Verus

PERSPECTIVES THAT DRIVE ENTERPRISE SUCCESS

MAY 2018

Asset/Liability Study

Tulare County Employees' Retirement Association

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Verus

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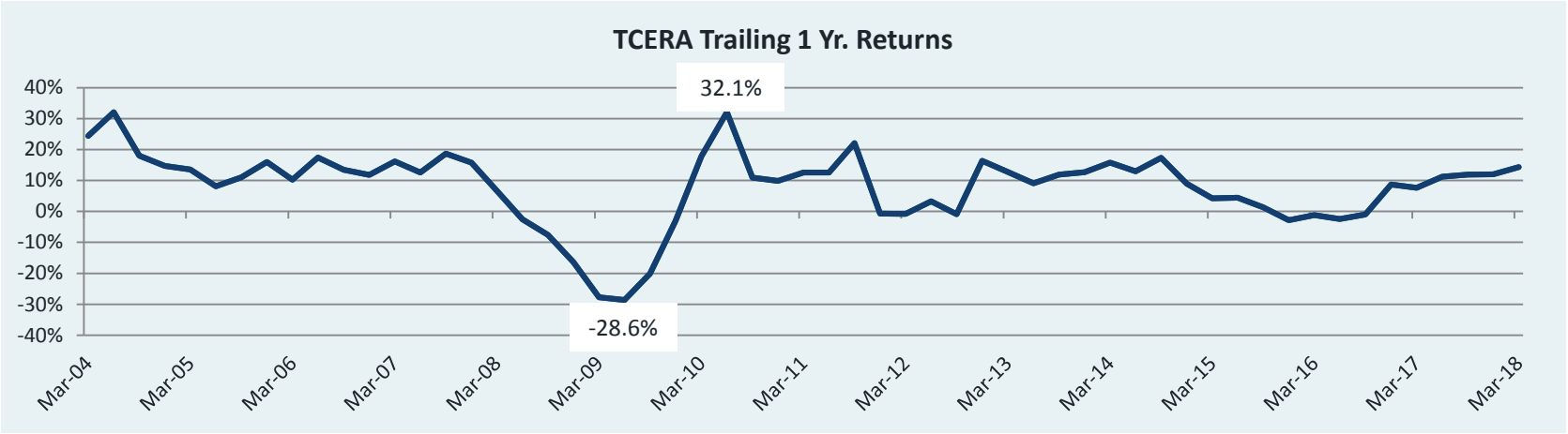
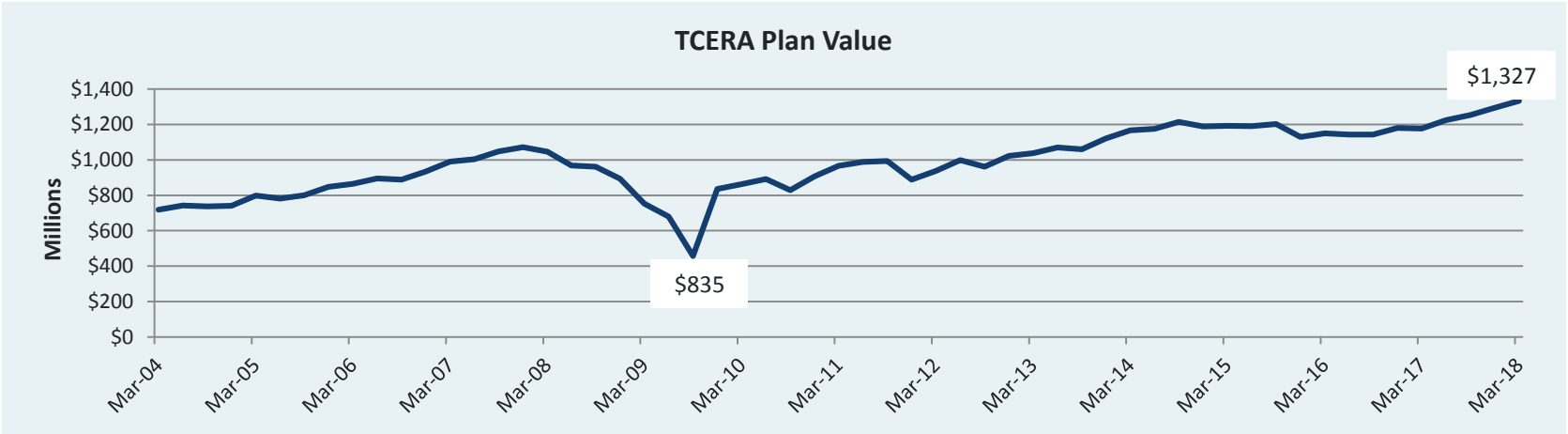
Setting the stage

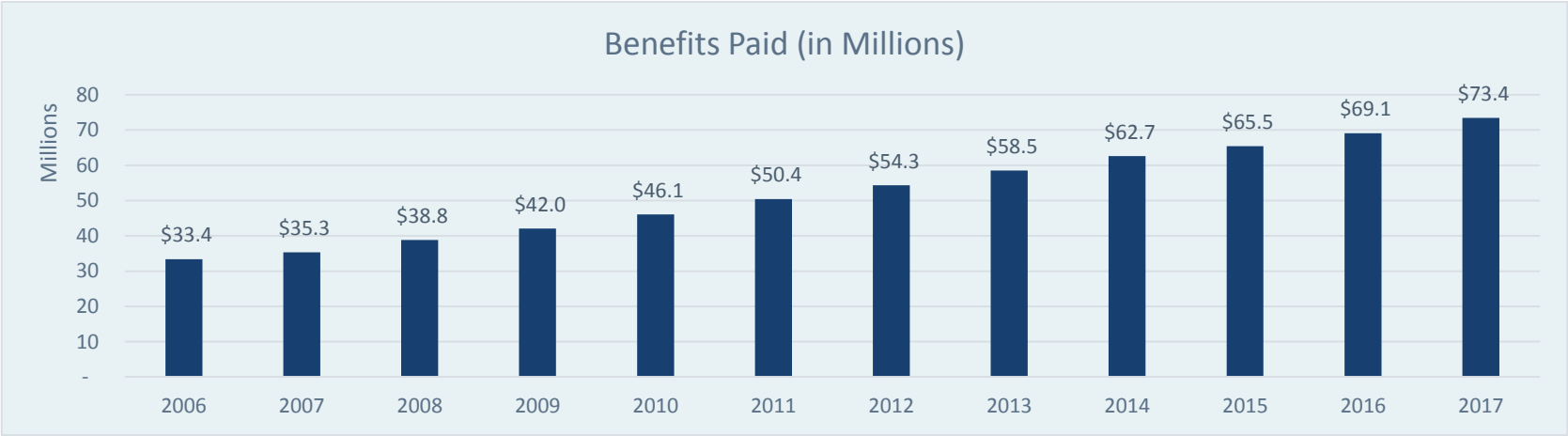
Rolling returns and plan value



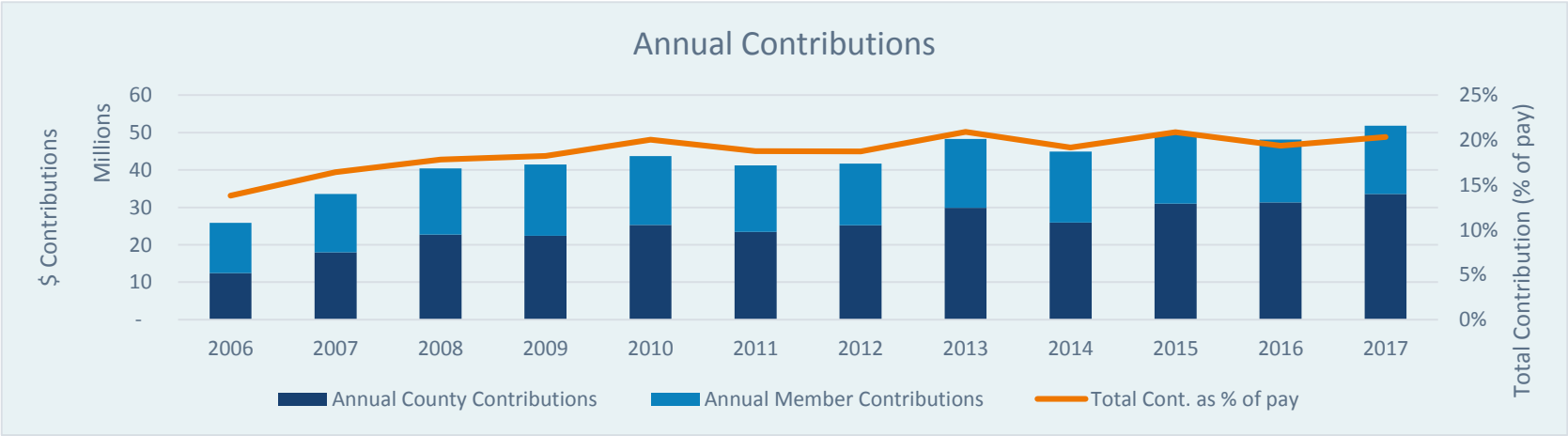


Although historical returns have not consistently met the assumed rate, assets have recovered significantly since the Global Financial Crisis.

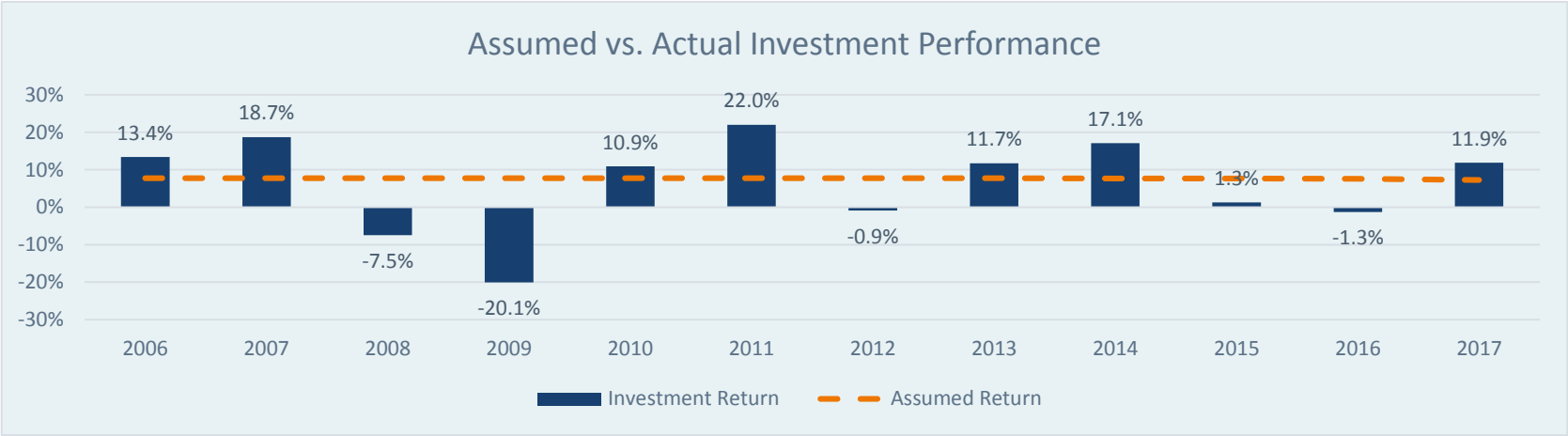
Benefit payments and contributions



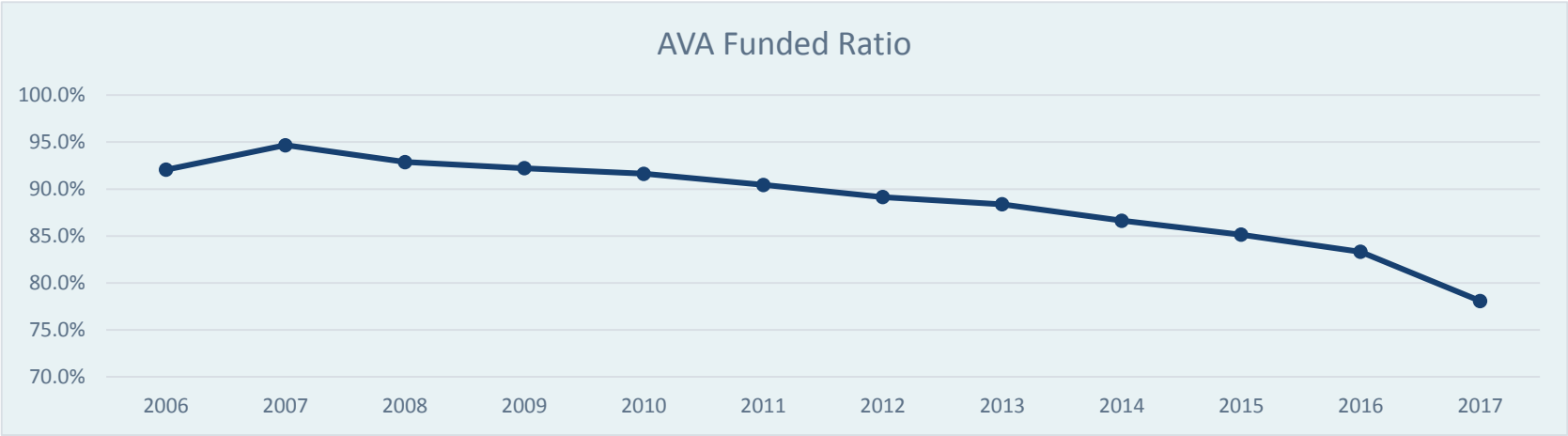
Aggregate benefits have increased steadily, and plan sponsor contributions have risen as well.



Returns and funding

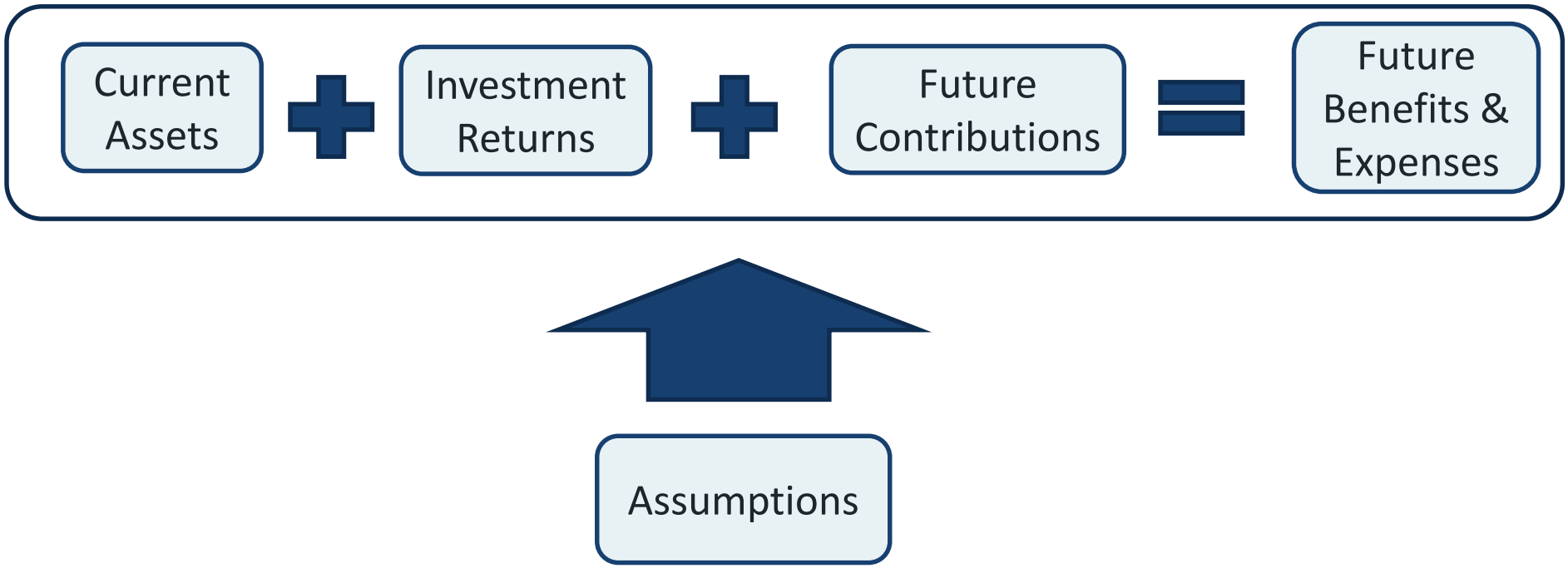


Market returns below the assumed rate has led to declining liability coverage.

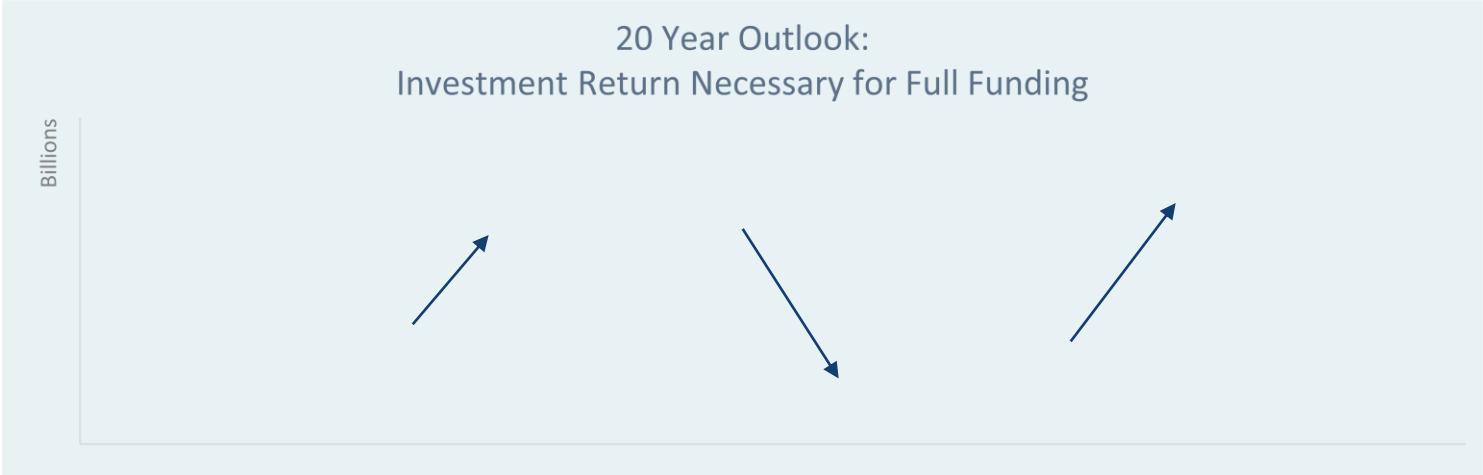


Deterministic projections

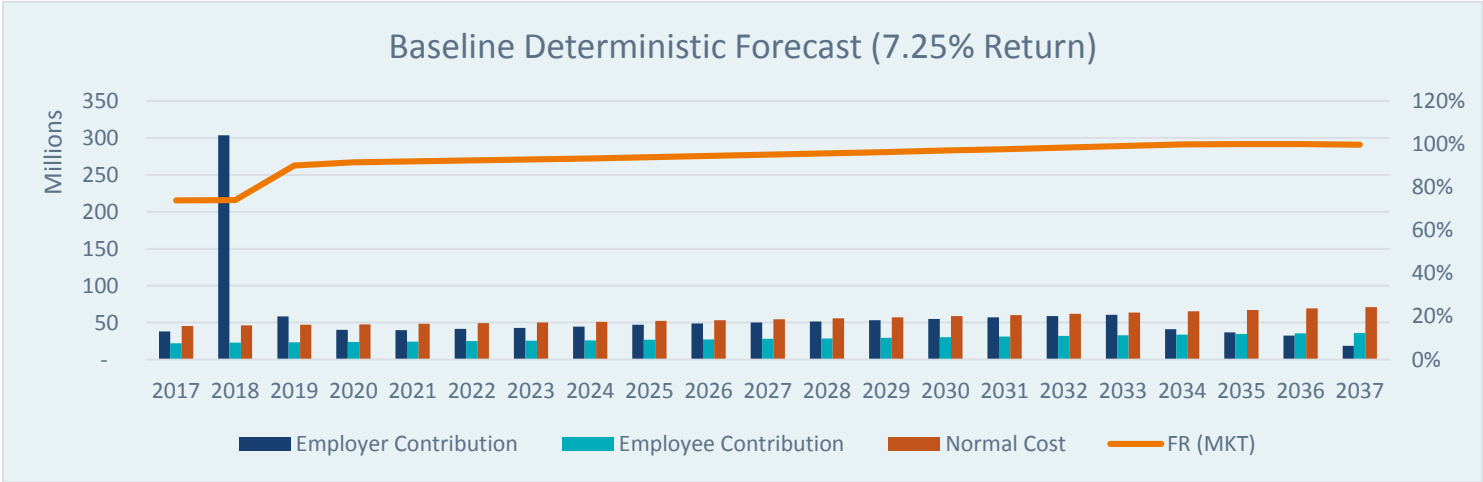
The pension equation



The pension equation in action



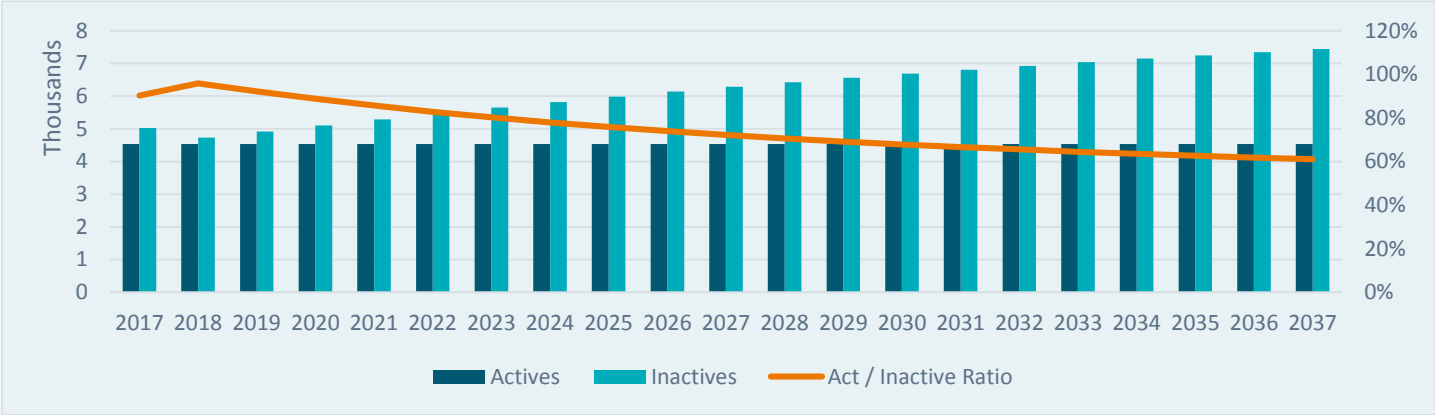
Under the current funding policy, the Plan will require approx. $3.6b of investment returns to become fully funded by 2037.



Assuming the current discount rate of 7.25%, contributions will rise steadily until the Plan is fully funded.

Impact of plan demographics

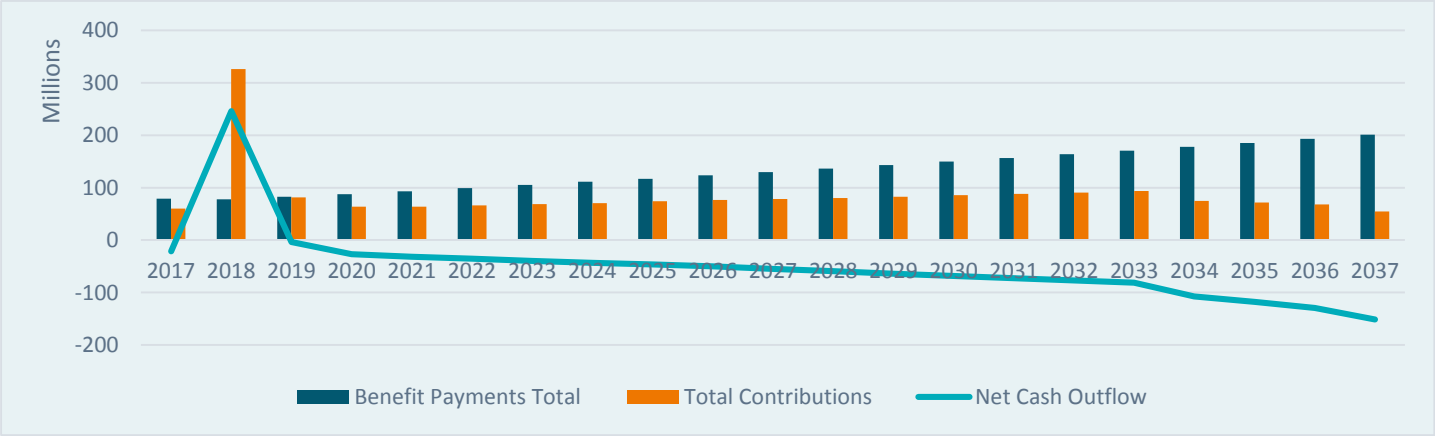
ACTIVE TO INACTIVE RATIO



Inactive count includes retirees, beneficiaries, and terminated vested members.

Assuming zero plan growth, the proportion of active members to retirees declines steadily over the next 20 years.

BENEFIT PAYMENTS, CONTRIBUTIONS, AND OUTFLOW

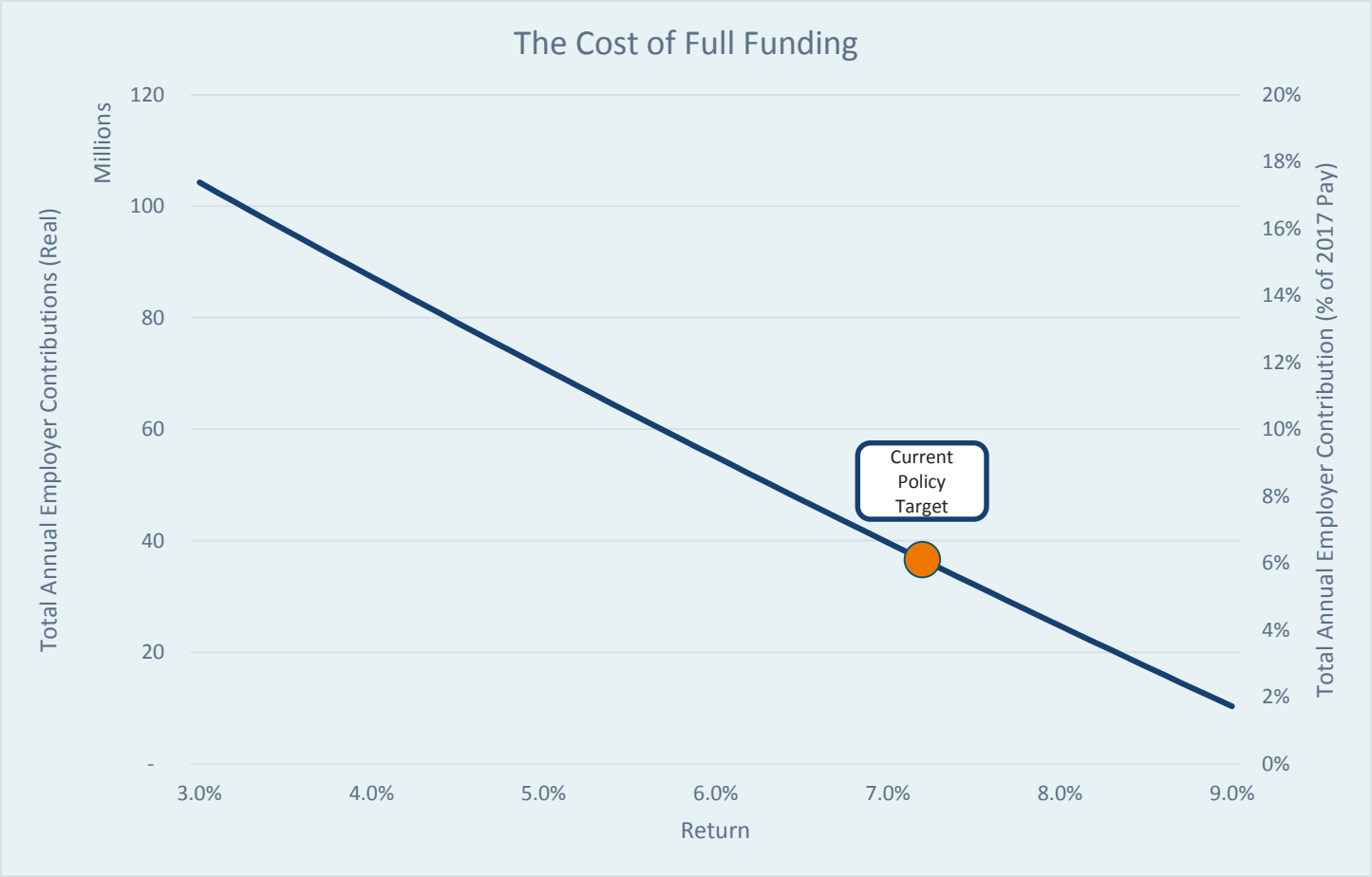


Includes employer and employee contributions projected at a return of 7.25%.

As the plans funding improves and inactive pool grows larger, there is a greater strain on investments to meet cashflow needs.

Getting to fully funded: investment returns vs. contributions

THE COST OF FULL FUNDING



There is a relationship between the contributions the plan makes and the return which it must attain to achieve its goals.

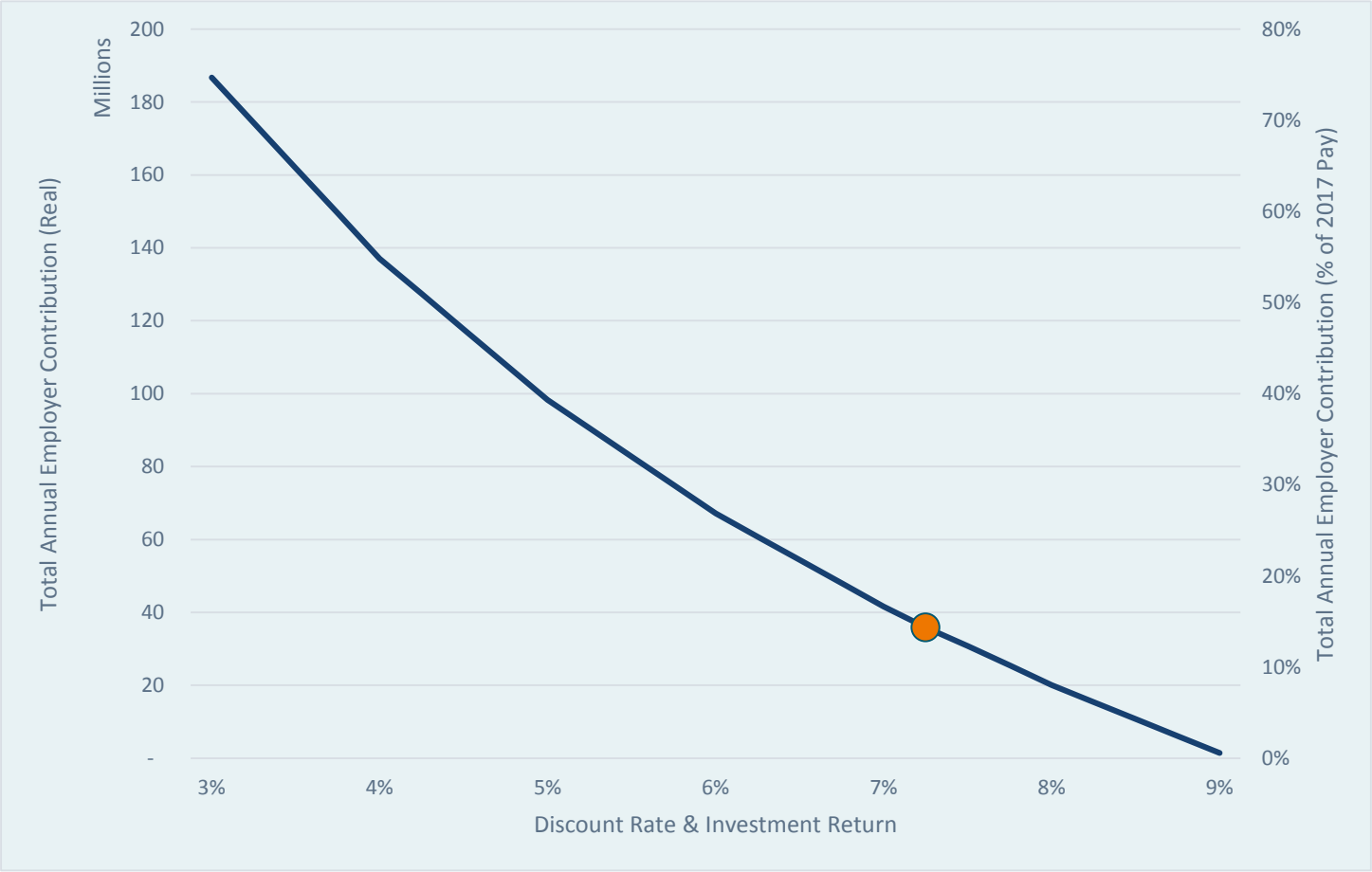
Current total contributions amount to roughly 37 million.

The Annual Required Contribution (ARC) contribution plan will (if our projections of the current policy are correct), increase contributions in line with this chart.

Contributions reflected in this graph are displayed as an annual cost in real terms via the inflation assumption of 3.0% in addition to the $250,000,000 POB payment in year 2018. Assumes all other assumptions (mortality, disability, plan growth, etc.) are met exactly.

Cost of de-risking

THE COST OF DE-RISKING

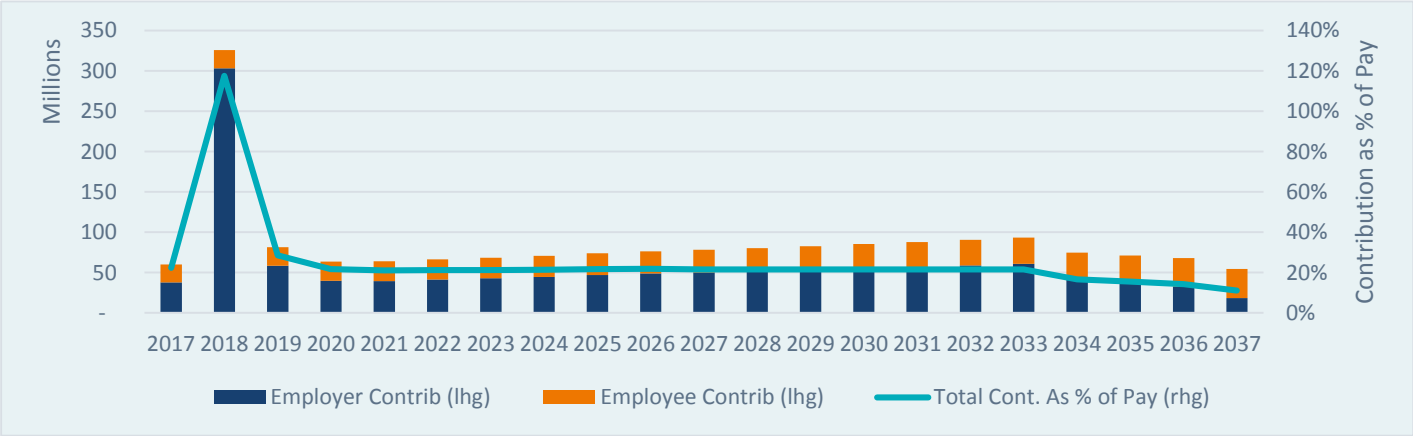


Assuming the current funding policy, a 1% change in the discount rate results in a change of roughly $25mm in total real contributions through 2037.

Contributions reflected in this graph are displayed as an annual cost in real terms via the inflation assumption of 3.0% in addition to the $250,000,000 POB payment in year 2018. Data displayed in this chart assumes investment returns equal the discount rate for the entire modeling period and all other assumptions (mortality, disability, plan growth, etc.) are met exactly.

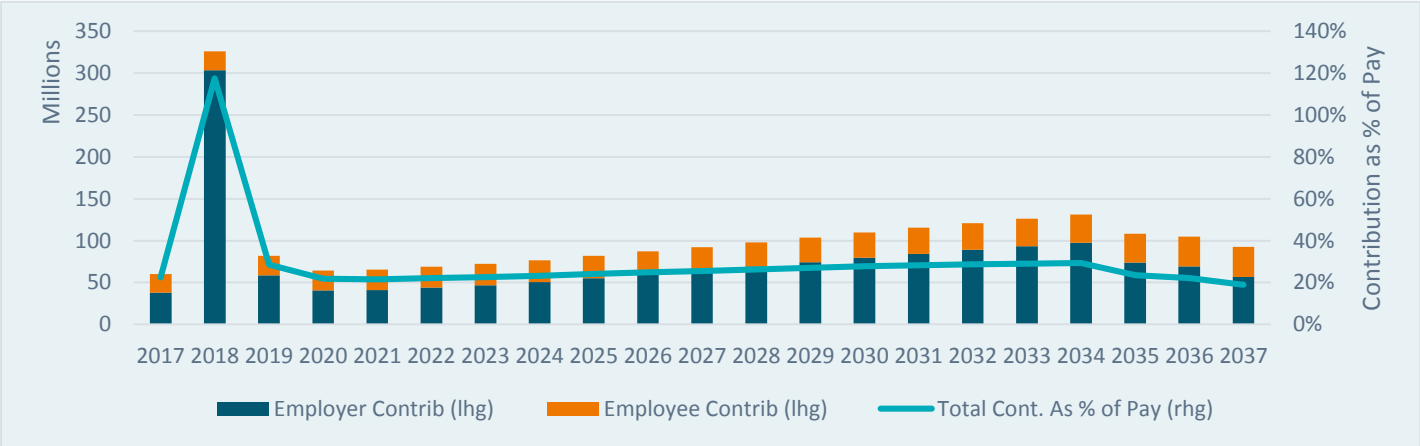
Contributions as a % of pay

BASELINE PROJECTION: 7.25% RETURN SCENARIO



Assuming current funding policy, baseline projections show contributions as a % of pay slowly declines from 21% to 15-17% in 2037.

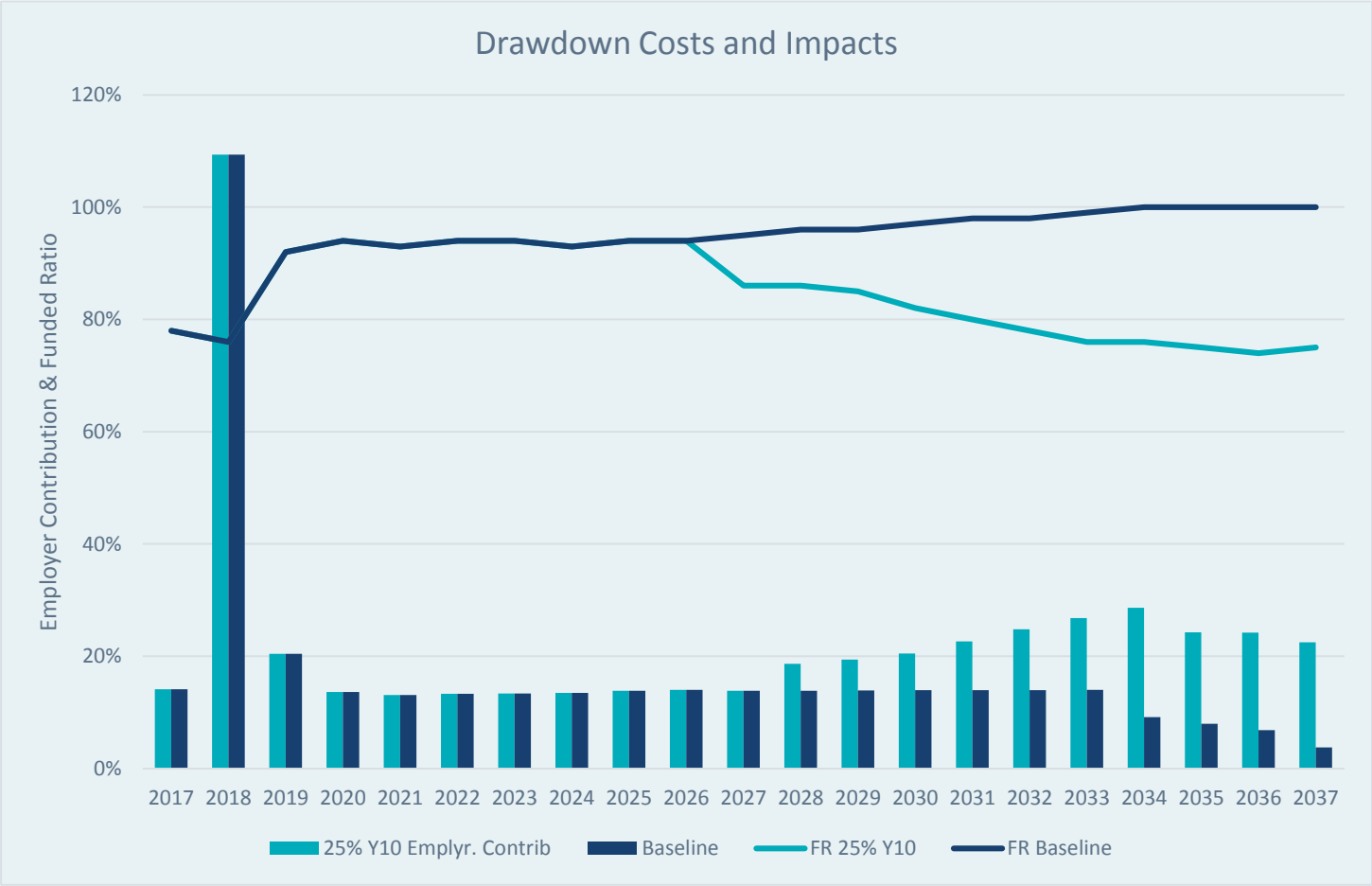
ALTERNATIVE PROJECTION: 5.6% 10 YR & 7.25% 10 YR RETURN SCENARIO



If the Plan achieves a return of 5.6% for the first 10 years and 7.25% thereafter, contributions remain stable around 20-23% of pay.

Cost of a drawdown

IMPACT OF 25% DRAWDOWN ON CONTRIBUTIONS (7.25% INVESTMENT RETURN OTHERWISE)

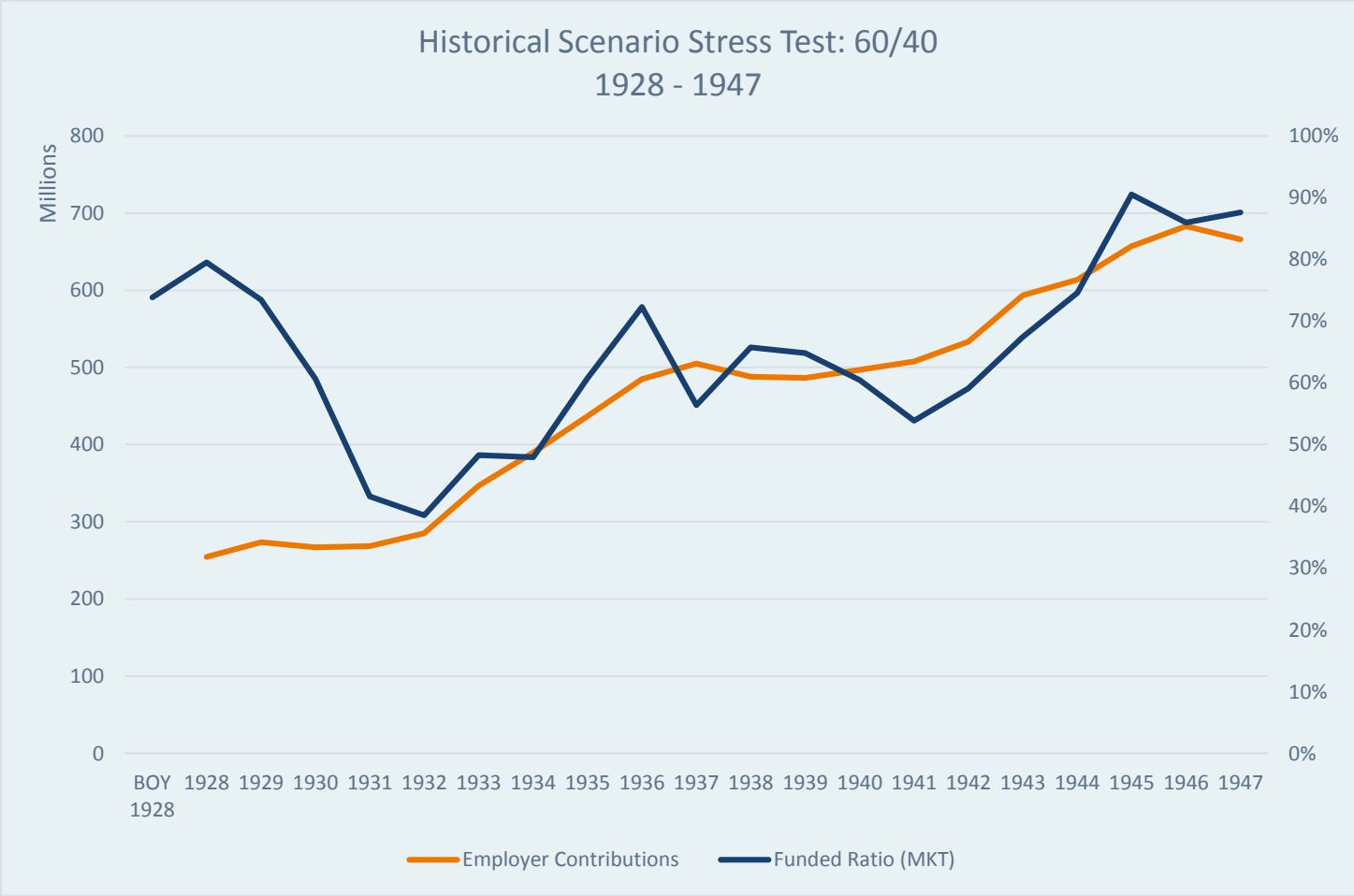


A significant drawdown may require an adjustment to the current funding policy.

Assumes a year to year return of 7.25% before and after the one year drawdown of 25%.

Path dependency: Deterministic Stress Tests

HISTORICAL SCENARIO STRESS TEST: 1928 -1947 (60/40 ALLOCATION)



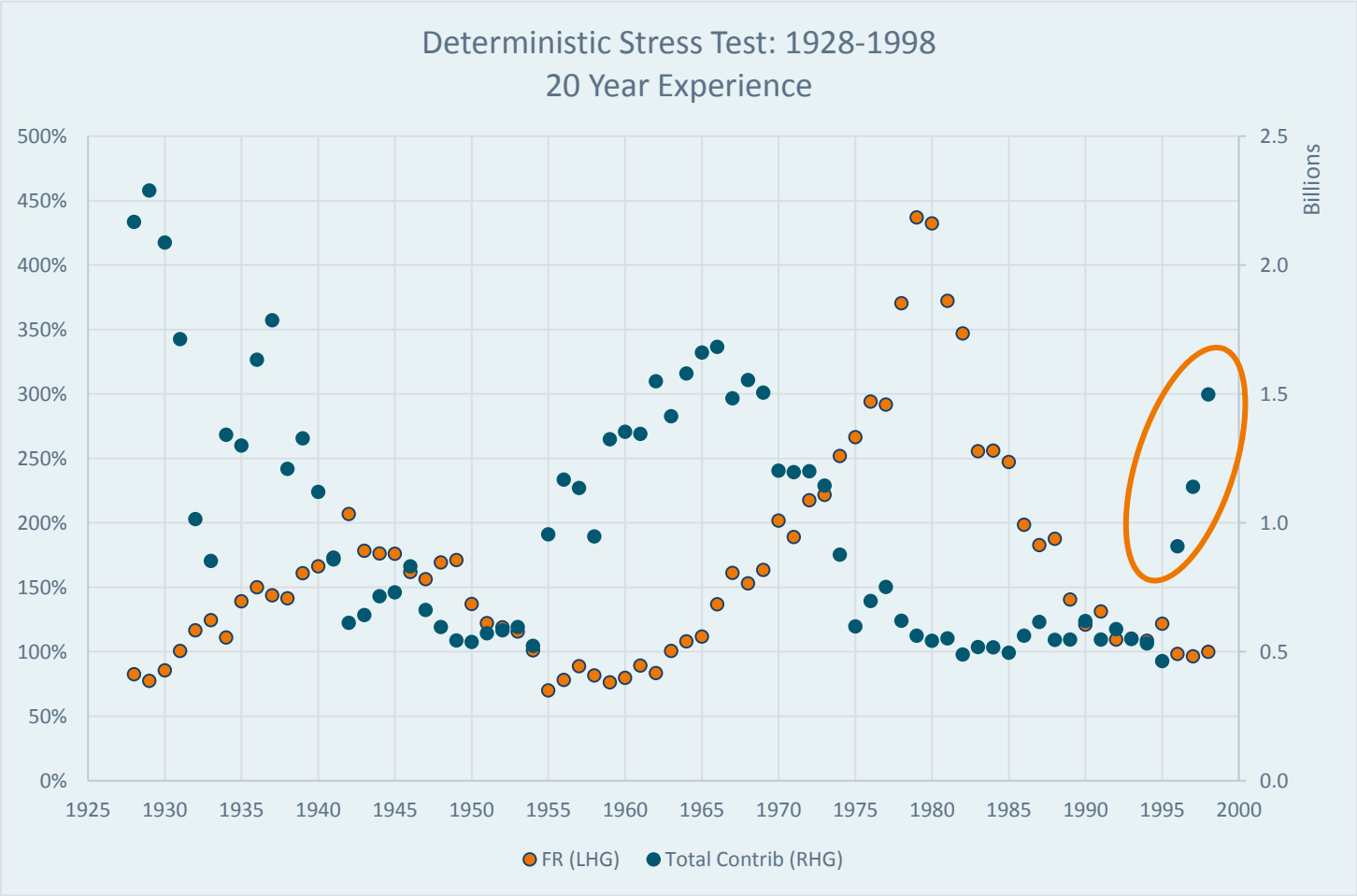
Assume the pension has a traditional 60/40 allocation and were to experience some historical market movements.

In the case of 1928-1947, the plan's funding policy would have the employer contribute 8.9b over 20 years. Our baseline assumptions have the employer contribution amount at 2.1b (including the .25B POB).

Assumes portfolio allocation is 60% S&P 500 and 10% 10 Year US Treasuries.

Path dependency: Deterministic Stress Tests

HISTORICAL SCENARIO STRESS TEST: ALL 20 YEAR PERIODS (60/40 ALLOCATION)



Now view the relationship of cost to outcome for every 20 year scenario.

Differences in just one year of investment performance and one year of return timing can have dramatic impacts on the costs and financial results of the plan.

For example, take 1996, 1997, and 1998. What causes the difference of nearly 0.6 billion dollars in contributions?

Assumes portfolio allocation is 60% S&P 500 and 10% 10 Year US Treasuries.

Path dependency: Deterministic Stress Tests

60/40 PORTFOLIO RETURN: THREE 20 YEAR PERIODS

1996-2016: Has two years of >20% investment performance, both drawdowns occur latest

1997-2017: Has two years of >20% investment performance, 1 year drawdown timing difference resulting in roughly 0.6b contribution difference from prior year.

1998-2018: Only 1 year of >20% return performance, earliest drawdowns, 1b difference from prior year.

Stochastic projections

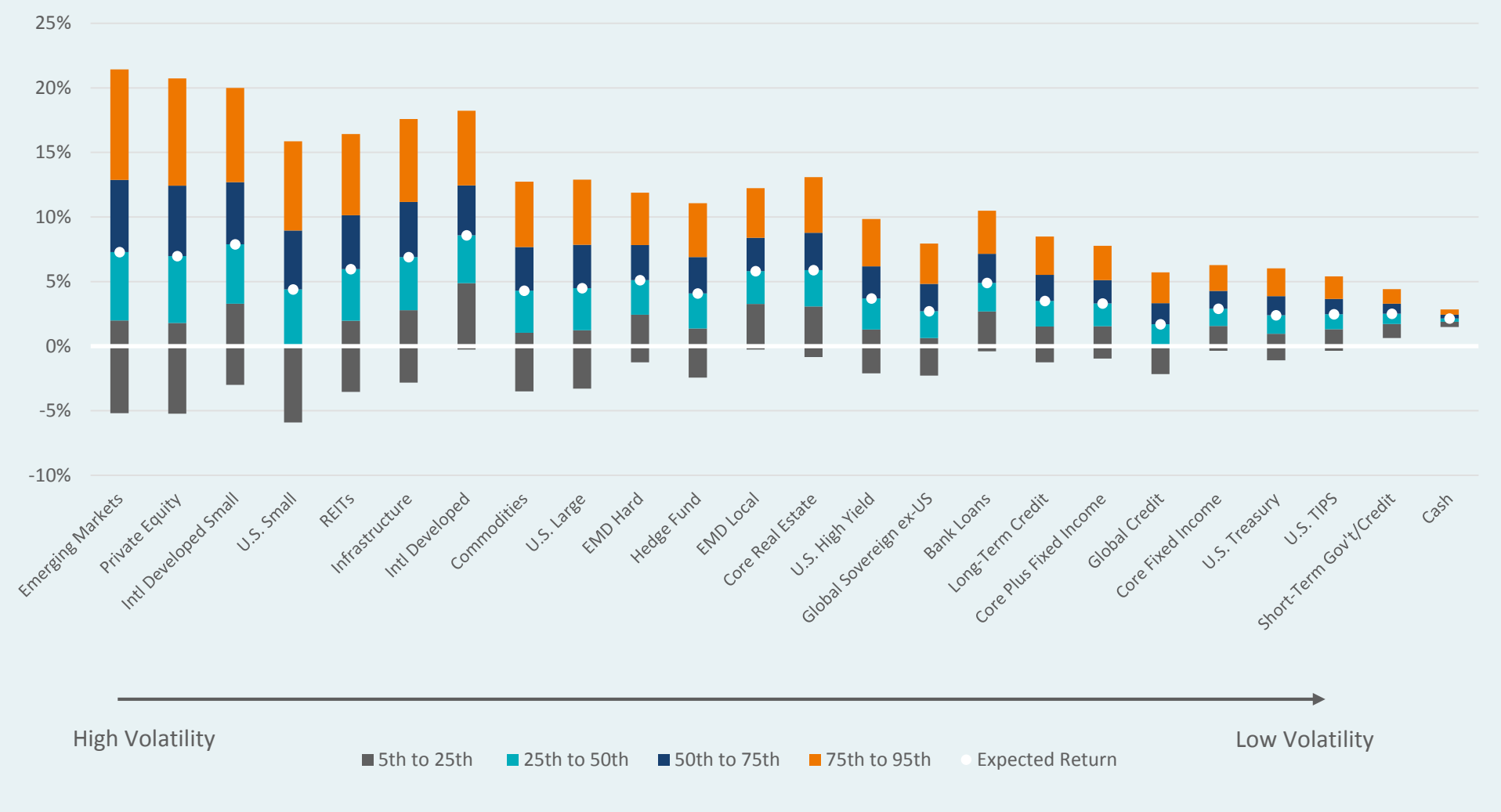
10-year return & risk assumptions

Asset Class	Index Proxy	Ten Year Return Forecast Geometric	Ten Year Return Forecast Arithmetic	Standard Deviation Forecast	Sharpe Ratio Forecast (g)	Sharpe Ratio Forecast (a)	10-Year Historical Sharpe Ratio (g)	10-Year Historical Sharpe Ratio (a)
Equities								
U.S. Large	S&P 500	4.5%	5.6%	15.7%	0.15	0.22	0.50	0.56
U.S. Small	Russell 2000	4.4%	6.5%	21.5%	0.10	0.20	0.36	0.44
International Developed	MSCI EAFE	8.6%	10.1%	18.1%	0.35	0.44	0.11	0.2
International Developed Hedged	MSCI EAFE Hedged	8.6%	9.8%	16.2%	0.40	0.47	0.21	0.28
International Small	MSCI EAFE Small Cap	7.9%	10.2%	22.7%	0.25	0.35	0.24	0.33
International Small Hedged	MSCI EAFE Small Cap Hedged	7.9%	9.7%	20.1%	0.28	0.37	0.36	0.43
Emerging Markets	MSCI EM	7.3%	10.4%	26.6%	0.19	0.31	0.17	0.28
Global Equity	MSCI ACWI	6.3%	7.7%	17.5%	0.23	0.31	0.27	0.35
Private Equity	Cambridge Private Equity	6.4%	9.3%	25.8%	0.16	0.28	0.93	0.92
Fixed Income								
Cash	30 Day T-Bills	2.2%	2.2%	1.2%	-	-	-	-
U.S. TIPS	BBgBarc U.S. TIPS 5 - 10	2.6%	2.7%	5.5%	0.07	0.09	0.57	0.59
U.S. Treasury	BBgBarc Treasury 7-10 Year	2.4%	2.6%	6.8%	0.03	0.06	0.68	0.70
Global Sovereign ex U.S.	BBgBarc Global Treasury ex U.S.	2.7%	3.2%	9.9%	0.05	0.10	0.30	0.33
Global Sovereign ex U.S. Hedged	BBgBarc Global Treasury ex U.S. Hedged	2.7%	2.8%	3.3%	0.15	0.18	1.23	1.22
Core Fixed Income	BBgBarc U.S. Aggregate Bond	2.9%	3.1%	6.4%	0.11	0.14	1.09	1.08
Core Plus Fixed Income	BBgBarc U.S. Corporate IG	3.3%	3.6%	8.4%	0.13	0.17	0.81	0.81
Short-Term Gov't/Credit	BBgBarc U.S. Gov't/Credit 1 - 3 year	2.5%	2.6%	3.7%	0.08	0.11	1.36	1.34
Short-Term Credit	BBgBarc Credit 1-3 Year	2.4%	2.5%	3.7%	0.05	0.08	1.05	1.05
Long-Term Credit	BBgBarc Long U.S. Corporate	3.5%	3.9%	9.4%	0.14	0.18	0.64	0.67
High Yield Corp. Credit	BBgBarc U.S. Corporate High Yield	3.7%	4.3%	11.6%	0.13	0.18	0.64	0.67
Bank Loans	S&P/LSTA	4.9%	5.4%	10.5%	0.26	0.30	0.48	0.51
Global Credit	BBgBarc Global Credit	1.7%	2.0%	7.6%	-0.07	-0.03	0.59	0.61
Global Credit Hedged	BBgBarc Global Credit Hedged	1.7%	1.8%	5.0%	-0.10	-0.08	1.01	1.00
Emerging Markets Debt (Hard)	JPM EMBI Global Diversified	5.1%	5.9%	12.8%	0.23	0.29	0.74	0.76
Emerging Markets Debt (Local)	JPM GBI EM Global Diversified	5.8%	6.5%	12.1%	0.30	0.36	0.31	0.37
Private Credit	Bank Loans + 200 bps	6.9%	7.5%	10.5%	0.45	0.50	-	-
Other								
Commodities	Bloomberg Commodity	4.3%	5.5%	15.9%	0.13	0.21	-0.33	-0.25
Hedge Funds	HFRI Fund of Funds	4.0%	4.8%	7.9%	0.23	0.33	0.21	0.23
Hedge Fund of Funds	HFRI Fund of Funds	3.0%	3.8%	7.9%	0.10	0.20	0.21	0.23
Hedge Funds - Equity Hedge	HFRI Equity Hedge	4.2%	5.5%	11.1%	0.18	0.30	0.36	0.39
Hedge Funds - Event Driven	HFRI Event Driven	4.5%	5.6%	9.9%	0.22	0.34	0.55	0.57
Hedge Funds - Relative Value	HFRI Relative Value	3.9%	4.5%	6.8%	0.25	0.34	0.89	0.89
Hedge Funds - Macro	HFRI Macro	3.3%	4.7%	8.5%	0.12	0.29	0.43	0.44
Core Real Estate	NCREIF Property	6.0%	6.7%	12.7%	0.30	0.35	0.77	0.75
Value-Add Real Estate	NCREIF Property + 200bps	8.0%	9.7%	19.5%	0.30	0.38	-	-
Opportunistic Real Estate	NCREIF Property + 400bps	10.0%	12.9%	26.0%	0.30	0.41	-	-
REITs	Wilshire REIT	6.0%	7.7%	19.5%	0.19	0.28	0.16	0.28
Infrastructure	S&P Global Infrastructure	7.1%	8.7%	18.9%	0.26	0.34	0.27	0.34
Risk Parity	Risk Parity	7.2%	7.7%	10.0%	0.50	0.55	-	-
Currency Beta	Russell Conscious Currency	2.2%	2.3%	4.4%	0.00	0.02	0.23	0.24
Inflation		2.1%	-	-	-	-	-	-

Investors wishing to produce expected geometric return forecasts for their portfolios should use the arithmetic return forecasts provided here as inputs into that calculation, rather than the single-asset-class geometric return forecasts. This is the industry standard approach, but requires a complex explanation only a heavy quant could love, so we have chosen not to provide further details in this document – we will happily provide those details to any readers of this who are interested.

Range of likely 10 year outcomes

10 YEAR RETURN 90% CONFIDENCE INTERVAL



Asset mixes

	Policy	Current	7.25% Mix	80/20	70/30	60/40	50/50	Return	Standard Deviation
US Large	15.0	16.7	0.0	0.0	0.0	0.0	0.0	*4.5*	*15.7*
US Small	5.0	5.6	0.0	0.0	0.0	0.0	0.0	*4.4*	*21.5*
Total Domestic Equity	***20.0***	***22.3***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***		
International Developed	15.0	16.4	0.0	0.0	0.0	0.0	0.0	*8.6*	*18.1*
Emerging Markets	5.0	5.3	0.0	0.0	0.0	0.0	0.0	*7.3*	*26.6*
Total Int'l Equity	***20.0***	***21.7***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***		
Global Equity	3.0	3.4	0.0	80.0	70.0	60.0	50.0	*6.3*	*17.5*
Total Equity	***43.0***	***47.4***	***0.0***	***80.0***	***70.0***	***60.0***	***50.0***		
Core Fixed Income	22.0	20.3	0.0	20.0	30.0	40.0	50.0	*2.9*	*6.4*
US Treasury	0.0	0.0	2.6	0.0	0.0	0.0	0.0	*2.4*	*6.8*
High Yield Corp. Credit	0.0	1.5	0.0	0.0	0.0	0.0	0.0	*3.7*	*11.6*
Global Credit	5.0	4.9	0.0	0.0	0.0	0.0	0.0	*1.7*	*7.6*
US TIPS	0.0	0.8	0.0	0.0	0.0	0.0	0.0	*2.6*	*5.5*
Total Fixed Income	***27.0***	***27.5***	***2.6***	***20.0***	***30.0***	***40.0***	***50.0***		
Commodities	5.0	3.2	0.0	0.0	0.0	0.0	0.0	*4.3*	*15.9*
Core Real Estate	10.0	8.7	0.0	0.0	0.0	0.0	0.0	*6.0*	*12.7*
Opportunistic Real Estate	0.0	0.0	15.1	0.0	0.0	0.0	0.0	*10.0*	*26.0*
Total Real Assets	***15.0***	***11.9***	***15.1***	***0.0***	***0.0***	***0.0***	***0.0***		
Hedge Funds (FoF)	5.0	4.7	0.0	0.0	0.0	0.0	0.0	*3.0*	*7.9*
Risk Parity	0.0	0.0	45.6	0.0	0.0	0.0	0.0	*7.2*	*10.0*
Private Equity	5.0	3.8	0.0	0.0	0.0	0.0	0.0	*7.0*	*25.8*
Private Credit	5.0	2.9	21.8	0.0	0.0	0.0	0.0	*6.9*	*10.5*
Total Non-Public Investments	***15.0***	***11.4***	***67.4***	***0.0***	***0.0***	***0.0***	***0.0***		
Cash	0.0	1.8	14.9	0.0	0.0	0.0	0.0	*2.2*	*1.2*
Total Allocation	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**		

Source: MPI, Verus

Note: Current mix as of 4/30/2018

Mean-variance analysis

	Policy	Current	7.25% Mix	80/20	70/30	60/40	50/50
Mean Variance Analysis							
Forecast 10 Year Return	***5.6***	***5.5***	***7.3***	***5.8***	***5.6***	***5.3***	***4.9***
Standard Deviation	10.9	11.1	7.3	14.5	12.9	11.3	9.8
Return/Std. Deviation	*0.5*	*0.5*	*1.0*	*0.4*	*0.4*	*0.5*	*0.5*
1st percentile ret. 1 year	*-22.5*	*-22.2*	*-14.0*	*-37.0*	*-32.2*	*-27.4*	*-23.8*
Sharpe Ratio	0.36	0.34	0.71	0.31	0.31	0.32	0.32

Source: MPI, Verus

Risk decomposition

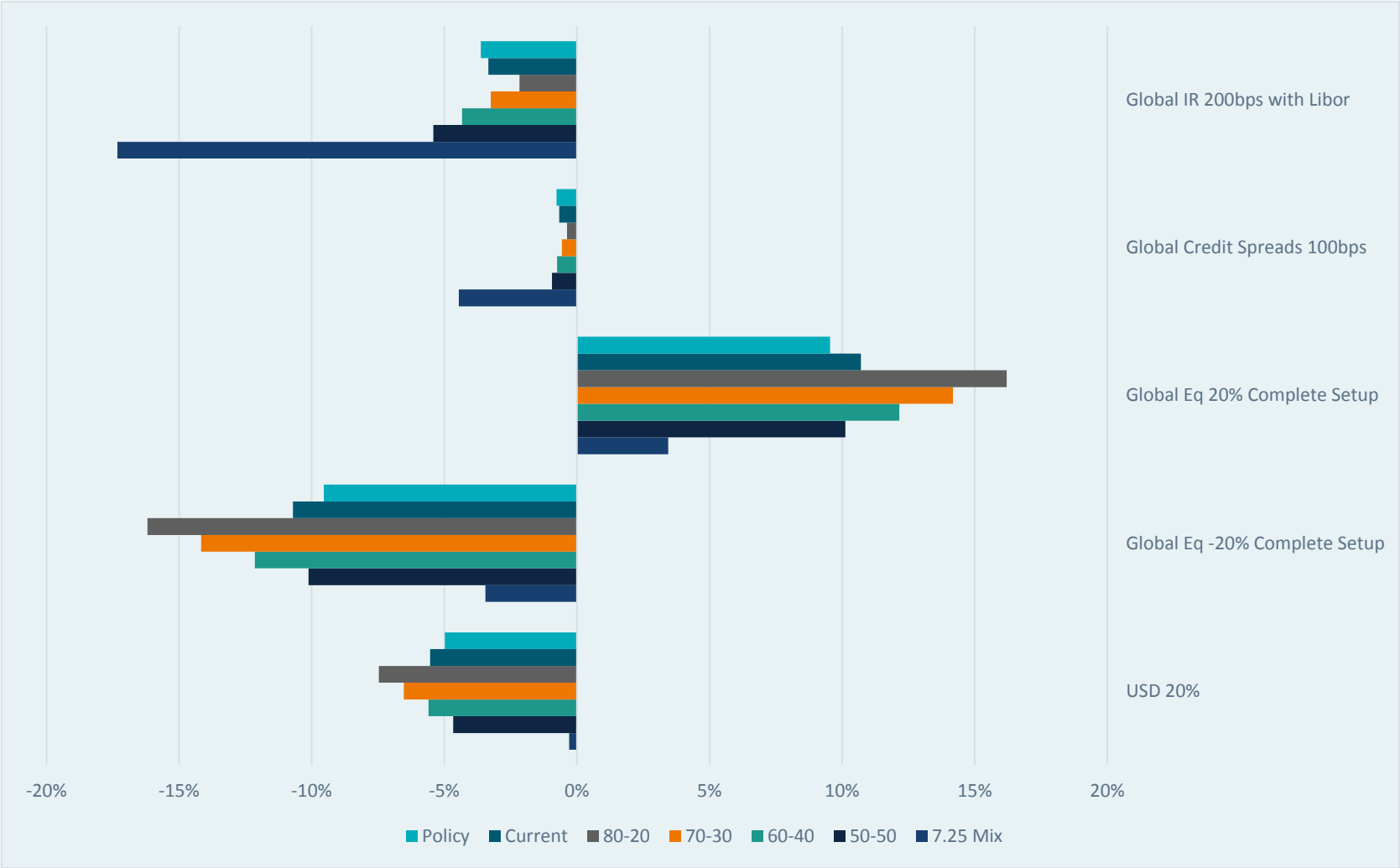
The equity risk factor dominates most portfolios.

Source: Barra, Ex-Ante Volatility

Scenario analysis

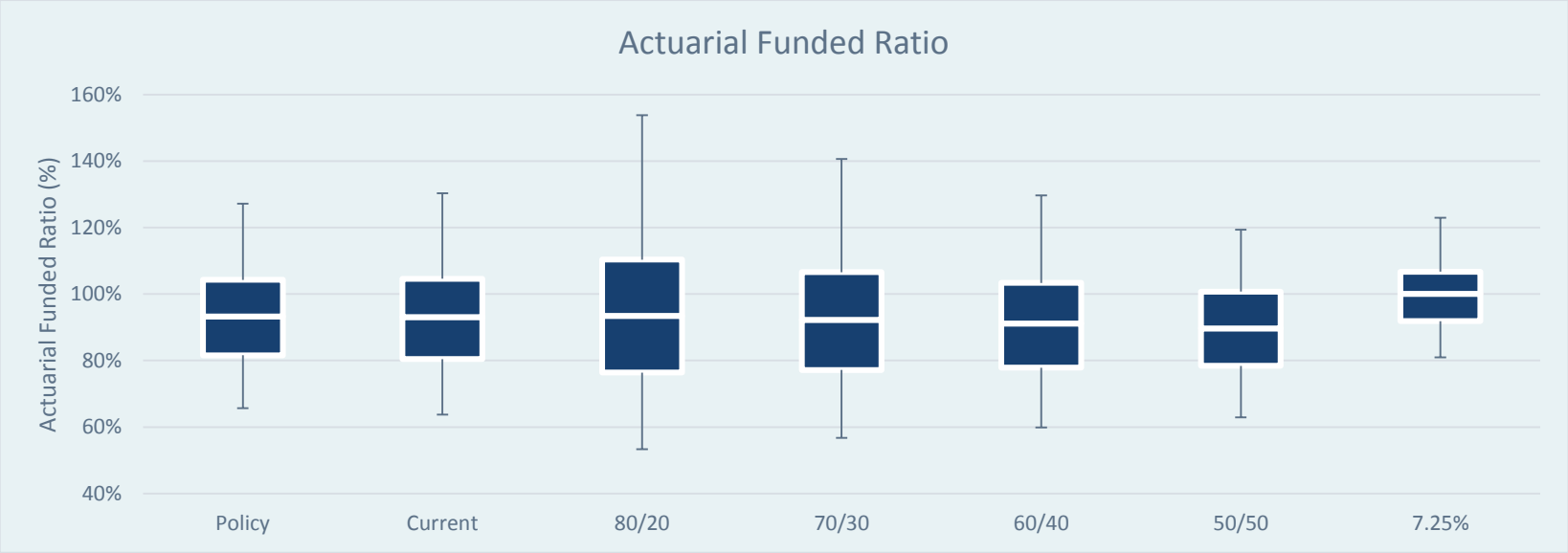
Source: Barra

Stress tests



Source: Barra

Funded status: 10 year forecast



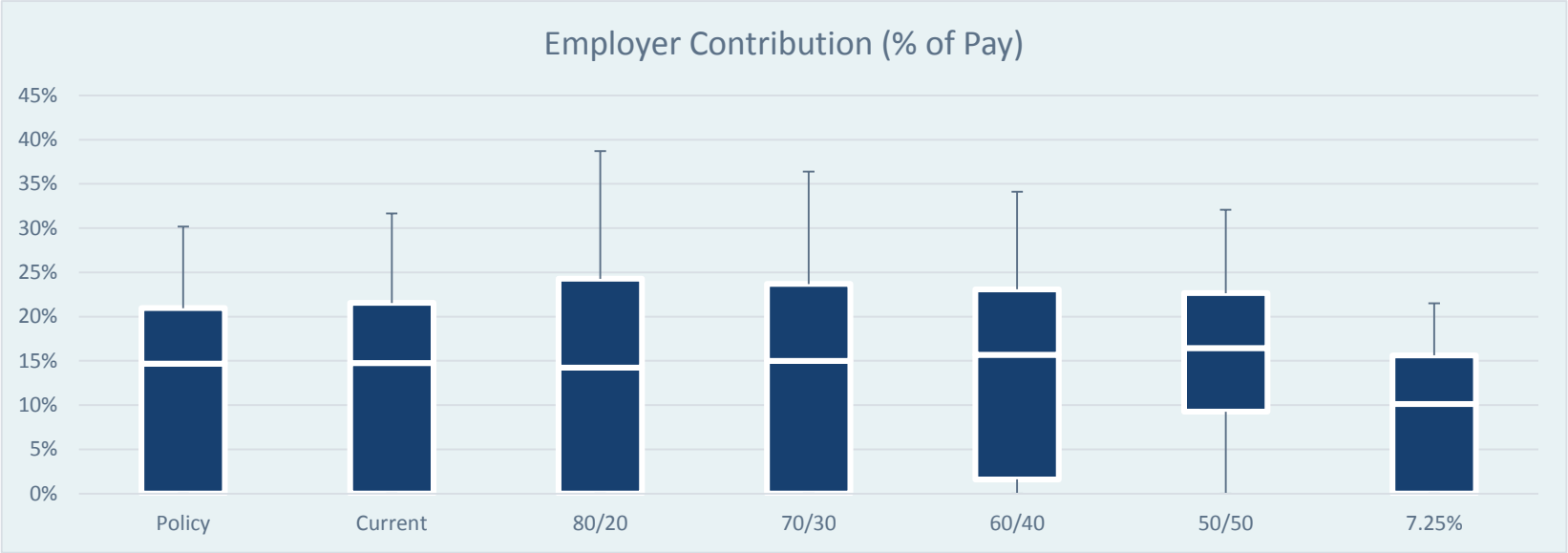
FUNDED STATUS – STOCHASTIC OUTCOMES IN 10 YEARS

	Policy	Current	80/20	70/30	60/40	50/50	7.25%
Best Case (95%)	127.18%	130.30%	153.80%	140.64%	129.70%	119.34%	122.94%
Median Outcome (50%)	93.23%	93.03%	93.45%	92.24%	91.16%	89.70%	100.05%
Worst Case (5%)	65.67%	63.73%	53.30%	56.74%	59.83%	62.89%	80.99%
CVAR (5%)	58.0%	55.6%	41.9%	46.3%	50.4%	54.4%	76.3%

Projections include $250,000,000 POB in 2018.

Source: ProVal, Verus

Employer contributions: 10 year forecast



EMPLOYER CONTRIBUTIONS – STOCHASTIC OUTCOMES IN 10 YEARS

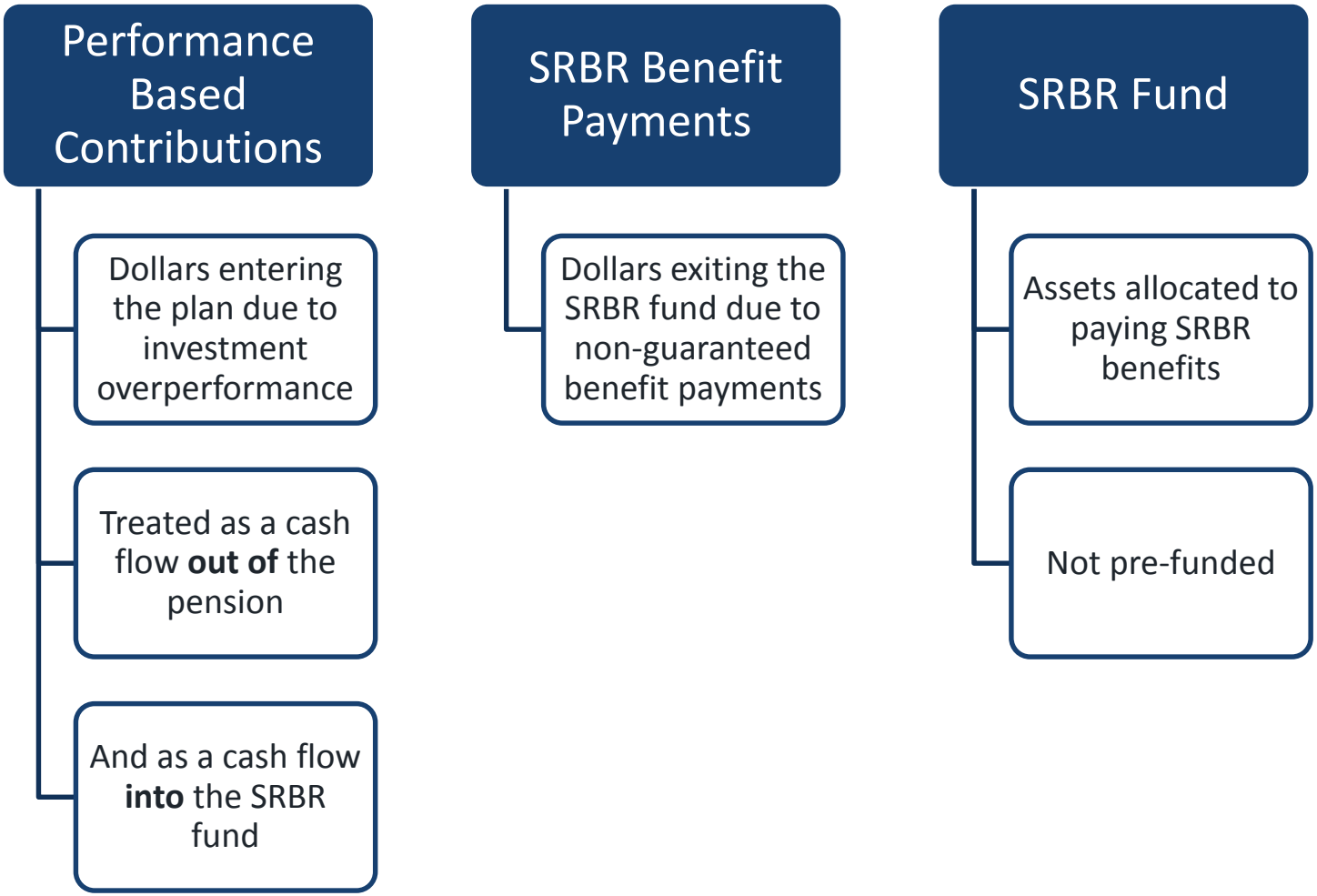
	Policy	Current	80/20	70/30	60/40	50/50	7.25%
Best Case (95%)	0.0%	0.0%	0.0%	0.0%	0.0%	0.00%	0.00%
Median Outcome (50%)	14.7%	14.8%	14.2%	15.0%	15.7%	16.43%	10.11%
Worst Case (5%)	30.2%	31.7%	38.7%	36.4%	34.1%	32.07%	21.49%
CVAR (5%)	37.0%	38.7%	48.2%	45.2%	42.3%	39.5%	25.6%

Projections include $250,000,000 POB in 2018.

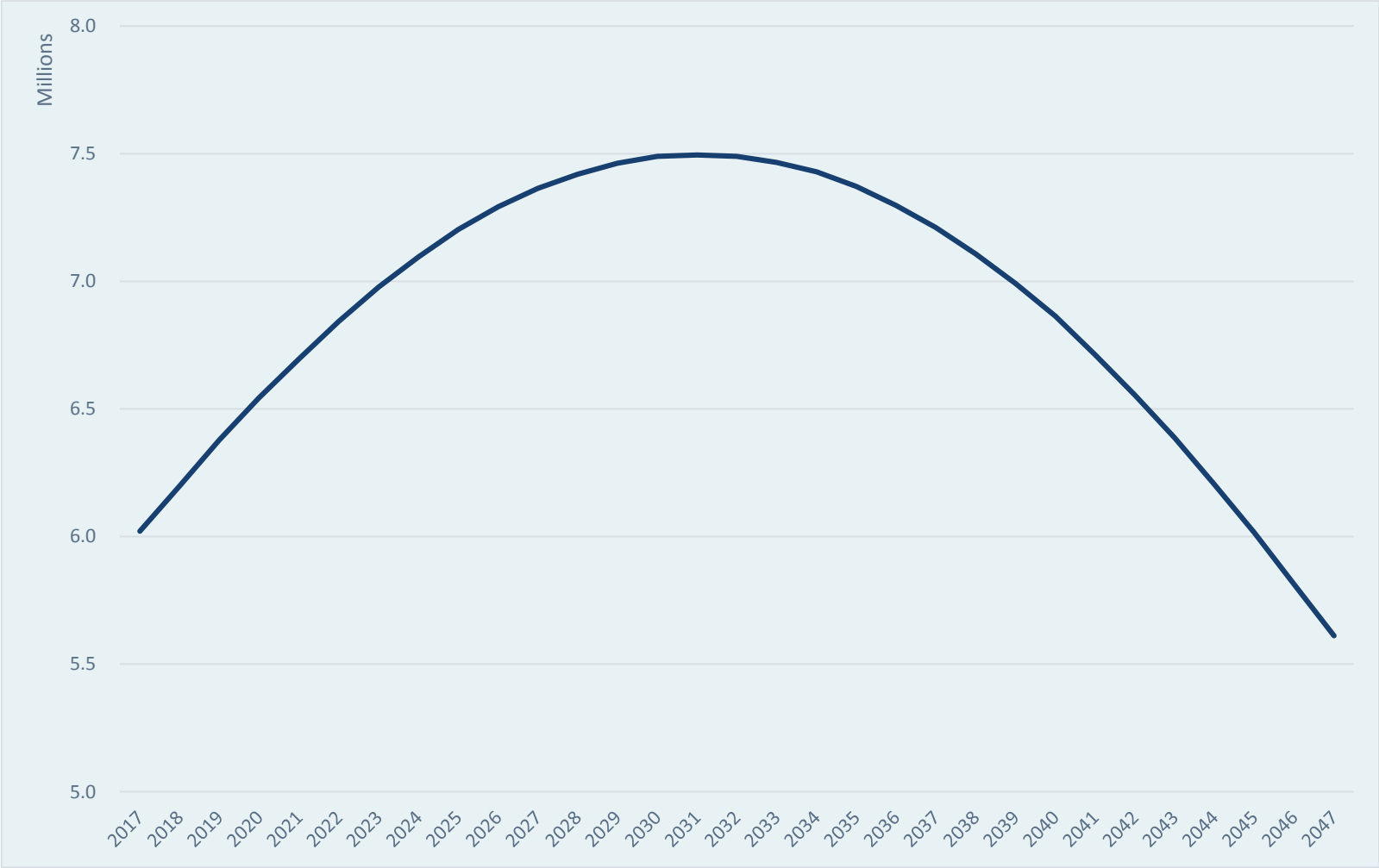
Source: ProVal, Verus

SRBR Impact

Overview of Supplemental Retiree Benefit Reserve (SRBR)



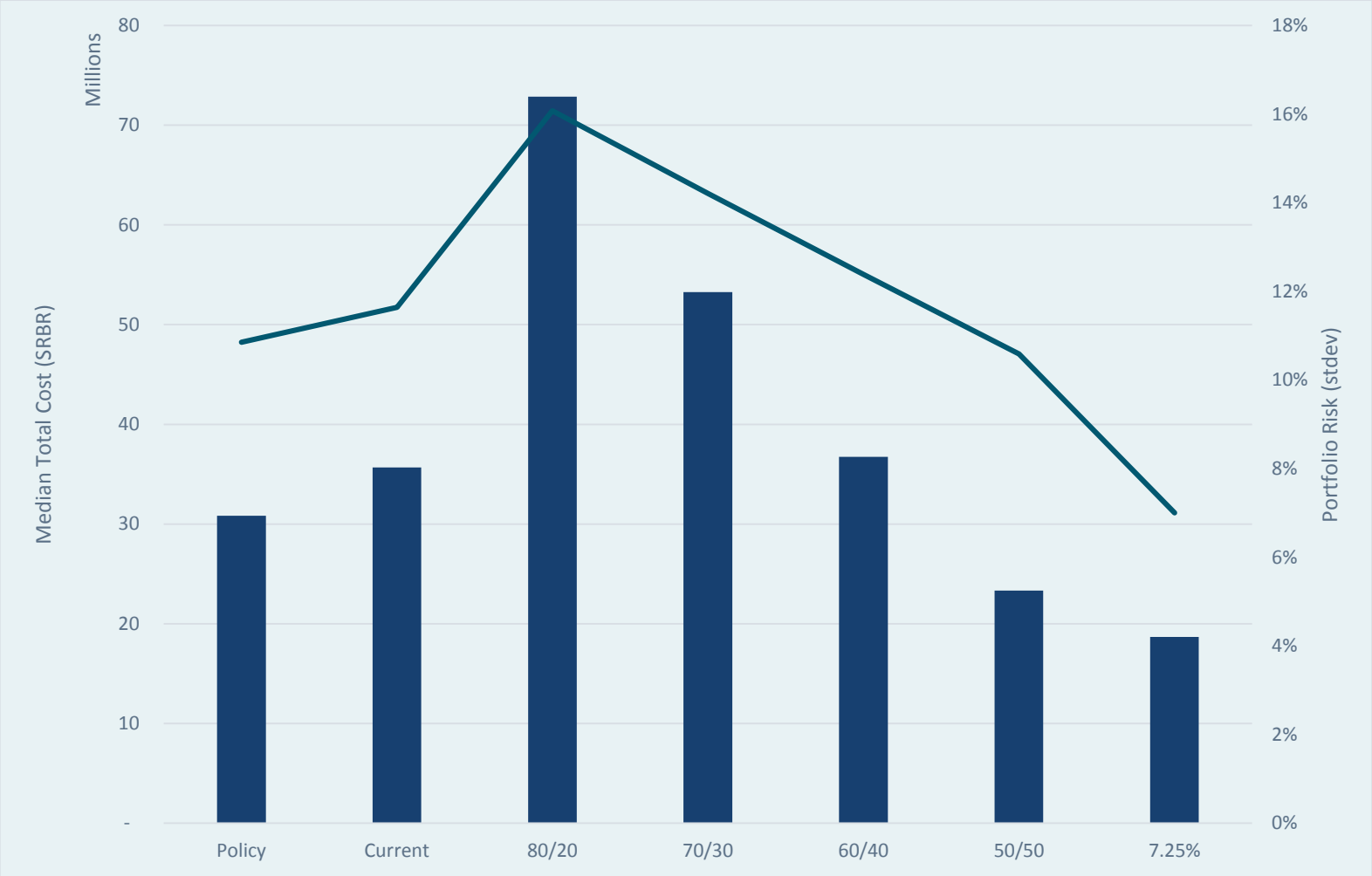
SRBR Benefit Payments (expected)



Calculated SRBR expenses are meant to be rough approximations subject to change. We expect withdrawals for benefit payments to increase over the next 20 years before gradually decreasing.

Projected SRBR expenses are based on the existing benefits of the SRBR which are assumed to remain constant.

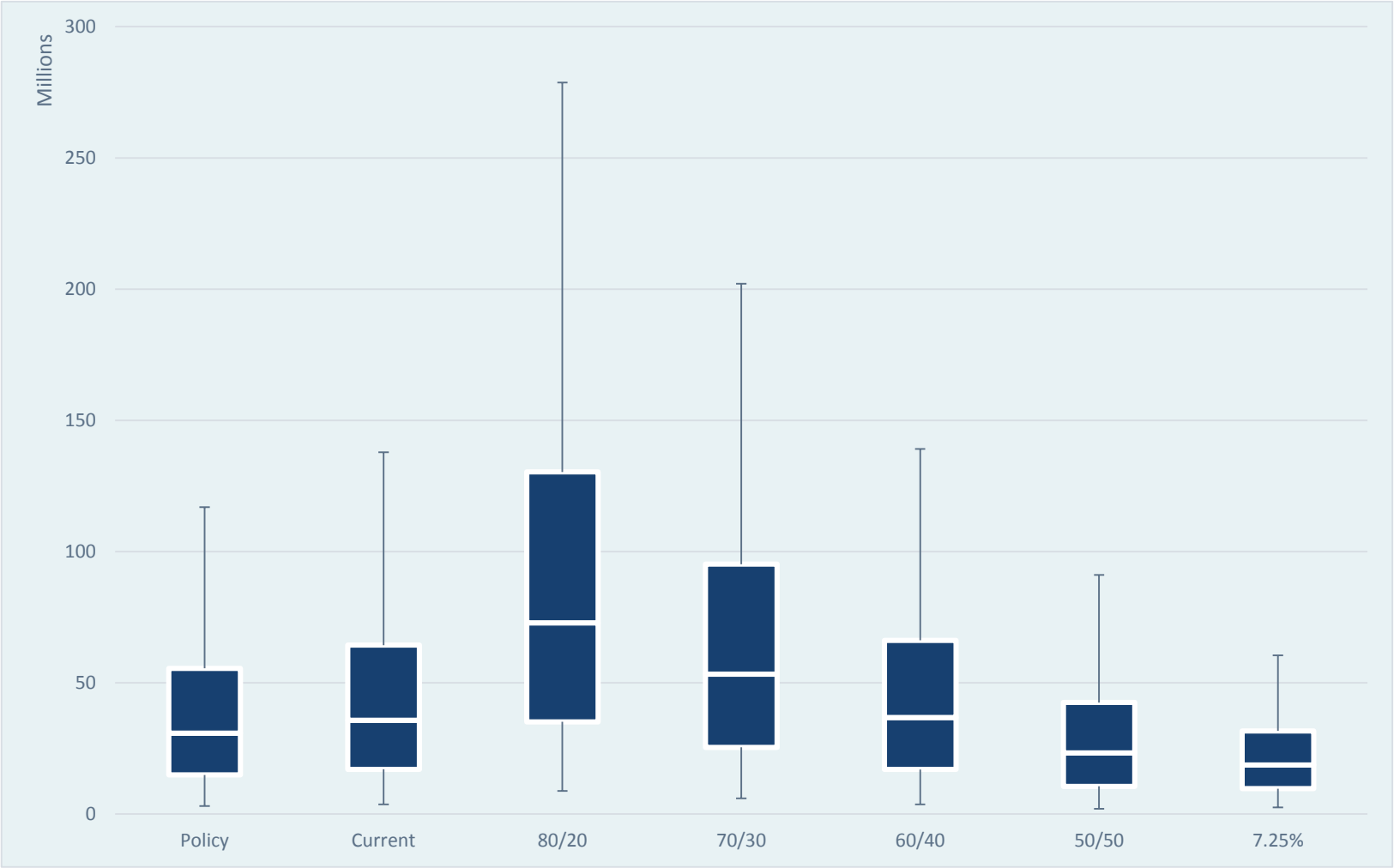
SRBR Performance Based Contributions: Median 10 Year Horizon



SRBR investment cost is defined as the monies taken from the investment account during times of overperformance. This cost is primarily driven by projected portfolio volatility.

Total cost calculated as the sum of all projected contributions to SRBR fund over a 10 year period excluding any actuarial gain obtained from the $250,000,000 POB contribution in 2018.

SRBR Performance Based Contributions: 10 Year Horizon

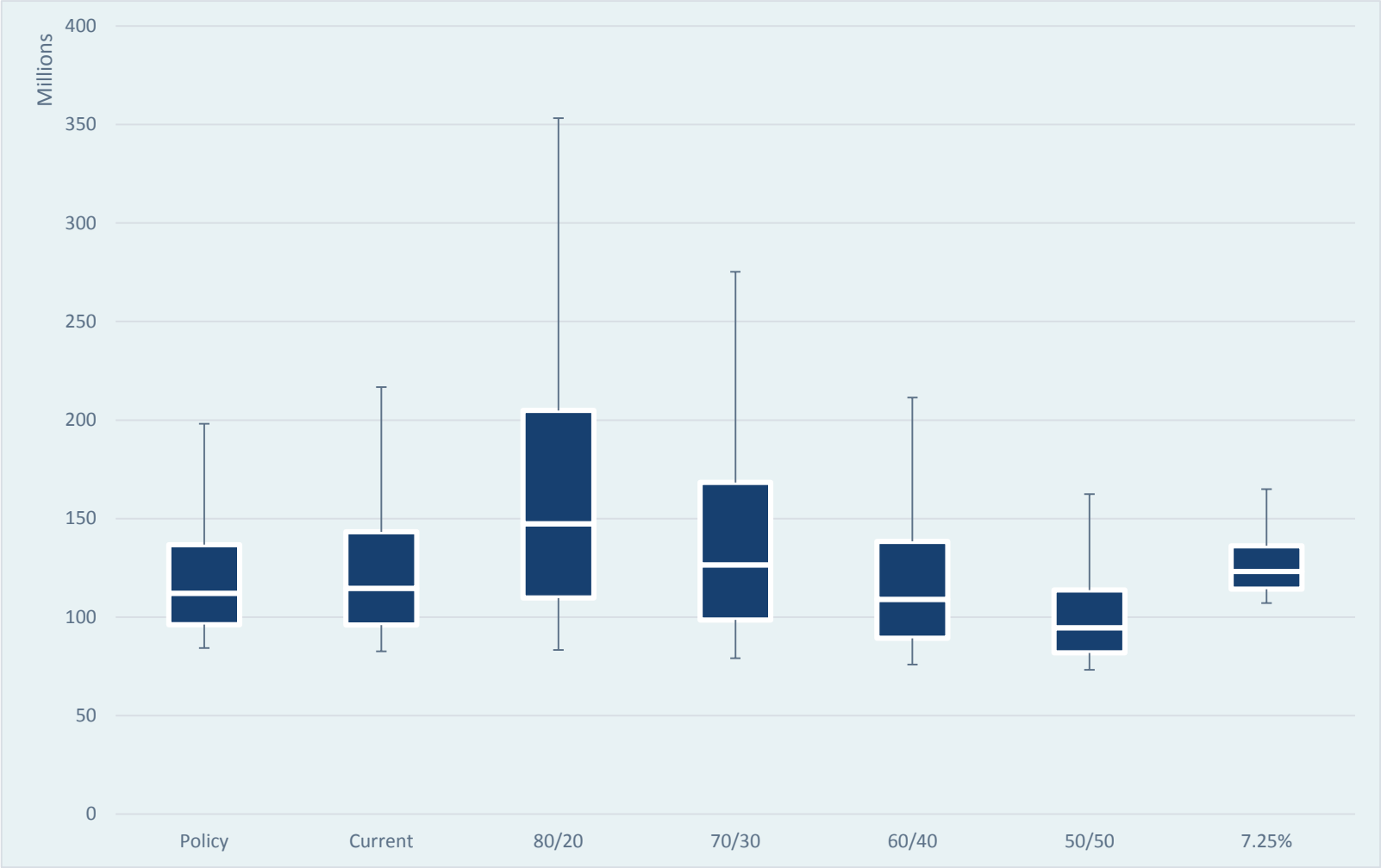


SRBR investment cost is defined as the monies taken from the investment account during times of overperformance. This cost is primarily driven by projected portfolio volatility.

We expect a total, median cost of 30-40m over a 10 year period.

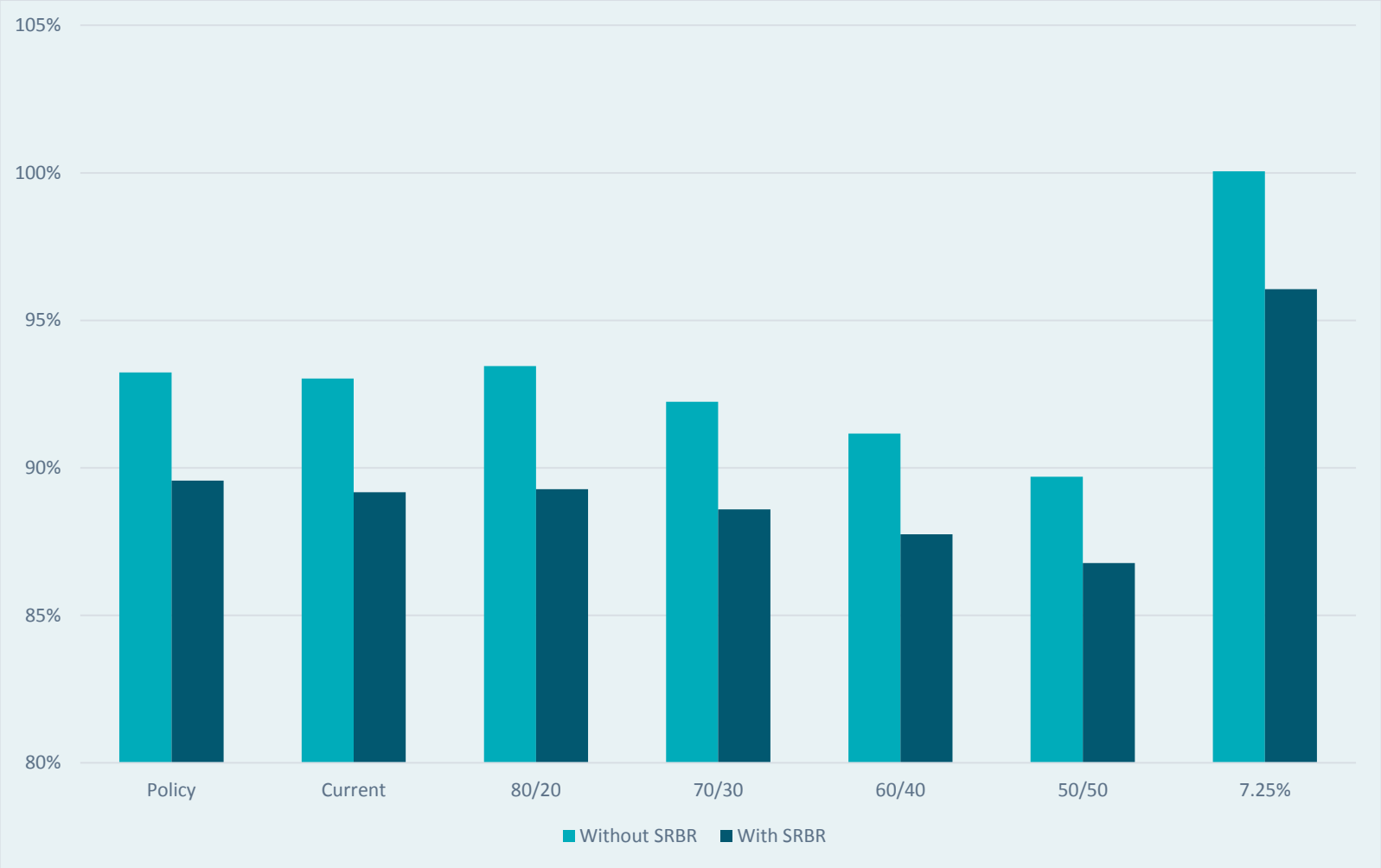
Total cost calculated as the sum of all projected contributions to SRBR fund over a 10 year period excluding any actuarial gain obtained from the $250,000,000 POB contribution in 2018.

SRBR Fund Value: 10 Year Horizon



Total cost calculated as the sum of all projected contributions to SRBR fund over a 10 year period excluding any actuarial gain obtained from the $250,000,000 POB contribution in 2018. Inclusive of SRBR benefit payments projection.

SRBR Fund Impact: Median Funded Status 10 Year Horizon



The SRBR's impact on the projected, median, actuarial funded ratio over a 10 year horizon is roughly 3-4%

Compares the projected, median 10 year actuarial funded ratio outcomes both with and without SRBR impacts. Assumes total cost calculated as the sum of all projected contributions to SRBR fund over a 10 year period excluding any actuarial gain obtained from the $250,000,000 POB contribution in 2018.

Appendix

Notes

- Assumed return: 7.25%
  - 3.0% inflation
  - 4.25% real return
- Plan projections assume constant population (zero plan growth)
- COLA: Plan contains a COLA which changes based on the CPI on maximums, which differ based on benefit tier.
  - Tier 1 Maximum = 3%
  - Tier 2-4 Maximum = 2%
  - Currently illustrated at CPI Maximum for each tier.
- Amortization: fixed period of 19 years since 2015. Deviations in experience from assumptions is amortized over a new closed 19 year periods.
- Asset growth projections are supplied by Verus' 2017 Capital Market Assumptions