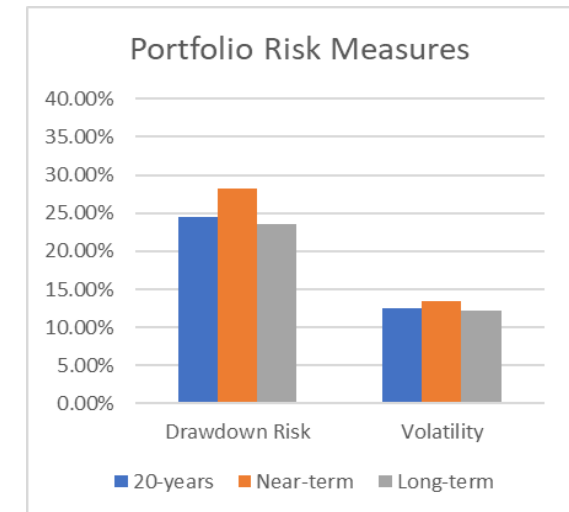
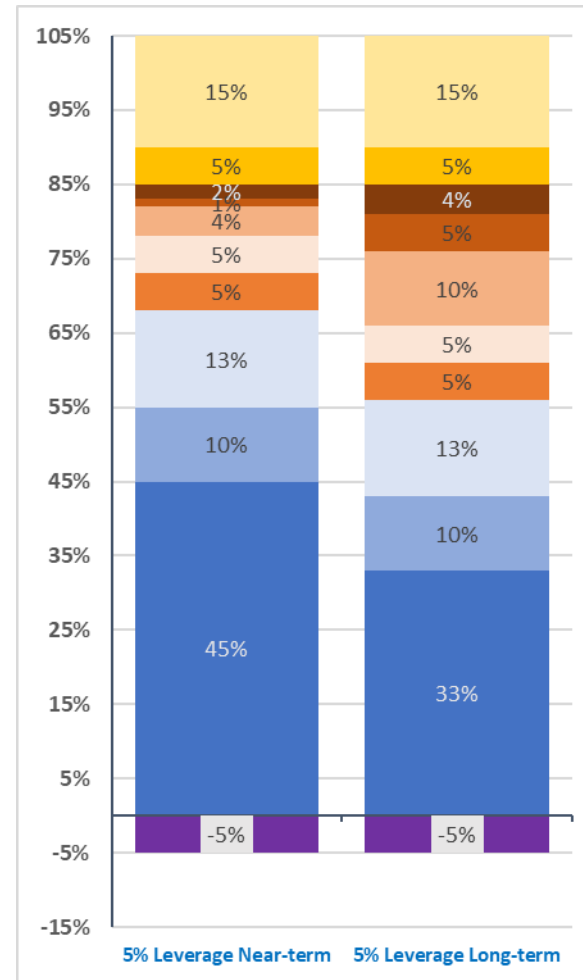
In comparison to other candidate portfolios:

Pros

- Highest projected return at 7.0%
- Highest discount rate
- Lowest projected contributions

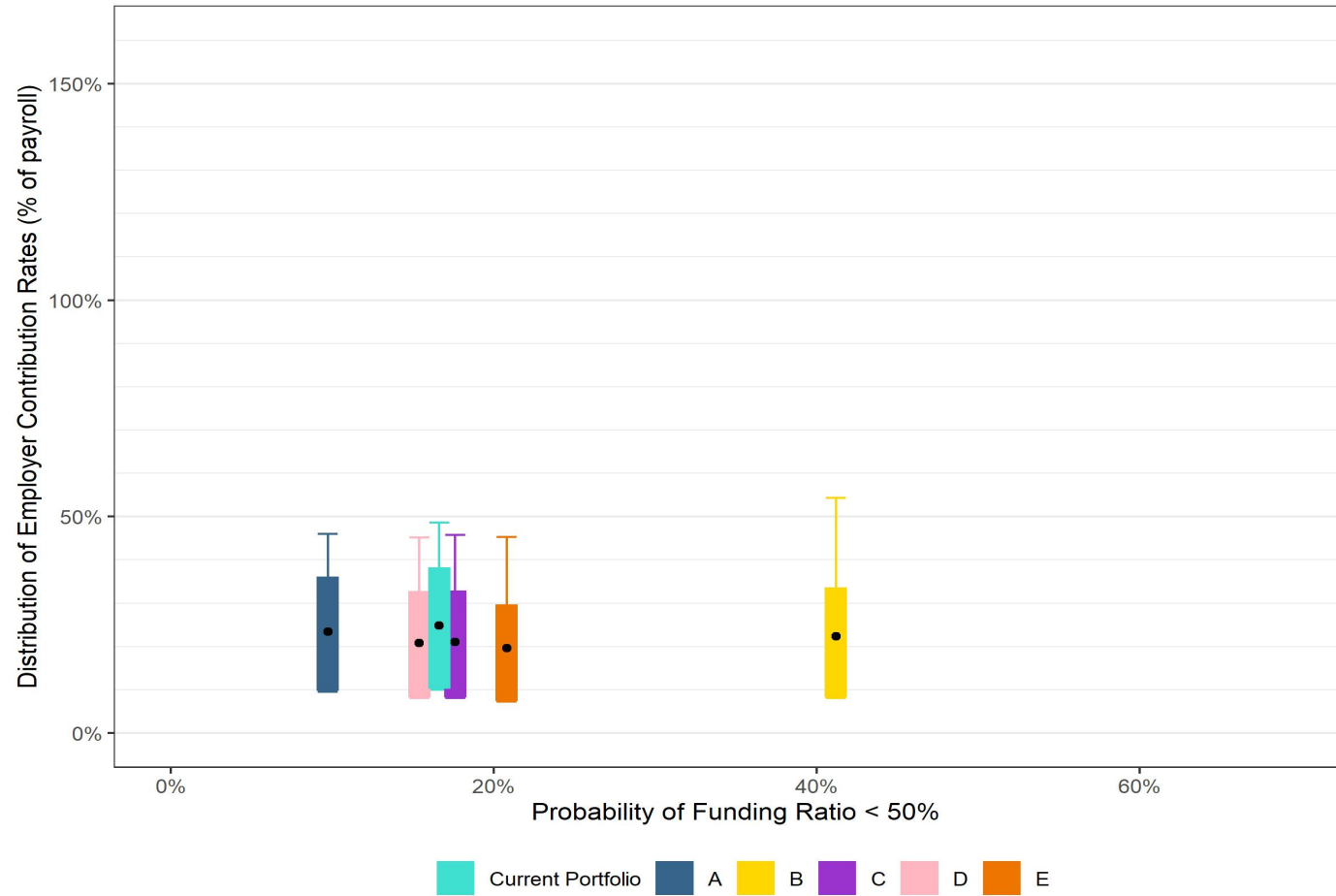
Cons

- 7.0% return target not feasible without 5% leverage
- Private asset deployment requires policy changes
- Potential increased exposure to ESG issues
- Higher portfolio, contribution and funding risk compared to portfolio A and current portfolio



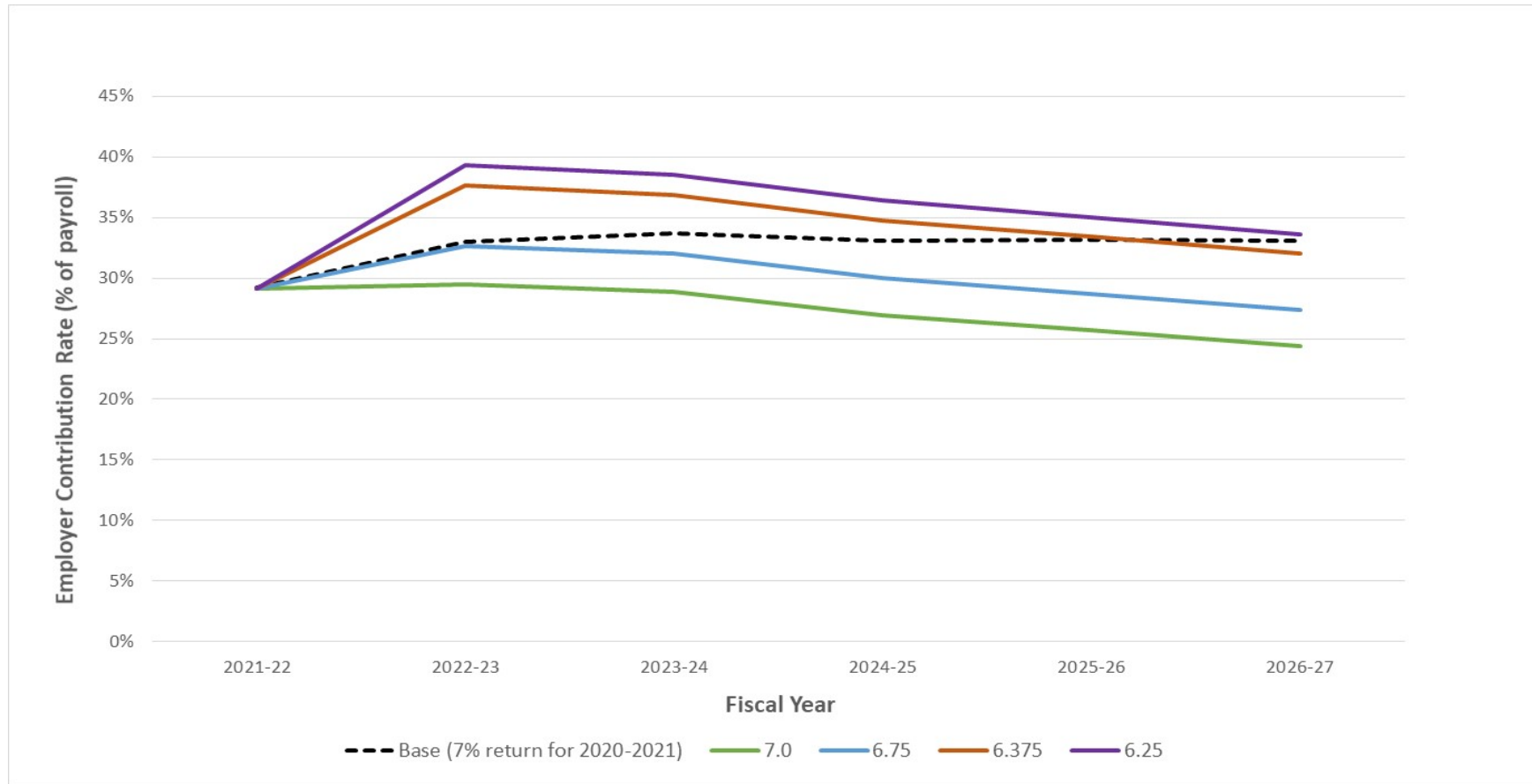
Employer Analysis – State Miscellaneous: Baseline

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



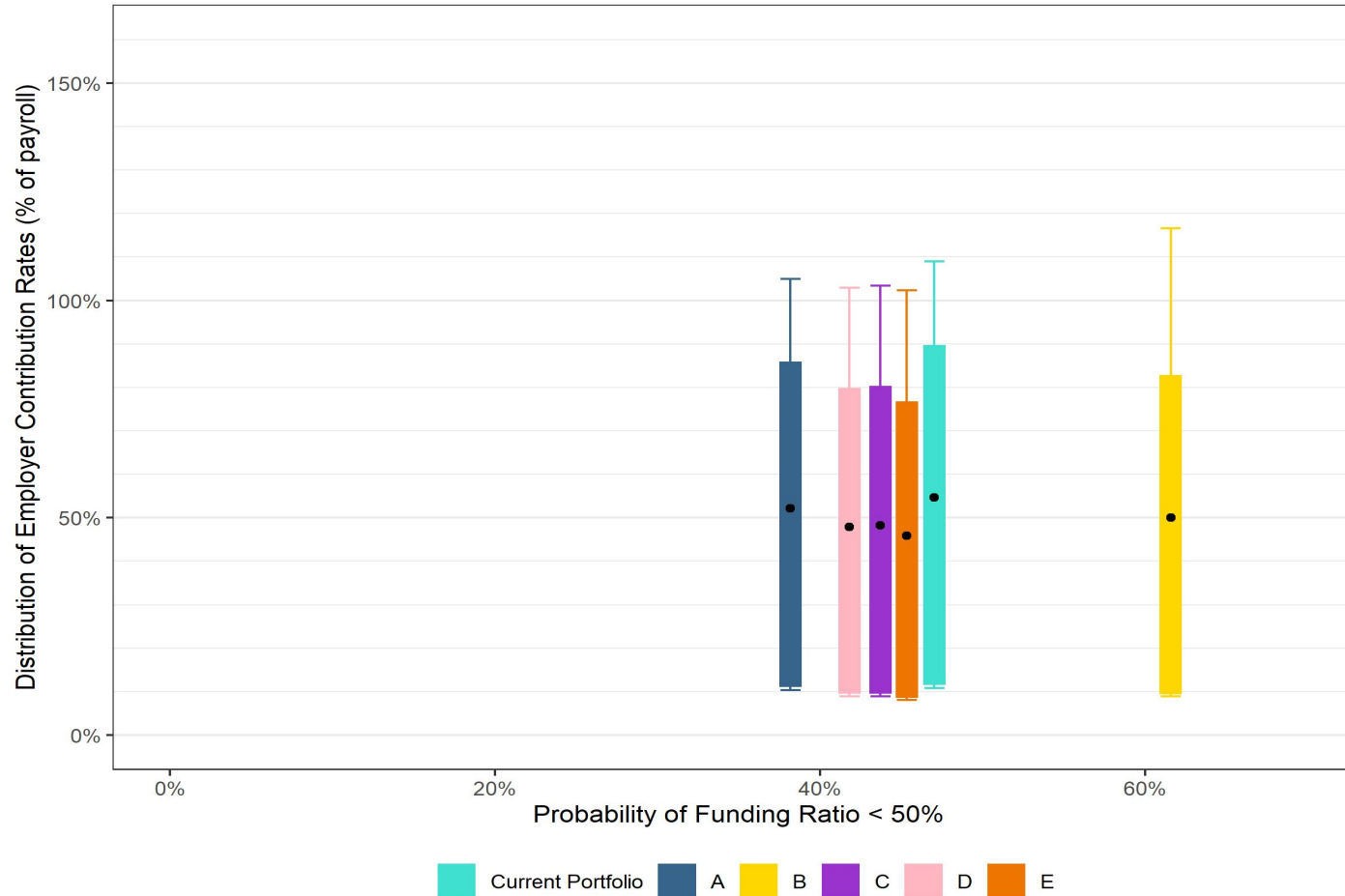
Employer Contribution Analysis – State Misc. Plan: Baseline

Projected Employer Contributions Rates Under Alternate Discount Rates Assuming Future Experience Matches Assumptions

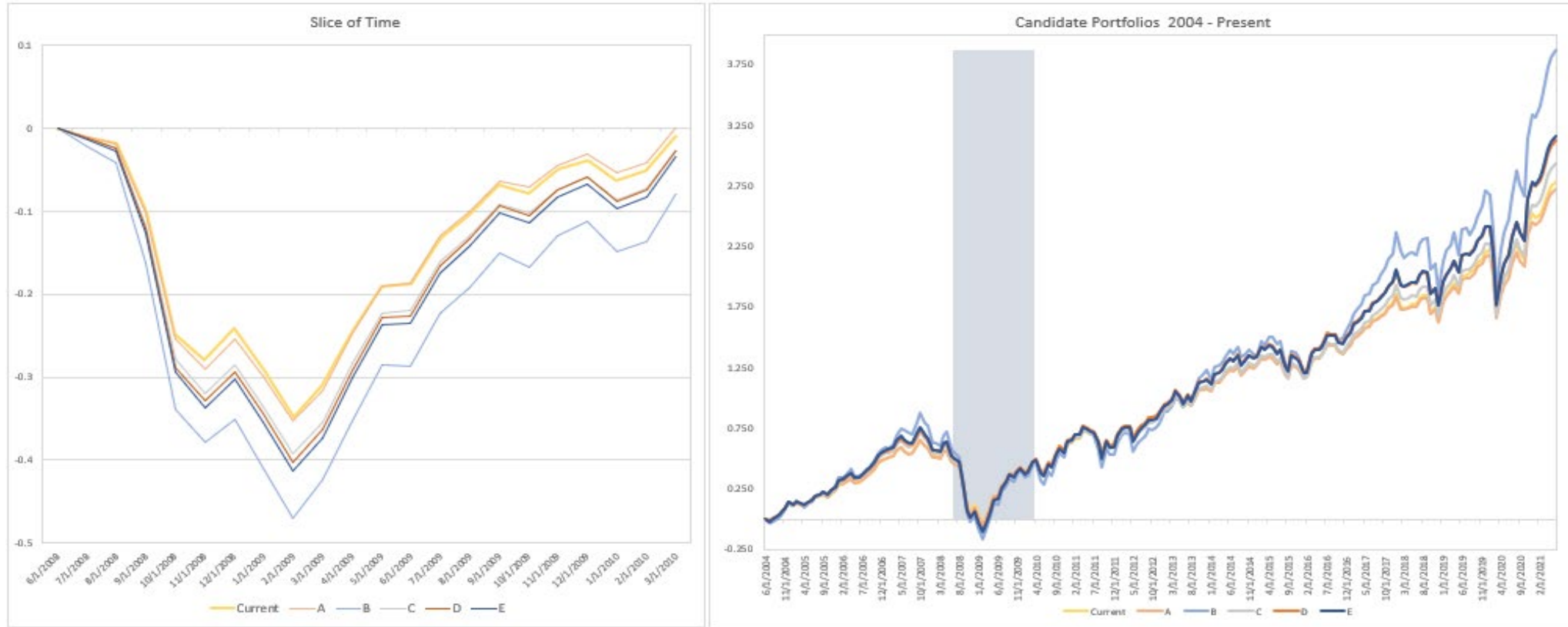


Employer Analysis – Lower Funded Misc. Plan: Baseline

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



Candidate Portfolio Historical Returns Test

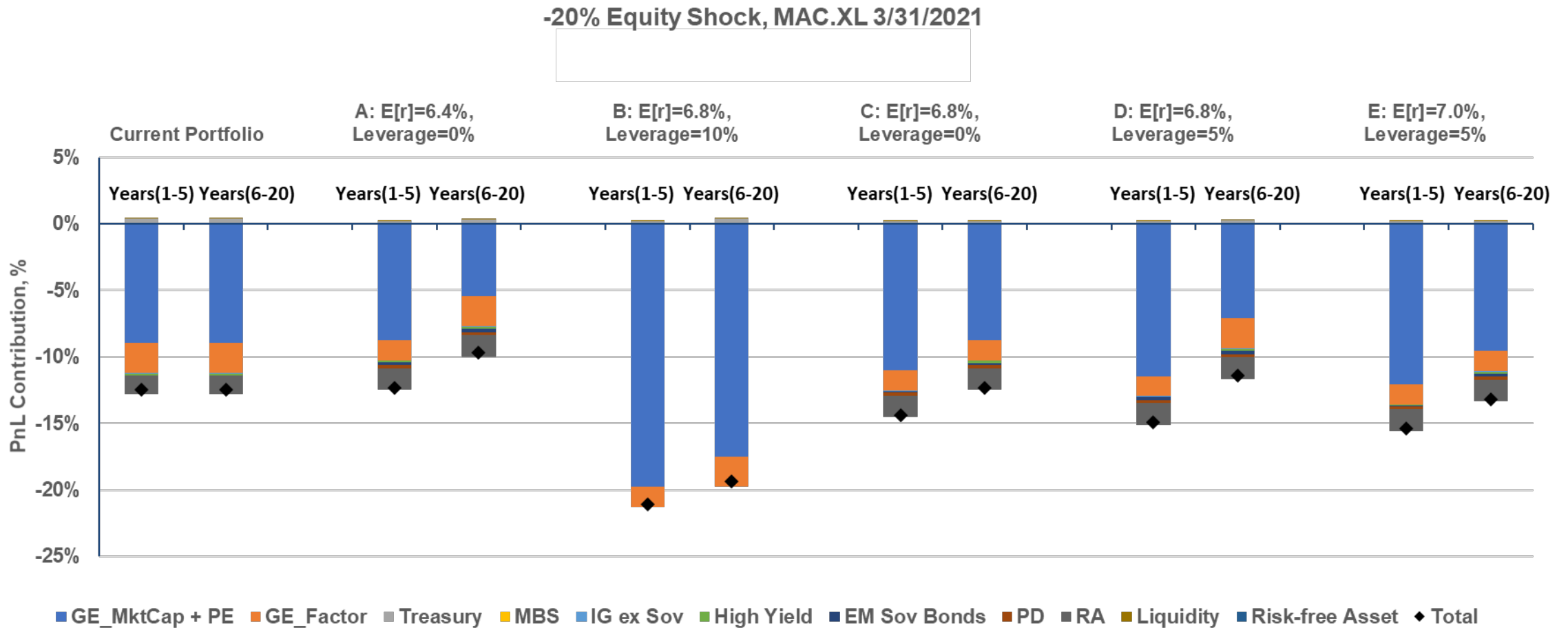


June 04 – June 21	Current	A	B	C	D	E
Return	8.1%	8.0%	9.8%	8.4%	8.7%	8.7%
Max Drawdown	-42%	-42%	-55%	-47%	-48%	-49%
Volatility	11.0%	11.2%	15.9%	12.5%	12.9%	13.3%

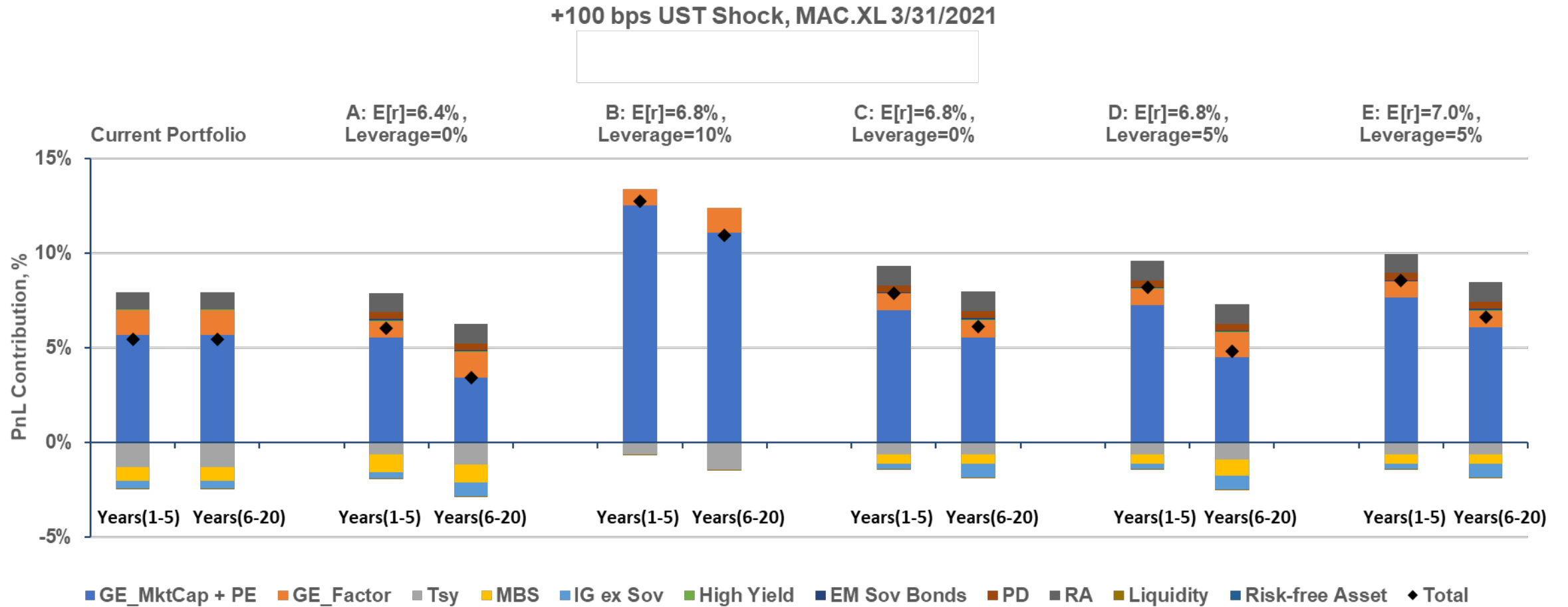
Data: Candidate Portfolio Historical Return Profile with PERF Benchmarks, 1-5 Year MPO Asset Weights



Candidate Portfolio Stress Test: Equities Down 20%



Candidate Portfolio Stress Test: Interest Rates Up 1%



Data : Candidate Portfolio Historical Return Profile with PERF Benchmarks and MPO Asset Weights
 Results : MSCI Barra Application

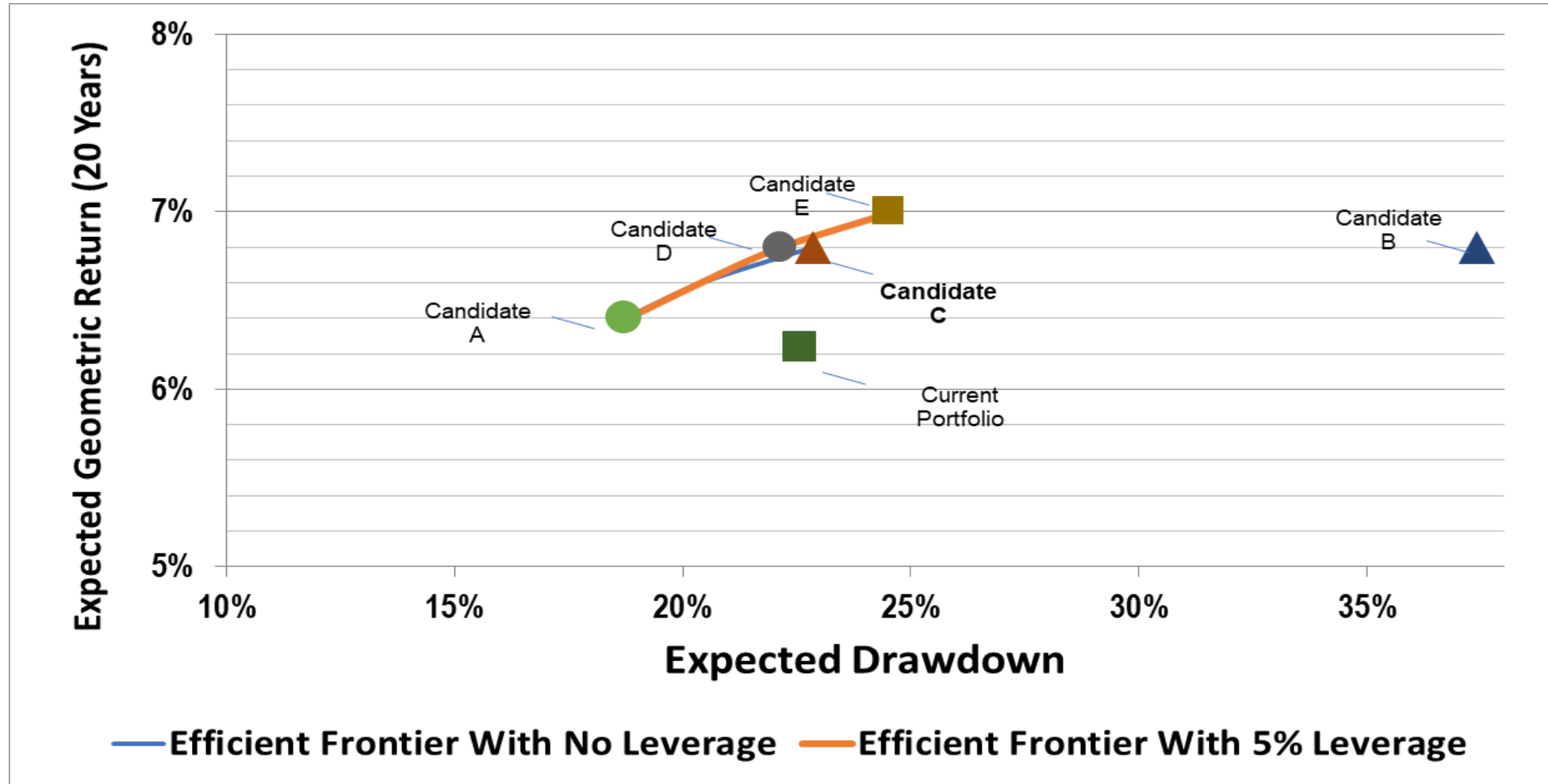
Economic Scenario Analysis

In general, though overall returns differ by economic upside or downside scenario, the base portfolio compares well to risk equivalent optimal portfolios in the upside and downside scenario.

Portfolio	Projected Returns by Economic Scenario				
	Base case	Downside	Downside Optimal Portfolio	Upside	Upside Optimal Portfolio
Current	6.2%	5.9%	5.9%	6.9%	6.9%
Candidate A	6.4%	6.0%	6.0%	7.0%	7.0%
Candidate B	6.8%	6.4%	6.4%	7.6%	7.6%
Candidate C	6.8%	6.3%	6.3%	7.5%	7.5%
Candidate D	6.8%	6.3%	6.4%	7.4%	7.5%
Candidate E	7.0%	6.5%	6.5%	7.7%	7.7%

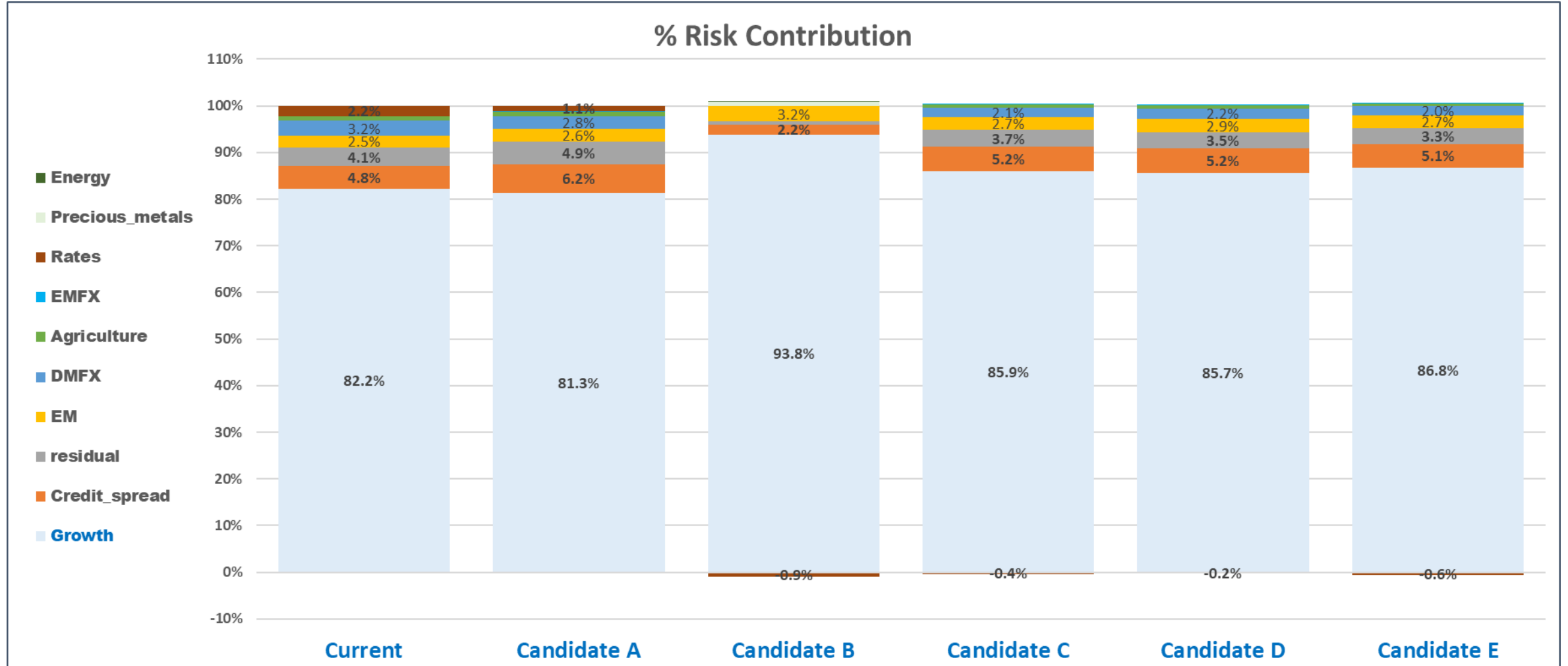
Appendix

Portfolio Comparison – Efficient Frontier



Data: Candidate Portfolios and Current Portfolio MPO Key Performance Indicators

Candidate Portfolios Macro Risk Factors

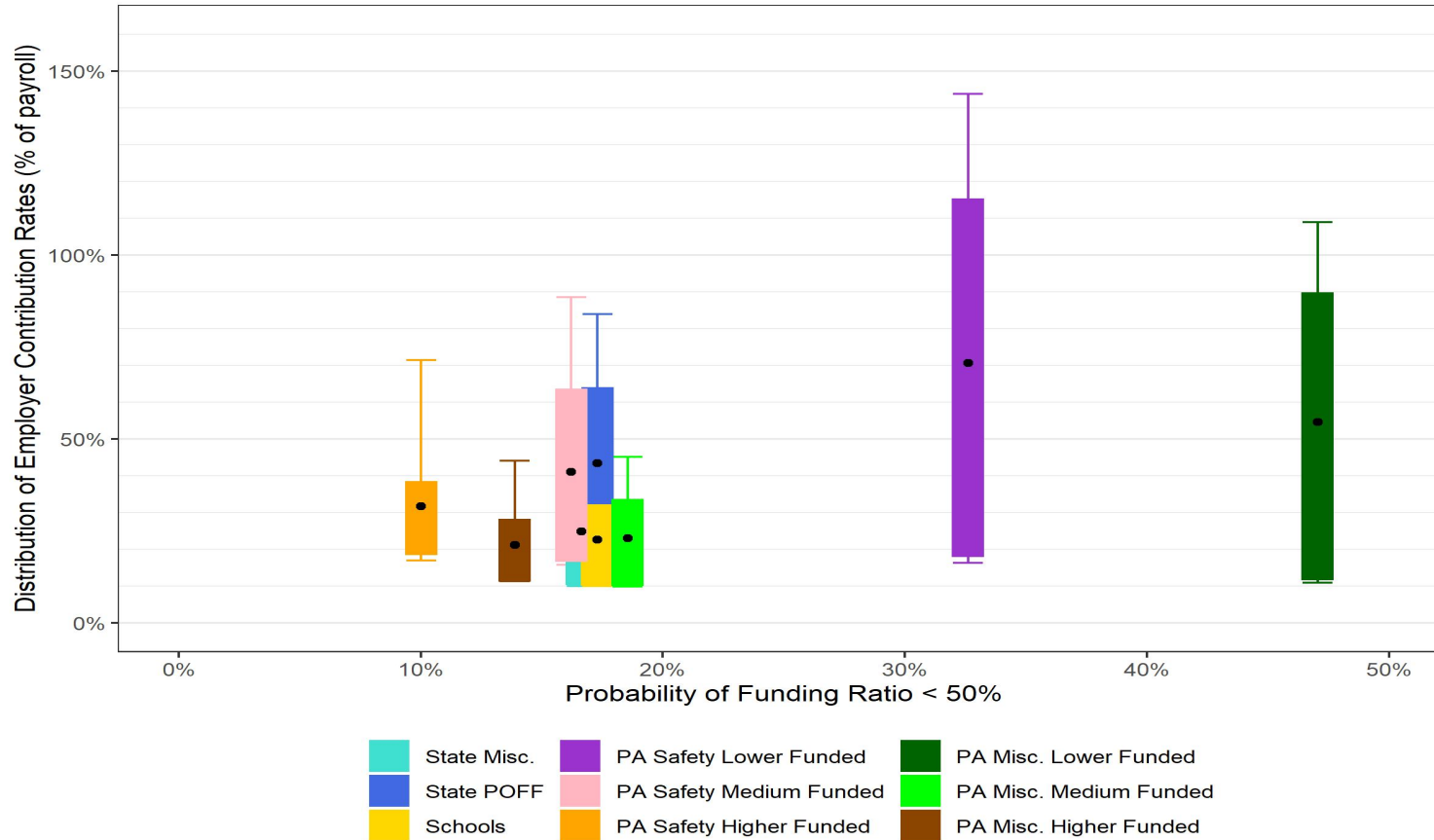


Portfolios Near-term Weights for Historical Returns up to 6/30/2021
 Source: DB Macro Risk Factor analysis code (model factor input data as of 8/19/2021)



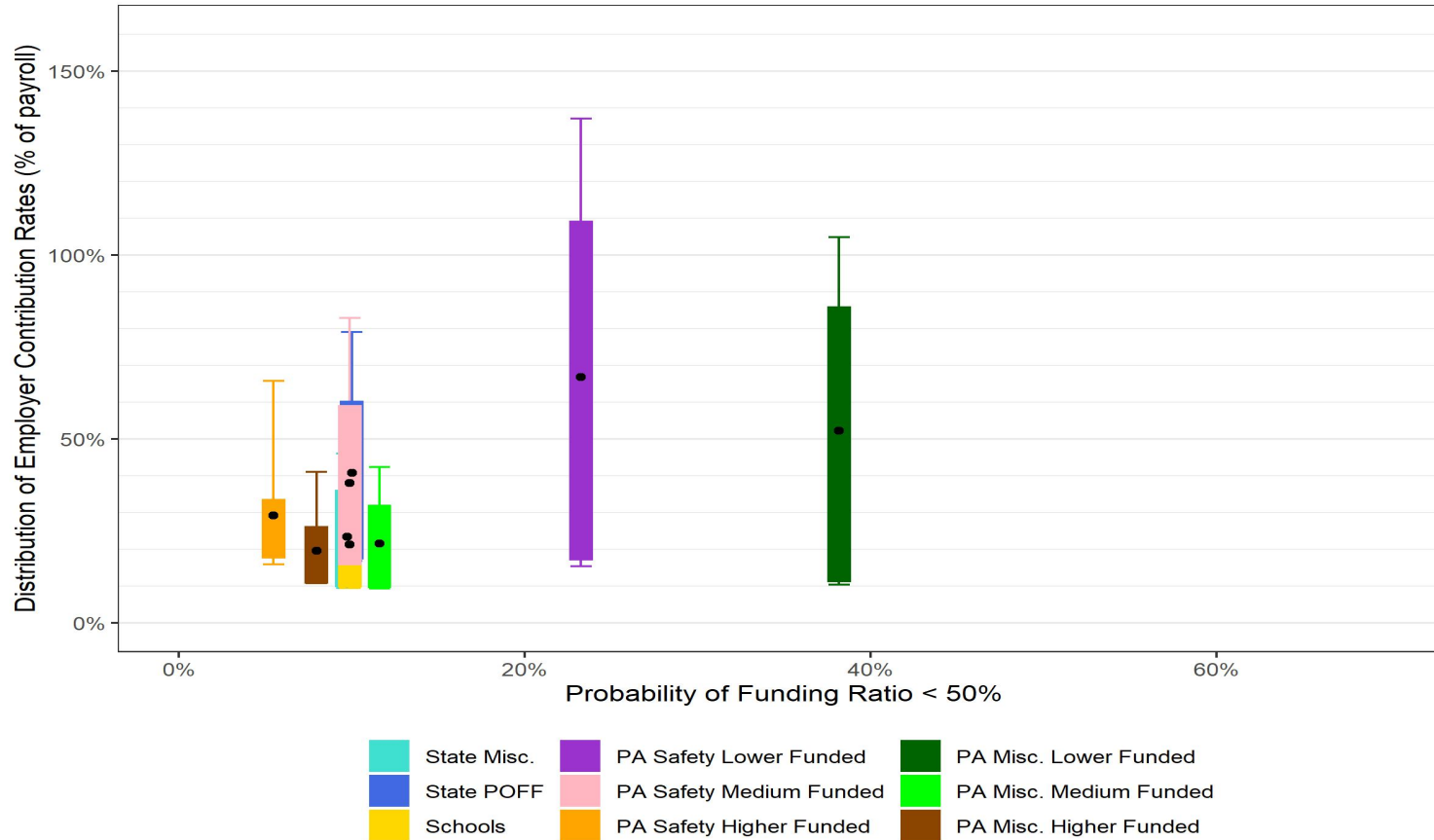
Current Portfolio: status quo

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



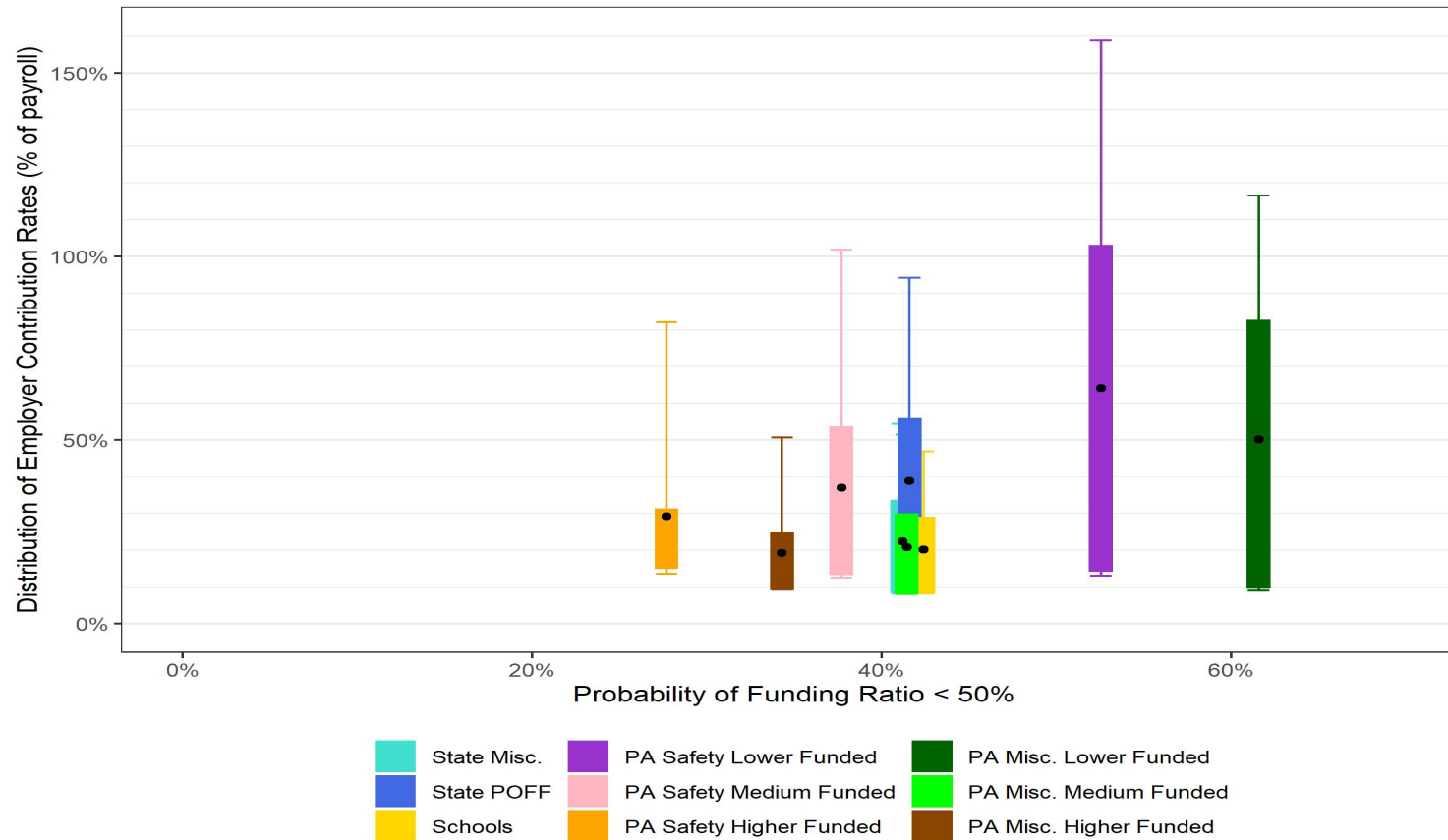
Candidate Portfolio A: lower risk/return

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



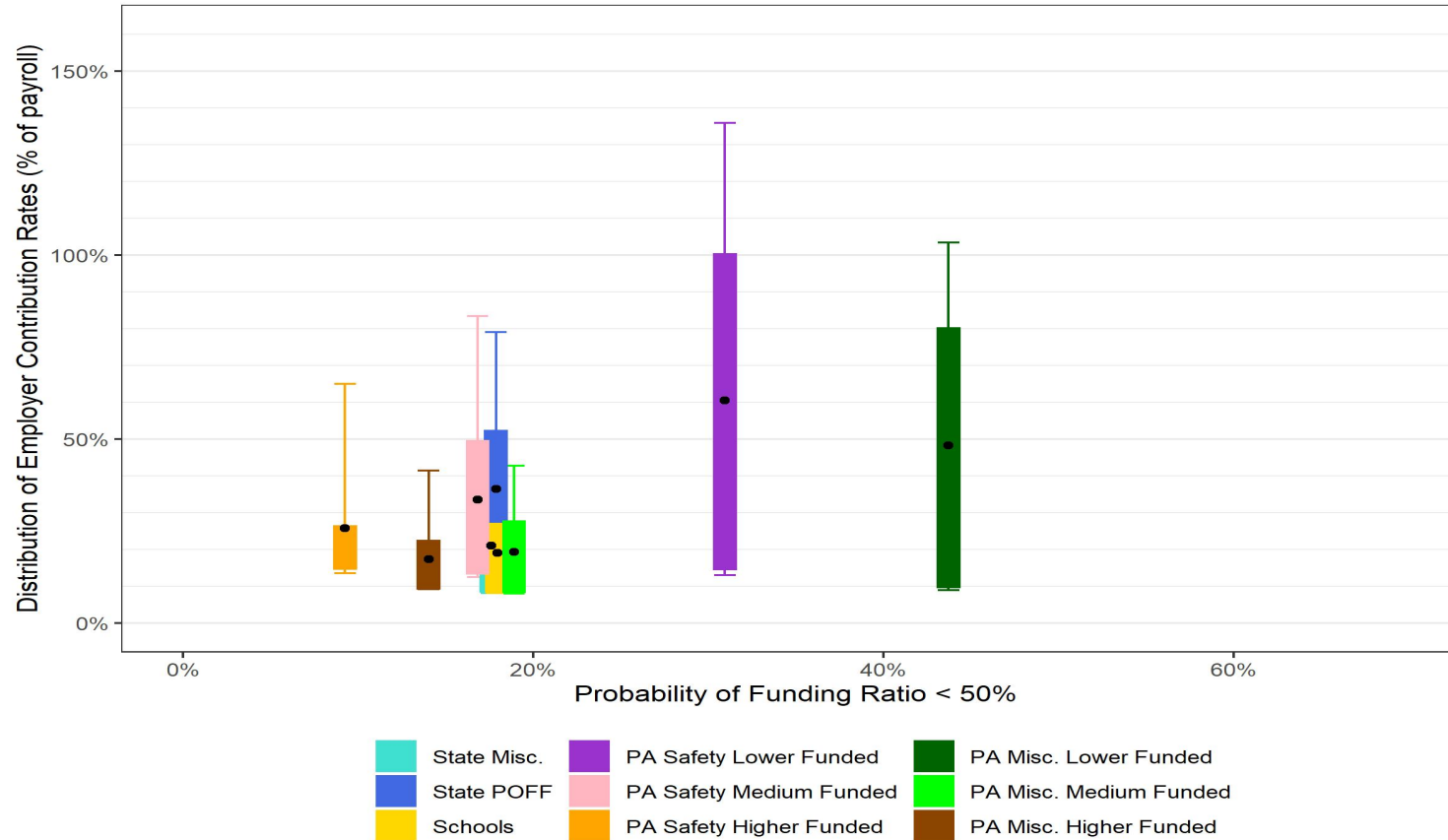
Candidate Portfolio B: higher risk/return, public assets, 10% leverage

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



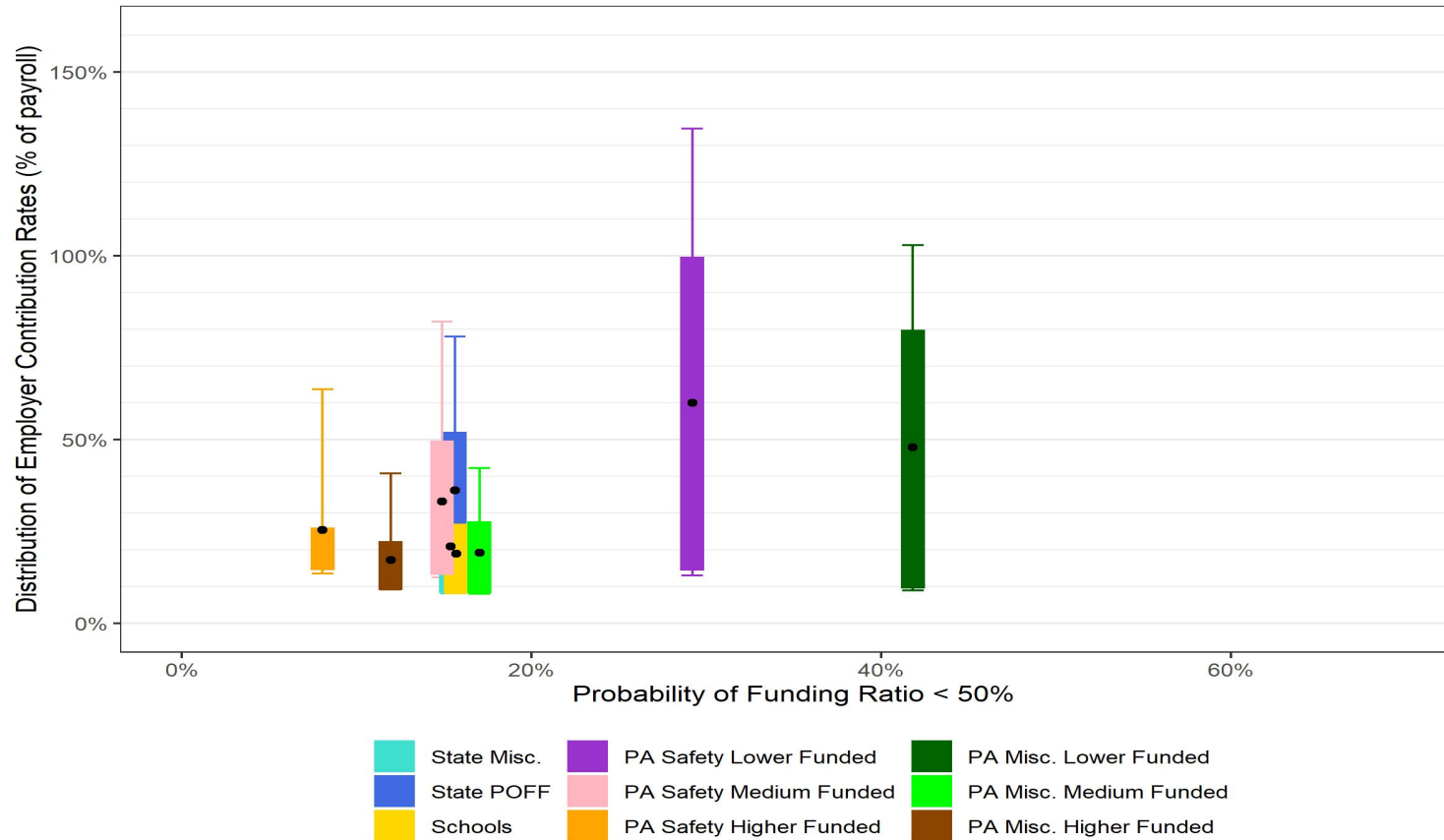
Candidate Portfolio C: higher risk/return, diversified

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



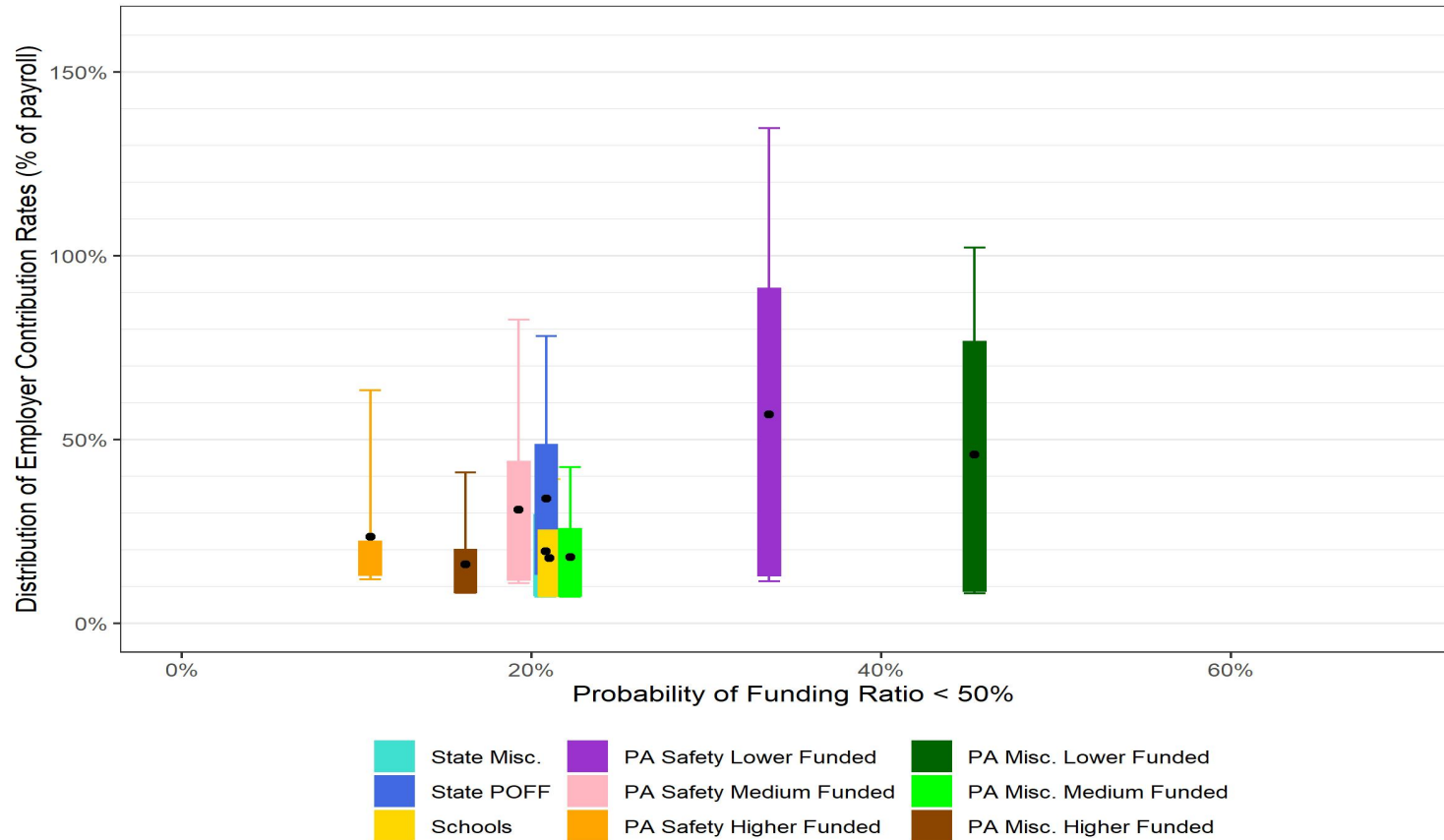
Candidate Portfolio D: higher risk/return, diversified, 5% leverage

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



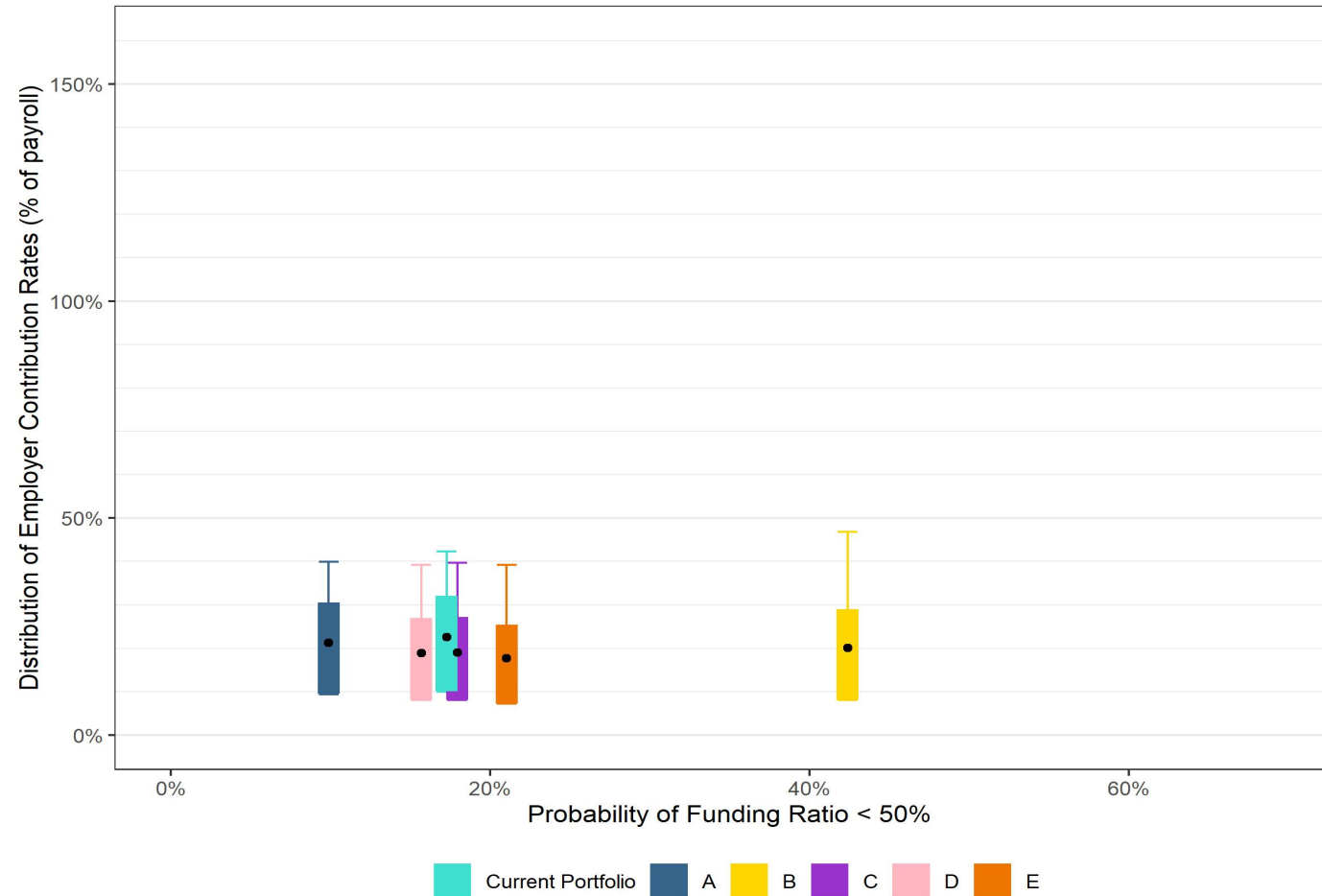
Candidate Portfolio E: highest risk/return, diversified, 5% leverage

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



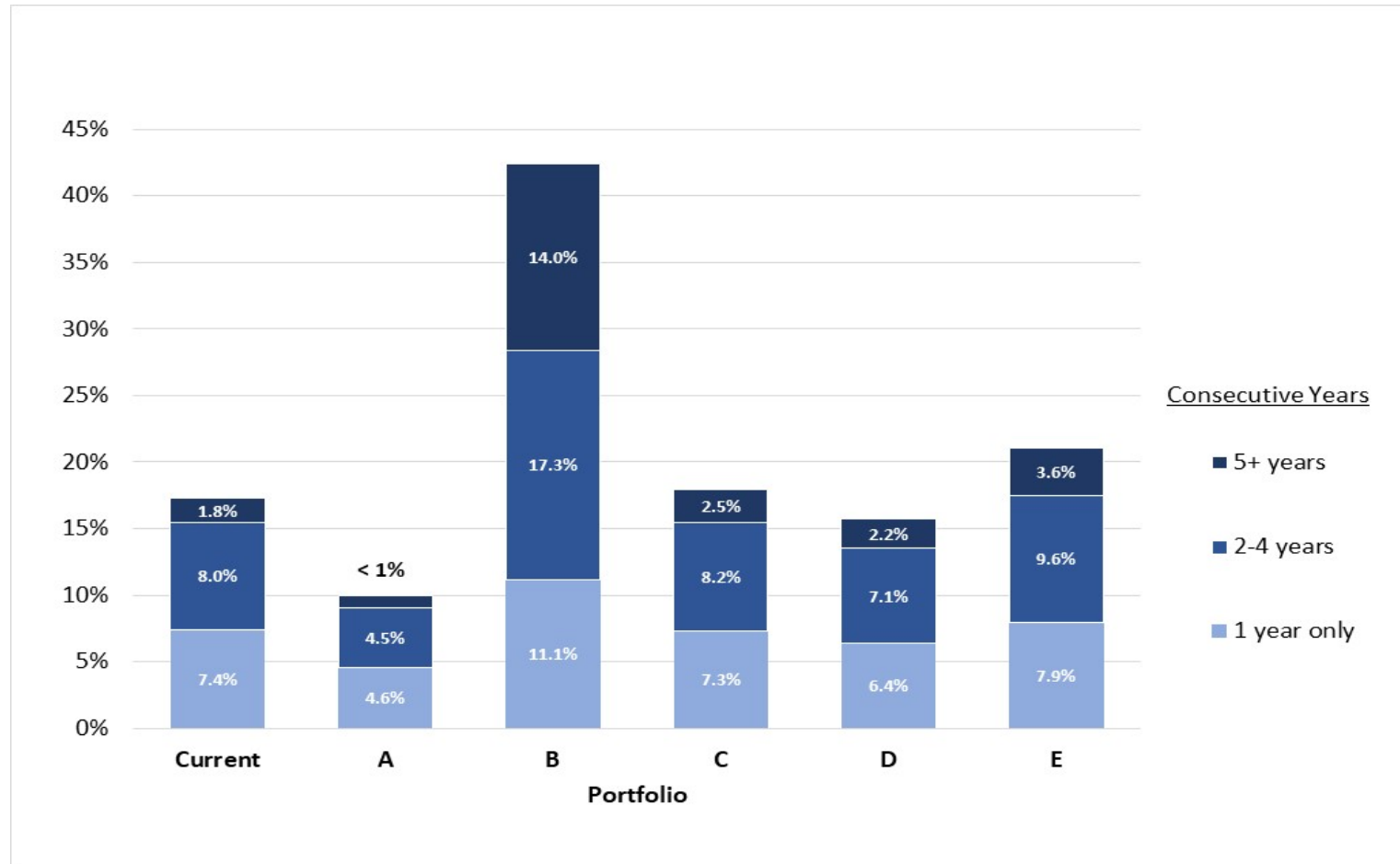
Employer Analysis – Schools: Baseline Economic Scenario

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



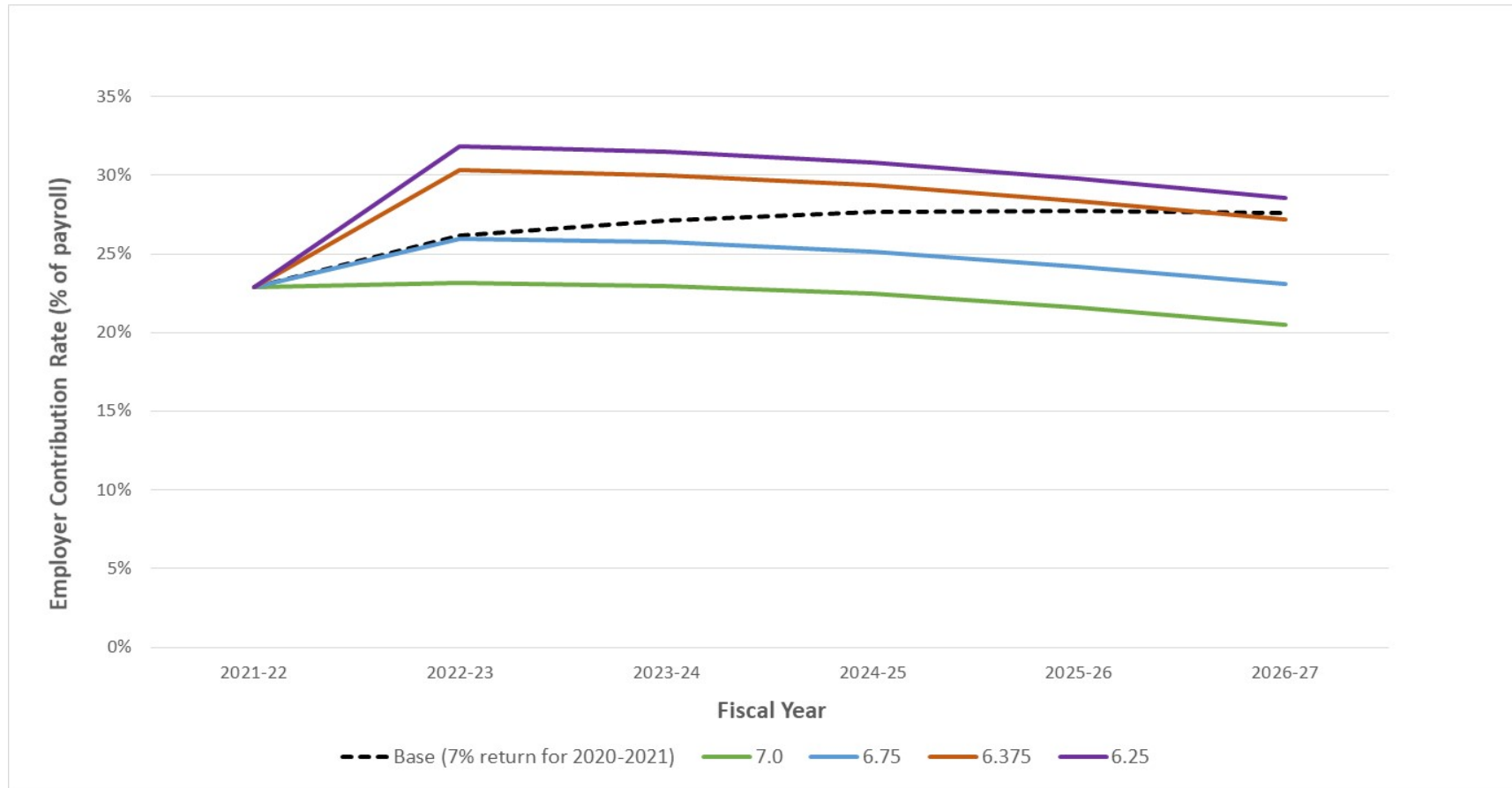
Employer Analysis – Schools Plan: Baseline

Probability of Funded Status Below 50% for Various Consecutive Year Periods



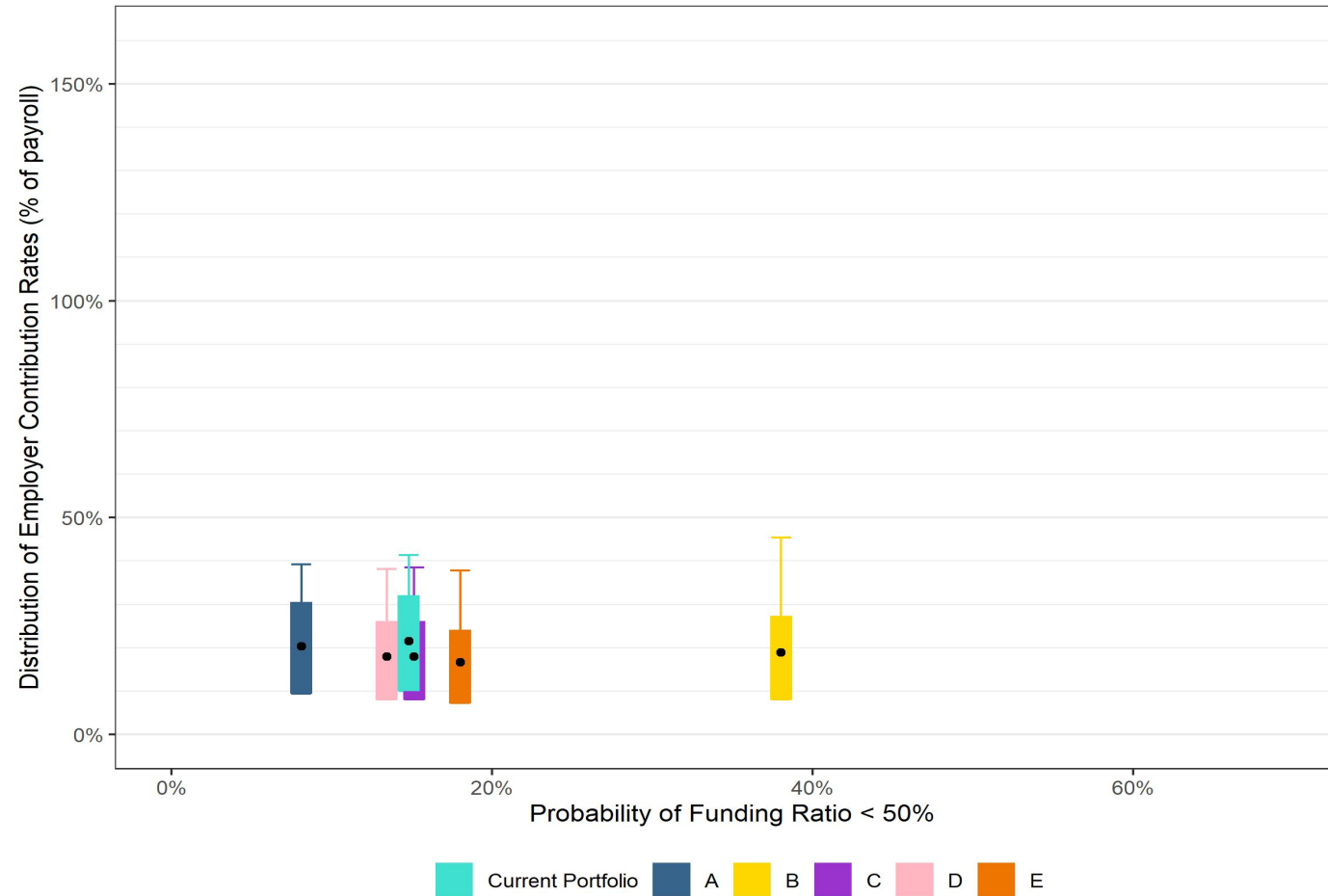
Employer Contribution Analysis – Schools: Baseline

Projected Employer Contributions Rates Under Alternate Discount Rates Assuming Future Experience Matches Assumptions



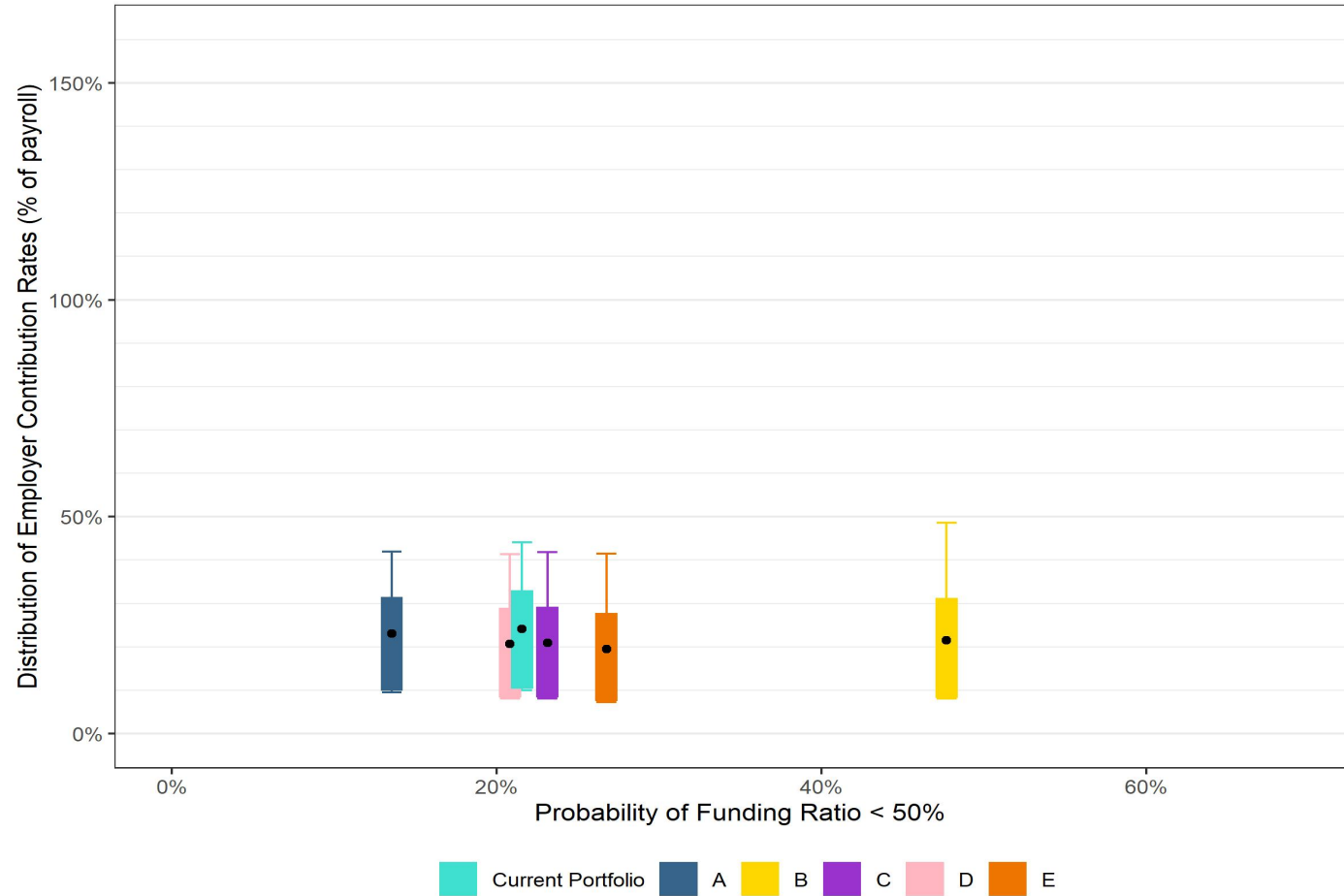
Employer Analysis – Schools: Upside Economic Scenario

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



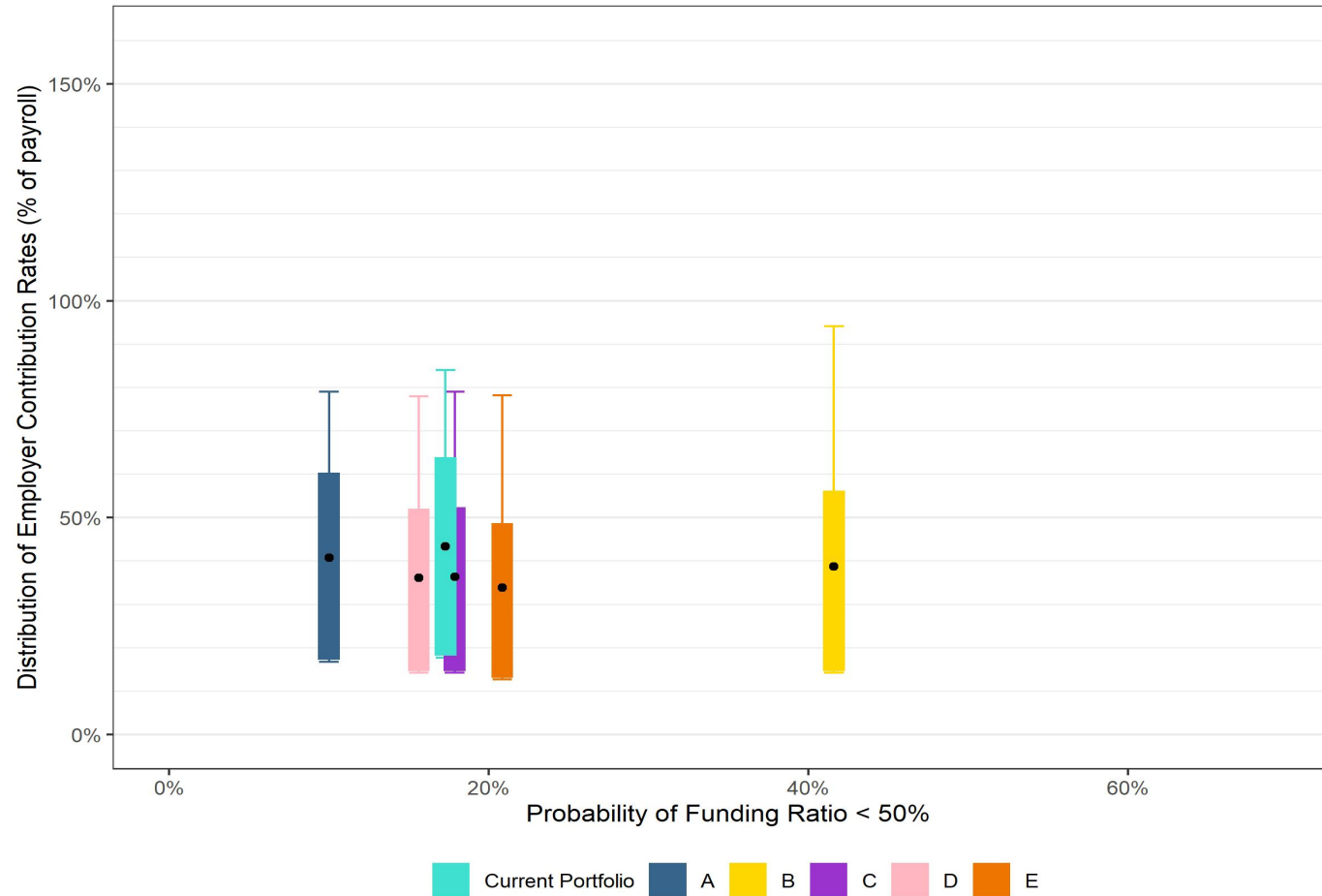
Employer Analysis – Schools: Downside Economic Scenario

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



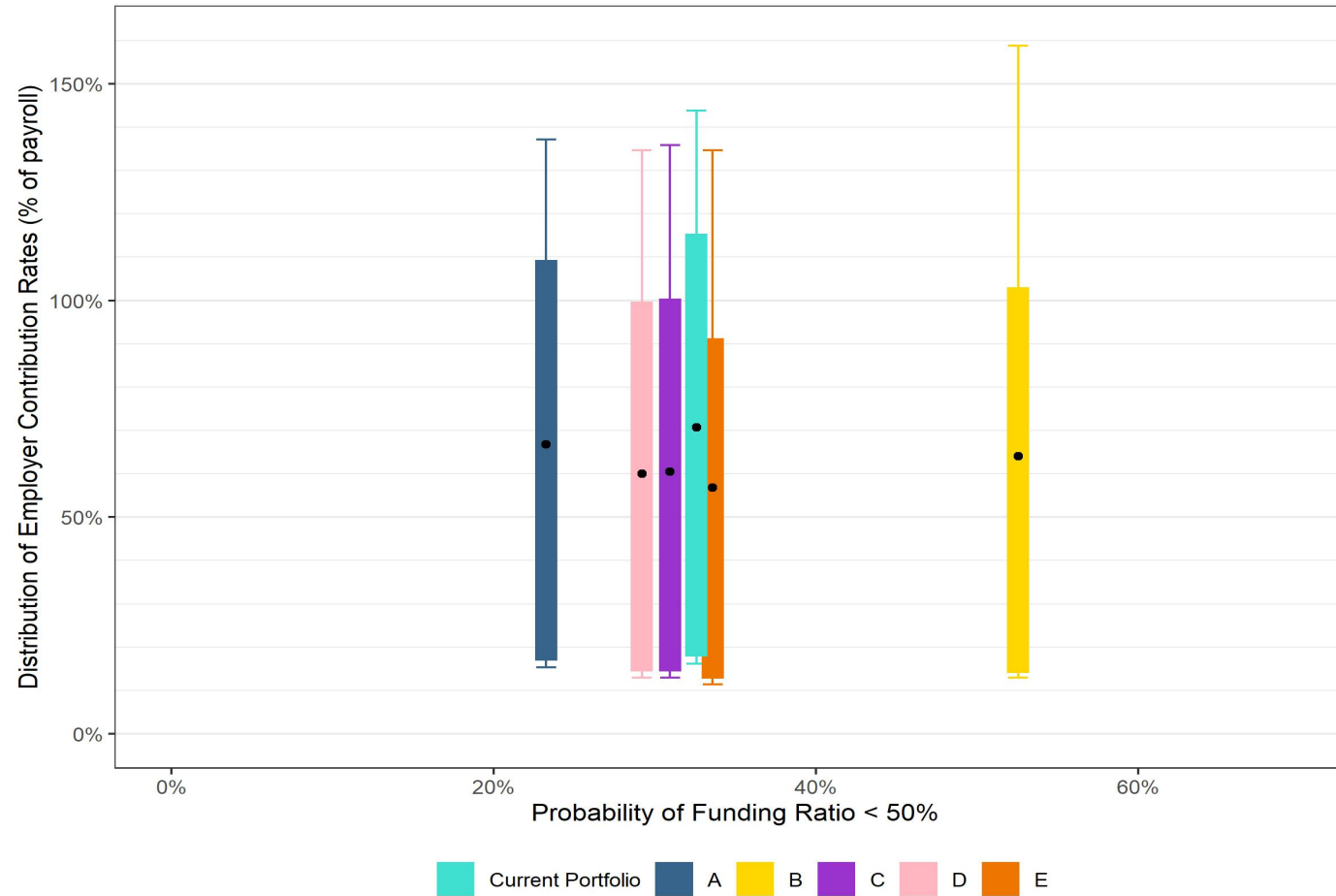
Employer Analysis – State POFF: Baseline

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



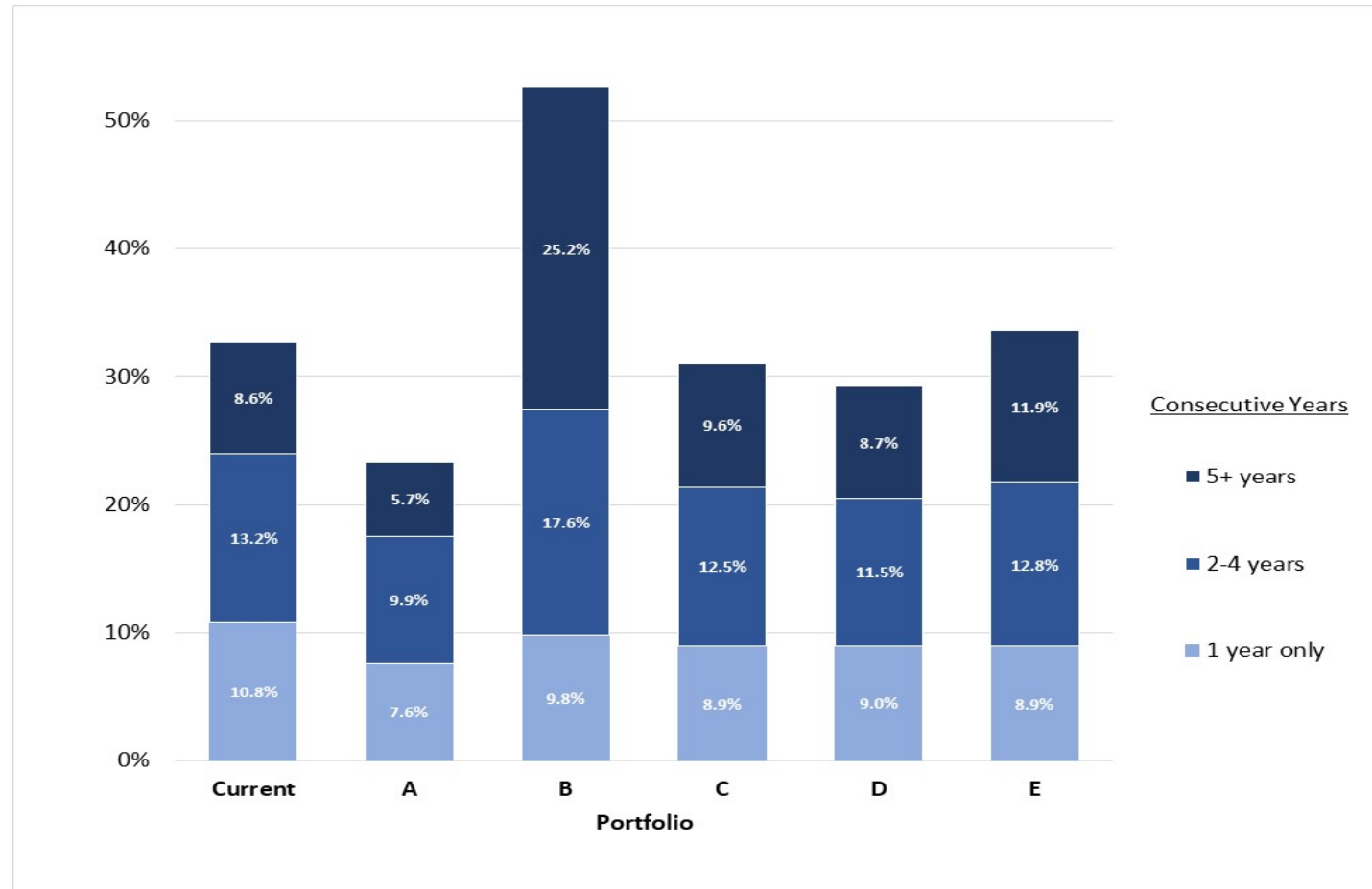
Employer Analysis – Lower Funded Safety Plan: Baseline

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



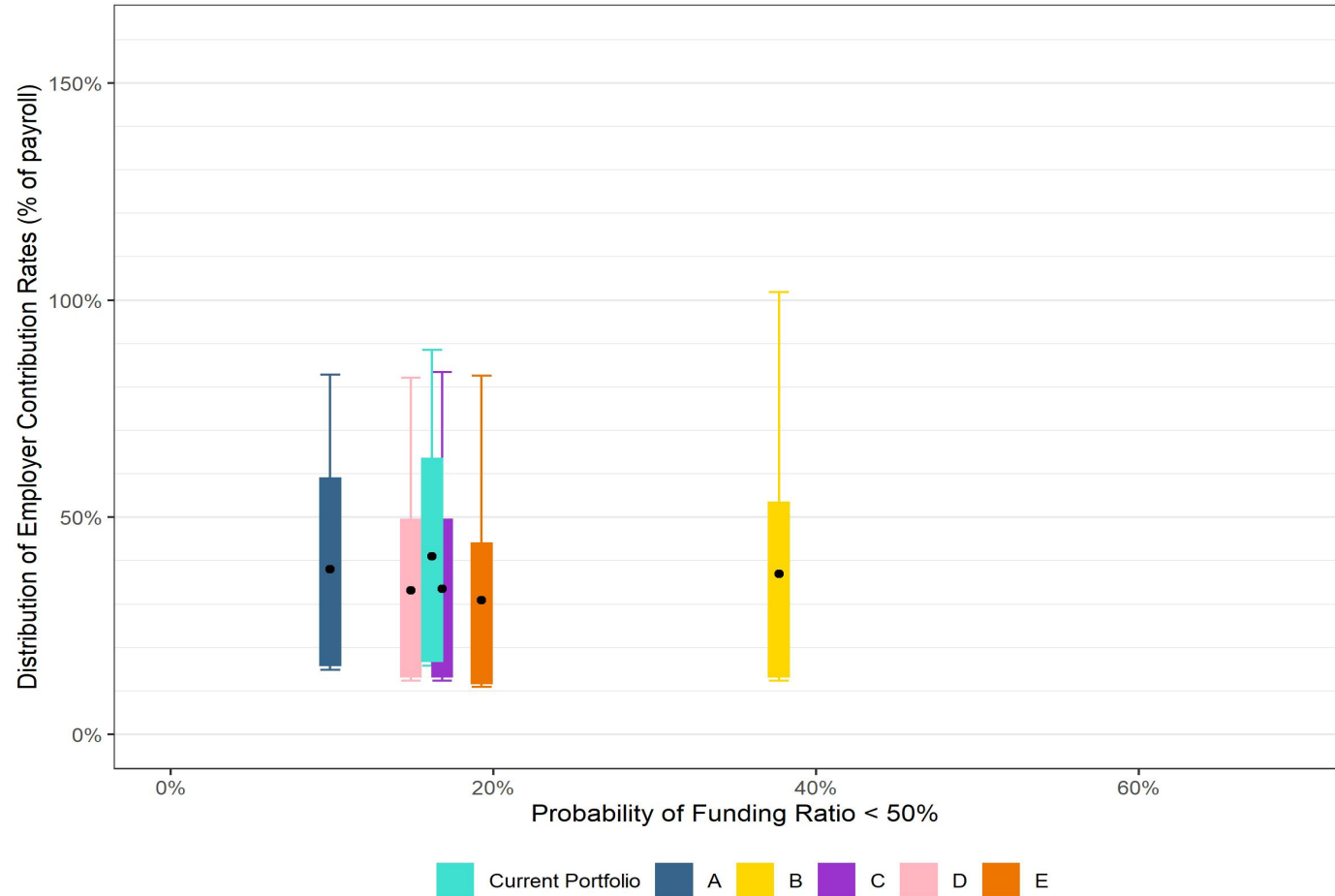
Employer Analysis – Lower Funded Safety Plan: Baseline

Probability of Funded Status Below 50% for Various Consecutive Year Periods



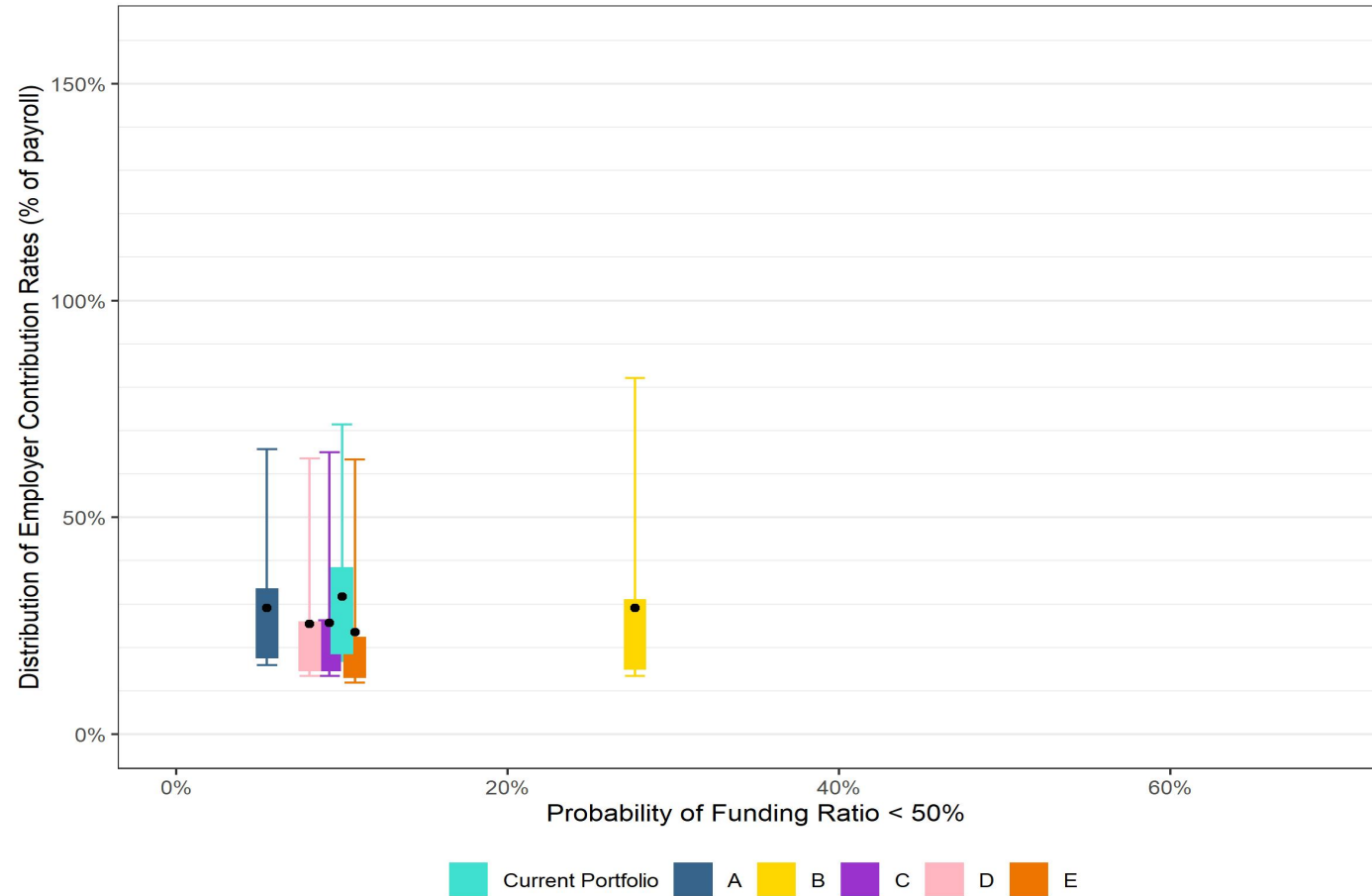
Employer Analysis – Medium Funded Safety Plan: Baseline

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



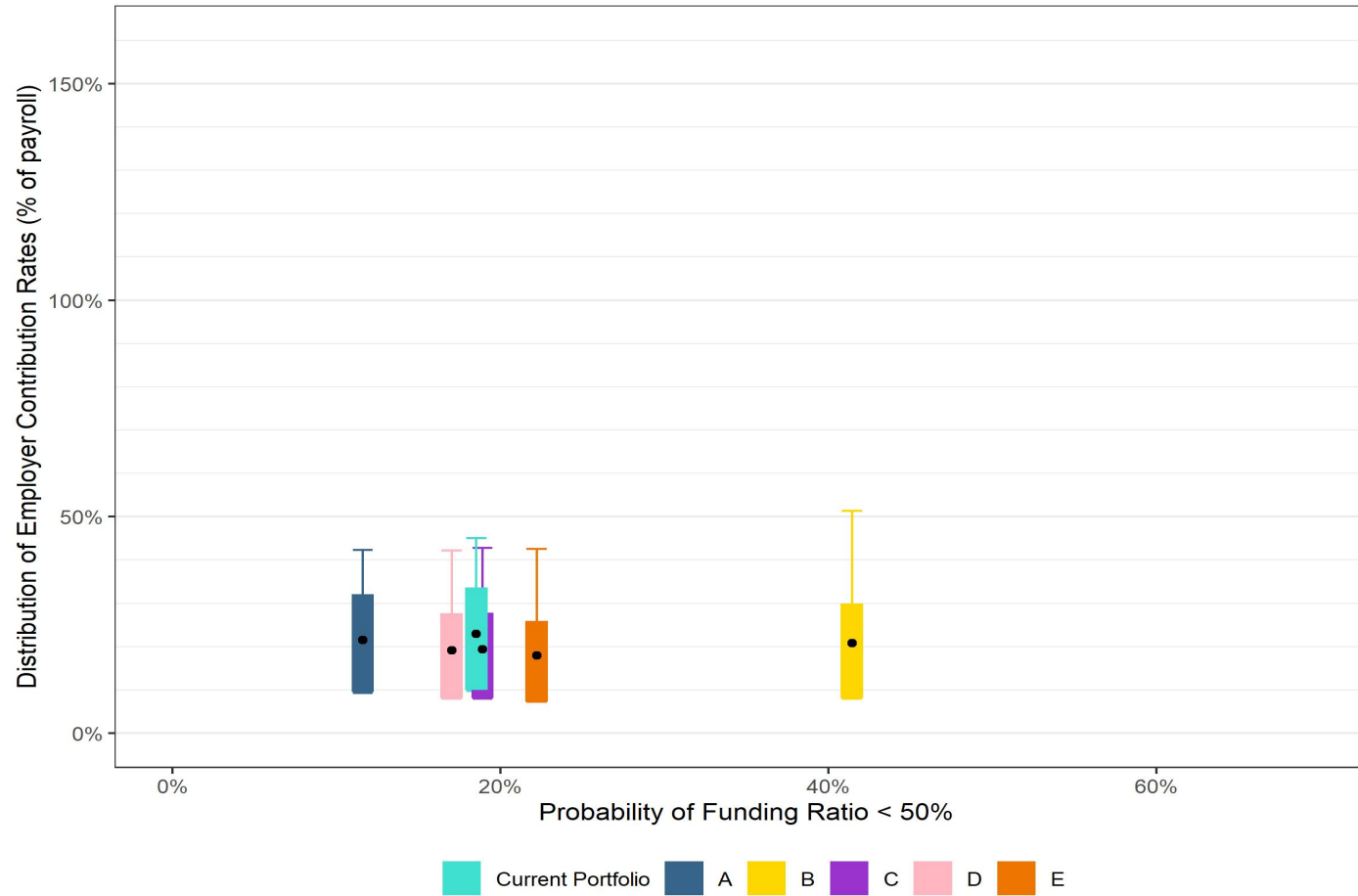
Employer Analysis – Higher Funded Safety Plan: Baseline

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



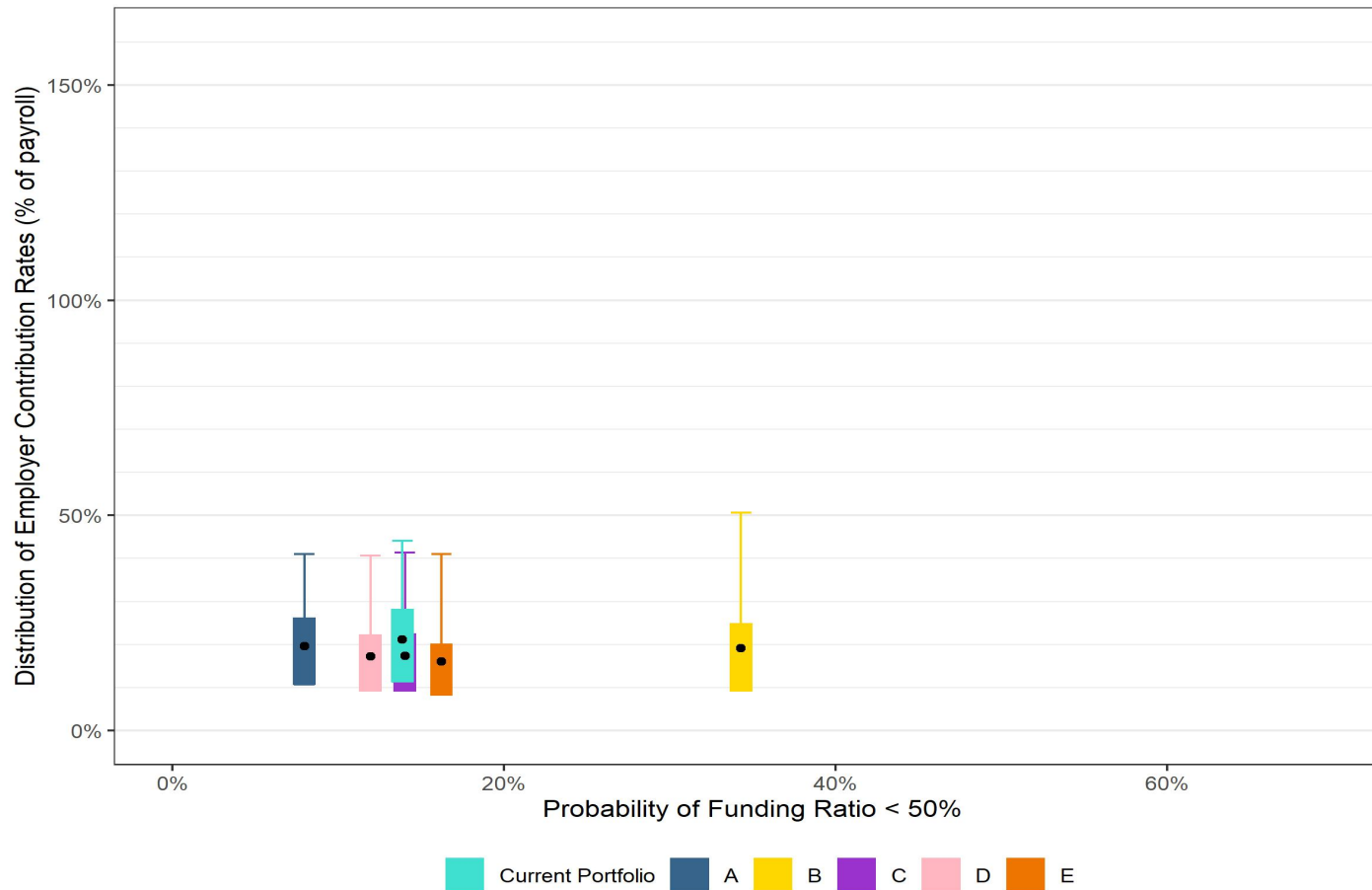
Employer Analysis – Medium Funded Misc. Plan: Baseline

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



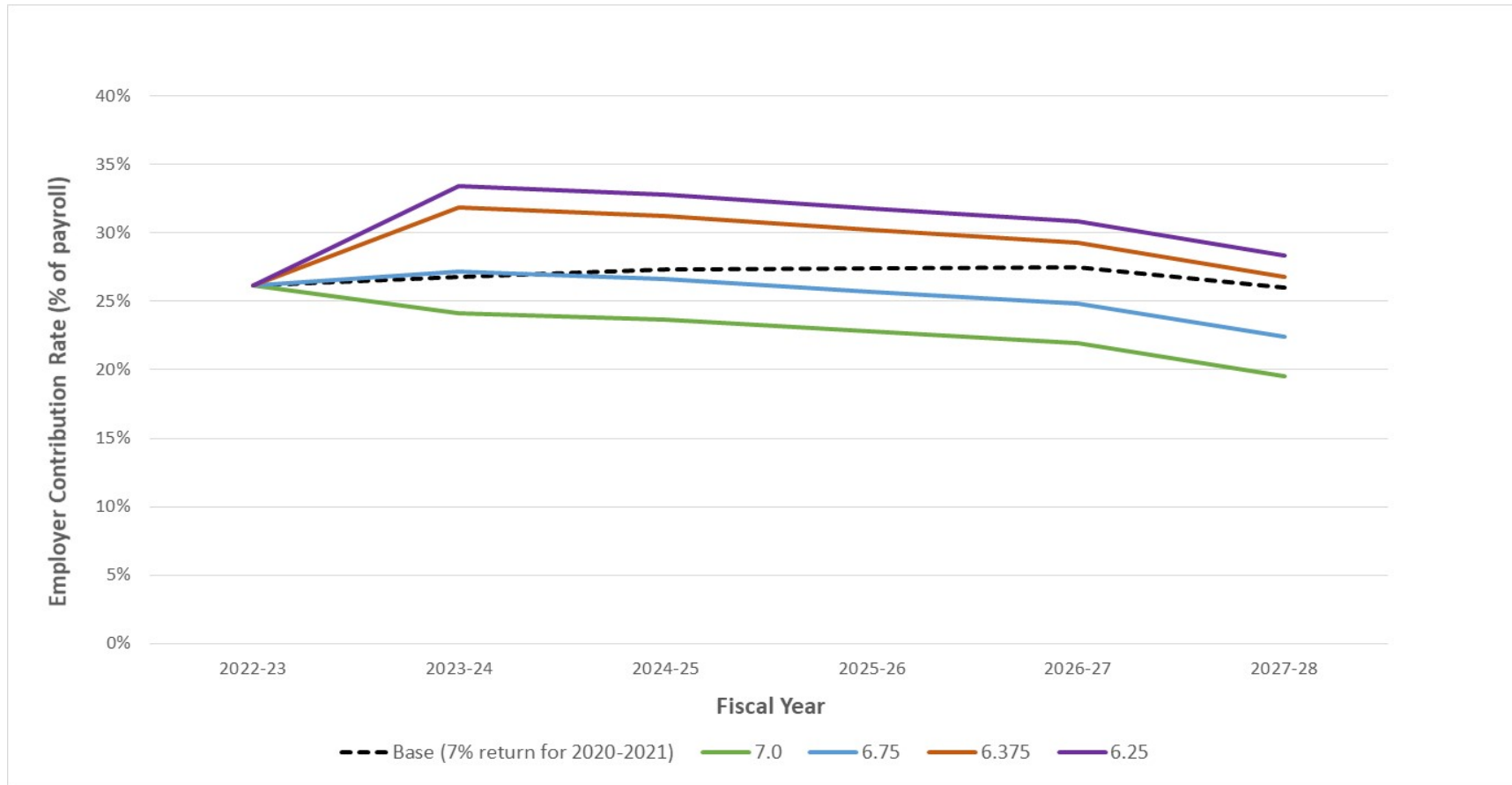
Employer Analysis – Higher Funded Misc. Plan: Baseline

Projected Employer Contribution Rates vs Probability of Funding Ratio Falling Below 50%



Employer Contribution Analysis – PA Misc. Plan: Baseline

Projected Employer Contributions Rates Under Alternate Discount Rates Assuming Future Experience Matches Assumptions



Employer Contribution Analysis – PA Safety Plan: Baseline

Projected Employer Contributions Rates Under Alternate Discount Rates Assuming Future Experience Matches Assumptions

