Wisconsin Retirement System

Experience Study Results for 2015-2017

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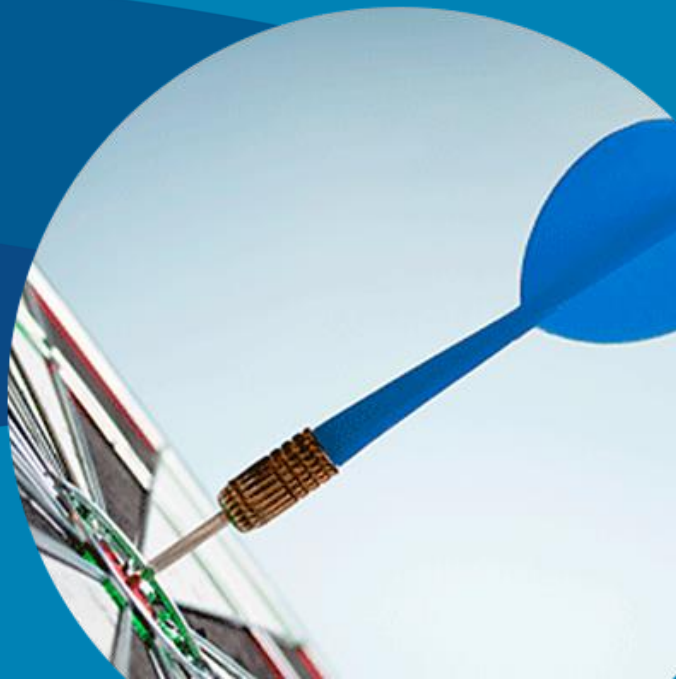

Agenda

1. Introduction
2. Experience Study Process
3. Demographic Assumptions
4. Mortality Assumption
5. Economic Assumptions
6. Effect on Valuation Results

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Introduction

- Each year the actuarial liabilities of WRS are calculated as part of the December 31 valuation
- In order to perform the valuation, we must make assumptions about the future experience of the System with regard to various risk areas
- The results of the liability calculations depend upon those assumptions

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Introduction

Primary Risks	
Demographic	**Economic**
Normal Retirement	Price Inflation
Early Retirement	Wage Inflation
Death-in-Service	Investment Return
Disability	
Other Separations	
Pre and Post Mortality	
Merit and Longevity Pay Increases	

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Introduction

- Assumptions should be carefully chosen and continually monitored
  - Continued use of outdated assumptions can lead to ...

Introduction

Understated costs resulting in:

- Sharp increases in required contributions at some point in the future leading to a large burden on future taxpayers
- In extreme cases, an inability to pay benefits when due

Overstated costs resulting in:

- Benefit levels that are kept below the level that could be supported by the employer and member contribution rates
- An unnecessarily large burden on the current generation of members, employers and taxpayers

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Introduction

- No single set of assumptions will be suitable indefinitely
- Things change, and our understanding of things also changes
- WRS statutes require reviewing assumptions every 3 years
- A systematic review of assumptions is called an “Experience Study”

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Experience Study Process

Analysis

- Based upon experience during 2015 - 2017
- Compared trends with prior studies
- Generally, we give confirmed trends more credibility than non-confirmed trends
- Some assumptions were set using "liability weighting" - Instead of counting people to set assumption we counted liabilities

Philosophy

Do not overreact to results from any single experience period

- It is better to make a series of small changes in the right direction, rather than a single large change that could turn out with hindsight to be in the wrong direction

Assumptions

- Demographic assumptions typically recommended by actuary and adopted by Board
- Economic assumptions – actuary recommends range of reasonable economic alternatives and Board adopts based on input from actuary and advisors

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DEMOGRAPHIC ASSUMPTIONS

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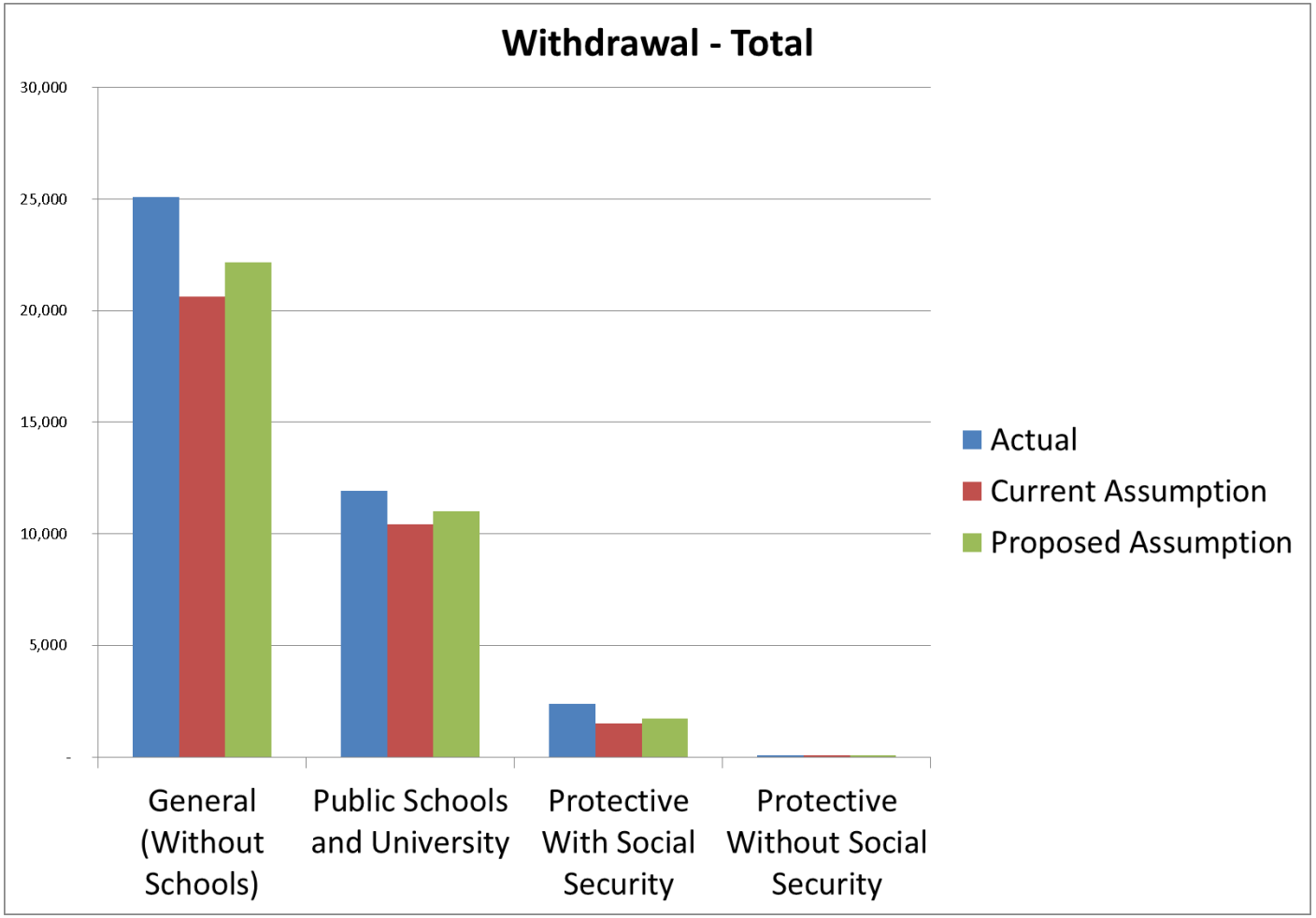
Summary of Withdrawal Experience Results (Liability Based)



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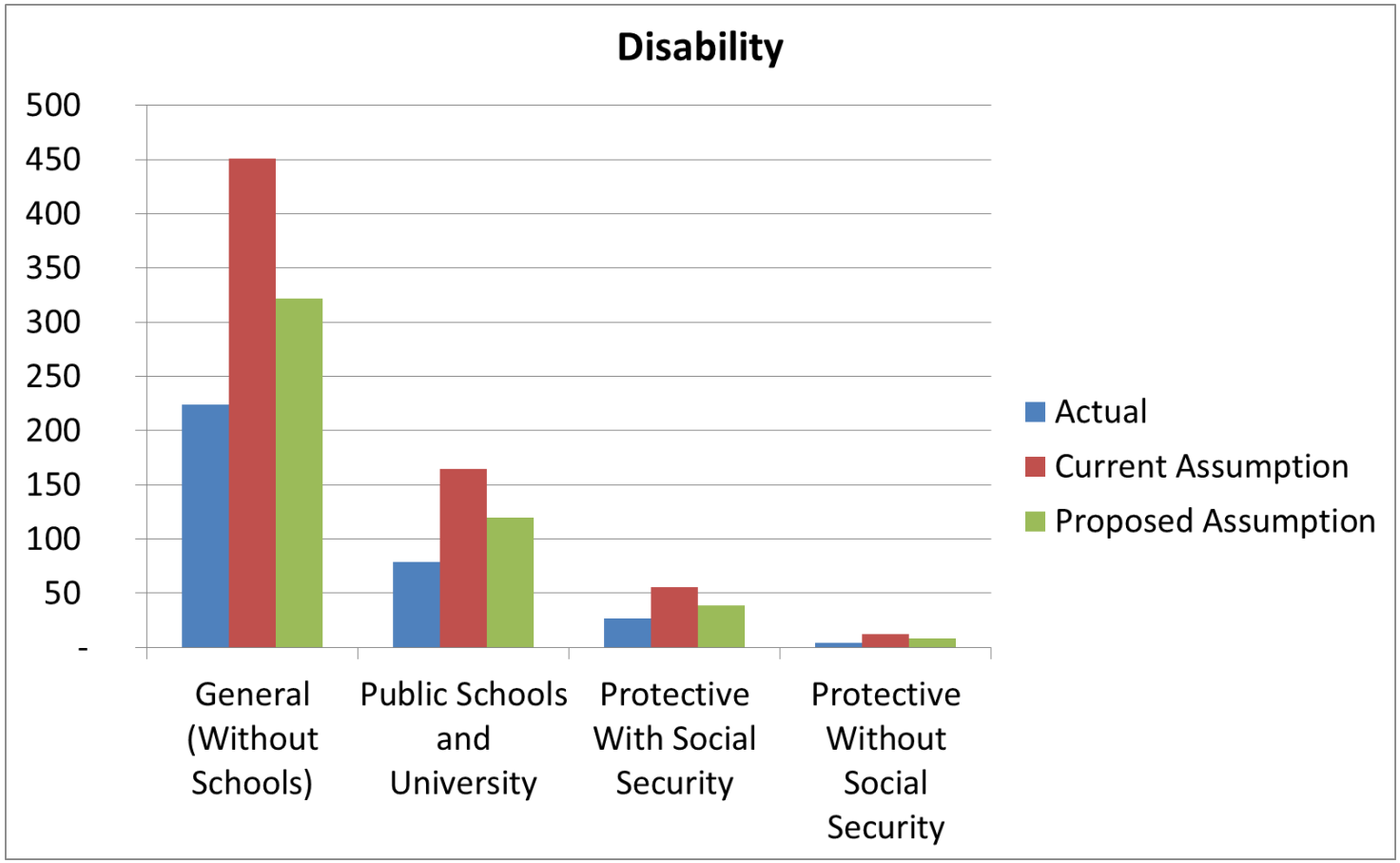
Summary of Disability Experience Results (Population Based)



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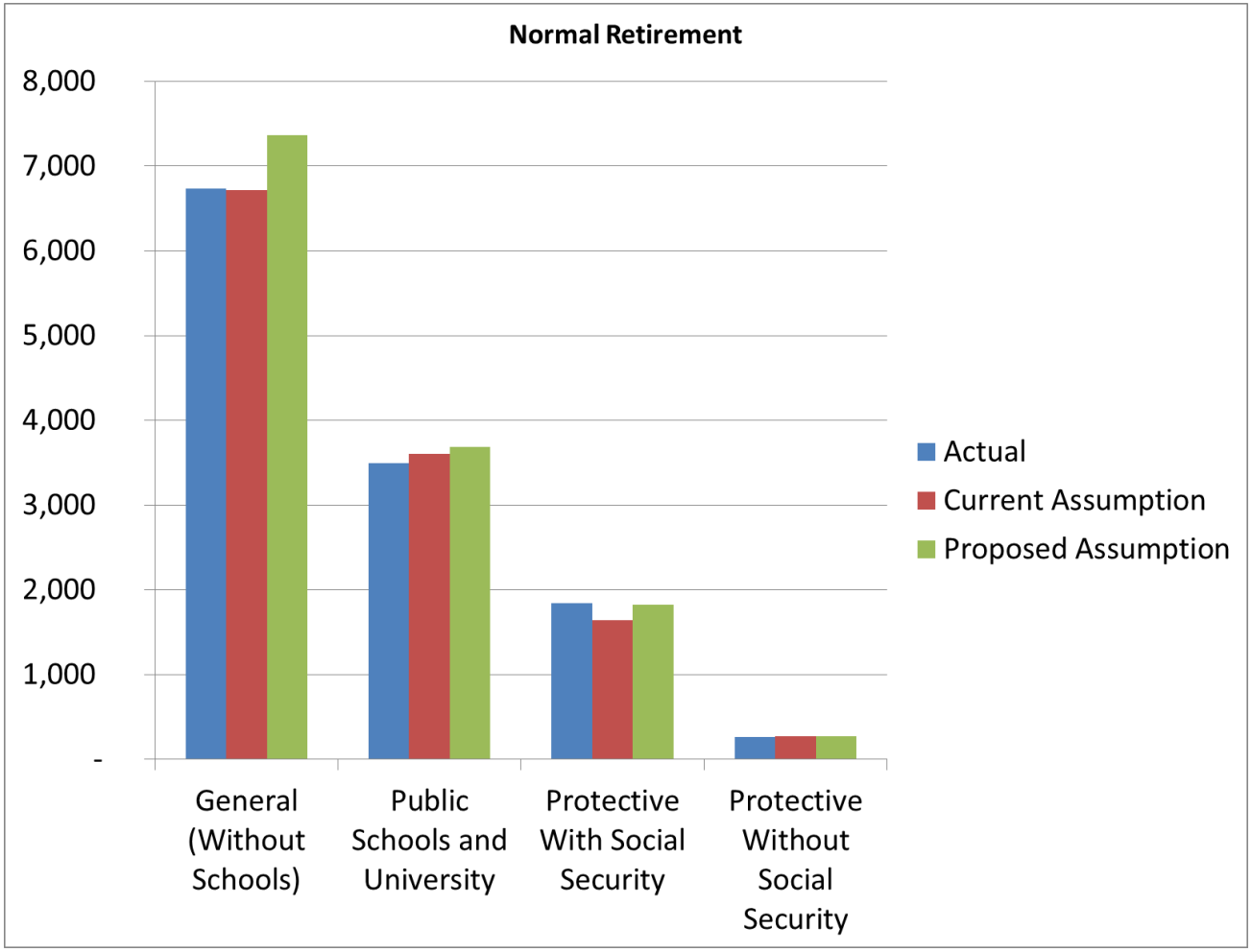
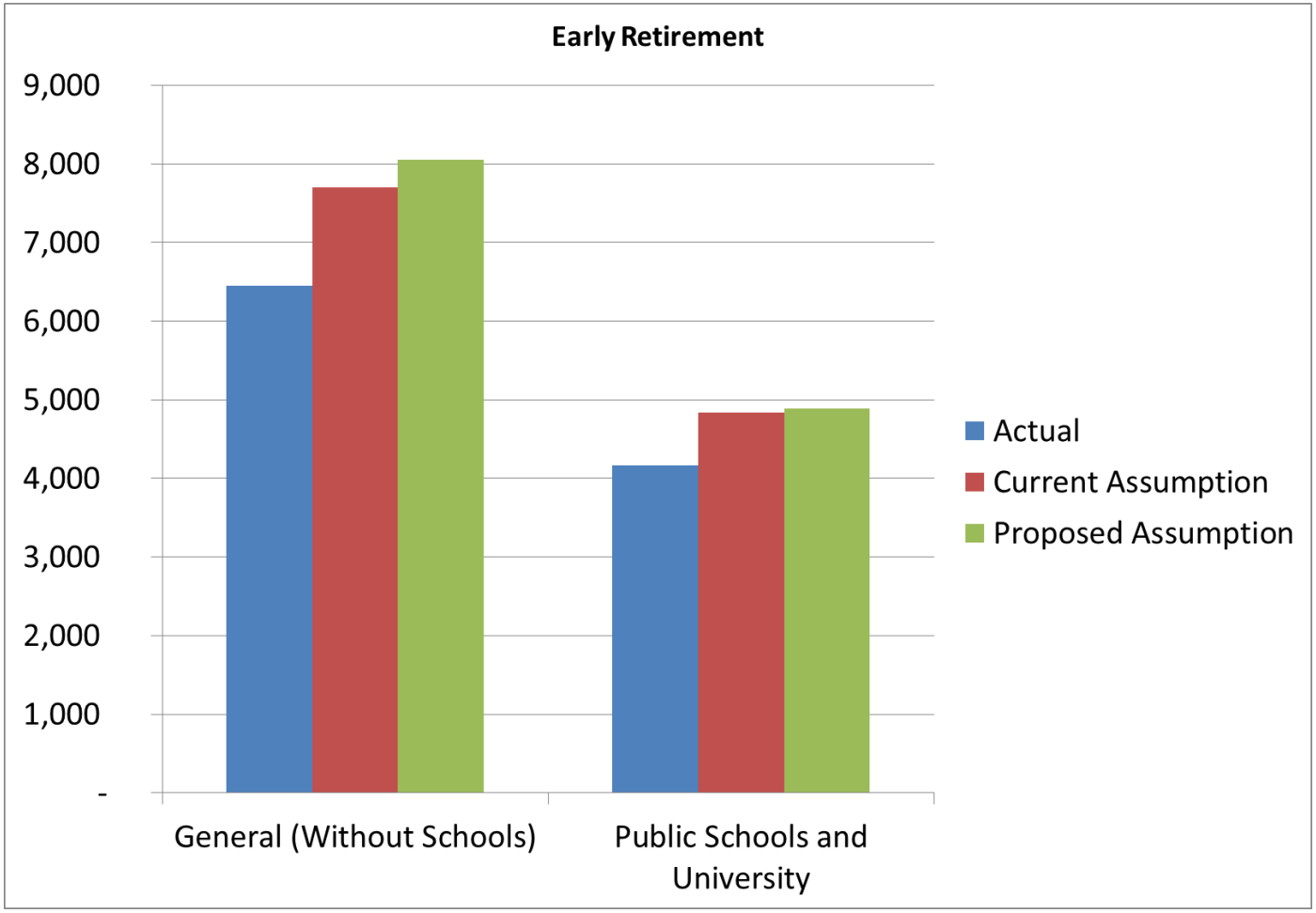
Summary of Normal Retirement Experience Results (Liability Based)



The figures shown are for people below age 75.

Summary of Early Retirement Experience Results (Liability Based)



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Public Pension Mortality Study Highlights

- Exposure Draft issued October 2018
- First ever study of Public Pension Mortality
- Resulted in 94 individual mortality tables (Generally named “PUB” tables)
- Rates developed by job category
  - Teachers
  - Public Safety
  - General

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Public Pension Mortality Study Highlights

- For each job category, rates were developed for:
  - Employees
  - Retirees
  - Disabled Retiree
  - Contingent Survivors
- For each sub-category, rates were developed
  - Total Subpopulation
  - Above Median
  - Below Median
- All of these tables were developed on head count and benefit weighted basis for both males and females

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Public Pension Mortality Study Highlights

Job Category	Employees	Retirees	Disabled Retirees	Cont. Survivors
Teachers	• Total Subpopulation • Above-Median • Below-Median	• Total Subpopulation • Above-Median • Below-Median	• Total Subpopulation[1]	• Total Subpopulation • Above-Median • Below-Median
Public Safety	• Total Subpopulation • Above-Median • Below-Median	• Total Subpopulation • Above-Median • Below-Median	• Total Subpopulation	
General	• Total Subpopulation • Above-Median • Below-Median	• Total Subpopulation • Above-Median • Below-Median	• Total Subpopulation[1]	

[1] The Teacher and General subpopulations were combined for the Disabled Retiree tables

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Key Findings

- Teachers live long – VERY long
- Data also broken out by Region
  - Northeast
  - Midwest
  - West
  - South
- Higher correlation found between income/education rather than Region
  - Higher Income retirees tend to live longer

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Mortality Experience
Comparison of Tables

Type of Table	Age	Life Expectancy[3]	
		Male	Female
Wisconsin[1]	65	21.3	23.7
PUB-Public Safety [2]	65	20.4	22.3
PUB-General [2]	65	20.8	23.3
PUB-Teachers [2]	65	22.4	24.6

[1] Wisconsin table represents the proposed mortality assumption.
[2] PUB tables have a base year of 2010 and are projected using 60% of MP-2018.
[3] Based on retirements in 2018.

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Mortality Experience

- In the prior experience study, GRS recommended Generational Mortality which has two components
  - Base table for current rates (based on WRS data)
  - Improvement scale table for future rates (based on Social Security data)
- Base table
  - GRS analyzed WRS experience on headcount and 'benefit weighted' basis
    - Headcount basis provided close match to actual experience
    - Benefit Weighted basis indicated members with higher incomes tend to live longer

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Mortality Experience – Male Retirees Based on Population Counts

Age	Life Years Exposure	Post - Retirement Death			Post - Retirement Death Rates			A/E Ratio	
		Actual Experience	Expected			Expected			
			Present	Proposed	Actual	Present	Proposed	Present	Proposed
55-59	16,640	85	81	78	0.0051	0.0048	0.0046	1.0494	1.0897
60-64	37,408	241	250	241	0.0064	0.0063	0.0061	0.9640	1.0000
65-69	57,772	535	620	594	0.0093	0.0106	0.0102	0.8629	0.9007
70-74	46,392	722	807	767	0.0156	0.0173	0.0164	0.8947	0.9413
75-79	31,191	961	949	899	0.0308	0.0301	0.0285	1.0126	1.0690
80-84	21,866	1,267	1,245	1,180	0.0579	0.0574	0.0544	1.0177	1.0737
85-89	13,105	1,383	1,346	1,276	0.1055	0.1064	0.1008	1.0275	1.0839
90-94	5,189	944	886	840	0.1819	0.1758	0.1668	1.0655	1.1238
95-99	1,077	328	308	291	0.3045	0.3121	0.2955	1.0649	1.1271
Totals	**233,097**	**6,474**	**6,499**	**6,173**	**0.0278**	**0.0279**	**0.0265**	**0.9962**	**1.0488**

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Mortality Experience – Male Retirees Based on Benefit Weighted Rates

Age	Benefit Weighted Exposure	Post - Retirement Death			Post - Retirement Death Rates			A/E Ratio	
		Actual Experience	Expected			Expected			
			Present	Proposed	Actual	Present	Proposed	Present	Proposed
55-59	37,456,555	133,361	183,612	175,727	0.0036	0.0048	0.0046	0.7263	0.7589
60-64	89,640,562	490,696	599,795	576,566	0.0055	0.0063	0.0061	0.8181	0.8511
65-69	138,889,253	1,175,334	1,490,569	1,429,473	0.0085	0.0106	0.0102	0.7885	0.8222
70-74	113,393,797	1,620,588	1,973,791	1,877,232	0.0143	0.0173	0.0164	0.8211	0.8633
75-79	77,133,994	2,082,173	2,347,309	2,224,147	0.0270	0.0301	0.0285	0.8870	0.9362
80-84	55,420,361	2,868,903	3,160,573	2,993,662	0.0518	0.0574	0.0544	0.9077	0.9583
85-89	34,261,629	3,335,852	3,514,670	3,331,811	0.0974	0.1064	0.1008	0.9491	1.0012
90-94	13,189,117	2,213,130	2,245,962	2,130,294	0.1678	0.1758	0.1668	0.9854	1.0389
95-99	2,491,860	660,048	709,680	672,028	0.2649	0.3121	0.2955	0.9301	0.9822
Totals	**567,344,033**	**14,592,321**	**16,241,859**	**15,426,181**	**0.0257**	**0.0279**	**0.0265**	**0.8984**	**0.9459**

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Mortality Experience
Projection Scale Examples

Year of Retirement	Age	Life Expectancy	
		Male	Female
2018 (MP2015)	65	22.2	24.7
2018 (MP2016)	65	22.0	24.4
2018 (MP2017)	65	21.9	24.3
2018 (MP2018)	65	21.8	24.2

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Mortality Experience - Recommendations

Base Table

Current Mortality Rates

- Adopt mortality rates halfway between population and benefit weighted rates
- Review again in 3 years to determine if mortality losses persist

Projection Scale Table

Future Mortality Rates

- Adopt 60% of MP-2018 projection scale
- Goal would be to eventually adopt 100% of projection scale when projected rates begin to stabilize

Similar adjustments for Disabled and Pre-retirement mortality tables

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Mortality Experience - Impact

Active Lives Valuation

- Slight upward pressure on contribution rates

Retired Lives Valuation

- Recommend phasing into the new tables over the next three years
- Results in mortality reserve adjustment of approximately 0.2% per year
- This is done to smooth out the impact on dividends
- Overall impact for retirees much smaller than prior years

Historical Mortality Improvement Impact on Dividends

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 - 2020 =
0.2% Decrease/year

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Benefit Option Factors

- Option factors for benefit calculations are typically updated whenever mortality or interest rate changes are made

Age		Joint and 75%		Joint and 100%	
Retiree	Beneficiary	Current	Proposed	Current	Proposed
50	45	0.927	0.929	0.905	0.908
55	50	0.910	0.912	0.884	0.886
60	55	0.891	0.894	0.860	0.863
65	60	0.866	0.870	0.829	0.834
75	70	0.800	0.805	0.750	0.756

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Current Economic Assumptions

Price Inflation	2.70%
Wage Inflation/Payroll Growth	3.20%
Investment Return	7.20%

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Comments on Economic Assumption Selection

- We are not investment experts, we look at the following items:
  - Historical Trends
  - Forward expectations of Investment Consultants
  - Comparison to other Systems
- Typically a Board decision with input from Investment Experts and Actuary
- But Actuary must comply with Actuarial Standards of Practice and certify the assumption as reasonable

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Economic Assumptions

ASOP No. 27

Guidance regarding the selection of economic assumptions is governed by Actuarial Statement of Practice (ASOP) No. 27

ASOP No. 27 requires that the selected economic assumptions be consistent with one another

That is, the selection of the investment return assumption should be consistent with the selection of the wage inflation and price inflation assumptions

- Lowering the price inflation assumption but not the investment return assumption implies expected real return is increasing

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Economic Assumptions

ASOP No. 27

New Standard eliminates reasonable range (25th to 75th percentile)

Actuary must select reasonable assumptions

- Appropriate for purposes of measurement
- Reflects actuary's professional judgment
- Takes into account historical and current data
- Has no significant bias except when provision for adverse deviation
- Reflects actuary's estimate of future experience

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Historical Prices and Wages

Year	Annual Increase in		
	Prices (CPI-U)	Wages (NAE)	Difference
1958-1967	1.8%	3.7%	1.9%
1968-1977	6.2%	6.5%	0.3%
1978-1987	6.4%	6.5%	0.1%
1988-1997	3.4%	4.1%	0.7%
1998-2007	2.7%	4.0%	1.3%
2008-2017	1.6%	2.4%	0.8%
3-Year Avg	1.6%	3.4%	1.8%
5-Year Avg	1.4%	3.0%	1.6%
10-Year Avg	1.6%	2.4%	0.8%
20-Year Avg	2.1%	3.2%	1.1%
30-Year Avg	2.6%	3.5%	0.9%
50-Year Avg	4.0%	4.7%	0.7%

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Forward Looking Price Inflation

Forward-Looking Price Inflation Forecasts	
Congressional Budget Office	
5-Year Annual Average	2.20%
10-Year Annual Average	2.30%
Federal Reserve Bank of Philadelphia	
5-Year Annual Average	2.22%
10-Year Annual Average	2.20%
Federal Reserve Bank of Cleveland	
10-Year Expectation	2.14%
20-Year Expectation	2.25%
30-Year Expectation	2.34%
Federal Reserve Bank of St. Louis	
10-Year Breakeven Inflation	2.08%
20-Year Breakeven Inflation	2.13%
30-Year Breakeven Inflation	2.15%
U.S. Department of the Treasury	
10-Year Breakeven Inflation	2.09%
20-Year Breakeven Inflation	2.12%
30-Year Breakeven Inflation	2.19%
50-Year Breakeven Inflation	2.23%
100-Year Breakeven Inflation	2.25%
Social Security Trustees	
Ultimate Intermediate Assumption	2.60%

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Wage Inflation for WRS

Period	Wage Inflation
Last 3 Years	1.6%
Last 5 Years	1.9%
Last 10 Years	1.9%
Last 15 Years	2.3%
Last 20 Years	2.5%

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Inflation for WRS

Price Inflation

- Long term averages approach 4%, while shorter term averages range between 2% and 3%
- Investment consulting firm's expectations average 2.2%
- 2018 annual report of the Social Security Trustees uses 2.6% as the intermediate assumption
- Reasonable range is between 2.0% and 2.5%
- Recommend lowering price inflation from 2.7% to 2.5% or 2.3%

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Inflation for WRS

Wage Inflation

- Long term averages result in spread over Price inflation of 0.5% to 1%.
- Results in a Wage Inflation reasonable range of 2.50% to 3.25%.
- Average Salaries for WRS have increased approximately 2.5% over the last 20 years. Statistic may be distorted by growth in population and other factors.
- Recommend lowering wage inflation assumption from 3.2% to 3.0% or 2.8%, based on 0.5% spread between prices & wages.

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Investment Return

Capital Markets

- GRS does not provide investment advice
- GRS maintains a database of capital market assumptions from twelve different investment consulting firms
- GRS uses the capital market assumptions to estimate the return that each consultant would expect the client's portfolio to produce
  - The intention is to avoid giving undue weight to the expectation of any particular consulting firm

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Investment Return

Capital Markets

- Actuarial expected return may differ from Investment consultant
  - Differences in time horizon
  - Actuaries generally not allowed to include alpha
    - assume that an active investment management strategy will produce superior investment performance compared to a passive management strategy
  - Actuaries are allowed to include margin for adverse deviation

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Investment Consulting Firms Surveyed

- Callan
- Wilshire
- NEPC
- PCA
- Bank of New York Mellon
- JP Morgan
- RV Kuhn
- Mercer
- Marquette
- Summit
- Aon
- Voya

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WRS Asset Allocation

Asset Class	*Asset Allocation*
Global Equities	50.00%
Fixed Income	24.50%
Inflation Sensitive Assets	15.50%
Real Estate	8.00%
Private Equity/Debt	8.00%
Multi-Asset	4.00%
Cash Equivalents	-10.00%
Total	100.00%

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Investment Return (Arithmetic Expectation)

Investment Consultant	Investment Consultant Expected Nominal Return	Investment Consultant Inflation Assumption	Expected Real Return (2)–(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)	Plan Incurred Administrative Expenses	Expected Nominal Return Net of Expenses (6)-(7)		Standard Deviation of Expected Return (1-Year)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		(9)
1	6.03%	2.20%	3.83%	2.50%	6.33%	0.05%	6.28%		12.96%
2	6.55%	2.26%	4.29%	2.50%	6.79%	0.05%	6.74%		11.21%
3	6.86%	2.50%	4.36%	2.50%	6.86%	0.05%	6.81%		13.62%
4	6.48%	2.00%	4.48%	2.50%	6.98%	0.05%	6.93%		11.07%
5	6.77%	2.21%	4.55%	2.50%	7.05%	0.05%	7.00%		14.31%
6	7.14%	2.50%	4.64%	2.50%	7.14%	0.05%	7.09%		13.74%
7	6.70%	2.00%	4.70%	2.50%	7.20%	0.05%	7.15%		12.80%
8	7.15%	2.26%	4.89%	2.50%	7.39%	0.05%	7.34%		14.58%
9	7.37%	2.31%	5.07%	2.50%	7.57%	0.05%	7.52%		12.74%
10	7.10%	1.95%	5.15%	2.50%	7.65%	0.05%	7.60%		12.96%
11	7.83%	2.25%	5.58%	2.50%	8.08%	0.05%	8.03%		16.51%
12	8.28%	2.00%	6.28%	2.50%	8.78%	0.05%	8.73%		11.20%
Average	**7.02%**	**2.20%**	**4.82%**	**2.50%**	**7.32%**	**0.05%**	**7.27%**		**13.14%**

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Investment Return (Geometric Expectation)

Investment Consultant	Distribution of 20-Year Average Geometric Net Nominal Return			Probability of exceeding 7.20%
	40th	50th	60th	
(1)	(2)	(3)	(4)	(5)
1	4.77%	5.50%	6.23%	27.79%
2	5.53%	6.15%	6.79%	33.78%
3	5.19%	5.95%	6.71%	33.96%
4	5.75%	6.37%	6.99%	36.75%
5	5.26%	6.06%	6.86%	35.98%
6	5.46%	6.22%	7.00%	37.44%
7	5.68%	6.39%	7.11%	38.81%
8	5.55%	6.36%	7.18%	39.79%
9	6.06%	6.77%	7.49%	43.96%
10	6.11%	6.83%	7.56%	44.88%
11	5.87%	6.79%	7.71%	45.47%
12	7.53%	8.16%	8.79%	65.08%
Average	**5.73%**	**6.46%**	**7.20%**	**40.31%**

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Investment Return

Comments

- Consultants not in agreement
- Significant range of results
- ASOP standards require reasonable estimate:
  - 6.5% (geometric median)
  - 7.3% (arithmetic mean)
- Based upon the data we reviewed, the portfolio has a 50% chance of producing 6.5% compounded return over the next 10 years and a 40% chance of producing 7.2%

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Investment Return

NEPC Outlook

- Price Inflation outlook is 2.5%
- 5-7 Year Expected Return is 6.0%
- 30 Year Expected Return is 7.3%

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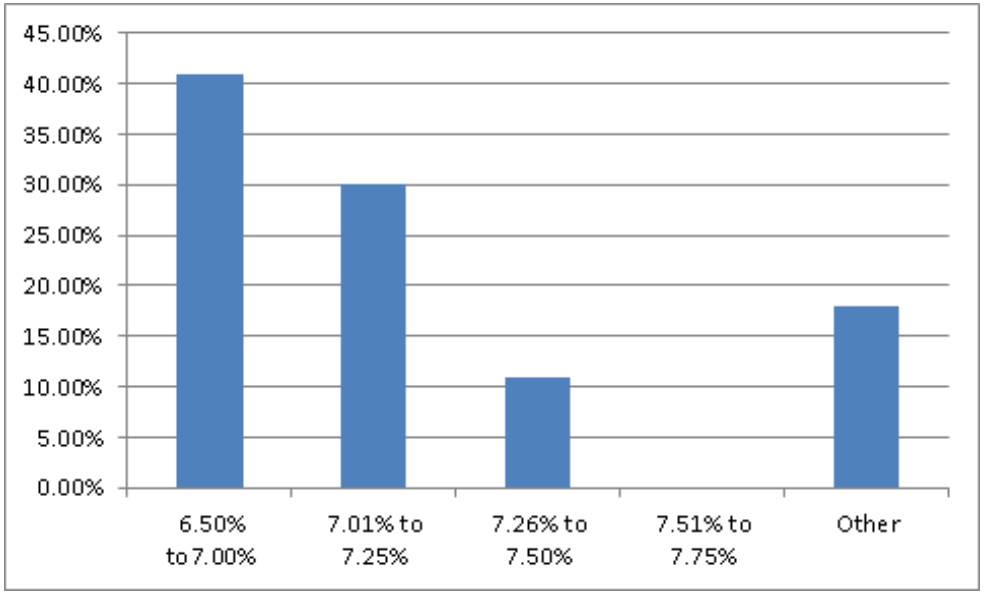
What Are Other Actuaries Recommending?

- Recent Survey of Assumed Investment Return recommended by Public Sector Actuaries



- NASRA surveys will tend to lag actuarial recommendations by 1 to 3 years

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What Are Other Systems Doing?

- Recent changes by other Systems
  - CALPERS – 7.5% to 7.0% over 3 years
  - CALSTRS – 7.5% to 7.0% over 2 years
  - State of Michigan – 7.5% to 7.05%
  - Ohio PERS – 7.5% to 7.2%
  - Texas Teachers 8.0% to 7.25%
  - Minnesota (PERA & SRS) – 8.0% to 7.5%
  - Minnesota Teachers – 8.5% to 7.5%
  - Kentucky – 6.75% to 5.25%
  - Illinois SURS – 7.25% to 6.75%
  - Illinois SERS – 8.5% to 7.0% (since 2010)
  - Chicago Public Schools – 7.25% to 7.0%
- 75% of the 129 plans that NASRA surveys have lowered their assumption since 2010.

Investment Return

Comments

- 7.2% assumption is currently near the upper end of the reasonable range and has been in effect since 2010
- Historically conservative, 7.2% is now closer to the median compared to peers (and trending downward)
- Making a modest change now (when contribution rates are relatively stable)may be prudent as opposed to larger change in the next study
- Consider reducing the investment return assumption from 7.2% to 7.0% or 6.8%

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Investment Return

Comments

- Changing the assumed return should not impact the asset allocation or what the fund will actually earn
  - Actuarial assumption is derived from current asset allocation (not vice-versa)
  - Reflects future expectation of current allocation
- Changing the assumed rate of return should not materially impact retiree dividends
  - Retiree Reserve is valued at 5%
  - Dividends are granted based on what is actually earned, not what the actuary assumes

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Investment Return

Comments

- Changing the assumed rate of return should not materially impact retiree dividends (continued)
  - Timing will be affected slightly because of the operation of the MRA
  - Initial recognition amount will be smaller if return is lowered, but
    - Gains will be larger and spread over 5 years, and.
    - Similarly, losses will be smaller, and also spread over 5 years

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Summary of Economic Scenarios

Measure	Current Assumption	Reasonable Range	Recommended Assumption
Price Inflation	2.7%	2.0%-2.5%	2.3%-2.5%
Wage Inflation	3.2%	2.7%-3.2%	2.8%-3.0%
Investment Return	7.2%	6.5%-7.3%	6.8%-7.0%

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Summary of Results – Active Lives Valuation

Hypothetical Normal Cost Rates Based on the December 31, 2017 Active Lives Valuation

	Current	Demographic Changes Only	Proposed Assumptions (including Demographic Changes)		
Price Inflation	2.70%	2.70%	2.50%	2.30%	2.50%
Wage Inflation	3.20%	3.20%	3.00%	2.80%	3.00%
Investment Return	7.20%	7.20%	7.00%	6.80%	6.80%
General and Executive & Elected	13.1%	13.1%	13.1%	13.2%	13.6%
Protective With Social Security	17.1%	17.5%	17.7%	17.9%	18.3%
Protective Without Social Security	21.5%	21.9%	22.1%	22.4%	23.1%

New assumptions would be first be used in the December 31, 2018 valuation which would first impact rates in 2020.

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Implementation Schedule

- We recommend that the assumption changes be effective for the December 31, 2018 and following valuation EXCEPT for those changes that directly impact plan participants.
  - Various factors used in benefit administration.
- We recommend that changes affecting plan participants be effective January 1, 2020 in order to allow time for communication and for staff to update computer systems.

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Disclaimers

- This presentation is intended to be used in conjunction with the 2015-2017 Experience Study report issued on November 18, 2018. This presentation should not be relied on for any purpose other than the purpose described in the valuation report.
- This presentation shall not be construed to provide tax advice, legal advice or investment advice.
- If you need additional information in order to make an informed decision, please contact the authors.

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