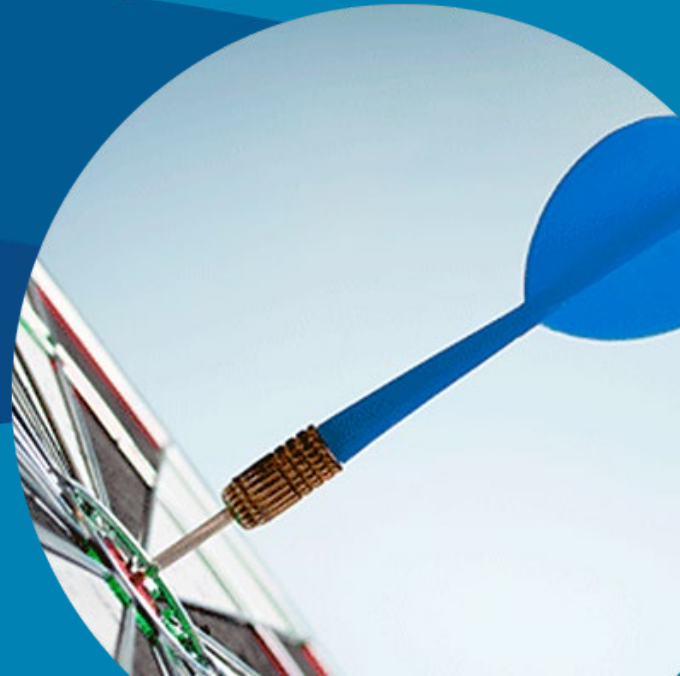




Wisconsin Retirement System

41st Annual Actuarial Valuation as of
December 31, 2021 and Gain/Loss
Analysis

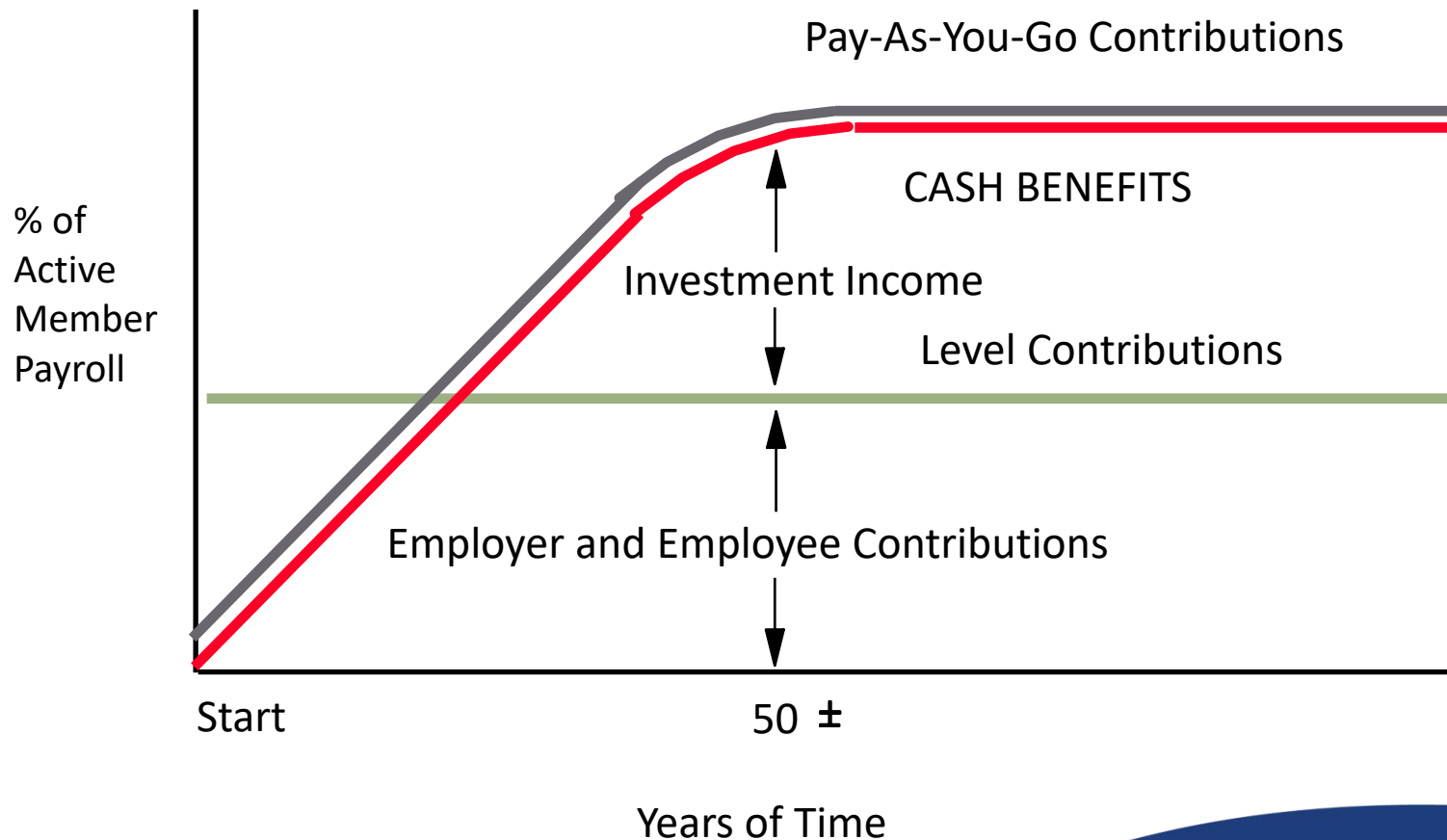
June 2022



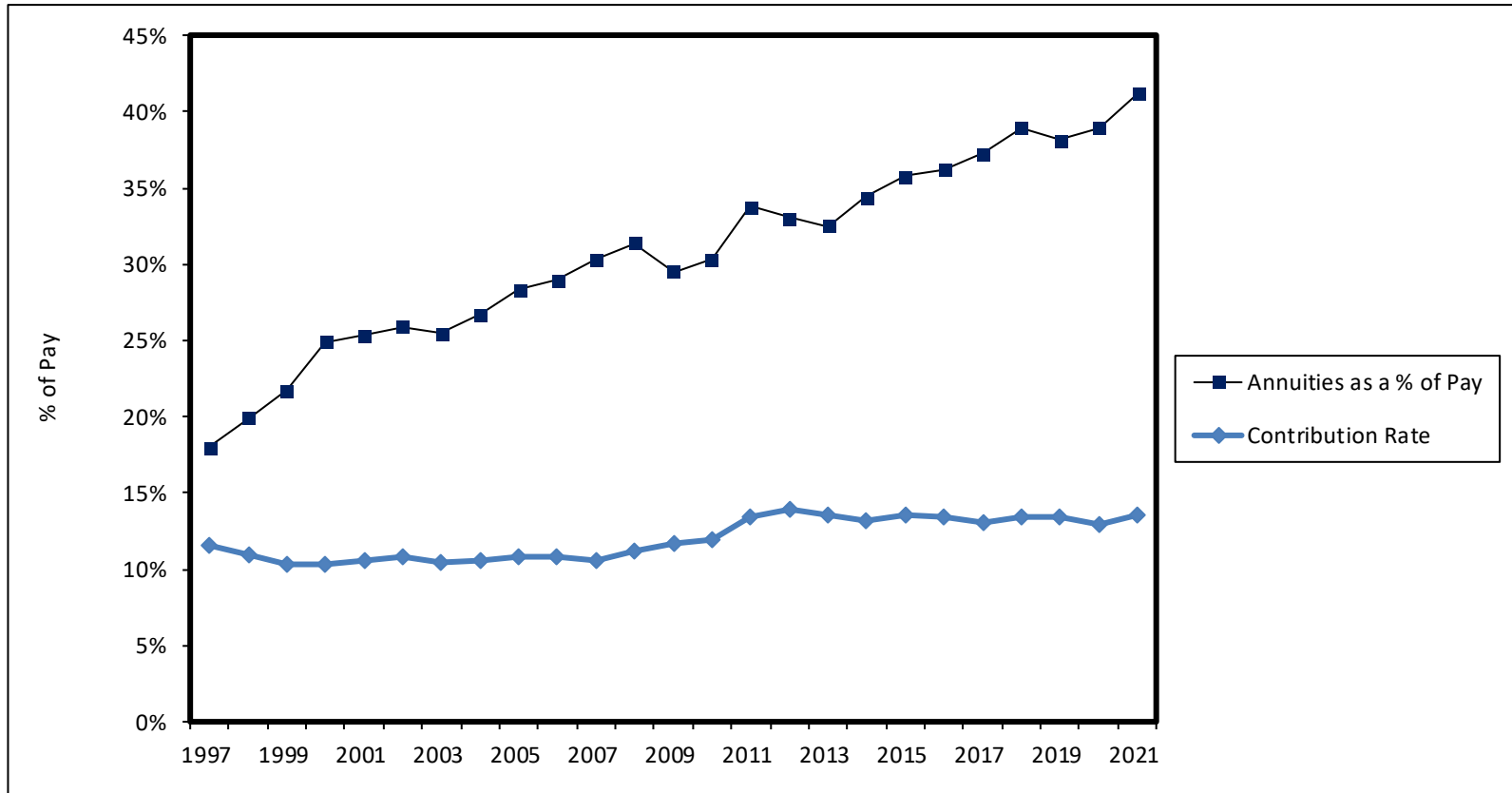
Funding Objectives

- Intergenerational equity with respect to plan costs
- Stable or increasing ratio of assets to liabilities
- Stable pattern of contribution rates

Financing Diagram



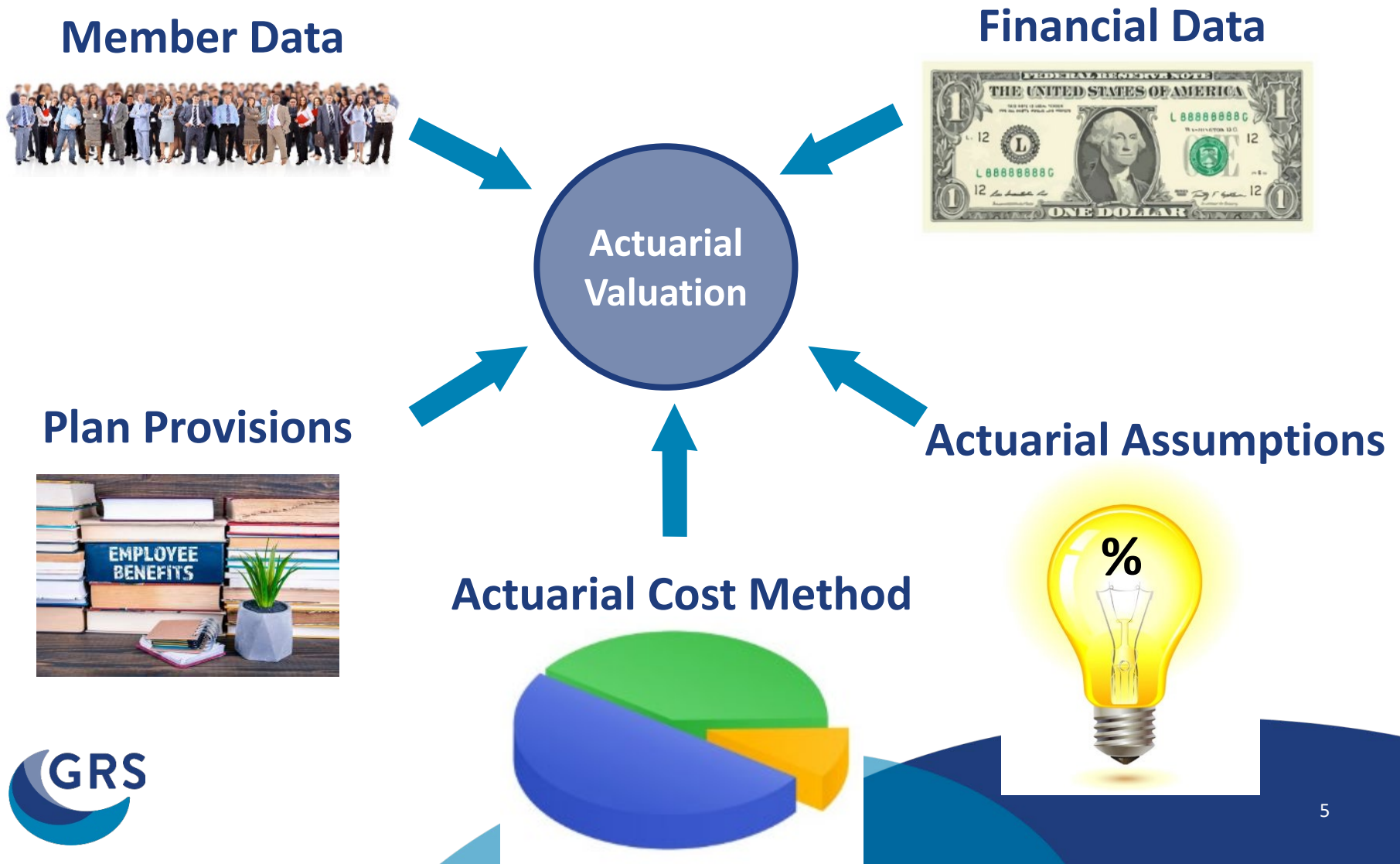
Annuities as a % of Payroll and WRS Average Total Contribution Rate*



Annuities are expected to continue to increase as a percent of payroll for several more decades.

**Average total rate shown is for General Participants.*

Actuarial Valuation Process

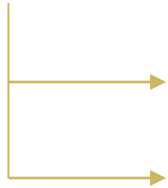


Active Participants at December 31, 2021

Valuation Group	Number	Annual Earnings (\$ Millions)	Group Averages			
			Earnings	Age	Years of Service	Contribs.
General	234,494	\$13,642.5	\$58,179	45.0	11.0	\$68,140
Executive Group & Elected Officials	1,252	117.0	93,428	54.9	14.0	126,882
Protective Occupation with Social Security	19,175	1,404.6	73,249	39.7	12.0	80,525
Protective Occupation without Social Security	2,762	245.9	89,016	40.4	13.5	99,281
Total Active Participants	257,683	\$15,410.0	\$59,802	44.6	11.1	\$69,680
Prior Year	258,338	\$15,065.6	\$58,317	44.8	11.2	\$64,823

All Participants at December 31, 2021

Active Lives
Valuation



Valuation Group	Number	Average Annual Earnings/Benefits*
Actives	257,683	\$59,802
Inactives	174,799	\$20,059
Retirees & Beneficiaries	228,161	\$27,810
Total Participants	660,643	

Retired Lives
Valuation



* For inactives, average money purchase balance.

Actuarial Assumptions Update

- Reviewed 2018-2020 WRS experience study at December 2021 Board meeting
- Updated demographic assumptions including mortality
- Changed investment return assumption from 7.0% to 6.8%
- Other fine-tuning based on actuarial audits

Actuarial Assumptions Update

Mortality Improvement Illustration

Year of Birth	Year Turn Age 65	Life Expectancy*	
		Male	Female
1960	2025	22.1	24.1
1970	2035	22.8	24.7
1980	2045	23.5	25.3
1990	2055	24.1	25.9
2000	2065	24.7	26.5

** Based on the proposed 2020 WRS Experience Table for Healthy Retirees and projected with mortality improvements using the fully generational MP-2021 projection scale from a base year of 2010.*

Reflecting historic increases in life expectancy led to

- 1. Increased Employer contribution rates, and**
- 2. Retiree dividend adjustments**

Actuarial Assumptions Update

Mortality – 2018-2020 Experience Study Impact

Active Lives Valuation

- Slight upward pressure on contribution rates

Retired Lives Valuation

- Approximately cost neutral
- No phase-in of mortality reserve adjustment needed

Key point: Introduction of Generational Mortality in recent years has decreased impact of mortality update on contribution rates and dividends

Actuarial Assumptions Update

Historical Mortality Impact on Dividends

Over last 15 years
Consistent Phase-in
Of dividend decrease

Year	Decrease
2006	0.5%
2007	0.5%
2008	0.5%
2009	0.3%
2010	0.3%
2011	0.4%
2012	0.3%
2013	0.3%
2014	0.4%
2015	0.5%
2016	0.5%
2017	0.5%
2018	0.2%
2019	0.2%
2020	0.2%

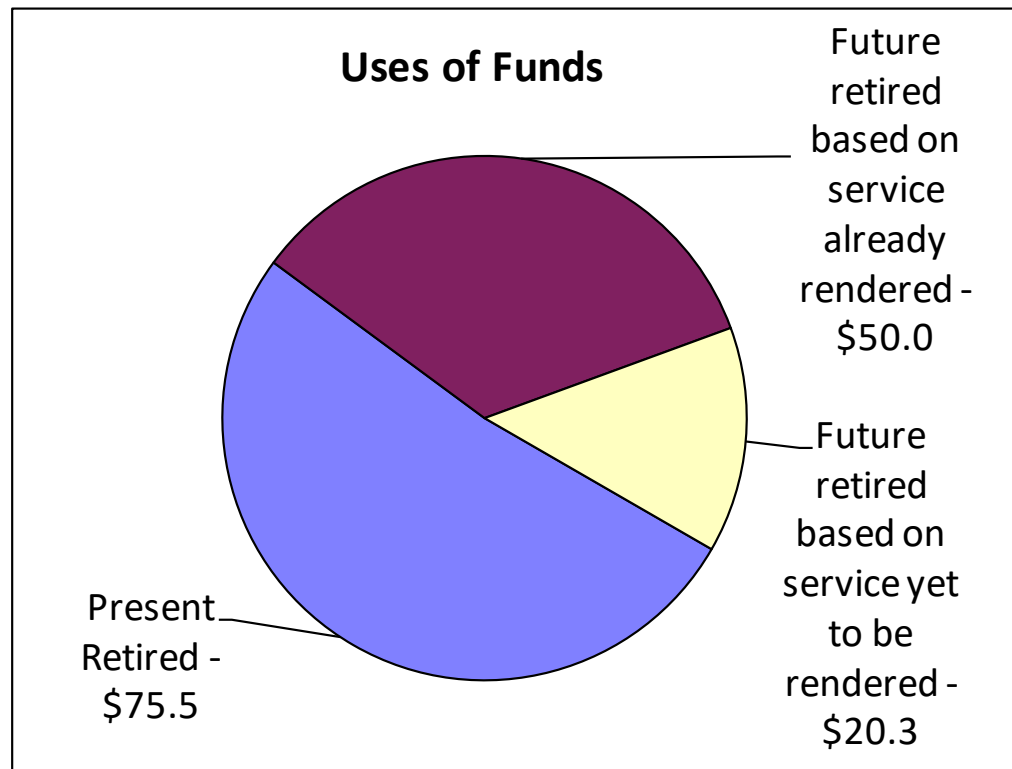
Looking ahead
No phase-in
2021-2023

Actuarial Assumptions Update

Mortality Experience – Summary

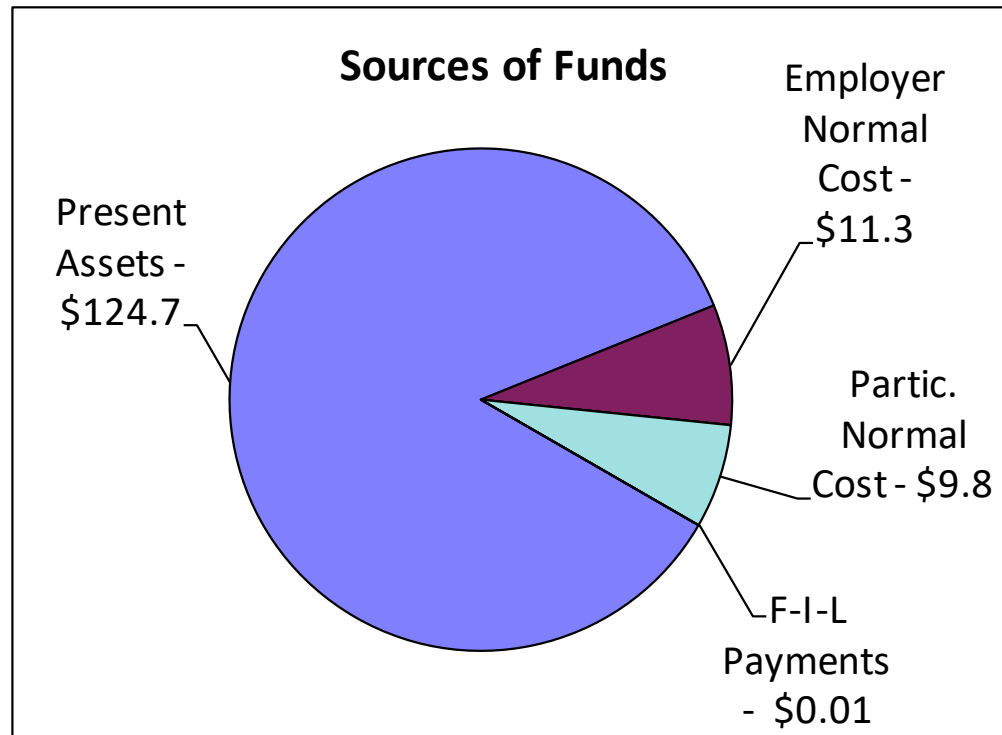
- All assumptions are continually fine-tuned to best approximate future reality
- WRS has separate Trust Funds and valuations for Annuitants vs. Employers/Employees
- Mortality impacts all members, separately impacting those in Annuitant Trust and Employer/Employee Trust

\$145.8 Billion* of Benefit Promises to Present Active and Retired Members

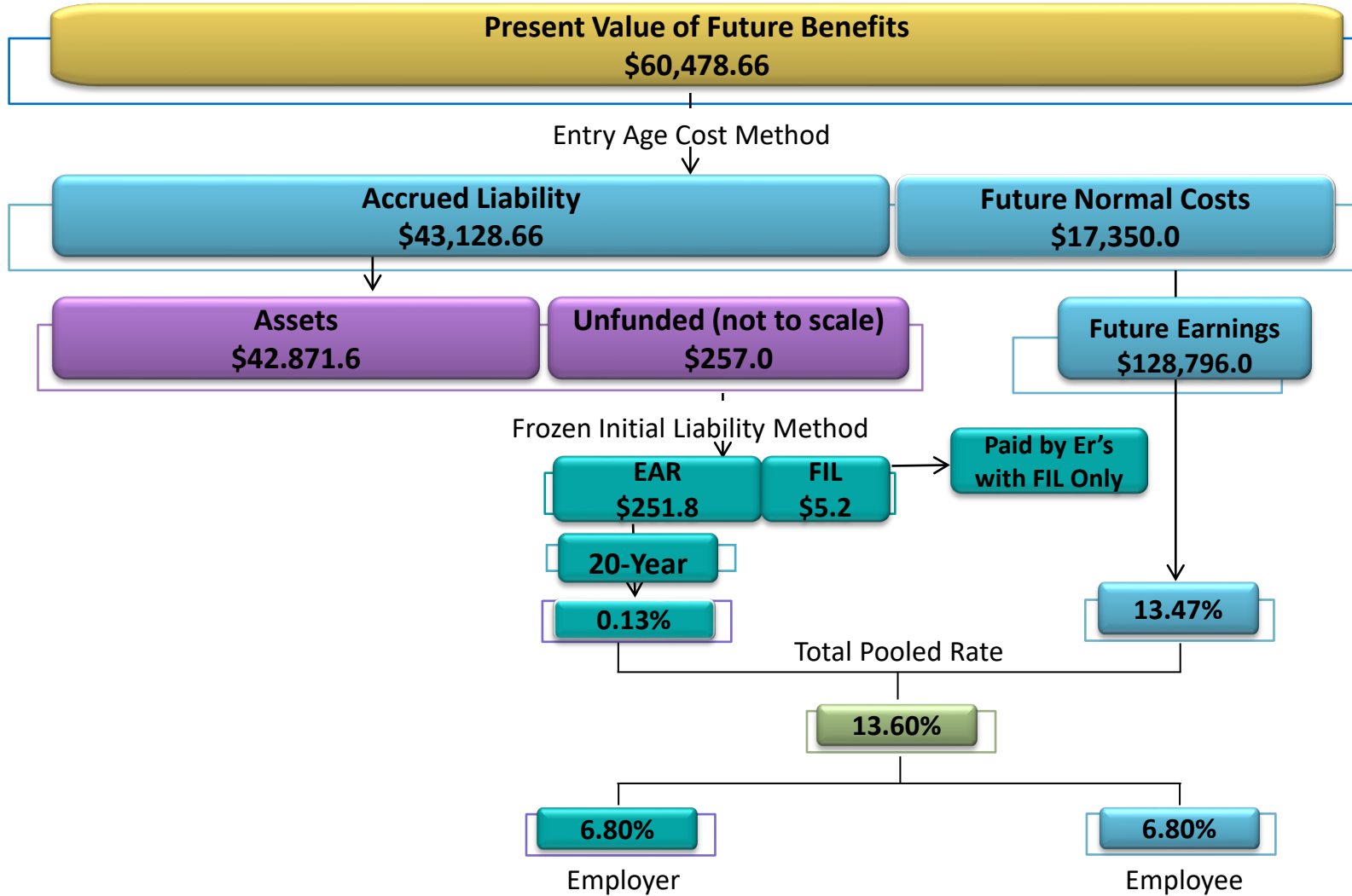


* Present value of future benefits; all divisions combined.

Sources of Funds for Financing \$145.8 Billion of Benefit Promises



Actuarial Valuation Process Illustration for General/Elected Group (\$ Millions)



Actuarial Assumptions Update

Experience Study Contribution Impact

Group	Experience Study (Estimated)*	December 31, 2021 Valuation (Actual)
General and Exec/Elected	13.4%	13.6%
Protective - With SS	20.3%	20.0%
Protective - Without SS	24.7%	24.9%

* Note: Experience study based on preliminary assets (report issued November 2021) and prior year data

Summary of December 31, 2021 Valuation Results

	General, Executive & Elected Officials		Protective Occupation				Average
			With Soc. Sec.		Without Soc. Sec.		
	2023	2022	2023	2022	2023	2022	2023
Employer Normal Cost	6.80%	6.50%	13.20%	12.00%	18.10%	16.40%	7.65%
Participant Normal Cost	6.80%	6.50%	6.80%	6.50%	6.80%	6.50%	6.80%
Total Normal Cost	13.6%	13.0%	20.0%	18.5%	24.9%	22.9%	14.5%
Estimated Total NC (\$ millions)*	\$1,985.3	\$1,849.6	\$298.0	\$277.6	\$64.9	\$58.3	

* Based on payroll projected from valuation date to fiscal year using the payroll growth assumption.

Comparative Statement of Total Average Contribution Rates

Valuation 12/31	General	Executive & Elected	Protective with Soc. Sec.	Protective without Soc. Sec.
2001	10.63%	11.66%	11.68%	13.68%
2006	10.79%	11.56%	13.37%	14.57%
2011	13.40%	14.00%	16.40%	19.30%
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	13.00%	13.00%	18.52%	23.86%
2021	13.60%	13.60%	20.03%	24.90%

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

Protective Contribution Rate Levels

- Higher contribution rates compared to General Employees
 - Higher benefit multipliers
 - Protective = 2% or 2.5% (with or without Soc. Security)
 - General & Executive/Elected = 1.6%
 - Earlier Normal Retirement Eligibility
 - Protective at Age 54 or Age 53 with 25 years of service
 - General & Executive/Elected at Age 65/62 or Age 57 with 30 years of service

Protective Contribution Rate Levels

- More volatile contribution rates compared to General Employees
 - Asset/Payroll ratios¹
 - Protective = 347% - 455% (with - without Soc. Security)
 - General & Executive/Elected = 312%
 - Liability/Payroll ratios¹
 - Protective = 382% - 488% (with - without Soc. Security)
 - General & Executive/Elected = 313%

¹ From active lives valuation

Protective Contribution Rate Levels

- Higher liability volatility for Protectives has accentuated the impact of assumption changes
- Results of last 3 experience studies cumulatively increased contribution rates:
 - General: 1.37% added to rate
 - Prot. with SS: 4.35% added to rate
 - Prot. without SS: 4.72% added to rate

Reasons for Contribution Changes

	General, Executive & Elected	Protective with Soc. Sec.	Protective without Soc. Sec.
2022 Normal Cost Rate	13.00%	18.50%	22.90%
Effect of Benefit Change	0.00%	0.00%	0.00%
Effect of Assumption Change	1.00%	2.60%	2.90%
Effect of Asset Performance	(0.45)%	(0.92)%	(1.12)%
Effect of Salary Experience	(0.04)%	(0.32)%	(0.04)%
Effect of Money Purchase Benefit	0.10%	0.10%	0.10%
Demographic and Other Experience	(0.01)%	0.04%	0.16%
2023 Normal Cost Rate	13.60%	20.00%	24.90%

Generally
zero when
not Exper.
Study year

The effect of Asset Performance is different for each group because the ratio of assets to payroll is different for each group.

Impact of Asset Gains/Losses

- Asset gains and losses above or below the assumed rate of return are smoothed in over the current year and four future years
- Four years after a valuation date, all asset gains or losses known at valuation date are fully recognized
- Statutory smoothing method in WRS is referred to as the Market Recognition Account (MRA)

Operation of Market Recognition Account (MRA)

- \$ Millions

	<u>2021</u>	<u>2022</u>	<u>2023</u>	<u>2024</u>	<u>2025</u>
Actual Investment Return	\$ 19,957				
Assumed Investment Return	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

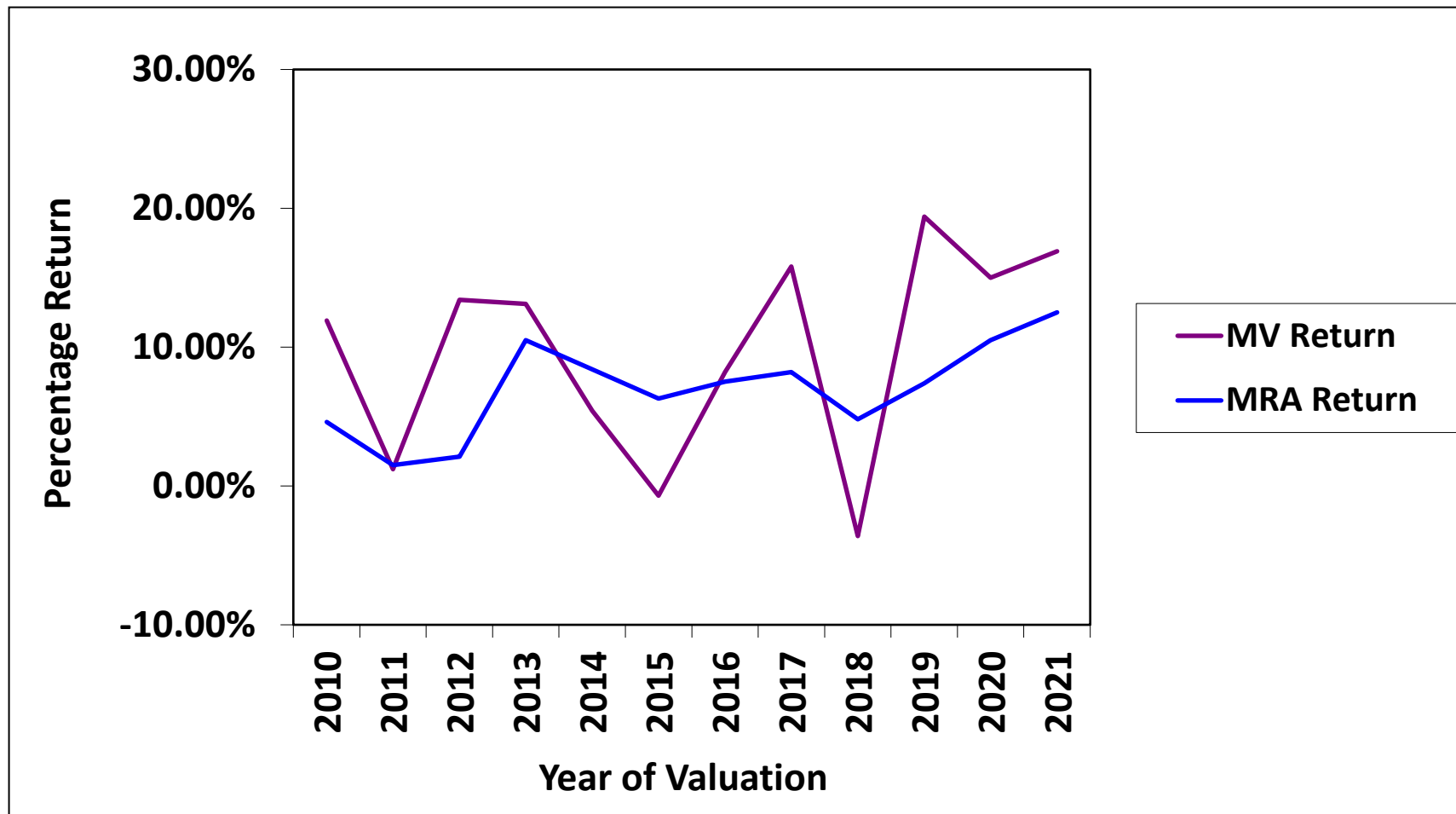
Reconciliation of Market Recognition Account (MRA)

	<u>\$ Millions</u>
MRA at Beginning of Year	\$ 108,808.6
Non-Investment Cash Flow	(3,854.1)
Assumed Return (at 7.0%)	7,481.7
Phase-in of Gains/(losses)	5,885.0
MRA at End of Year	\$118,321.2
MRA Rate of Return	12.50%
Market Value Rate of Return	16.90%

Assets in MRA include non WRS programs such as Sick Leave, Duty Disability, etc.

Market value rate of return shown as calculated by GRS and may differ from returns calculated by SWIB and/or ETF.

Market Value Return vs. Market Recognition (Actuarial) Return



WRS Funded Status

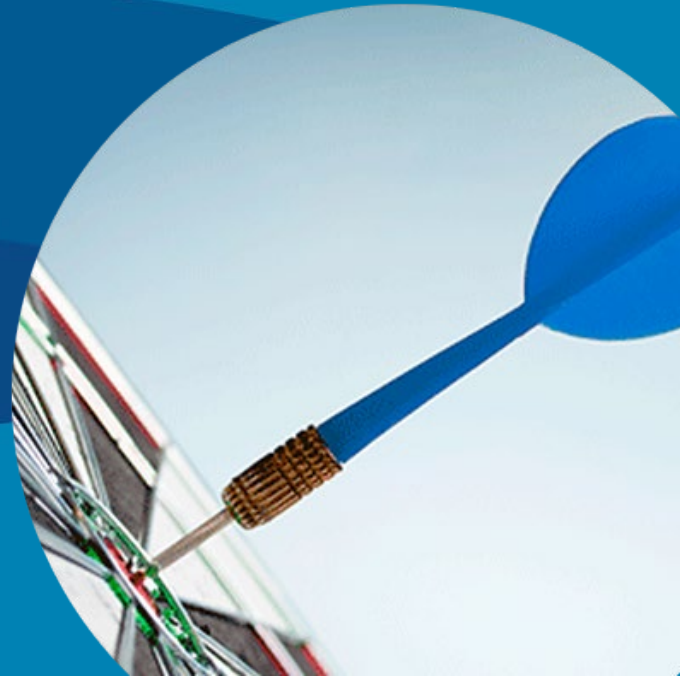
	Frozen Initial	Entry Age
2017	100.0%	99.5%
2018	100.0%	98.6%
2019	100.0%	98.6%
2020	100.0%	99.1%
2021	100.0%	99.3%

Concluding Remarks

- There are \$17.7 billion of unrecognized gains in the MRA
- Due to the cost sharing nature of WRS, asset gains have been traditionally shared by:
 - Employees (through increased money purchase benefits and decreases in contributions)
 - Employers (through decreases in contributions)
 - Retirees (through increased dividends)



Gain/Loss Analysis



2021 Gain/Loss Analysis

A Gain/Loss Analysis measures differences between actual and assumed experience in each Risk Area.

WRS Assumption Risk Areas

Primary Risks

Demographic

Normal retirement

Early retirement

Death-in-service

Disability

Other separations

Economic

Salary increases

Investment return

Why Have a Gain/Loss Analysis?

- To gain an understanding of reasons for contribution rate changes
- It is a year-by-year measure of the operation of assumptions
- To determine when assumption changes are needed
- To understand the nature of risk

The Nature of Defined Benefit Plan Risk

Investment Risk

- The risk that actual returns will differ from assumed returns.

Asset/Liability Mismatch

- The potential that changes in assets are not offset by changes in liabilities. Because of the way assets are invested in most public plans this is almost synonymous with investment risk.

Contribution Risk

- The risk that actual contributions will differ from expected contributions. This could occur, for example, if the plan's funding policy is not followed, or if there are changes in the covered population.

Retirement Sustainability Equation

- Asset/Liability Mismatch

$$C + I = B + E$$

B depends on

- ▶ Plan Provisions – at retirement, member receives x% of Final Average Pay times years of service
- ▶ Participant Experience – tenure, pay increases, etc.

Most Systems do not have asset changes offset by liability changes

Retirement Sustainability Equation

- **Smaller Asset/Liability Mismatch in WRS**

$$C + I = B + E$$

B depends on plan provisions, which incorporates **I** Experience

- ▶ Money Purchase DC benefit (changes with I results)
- ▶ Annual post-retirement adjustments to the monthly annuity benefit are based solely on investment returns
 - ▶ Dividends can increase or decrease

The Nature of Defined Benefit Plan Risk

Salary and Payroll Risk

- Individual pays and/or total covered payroll may not grow at the assumed rate. If covered payroll grows more slowly than assumed, or shrinks, actual contributions may fall short of expected contributions.

Longevity Risk

- Members may live for more or fewer years than expected, affecting the amount of pension income they will receive from the plan.

Other Demographic Risks

- Members may terminate, retire, or become disabled at rates other than expected, affecting both contribution rates and funded status.

Population Development During 2021

	<u>Actual</u>	<u>Expected</u>
Beginning Census	258,338	
(-) Normal Retirement	4,600	4,911
(-) Early Retirement	3,703	4,145
(-) Death	129	279
(-) Disability Retirement		
- Total Approved	243	158
- Less Pending	84	
- Net New	159	
(-) Other Separations	17,646	13,724
(-) Transfers Out	2,014	
(+) Transfers In	2,014	
(+) New Entrants	25,582	
Ending Census	257,683	

Population Development During 2021

Normal Retirements: Varied by group and gender. Overall, lower than expected, but net result on liabilities is a small loss.

Early Retirements: Lower than expected, overall producing a small loss.

Deaths: Among active participants were lower than expected. The net result for the past year was a small loss.

Disabilities: Close to expected, producing a small gain.

Other Separations: Varied by group, gender and service. Overall, higher than expected. The net result was a small gain.

Comparative Schedule of Experience Gains/Losses by Decrement

Divisions Combined (Millions)

	<u>2020</u>	<u>2021</u>
Normal Retirement	\$ (33.5)	\$ (27.4)
Early Retirement	(22.7)	(20.9)
Disability Retirement	(10.5)	4.2
Death with Benefit	(1.7)	(3.0)
Other Separations	(40.4)	20.1
	<u> </u>	<u> </u>
Total	\$ (108.8)	\$ (27.0)
As % of Liabilities	-0.24%	-0.06%

Components of Total Gain/(Loss)

	<u>Gain/(Loss) in Millions</u>	
	<u>2020</u>	<u>2021</u>
Economic Risk Areas	\$760	\$1,288
Decrement Risk Areas	(109)	(27)
Other Activity	<u>(149)</u>	<u>(90)</u>
Total Gain/(Loss)	\$502	\$1,171

Investment Earnings in 2021 (Active Participants)

	<u>\$ Millions</u>
A. Average balance on Participant and Employer Accumulation Reserves	\$44,159
B. Expected earnings: 7.0%	3,091
C. Earnings credited to Participant and Employer Accumulation Reserves	5,820
D. Gain (loss) from earnings: C - B	\$ 2,729

Investment Earnings in 2021

(Active Participants)

- \$2,729 million is the total recognized asset gain for the year for active participants
- However, part of the total gain/loss is allocated to Variable Excess accounts
- Some of the gain flows through to members via the operation of Money Purchase minimum benefits
- Must net these out to determine remaining core fund gain or loss
- Remaining portion affects contribution rates

Investment Earnings in 2021 (Active Participants)

	<u>\$ Millions</u>
Gross Gain/(Loss) for the Year (for Actives)	\$2,729
Less Estimated Gain/(Loss) due to Money Purchase	1,252
Less Estimated Gain/(Loss) due to Variable Excess	<u>348</u>
Net Core Fund Asset Gain/(Loss)	\$1,129

Salary Related Gain/Loss

- Pay increases were overall lower than expected, resulting in a gain

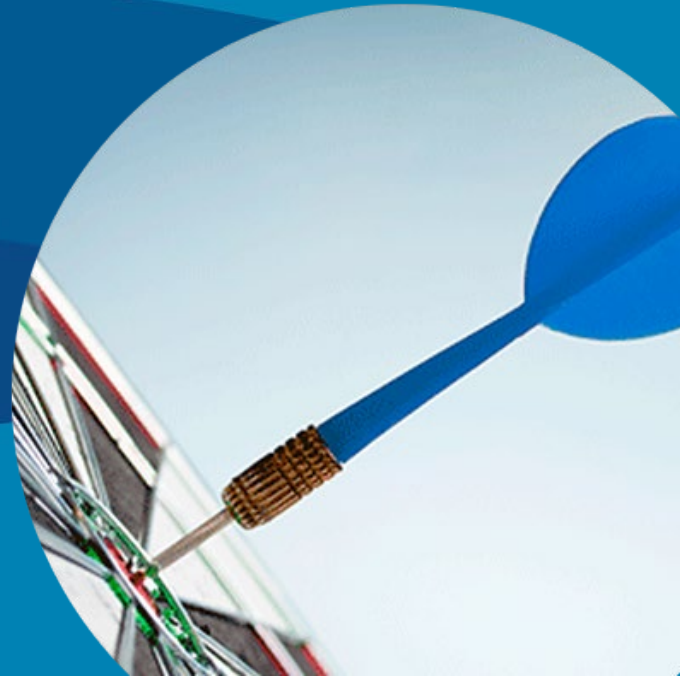
	Gain/Loss \$ Millions	% of Group Liabilities
General, Executive & Elected	\$92.0	0.2 %
Protective w/Soc. Sec.	65.8	1.3 %
Protective w/o Soc. Sec.	1.5	0.1 %
	\$159.3	0.3 %

Concluding Remarks

- Recognition of remaining prior asset gains and losses are expected over the next few years
- This Gain/Loss Analysis is the first in a regular 3-year experience cycle
- This study, together with the 2022 and 2023 results, will form the basis for the next experience study – to be performed after the December 31, 2023 valuation cycle



Current Events



Current Events

- COVID Implications for WRS
- Current Economic Market Implications for WRS
 - Inflation
 - Investment

COVID Dwindling (?)

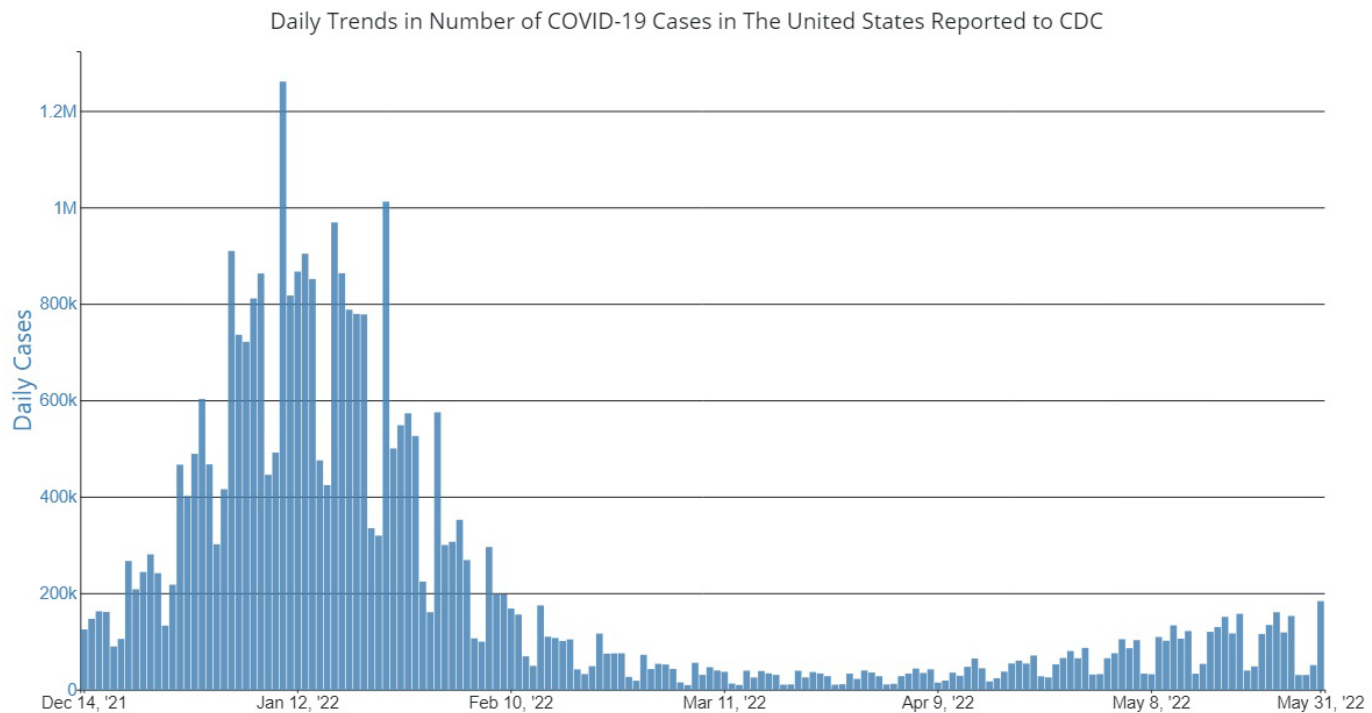
- CDC Data tracker as of June 1, 2022
 - Daily update for the United States

	Cases	Deaths
New (Daily Avg)	103,686	264
Total	84,176,694	1,002,422

258,655,540 of people 5+ (82.8%) have had at least one vaccination dose

COVID Dwindling (?)

- CDC Data tracker as of June 1, 2022
 - Daily update for the United States



COVID Implications for WRS

<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. Note: jump in $E[\text{Deaths}]$ in 2021 is due to new assumed mortality.

COVID Implications for WRS

- Average mortality rate remained elevated by a similar amount as last year, possible due to the pandemic
- Overall impact on 2022 Core Dividends 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

Economic Markets: Actual Inflation (CPI-U)

- Could be that a **1970s** replay is unlikely
 - 1974 inflation rate = 12.2%
 - 1979 inflation rate = 13.3%
- But, we may be moving on from 30+ year low inflation period

Calendar Year Period	Price Inflation (CPI)	National Average Earnings (NAE)
1950-1959	2.2%	4.5%
1960-1969	2.5%	4.3%
1970-1979	7.4%	6.9%
1980-1989	5.1%	5.8%
1990-1999	2.9%	4.2%
2000-2009	2.5%	2.9%
2010-2019	1.8%	2.9%
2020	1.4%	2.8%
2021	7.0%	6.2%
Last 52 Years	3.9%	4.5%

Economic Markets: Actual Earnings (NAE)

- Also may be moving on from low wage inflation start to 21st century
- WRS largely experienced pay gains in many of last 30 years
- A return to historical averages means higher inflation and **higher wages going forward** if living standards to be maintained
 - Given real wage growth

Calendar Year	Price Inflation	National Average Earnings (NAE)
Period	(CPI)	
1950-1959	2.2%	4.5%
1960-1969	2.5%	4.3%
1970-1979	7.4%	6.9%
1980-1989	5.1%	5.8%
1990-1999	2.9%	4.2%
2000-2009	2.5%	<u>2.9%</u>
2010-2019	1.8%	<u>2.9%</u>
2020	1.4%	<u>2.8%</u>
2021	7.0%	6.2%
Last 52 Years	3.9%	4.5%

Inflation Impact on WRS

- Dividends have provided inflation protection, on average, over the last 35 years
 - Note that preservation of purchasing power is generally not a specific objective
 - Results dependent on when member retires
- A new higher inflationary environment is unknown territory
 - Will dividends enable retirees to maintain living standard?

Investment Impact on WRS

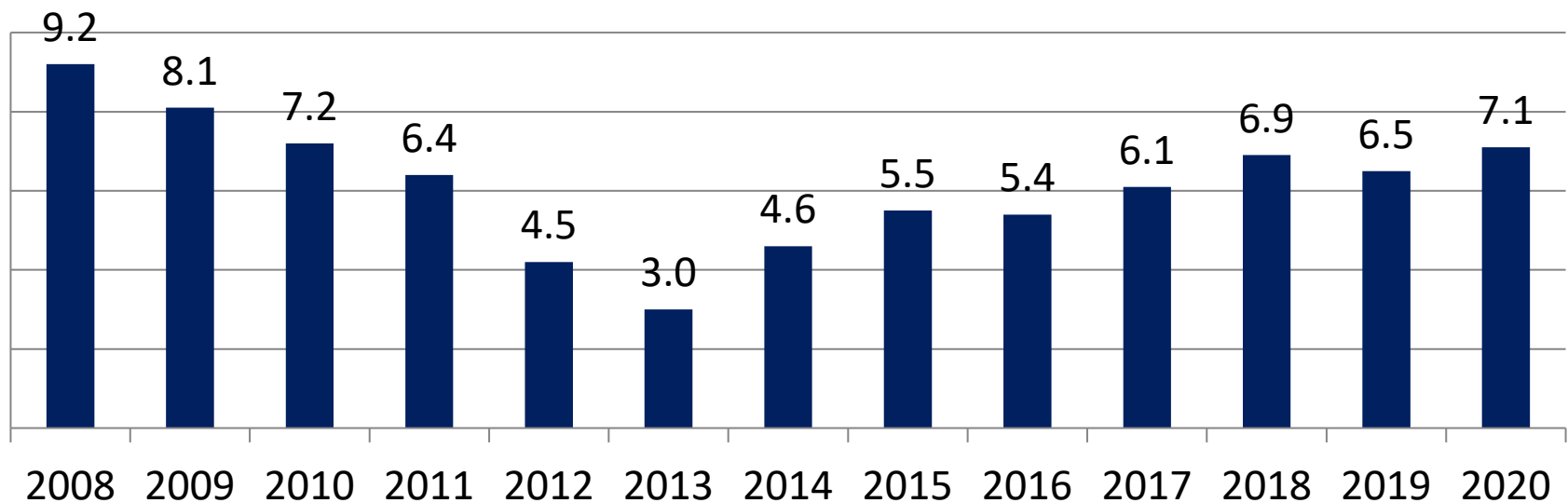
- GRS stress tested WRS with SWIB in 2021, investigating Black Swan scenarios
 - Generic: Negative 30% return in year 1, assumed return of 7% thereafter (no bounce back)
 - SWIB Model: Negative 23.4 % return in year 1, bounceback 21.1% return in year 2, followed by 7.89% return for 8 years and 7% thereafter
- In a highly diversified portfolio like WRS', actual large one year asset losses (-23%, -30%) would reflect asset market meltdown in total

Investment Impact on WRS

- Deterministic stress test investigated impact on
 - Contribution rates
 - Expected dividends
 - 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.)

Historic Dividend Liability ("Past Dividend Liability")

**Liability for Remaining Dividend
(Billions)**



Notes: 1) drawdown of the reserve via dividend reductions in 2008- 2013 followed by the dividend buildup affects different cohorts of retirees differently.
2) Mortality impacts the past dividend liability in 2015-2016, 2018-2019.

Investment Impact on WRS: 2021 SWIB Study Results Summary

Measure	Generic Black Swan “-30% Return Without Bounceback”	SWIB Model “-23% Return With Bounceback”
Dividend Liability	Depletion in 2025	Not depleted
Retiree Liability	Becomes underfunded	Not underfunded
Dividend impact	A series of negative dividends... Until most people at original benefit... Followed by an extended period of no dividends... Dividends could resume in 10 years	Negative dividends in 4 out of first 5 years... Followed by a return to positive dividends
Contrib. Rate Impact	Contribution Rate gradually increases by about 3% of payroll in year 5 and slowly declines thereafter	Contribution Rate gradually increases by about 2.5% of payroll in year 5 but declines thereafter

-
- QUESTIONS?

Disclaimers

- This presentation shall not be construed to provide tax advice, legal advice or investment advice.
- Brian Murphy, Mark Buis and James Anderson are Members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.
- 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 “Forty-First Annual Actuarial Valuation and Gain Loss Analysis.”
- If you need additional information to make an informed decision about the contents of this presentation or the contents of the full report, or if anything appears to be missing or incomplete, please contact us before making use of the information.