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State Administration and Veteran's Affairs Interim Committee

Experience Study Results
Five-year Period Ending June 30, 2021

Presented May 25, 2022

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Actuarial Valuations

- The Actuarial Valuation process uses various inputs to develop various results

- Over the short term, contributions determined by the actuarial valuation are based upon estimated investment returns, benefits and expenses, which utilize assumptions and the Actuarial Methods (Funding Policy) recommended by the actuary and adopted by the Board

- Over the long term, contributions are adjusted to reflect actual investment returns, benefits and expenses

Inputs

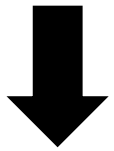
Member Data

Asset Data

Benefit Provisions

Assumptions

Actuarial Methods



Results

Employer Contributions

Actuarial Accrued Liability

Actuarial Value of Assets

Actuarial Gain/Loss

Funded Ratio/UAAL

Projections

Actuarial Valuations

- Best estimate of ultimate costs
- Requires use of assumptions to estimate benefit payouts
  - When?
  - How much?
  - How long?
- Assumptions should represent the best estimate of future experience
- Each assumption should be individually reasonable

Actuarial Assumptions

- No "correct" assumptions
  - Blend of art and science
  - Range of acceptable assumptions
- More aggressive assumptions are more likely to generate actuarial losses in future years; more conservative assumptions are likely to generate actuarial gains
- Assumptions are long term estimates
  - Experience emerges short term
  - Year-to-year fluctuations expected
- Most powerful assumption is the investment return assumption
- Ultimate responsibility for selection of assumptions lies with the Board of Trustees

Selection of Assumptions

Economic

- Investment Return
- Payroll Growth Rate
- Inflation
- Wage Inflation

Demographic

- Retirement Rates
- Merit Pay Increases
- Disability
- Turnover
- Mortality

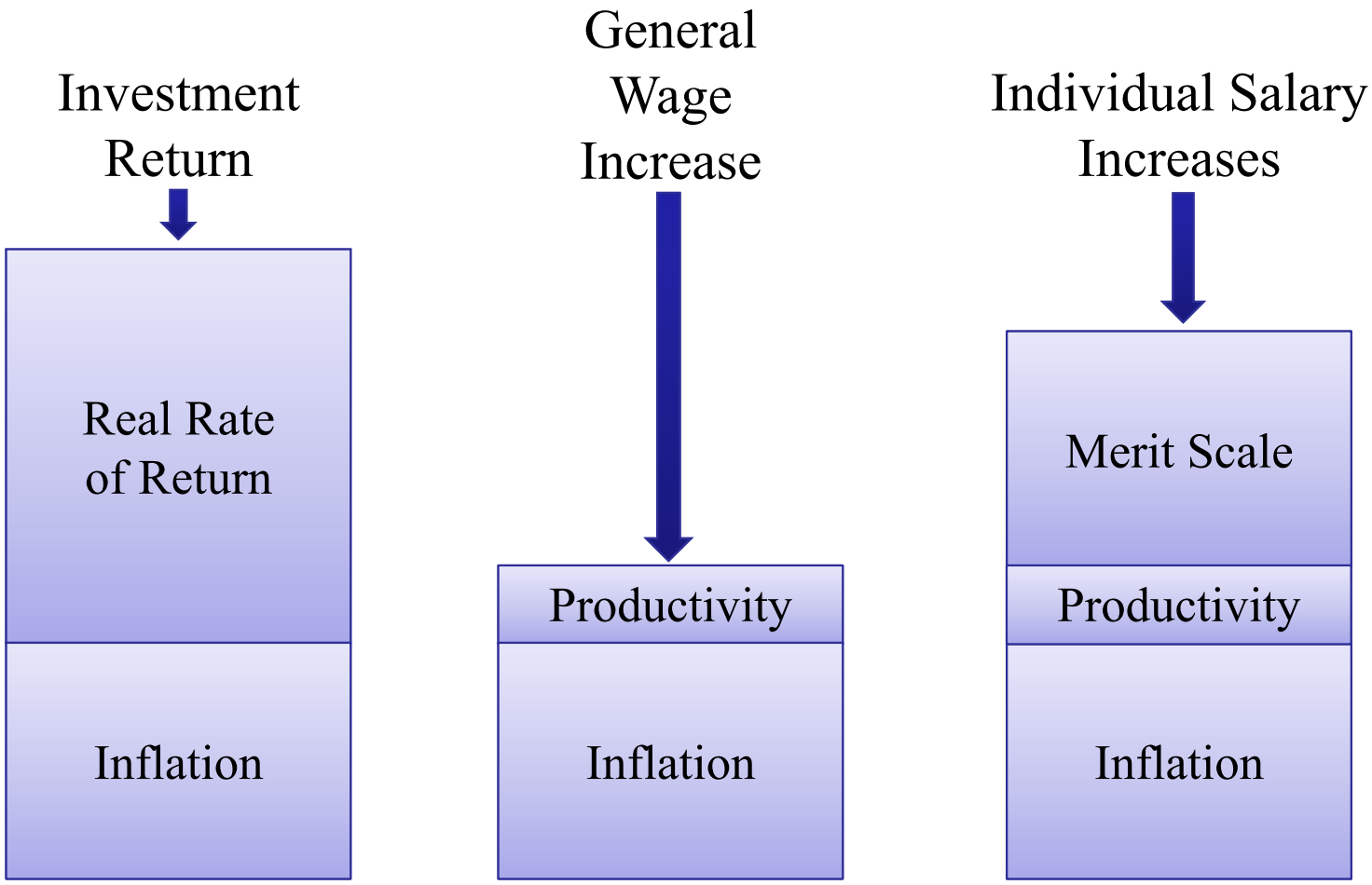
Our Philosophy

- Do Not Overreact
  - Typically, we do not make significant changes in actuarial assumptions unless a major event causes changes in expectations.
- Anticipate Trends
  - If an identified trend is expected to continue, like improved retiree mortality experience, then our assumptions should reflect these anticipated trends.
- Simplify
  - We identify which factors are significant and eliminate the ones that will not have a material impact on results.

Economic Assumptions

- Assumptions reviewed
  - Price inflation
  - Investment return
  - Wage inflation
- Actuarial Standard of Practice (ASOP) No. 27, *"Selection of Economic Assumptions for Measuring Pension Obligations"* provides guidance to actuaries in selecting economic assumptions for measuring obligations under defined benefit plans.

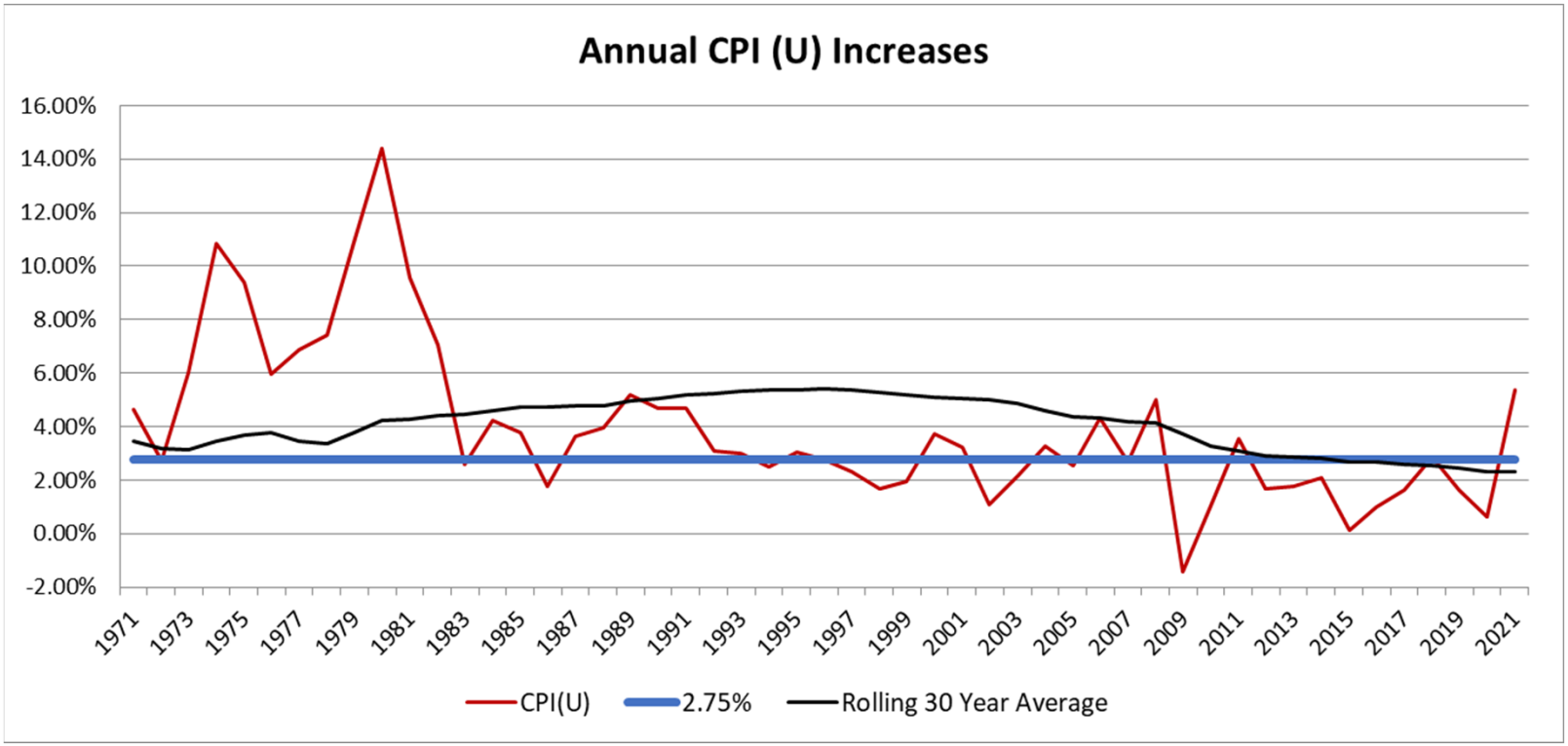
Building Block Method is Used to Develop Economic Assumptions



Note: inflation assumption and productivity must be consistent in all assumptions.

Economic Assumptions
Price Inflation

- Historical data: Annual CPI (U) Increases



Economic Assumptions
Price Inflation

- Recommendation:
  - Median inflation published in the "First Quarter 2022 Survey of Professional Forecasters" published by the Philadelphia Federal Reserve Bank is 2.50%
  - Current breakeven rates of inflation (as of 3/31/2022)
    - 10-year = 2.84%; 20-year = 2.79%; 30-year = 2.47%
  - Based on this data and current inflationary trends we recommend retaining the current inflation assumption

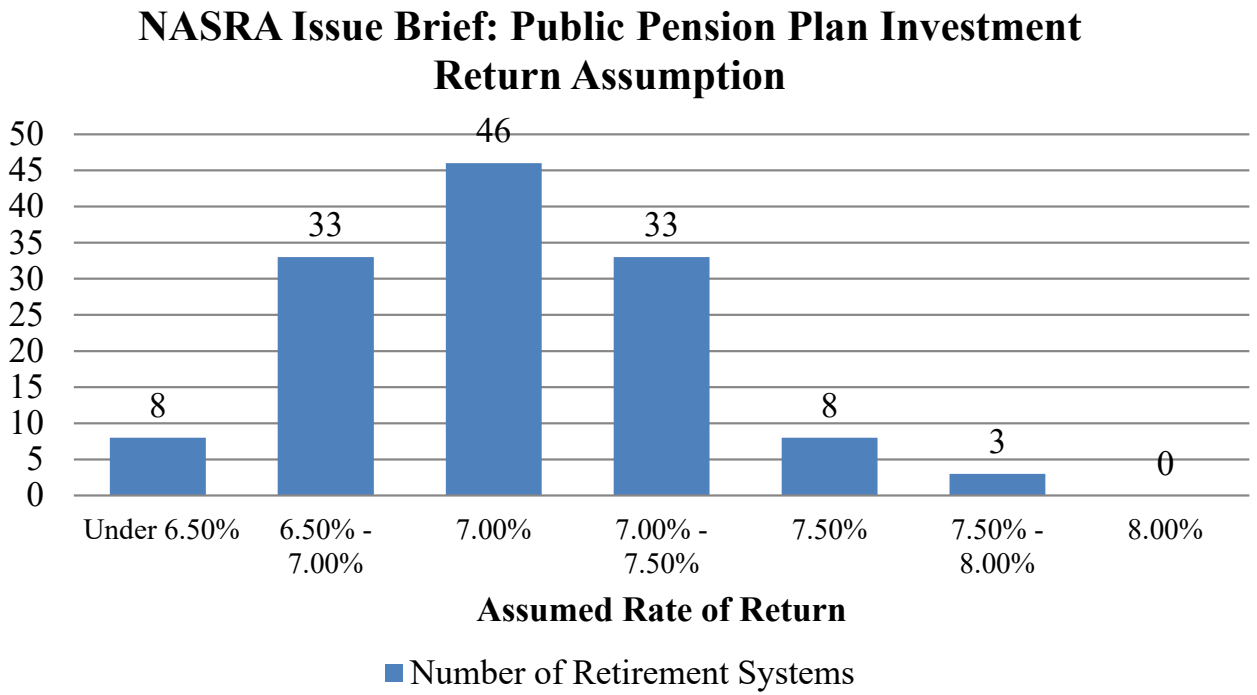
Price Inflation Assumption	
Recommended	2.75%

Economic Assumptions
Investment Return

- Recent Experience

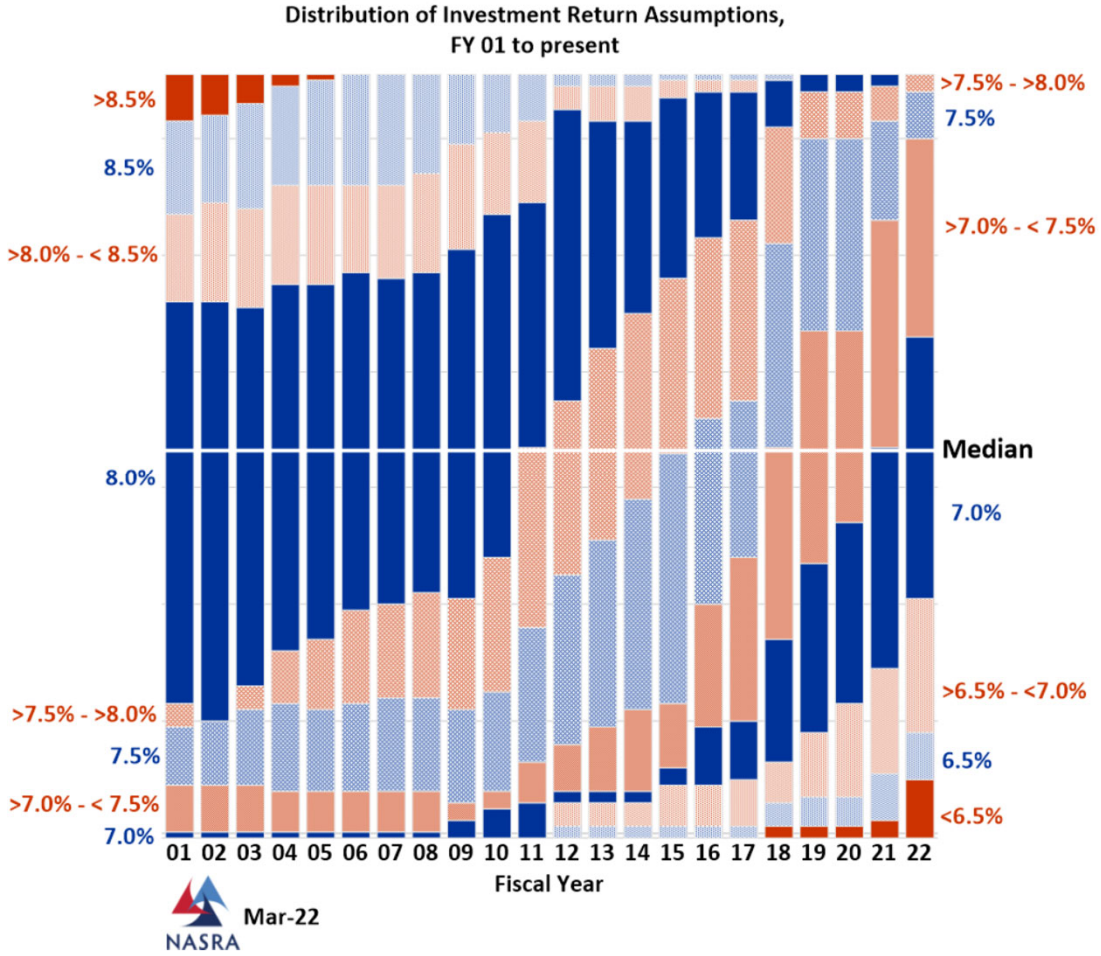
Market Value Rate of Return									
Year Ending 6/30	PERS	TRS	JRS	SRS	GWPORS	HPORS	MPORS	FURS	VFCA
2012	2.27%	2.20%	2.20%	2.32%	2.31%	2.24%	2.40%	2.42%	1.67%
2013	12.99%	12.90%	12.72%	12.88%	12.69%	12.88%	12.42%	12.43%	12.01%
2014	17.12%	17.10%	17.03%	17.08%	16.97%	17.10%	16.53%	16.53%	16.23%
2015	4.60%	4.60%	4.59%	4.60%	4.58%	4.60%	4.52%	4.52%	4.49%
2016	2.02%	2.10%	2.06%	2.06%	2.11%	2.04%	2.13%	2.15%	1.84%
2017	11.93%	11.90%	11.91%	11.95%	11.92%	11.87%	11.56%	11.56%	11.51%
2018	8.90%	8.80%	8.88%	8.83%	8.81%	8.86%	8.65%	8.63%	8.68%
2019	5.65%	5.70%	5.64%	5.70%	5.72%	5.63%	5.42%	5.44%	5.41%
2020	2.73%	2.70%	2.72%	2.71%	2.70%	2.66%	2.65%	2.64%	2.66%
2021	27.80%	27.70%	27.69%	27.82%	27.66%	27.80%	27.07%	27.04%	26.93%
Average	9.34%	9.31%	9.28%	9.33%	9.29%	9.30%	9.09%	9.09%	8.89%

Economic Assumptions
Investment Return



The median assumed rate of return among Public Retirement Systems is 7.00% according to the February 2021 NASRA Issue Brief: "Public Pension Plan Investment Return Assumptions"

Economic Assumptions
Investment Return



The median assumed rate of return among Public Retirement Systems has been trending down for the past decade.

Economic Assumptions
Investment Return

- Stochastic projection expected range of real rates of return, net of expenses:

Time Span In Years	Mean Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	5.40%	12.58%	-13.94%	-3.41%	4.66%	13.40%	27.27%
5	4.81	5.58	-4.11	0.97	4.66	8.48	14.23
10	4.73	3.94	-1.62	2.04	4.66	7.35	11.34
20	4.69	2.79	0.18	2.80	4.66	6.55	9.34
30	4.68	2.27	0.99	3.14	4.66	6.20	8.46
50	4.67	1.76	1.80	3.48	4.66	5.85	7.59

- Based on current capital market assumptions and policy target asset allocation

Economic Assumptions
Administrative Expenses

	MPERA Systems			TRS		
FY Ending June 30,	Administrative Expenses	Market Value of Assets	Expense Ratio	Administrative Expenses	Market Value of Assets	Expense Ratio
2017	$6,638,528	$7,032,659,279	0.09%	$2,459,458	$3,950,704,563	0.06%
2018	$6,463,555	$7,475,224,879	0.09%	$2,849,527	$4,148,324,206	0.07%
2019	$5,160,673	$7,685,372,436	0.07%	$2,947,109	$4,220,285,752	0.07%
2020	$5,794,401	$7,669,708,009	0.08%	$3,767,693	$4,167,839,558	0.09%
2021	$6,892,166	$9,516,857,085	0.07%	$3,936,633	$5,116,849,108	0.08%

- Recommendation: Implicit assumption – Investment return net of investment AND administrative expenses
  - Investment assumption reduced by 0.08% for MPERA Systems and 0.09% for TRS

Economic Assumptions
Investment Return

- Stochastic Projection Approach
  - Projection results – 50 years:

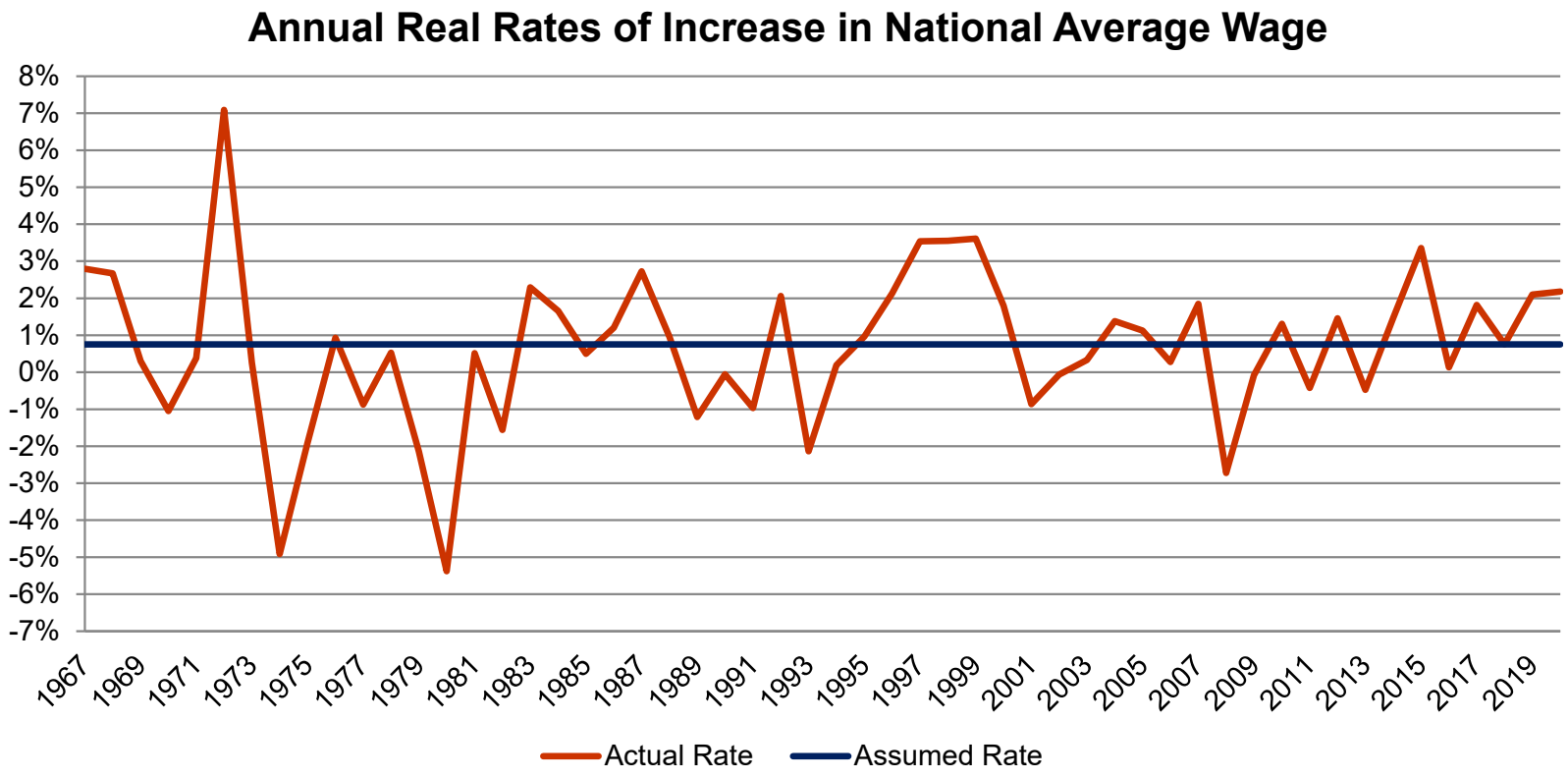
	MPERA Systems	TRS
Item	50th Percentile	50th Percentile
Real Rate of Return	4.66%	4.66%
Inflation	2.75%	2.75%
Investment Expenses	0.00%	0.00%
Administrative Expenses	(0.08)%	(0.09)%
Net Investment Return	7.33%	7.32%

Economic Assumptions
Investment Return

- Recommend assumed rate of 7.30%, close to the 50th percentile.
- The average assumed rate of return of large public retirement systems has been declining, possibly driven by historically low inflation environment.
- Currently inflation is on the rise and is returning to levels closer to historical norms.

Economic Assumptions
Wage Inflation

- Social Security Administration data



Economic Assumptions
Wage Inflation

- Historical Experience:

Period	Wage Inflation	Price Inflation	Real Wage Growth
2011-2020	2.9%	1.5%	1.4%
2001-2020	2.8%	2.0%	0.8%
1991-2020	3.3%	2.2%	1.1%
1981-2020	3.6%	2.7%	0.9%
1971-2020	4.5%	3.8%	0.7%
1961-2020	4.5%	3.7%	0.8%

- This shows real wage growth across all sectors
  - In general, public employees tend to receive compensation more in the form of benefits than wage, so these may be on the high end

Economic Assumptions
Wage Inflation

- Recommendation

Wage Inflation Assumption	
Recommended	
Real Wage Growth	0.75%
Price Inflation	2.75%
Total	3.50%

Demographic Assumptions

- Assumptions Reviewed
  - Post-Retirement Mortality
  - Pre-Retirement Mortality
  - Rates of Service Retirement
  - Rates of Disability Retirement
  - Rates of Withdrawal
  - Rates of Salary Increase for Merit and Promotions

- Actuarial Standard of Practice (ASOP) No. 35, *"Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations"* provides guidance to actuaries in selecting demographic assumptions for measuring obligations under defined benefit plans.

Measuring Demographic Experience (Count vs Liability Basis)

Count Basis

- **Step 1**: Determine number of members changing membership status (decrements) during study period, tabulated by groupings that may include age, duration, gender and plan
- **Step 2**: Determine number of members expected to change status by multiplying membership statistics (called exposures) by the expected rates of decrement
- **Step 3**: Compare number of actual decrements to number of expected decrements, called the Actual to Expected Ratio (expressed as %)

Liability Basis

- Same steps as Count Basis, but results are based on the estimated liability of members instead of the count of members

Demographic Assumptions

- Compare what actually happened to individual members with what was expected to happen based on the actuarial assumptions
- Assess credibility – amount of weight assigned to the recent experience
  - Length of study period
  - Unusual events during study period
  - Size of the group
- Key evaluation tool is actual decrements/expected decrements (called *Actual/Expected* or *A/E ratio*)
  - "Decrement" is a change in the member's status (e.g., retirement, termination, death)

Measuring Demographic Experience (Example)

- 10 members eligible to retire at age 62
- Actuarial assumption is 10% retire at age 62

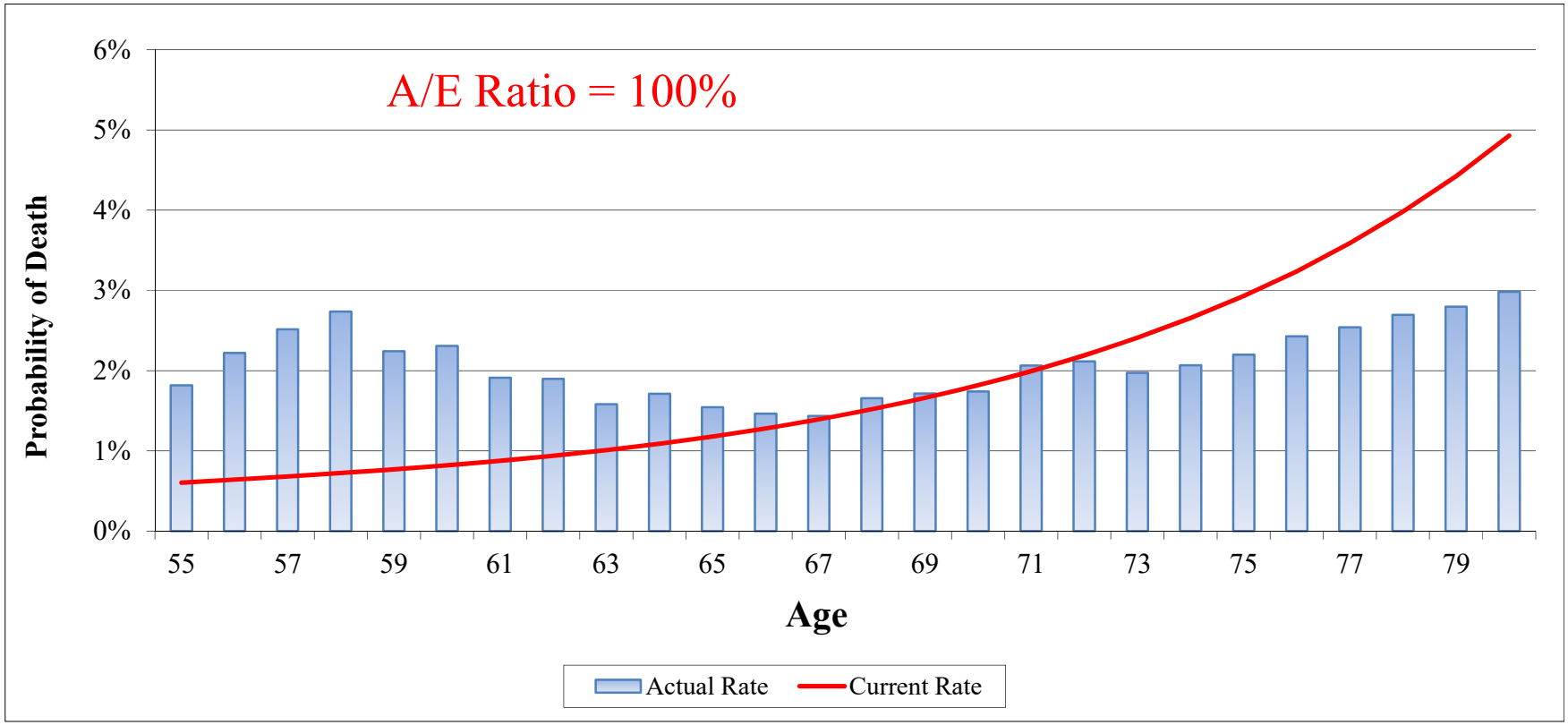
Count	Salary	Service	Liability Weighted
8	$ 20,000	5	$ 800,000
2	80,000	20	3,200,000
10			4,000,000

- Actual Experience: 1 member with $80,000 and 20 years retires

	Count Basis	Liability Weighted
Exposure	10	$4,000,000
Expected Decrement	1	400,000
Actual Decrement	1	1,600,000
Actual/Expected Ratio	100%	400%

Evaluating the Results of Demographic Experience

- Generally, the closer the Actual/Expected ratio is to 100%, the better the current assumption anticipated the overall experience. However, the pattern of the actual experience may vary significantly from the assumption indicating a need for change.



Demographic Assumptions

- Funds reviewed
  - PERS
  - TRS
  - JRS
  - SRS
  - GWPORS
  - HPORS
  - MPORS
  - FURS
  - VFCA
- Results compare actual and expected decrements and present recommended changes, if any.

Demographic Assumptions (Healthy Mortality)

- Rates of Pre- and Post-Retirement Mortality
  - Benefits are paid over a retiree's life; therefore, it is important to accurately reflect the typical life expectancy
  - The mortality assumption is used to determine the number of deaths that will occur during the year
  - Studied based on gender and age
  - Liability weighted analysis performed using the retirees and beneficiary's retirement benefit as a proxy for liability
  - The Society of Actuaries recently released as set of mortality tables based solely on public plan data. The family of tables is called the Pub-2010 tables

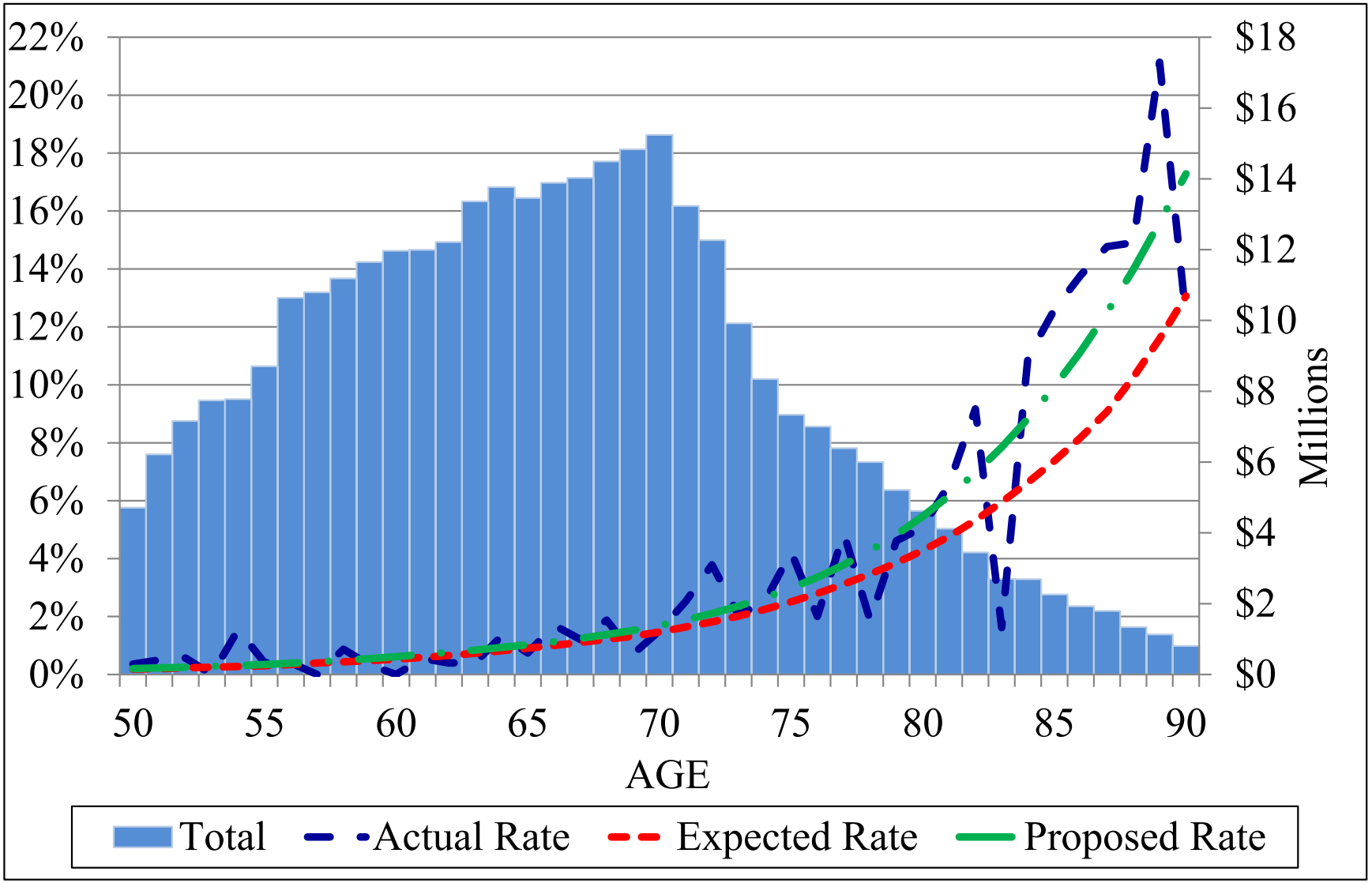
Demographic Assumptions (Mortality)

- Under Actuarial Standards of Practice, actuary must consider mortality improvements
- Mortality table assumption generally accounts for future improvements by either maintaining a margin for mortality improvement or by generationally projecting future improvements

Demographic Assumptions (Public Safety Retiree Mortality)

- Mortality experience was analyzed for the Public Safety Systems and General Employee Systems separately.
- Public Safety Systems include FURS, GWPORS, HPORS, MPORS, SRS, and VFCA.
- For the Public Safety Systems, experience yielded actual/expected ratios of 130% and 90% respectively for male and female retiree mortality experience.
- Mortality table should include future improvement either by including a margin or directly by projecting generationally.
- Recommend change in healthy mortality to the PubS-2010 Amount Weighted Healthy Retiree Mortality Table projected to 2021, set forward 1 year and adjusted 105% for males, with no adjustment for females. Future improvement in mortality rates is reflected by applying the MP-2021 projection scale generationally.
- Actual expected ratio under proposed assumption is 106% and 92% for males and females respectively.

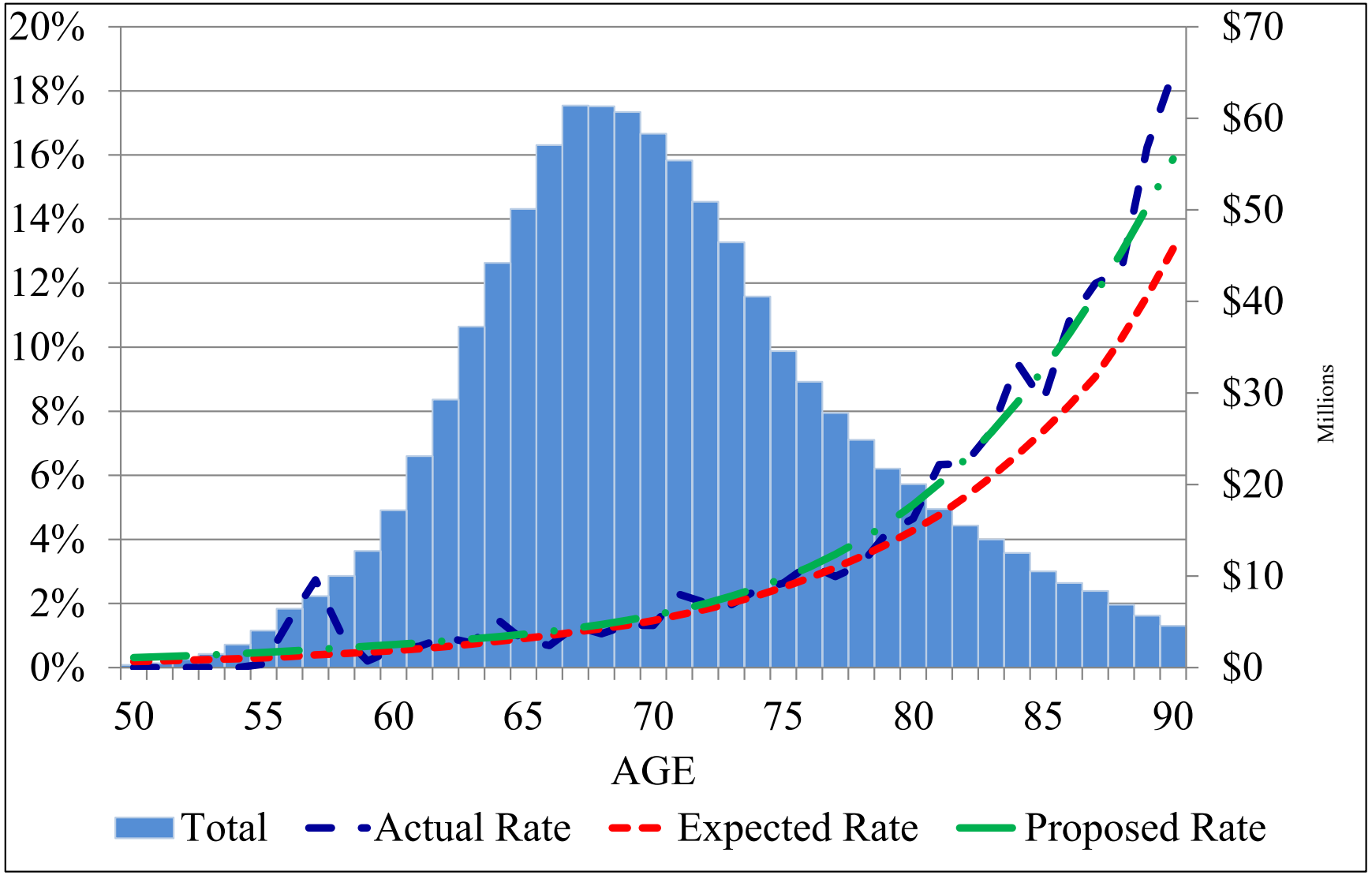
Demographic Assumptions (Public Safety Male Retiree Mortality)



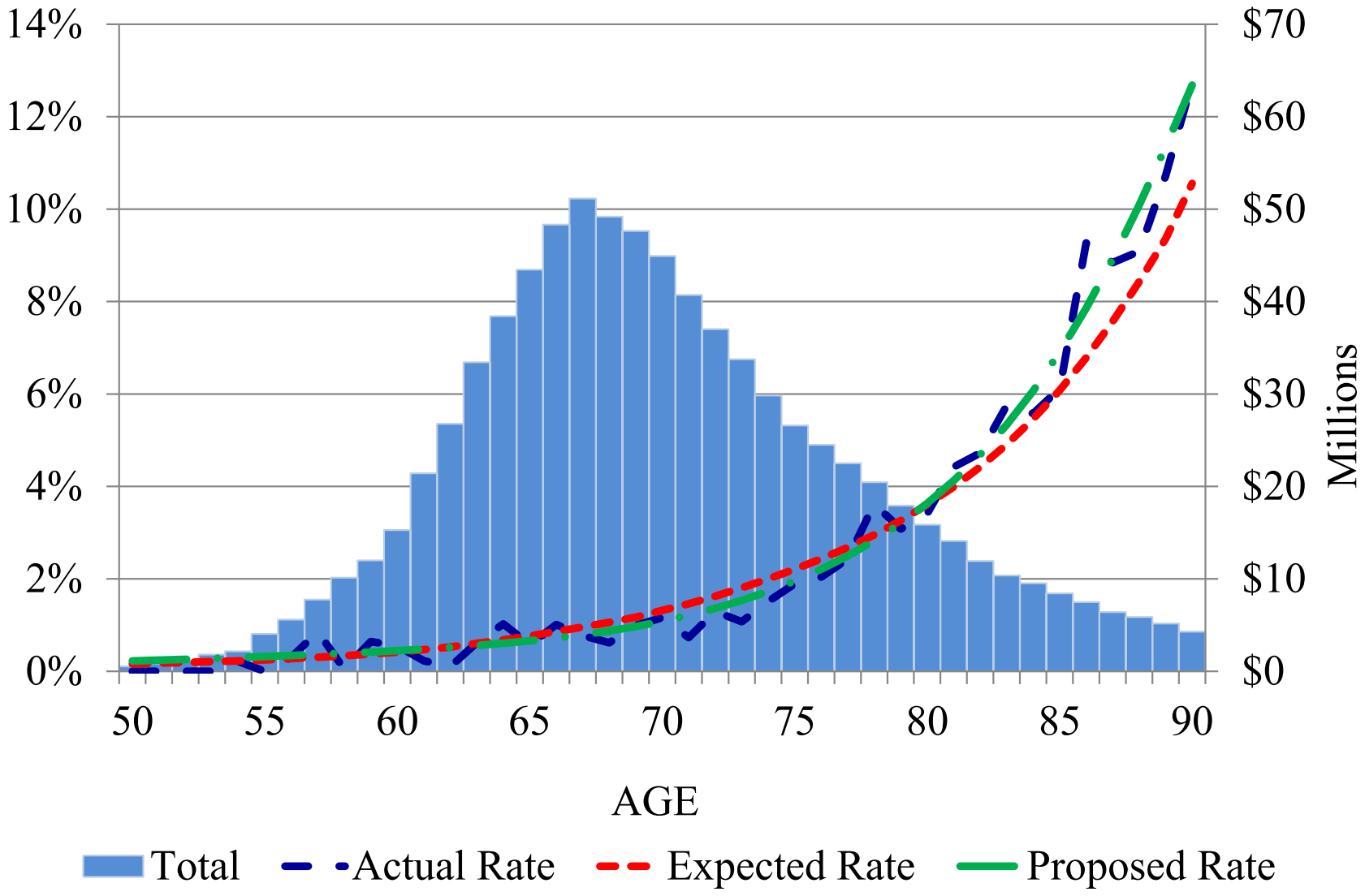
Demographic Assumptions (General Employee Retiree Mortality)

- General Employee Systems include PERS and JRS.
- For the General Employee Systems, experience yielded actual/expected ratios of 118% and 102% respectively for healthy male and female mortality experience.
- Mortality table should include future improvement either by including a margin or directly by projecting generationally.
- Recommend change in retiree mortality to the PubG-2010 Amount Weighted Healthy Retiree Mortality Table projected to 2021, with ages set forward 1 year and adjusted 104% for males and 103% for females. Future improvement in mortality rates is reflected by applying the MP-2021 projection scale generationally.
- Actual expected ratio under proposed assumption is 100% and 101% for males and females respectively.

Demographic Assumptions (Male Retiree Mortality)



Demographic Assumptions (Female Retiree Mortality)



Recommended Mortality Assumptions

- Our recommendation is to use the same PUB2010 family of mortality tables for Actives, Disabled and Beneficiaries
- **Recommendation for Active (pre-retirement) Tables:**
  - Public Safety Systems: PubS-2010 Safety Amount Weighted Employee Mortality Table
  - General Employee Systems: PubG-2010 Amount Weighted Employee Mortality Table
- **Recommendation for Disabled Tables:**
  - Public Safety Systems: PubS-2010 Amount Weighted Disabled Retiree Mortality Table Projected to 2021, with ages set forward 1 year for males
  - General Employee Systems: PubG-2010 Amount Weighted Disabled Retiree Mortality Table projected to 2021, with ages set forward 1 year for males and females
- **Recommendation for Beneficiary Tables:**
  - Public Safety Systems: PubS-2010 Amount Weighted Contingent Survivor Mortality Table, with ages set forward 1 year for males
  - General Employee Systems: PubG-2010 Amount Weighted Contingent Survivor Mortality Table projected to 2021, with ages set forward 1 year for males and females

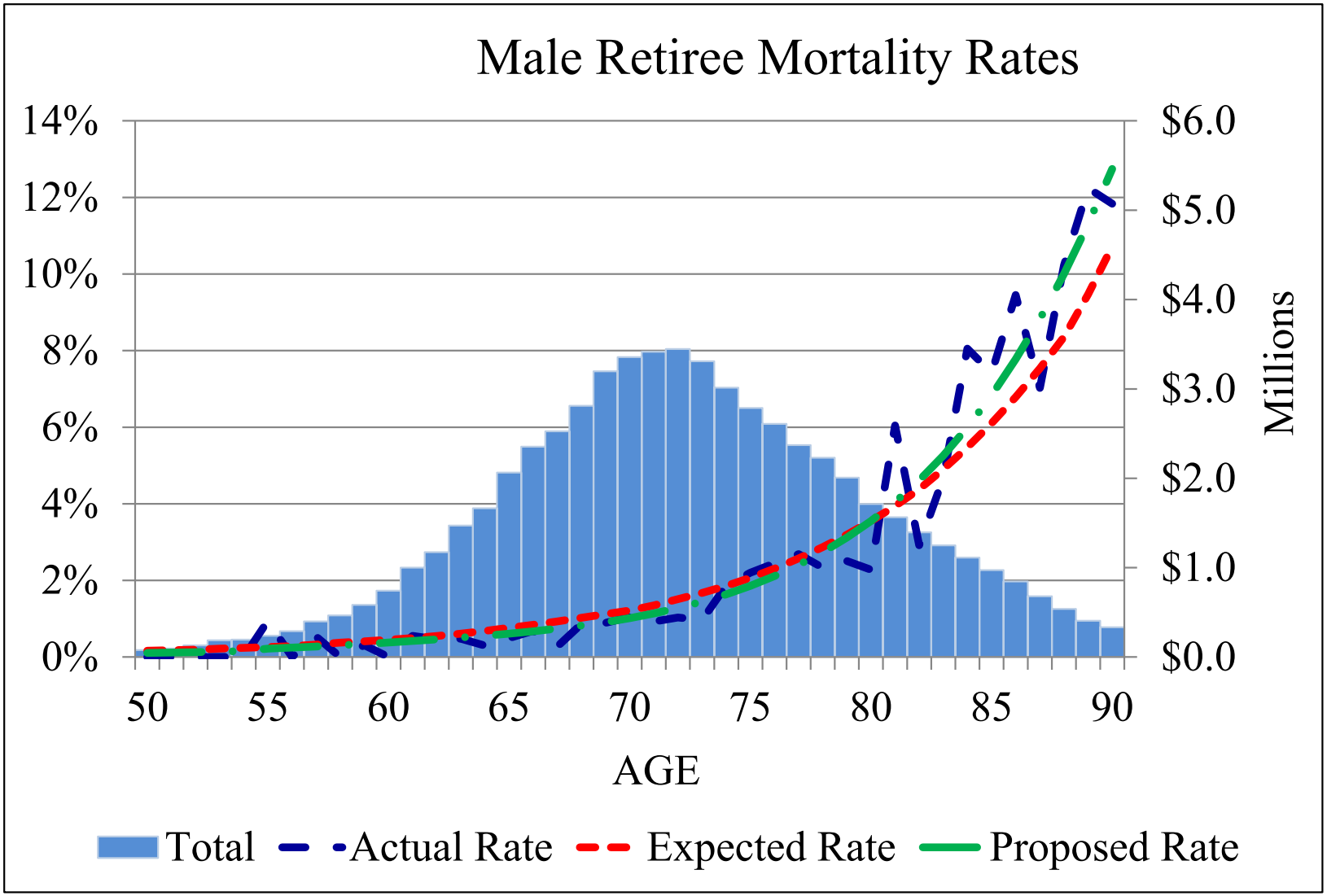
TRS Demographic Assumptions (Mortality)

- Rates of Pre- and Post-Retirement Mortality
  - A/E ratios under current and proposed assumption

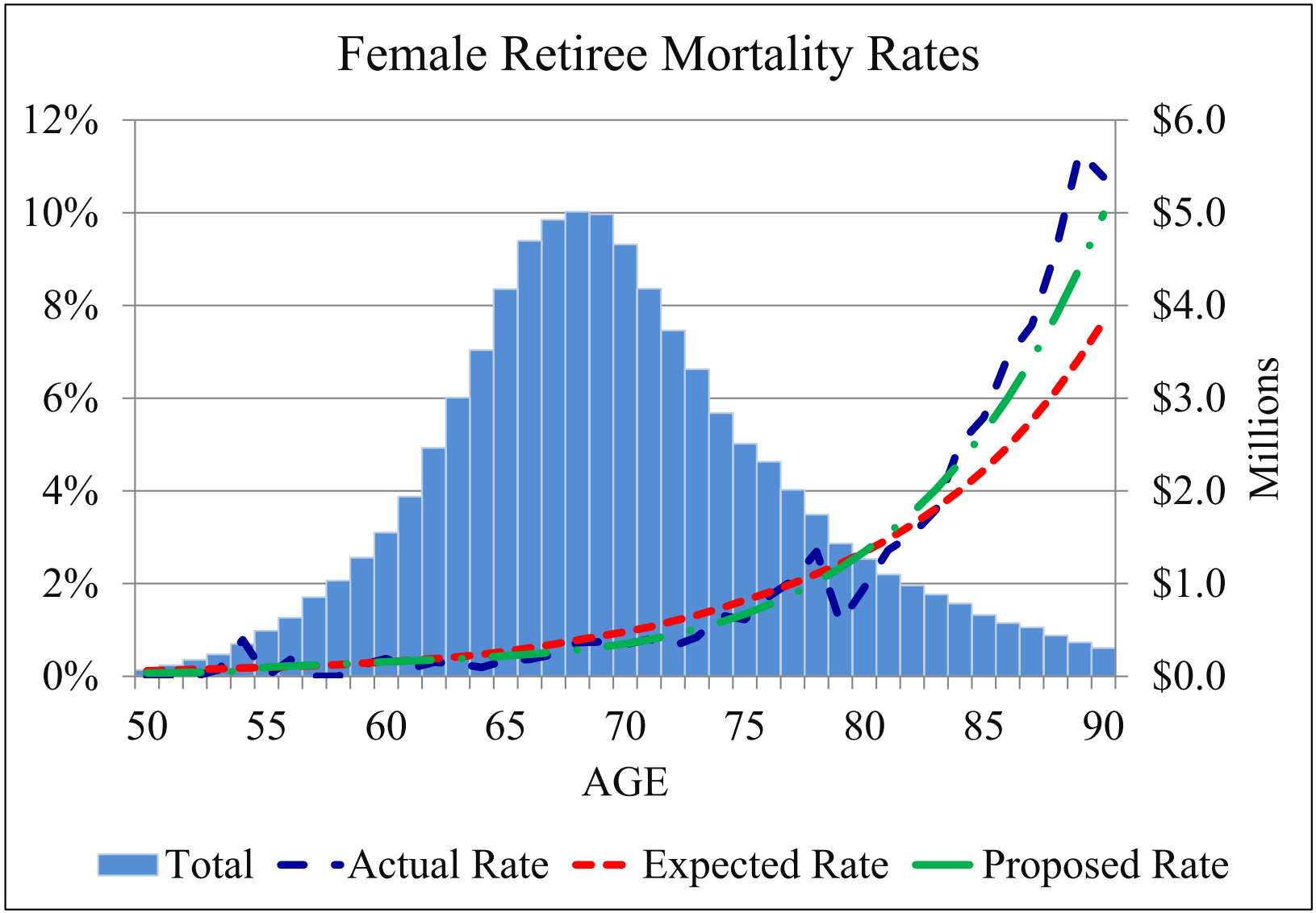
	Current Assumption		Proposed Assumption	
	Males	Female	Male	Female
Healthy Retirees	100%	100%	100%	102%
Contingent Survivors	173%	140%	122%	105%
Disabled Retirees	159%	168%	162%	184%

  - Not enough experience to perform an analysis for deaths occurring to active employee, contingent survivors and disabled retirees therefore we have recommended the standard table without adjustment.

Demographic Assumptions (Retiree Mortality)



Demographic Assumptions (Retiree Mortality)



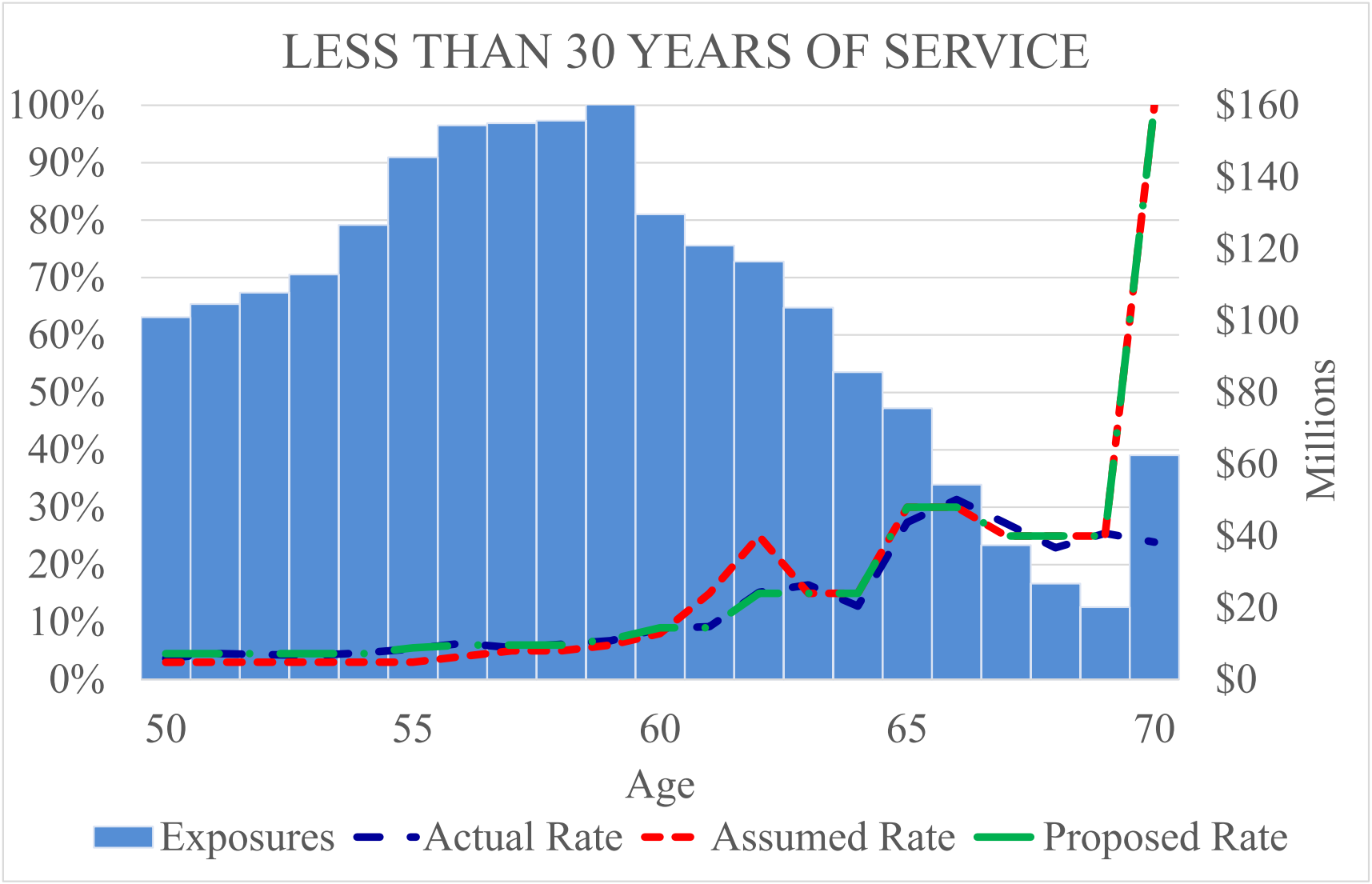
Recommended Mortality Assumptions

- Future improvement for pre-retirement and beneficiary tables are projected generationally using Scale MP-2021

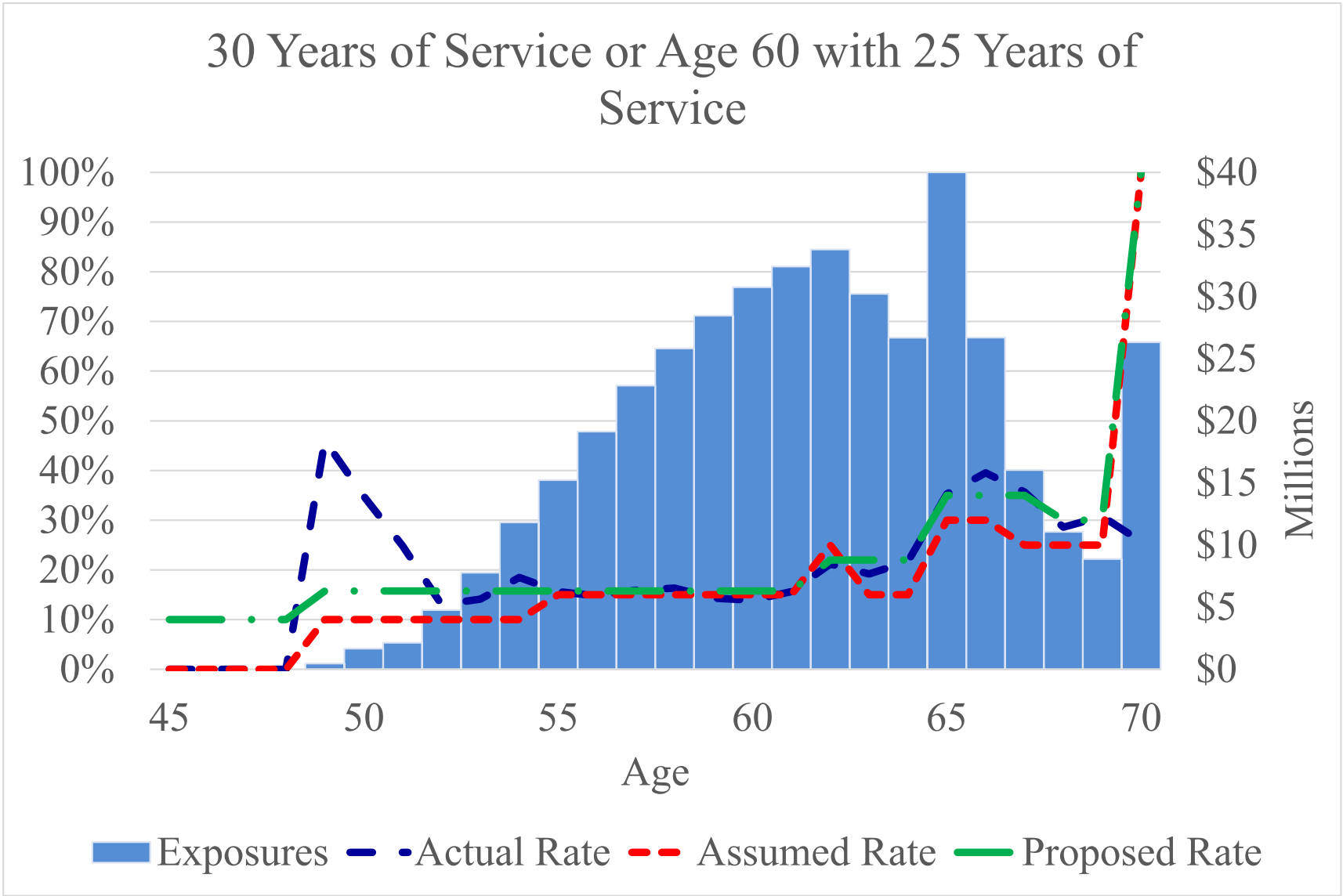
PERS Demographic Assumptions (Service Retirements)

- Reduced retirement benefit
  - Retirement experience was investigated separately for members who had less than 30 years of service and for members who had 30 or more years of service or who were at least age 60 with at least 25 years of service.
  - Experience yielded actual/expected ratios of 104%.
  - In general, retirements were more than anticipated.
  - We recommend adjusting the assumed rates to reflect recent experience.
    - Recommended assumptions produce an actual/expected ratio of 99%

PERS Demographic Assumptions (Service Retirements)



PERS Demographic Assumptions (Service Retirements)



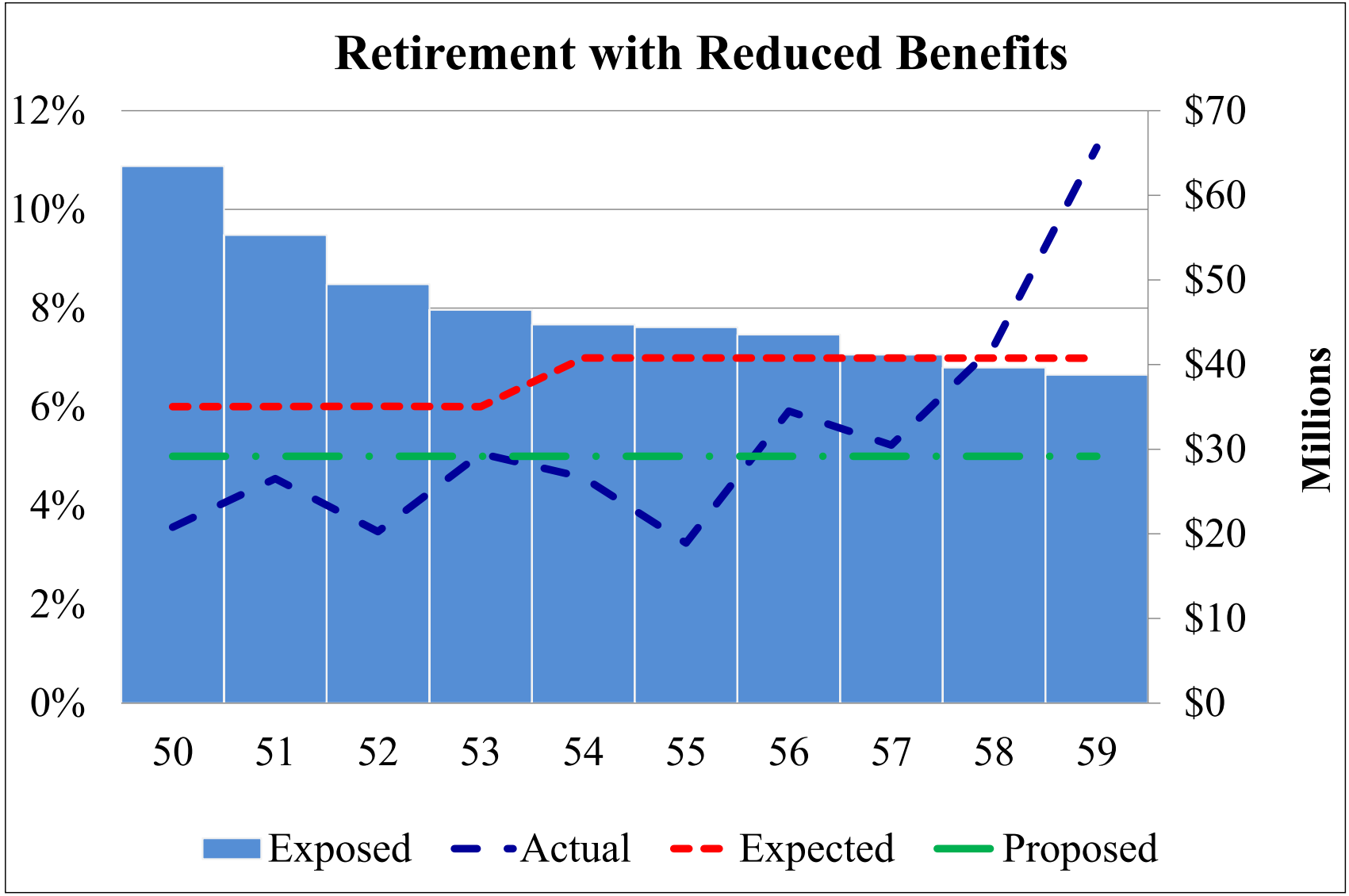
TRS Demographic Assumptions (Service Retirements)

- Rates of retirement
  - Tier One
    - Unreduced retirement
      - Age 60 with 5 years of service
      - 25 years of service
    - Reduced Retirement
      - Age 50 with 5 years of service
  - Tier Two
    - Unreduced retirement
      - Age 60 with 5 years of service
      - Age 55 with 30 years of service
    - Reduced Retirement
      - Age 55 with 5 years of service

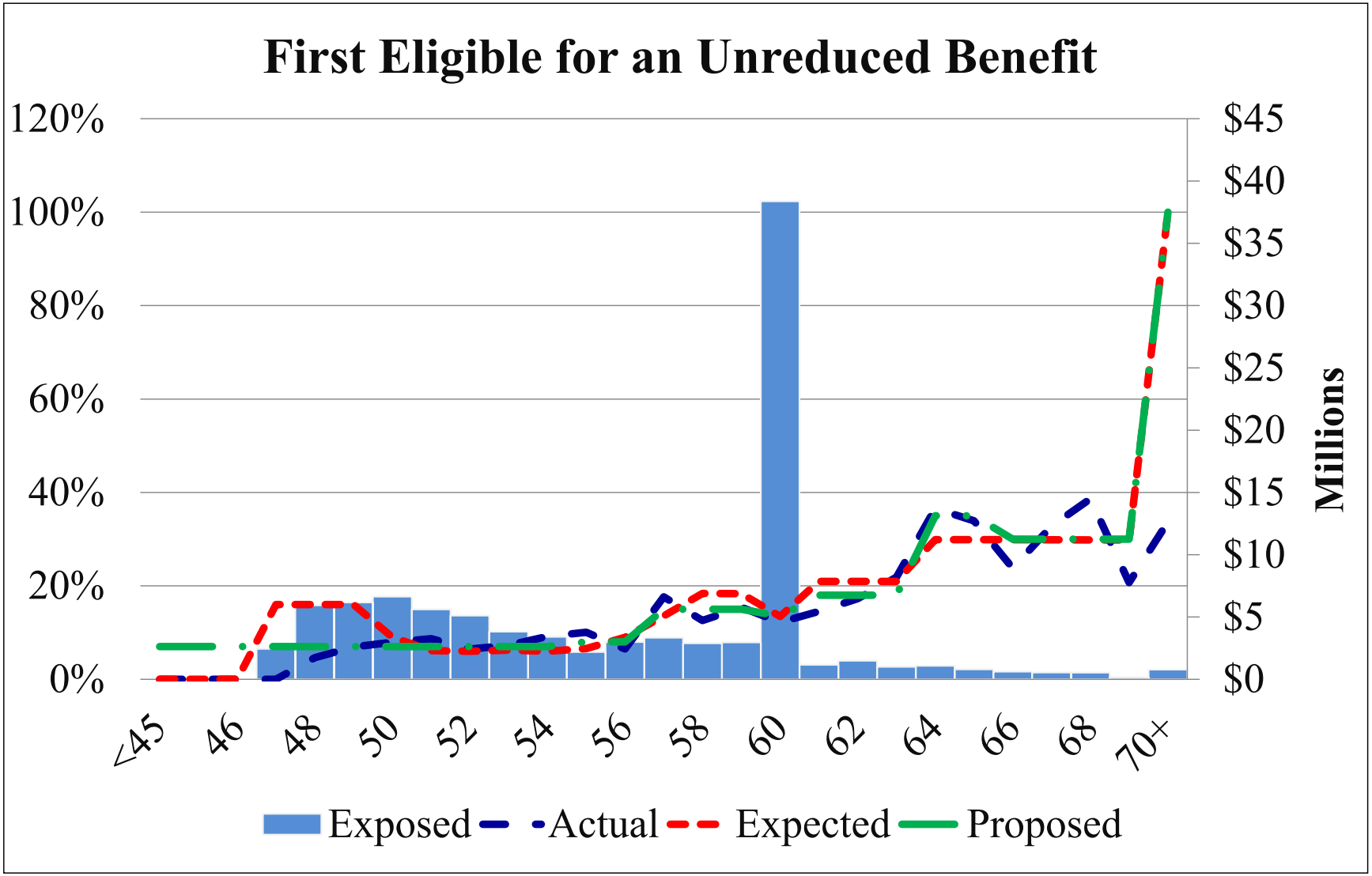
TRS Demographic Assumptions (Service Retirements)

- Rates of retirement
  - Studied in the following groups
    - Unreduced retirement (first eligibility)
    - Unreduced retirement (beyond first eligibility)
    - Reduced Retirement
  - A/E ratio under current assumptions
    - Unreduced retirement (first eligibility) – 85%
    - Unreduced retirement (beyond first eligibility) – 104%
    - Reduced Retirement – 80%
  - A/E ratio under proposed assumptions
    - Unreduced retirement (first eligibility) – 95%
    - Unreduced retirement (beyond first eligibility) – 98%
    - Reduced Retirement – 104%

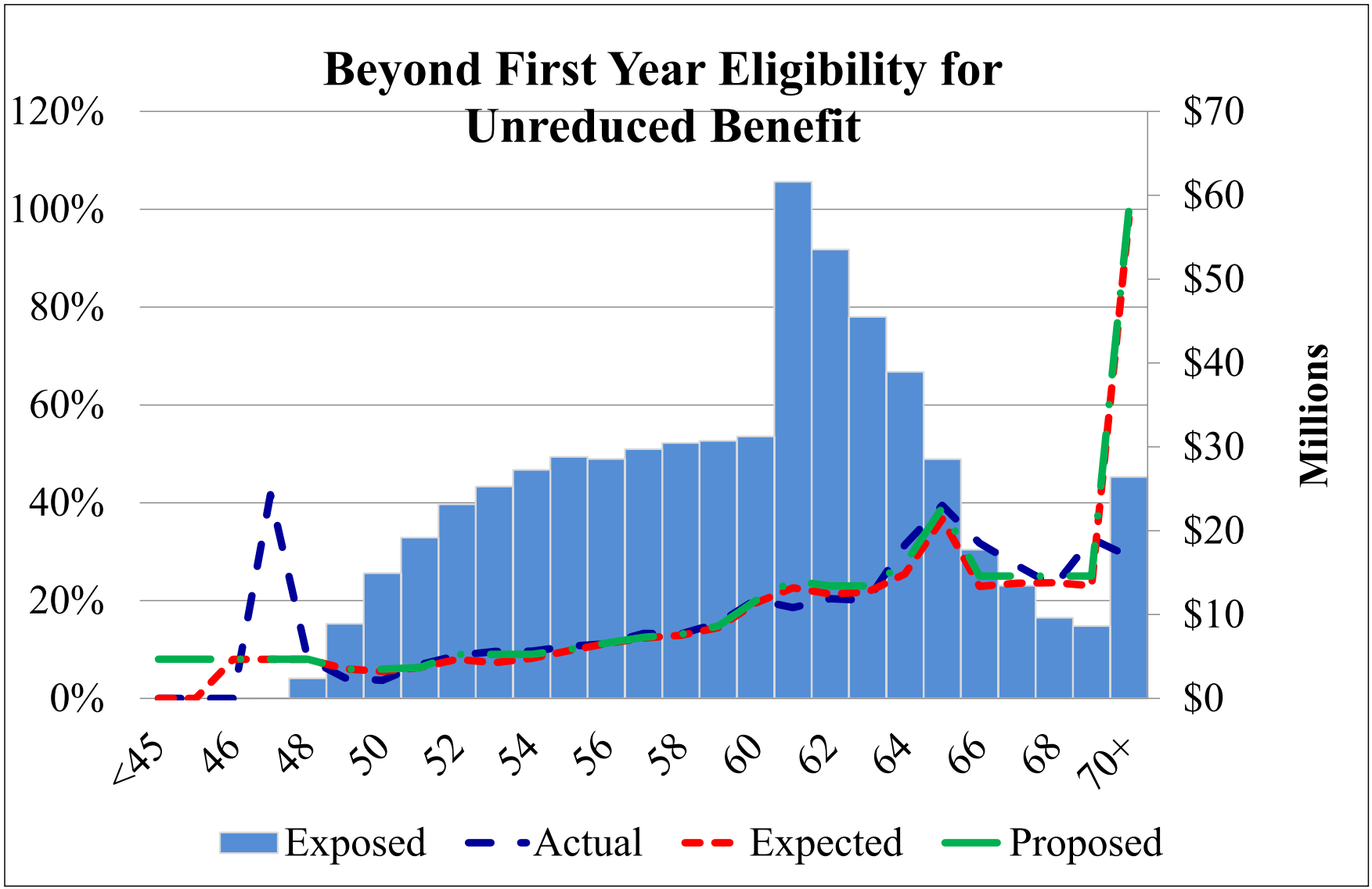
TRS Demographic Assumptions (Service Retirements)



TRS Demographic Assumptions (Service Retirements)



TRS Demographic Assumptions (Service Retirements)



Demographic Assumptions (Service Retirements)

	A/E Ratio (Current Assumption)	A/E Ratio (Recommended Assumption)
JRS	177.18%	88.72%
HPORS	169.75%	123.38%
SRS	158.98%	87.80%
GWPORS	102.60%	103.95%
MPORS	101.57%	99.02%
FURS	112.93%	82.94%
VFCA	82.93%	95.75%

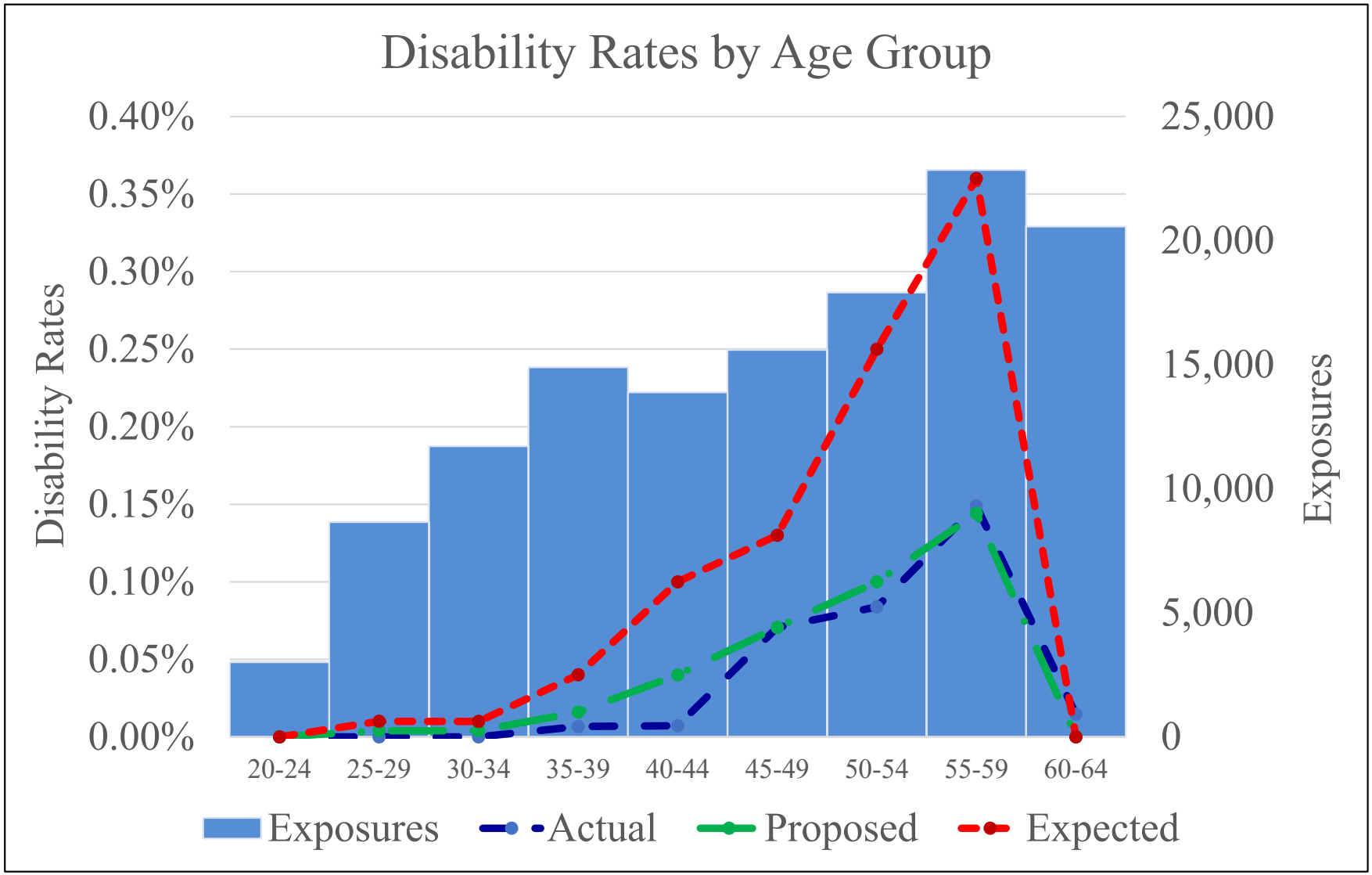
PERS Demographic Assumptions (Disability Retirements)

- Experience yielded an actual/expected ratio of 38%.
- An actual/expected ratio that is less than 100% indicates that the number of disability retirements over the experience period was less than anticipated.
- Disability retirements represent a small component of the Retirement System's obligation.
- Recommend reducing the assumed rates of disability.
  - Recommended rates produce an actual/expected ratio of 92%

TRS Demographic Assumptions (Disability Retirements)

- Rates of disability
  - Used to determine the expected number of members who will become disabled during the year
  - Studied based on age
  - Headcount weighted analysis performed
  - A/E ratio under current assumptions – 73%
  - Current assumption overestimated the number of disability retirements. If we combine current experience with experience from two prior experience studies, the total number of disability retirements was 103 compared to the expected number of disability retirements which was 117. The A/E ratio on this basis is 88%.
  - Over the short-term, the assumption overestimated the number of retirements, but over longer experience periods, the assumption has been a closer estimate of actual experience. In general, there is not enough information to warrant revising assumed disability retirements at this time.

PERS Demographic Assumptions (Disability Retirements)



Demographic Assumptions (Disability Retirements)

	A/E Ratio (Current Assumption)	A/E Ratio (Recommended Assumption)
PERS & JRS	38.34%	92.13%
Public Safety	71.41%	84.05%

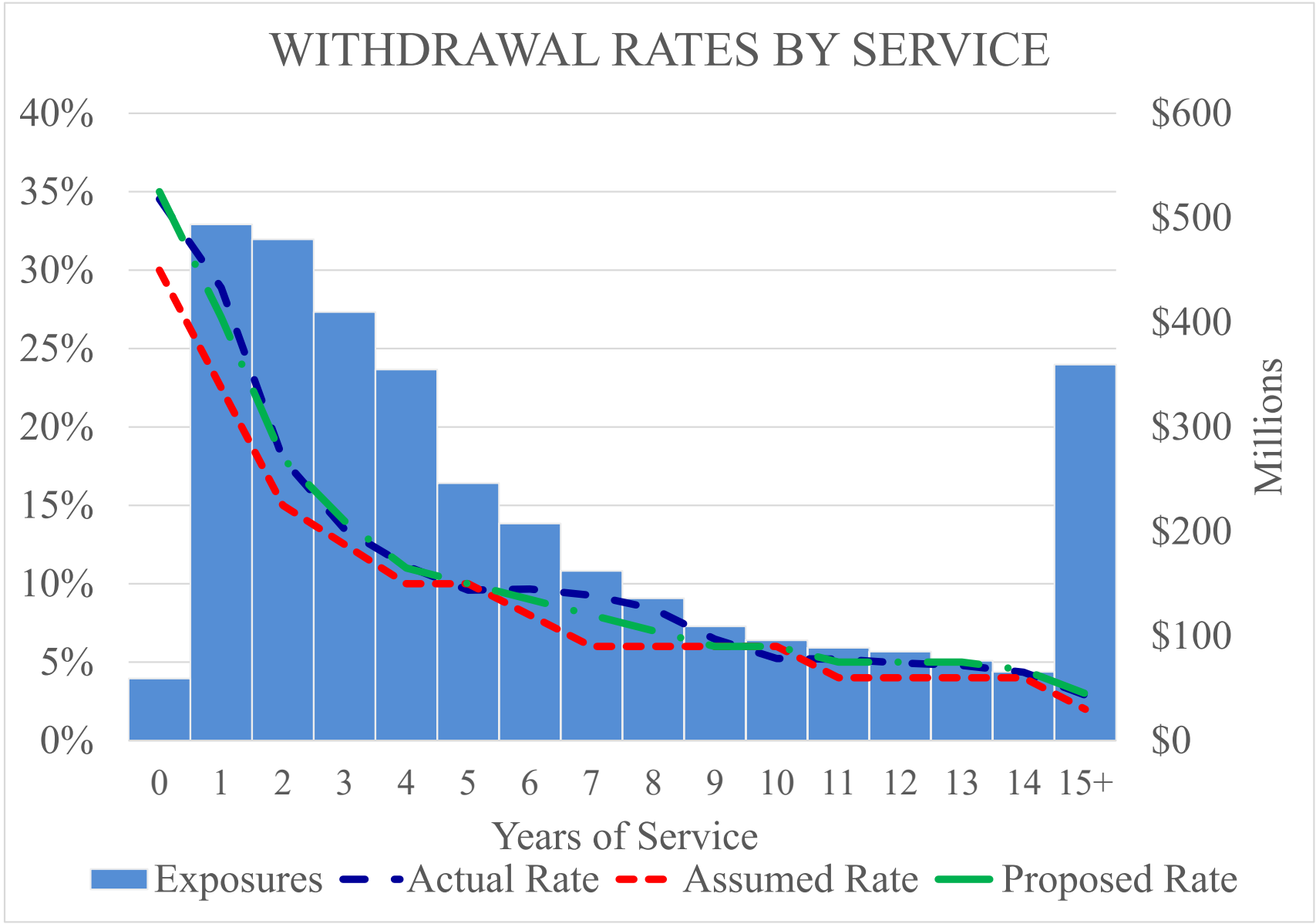
Demographic Assumptions (Withdrawal Rates)

- Rates of Withdrawal
  - Used to determine the expected number of separations from active service that will occur prior to becoming eligible for retirement as a result of resignation or dismissal
  - Studied separately for full-time/part-time members without regard to gender and based on years of service
  - Liability weighted analysis performed
    - Members who have a higher liability have a larger impact on the gains and losses that occur in the annual valuation
    - Studied on a liability basis using compensation and service as a proxy for the member's liability

PERS Demographic Assumptions (Withdrawal Rates)

- Experience yielded actual/expected ratio of 119%.
- A ratio greater than 100% indicates that there were more withdrawals than expected.
- Overall, the assumed rates of withdrawal underestimated the number withdrawals during the experience period.
- Recommend revising assumption to better match experience
  - Recommended assumption produces an actual/expected ratio of 102%

PERS Demographic Assumptions (Withdrawal Rates)



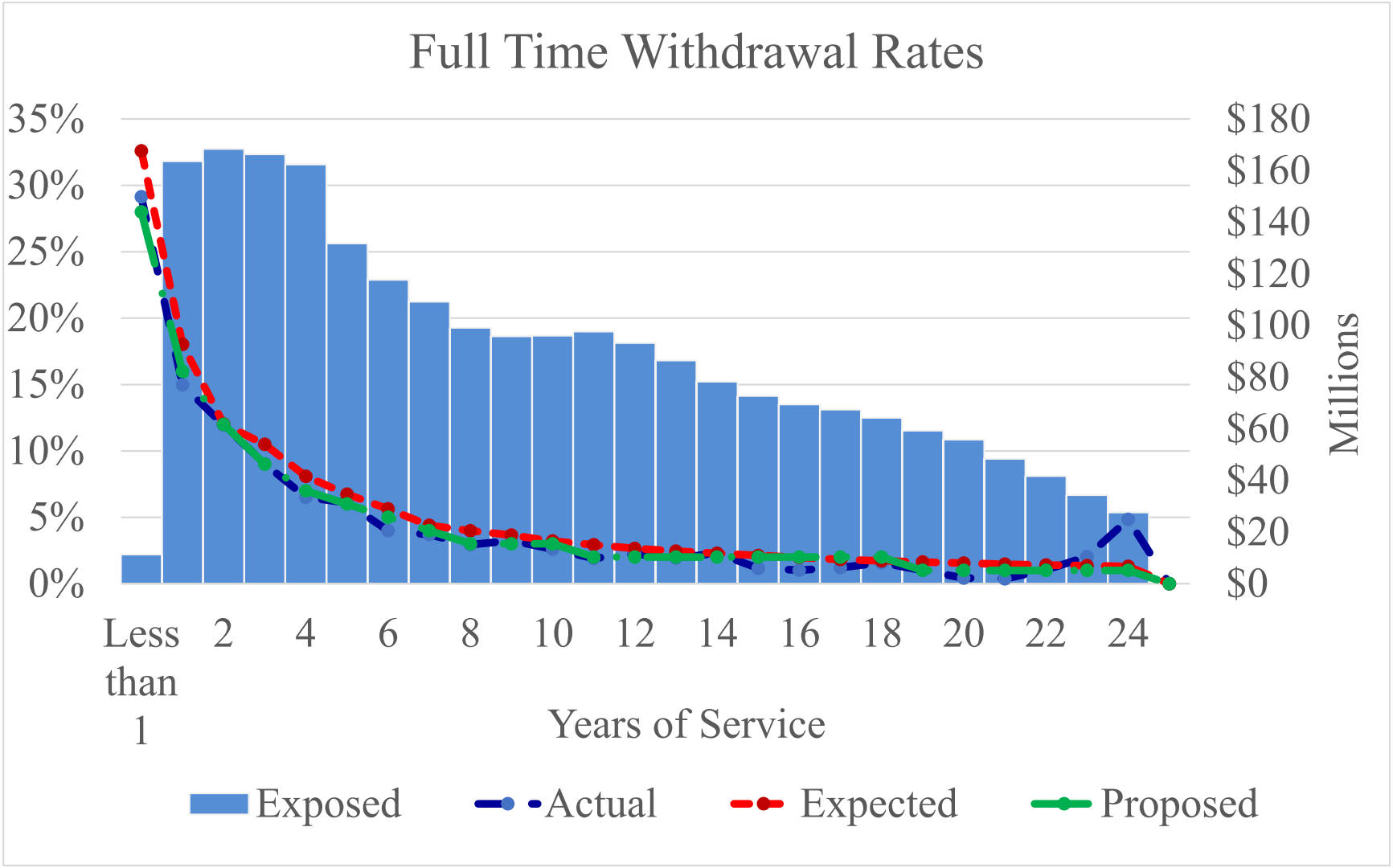
Demographic Assumptions (Withdrawal Rates)

	A/E Ratio (Current Assumption)	A/E Ratio (Recommended Assumption)
PERS	119.31%	102.44%
JRS	N/A	N/A
HPORS	103.30%	103.30%
SRS	133.49%	105.72%
GWPORS	110.98%	106.05%
MPORS	117.30%	112.77%
FURS	130.00%	120.55%
VFCA	93.91%	93.91%

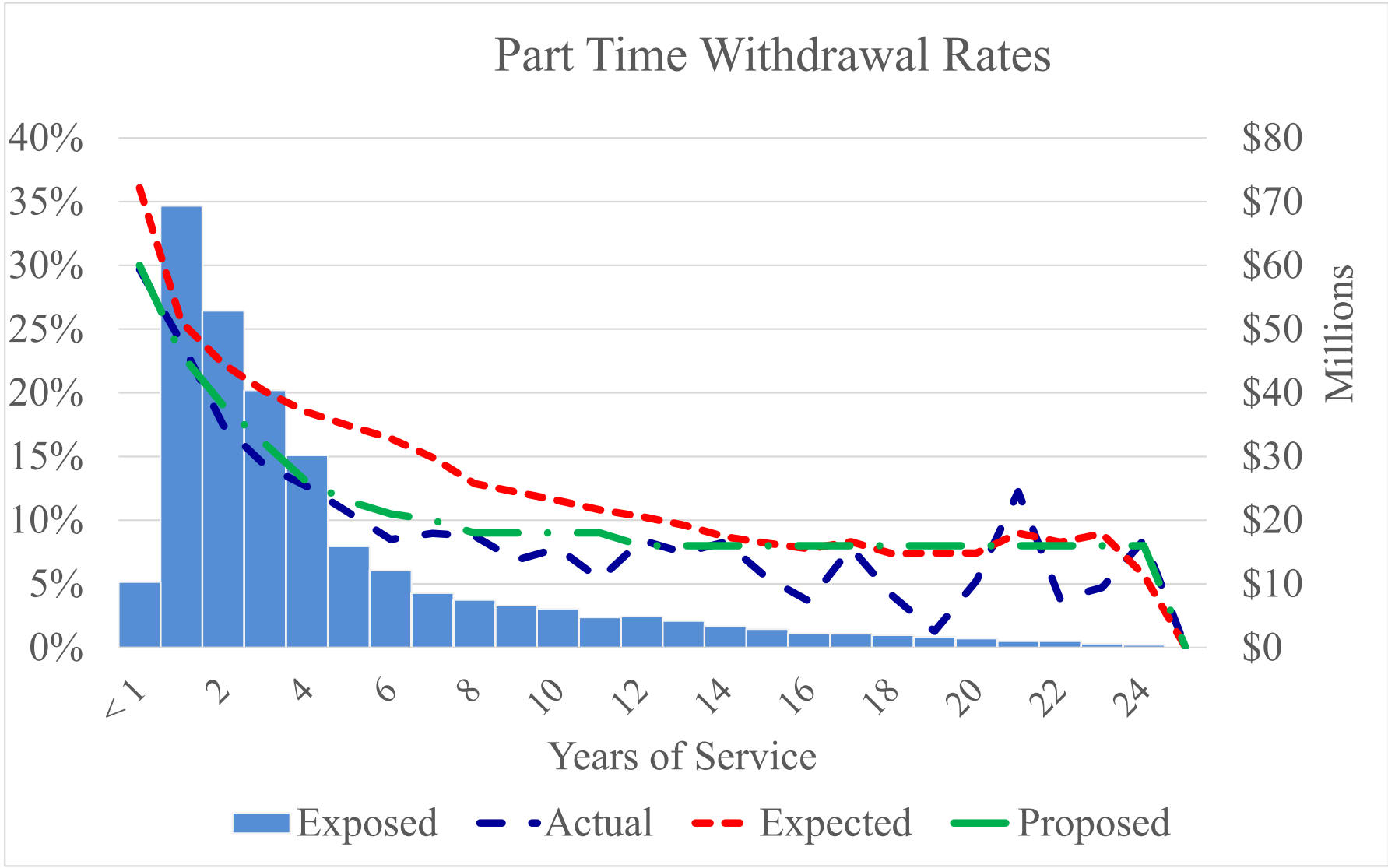
TRS Demographic Assumptions (Withdrawal Rates)

- Rates of Withdrawal
  - During the experience period, the current assumption overestimated the expected number of withdrawals for member with less than 12 years of service.
  - Recommend updating the withdrawal assumption to reflect recent experience
  - A/E ratio under current assumptions
    - Full Time - 85%
    - Part Time – 78%
  - A/E ratio under proposed assumptions
    - Full Time – 96%
    - Part Time – 95%

Demographic Assumptions (Withdrawal Rates)



Demographic Assumptions (Withdrawal Rates)



PERS Demographic Assumptions (Salary Increase Experience)

- Experience yields an actual/expected ratio equal to 99.9%.
- In general, salary increases were as anticipated for the investigation period.
- We have recommended no change in wage inflation, which is a component of salary scale.
- In addition, we recommend no change to the merit component of the salary scales at this time.

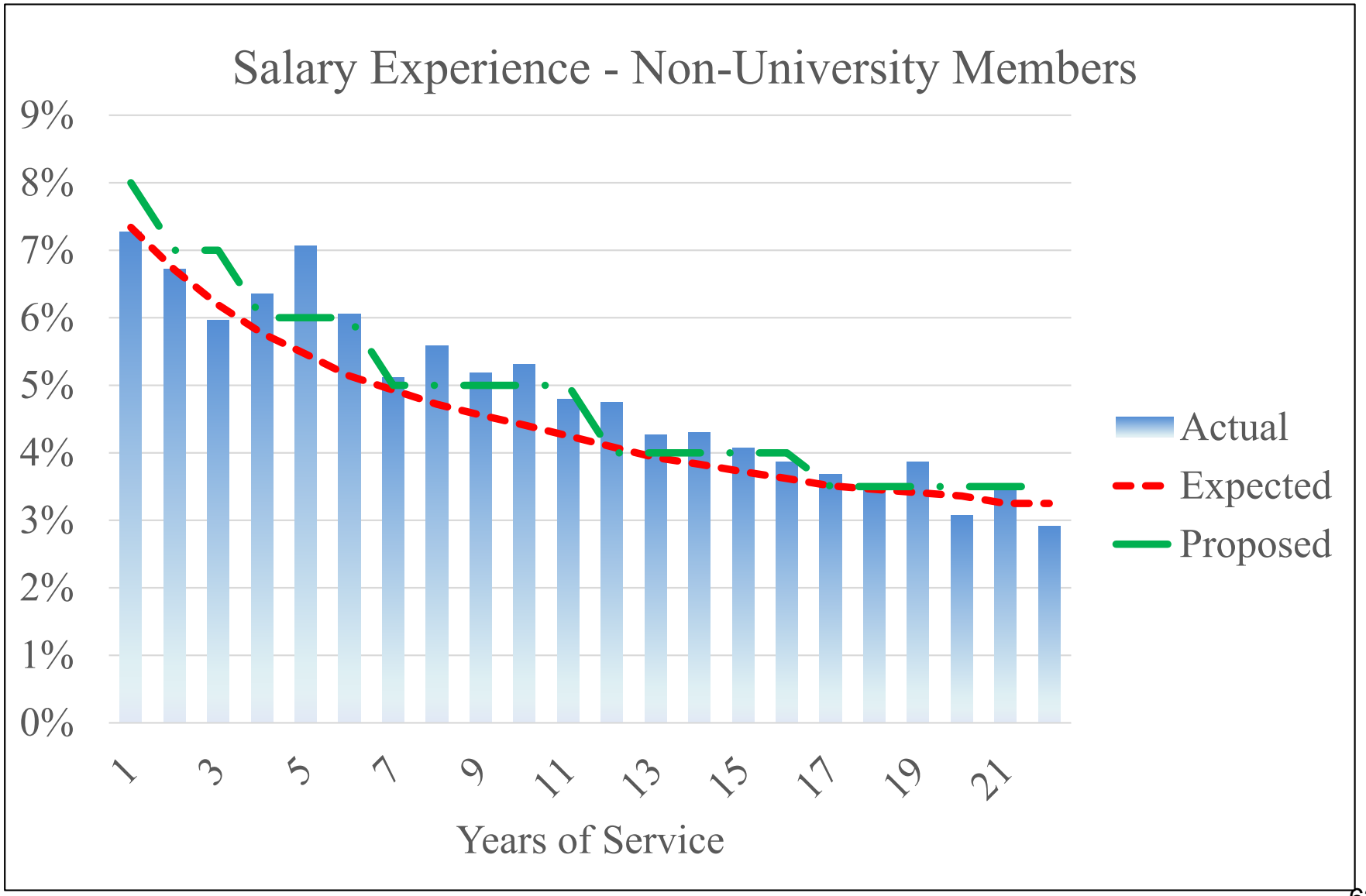
Public Safety Demographic Assumptions (Salary Increase Experience)

- Experience yields an actual/expected ratio equal to 100.7%.
- In general, salary increases were as anticipated for the investigation period for 0 to 6 years of service and higher that anticipated for years of service greater than 7 seven years of service.
- We have recommended no change in wage inflation, which is a component of salary scale.
- We recommend increasing the merit scale slightly for years of service for 7 + years of service.
- The actual/expected ratio under the proposed assumption is 100.1%.

TRS Demographic Assumptions (Salary Increase Experience)

- Experience yielded an actual/expected ratio of 101% and 99% for non-university members and university members.
- Recommend adjustment to the merit component of the salary scales for non-university members to provide a better fit.
- The increase in real wage growth assumption (covered later) was reflected in the final salary scales.

Demographic Assumptions (Salary Increase Experience)



Demographic Assumptions
Other Systems

Retirement Plan	Assumption Changes
Public Employees' Retirement System Long-Term Disability Plan	Mortality, Retirement, Disability, Withdrawal
Teachers Retirement System	Mortality, Retirement, Withdrawal, Merit Scale
Judges' Retirement System	Mortality, Retirement, Disability
Sheriffs' Retirement System	Mortality, Retirement, Disability, Withdrawal, Merit Scale
Game Wardens' and Peace Officers' Retirement System	Mortality, Retirement, Disability, Withdrawal, Merit Scale
Highway Patrol Officers' Retirement System	Mortality, Retirement, Disability, Merit Scale
Municipal Police Officers' Retirement System	Mortality, Retirement, Disability, Withdrawal, Merit Scale
Firefighters' United Retirement System	Mortality, Retirement, Disability, Withdrawal, Merit Scale
Volunteer Firefighters' Compensation Act	Mortality, Retirement

Other Assumptions

- Interest on Member Contributions – Recommend an assumed interest on members contributions to the rate adopted by the Board each year.

Actuarial Methods

- Actuarial Cost Method
  - Recommend no change in the Entry Age Normal Cost Method for all plans
- Actuarial Smoothing of Assets
  - Recommend no change in 4-year smoothing of market value gains and losses
- Amortization of Unfunded Accrued Liability (UAL)
  - Recommend no change in Level Percent of Payroll Amortization Payment Method
    - **Recommend payroll growth assumption of 3.25%**
  - UAL is amortized as one single amount each valuation
  - Amortization period is "open" and is solved for each valuation
  - Result depends on UAL and fixed contribution rate

Impact of Recommendations (Amortization Period)

	Before Changes	Demographic Changes	Economic & Demographic Changes
Public Employees' Retirement System	28	26	37
Teachers Retirement System	24	23	27
Public Employees' Retirement System Long-Term Disability Plan	0	0	0
Judges' Retirement System	0	0	0
Sheriffs' Retirement System	18	16	41
Game Wardens' and Peace Officers' Retirement System	35	29	Infinite
Highway Patrol Officers' Retirement System	26	30	62
Municipal Police Officers' Retirement System	15	15	26
Firefighters' United Retirement System	6	8	14
Volunteer Firefighters' Compensation Act	1	0	1

Impact of Recommendations (Funded Ratio)

	Before Changes	Demographic Changes	Economic & Demographic Changes
Public Employees' Retirement System	76.34%	76.46%	73.70%
Teachers Retirement System	71.43%	72.31%	70.61%
Public Employees' Retirement System Long-Term Disability Plan	134.85%	385.59%	484.89%
Judges' Retirement System	176.55%	176.80%	171.35%
Sheriffs' Retirement System	83.40%	83.01%	78.10%
Game Wardens' and Peace Officers' Retirement System	85.06%	85.42%	79.35%
Highway Patrol Officers' Retirement System	66.67%	66.00%	62.69%
Municipal Police Officers' Retirement System	74.31%	73.50%	69.30%
Firefighters' United Retirement System	85.97%	83.67%	78.48%
Volunteer Firefighters' Compensation Act	99.98%	103.16%	100.00%

Actuarial Certification and Disclosures

- Todd B. Green, is a member of the American Academy of Actuaries, Associate of the Society of Actuaries, and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.