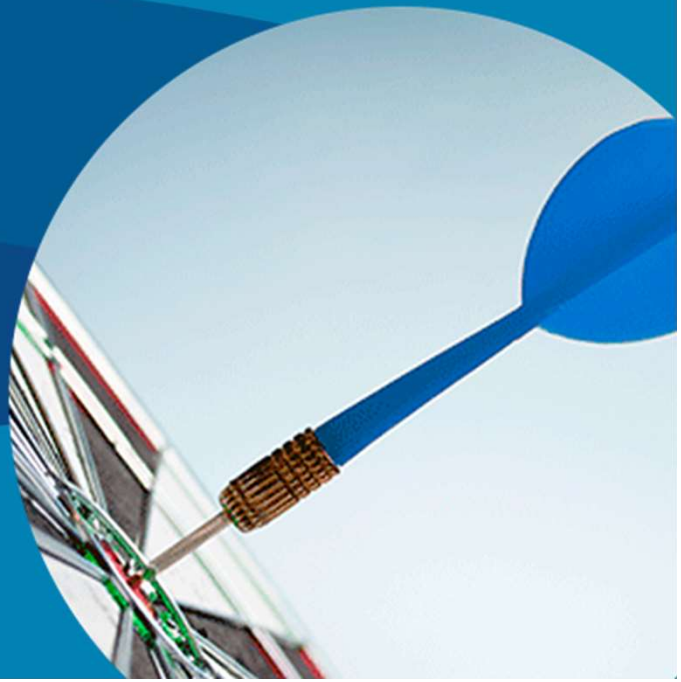
State of Wisconsin Investment Board (SWIB)

Wisconsin Retirement System
Actuarial Overview and Stress Testing Scenarios

October 2021



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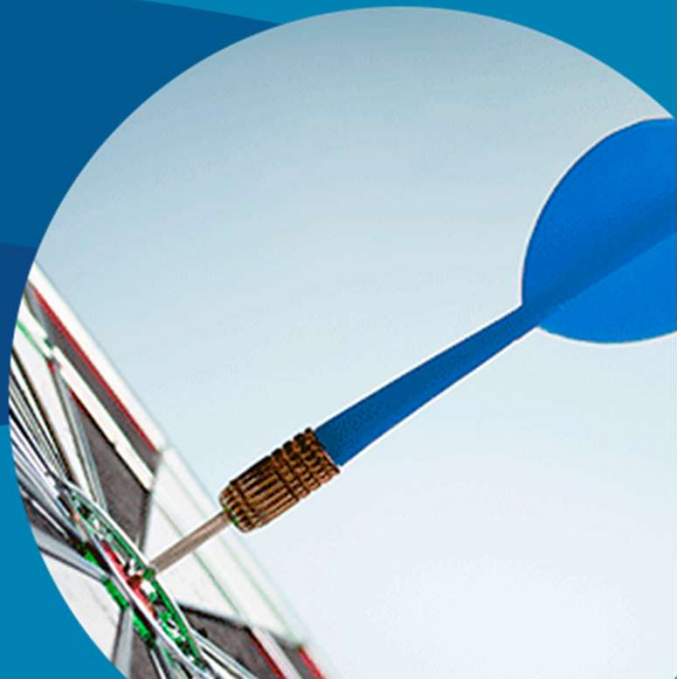
Topics

- Executive Summary
- WRS – The Big Picture
- Stress Testing Results – Deterministic
- Stress Testing Results – Stochastic
- Appendix

Executive Summary



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Objectives of this Presentation

- Provide an overview of the WRS
  - Relationship of Investment Return to Success Measures
  - Effects of bad outcomes
- Evaluate several points along the asset allocation spectrum against the measures of success
  - Deterministic stress tests
  - Stochastic simulations
- Find the “Sweet Spot” if it exists

2021 Executive Summary

- Deterministic stress test of WRS

Single year Black Swan investment scenarios show:

  - Contribution rate increases by up to ~ 3-4% of payroll once loss fully works into the Market Recognition Account
  - Series of negative dividends, depletion of Dividend Reserve and several years until Dividends resume
  - Contribution Rates are generally more stable than retiree Dividends

New “Stagflation with bounce back” scenario not as dire

2021 Executive Summary

- Overall stochastic stress test results similar to 2019 study
  - Excellent market returns during 2019-2020
  - Much higher standard deviation of future returns
- Updated comparison summary to 20-year period from 10-year period

2021 Executive Summary

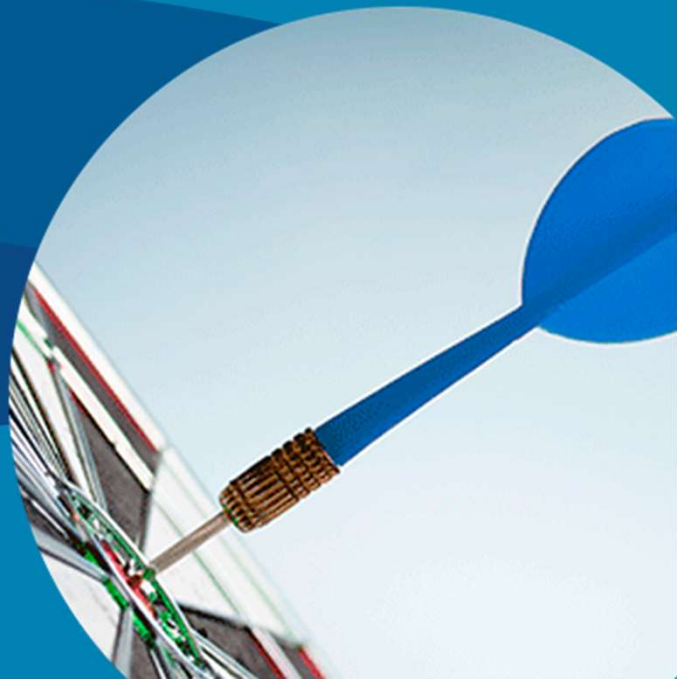
Result of this year's stress testing of the Wisconsin Retirement System

- Continue to target 'Goldilocks zone' that provides for positive return with appropriate downside protection
  - Expected Rate of Return = 6-7%
  - Corresponding Standard Deviations of Returns = 15.5%-20.4%(while this is the mathematical result, stakeholders should consider carefully the effects of such a large amount of volatility prior to implementation)

2021 Observations

- Changes from 2019 Study
  - Compounded returns for 2019 (19.4%) and 2020 (15.0%) were higher than assumed rate of 7.0%
  - Much higher Standard Deviation than 2019 Study
- Overall results are similar to 2019 study
  - Slightly lower probability of depleting dividend liability due to increase in dividend liability (as percentage of total liability)
  - Wider range of results due to higher standard deviation

WRS – The Big Picture



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WRS Participants in Total

Valuation Group	Number	Average Annual Earnings/Benefits*
Actives	258,338	$58,317
Inactives	169,166	$18,228
Retirees & Beneficiaries	222,723	$26,369
Total Participants	**650,227**	

** For inactives, average money purchase balance.*

Data as of December 31, 2020

WRS Benefits

- Defined Benefit Plan:
  - 1.6% x Final Average Compensation x Service (most participants)
  - Different benefits for protective occupations
  - Provides benefits in the case of death or disability prior to retirement

WRS Funding

- WRS receives contributions in approximately equal amounts from employers and participants
- More than $125 billion in assets at 12/31/2020
- WRS is widely recognized as one of the most well funded systems in the country

WRS Investments

- Core Fund (Most Assets)
  - Diversified portfolio with results smoothed for WRS purposes via the Market Recognition Account (MRA)
- Variable Fund (Some Assets)
  - 100% Common Stock -- no smoothing of results
  - Participants can choose to invest up to half of their own contributions in this fund
    - They bear the risks and reap the rewards of this choice

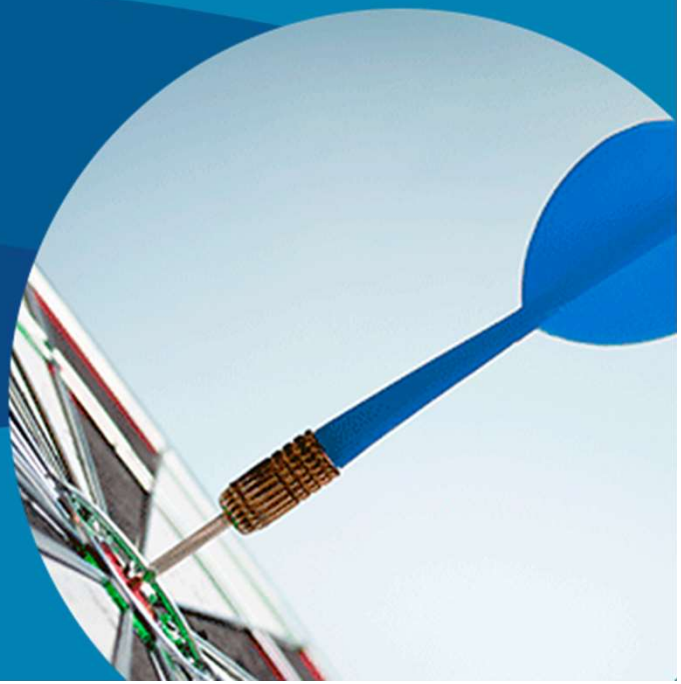
WRS Actuarial Assumptions

- Non-Retired Assets: 7%
- Retired Assets: 5% (This is a statutory assumption that is really a benefit condition)
- Other assumptions relate to active participants salary, rates of turnover, disability, mortality, etc.
- Investment return assumption (7%) is the most important

WRS Risk Sharing

- Investment earnings increase (or decrease) active and inactive member account balances
  - Affects their benefits when they retire via the operation of the Money Purchase Minimum benefit (MPM)
- Investment earnings (smoothed) above or below 5% affect dividends paid to retirees
- Active members and employers share in contribution rate changes

Stress Testing Results - Deterministic



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WRS Stress Testing (limitations and simplifications)

- Goal is to understand the potential effect of various levels of stress on the system (not calculate exact predictions)
- Simplifying assumptions
  - Retiree funded status allowed to become negative and recover over time
  - Typical dividend adjustments assumed to average to zero
  - Iterative impact between Money purchase minimum and contribution rates assumed to average to zero
  - Modified Normal distribution in future years (standard deviation gradually declines in future years)

Stress Testing

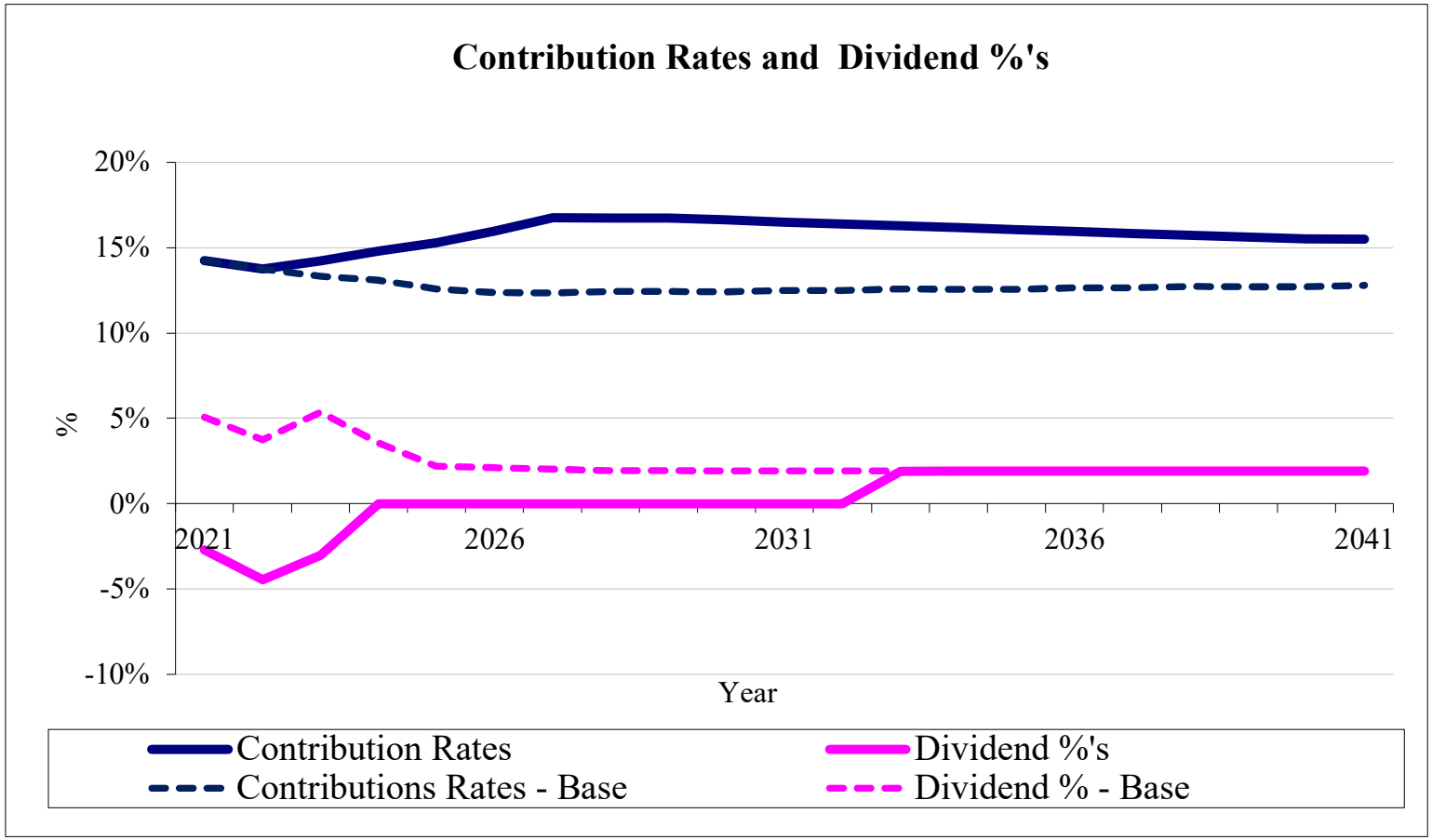
- Stress test provides insight into how the System would respond to severely unfavorable markets
- For the WRS, stress test can answer questions:
  - What would it take to deplete the dividend liability?
  - What would it take to increase contribution rates 25%?
  - What is the impact of an inflation resurgence?

Stress Testing

- Deterministic stress tests studied herein:
  - Negative 30% return in year 1, followed by assumed return of 7% thereafter (no bounce back)
  - Negative 40% return in year 1, followed by assumed return of 7% thereafter (no bounce back)
  - Stagflation scenario
    - Go to, and stay at, 4% inflation
    - Asset drop followed by Asset bounceback

Underlying valuation assumptions held constant, including 7% investment return and 3% wage inflation assumptions

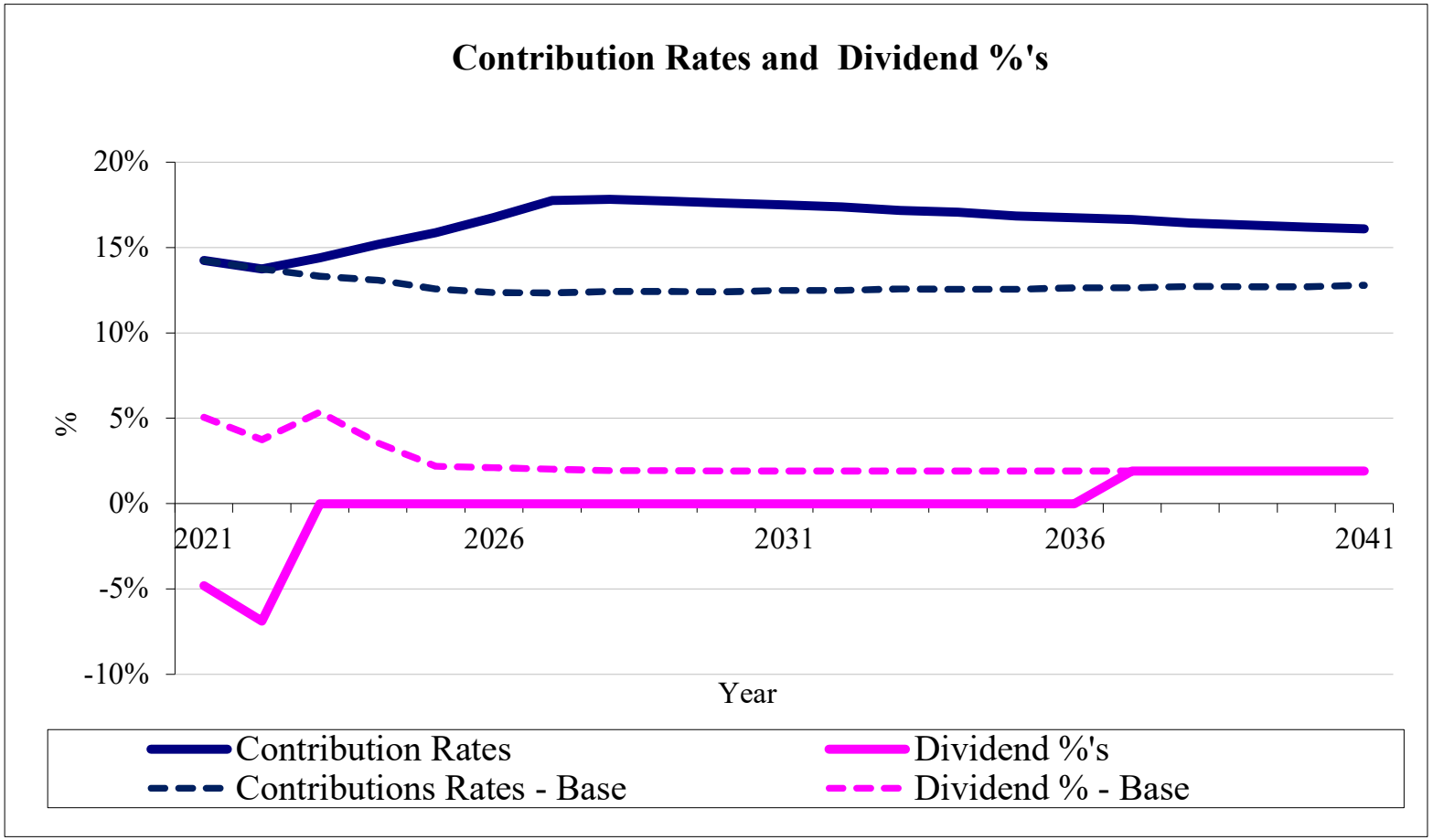
Stress Test 1 – Negative 30% Return in 2021 Followed by 7.0% Thereafter



Stress Test 1 – Negative 30% Return in 2021 Followed by 7.0% Thereafter

- Dividend Liability is depleted by 2025
- Retiree Liability becomes underfunded
- There will be a series of negative dividends, until most people are at the floor, followed by an extended period of no dividends
- Dividends could resume in 2031
- Contribution Rate gradually increases by about 3% of payroll in year 5 and slowly declines thereafter

Stress Test 2 – Negative 40% Return in 2021 Followed by 7.0% Thereafter



Stress Test 2 – Negative 40% Return in 2021 Followed by 7.0% Thereafter

- Dividend Liability is depleted by 2023
- Retiree Liability becomes underfunded
- There will be a series of negative dividends, until most people are at the floor, followed by a long period of no dividends
- Dividends could resume in 2038
- Contribution Rate gradually increases by about 4% of payroll in year 5 and slowly declines thereafter

Stress Test 3 – Stagflation Scenario

- Amplification of asset stress test shown to the Board using ETF's MRA modeling
  - Includes market bounceback
- Results incorporate WRS liability projection
  - Projected costs based on current assumptions, including 7% investment return and 3% wage inflation

Stress Test 3 – Stagflation Scenario
Market Value Asset Returns

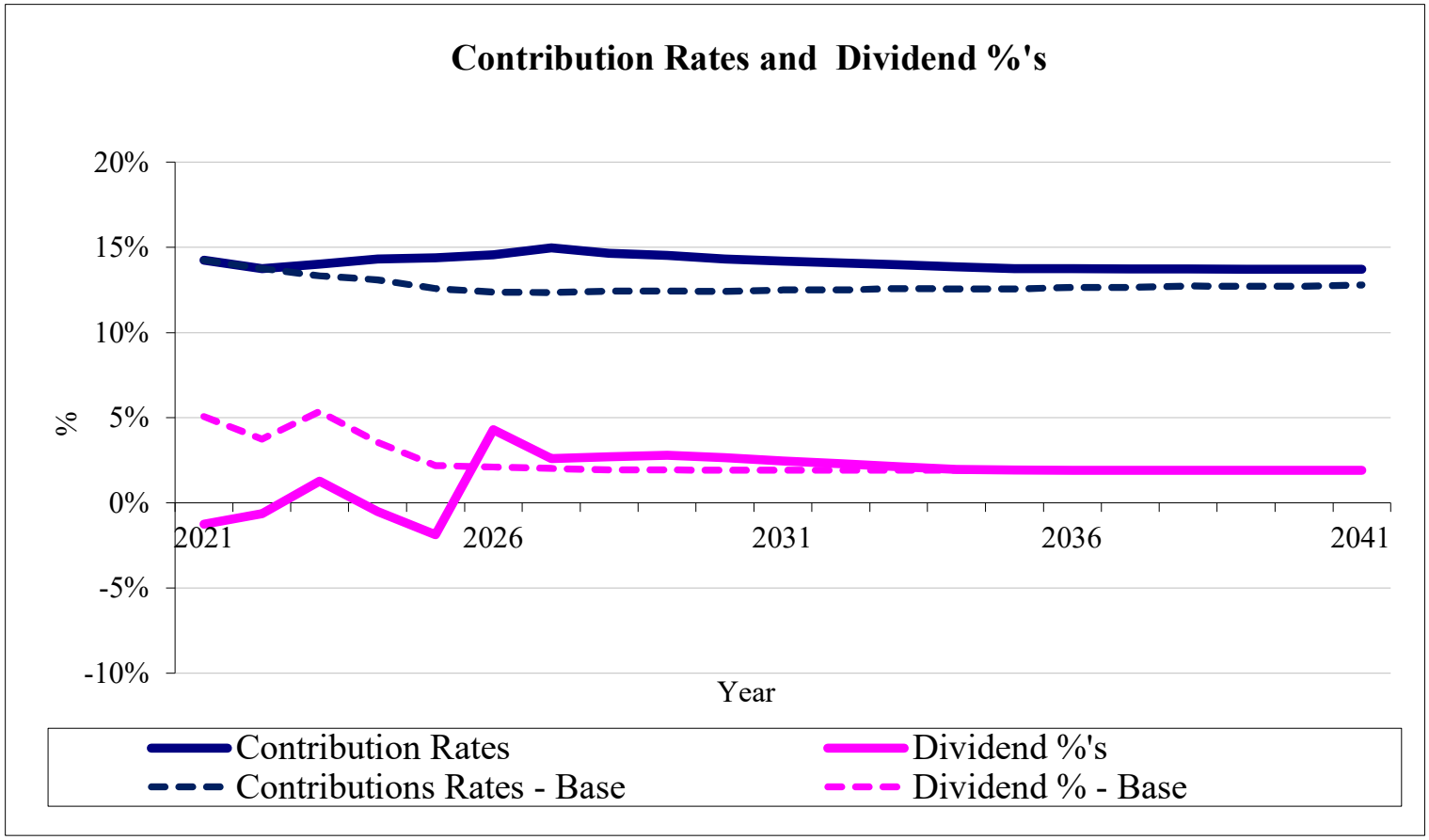
Return Shock

Year 1	-23.40%
Year 2	21.10%
Years 3-10	7.89%
Years 11+	7.00%

Recover

Return to Normal

Stress Test 3 – Stagflation Scenario



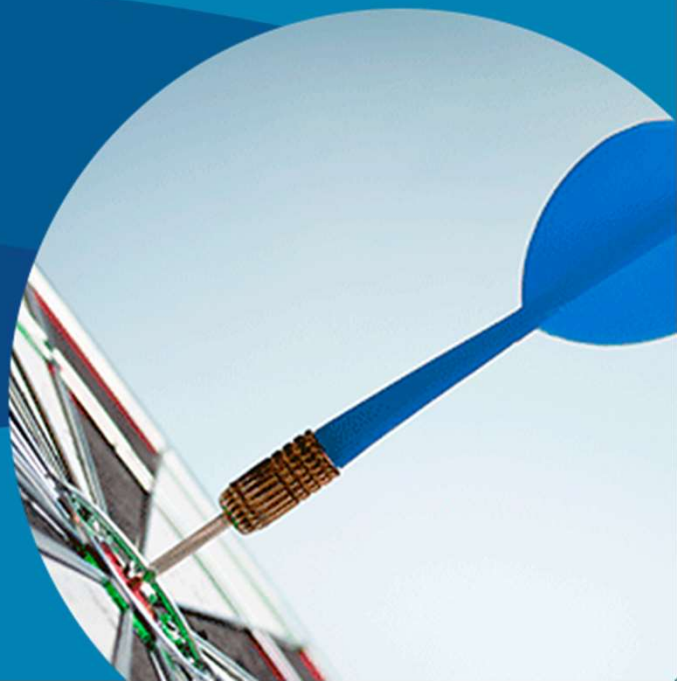
Stress Test 3 – Stagflation Scenario

- Dividend Liability is not depleted
- Retiree Liability not underfunded
- Negative dividends in 4 out of first 5 years, followed by a return to positive dividends
- Contribution Rate gradually increases by about 2.5% of payroll in year 5 but declines thereafter

Stress Test Observations

- Contribution rates are generally more stable than dividend rates
- Due to build up of Dividend Liability, it would take a very large negative return to deplete the dividend liability
- Retirees' assets are almost 65% of the total
- Proportions allocated to Retiree reserve, money purchase minimum and EAR change and evolve over time

Stress Testing Results - Stochastic



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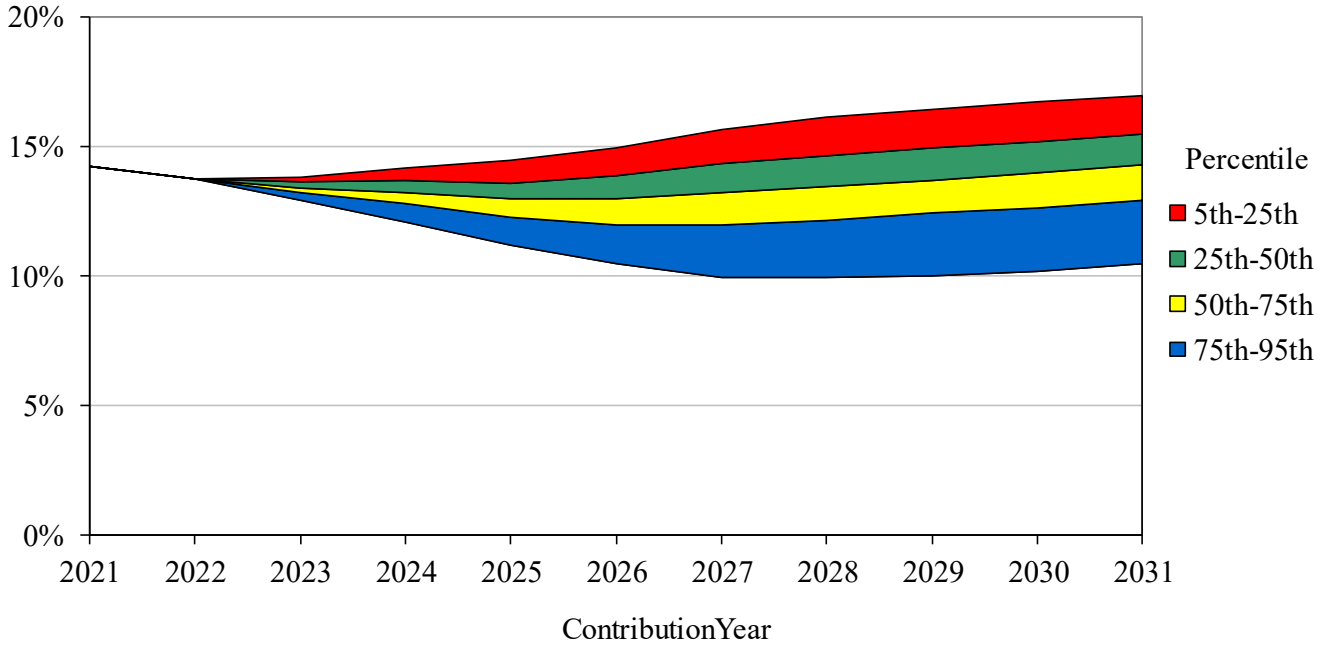
Monte Carlo Simulations

- Based on 10,000 random trials (normal distribution)
- Valuation Assumptions held constant
- Assumes seven sets of expected return/standard deviations (provided by NEPC)

Actuarial Rate →

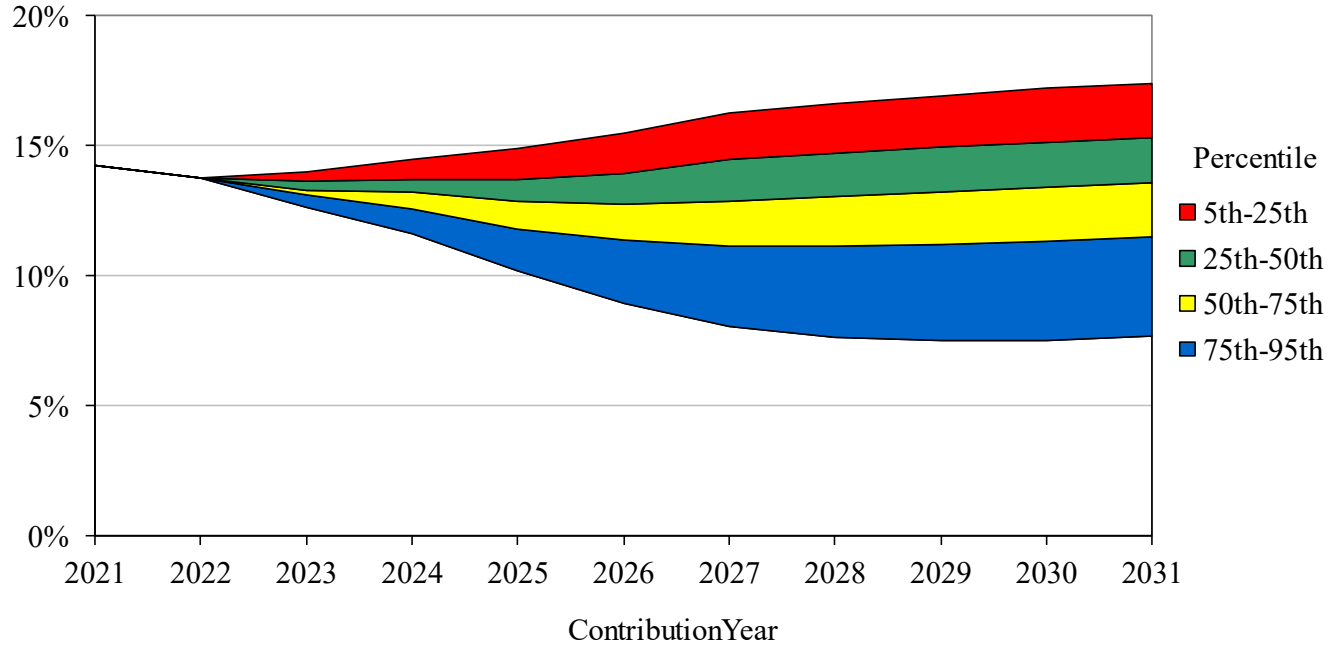
	Expected Return		Standard Deviation
	Geometric	Arithmetic	
Scenario 1	4.0%	4.3%	6.9%
Scenario 2	5.0%	5.5%	11.3%
Scenario 3	6.0%	7.0%	15.5%
Scenario 4	7.0%	8.7%	20.4%
Scenario 5	8.0%	10.7%	26.3%
Scenario 6	9.0%	13.3%	33.7%
Scenario 7	10.0%	16.8%	44.0%

Contribution as a % of Payroll
Scenario 2 – 5.0% Return, 11.3% Volatility



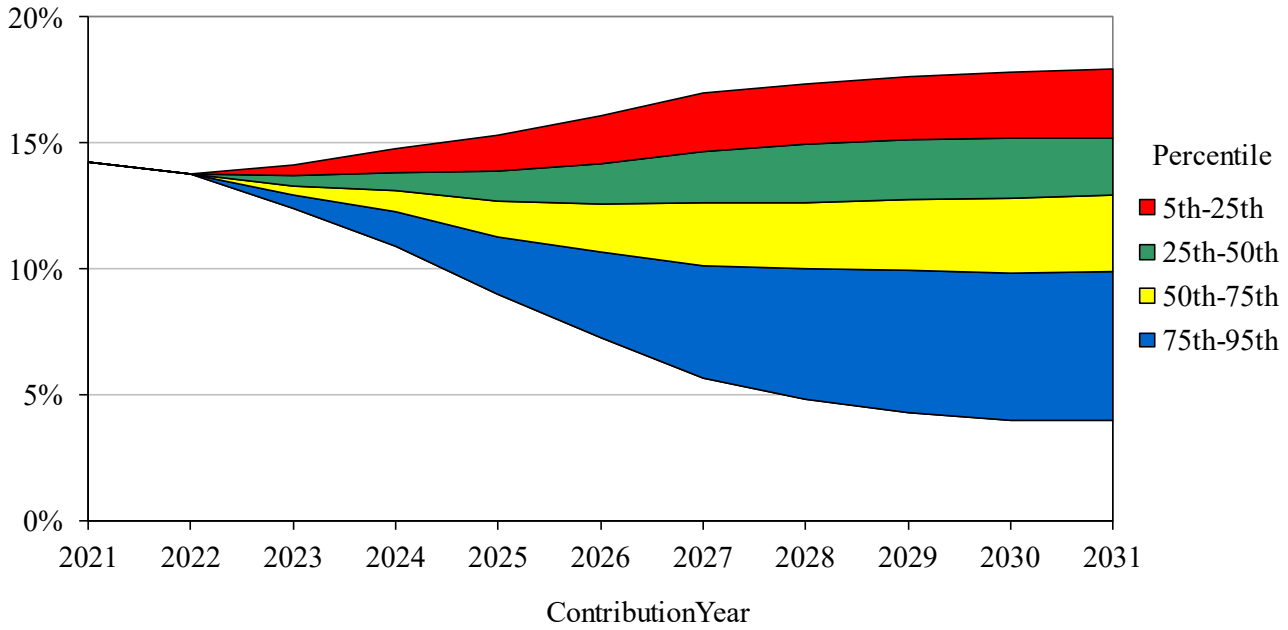
5th Percentile	14.2%	13.7%	13.8%	14.2%	14.5%	15.0%	15.7%	16.1%	16.4%	16.7%	17.0%
25th Percentile	14.2%	13.7%	13.6%	13.7%	13.6%	13.9%	14.4%	14.6%	14.9%	15.2%	15.5%
Median	14.2%	13.7%	13.4%	13.2%	13.0%	13.0%	13.3%	13.4%	13.7%	14.0%	14.3%
75th Percentile	14.2%	13.7%	13.2%	12.8%	12.3%	12.0%	12.0%	12.1%	12.4%	12.6%	12.9%
95th Percentile	14.2%	13.7%	12.9%	12.1%	11.2%	10.5%	10.0%	9.9%	10.0%	10.2%	10.5%

Contribution as a % of Payroll
Scenario 3 – 6.0% Return, 15.5% Volatility



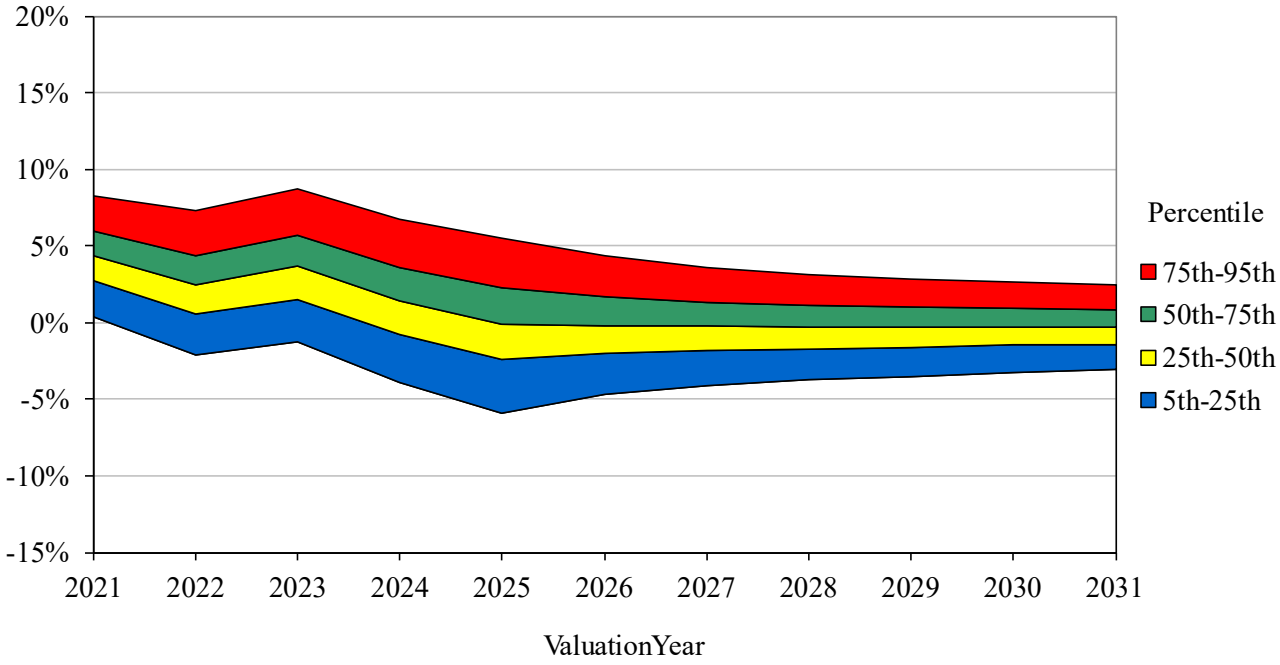
5th Percentile	14.2%	13.7%	14.0%	14.5%	14.9%	15.5%	16.3%	16.6%	16.9%	17.2%	17.4%
25th Percentile	14.2%	13.7%	13.6%	13.7%	13.7%	14.0%	14.5%	14.7%	14.9%	15.1%	15.3%
Median	14.2%	13.7%	13.3%	13.2%	12.9%	12.8%	12.9%	13.0%	13.2%	13.4%	13.6%
75th Percentile	14.2%	13.7%	13.1%	12.6%	11.8%	11.4%	11.2%	11.1%	11.2%	11.3%	11.5%
95th Percentile	14.2%	13.7%	12.6%	11.6%	10.2%	9.0%	8.1%	7.6%	7.5%	7.5%	7.7%

Contribution as a % of Payroll
Scenario 4 – 7.0% Return, 20.4% Volatility



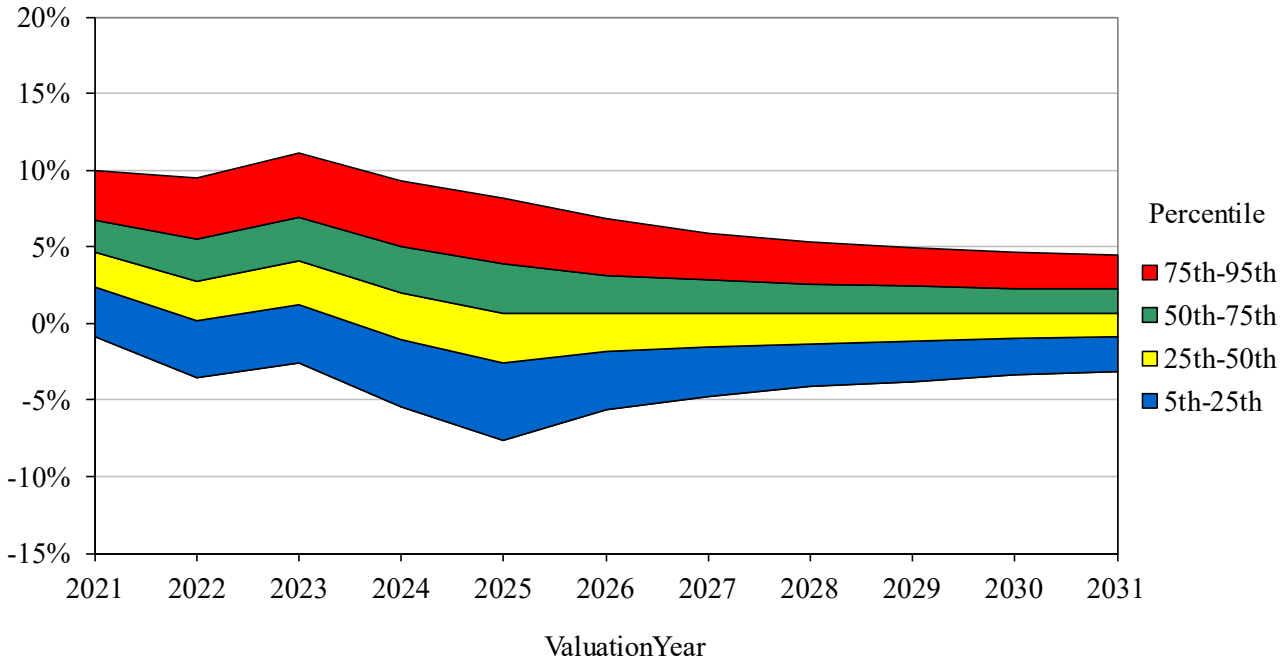
5th Percentile	14.2%	13.7%	14.1%	14.8%	15.3%	16.1%	17.0%	17.3%	17.6%	17.8%	17.9%
25th Percentile	14.2%	13.7%	13.7%	13.8%	13.9%	14.2%	14.7%	14.9%	15.1%	15.2%	15.2%
Median	14.2%	13.7%	13.3%	13.1%	12.7%	12.6%	12.7%	12.6%	12.7%	12.8%	12.9%
75th Percentile	14.2%	13.7%	12.9%	12.3%	11.3%	10.7%	10.2%	10.0%	9.9%	9.8%	9.9%
95th Percentile	14.2%	13.7%	12.4%	10.9%	9.0%	7.3%	5.7%	4.8%	4.3%	4.0%	4.0%

Dividend Rates
Scenario 2 – 5.0% Return, 11.3% Volatility



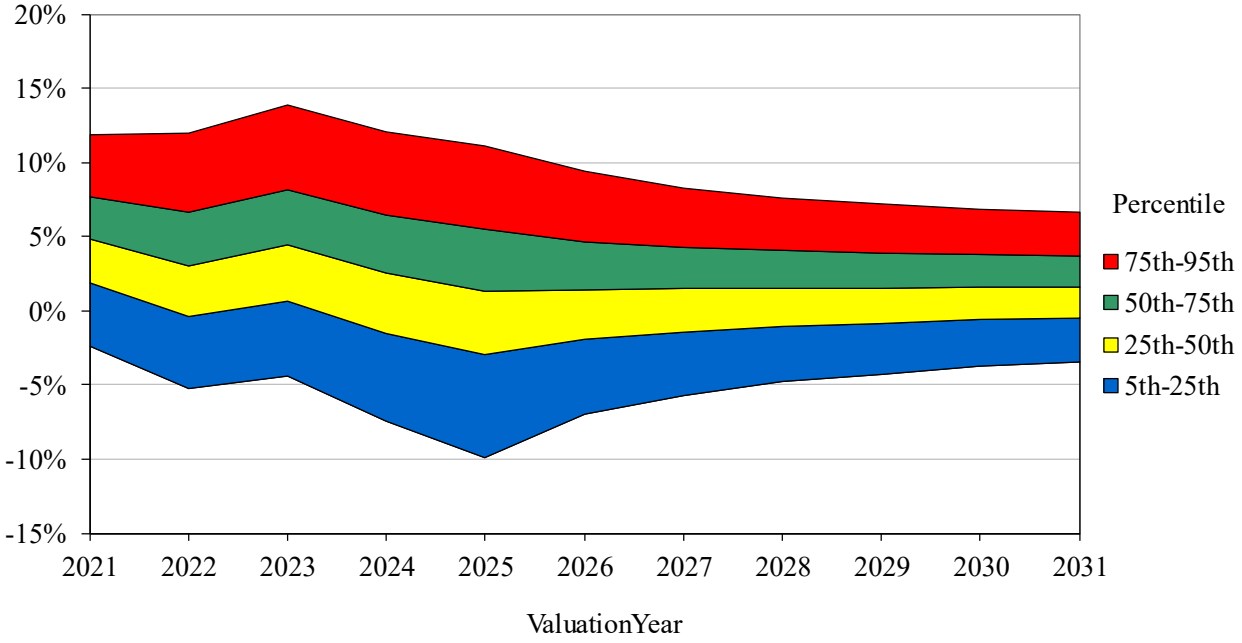
5th Percentile	0.4%	-2.1%	-1.2%	-3.9%	-6.0%	-4.7%	-4.1%	-3.7%	-3.5%	-3.2%	-3.0%
25th Percentile	2.8%	0.6%	1.6%	-0.8%	-2.4%	-2.0%	-1.8%	-1.7%	-1.6%	-1.5%	-1.4%
Median	4.4%	2.5%	3.7%	1.5%	-0.1%	-0.2%	-0.2%	-0.3%	-0.3%	-0.3%	-0.3%
75th Percentile	6.0%	4.4%	5.7%	3.6%	2.3%	1.7%	1.4%	1.2%	1.0%	0.9%	0.9%
95th Percentile	8.3%	7.3%	8.7%	6.7%	5.5%	4.3%	3.6%	3.1%	2.9%	2.6%	2.5%

Dividend Rates
Scenario 3 – 6.0% Return, 15.5% Volatility



5th Percentile	-0.9%	-3.5%	-2.6%	-5.4%	-7.6%	-5.6%	-4.8%	-4.1%	-3.8%	-3.4%	-3.2%
25th Percentile	2.4%	0.2%	1.2%	-1.0%	-2.5%	-1.8%	-1.5%	-1.3%	-1.2%	-1.0%	-0.9%
Median	4.6%	2.8%	4.1%	2.0%	0.7%	0.7%	0.7%	0.6%	0.7%	0.7%	0.7%
75th Percentile	6.8%	5.5%	6.9%	5.0%	3.9%	3.2%	2.8%	2.6%	2.4%	2.3%	2.3%
95th Percentile	10.0%	9.5%	11.1%	9.3%	8.2%	6.8%	5.9%	5.3%	5.0%	4.7%	4.5%

Dividend Rates
Scenario 4 – 7.0% Return, 20.4% Volatility



5th Percentile	-2.4%	-5.2%	-4.4%	-7.4%	-9.9%	-7.0%	-5.7%	-4.8%	-4.3%	-3.7%	-3.5%
25th Percentile	1.9%	-0.4%	0.7%	-1.5%	-3.0%	-1.9%	-1.4%	-1.1%	-0.8%	-0.6%	-0.5%
Median	4.8%	3.1%	4.5%	2.5%	1.3%	1.4%	1.5%	1.5%	1.5%	1.6%	1.6%
75th Percentile	7.7%	6.6%	8.2%	6.5%	5.5%	4.7%	4.3%	4.1%	3.9%	3.8%	3.7%
95th Percentile	11.9%	12.0%	13.9%	12.1%	11.1%	9.4%	8.3%	7.6%	7.2%	6.9%	6.6%

Stress Testing Dividend Depletion and Retiree Funded Status

- Definitions
  - Dividend Liability = Total Retiree Liability (w/div.)
    less Base Benefit Liability (w/o div.)
  - Retiree Funded Status =

    Total Retiree Liability (w/div.) / Base Benefit Liability (w/o div.)
- Dividend Stress Test studied
  - Probability that dividend liability will be depleted
  - Number of paths leading to Dividend Depletion
  - Worst case scenario of Retiree Funded Status
  - Depletion Severity measure

Stress Testing Dividend Depletion and Retiree Funded Status

Probability {Dividend Depletion in year i}

Represents the number of times the Retiree Funded Status is less than 1 in year i divided by 10,000 (allows for recovery in future years)

Dividend Stress Test

Probability That Dividend Liability Will Be Depleted in Year (allows for recovery in future year)

Actuarial Rate →

	Expected ROR	Standard Deviation	Year 1	Year 5	Year 10	Year 20	Year 50
1	4.0%	6.9%	0.0%	0.1%	3.4%	24.9%	90.4%
2	5.0%	11.3%	0.0%	2.0%	7.4%	12.9%	23.9%
3	6.0%	15.5%	0.0%	5.4%	9.8%	8.9%	5.7%
4	7.0%	20.4%	0.0%	10.1%	12.6%	8.4%	2.4%
5	8.0%	26.3%	0.0%	15.1%	16.3%	10.1%	2.1%
6	9.0%	33.7%	0.2%	20.2%	21.1%	13.1%	2.9%
7	10.0%	44.0%	1.2%	26.2%	27.7%	19.1%	5.4%

Stress Testing Dividend Depletion and Retiree Funded Status

Percentage of paths leading to Dividend Depletion on or before year i

Counts the number of times on or before year i the Retiree Funded Status is less than 1 (does not allow for recovery in future years)

Dividend Stress Test

Percentage of Paths Leading to Dividend Depletion on or before year i

Actuarial Rate →

	Expected ROR	Standard Deviation	Year 1	Year 5	Year 10	Year 20	Year 50
1	4.0%	6.9%	0.0%	0.1%	3.5%	25.2%	90.9%
2	5.0%	11.3%	0.0%	2.0%	7.8%	15.2%	32.2%
3	6.0%	15.5%	0.0%	5.4%	11.5%	15.0%	18.8%
4	7.0%	20.4%	0.0%	10.1%	15.9%	18.1%	19.5%
5	8.0%	26.3%	0.0%	15.2%	21.8%	22.8%	23.7%
6	9.0%	33.7%	0.2%	20.2%	26.6%	28.5%	29.4%
7	10.0%	44.0%	1.2%	26.3%	34.0%	36.6%	37.7%

Stress Testing Dividend Depletion and Retiree Funded Status

Worst Case Scenario of Retiree Funded Status

Finds the 5th percentile of retiree funded status for any given year in any given scenario (very unlikely scenario)

Dividend Stress Test

Worst Case Scenario of Retiree Funded Status (% of Floor Benefit That Is Funded)

Actuarial Rate →

	Expected ROR	Standard Deviation	Year 1	Year 5	Year 10	Year 20	Year 50
1	4.0%	6.9%	121%	113%	101%	87%	59%
2	5.0%	11.3%	119%	106%	96%	89%	76%
3	6.0%	15.5%	118%	99%	90%	91%	97%
4	7.0%	20.4%	116%	90%	83%	89%	118%
5	8.0%	26.3%	114%	78%	71%	82%	133%
6	9.0%	33.7%	111%	64%	55%	67%	128%
7	10.0%	44.0%	107%	43%	35%	43%	92%

Worst Case Scenario based on 5st Percentile (i.e., 5% probability)

Stress Testing Dividend
Depletion and Retiree Funded Status

Depletion Severity Measure

Of the stress test simulations that result in a Retiree Funded Status of less than 1, finds the average Retiree Funded Status (or degree of depletion)

Stochastic Stress Testing

Dividend Stress Test
Depletion Severity Measure

Average Retiree Funded Status for Depletion Scenarios

Actuarial Rate →

	Expected ROR	Standard Deviation	Year 1	Year 5	Year 10	Year 20	Year 50
1	4.0%	6.9%	N/A	96%	95%	92%	77%
2	5.0%	11.3%	N/A	94%	92%	90%	85%
3	6.0%	15.5%	N/A	91%	88%	87%	86%
4	7.0%	20.4%	N/A	87%	83%	83%	85%
5	8.0%	26.3%	96%	82%	78%	78%	78%
6	9.0%	33.7%	98%	75%	70%	71%	72%
7	10.0%	44.0%	96%	66%	61%	61%	63%

Dividend Stress Test Observations

- The low risk scenarios are actually risky in the sense that, for example, 4% and 5% expected return has a much higher chance of dividend depletion in later years than higher risk scenarios
- Must balance short and long term volatility
- Consider probability of dividend depletion
- Consider level of worst case scenario that is acceptable

Combination of All Scenarios

2031 Results by %-tile of Investment Return Outcomes

			Contribution Rates			Dividend Rates			Highest	Worst Retiree
	ROR	StdDev	95th	50th	5th	95th	50th	5th	Div. Dep. PRB	Funded %
1	4.0%	6.9%	12.9%	14.9%	16.6%	0.5%	-1.2%	-2.9%	90%/yr50	59%/yr50
2	5.0%	11.3%	10.0%	14.3%	17.0%	2.0%	-0.3%	-3.0%	24%/yr50	76%/yr50
3	6.0%	15.5%	7.7%	13.6%	17.4%	4.5%	0.7%	-3.2%	10%/yr10	90%/yr10
4	7.0%	20.4%	4.0%	12.9%	17.9%	6.6%	1.6%	-3.5%	13%/yr10	83%/yr10
5	8.0%	26.3%	0.0%	12.2%	18.6%	9.0%	2.4%	-4.1%	16%/yr10	71%/yr10
6	9.0%	33.7%	0.0%	11.7%	19.6%	11.6%	3.2%	-5.2%	21%/yr10	55%/yr10
7	10.0%	44.0%	0.0%	11.4%	21.2%	14.6%	3.7%	-7.1%	28%/yr10	35%/yr10

Actuarial Rate →

Portfolios with higher expected return result in higher expected contributions and lower expected dividends

Higher assumed rates of return are associated with higher standard deviation (i.e., risk) and 5th percentile scenario for retiree dividend pool falling below 80%

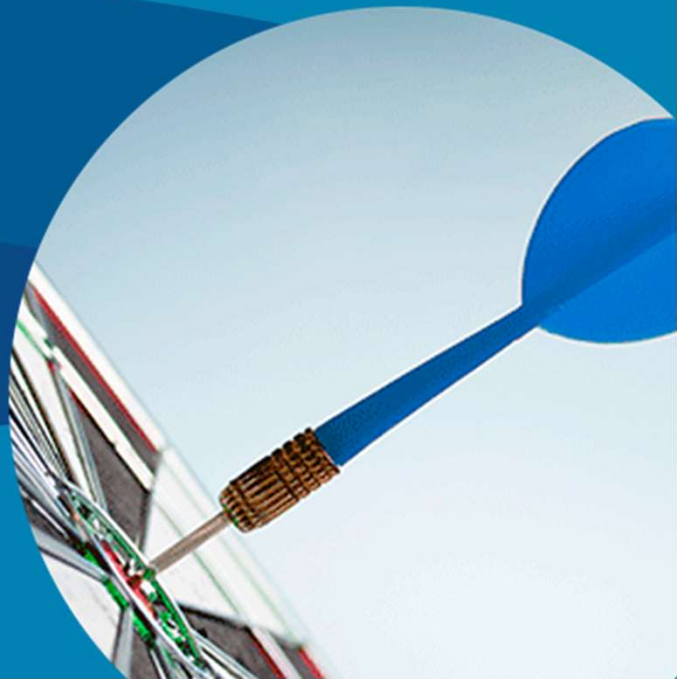
Scenarios 3 and 4 represent potential ‘Goldilocks Zone’

2021 Observations

- Changes from 2019 Study
  - Compounded returns over 2019 and 2020 were 17.2% over 2 years
    - higher than assumed rate of 7.0%
  - Much higher Standard Deviation than 2019 Study
- Overall results are similar to 2019 study
  - Slightly lower probability of depleting dividend liability due to increase in dividend liability (as percentage of total liability)
  - Wider range of results due to higher standard deviation
- Continue to target 'Goldilocks zone' that provides for positive return with appropriate downside protection

- QUESTIONS?

Appendix



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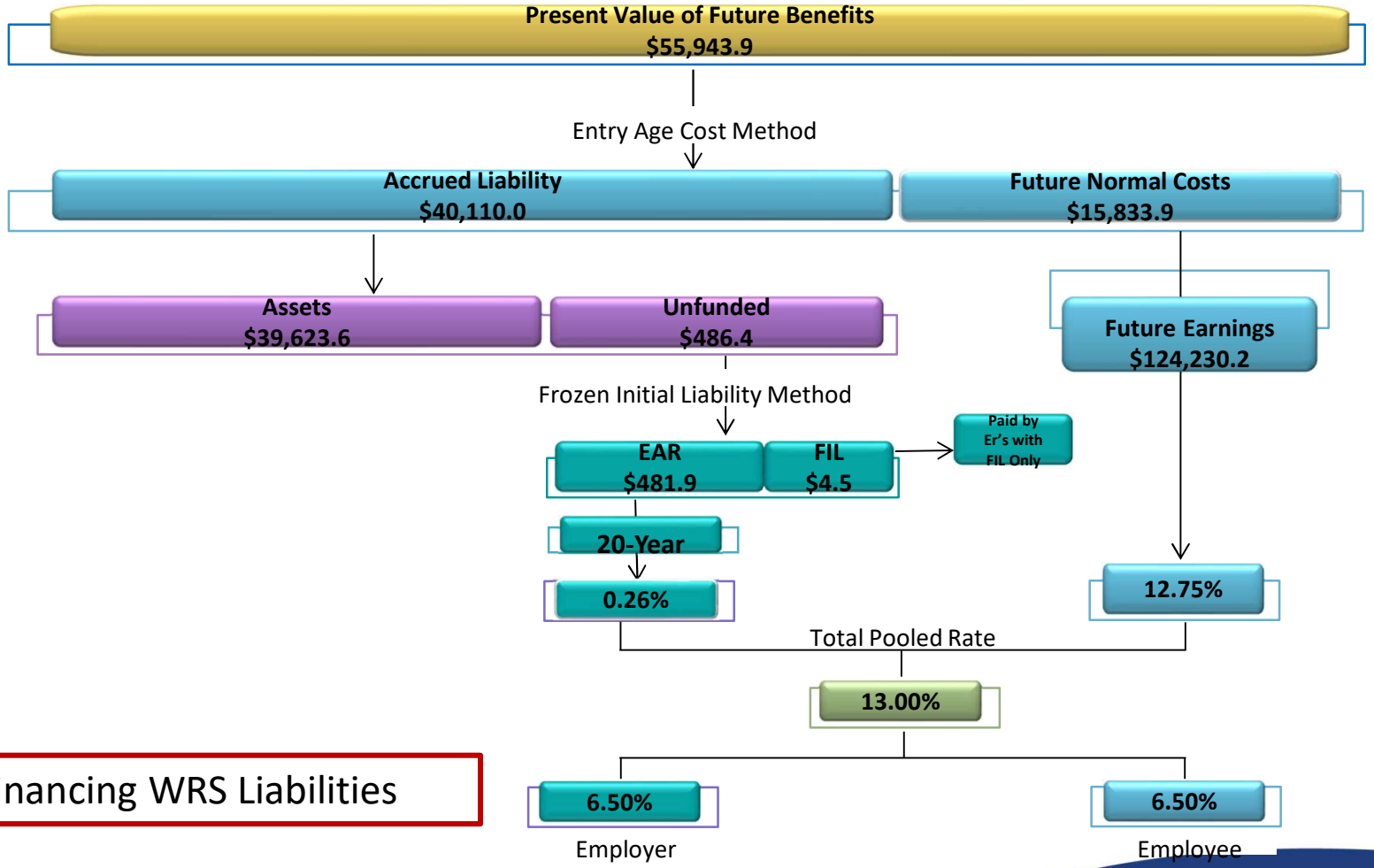
Operation of Market Recognition Account (MRA) - $ Millions

	2020	2021	2022	2023	2024
Actual Investment Return	$ 15,868				
Assumed Investment Return	7,000				
Gain/(Loss) to be phased-in	8,868				
Phased-in recognition					
• Current year	$ 1,774	?	?	?	?
• First prior year	2,204	$ 1,774	?	?	?
• Second prior year	(2,049)	2,204	$ 1,774	?	?
• Third prior year	1,461	(2,049)	2,204	$ 1,774	?
• Fourth prior year	120	1,461	(2,049)	2,204	$ 1,774
Total recognized Gain/(Loss)	$ 3,510	$ 3,390	$ 1,929	$ 3,978	$ 1,774

2021-2024: Expect $11.1 billion in deferred asset *GAINS* -- Shared by annuitants, actives and employers

Actuarial Valuation Process – Active Lives Valuation
Illustration for General/Elected Group ($ Millions)



Financing WRS Liabilities

Comparative Statement of Total Average Contribution Rates

Valuation 12/31	General	Executive & Elected	Protective with Soc. Sec.	Protective without Soc. Sec.
2000	10.30%	12.70%	11.80%	14.90%
2005	10.81%	11.56%	13.38%	14.56%
2010	11.90%	14.10%	14.90%	17.50%
2015	13.67%	13.67%	17.50%	21.80%
2016	13.43%	13.43%	17.43%	21.65%
2017	13.12%	13.12%	17.10%	21.59%
2018	13.54%	13.54%	18.41%	23.02%
2019	13.53%	13.53%	18.51%	23.11%
2020	13.01%	13.01%	18.52%	23.86%

Executive and Elected employee and employer rates for CY 2016 and beyond are made in accordance with the combined General/Executive & Elected results.

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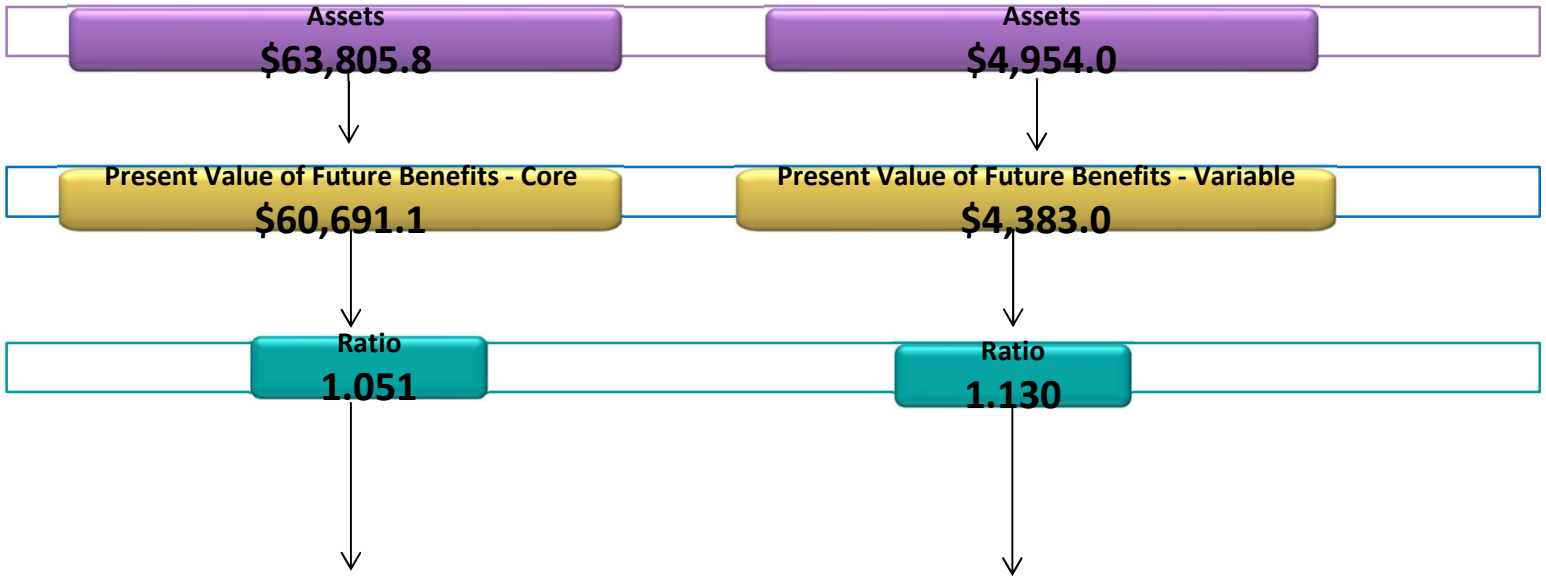
Pages B-5 & B-6

Actuarial Valuation Process – 2020 Retired Lives Valuation Illustration ($ Millions)



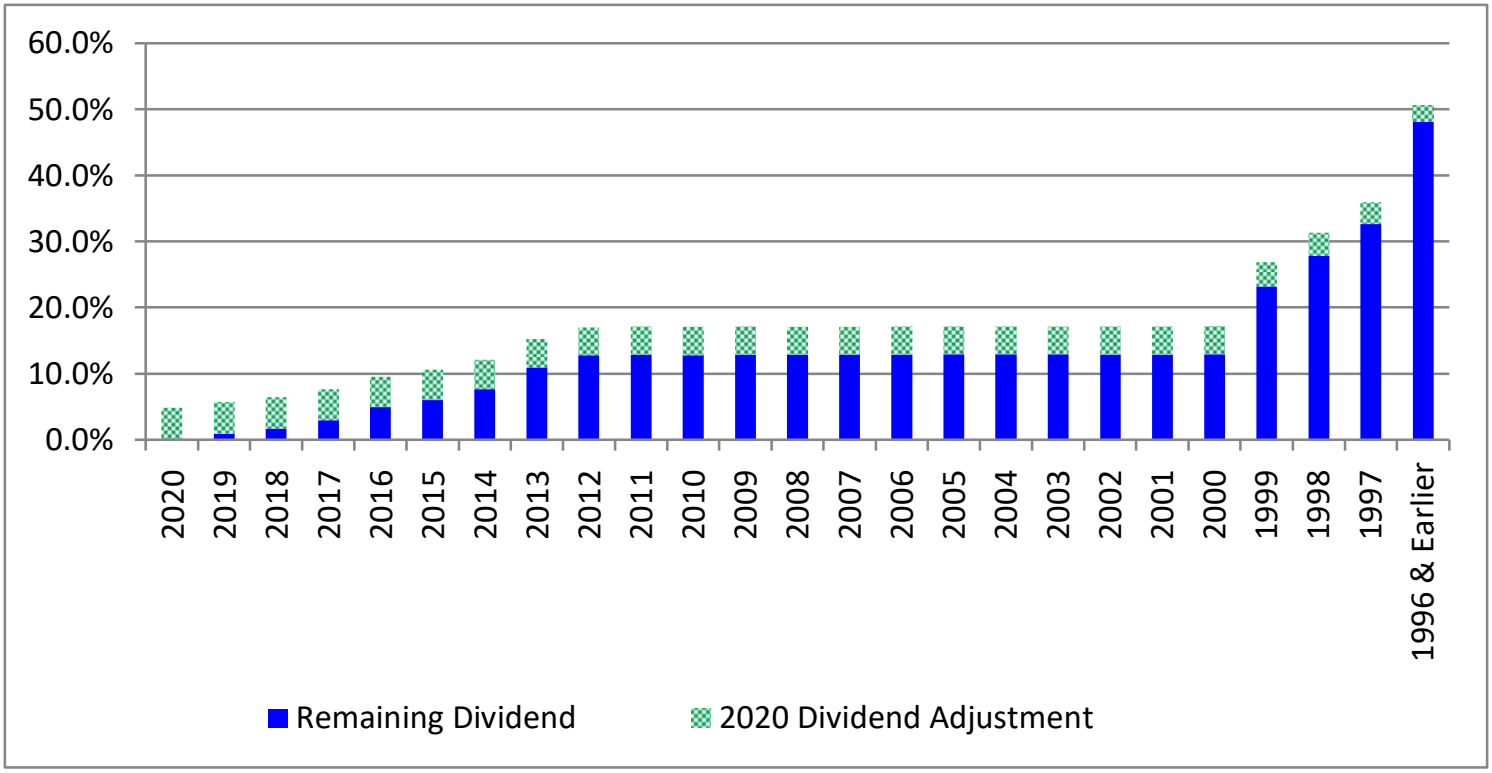
Core effective earnings rate = 10.9%, dividend adjustment = 5.1%.
Variable effective earnings rate = 18.0%, and the variable adjustment = 13.0%.

Liability Attributable to Dividends – "Dividend Liability"

Valuation	Liability for Dividend Remaining (Billions)	Liability for Dividend Adjustment (Billions)	Liability after Dividend Adjustment (Billions)
12/31/2011	$6.4	$(1.7)	$4.7
12/31/2012	4.5	(1.3)	3.2
12/31/2013	3.0	2.0	5.0
12/31/2014	4.6	1.3	5.9
12/31/2015	5.5	0.2	5.7
12/31/2016	5.4	1.0	6.4
12/31/2017	6.1	1.3	7.4
12/31/2018	6.9	0.0	6.9
12/31/2019	6.5	1.0	7.5
12/31/2020	7.0	3.1	10.1
12/31/2021 (est)	9.6		

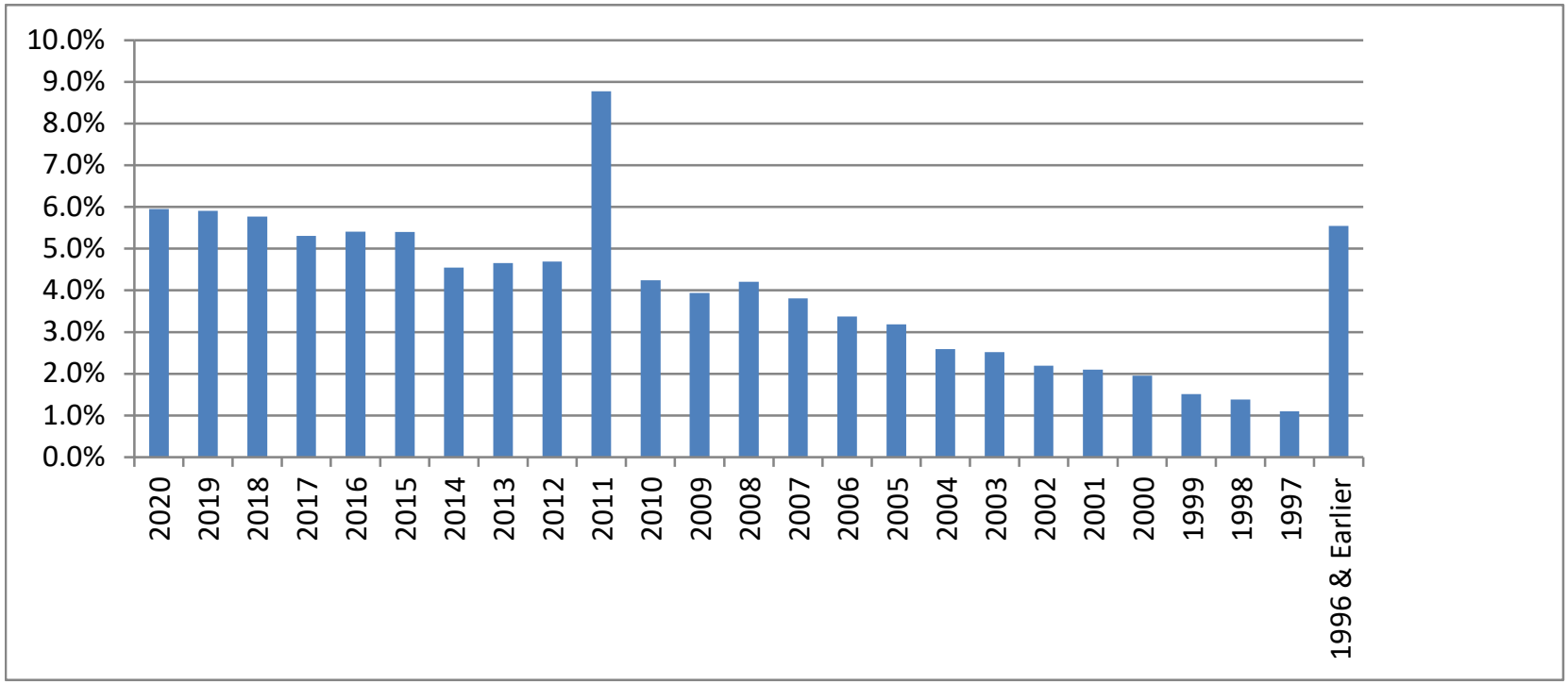
- "Liability for dividend remaining" = value of all previously granted dividends (=$9.2B at 12/31/2008)
- 2021 liability for dividends remaining is >2008, BUT as a percentage of total liabilities, it is smaller
- Potential asset losses could decrease the liability for dividend remaining to low levels

Dividend Remaining (as a Percentage of Total Benefit) by Year of Retirement



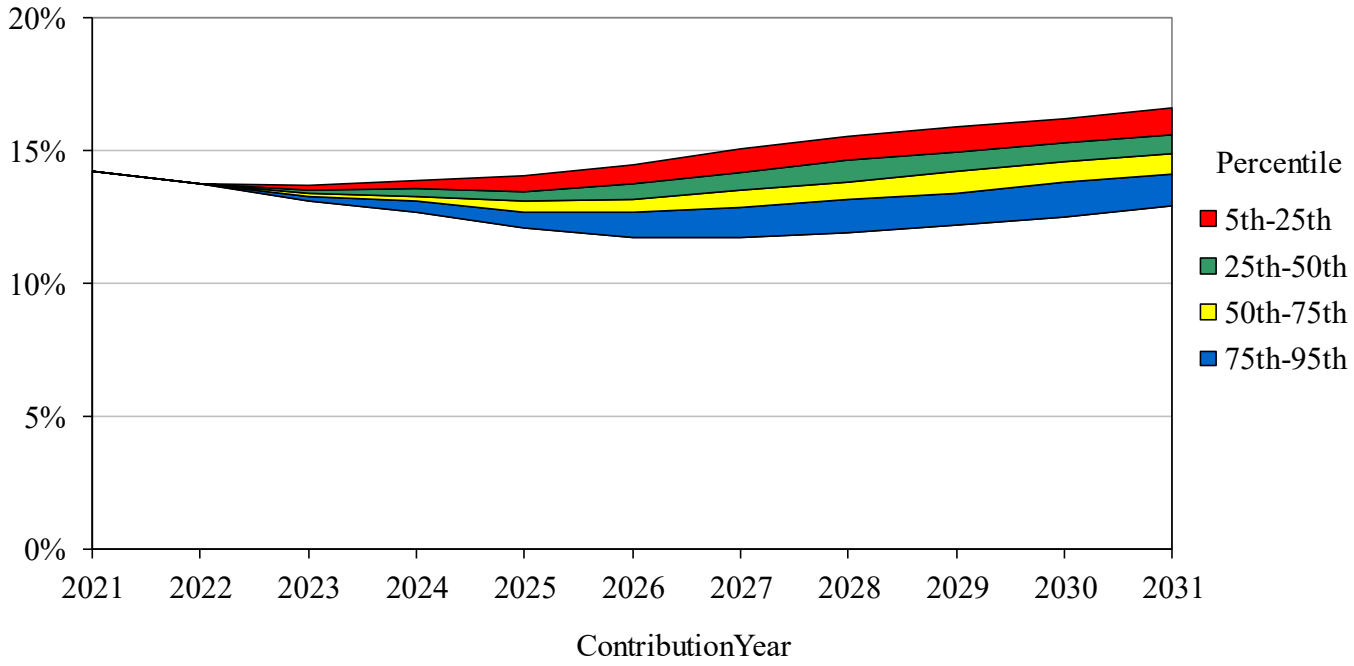
(Report-7)

Liabilities (as a Percentage of Total) by Year of Retirement



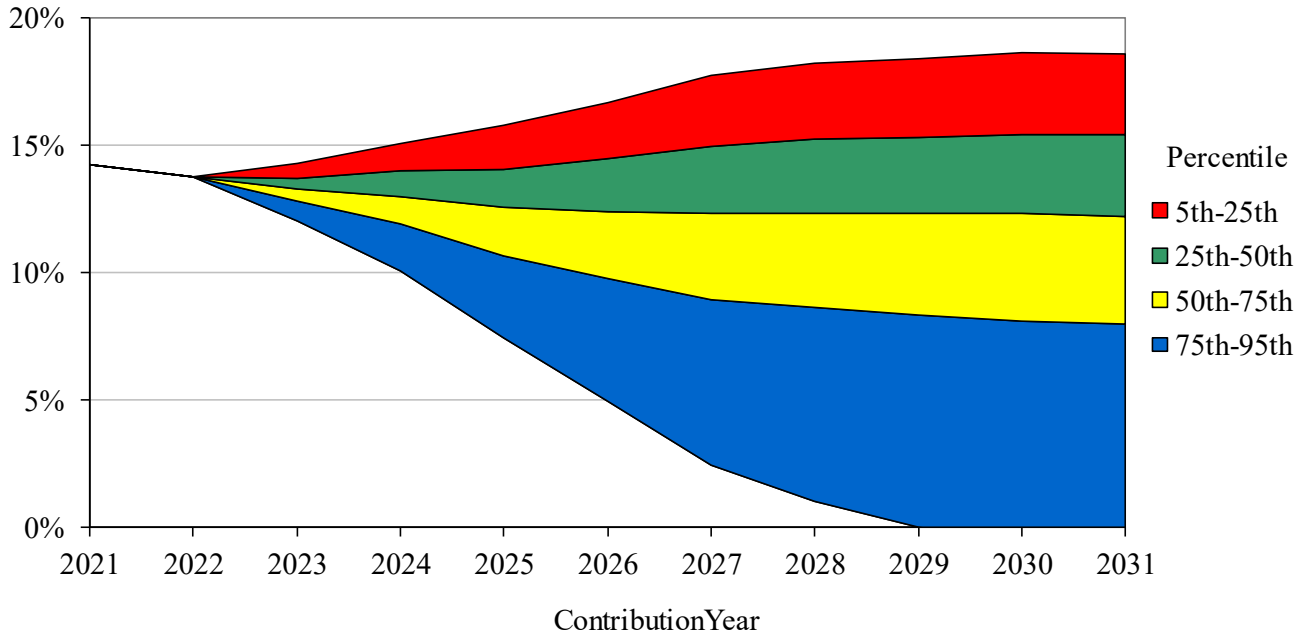
(Report-7)

Contribution as a % of Payroll
Scenario 1 – 4.0% Return, 6.9% Volatility



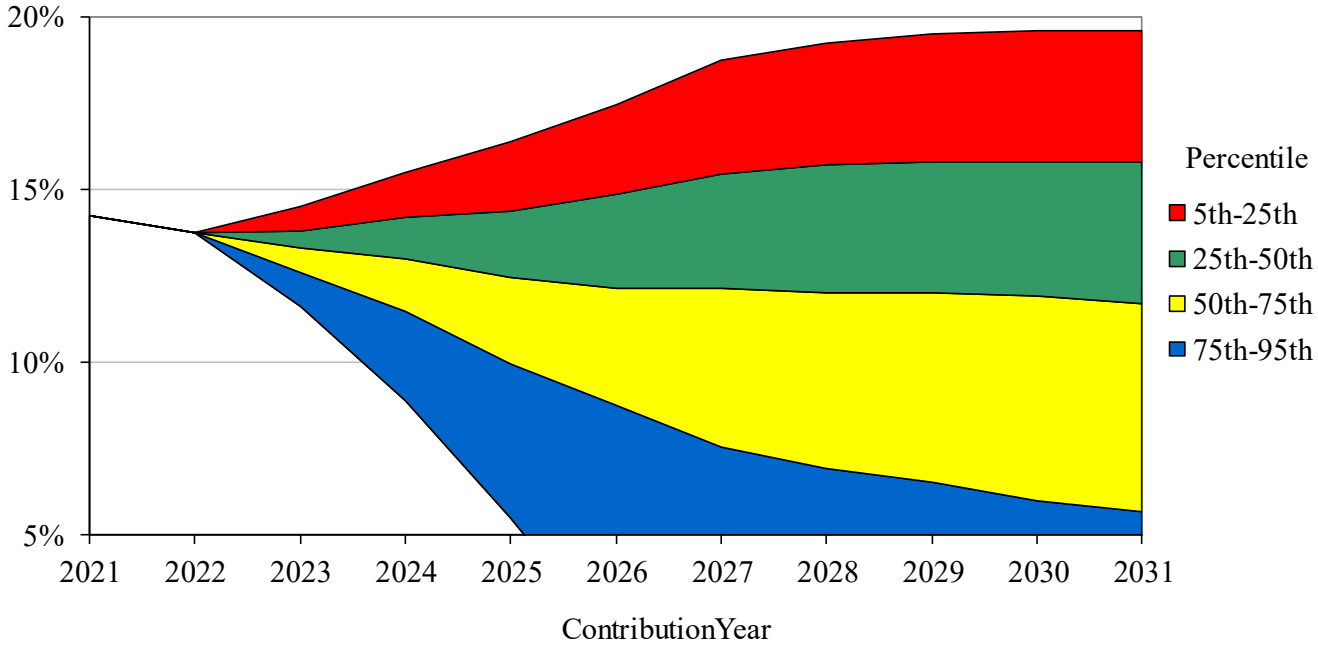
5th Percentile	14.2%	13.7%	13.7%	13.9%	14.1%	14.5%	15.1%	15.5%	15.9%	16.2%	16.6%
25th Percentile	14.2%	13.7%	13.5%	13.6%	13.5%	13.8%	14.2%	14.6%	14.9%	15.3%	15.6%
Median	14.2%	13.7%	13.4%	13.3%	13.1%	13.2%	13.6%	13.8%	14.2%	14.6%	14.9%
75th Percentile	14.2%	13.7%	13.3%	13.1%	12.7%	12.7%	12.9%	13.1%	13.4%	13.8%	14.1%
95th Percentile	14.2%	13.7%	13.1%	12.7%	12.1%	11.8%	11.8%	11.9%	12.2%	12.5%	12.9%

Contribution as a % of Payroll
Scenario 5 – 8.0% Return, 26.3% Volatility



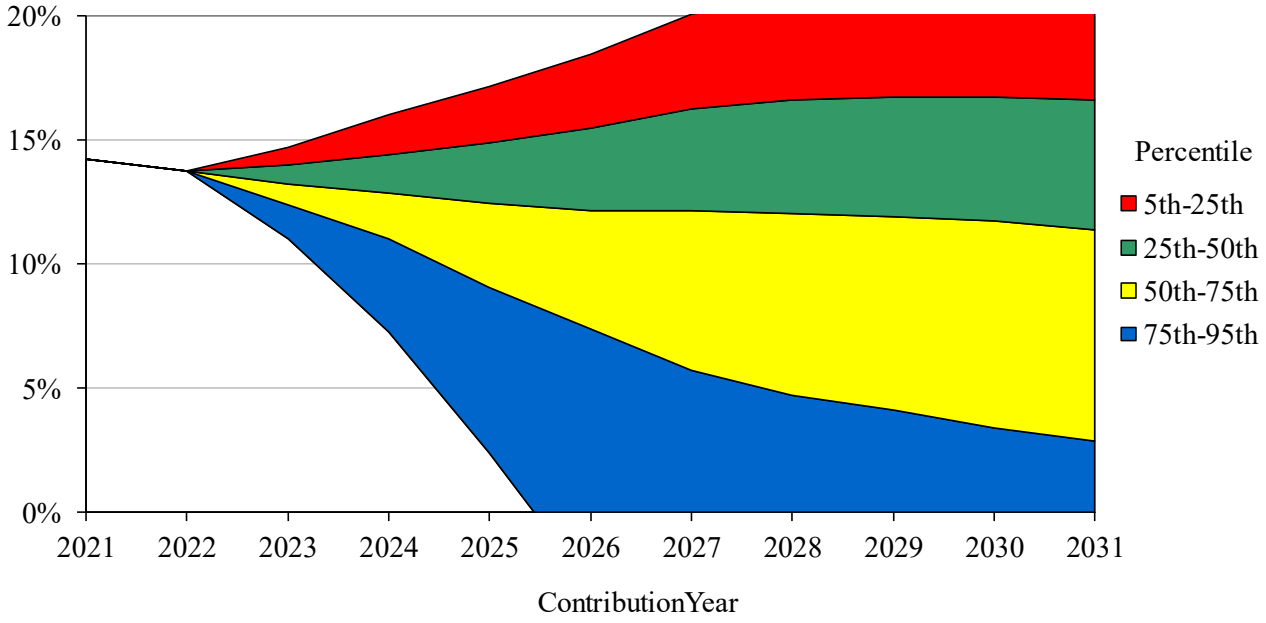
5th Percentile	14.2%	13.7%	14.3%	15.1%	15.8%	16.7%	17.8%	18.2%	18.4%	18.6%	18.6%
25th Percentile	14.2%	13.7%	13.7%	14.0%	14.1%	14.5%	15.0%	15.2%	15.3%	15.4%	15.4%
Median	14.2%	13.7%	13.3%	13.0%	12.6%	12.4%	12.4%	12.3%	12.3%	12.3%	12.2%
75th Percentile	14.2%	13.7%	12.8%	11.9%	10.7%	9.8%	9.0%	8.6%	8.3%	8.1%	8.0%
95th Percentile	14.2%	13.7%	12.0%	10.1%	7.5%	5.0%	2.5%	1.0%	0.0%	0.0%	0.0%

Contribution as a % of Payroll
Scenario 6 – 9.0% Return, 33.7% Volatility



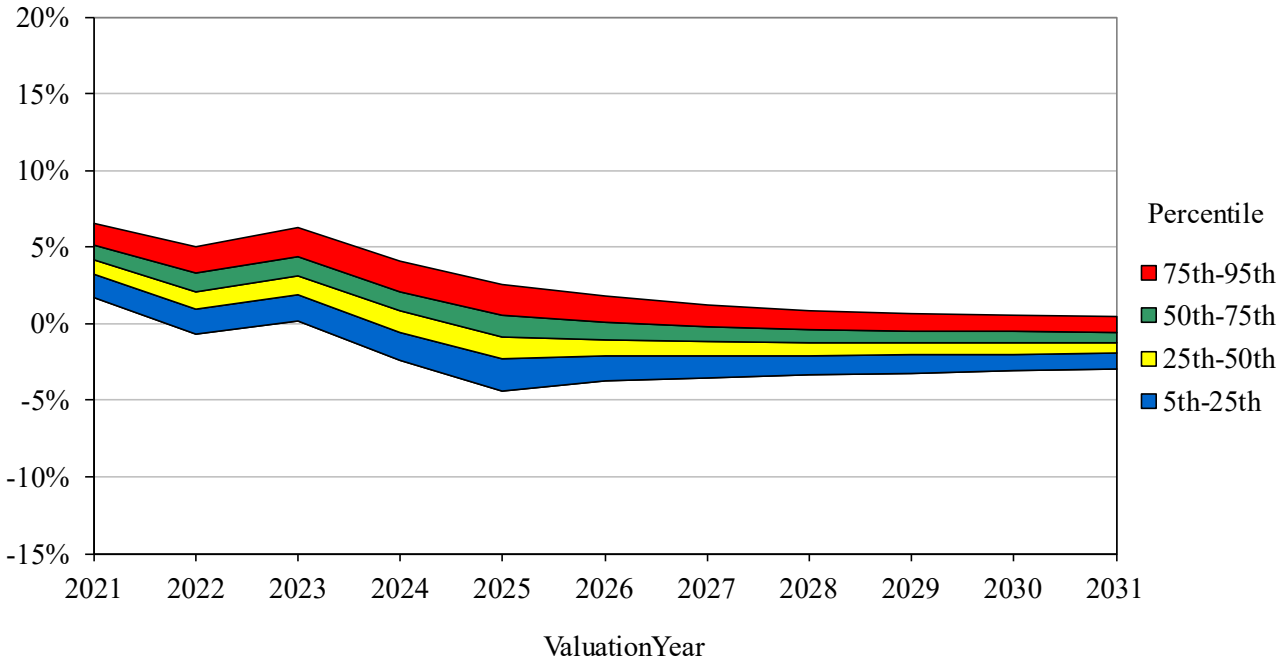
5th Percentile	14.2%	13.7%	14.5%	15.5%	16.4%	17.5%	18.8%	19.2%	19.5%	19.6%	19.6%
25th Percentile	14.2%	13.7%	13.8%	14.2%	14.4%	14.9%	15.5%	15.7%	15.8%	15.8%	15.8%
Median	14.2%	13.7%	13.3%	13.0%	12.5%	12.2%	12.2%	12.0%	12.0%	11.9%	11.7%
75th Percentile	14.2%	13.7%	12.6%	11.5%	10.0%	8.8%	7.6%	6.9%	6.5%	6.0%	5.7%
95th Percentile	14.2%	13.7%	11.6%	8.9%	5.5%	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%

Contribution as a % of Payroll
Scenario 7 – 10.0% Return, 44.0% Volatility



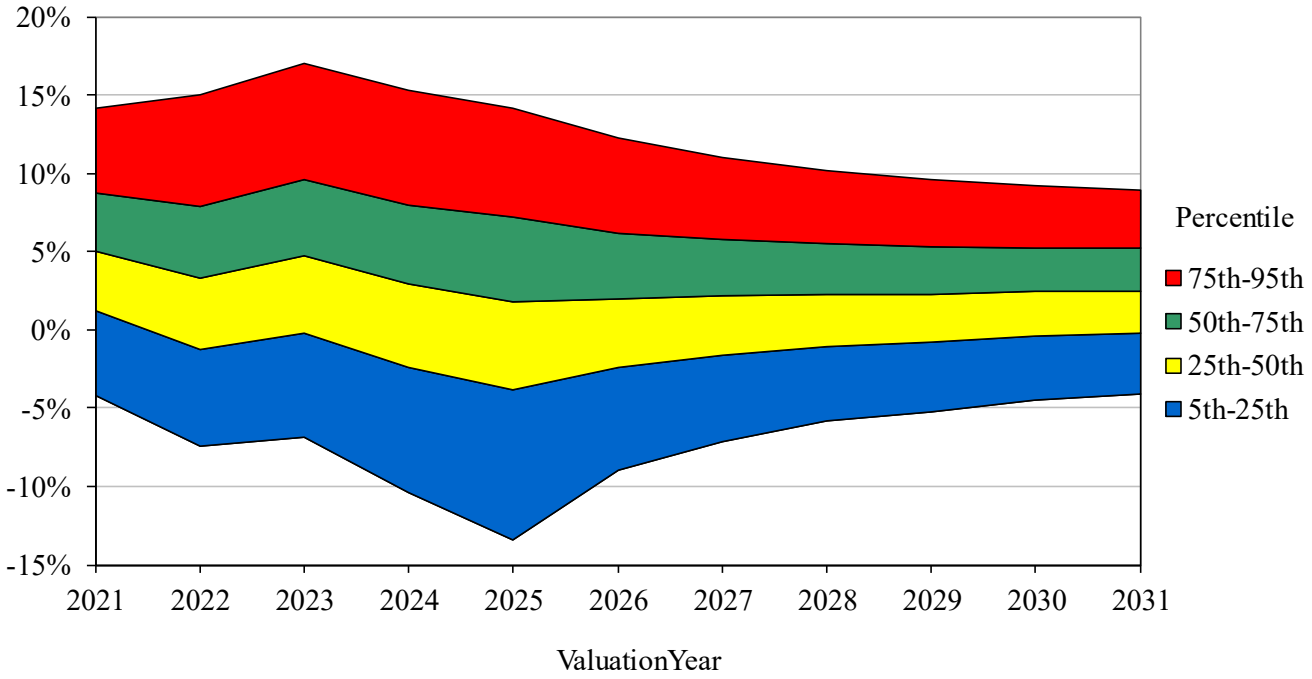
5th Percentile	14.2%	13.7%	14.7%	16.0%	17.2%	18.5%	20.1%	20.6%	21.0%	21.2%	21.2%
25th Percentile	14.2%	13.7%	14.0%	14.4%	14.9%	15.5%	16.3%	16.6%	16.7%	16.7%	16.6%
Median	14.2%	13.7%	13.2%	12.9%	12.5%	12.2%	12.2%	12.0%	11.9%	11.7%	11.4%
75th Percentile	14.2%	13.7%	12.4%	11.0%	9.1%	7.4%	5.8%	4.7%	4.1%	3.4%	2.9%
95th Percentile	14.2%	13.7%	11.0%	7.3%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Dividend Rates
Scenario 1 – 4.0% Return, 6.9% Volatility



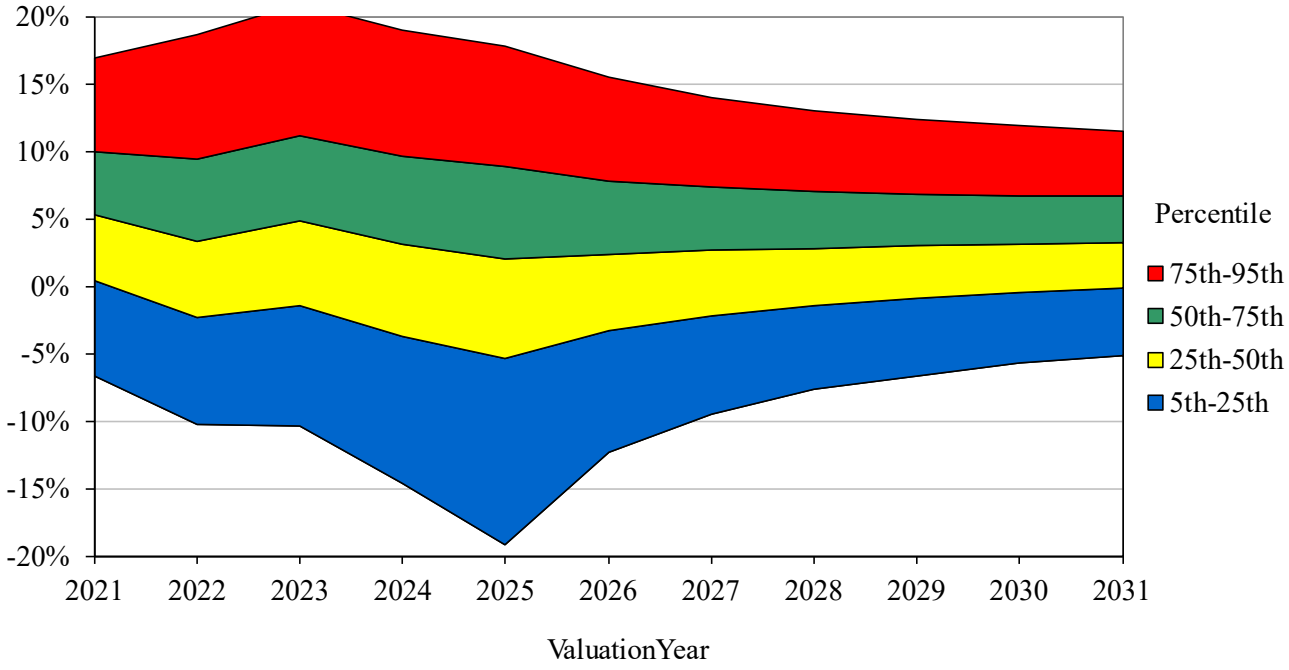
5th Percentile	1.7%	-0.6%	0.2%	-2.4%	-4.4%	-3.8%	-3.5%	-3.3%	-3.2%	-3.0%	-2.9%
25th Percentile	3.2%	1.0%	1.9%	-0.5%	-2.3%	-2.1%	-2.1%	-2.1%	-2.0%	-2.0%	-1.9%
Median	4.2%	2.1%	3.2%	0.8%	-0.9%	-1.0%	-1.1%	-1.2%	-1.2%	-1.2%	-1.2%
75th Percentile	5.2%	3.3%	4.4%	2.1%	0.6%	0.1%	-0.2%	-0.3%	-0.4%	-0.5%	-0.5%
95th Percentile	6.6%	5.1%	6.2%	4.1%	2.6%	1.8%	1.2%	0.9%	0.7%	0.5%	0.5%

Dividend Rates
Scenario 5 – 8.0% Return, 26.3% Volatility



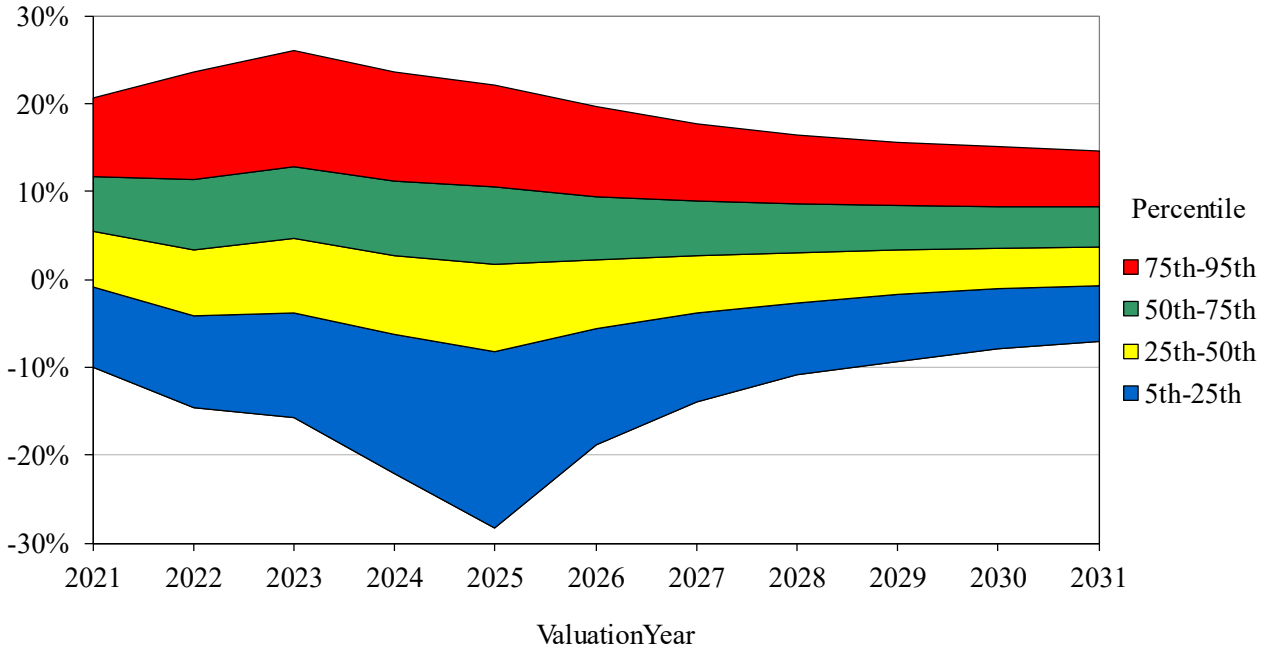
5th Percentile	-4.2%	-7.5%	-6.9%	-10.3%	-13.4%	-9.0%	-7.2%	-5.8%	-5.2%	-4.4%	-4.1%
25th Percentile	1.3%	-1.2%	-0.2%	-2.4%	-3.8%	-2.4%	-1.6%	-1.1%	-0.7%	-0.4%	-0.2%
Median	5.1%	3.3%	4.8%	2.9%	1.8%	2.0%	2.2%	2.2%	2.3%	2.4%	2.4%
75th Percentile	8.8%	7.9%	9.6%	8.0%	7.2%	6.2%	5.8%	5.5%	5.4%	5.3%	5.2%
95th Percentile	14.2%	15.0%	17.1%	15.3%	14.2%	12.2%	11.0%	10.1%	9.6%	9.3%	9.0%

Dividend Rates
Scenario 6 – 9.0% Return, 33.7% Volatility



5th Percentile	-6.6%	-10.3%	-10.4%	-14.7%	-19.2%	-12.3%	-9.5%	-7.7%	-6.7%	-5.7%	-5.2%
25th Percentile	0.4%	-2.3%	-1.5%	-3.8%	-5.3%	-3.3%	-2.2%	-1.5%	-0.9%	-0.4%	-0.2%
Median	5.3%	3.4%	4.9%	3.1%	2.1%	2.4%	2.7%	2.8%	3.0%	3.1%	3.2%
75th Percentile	10.0%	9.4%	11.1%	9.6%	8.9%	7.8%	7.4%	7.0%	6.9%	6.8%	6.7%
95th Percentile	17.0%	18.6%	20.9%	19.0%	17.8%	15.5%	14.0%	13.0%	12.4%	11.9%	11.6%

Dividend Rates
Scenario 7 – 10.0% Return, 44.0% Volatility



5th Percentile	-10.0%	-14.6%	-15.8%	-22.1%	-28.3%	-18.8%	-13.9%	-10.8%	-9.4%	-7.9%	-7.1%
25th Percentile	-0.8%	-4.2%	-3.7%	-6.3%	-8.2%	-5.6%	-3.8%	-2.7%	-1.7%	-1.1%	-0.7%
Median	5.5%	3.3%	4.7%	2.8%	1.7%	2.2%	2.7%	3.0%	3.3%	3.6%	3.7%
75th Percentile	11.7%	11.3%	12.9%	11.3%	10.6%	9.4%	8.9%	8.5%	8.4%	8.3%	8.3%
95th Percentile	20.8%	23.7%	26.0%	23.6%	22.2%	19.7%	17.8%	16.4%	15.6%	15.1%	14.6%

Combination of All Scenarios

2041 Results by %-tile of Investment Return Outcomes

	ROR	StdDev	Contribution Rates 95th	Contribution Rates 50th	Contribution Rates 5th	Dividend Rates 95th	Dividend Rates 50th	Dividend Rates 5th	Highest Div. Dep. PRB	Worst Retiree Funded %
1	4.0%	6.9%	16.0%	17.5%	18.8%	0.4%	-1.1%	-2.6%	90%/yr50	59%/yr50
2	5.0%	11.3%	13.2%	16.2%	18.5%	2.3%	-0.2%	-2.7%	24%/yr50	76%/yr50
3	6.0%	15.5%	9.7%	14.7%	18.1%	4.2%	0.8%	-2.7%	10%/yr10	90%/yr10
4	7.0%	20.4%	4.8%	13.1%	17.9%	6.3%	1.7%	-3.0%	13%/yr10	83%/yr10
5	8.0%	26.3%	0.0%	11.3%	18.0%	8.7%	2.6%	-3.4%	16%/yr10	71%/yr10
6	9.0%	33.7%	0.0%	9.4%	18.4%	11.3%	3.5%	-4.4%	21%/yr10	55%/yr10
7	10.0%	44.0%	0.0%	7.6%	19.4%	14.4%	4.2%	-6.1%	28%/yr10	35%/yr10

Actuarial Rate →

Portfolios with higher expected rates of return result in higher expected contributions and lower expected dividends

Higher assumed rates of return are associated with higher standard deviation (i.e., risk) and 5th percentile scenario for retiree dividend pool falling below 80%

Scenarios 3 and 4 represent potential 'Goldilocks Zone'

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- This is one of multiple documents comprising the actuarial report. Additional information regarding actuarial assumptions and methods, and important additional disclosures are provided in the full report entitled "Fortieth Annual Actuarial Valuation and Gain Loss Analysis."
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