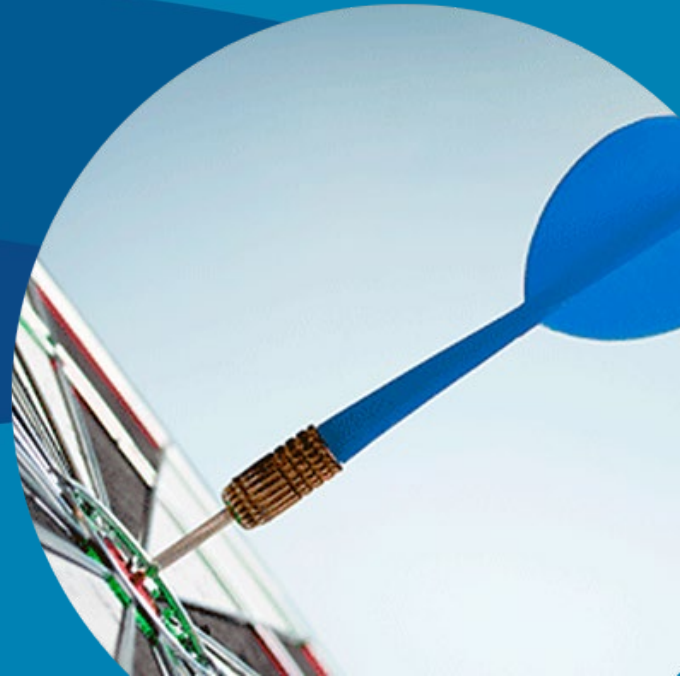




Wisconsin Retirement System

40th Annual Actuarial Valuation as of
December 31, 2020 and Gain/Loss
Analysis

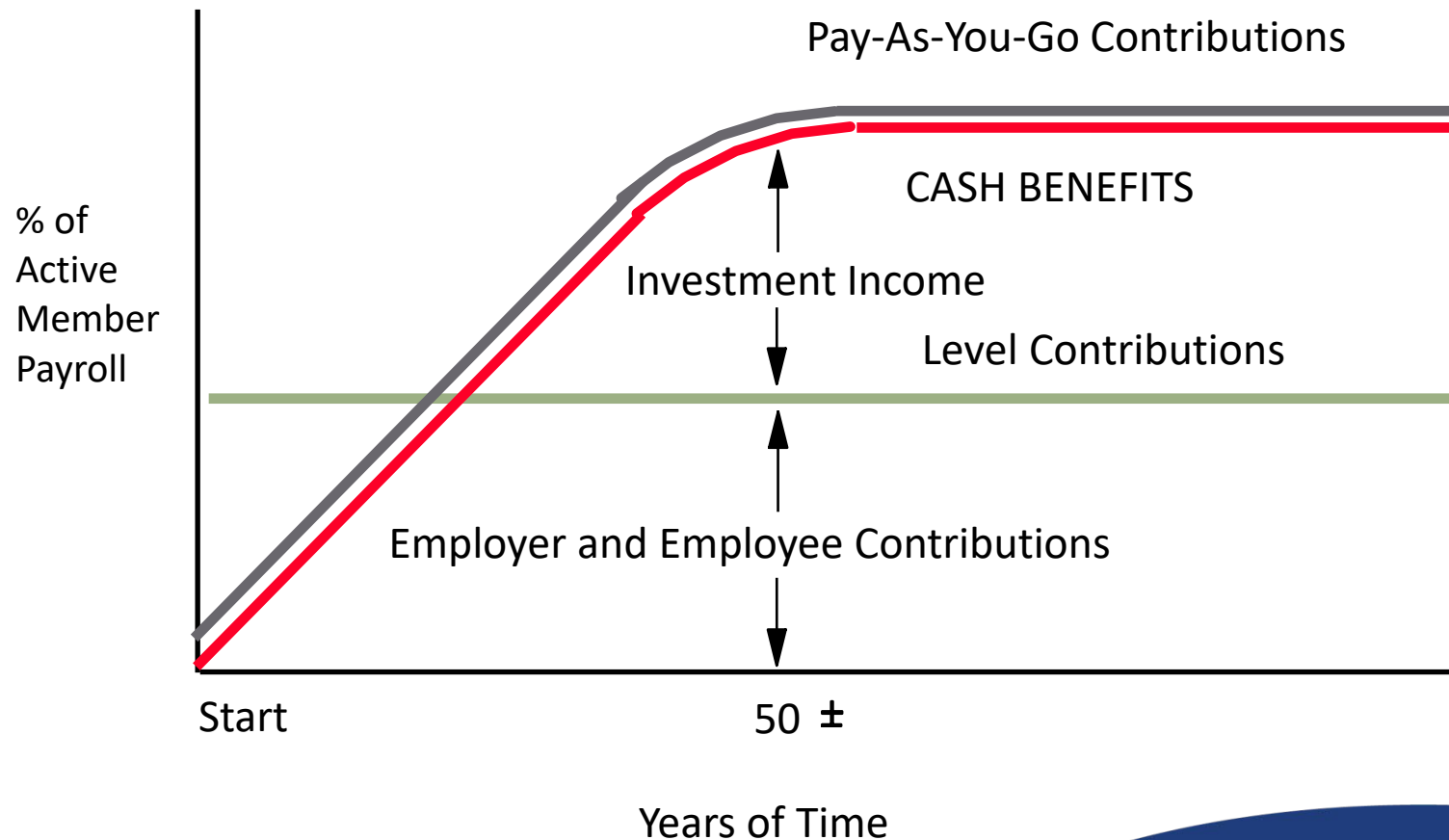
June 2021



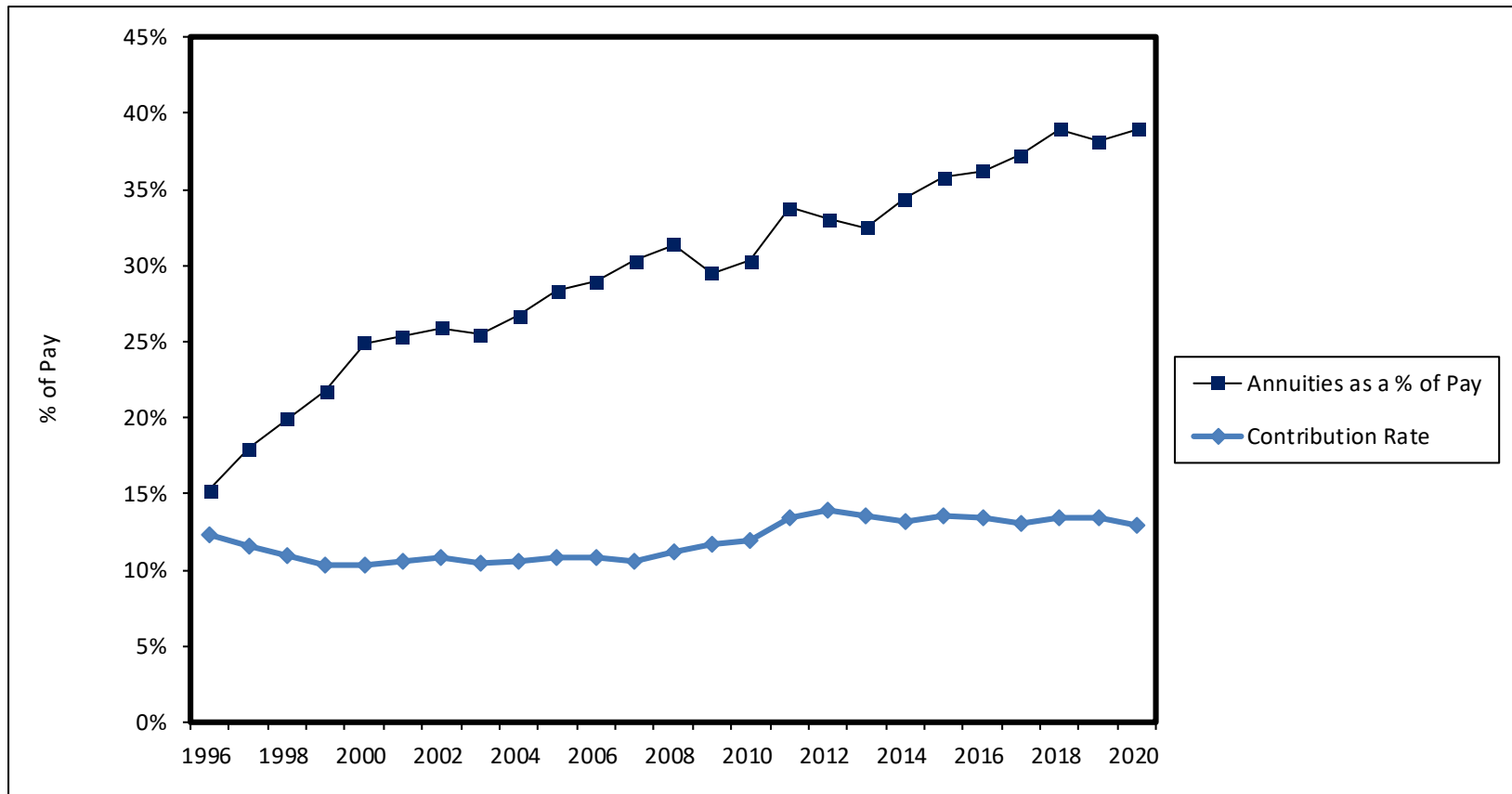
Funding Objectives

- 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.*

Active Participants

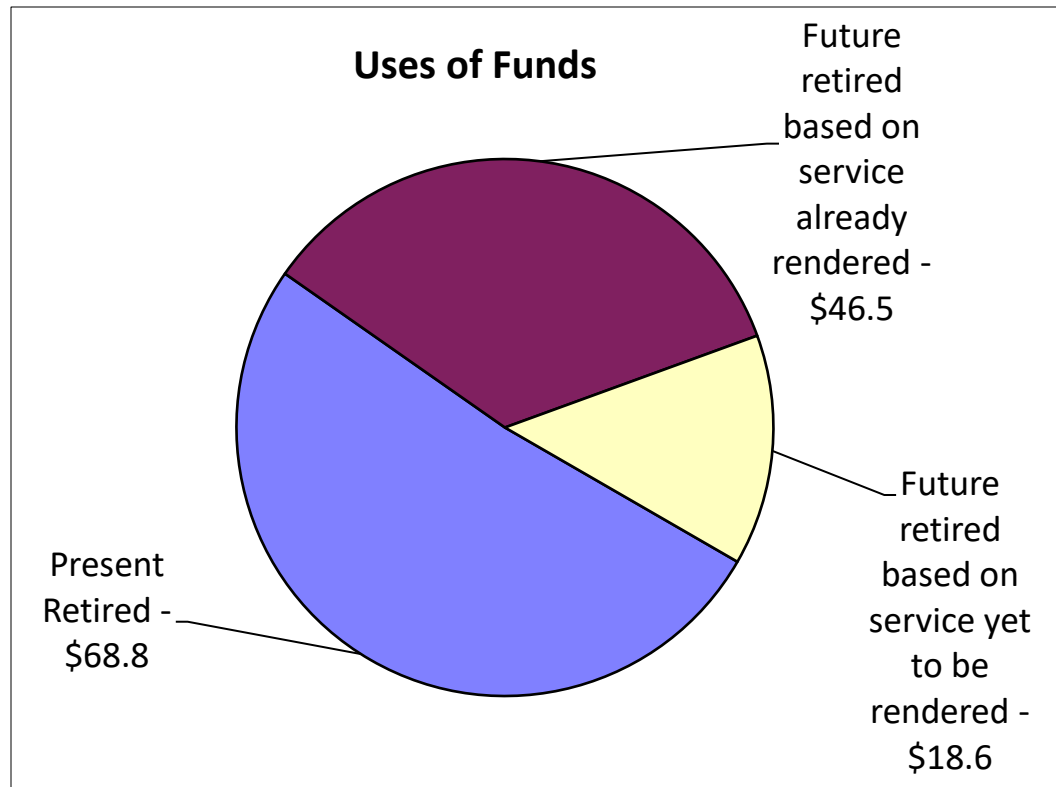
Valuation Group	Number	Annual Earnings (\$Millions)	Group Averages			
			Earnings	Age	Years of Service	Contribs.
General	234,628	\$13,294.7	\$56,663	45.2	11.1	\$63,450
Executive Group & Elected Officials	1,280	116.3	90,894	55.4	14.1	118,510
Protective Occupation with Social Security	19,676	1,414.6	71,893	39.7	12.0	73,676
Protective Occupation without Social Security	2,754	240.0	87,136	40.7	13.9	93,611
Total Active Participants	258,338	\$15,065.6	\$58,317	44.8	11.2	\$64,823
Prior Year	259,234	\$14,583.7	\$56,257	44.9	11.3	\$60,694

All Participants

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	

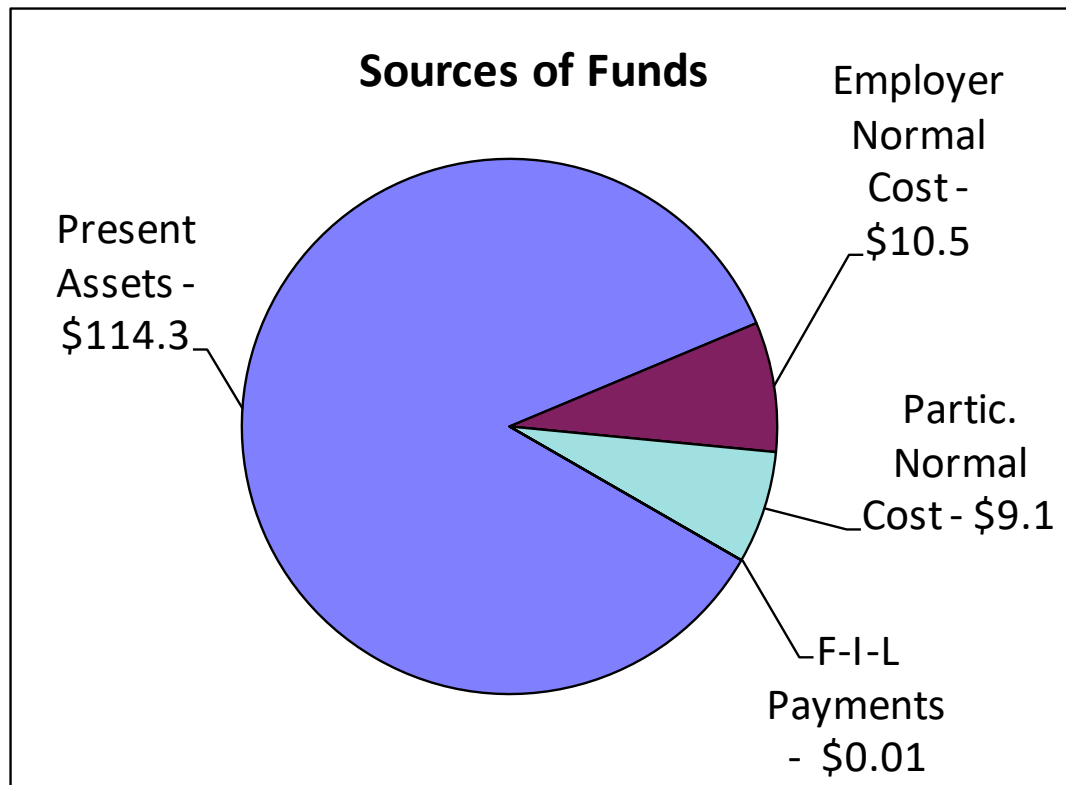
* For inactives, average money purchase balance.

\$133.9 Billion* of Benefit Promises to Present Active and Retired Members

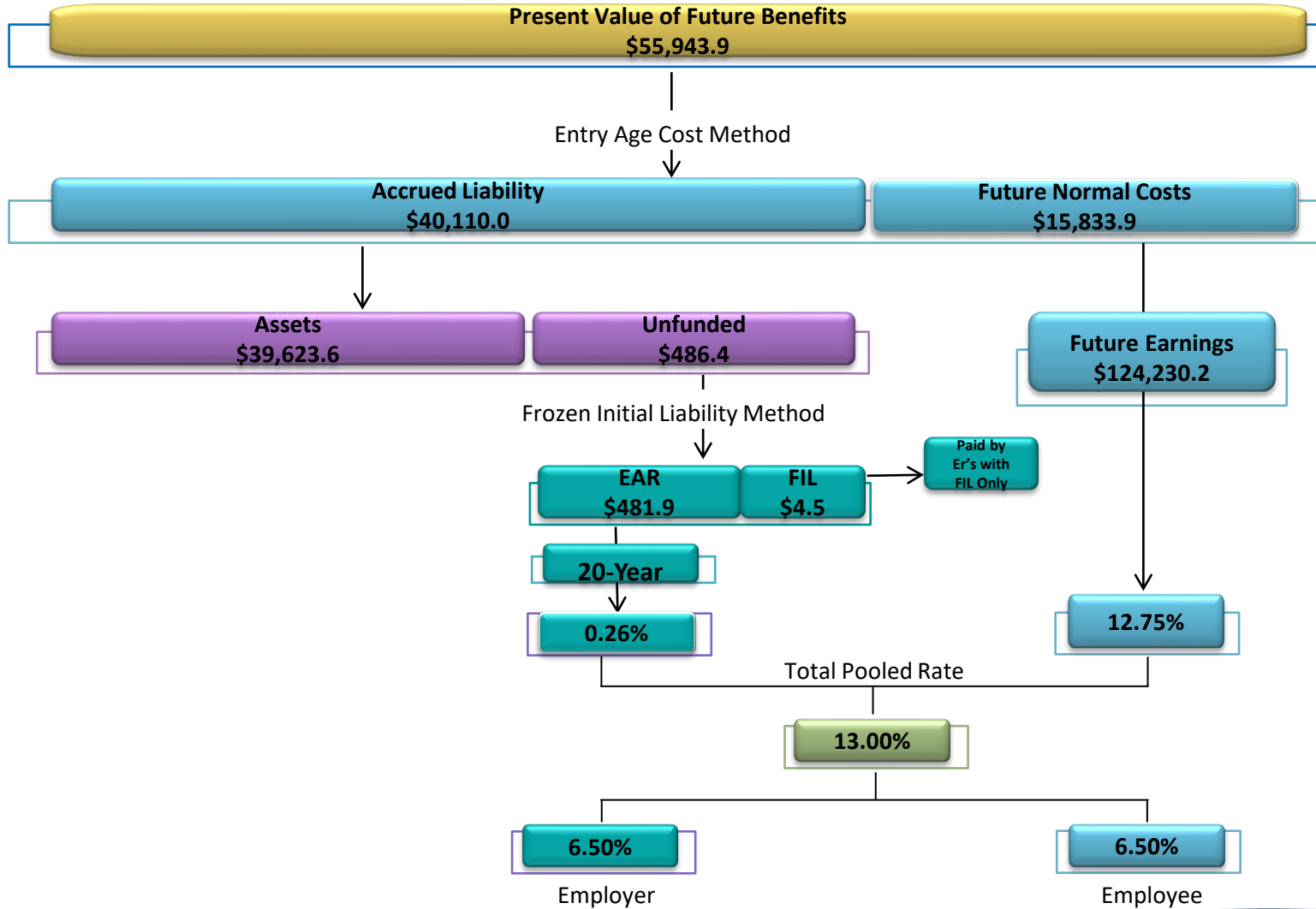


* Present value of future benefits; all divisions combined.

Sources of Funds for Financing \$133.9 Billion of Benefit Promises



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



Summary of December 31, 2020 Valuation Results

	General, Executive & Elected Officials		Protective Occupation				Average
			With Soc. Sec.		Without Soc. Sec.		
	2022	2021	2022	2021	2022	2021	2022
Employer Normal Cost	6.50%	6.75%	12.00%	11.75%	16.40%	16.35%	7.20%
Participant Normal Cost	6.50%	6.75%	6.50%	6.75%	6.50%	6.75%	6.50%
Total Normal Cost	13.0%	13.5%	18.5%	18.5%	22.9%	23.1%	13.7%
Estimated Total NC (\$ millions)*	\$1,849.6	\$1,867.4	\$277.6	\$258.0	\$58.3	\$56.5	

* 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.
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/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 = 324% - 439% (with - without Soc. Security)
 - General & Executive/Elected = 295%
 - Liability/Payroll ratios¹
 - Protective = 356% - 464% (with - without Soc. Security)
 - General & Executive/Elected = 299%

¹ From active lives valuation

Reasons for Contribution Changes

	General, Executive & Elected	Protective with Soc. Sec.	Protective without Soc. Sec.
2020 Normal Cost Rate	13.50%	18.50%	23.10%
Effect of Benefit Change	0.00%	0.00%	0.00%
Effect of Assumption Change	0.00%	0.00%	0.00%
Effect of Asset Performance	(0.52)%	(0.70)%	(1.03)%
Effect of Salary Experience	0.13%	0.72%	0.61%
Effect of Money Purchase Benefit	(0.15)%	(0.05)%	(0.01)%
Demographic and Other Experience	0.04%	0.03%	0.23%
2021 Normal Cost Rate	13.00%	18.50%	22.90%

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>2020</u>	<u>2021</u>	<u>2022</u>	<u>2023</u>	<u>2024</u>
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

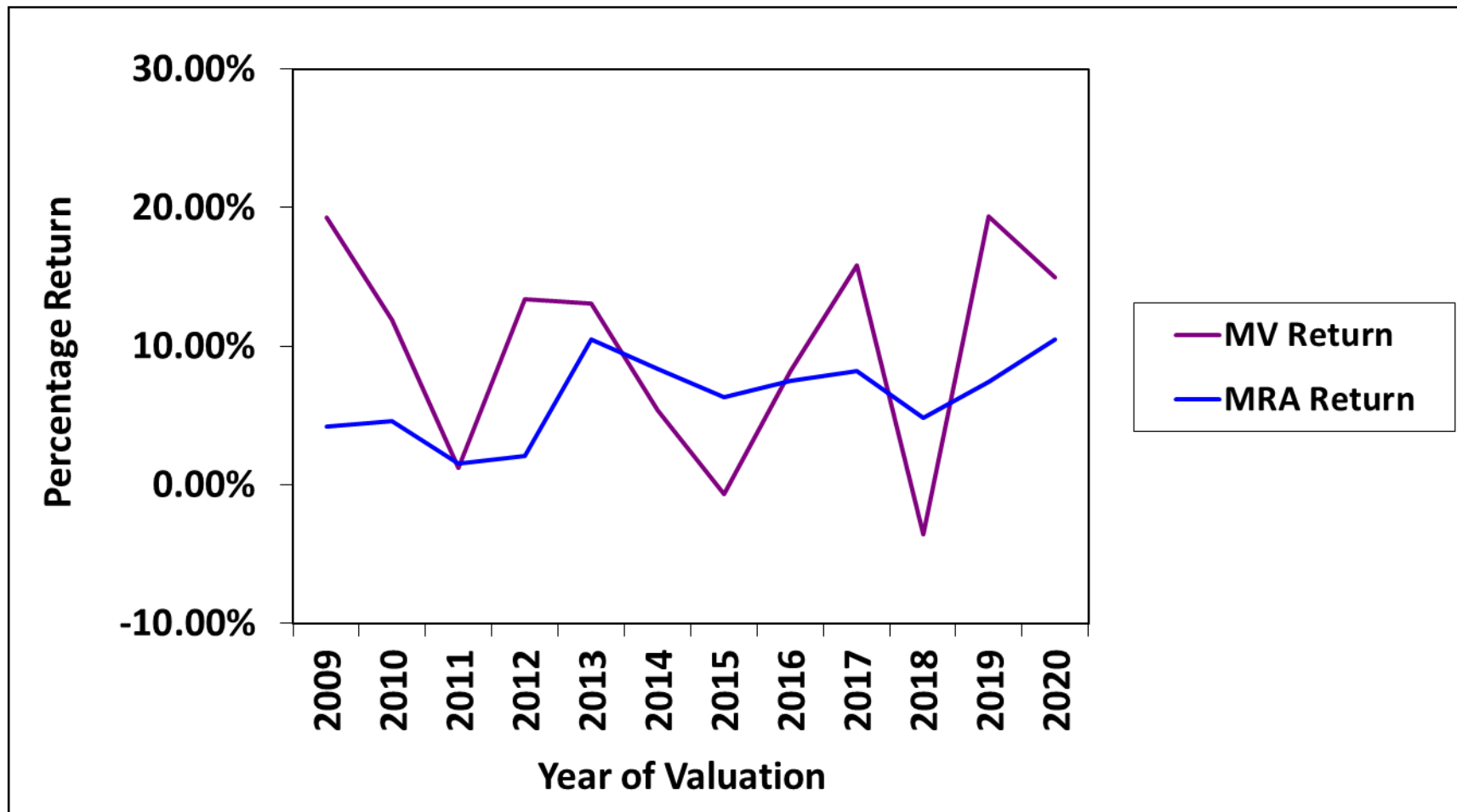
Reconciliation of Market Recognition Account (MRA)

	<u>\$ Millions</u>
MRA at Beginning of Year	\$ 101,741.9
Non-Investment Cash Flow	(3,484.9)
Assumed Return (at 7.0%)	7,000.0
Phase-in of Gains/(losses)	3,509.8
MRA at End of Year	\$108,766.8
MRA Rate of Return	10.50%
Market Value Rate of Return	15.00%

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

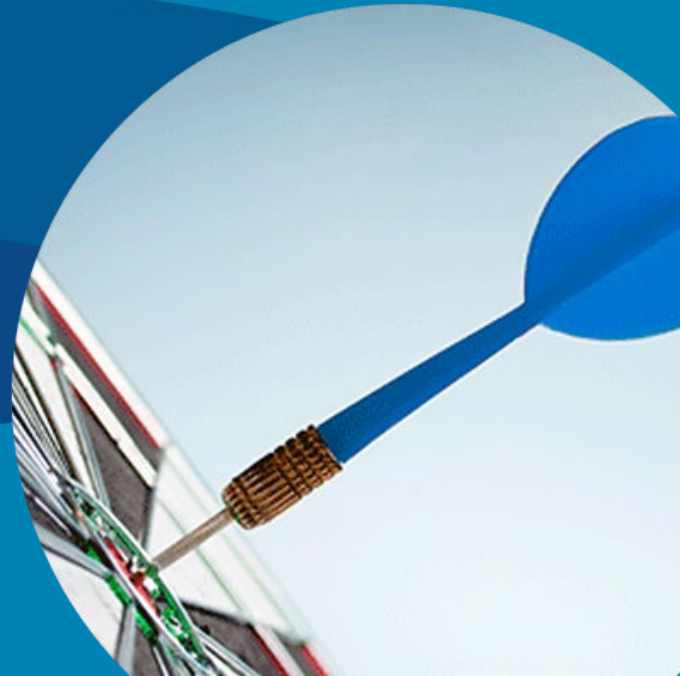
	Frozen Initial	Entry Age
2017	100.0%	99.5%
2018	100.0%	98.6%
2019	100.0%	98.6%
2020	100.0%	99.1%

Concluding Remarks

- There are \$11.1 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



2020 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 2020

	<u>Actual</u>	<u>Expected</u>
Beginning Census	259,234	
(-) Normal Retirement	4,468	4,630
(-) Early Retirement	3,683	4,168
(-) Death	119	244
(-) Disability Retirement		
- Total Approved	295	118
- Less Pending	87	
- Net New	208	
(-) Other Separations	14,137	13,891
(-) Transfers Out	1,970	
(+) Transfers In	1,970	
(+) New Entrants	21,719	
Ending Census	258,338	

Population Development During 2020

Normal Retirements: Varied by group and gender. Overall, slightly 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: Greater than expected, producing a loss.

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

Components of Total Gain/(Loss)

	Gain/(Loss) in Millions	
	2019	2020
Economic Risk Areas	\$95	\$760
Decrement Risk Areas	(61)	(109)
Other Activity	<u>(122)</u>	<u>(149)</u>
Total Gain/(Loss)	\$ (89)	\$502

Investment Earnings in 2020 (Active Participants)

\$ Millions

A. Average balance on Participant and Employer Accumulation Reserves	\$41,630
B. Expected earnings: 7.0%	2,914
C. Earnings credited to Participant and Employer Accumulation Reserves	4,113
D. Gain (loss) from earnings: C - B	\$ 1,199

Investment Earnings in 2020

(Active Participants)

- \$1,746 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 2020 (Active Participants)

	<u>\$ Millions</u>
Gross Gain/(Loss) for the Year (for Actives)	\$1,746
Less Estimated Gain/(Loss) due to Money Purchase	260
Less Estimated Gain/(Loss) due to Variable Excess	<u>287</u>
Net Core Fund Asset Gain/(Loss)	\$1,199

Comparative Schedule of Experience Gains/Losses by Decrement

Divisions Combined (Millions)

	<u>2019</u>	<u>2020</u>
Normal Retirement	\$ (25.1)	\$ (33.5)
Early Retirement	(13.3)	(22.7)
Disability Retirement	(5.5)	(10.5)
Death with Benefit	(3.7)	(1.7)
Other Separations	(13.5)	(40.4)
Total	\$ (61.1)	\$ (108.8)
As % of Liabilities	-0.14%	-0.24%

Salary Related Gain/Loss

- Pay increases were overall higher than expected, resulting in a loss

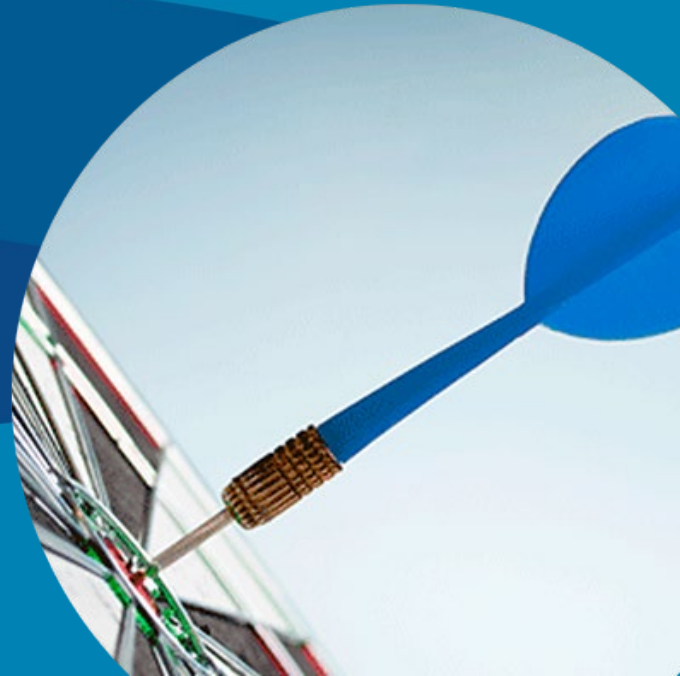
	Gain/Loss	% of Group
	\$ Millions	Liabilities
General, Executive & Elected	\$(267.3)	(0.7)%
Protective w/Soc. Sec.	(150.5)	(3.3)%
Protective w/o Soc. Sec.	(21.3)	(2.0)%
	\$(439.1)	(1.0)%

Concluding Remarks

- Recognition of remaining prior asset gains and losses are expected over the next few years
- This Gain/Loss Analysis is the third in a regular 3-year experience cycle
- This study, together with the 2018 and 2019 results, will form the basis for the next experience study – to be performed after the December 31, 2020 valuation cycle



Current Events



2018-2020 WRS Experience Study

- A summary of, and expansion on, the annual Gain/Loss analysis
 - Performed to refine assumptions every 3 years
 - Board selection and approval required
- Delivery at December 2021 Board meeting

2018-2020 WRS Experience Study

The Concept of Present Value

1

Actuarial calculations almost always begin with the calculation of a present value (“PV”)

2

PV (\$ payable in the future) = the amount of money that, if we had it today, would accumulate to the amount that will be payable considering:

- Investment Return
- Probability that money will be paid

3

The calculation of the present value depends upon assumptions

2018-2020 WRS Experience Study

Present Value Assumptions



Investment Return

- Relates to Economic Assumptions



Probability that Money will be Paid

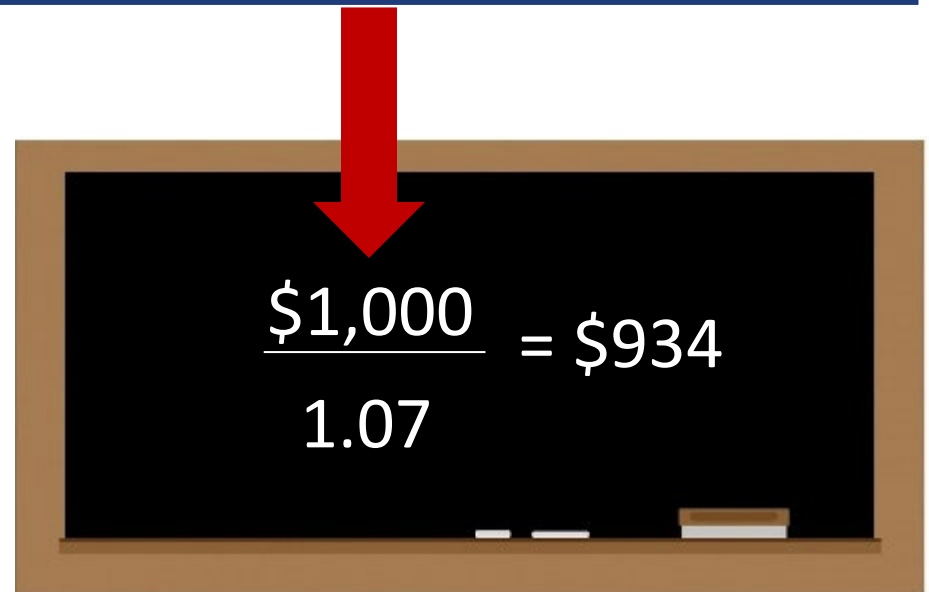
- Relates to Demographic Assumptions, Mortality, Turnover, etc.

2018-2020 WRS Experience Study

Present Value Examples

The present value of \$1,000 payable 1 year from now to a bank at 7% interest is \$934.

The present value of \$1,000 payable 1 year from now to a person who is 99 years old today, provided that the person is alive 1 year from now, is probably less than \$500.



A chalkboard with a brown frame and a black surface. A red arrow points down from the top center to the equation. The equation is written in white chalk: $\frac{\$1,000}{1.07} = \934 . There are some small white marks on the chalkboard surface, including a small stack of books on the right side.

$$\frac{\$1,000}{1.07} = \$934$$

But if the 99 year old lives the entire year, you will owe the whole \$1,000.

Selection of Assumptions

What Are They?

Economic

- Investment Return
- Payroll Growth Rate
- Promotional/Step Pay Increases
- Population Growth Rate (Usually, a constant population size is assumed)

Demographic

- Retirement Rates
- Disability
- Turnover
- Mortality

Who Selects Them?

Economic

- Board
- Actuary
- Other Advisors

Demographic

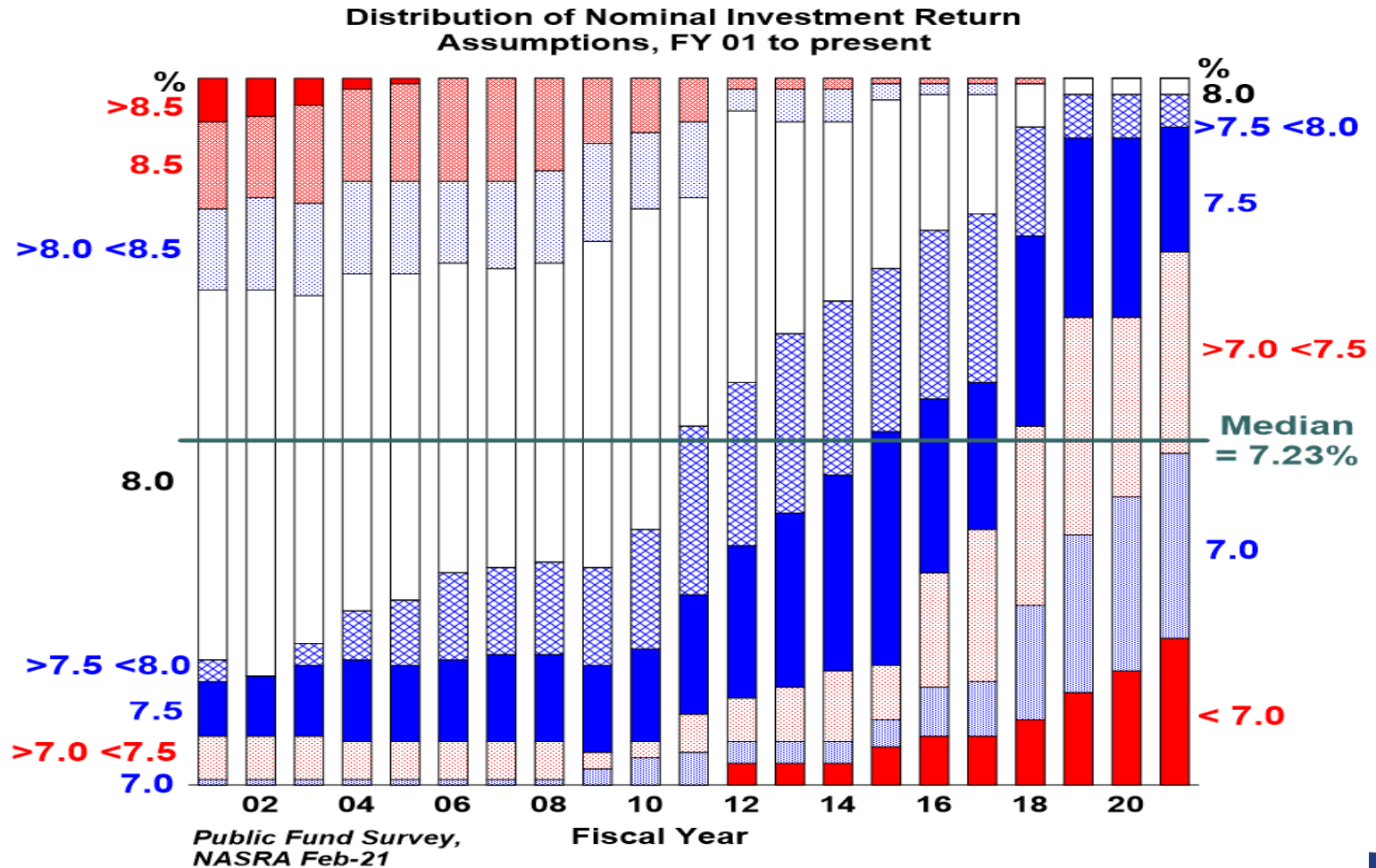
- Mostly Actuary
- Board Approves



Changes in Major Assumptions

Effect on Liabilities and Contributions		
Assumption	Action	Usual Effect
Interest Rate	Decrease	Increase
Wage Inflation	Increase	Increase
Spread	Increase	Decrease
Population Growth	Increase	Decrease
Retirement	Retire Younger	Increase
Turnover	More Quits	Decrease
Mortality	Live Longer	Increase

Public Pension Investment Return Assumptions: N= 130 Large Public Pension Plans, 2001-2020



2018-2020 WRS Experience Study

- Previous study (2015-2017) highlights
 - A LOT of discussion about mortality
 - Approval of new demographic assumptions
 - Approval of 20 bp drop in Wage Inflation and Assumed Investment return
 - Impact on contribution rates
 - 60 bp increase for Protectives
 - no measurable change for General

2018-2020 WRS Experience Study

- Forthcoming study 2018-2020 expectations
 - A LOT of discussion about mortality, investigation of new PUB-2010 and MP-2021 tables
 - Investigation and approval of new demographic assumptions
 - Investigation and approval of new economic assumptions

-
- 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 “Thirty-Ninth 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.