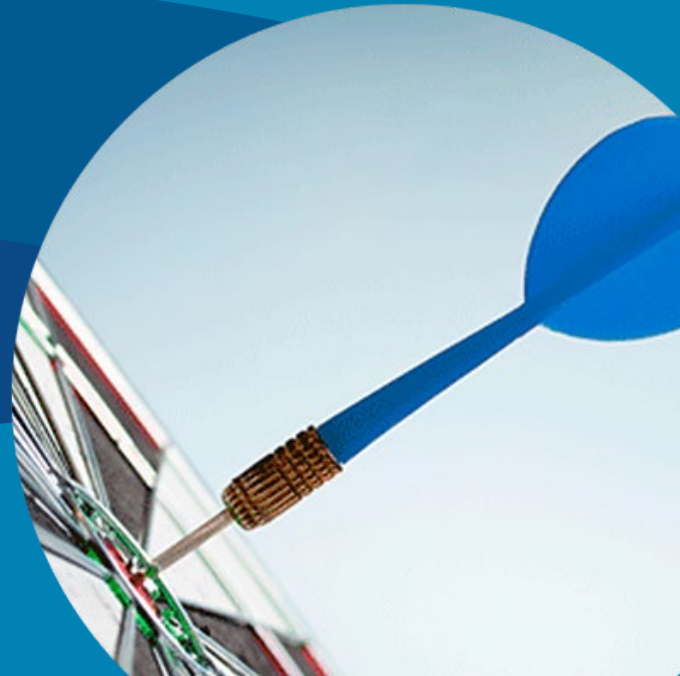




Wisconsin Retirement System

40th Annual Actuarial Valuation of
Retired Lives
December 31, 2022



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, 2022

\$ Millions

	Core	Variable
Number of Annuitants	233,804	43,007
Annual Amount of Annuities Paid	\$ 6,409.7	\$ 578.5
Fund Balance	72,108.4	4,403.0
Actuarial Reserve	70,987.2	5,586.5
Ratio	1.016	0.788

Core effective earnings rate = 6.5%, dividend adjustment = 1.6%.

Variable effective earnings rate = -18.0%, and the variable adjustment = -21.0%.

(Report- Cover Letter & Pages 6 and 16)



Summary of Results – Annuity Adjustments

- * 1.6% Core Dividend < 6.5% CPI Increase
- * -21% Variable Adjustment follows 15%/13% Adjustments in previous 2 years

- Positive core dividend despite volatile investment markets
 - Lags behind current CPI environment
 - However, was 7.4%/5.1% prior two years exceeded CPI
- Negative variable adjustment
 - Previous 3 years had double digit positive variable adjustments
 - Similar to previous periods with consecutive double digit variable adjustments, decreased variable adjustment reflects weaker subsequent market returns

Summary of Results – Core Assets

Due to smoothing via Market Recognition Account, as of December 31, 2022 there are approximately \$7.0 billion in unrecognized losses in the Core fund

- Last year was \$17.7 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 decrease probability of future positive annuity adjustments

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

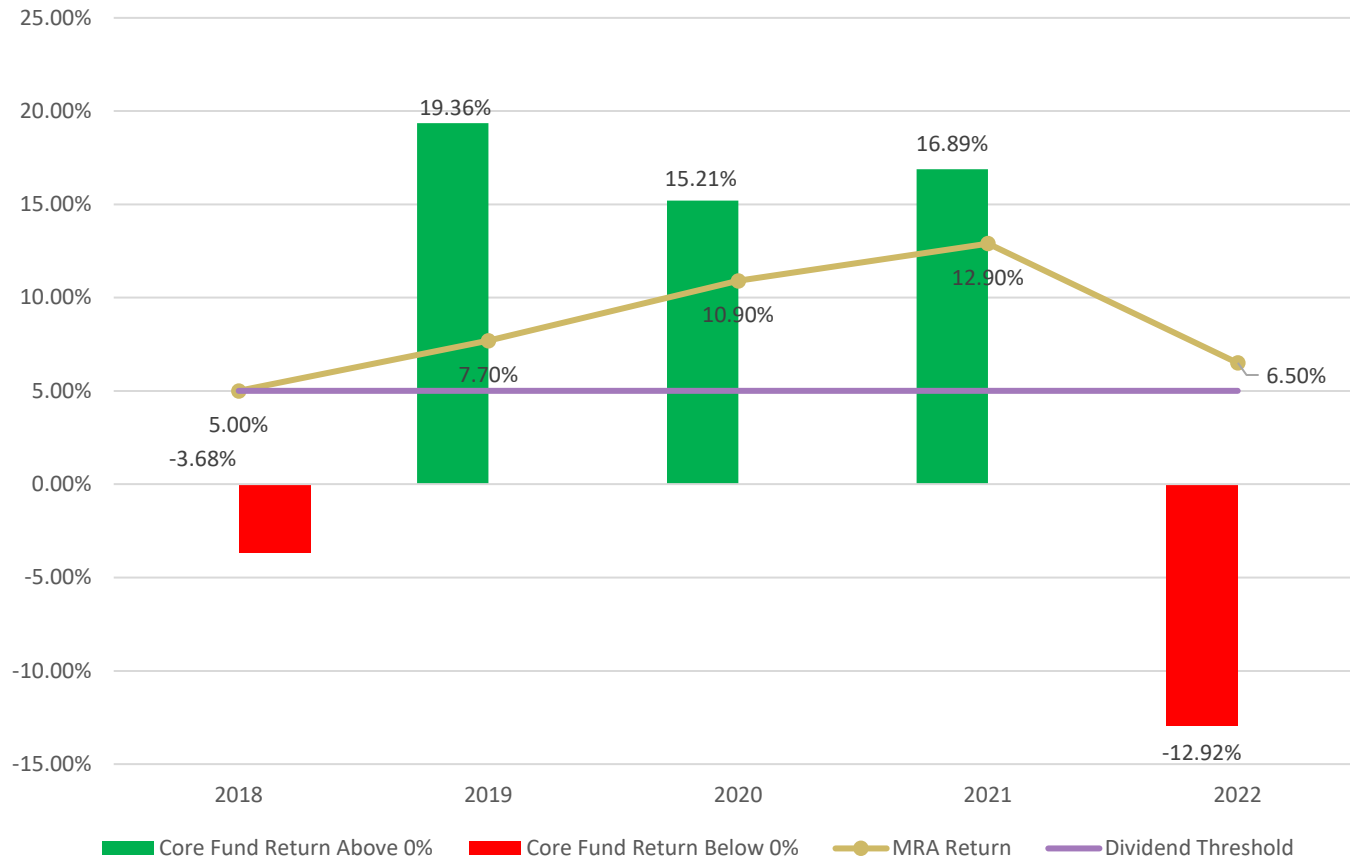
Operation of Market Recognition Account (MRA)

– \$ Millions **2022 Valuation**

	<u>2022</u>	<u>2023</u>	<u>2024</u>	<u>2025</u>	<u>2026</u>
Actual Investment Earnings	\$ (17,445)				
Assumed Investment Earnings	7,894				
Gain/(Loss) to be phased-in	(25,339)				
Phased-in recognition					
• Current year	\$ (5,068)	?	?	?	?
• First prior year	2,495	\$ (5,068)	?	?	?
• Second prior year	1,774	2,495	\$(5,068)	?	?
• Third prior year	2,204	1,774	2,495	\$ (5,068)	?
• Fourth prior year	<u>(2,049)</u>	<u>2,204</u>	<u>1,774</u>	<u>2,495</u>	<u>\$ (5,068)</u>
Total recognized gain (loss)	\$ (644)	\$ 1,405	\$ (799)	\$ (2,573)	\$ (5,068)

2023-2026: Expect \$7.0 billion in deferred asset LOSSES
-- Shared by annuitants, actives and employers

Core Fund Returns – Market Value vs. Market Recognition Account



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)

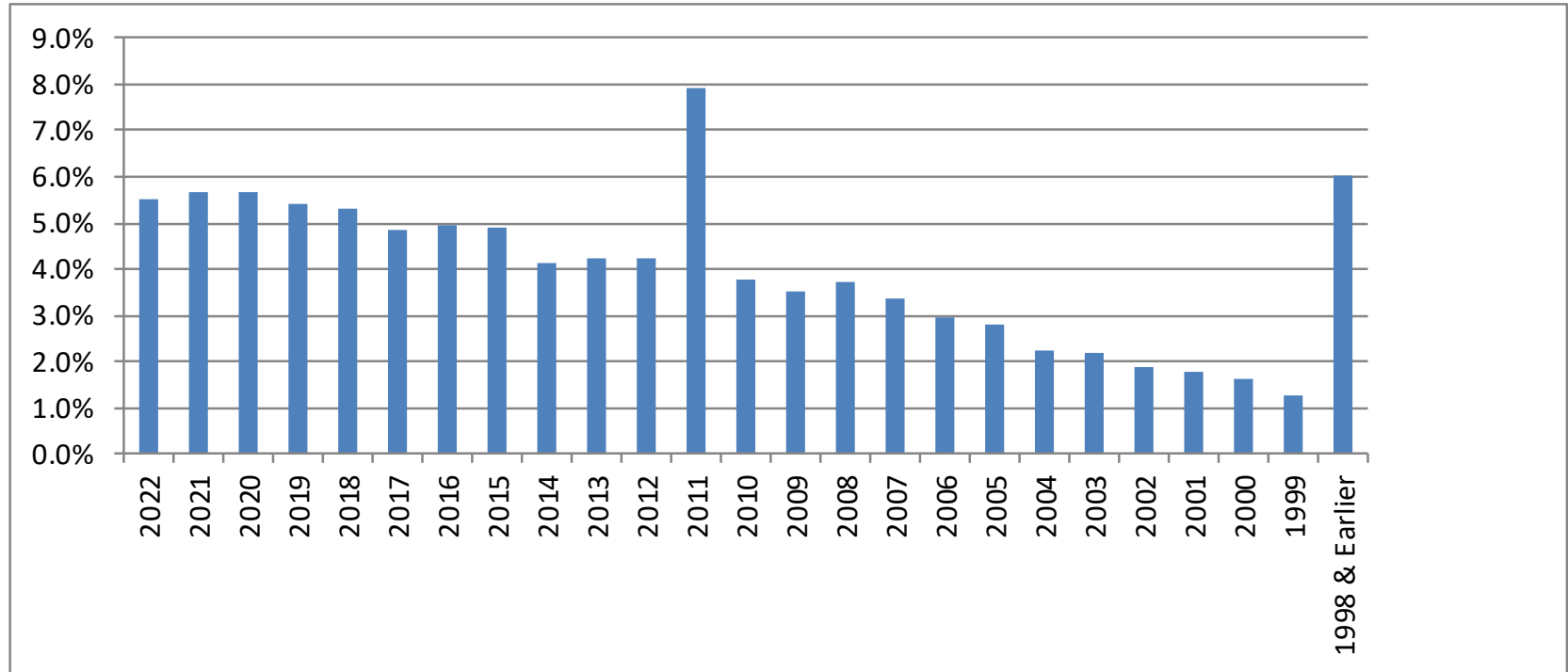
Primary Sources of Core Dividend

	<u>% of APV⁽¹⁾</u>
1. SWIB net of fee investment return	(12.92)%
2. MRA adjustment	<u>19.42%</u>
3. Published effective earnings rate	6.50%
4. Adjustment to relate earnings to average core annuity fund balance	<u>(0.30)%</u>
5. Earnings rate based on average balance	6.20%
6. Expected dividend before adjustments: 1.062/1.05-1	1.14%
7. Adjustment to relate average asset to ending liability	0.05%
8. Carryover from last year due to timing of dividend, accounting adjustments and rounding	0.34%
9. Experience study adjustment	0.00%
10. Experience and other effects	0.05%
11. Statutory adjustment to round to nearest one-tenth percent	<u>0.02%</u>
12. Computed average dividend rate: (6)+(7)+(8)+(9)+(10)+(11)	1.6%
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%	1.6%

⁽¹⁾ Actuarial Present Value

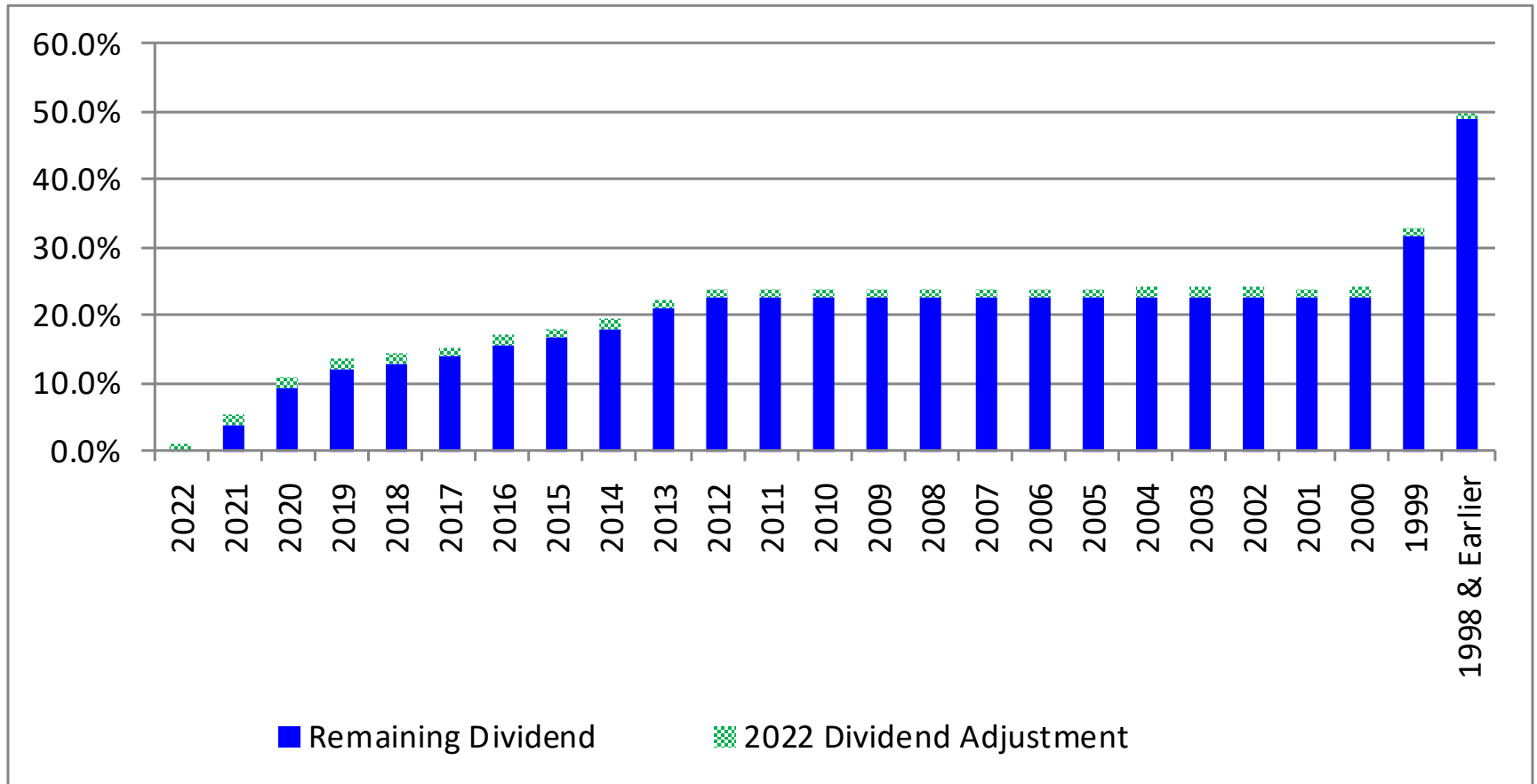


Liabilities (as a Percentage of Total) by Year of Retirement



(Report-7)

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



(Report-7)



Liability Attributable to Dividends – “Dividend Liability”

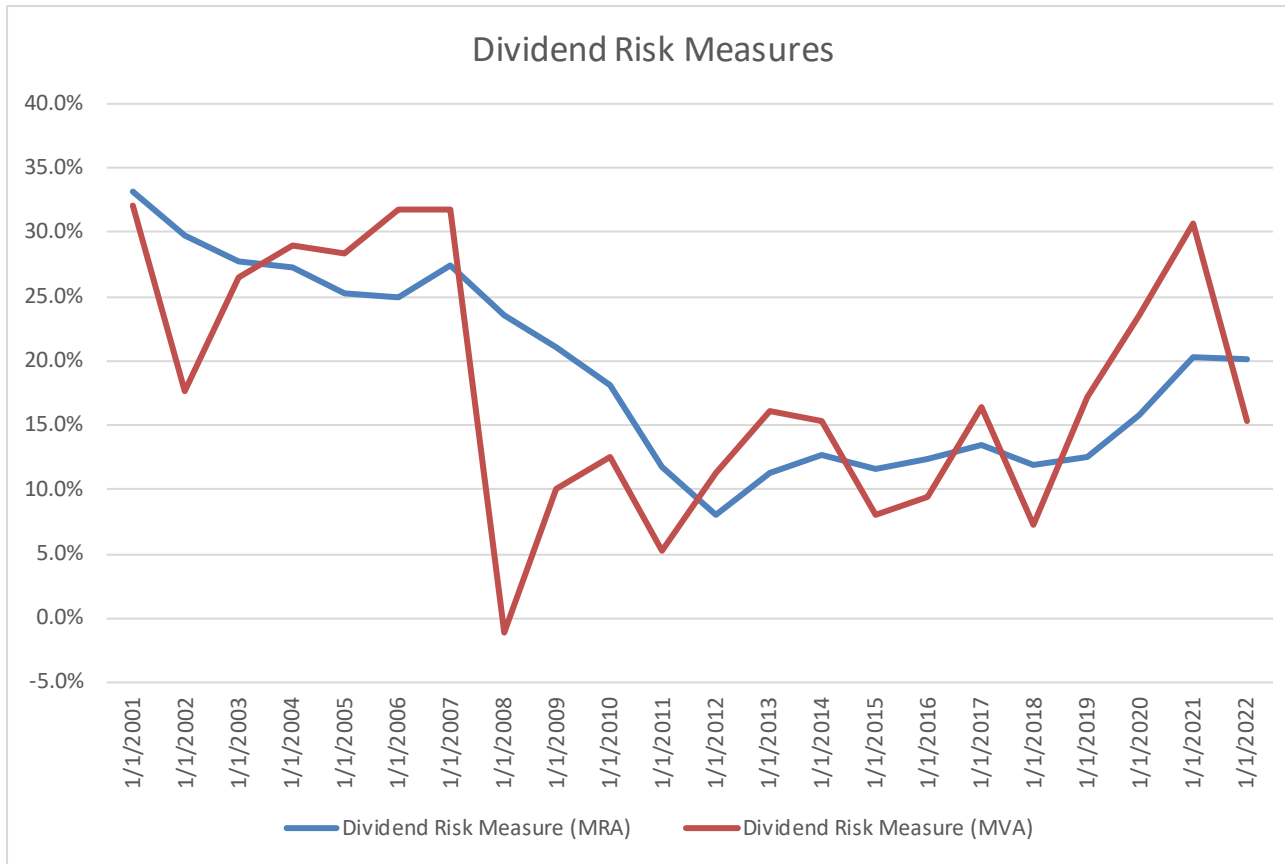
Valuation	Liability for Dividend Remaining (billions)	Liability for Dividend Adjustment (billions)	Liability after Dividend Adjustment (billions)
12/31/2013	\$3.0	\$2.0	\$5.0
12/31/2014	4.6	1.3	5.9
12/31/2015	5.5	0.2	5.7
12/31/2016	5.4	1.0	6.4
12/31/2017	6.1	1.3	7.4
12/31/2018	6.9	0.0	6.9
12/31/2019	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	13.4	1.1	14.5

- “Liability for dividend remaining” = value of all previously granted dividends (=\$9.2B at 12/31/2008)
- 2023 “liability for dividend 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 Risk Measure (MRA)

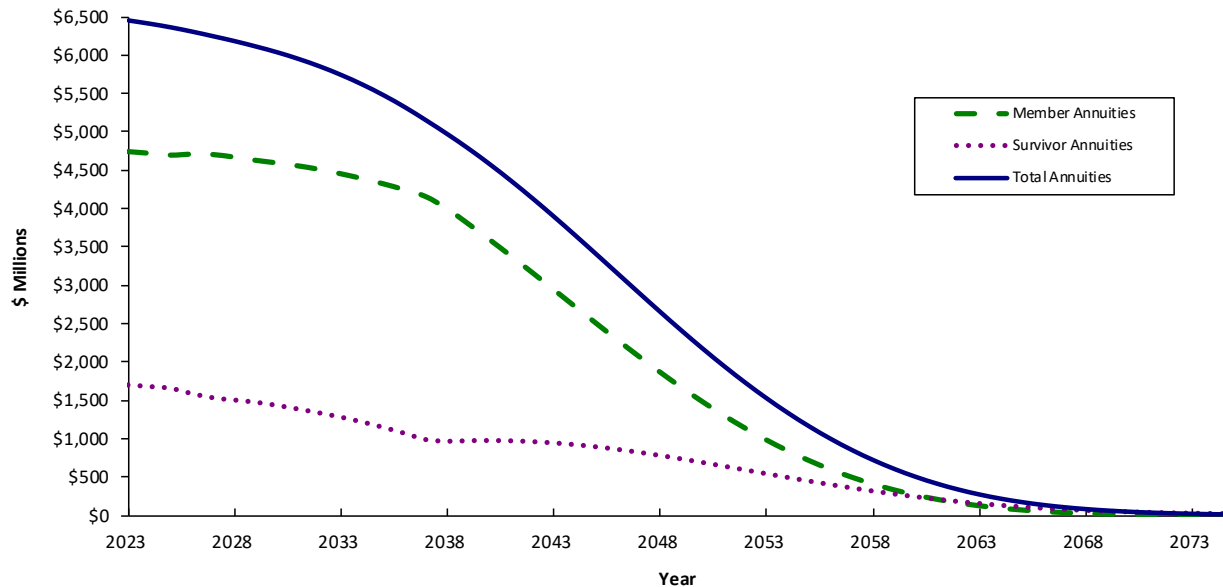
- Dividend Liability (after Dividend adjustment in April) / Total Core Retiree Assets
- Example (2022)
 - Dividend Liability = 14.5 billion
 - Total Retiree Assets (Core) = 72.1 billion
 - Dividend Risk Measure = $14.5/72.1 = 20.1\%$
- In other words, Retiree Assets (after MRA smoothing) would need to decrease by 20.1% to deplete the existing Dividend Liability by year end.
- Dividend Risk Measure was 20.3% 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	\$149.6	\$118.8
Present Assets	72.1	72.1
Future Investment Return Needed	77.5	46.7

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)



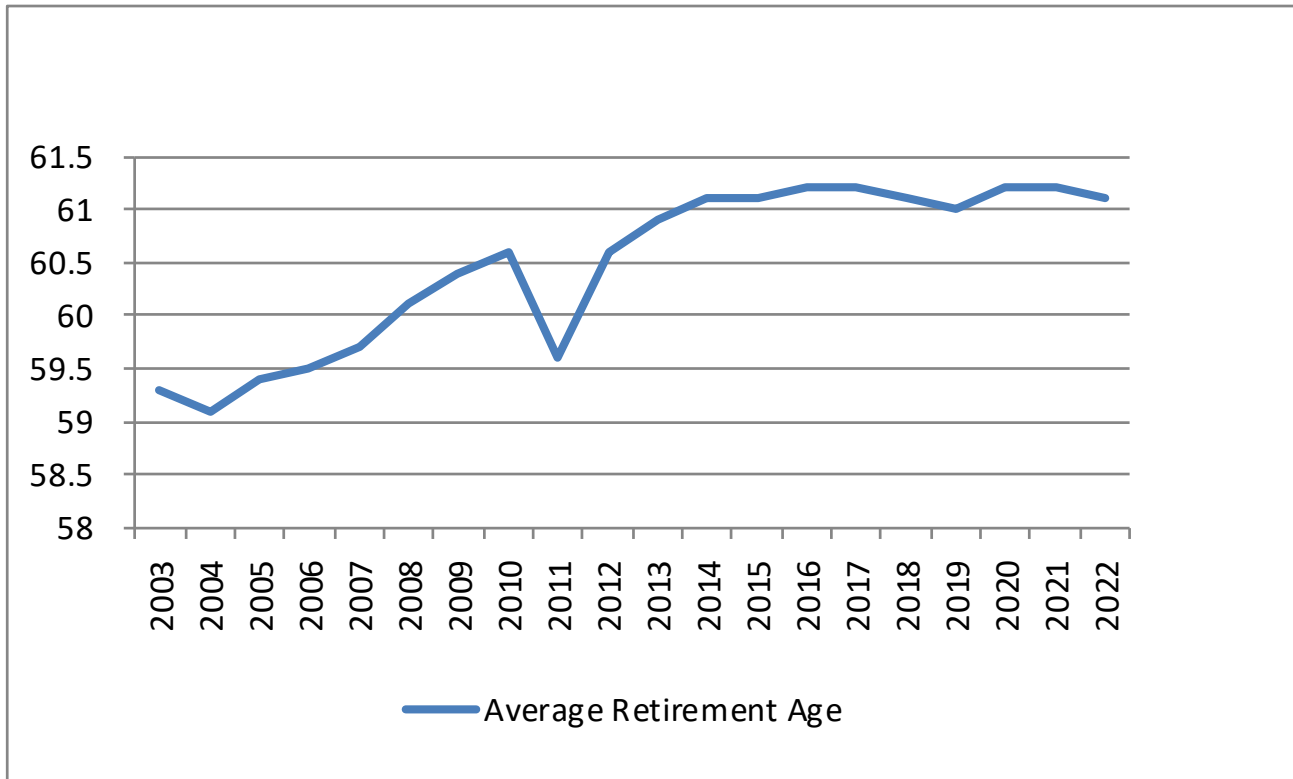
Primary Sources of Variable Adjustment

	<u>% of APV⁽¹⁾</u>
1. SWIB net of fee investment return	(17.8)%
2. Adjustment to published effective rate	<u>(0.2)%</u>
3. Published effective earnings rate	(18.0)%
4. Adjustment to relate earnings to average variable annuity fund balance	<u>0.3%</u>
5. Earnings rate based on average balance	(17.7)%
6. Expected change before adjustments: $(1-0.177)/1.05-1$	(21.6)%
7. Adjustment to relate average asset to ending liability	(0.6)%
8. Carryover from last year due to timing of distribution, accounting adjustments and truncation	0.6%
9. Experience study adjustment	0.0%
10. Experience and other effects	0.4%
11. Statutory adjustment: (truncate to whole percent)	<u>0.2%</u>
12. Variable annuity change: (6)+(7)+(8)+(9)+(10)+(11)	(21.0)%

⁽¹⁾ Actuarial Present Value



Average Retirement Age



Summary of Mortality Experience 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
12/31/2022	6,060	6,204	144	0.0277

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 prior two years, possibly due to the pandemic
- Overall impact on Core Dividend relatively small
- Only three years of experience at this point
- Is this the new normal? Or will mortality revert to pre-pandemic levels?

Recent Society of Actuaries Study

Table 3.1

EXCESS MORTALITY PERCENTAGES FOR THE 40 WEEKS MAR. 22, 2020, THROUGH DEC. 26, 2020

Age	Females			Males		
	Total A/E	COVID-19	Exc. COVID-19	Total A/E	COVID-19	Exc. COVID-19
15–24	119.3%	3.8%	115.5%	125.8%	2.2%	123.6%
25–34	119.3%	6.6%	112.7%	123.3%	4.9%	118.5%
35–44	124.7%	9.8%	114.9%	129.7%	10.5%	119.2%
45–54	123.7%	13.2%	110.5%	129.6%	16.5%	113.2%
55–64	117.1%	14.3%	102.8%	122.1%	16.5%	105.6%
65–74	121.5%	17.3%	104.1%	124.0%	20.1%	104.0%
75–84	122.2%	18.4%	103.8%	124.6%	21.8%	102.9%
85+	120.2%	17.7%	102.5%	120.3%	19.8%	100.5%
Ages 65+	121.1%	17.8%	103.2%	123.0%	20.6%	102.4%
All ages	120.6%	16.7%	103.9%	123.3%	18.3%	105.0%

Recent Society of Actuaries Study

Table 3.2

EXCESS MORTALITY PERCENTAGES FOR THE 52 WEEKS JAN. 3, 2021, THROUGH JAN. 1, 2022

Age	Females			Males		
	Total A/E	COVID-19	Exc. COVID-19	Total A/E	COVID-19	Exc. COVID-19
15–24	130.5%	8.7%	121.8%	130.4%	4.5%	126.0%
25–34	128.9%	14.5%	114.4%	131.8%	9.7%	122.1%
35–44	143.8%	22.4%	121.4%	146.9%	19.1%	127.8%
45–54	136.1%	24.4%	111.7%	141.8%	26.0%	115.8%
55–64	122.8%	20.5%	102.2%	125.3%	20.5%	104.8%
65–74	122.6%	18.6%	104.1%	123.0%	18.9%	104.1%
75–84	114.5%	13.8%	100.7%	115.5%	16.4%	99.0%
85+	104.1%	9.4%	94.7%	106.2%	12.1%	94.1%
Ages 65+	111.3%	12.8%	98.6%	114.8%	15.8%	99.0%
All ages	114.6%	14.2%	100.4%	119.8%	16.8%	103.1%

Recent Society of Actuaries Study

Table 3.3

EXCESS MORTALITY PERCENTAGES FOR THE 26 WEEKS JAN. 2, 2022, THROUGH JUL. 2, 2022

Age	Females			Males		
	Total A/E	COVID-19	Exc. COVID-19	Total A/E	COVID-19	Exc. COVID-19
15–24	122.8%	4.6%	118.2%	122.9%	2.6%	120.3%
25–34	119.2%	7.5%	111.7%	121.4%	4.8%	116.6%
35–44	129.8%	10.7%	119.0%	134.8%	8.4%	126.4%
45–54	121.6%	12.9%	108.6%	125.6%	12.3%	113.3%
55–64	111.8%	12.7%	99.2%	113.0%	12.1%	101.0%
65–74	114.0%	12.7%	101.3%	114.3%	13.1%	101.2%
75–84	111.8%	11.0%	100.8%	112.8%	13.3%	99.5%
85+	102.8%	8.5%	94.3%	104.0%	11.6%	92.4%
Ages 65+	108.0%	10.2%	97.8%	110.4%	12.7%	97.7%
All ages	109.6%	10.4%	99.2%	113.0%	12.0%	101.0%

Recent Society of Actuaries Study

- Reporting methods of 'COVID' deaths varies from state to state and may not be as reliable
- Reporting of Excess Deaths is more reliable and similar to what we have seen in pension data in WRS and other states
- Every age group experienced more deaths than expected over last 3 years
- Many secondary impacts (isolation, delayed medical care, mental health, etc.) make it difficult to determine the root cause of excess deaths

Comparative Statement – Core

Valuation Date	Number	\$ Millions			Ratio	Change in		CPI*
		Annual Annuities	Fund Balance	Actuarial Reserve		Annuities		
						Average	Maximum	
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 %
2022	233,804	6,409.7	72,108.4	70,987.2	1.016	1.6%		6.5 %
35-Year Average						3.4 %		2.7 %
20-Year Average						1.5 %		2.5 %
10-Year Average						2.8 %		2.6 %
5-Year Average						3.1 %		3.8 %

**Based on December CPI-U67 index.*

(Report-21)

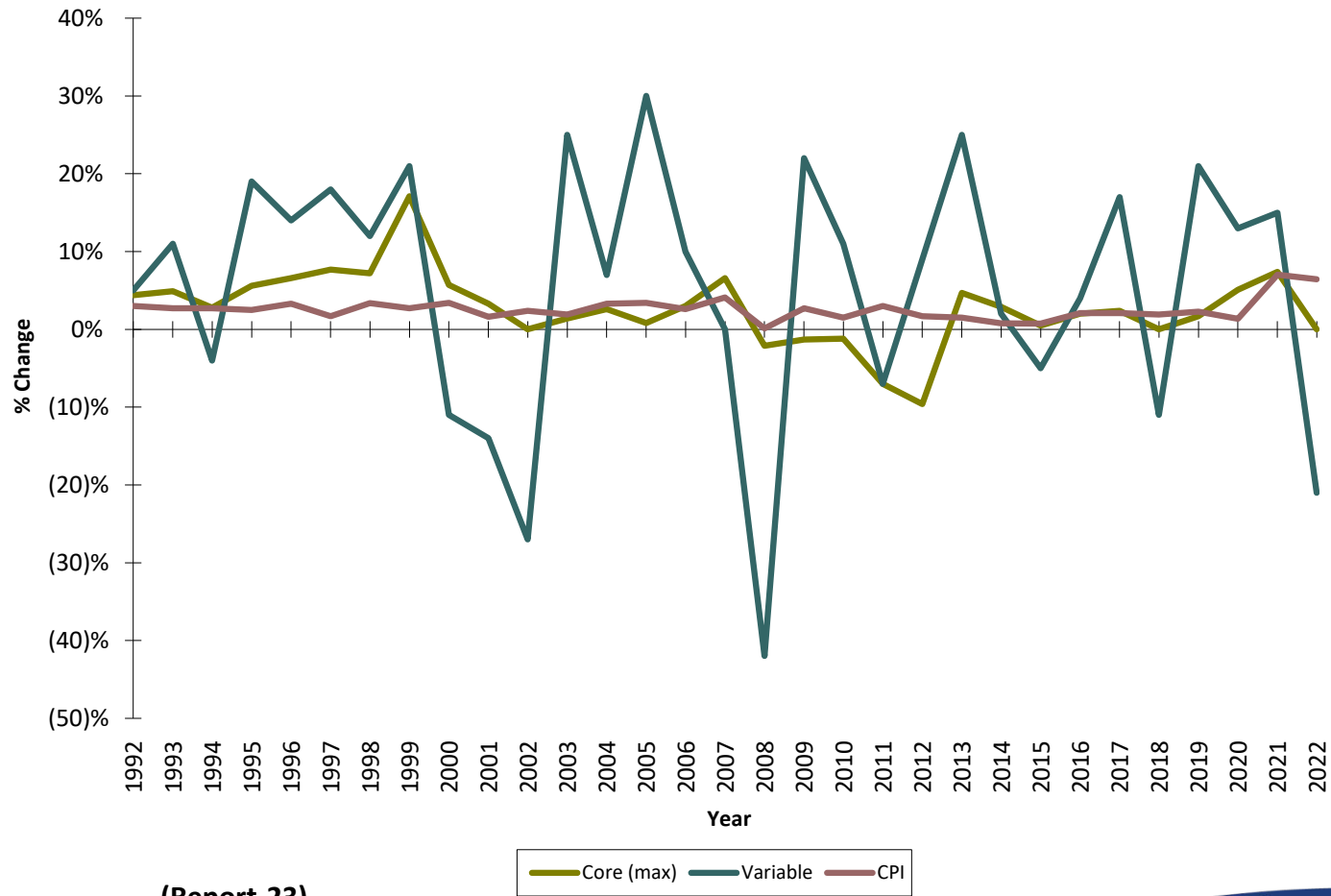
Comparative Statement – Variable

Valuation Date	Number	\$ Millions				Change in	
		Annual Annuities	Fund Balance	Actuarial Reserve	Ratio	Annuities	CPI*
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 %
2022	43,007	578.5	4,403.0	5,586.5	0.788	(21.0)%	6.5 %
35-Year Average						3.7 %	2.7 %
20-Year Average						3.5 %	2.5 %
10-Year Average						5.1 %	2.6 %
5-Year Average						2.3 %	3.8 %

*Based on December CPI-U67 index.

(Report-22)

History of % Dividend Adjustments



(Report-23)



Looking Ahead

- As of the December 31, 2022 valuation, there are about \$7.0 billion in unrecognized asset losses in the Core fund
 - About half of this will be applied to annuitant reserve
 - Will be recognized over the next four years
 - May decrease probability of future positive annuity adjustments
- We will continue monitoring various plan risks, including dividend liability risk

INVESTMENT RETURN ASSUMPTION REVISITED

Process of Setting the Investment Return Assumption

- GRS conducts an Experience Study every 3 years
 - Last study conducted after the 2020 valuation (fall of 2021)
 - Next study will be conducted after the 2023 valuation (fall of 2024)
 - GRS must also assert that the assumptions are reasonable every year (informal review for consistency with current trends/expectations)
- GRS performs Stress Testing with SWIB every 2 years
 - Next Study will be conducted in fall of 2023
 - SWIB provides up to date target allocations and stress test scenarios
 - GRS provides stress tests and develops sweet-spot (Goldilocks zone)
 - Due to cost sharing structure, portfolios that are too conservative can also be risky (i.e., lead to dividend depletion)

Updating the Investment Return Assumption

- WRS Investment Return Assumption Changes:
 - 2010 valuation: from 7.8% to 7.2%
 - 2018 valuation: from 7.2% to 7.0%
 - 2021 valuation: from 7.0% to 6.8%
- Decreases consistent with:
 - Decreased expected forward-looking returns
 - Changes among Statewide PERS

Impact of Recent 20 Basis Point Decreases in the Investment Return Assumption

- Retirees/Dividends
 - Valued at 5% (per Statute) so does not directly impact valuation of liabilities
 - Change in expected return has minor impact on MRA
 - 20 basis point change spread over a 5 year period
 - Dividend paid ultimately based on actual returns, not expected returns
 - Smoothing of assets delays the impact of investment returns on dividend adjustments

Impact of Recent 20 Basis Point Decreases in the Investment Return Assumption

- Employer Contribution Rates
 - Updated assumptions increased rates in 2021 valuation

Assumption Changed	Impact General	Impact Prot. W/SS	Impact Prot. W/o SS
All	1.0%	2.6%	2.9%
Investment Return only	0.5%	0.6%	1.0%

- Increases shared equally by employers and employees
 - Often mitigated by other changes (wage inflation, etc.)
- Similar “investment return only” impact in 2018 valuation

Changes in Forward-Looking Geometric Returns -- WRS Portfolio

Period	GRS CMAM 2019 Survey	GRS CMAM 2020 Survey	GRS CMAM 2021 Survey	SWIB/NEPC 2021	SWIB/NEPC 6/30/2022 ⁽¹⁾
10 Years	7.04%	6.54%	6.19%	5.40%	6.70%
20-30 Years	8.11%	7.61%	7.26%	6.60%	7.30%

⁽¹⁾ Based on current policy portfolio

- Across the board, higher future expectations reported from surveyed Investment Consultants at 12/31/2022
- Volatility in year-to-year expectations demonstrate the need for a carefully measured approach to change in assumptions

Conclusions

- Current investment return assumption is reasonable
- Due to poor investment returns in 2022 (and rise in short term rates), most investment consultants have increased their 10 year forecasts (100 basis points or more in some cases)
- This brings forecasts more in line with current assumptions for many systems
- High Volatility continues to add risk that should be accounted for

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 February 21, 2023. This presentation should not be relied on for any purpose other than the purpose described in the valuation report.
- Readers are cautioned to examine original source materials and to consult with subject matter experts before making decisions related to the subject matter of this presentation.
- This presentation expresses the views of the authors and does not necessarily express the views of Gabriel, Roeder, Smith & Company.