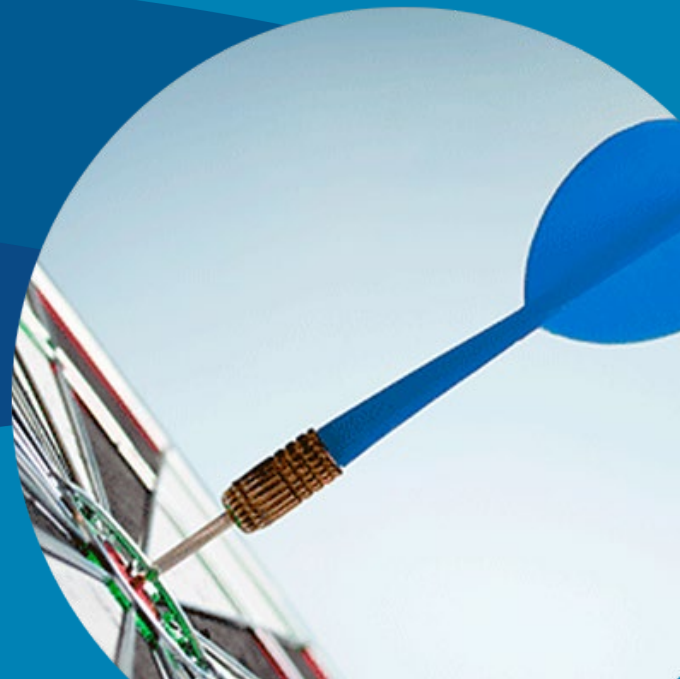




Wisconsin Retirement System

39th Annual Actuarial Valuation of
Retired Lives
December 31, 2021



Operation of the System (Simplified Description)

| | Core Annuities | Variable Annuities |
|--|--|--|
| Investment Return Hurdle to Trigger Annuity Adjustment | Returns over/under 5% | Returns over/under 5% |
| Ratio of Assets to Liabilities | If > 0.5%, dividend may be granted If <-0.5%, prior dividends reduced | If > 2%, variable annuity increased If <-2%, variable annuity decreased |
| Increase/Decrease Rounding Conventions | Rounded to nearest 0.1% | Truncated, carried to next year |
| Adjustment Effective Date | April following 12/31 valuation | April following 12/31 valuation |

Smoothing Mechanisms

Core

- Undesirable for retirees to experience wide swings in monthly benefits from year to year (especially downward swings)
- Mitigated in Core division by asset smoothing process and portfolio mix
- Asset smoothing has worked well historically, but could not prevent negative dividends in 2009-2013

Smoothing Mechanisms

Variable

- Variable fund is marked to market each year and subject to wide swings
- Dropping fractions of a percent from the adjustment is a form of smoothing
- Usually has very little effect due to the magnitude of the gains and losses

Summary of Results – December 31, 2021

\$ Millions

| | Core | Variable |
|---------------------------------|--------------|-----------------|
| Number of Annuitants | 228,161 | 42,251 |
| Annual Amount of Annuities Paid | \$ 5,842.6 | \$ 502.6 |
| Fund Balance | 69,910.7 | 5,618.0 |
| Actuarial Reserve | 65,085.4 | 4,866.0 |
| Ratio | 1.074 | 1.155 |

Core effective earnings rate = 12.9%, dividend adjustment = 7.4%.
Variable effective earnings rate = 20.0%, and the variable adjustment = 15.0%.

(Report- Cover Letter & Pages 6 and 16)



Summary of Results – Annuity Adjustments

- * 7.4% Core Dividend > 7.0% CPI Increase
- * 15% Variable Adjustment follows 13%/21% Adjustments in previous 2 years

- 4th highest core dividend since 1987, and highest core dividend since 1999
- 1st 3-year series of consecutive double digit variable adjustments since 1995-1999
 - Other periods with consecutive double digit variable adjustments followed by *decreased variable adjustments* – reflecting weaker subsequent market asset returns

Summary of Results – Core Assets

Due to smoothing via Market Recognition Account, as of December 31, 2021 there are approximately \$17.7 billion in unrecognized gains in the Core fund

- Last year was \$11.1 billion in unrecognized gains
- Will be recognized over the next four years
- Roughly ½ of gain applies to the annuitant reserve, the other half shared by active members and employers
- May increase probability of future positive annuity adjustments

Operation of Market Recognition Account (MRA)

– \$ Millions **2020 Valuation**

| | <u>2020</u> | <u>2021</u> | <u>2022</u> | <u>2023</u> | <u>2024</u> |
|------------------------------|-------------|-------------|-------------|-------------|-------------|
| Actual Investment Earnings | \$ 15,868 | | | | |
| Assumed Investment Earnings | 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

Operation of Market Recognition Account (MRA)

– \$ Millions **2021 Valuation**

| | <u>2021</u> | <u>2022</u> | <u>2023</u> | <u>2024</u> | <u>2025</u> |
|------------------------------|--------------|----------------|--------------|--------------|-----------------|
| Actual Investment Earnings | \$ 19,957 | | | | |
| Assumed Investment Earnings | 7,482 | | | | |
| Gain/(Loss) to be phased-in | 12,475 | | | | |
| Phased-in recognition | | | | | |
| • Current year | \$ 2,495 | ? | ? | ? | ? |
| • First prior year | 1,774 | \$ 2,495 | ? | ? | ? |
| • Second prior year | 2,204 | 1,774 | \$ 2,495 | ? | ? |
| • Third prior year | (2,049) | 2,204 | 1,774 | \$ 2,495 | ? |
| • Fourth prior year | <u>1,461</u> | <u>(2,049)</u> | <u>2,204</u> | <u>1,774</u> | <u>\$ 2,495</u> |
| Total recognized gain (loss) | \$ 5,885 | \$ 4,424 | \$ 6,473 | \$ 4,269 | \$ 2,495 |

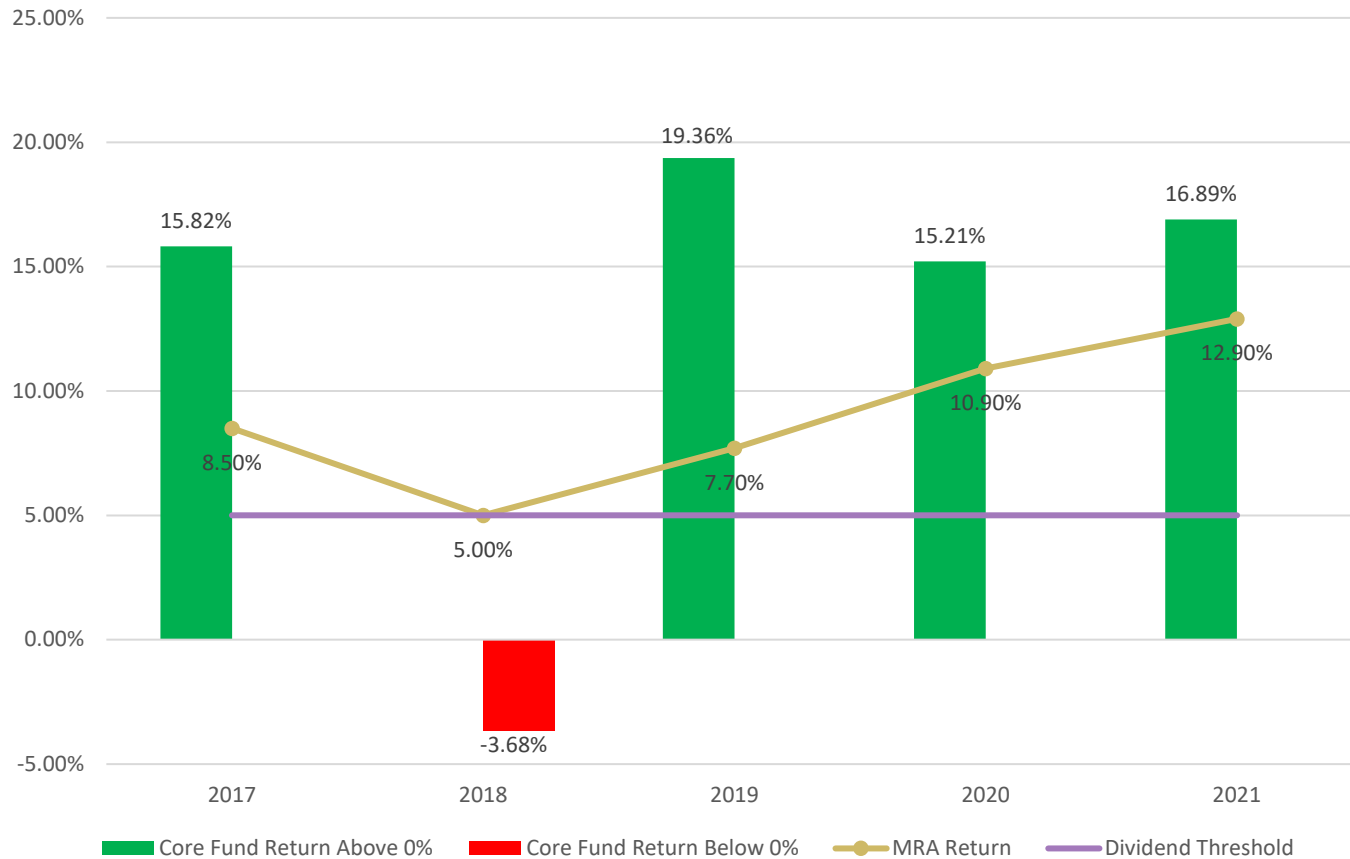
2022-2025: Expect \$17.7 billion in deferred asset GAINS
-- Shared by annuitants, actives and employers

Asset Rate of Return Calculation

$$\text{Rate of Return} = \text{Investment Earnings} / \text{Asset Value}$$

- Rate of Return will vary based on calculation inputs:
 - Asset value could be smoothed or unsmoothed
 - Asset value could be beginning, middle or end of year
 - Timing of Contributions and Benefit Payments will vary
- Result is different Rate of Return calculated by:
 - SWIB (investment manager)
 - ETF (calculations governed by statute)
 - GRS (actuaries)

Core Fund Returns – Market Value vs. Market Recognition Account



Translating Asset Rate of Return to Core Dividend “**R-e-S-F-A-P**”

Return: 2021 SWIB net of fee return = 16.89%

Smooth vs. 7.0%* Investment Return Assumption

- Return > assumption **S**moothed over 5 years
 - Leads to \$17.7 billion unrecognized gains shared by Retirees, Employees, Employers

Fund annuities at Investment Return 5% Threshold

- Core fund return > threshold provides **dividend before adjustments**: $1.1231/1.05 - 1 = 6.96\%$

Adjustments result in 7.4% dividend Paid



* 6.8% next year

Primary Sources of Core Dividend

| | <u>% of APV</u> |
|---|-----------------|
| 1. SWIB net of fee investment return | 16.89% |
| 2. MRA adjustment | (3.99)% |
| 3. Published effective earnings rate | 12.90% |
| 4. Adjustment to relate earnings to average core annuity fund balance | (0.59)% |
| 5. Earnings rate based on average balance | 12.31% |
| 6. Expected dividend before adjustments: $1.1231/1.05-1$ | 6.96% |
| 7. Adjustment to relate average asset to ending liability | 0.13% |
| 8. Carryover from last year due to timing of dividend, accounting adjustments and rounding | 0.26% |
| 9. Experience study adjustment | (0.02)% |
| 10. Experience and other effects | 0.08% |
| 11. Statutory adjustment to round to nearest one-tenth percent | (0.01)% |
| 12. Computed average dividend rate: (6)+(7)+(8)+(9)+(10)+(11) | 7.4% |
| 13. Adjustment for members at or near the statutory floor | 0.0% |
| 14. Final computed dividend rate: (12)+(13), if greater than 0.5% (or less than -0.5%) of core annuities, otherwise 0% | 7.4% |

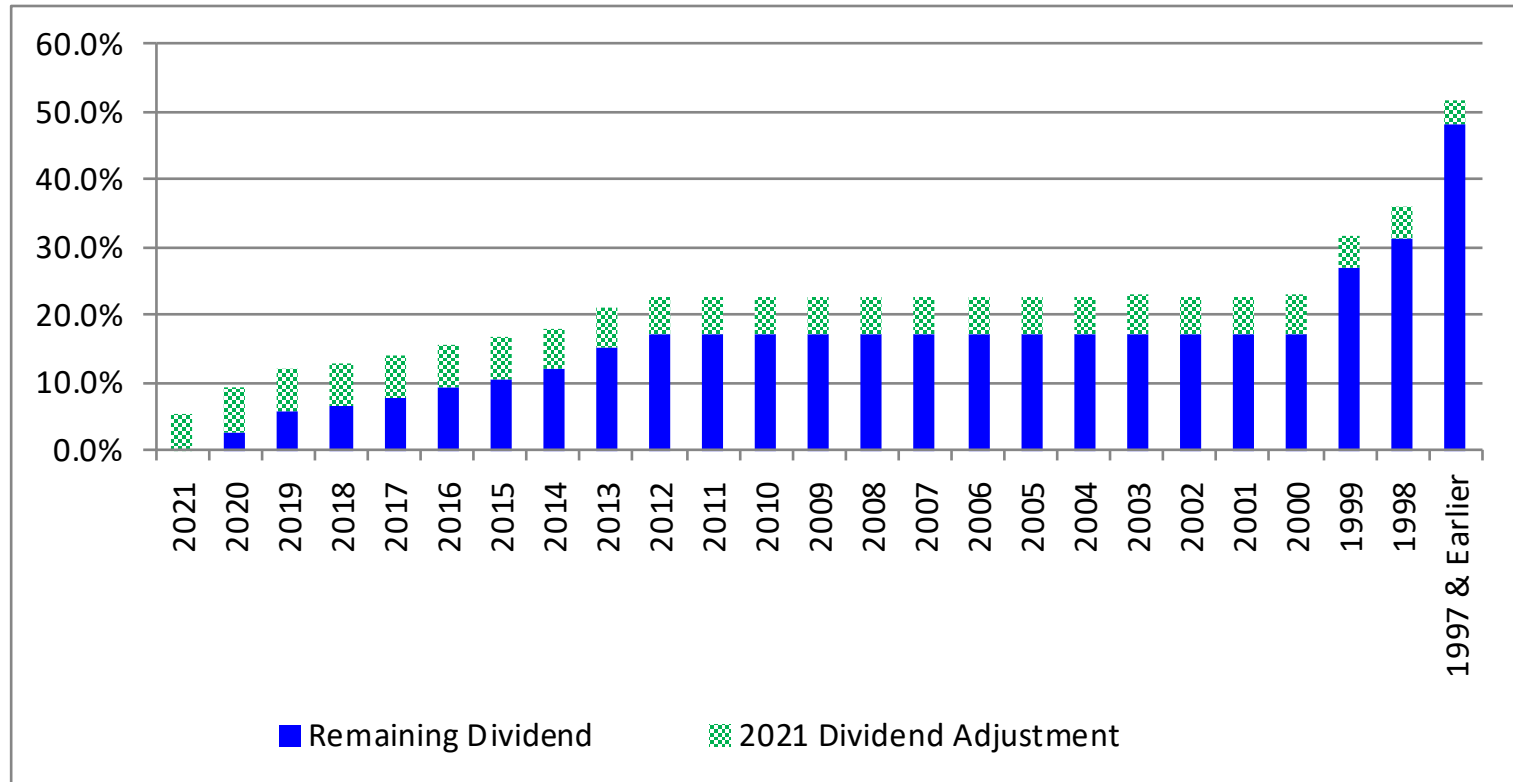


Liability Attributable to Dividends – “Dividend Liability”

| Valuation | Liability for Dividend Remaining (billions) | Liability for Dividend Adjustment (billions) | Liability after Dividend Adjustment (billions) |
|------------------|--|---|---|
| 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 | 9.4 | 4.8 | 14.2 |
| 12/31/2022 (est) | 13.3 | | |

- “Liability for dividend remaining” = value of all previously granted dividends (=\$9.2B at 12/31/2008)
- 2022 liability for dividends remaining is >2008, BUT as a percentage of total liabilities, it is smaller
- Substantial asset losses could decrease the liability for dividend remaining to low levels

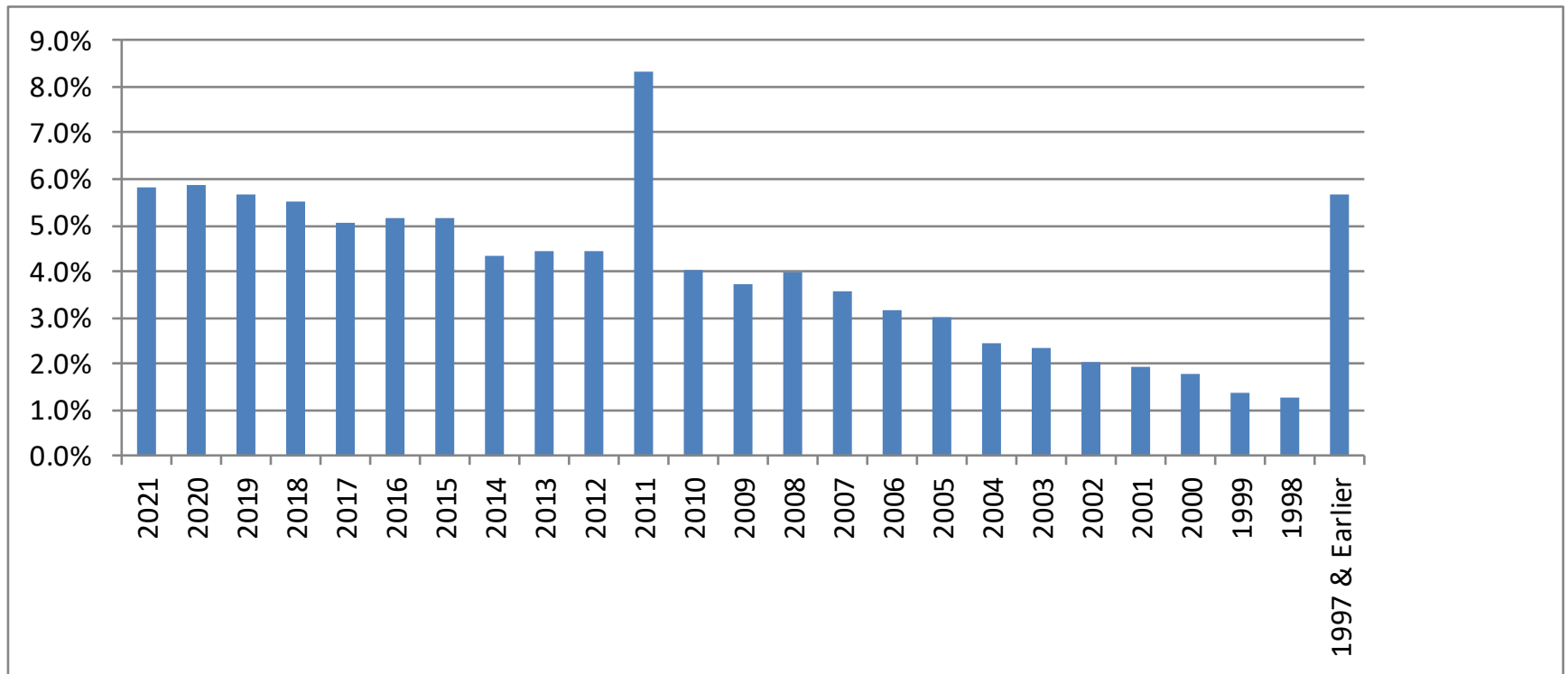
Dividend Remaining (as a Percentage of Total Benefit) by Year of Retirement



(Report-7)



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

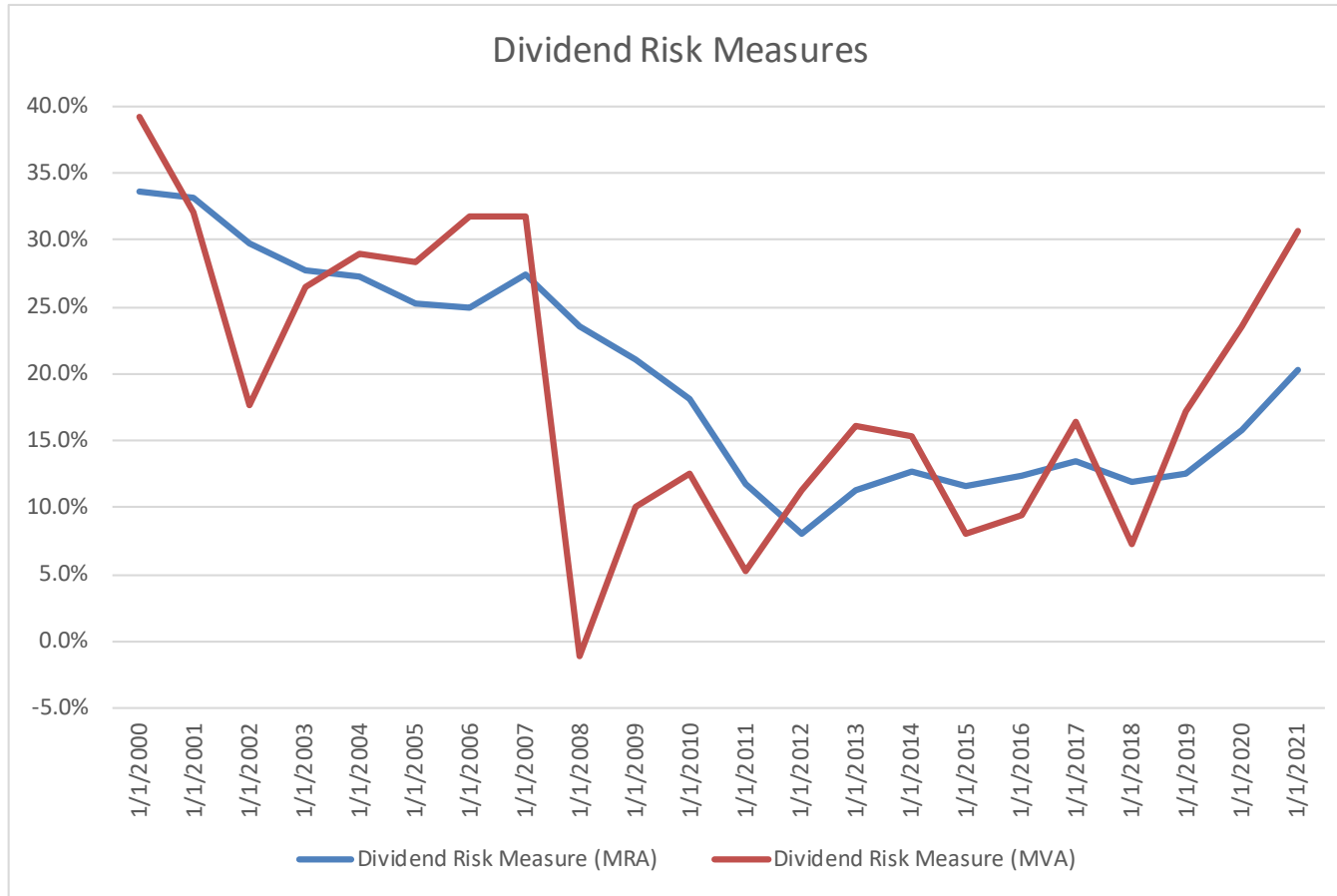


(Report-7)

Dividend Risk Measure (MRA)

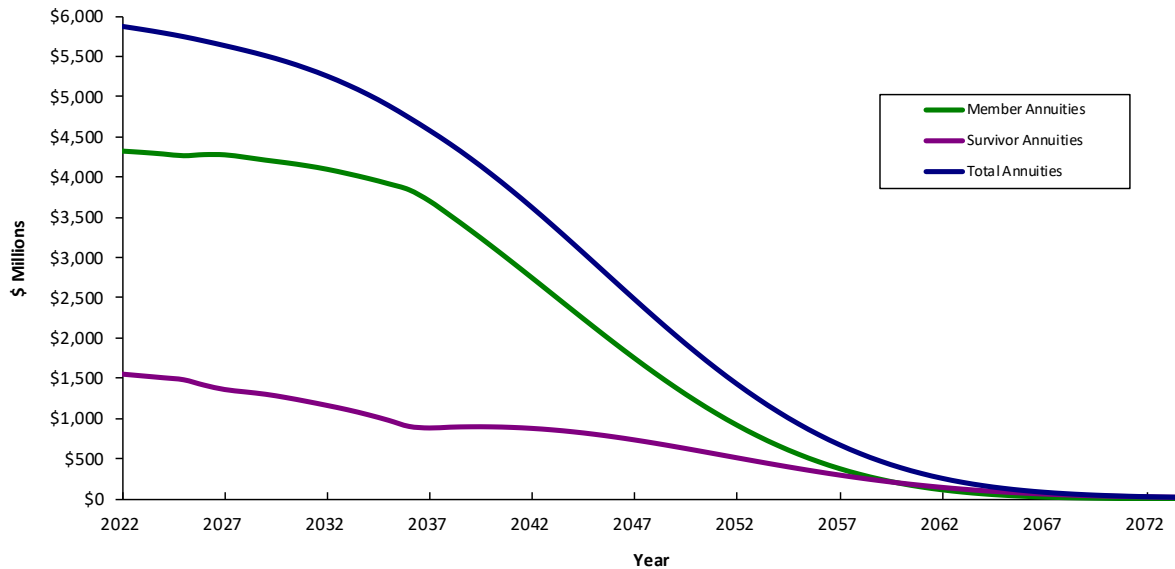
- Dividend Liability (after Dividend adjustment in April)
/ Total Core Retiree Assets
- Example (2021)
 - Dividend Liability = 14.2 billion
 - Total Retiree Assets (Core) = 69.9 billion
 - Dividend Risk Measure = $14.2/69.9 = 20.3\%$
- In other words, Retiree Assets (on MRA basis) would need to decrease by 20.3% to deplete the existing Dividend Liability (15.8% last year)

Dividend Risk Measures History*



*Higher values are desirable

Projected Future Core Annuities



\$ Billions

| | <u>With Expected Dividends</u> | <u>Without Expected Dividends</u> |
|---------------------------------|--------------------------------|-----------------------------------|
| Total Future Benefit Payments | \$137.7 | \$109.3 |
| Present Assets | 69.9 | 69.9 |
| Future Investment Return Needed | 67.8 | 39.4 |

Based upon the assumptions used in the valuation, future dividends are expected to be approximately 1.7% per year. Of course actual dividends will be based upon actual future investment return and the operation of the Market Recognition Account.

(Report-13)

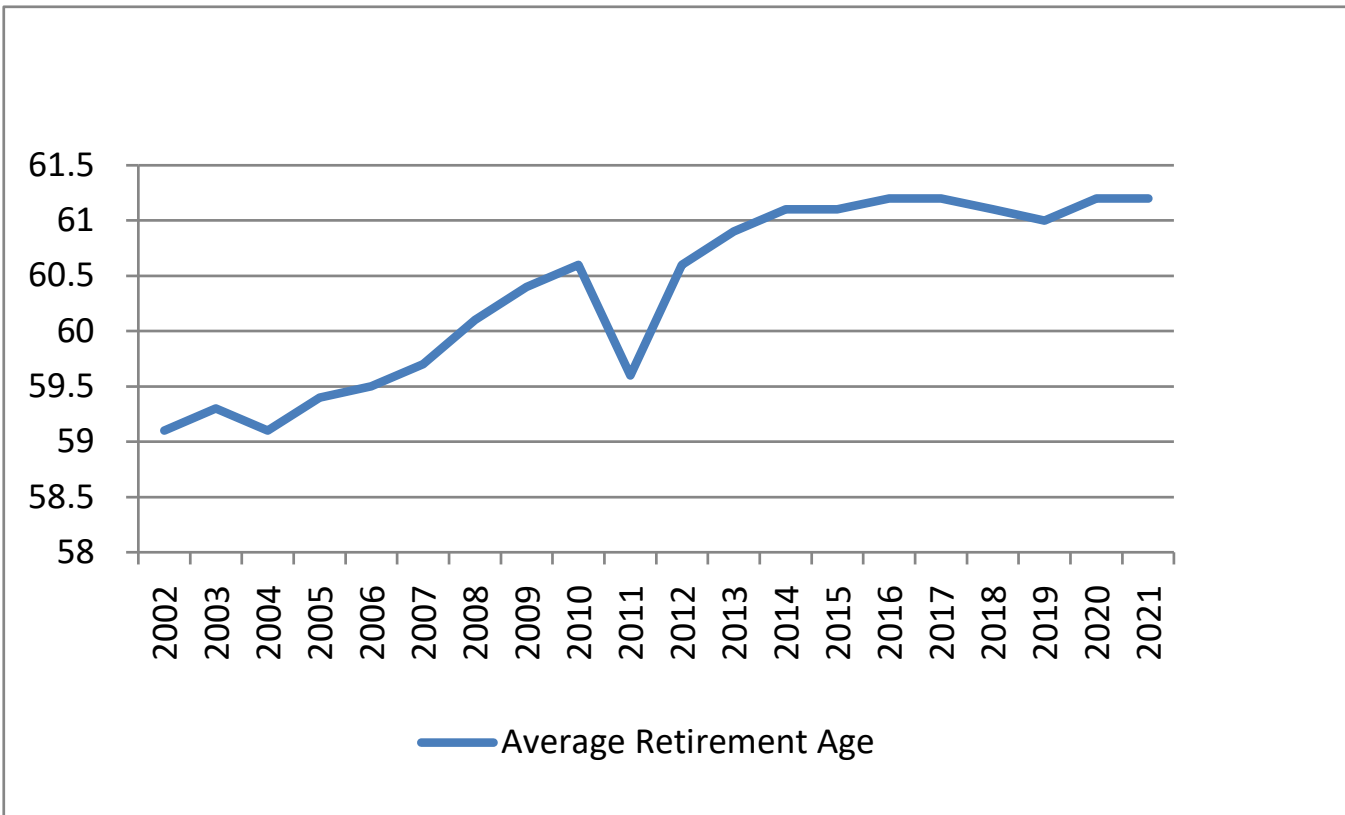


Primary Sources of Variable Adjustment

| | <u>% of APV</u> |
|--|-----------------|
| 1. SWIB net of fee investment return | 20.0% |
| 2. Adjustment to published effective rate | <u>0.0%</u> |
| 3. Published effective earnings rate | 20.0% |
| 4. Adjustment to relate earnings to average variable annuity fund balance | <u>(0.4)%</u> |
| 5. Earnings rate based on average balance | 19.6% |
| 6. Expected change before adjustments: $(1.196)/1.05-1$ | 13.9% |
| 7. Adjustment to relate average asset to ending liability | 0.4% |
| 8. Carryover from last year due to timing of distribution, accounting adjustments and truncation | 0.3% |
| 9. Experience study adjustment | 0.3% |
| 10. Experience and other effects | 0.6% |
| 11. Statutory adjustment: (truncate to whole percent) | <u>(0.5)%</u> |
| 12. Variable annuity change: (6)+(7)+(8)+(9)+(10)+(11) | 15.0% |

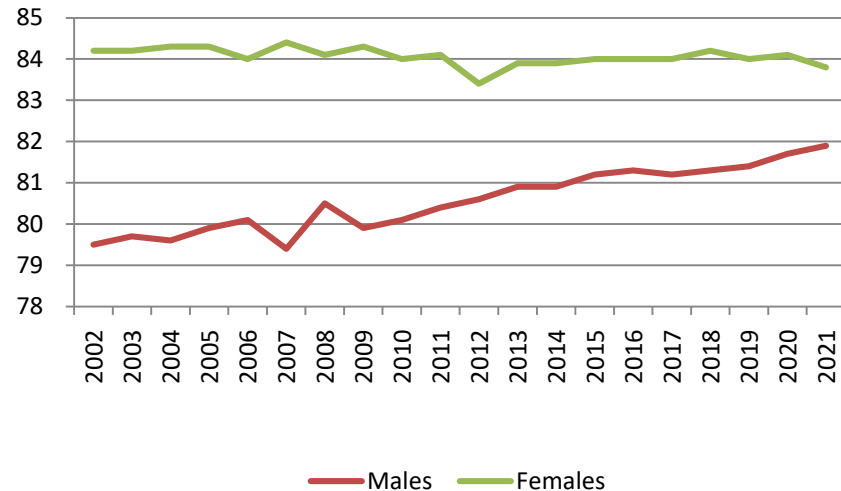


Average Retirement Age



Average Age at Death

Average age at death, while an interesting statistic, is not a proper measure of life expectancy, because it does not include people who have not yet died. The expected age at death for a 65-year-old is 86.9 for males and 88.9 for females.



Summary of Mortality Experience

| <u>Valuation</u> | <u>Expected Deaths</u> | <u>Actual Deaths</u> | <u>Difference</u> | <u>Death Rate</u> |
|------------------|------------------------|----------------------|-------------------|-------------------|
| 12/31/2018 | 4,937 | 5,032 | 95 | 0.0251 |
| 12/31/2019 | 5,147 | 5,147 | 0 | 0.0250 |
| 12/31/2020 | 5,384 | 5,788 | 404 | 0.0273 |
| 12/31/2021 | 5,837 | 5,996 | 159 | 0.0275 |

Although we cannot ascribe the increase in death rates directly to the pandemic, it is notable that the increase in death rate is appropriately coincident with the start of the COVID-19 pandemic.

Summary of Mortality Experience

- Average mortality rate remained elevated by a similar amount as last year, possible due to the pandemic
- Overall impact on Core Dividend relatively small
- Only two years of experience at this point
- Typically need three to five years of data to determine if this will be part of a longer term trend or an isolated short term event

Comparative Statement – Core

| Valuation Date | Number | \$ Millions | | | Ratio | Change in | | |
|------------------------|---------|------------------|--------------|-------------------|-------|--------------|---------|--------------|
| | | Annual Annuities | Fund Balance | Actuarial Reserve | | Annuities | | CPI* |
| | | | | | | Average | Maximum | |
| 2012 | 173,655 | \$ 3,806.3 | \$ 40,591.6 | \$ 41,852.4 | 0.970 | (3.0)% | (9.6)% | 1.7 % |
| 2013 | 180,056 | 3,800.7 | 44,273.2 | 42,300.5 | 1.047 | 4.7 % | | 1.5 % |
| 2014 | 185,605 | 4,102.3 | 47,135.7 | 45,790.7 | 1.029 | 2.9 % | | 0.8 % |
| 2015 | 191,795 | 4,364.9 | 49,147.0 | 48,897.5 | 1.005 | 0.5 % | | 0.7 % |
| 2016 | 197,647 | 4,523.1 | 51,972.0 | 50,941.4 | 1.020 | 2.0 % | | 2.1 % |
| 2017 | 203,202 | 4,747.0 | 54,900.0 | 53,590.0 | 1.024 | 2.4 % | | 2.1 % |
| 2018 | 211,126 | 5,040.9 | 56,493.8 | 56,629.3 | 0.998 | 0.0 % | | 1.9 % |
| 2019 | 216,944 | 5,183.7 | 59,138.4 | 58,157.0 | 1.017 | 1.7 % | | 2.3 % |
| 2020 | 222,723 | 5,423.2 | 63,805.8 | 60,691.1 | 1.051 | 5.1 % | | 1.4 % |
| 2021 | 228,161 | 5,842.6 | 69,910.7 | 65,085.4 | 1.074 | 7.4% | | 7.0 % |
| 35-Year Average | | | | | | 3.6 % | | 2.7 % |
| 20-Year Average | | | | | | 1.5 % | | 2.3 % |
| 10-Year Average | | | | | | 2.3 % | | 2.1 % |
| 5-Year Average | | | | | | 3.3 % | | 2.9 % |

**Based on December CPI-U67 index.*

(Report-21)

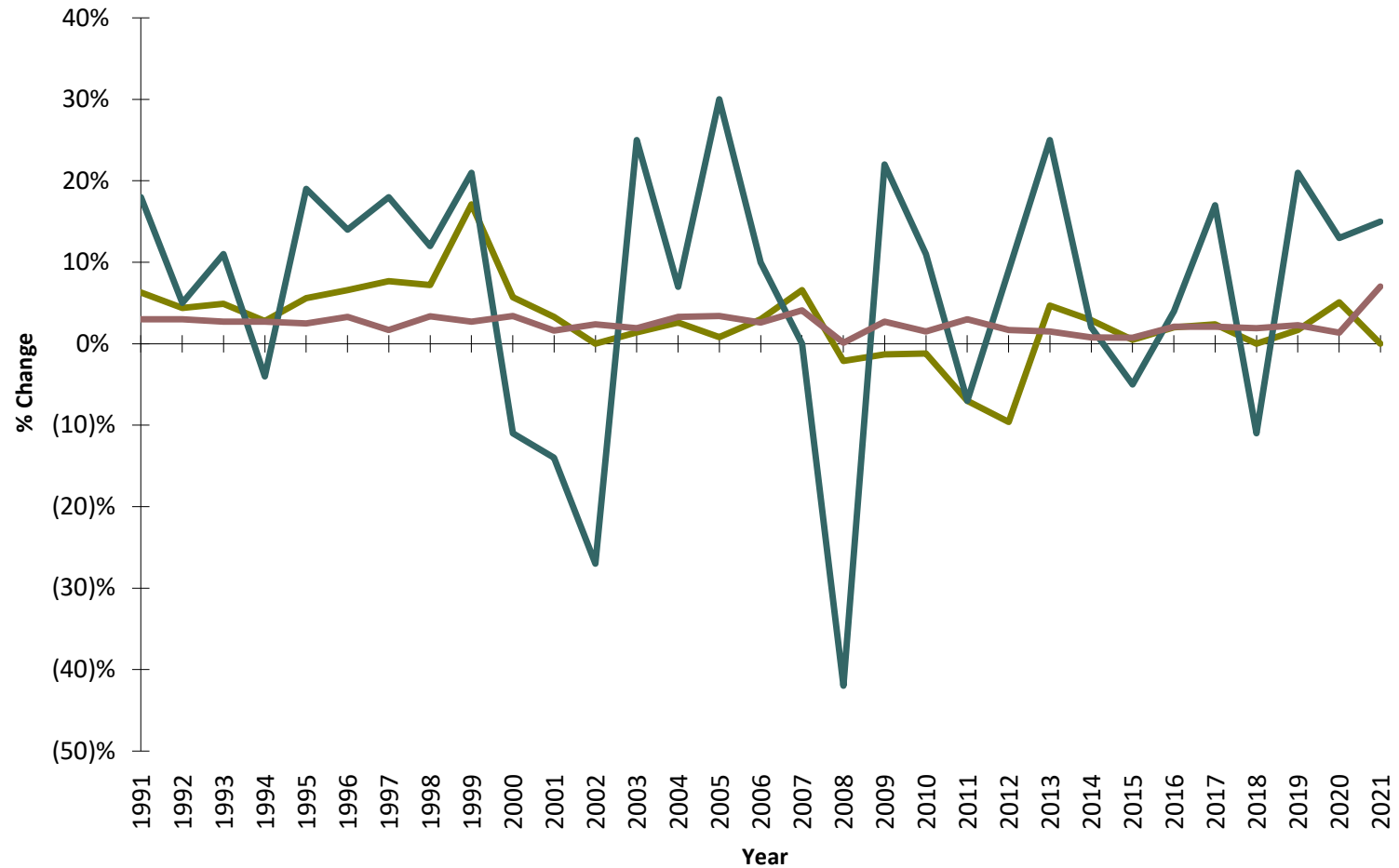
Comparative Statement – Variable

| Valuation Date | Number | \$ Millions | | | | Change in | |
|------------------------|--------|---------------------|-----------------|----------------------|-------|---------------|--------------|
| | | Annual Annuities | Fund Balance | Actuarial Reserve | Ratio | Annuities | CPI* |
| 2012 | 39,873 | \$ 304.6 | \$ 3,463.9 | \$ 3,169.6 | 1.093 | 9.0 % | 1.7 % |
| 2013 | 40,317 | 324.5 | 4,187.3 | 3,347.0 | 1.251 | 25.0 % | 1.5 % |
| 2014 | 39,420 | 386.5 | 3,995.4 | 3,917.1 | 1.020 | 2.0 % | 0.8 % |
| 2015 | 40,152 | 387.8 | 3,704.8 | 3,910.1 | 0.947 | (5.0)% | 0.7 % |
| 2016 | 40,647 | 363.6 | 3,792.0 | 3,645.1 | 1.040 | 4.0 % | 2.1 % |
| 2017 | 40,877 | 369.9 | 4,324.9 | 3,682.1 | 1.175 | 17.0 % | 2.1 % |
| 2018 | 41,187 | 425.8 | 3,738.6 | 4,207.6 | 0.891 | (10.0)% | 1.9 % |
| 2019 | 41,777 | 379.7 | 4,519.4 | 3,728.6 | 1.212 | 21.0 % | 2.3 % |
| 2020 | 41,753 | 449.7 | 4,954.0 | 4,383.0 | 1.130 | 13.0 % | 1.4 % |
| 2021 | 42,251 | 502.6 | 5,618.0 | 4,866.0 | 1.155 | 15.0 % | 7.0 % |
| 35-Year Average | | | | | | 4.3 % | 2.7 % |
| 20-Year Average | | | | | | 3.1 % | 2.3 % |
| 10-Year Average | | | | | | 8.6 % | 2.1 % |
| 5-Year Average | | | | | | 10.6 % | 2.9 % |

*Based on December CPI-U67 index.

(Report-22)

History of % Dividend Adjustments



(Report-23)



Looking Ahead

- As of the December 31, 2021 valuation, there are about \$17.7 billion in unrecognized asset gains in the Core fund
 - About half of this will be applied to annuitant reserve
 - Will be recognized over the next four years
 - May increase probability of future positive annuity adjustments
- We will continue monitoring various plan risks, including dividend liability risk

WRS STRESS TESTING

This is a brief summary of the material presented to the SWIB Board in 4th quarter, 2021

Objectives of the Study

- Investigate
 - Relationship of Investment Return to Success Measures
 - Effects of bad outcomes
- Evaluate several points along the Asset Allocation spectrum against the measures of success
- Find the “Sweet Spot” if it exists

Monte Carlo Simulations

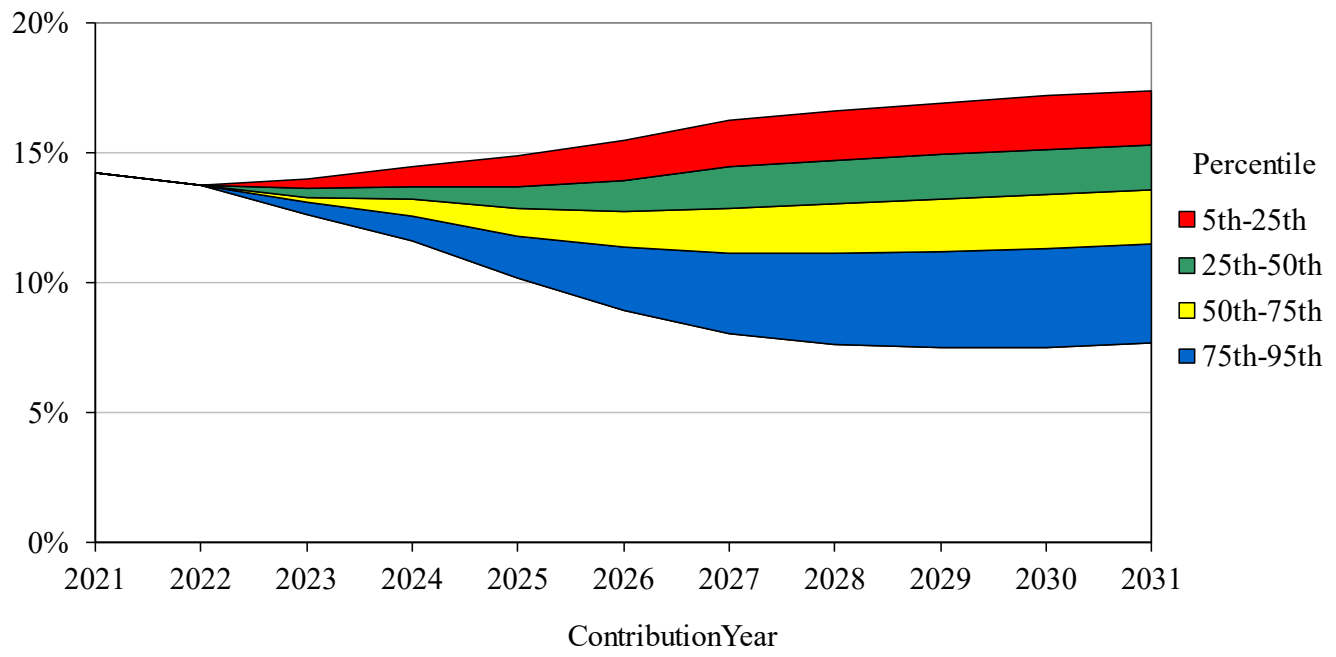
- Based on 10,000 random trials (normal distribution)
- Valuation Assumptions held constant
- Assumes seven sets of expected return/standard deviations (provided by NEPC)

| | 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% |

Actuarial Rate →

Contribution as a % of Payroll

Scenario 3 – 6.0% Return, 15.5%Volatility

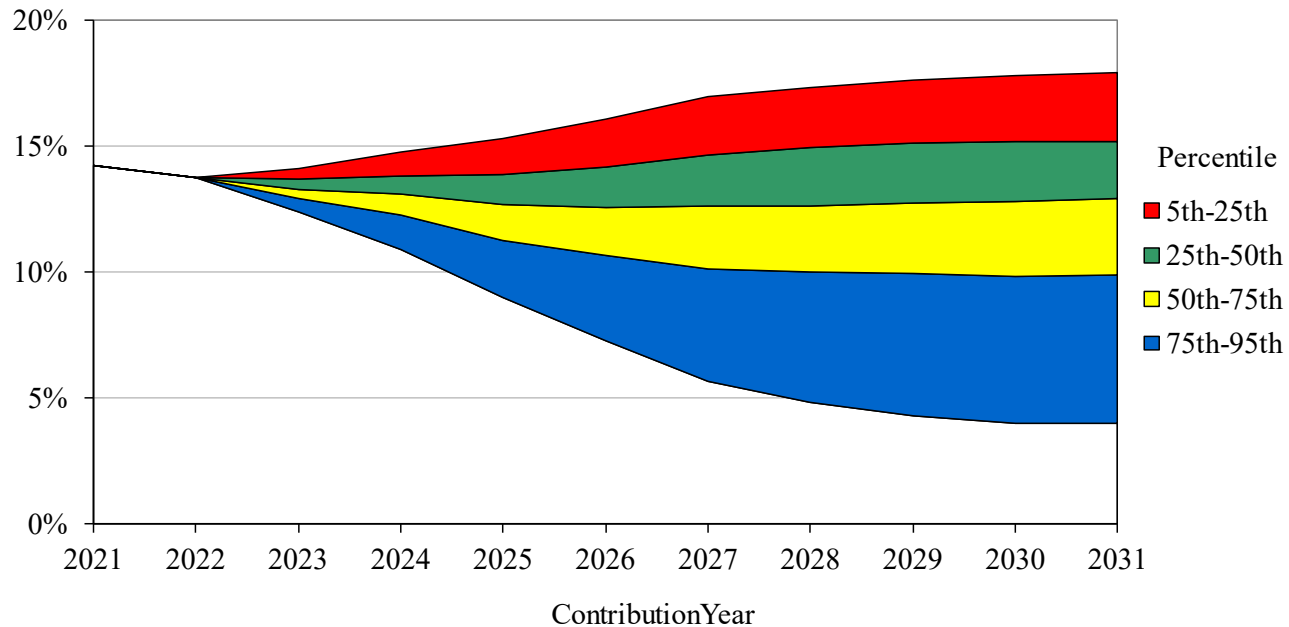


| | | | | | | | | | | | |
|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 5th Percentile | 14.2% | 13.7% | 14.0% | 14.5% | 14.9% | 15.5% | 16.3% | 16.6% | 16.9% | 17.2% | 17.4% |
| 25th Percentile | 14.2% | 13.7% | 13.6% | 13.7% | 13.7% | 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

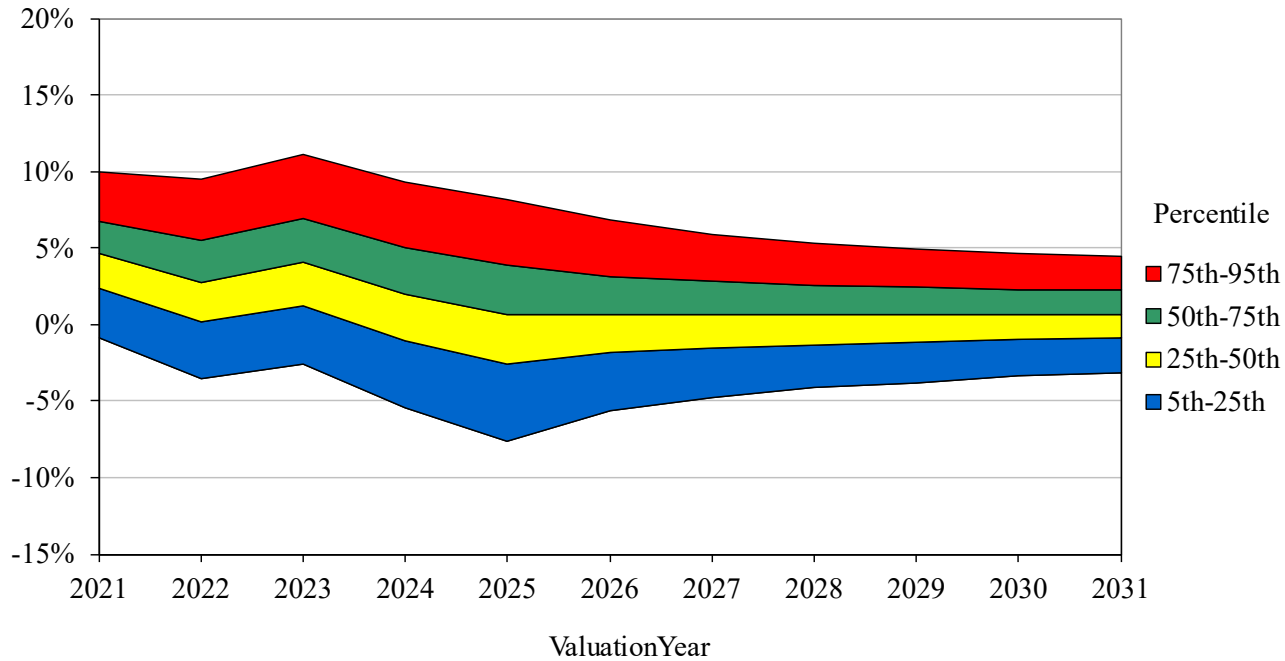
Scenario 4 – 7.0% Return, 20.4%Volatility



| | | | | | | | | | | | |
|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 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

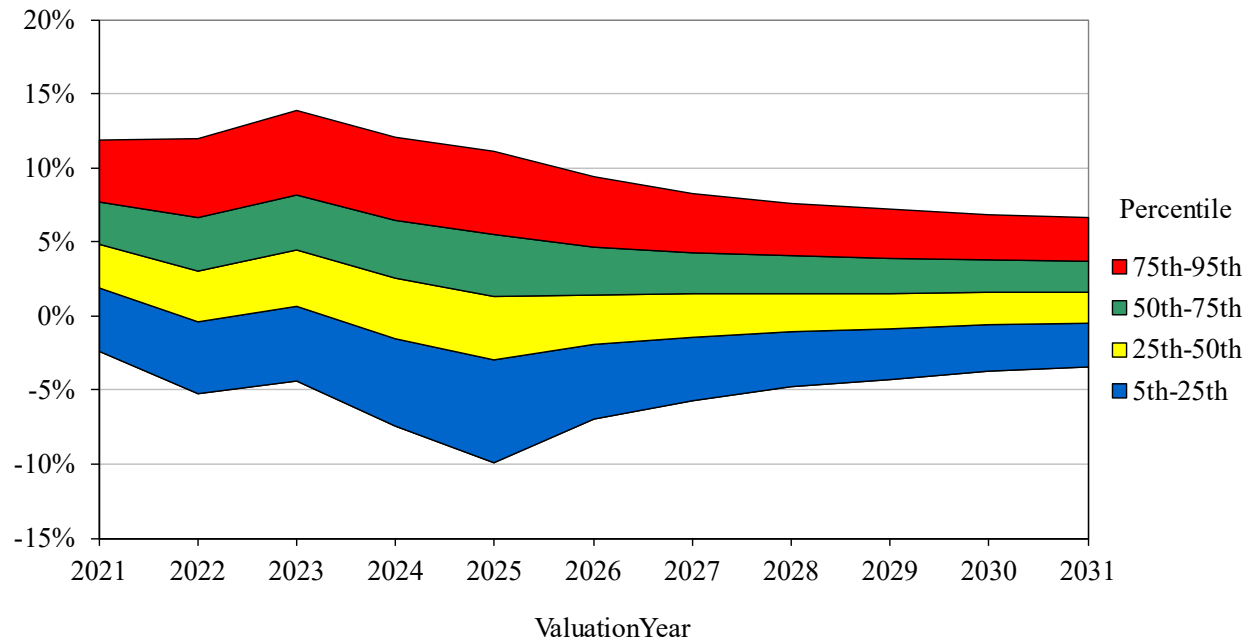
Scenario 3 – 6.0% Return, 15.5%Volatility



| | | | | | | | | | | | |
|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 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)

| | Expected ROR | Standard Deviation | Year | | | | |
|---|-----------------|-----------------------|------|-------|-------|-------|-------|
| | | | 1 | 5 | 10 | 20 | 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% |

Actuarial
Rate
→

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

| | Expected ROR | Standard Deviation | Year | | | | |
|---|--------------|--------------------|------|-------|-------|-------|-------|
| | | | 1 | 5 | 10 | 20 | 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% |

Actuarial Rate →

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)

| | Expected ROR | Standard Deviation | Year | | | | |
|---|-----------------|-----------------------|------|------|------|-----|------|
| | | | 1 | 5 | 10 | 20 | 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% |

Actuarial
Rate
→

Worst Case Scenario based on 5th 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)

Dividend Stress Test

Depletion Severity Measure

Average Retiree Funded Status for Depletion Scenarios

| | Expected ROR | Standard Deviation | Year | | | | |
|---|-----------------|-----------------------|------|-----|-----|-----|-----|
| | | | 1 | 5 | 10 | 20 | 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% |

Actuarial
Rate
→

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

| | ROR | StdDev | Contribution Rates | | | Dividend Rates | | | Highest | Worst Retiree |
|--------------------|-------|--------|--------------------|-------|-------|----------------|-------|-------|---------------|---------------|
| | | | 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 |
| Actuarial Rate → 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 |

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

Disclaimers

- This presentation shall not be construed to provide tax advice, legal advice or investment advice.
- This presentation is intended to be used in conjunction with the actuarial valuation report for retired lives issued on March 2, 2022. This presentation should not be relied on for any purpose other than the purpose described in the valuation report.
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