Milliman

Economic Assumptions & Actuarial Methods

OREGON PUBLIC EMPLOYEES RETIREMENT SYSTEM

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May 30, 2025

Four-Meeting Process – Assumptions & Methods

- March 31: Summary of process, background, and areas of focus
- May 28: Joint meeting with Oregon Investment Council (OIC)
  - Assumed rate – outlooks from OIC's consultants, Milliman
- **May 30: Economic assumptions, system funding methods**
  - **Inflation and system payroll growth**
  - **Actuarial methods, including amortization and rate collaring policy**
- July 25: Demographic assumptions, Board direction to actuary
  - Member-specific assumptions based on study of recent PERS experience
  - Assumptions and methods adopted for use in:
    - 12/31/2024 actuarial valuation with advisory 2027-2029 contribution rates
    - 12/31/2025 actuarial valuation with proposed final 2027-2029 contribution rates

Executive Summary

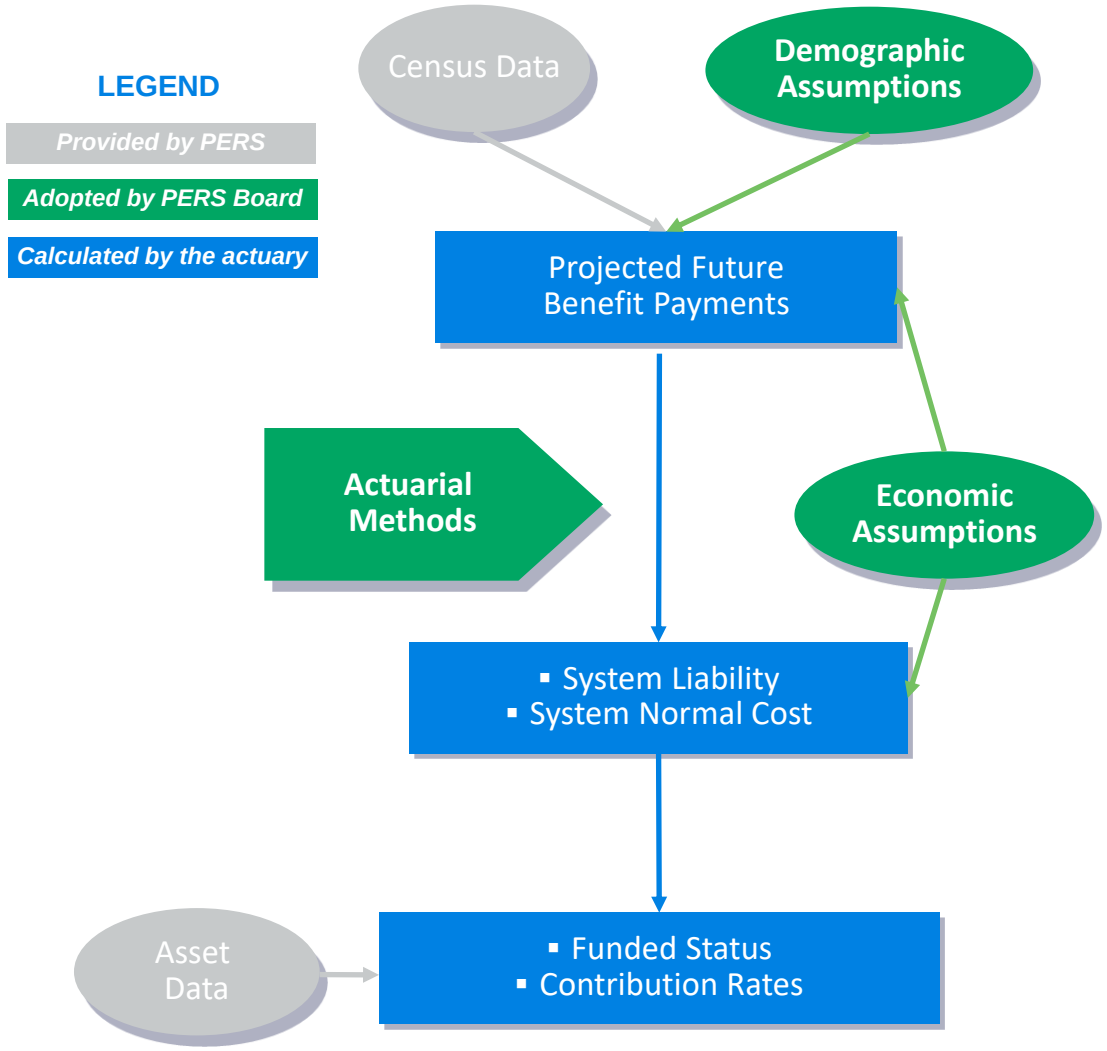
- Current economic assumptions are still reasonable based on review of updated data and expectations

- Investment return assumption:
  - Current capital market outlooks have median expected returns above 6.90%
  - Increasing (decreasing) the assumption 0.10% is estimated to decrease (increase) the system-wide 2027-29 uncollared total base contribution rate about 0.75% of pay

- The PERS Board will need to decide how to reflect Senate Bill 849 in the rate collar applied for School District 2027-29 biennium contribution rates
  - Decision can be made with other experience study decisions at July meeting

Two-Year Rate-Setting Cycle

- **July 2025: Assumptions & methods adopted by Board in consultation with the actuary**
- September 2025: System-wide 12/31/24 actuarial valuation results
- December 2025: Advisory 2027-2029 employer-specific contribution rates
- July 2026: System-wide 12/31/25 actuarial valuation results
- September 2026: Disclosure & adoption of employer-specific **2027-2029 contribution rates**



Valuation Process and Timeline

- Actuarial valuations are conducted annually
  - Alternate between “rate-setting” and “advisory” valuations
  - This valuation as of 12/31/2024 is advisory
- Board adopts contribution rates developed in rate-setting valuations, and those rates go into effect 18 months after the valuation date

Valuation Date	Employer Contribution Rates
12/31/2021 →	July 2023 – June 2025
12/31/2023 →	July 2025 – June 2027
12/31/2025 →	July 2027 – June 2029

Summary of Assumptions and Methods to Review

Economic Assumptions

- **Inflation**
- **Real wage growth**
- **System payroll growth**
- **Long-term investment return**
- Healthcare cost trend

Actuarial Methods

- **Actuarial cost method**
- **Amortization policy**
  - **UAL (shortfall) amortization**
  - **Side account / Pre-SLGRP rate adjustments**
- **Rate collar**
- **Contribution lag adjustment**

Demographic Assumptions

- Mortality
- Retirement
- Pre-retirement termination
- Disability
- Individual salary increases
- Final average salary adjustments
- Member redirect offsets
- RHIA & RHIPA assumptions

*Background information for **bold** topics discussed on following slides*

Guiding Objectives - Methods & Assumptions

- Transparent
- Predictable and stable rates
- Protect funded status
- Equitable across generations
- Actuarially sound
- GASB compliant

Some of the objectives can conflict, particularly in periods with significant volatility in investment return or projected benefit levels. Overall system funding policies should seek an appropriate balance between conflicting objectives.

Governance Structure

- Benefits:
  - Plan design set by Oregon Legislature
  - Subject to judicial review
- Earnings:
  - Asset allocation set by OIC
  - Actual returns determined by market
- Contributions:
  - Funding, including methods & assumptions, set by PERS Board
  - Since contributions are the balancing item in the fundamental cost equation, PERS Board policies primarily affect the **timing** of contributions
  - Different actuarial methods and assumptions produce different projected future contribution patterns

The Fundamental Cost Equation

- Long-term program costs are the contributions, which are governed by the “fundamental cost equation”:

BENEFITS =

CONTRIBUTIONS +

EARNINGS

Review of Non-Investment Economic Assumptions

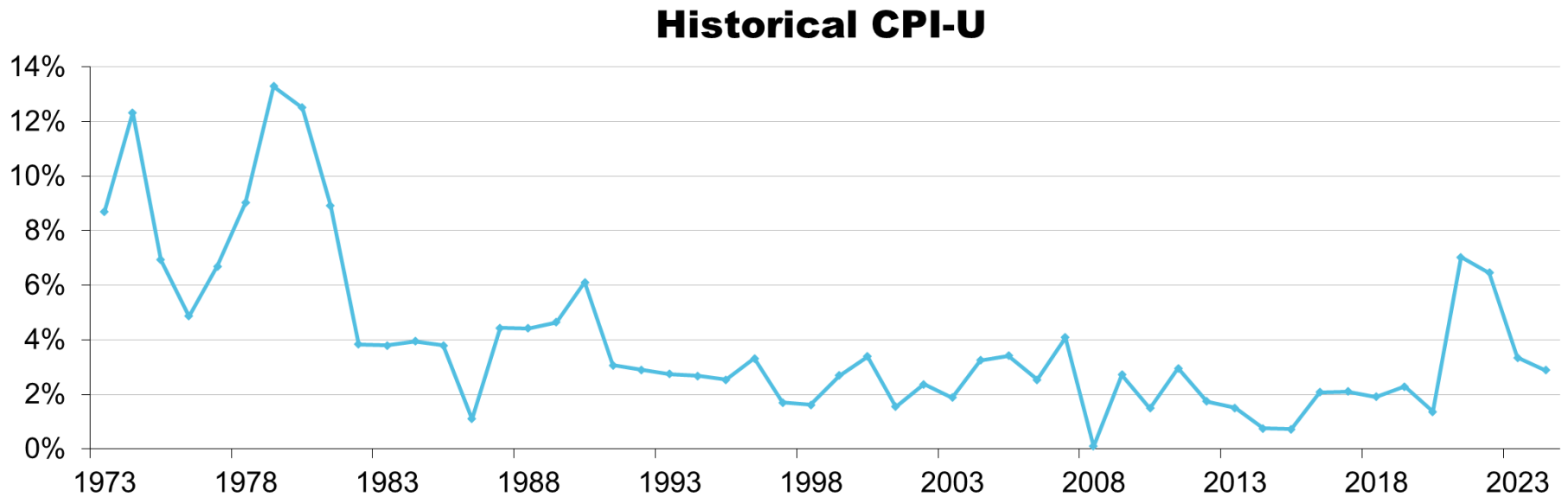
Non-Investment Economic Assumptions to Be Reviewed

	12/31/2023 Valuation "Current" Assumptions
Inflation	2.4%
Real Wage Growth	1.0%
System Payroll Growth	3.4%
Administrative Expenses	$64 million

Economic Assumptions
Inflation

- The inflation assumption affects other assumptions, including system payroll growth, investment return, and health care inflation
- Inflation can vary significantly over time; recent inflation has been much higher than the long-term expectation

Period Ending 12/31/2024	Average Inflation
10 years	3.00%
20 years	2.56%
30 years	2.52%
40 years	2.78%



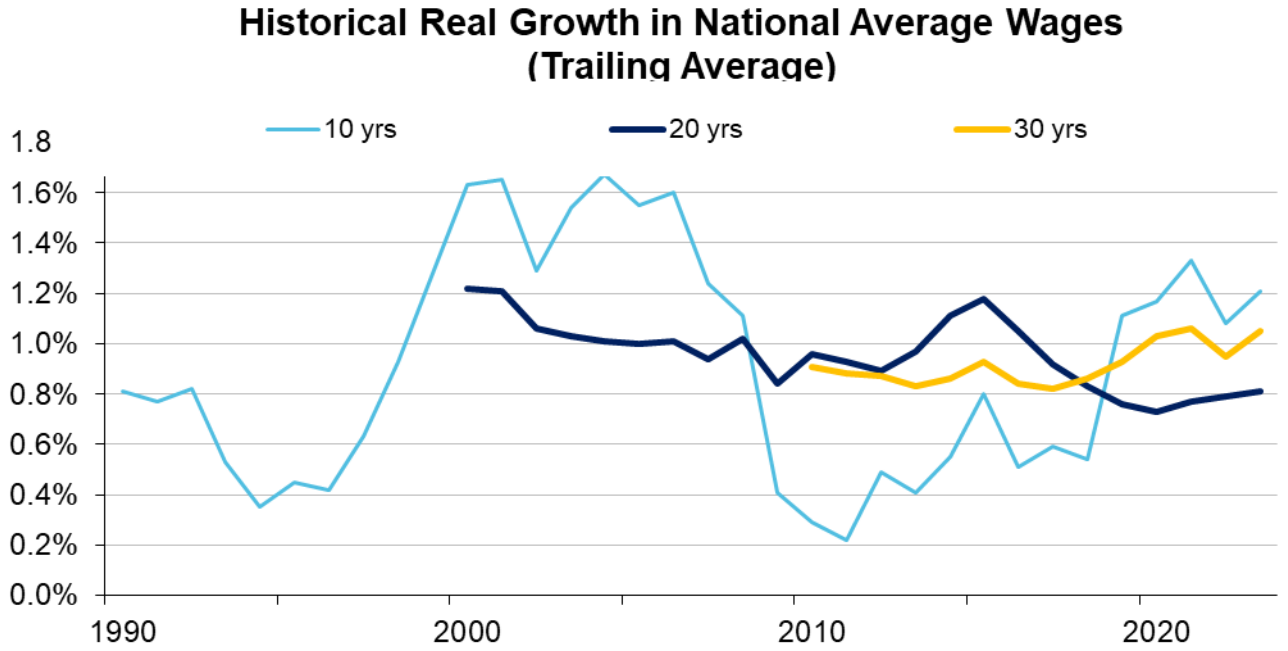
Economic Assumptions
Inflation

- One estimate of future inflation can be derived from comparing yields on Treasury securities and Treasury Inflation Protected Securities (TIPS)
- We also review expert forecasts of long-term inflation used for other similar purposes:
  - Social Security's current "intermediate cost" 30-year average inflation assumption is 2.41%, with an ultimate annual inflation of 2.40%
  - Cleveland Fed Inflation Forecast Model as of January 2025 results in 10-year average inflation of 2.44% and 30-year average inflation of 2.52%
- **We recommend maintaining the current assumption of 2.4%, which is reasonable**

As of 12/31/2024		
	10 Year	30 Year
Treasury Yield	4.58%	4.78%
TIPS Yield	2.24%	2.48%
"Breakeven" Inflation	**2.34%**	**2.30%**

Economic Assumptions
Real Wage Growth

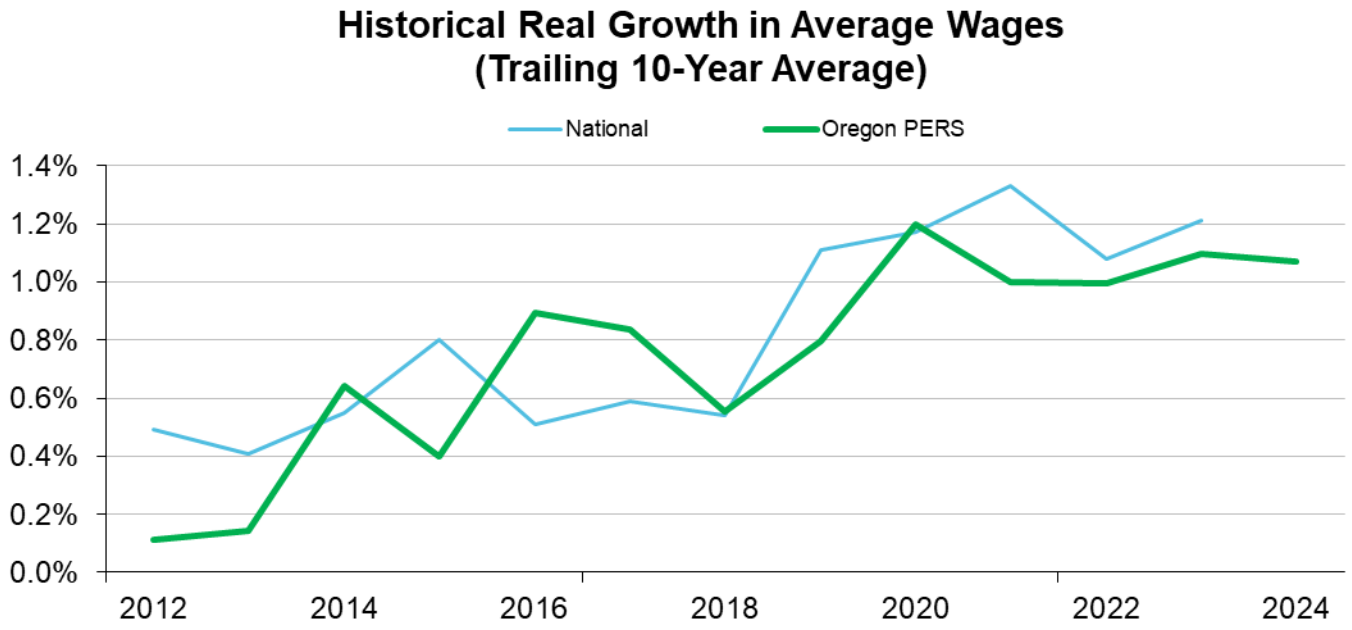
- Current assumption is 1.0%
- An individual member's assumed annual salary increase is composed of:
  - Inflation, plus
  - Real wage growth, plus
  - Individual merit/longevity component
- Real wage growth represents the increase in wages in excess of inflation for the entire group due to improvements in productivity and competitive market pressures
- Social Security's long-term "intermediate cost" real wage growth assumption is 1.14%



Most Recently Available	Average Real Wage Growth
10 Years	1.21%
20 Years	0.81%
30 Years	1.05%
40 Years	0.92%

Economic Assumptions
Real Wage Growth

- Trailing 10-year average of Oregon PERS' experience with real wage growth over has largely paralleled national trends, though lagged behind on average
- In our opinion, **the current assumption of 1.0% is reasonable**



Most Recently Available*	National	Oregon PERS
10 Years	1.21%	1.07%
20 Years	0.81%	0.86%

** National reflects data through 2023; Oregon PERS reflects data through 2024*

Economic Assumptions
System Payroll Growth

- Overall system payroll growth is assumed to equal the sum of:
  - Inflation
  - Real wage growth
  - Adjustment for expected system growth/decline (typically 0% if expecting steady population)
- The system payroll growth assumption determines the shape of the curve of payments to amortize the unfunded liability
- With an inflation assumption of 2.4% and a real wage growth assumption of 1.0%, the system payroll growth assumption is currently 3.4%
  - **A 3.4% assumption is reasonable** based on recent historical experience for Oregon PERS

Trailing Period as of 12/31/2023	Oregon PERS Average Annualized Growth in Valuation Payroll	Oregon PERS Average Annualized Growth in Average Payroll
5 Years	7.1%	5.4%
10 Years	5.9%	4.1%
15 Years	4.3%	3.5%
20 Years	4.6%	3.4%

Economic Assumptions
Administrative Expenses

- Actual administrative expenses for recent years are shown below
  - SB 1049 drove increase in pension administrative expenses, expected to be replaced by modernization costs

($ millions)	System-Wide (Tier One/Tier Two + OPSRP) Pension Administration Expenses		
Year	Actual Expenses	% of Beginning of Year Assets	% of Projected Payroll
2020	$56.5	0.09%	0.49%
2021	$59.9	0.09%	0.50%
2022	$61.5	0.08%	0.48%
2023	$66.2	0.09%	0.48%
2024	$68.5	0.09%	0.45%

  - Overall, 2024 administrative expenses were 0.09% of total assets, or 0.45% of projected payroll
  - **Proposed assumed annual expenses for 2025 and 2026: $72 million**

Non-Investment Economic Assumptions to Be Reviewed

	12/31/2023 Valuation Assumptions	12/31/2024 Valuation Proposed* Assumptions
Inflation	2.4%	2.4%
Real Wage Growth	1.0%	1.0%
System Payroll Growth	3.4%	3.4%
Administrative Expenses	$64 million	$72 million

No explicit assumption is made for investment-related expenses, which are accounted for implicitly in the analysis of the long-term investment return assumption.

*No action is requested on “proposed” assumptions today, since all assumptions and methods will be adopted at the July 2025 Board meeting

Long-Term Investment Return Assumption

Summary - Investment Return Assumption

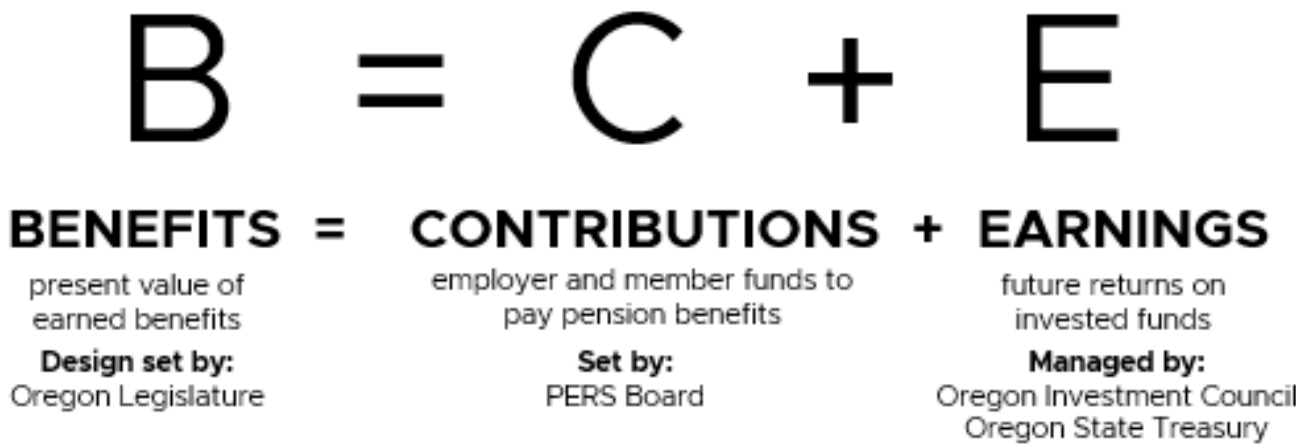
- No decision on the assumption is made at today's meeting
- Current capital market outlooks show expected returns above the 6.90% assumption adopted in 2021 and 2023
  - Outlooks are based on market conditions as of the start of 2025
- While the median result from both OIC's outlook and Milliman's are above the current 6.90% long-term future investment return assumption, the Board may want to leave the assumption unchanged
  - The lowering of the assumption was due to a decade-long trend in market conditions; while outlooks have risen, significant volatility and uncertainty remain
  - Using an assumption that is in the lower part of a reasonable range provides for some conservatism in the rate-setting process
  - Consistent with current practice for other large pension systems, which generally have not increased their return assumption

Long-Term Investment Return Assumption

- Uses of the investment return assumption
  - As a “discount rate” for establishing the:
    - Actuarial accrued liability, which is a net present value
    - Associated unfunded actuarial liability, also called the UAL or actuarial shortfall
  - Guaranteed crediting level for regular Tier One active member account balances
  - Annuitization rate for converting member account balances to lifetime money match monthly benefits

Reflecting expectations for both investment earnings and benefit levels for certain members, the assumption helps set a reasonable and appropriate budgeting glide path for projected employer contribution rates

Use of the Assumed Rate



- "B" is predictable with a relatively high degree of certainty
- "E" is the unpredictable **actual** future investment return on PERS assets
- "C" is the balancing item --- it must provide to "B" what "E" fails to cover

- The **assumed rate** is the Board's estimate of "E" to prudently set "C"
- The Board's decision on "E" does **not** affect actual future earnings

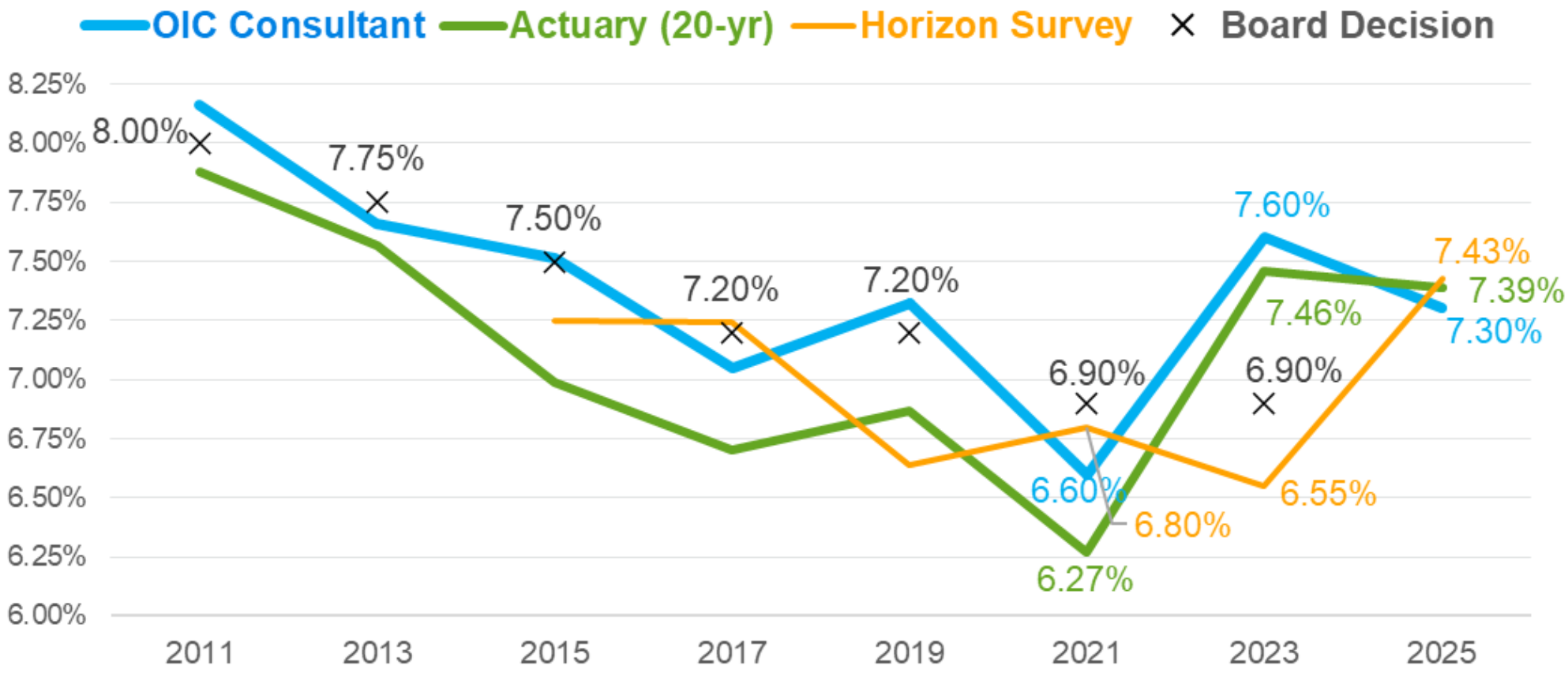
Investment Return 50th Percentile Outlooks

- We applied a standard mean/variance model to calculate 50th percentile return estimates based on capital market outlook assumptions from three sources
  - OIC assumption – reflects collaboration of OST staff and consultants Meketa & Aon
  - Milliman
  - 2024 Horizon survey of 10-year capital market assumptions (survey of 41 advisors)
    - The Horizon survey was published in August 2024, based on outlooks from the first half of 2024
- Estimates do not reflect any possible "alpha" due to selected managers potentially outperforming market benchmarks over the long term, net of fees
- Today's speakers are not credentialed investment advisors
  - We are presenting Milliman capital market outlook model results based on assumptions developed by Milliman's credentialed investment professionals

Details on Milliman and Horizon outlook assumptions are in the Appendix

Investment Return 50th Percentile Outlooks

Geometric Returns from Outlook Models in Current and Prior Seven Reviews



Horizon survey has a larger time lag than the other two outlooks

Investment Return 50th Percentile Outlooks

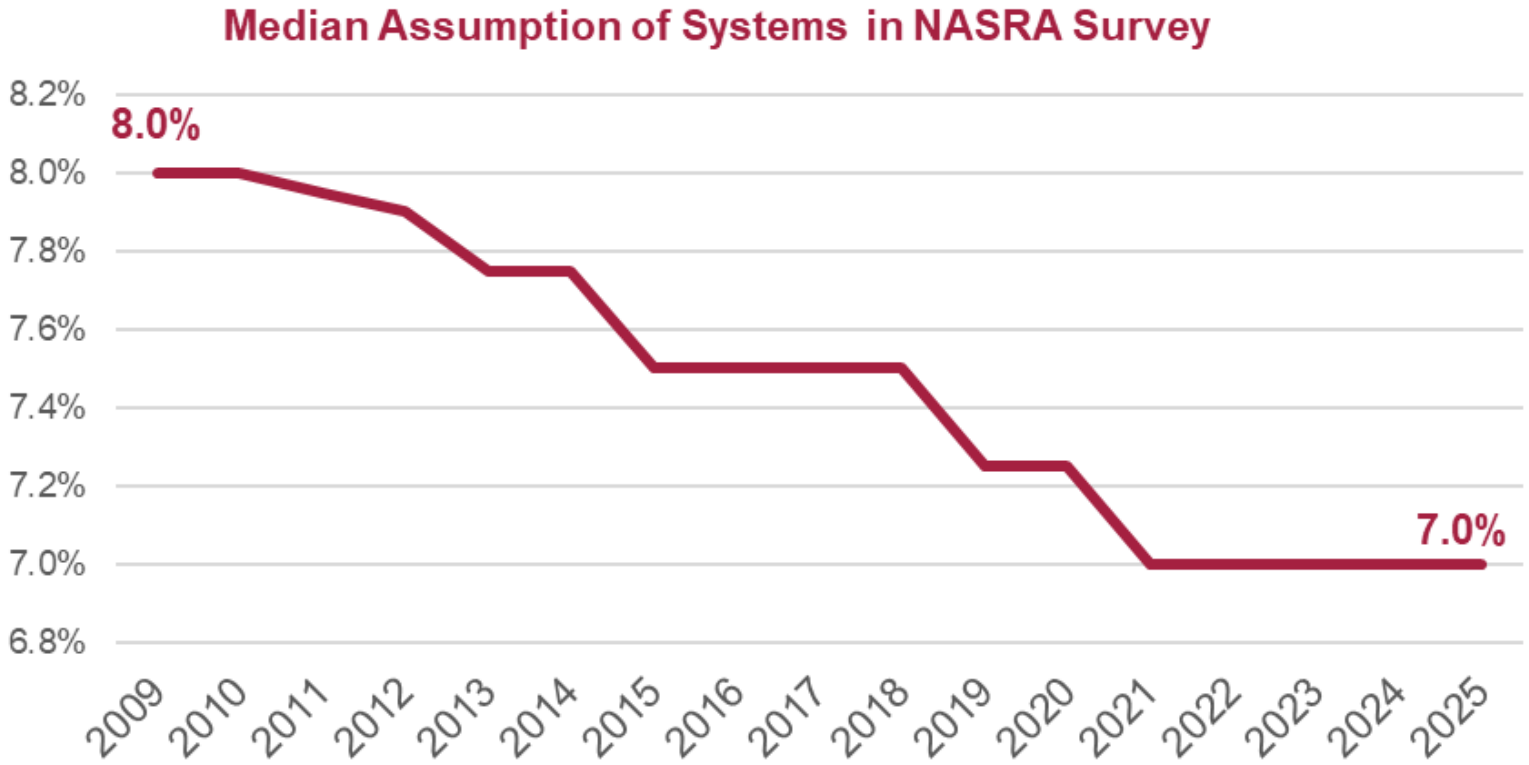
- Estimates are shown based on the OIC's long-term asset allocation

	OIC Consultant	Milliman	Milliman	Horizon
Median Annualized Return	**7.3%**	**7.07%**	**7.39%**	**7.43%**
Assumed Inflation	2.3%	2.37%	2.31%	2.42%
Timeframe Modeled	10 years	10 years	20 years	10 years

The median returns shown above are geometric annualized average returns over the timeframes indicated above for each provided set of capital market assumptions

Comparison to Peer Systems

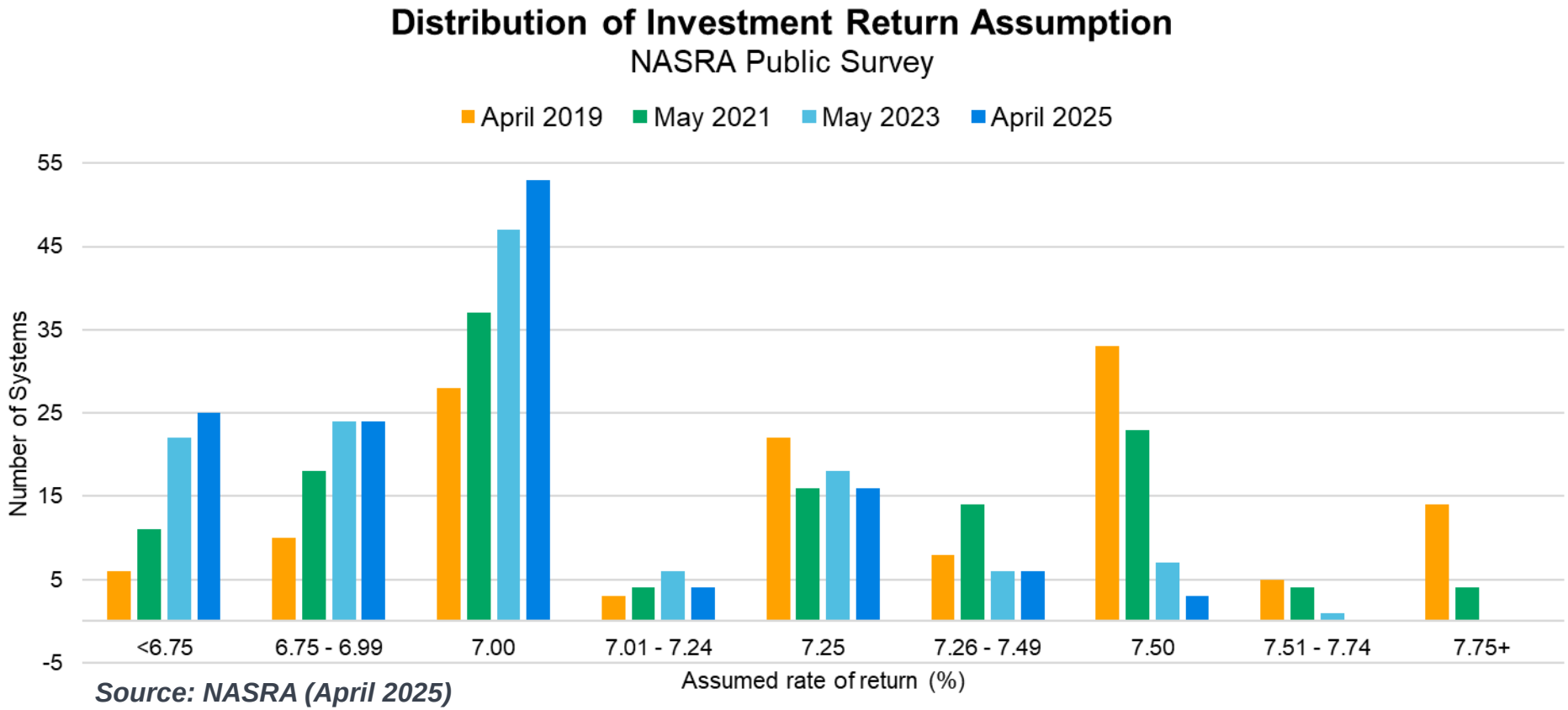
- There has been a downward trend in public plan return assumptions, with a current median assumption for large public systems of 7.0%; the mean average rate is approximately 6.9%
  - While capital market expectations have increased in the last couple years, so far large systems have generally not responded with increased return assumptions



Source: NASRA (April 2025)

Comparison to Peer Systems

- The distribution of about 130 systems tracked by the NASRA Public Fund Survey is shown below
- Six years ago, the most common assumption was 7.50%; now the most common assumption is 7.00% and over 75% of all plans have an assumption of 7.00% or lower



Source: NASRA (April 2025)

Effects of Changing the Assumed Return

- A higher investment return assumption would produce lower calculated liabilities and uncollared contribution rates as of the actuarial valuation date, while a lower investment return assumption would have the opposite effect
  - The effect on final collared contribution rates would be determined in accordance with the Board's policy
- Liabilities are net present values, as of the valuation date, of a benefit payment projection that stretches far into the future
  - Changing the assumption modifies the projected balance of the fundamental cost equation between future investment earnings and future contributions
    - The actual balance will depend on actual investment earnings, not on the assumed return adopted by the PERS Board
- For PERS, such an assumption change would also change benefits for future retirements calculated under Money Match

System-Average Liability and Contribution Rate Effects

Valuation Date:	12/31/2023	12/31/2024		
	Final 2025-27 at	Preliminary Estimated Advisory 2027-29 at		
Assumed Rate:	6.90%	7.00%	6.90%	6.80%
Funded Status (Excluding Side Accounts)	72%	74%	73%	72%
Unfunded Actuarial Liability (UAL) (Excluding Side Accounts)	$29.4 B	$28.0 B	$29.2 B	$30.4 B
System-Average Uncollared Total Contribution Rates				
Total Normal Cost Rate (Employer plus Member)	12.21%	11.79%	12.08%	12.37%
Tier One/Tier Two UAL Rate	12.15%	11.87%	12.17%	12.46%
OPSRP UAL Rate	2.86%	2.80%	2.96%	3.12%
Uncollared Total Base Rate	**27.22%**	**26.46%**	**27.21%**	**27.95%**
Change in uncollared base rate vs. 6.90% assumption		**(0.75%)**	**N/A**	**0.74%**

For context:

- 0.75% of projected 2027-29 biennial pay ≈ $260M
- Projected 2025-27 total contribution ≈ $7.7B

- Preliminary 12/31/2024 estimates do not reflect updated census information or assumption and/or method changes that may occur in the upcoming experience study

Considerations in Setting the Return Assumption

- OIC (primary opinion) and Milliman (second opinion) capital market outlooks currently show similar median expected future returns as the last return assumption review
  - Those capital market outlooks are based on data as of the beginning of 2025
  - No adjustments have been made in response to year-to-date market volatility and uncertainty
- While median outlook expectations are above the current 6.9% investment return assumption, the Board should consider leaving the assumption unchanged
  - Lowering the assumed rate from 8.0% to 6.9% in response to changing economic conditions and evolving capital market outlook expectations took a decade
    - Most boards have been wary of increasing the assumption to date
  - Actuarial Standards of Practice allow assumptions to reflect a margin for adverse deviation
    - A margin for conservatism is permissible, and increases the chance actual results exceed assumption

Actuarial Methods

Key Actuarial Methods

Details on methods with no proposed change are shown in the appendix

	12/31/2023 Valuation Methods	12/31/2024 Valuation Proposed* Methods
Cost Allocation Method	Entry Age Normal	No change
UAL (Shortfall) Amortization Method	Level percent of pay, layered fixed periods: *Tier One/Tier Two:* • Reamortized over 22 years as of 12/31/2019 per SB 1049 • 20 years as ongoing Board policy *OPSRP:* 16 years *RHIA/RHIPA:* 10 Years	No change
Rate Collar	UAL contribution rate for a rate pool is limited to a collared range based on prior biennium's rate. Limit is: • *Tier One/Tier Two:* 3% of payroll for large rate pools, 4% (with overrides) for Independent Employers • *OPSRP*: 1% of payroll Decreases to UAL rate are restricted if pool's funded status <90%	No change Determine effect of SB 849 on School District rate collar

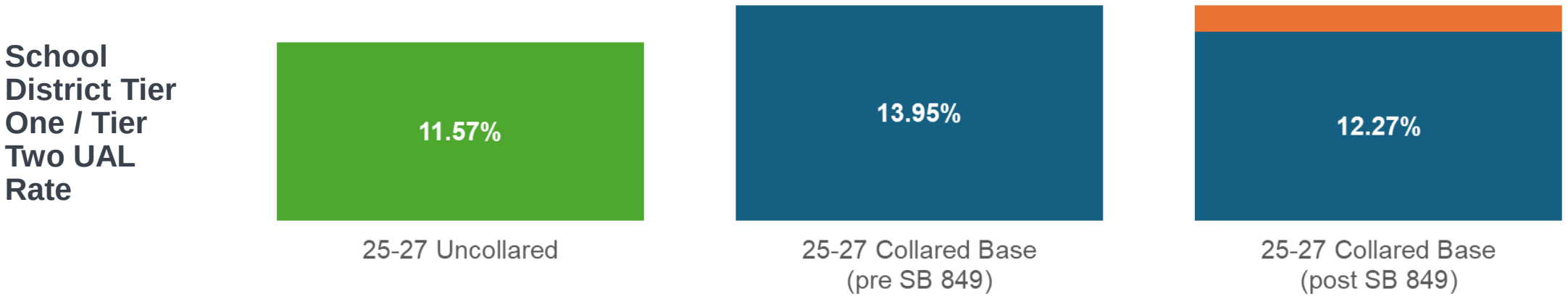
*No action is requested on "proposed" methods today, since all assumptions and methods will be adopted at the July 2025 Board meeting

Key Actuarial Methods (continued)

	12/31/2023 Valuation Methods	12/31/2024 Valuation Proposed Methods
Contribution Lag	No adjustment is made to UAL Rate, for the lag time between the December 31 rate-setting valuation date and when those rates go into effect 18 months later. The lag time is reflected in calculating side account rate adjustments and Pre-SLGRP rate adjustments.	No change
Amortization of Side Accounts	Amortization calculated as level percent of projected pay through December 31 of scheduled end year. Majority of current side accounts amortize to December 31, 2027. PERS to manage expiring amortizations.	No change
Amortization of Pre-SLGRP Amounts	Amortized as level percent of projected pay through July 1 18 months after scheduled end year to align with rate change timing. New amortizations set at 18 years from date employer joins the SLGRP. Pre-SLGRP pool liability and large majority of Transition Liabilities / Surpluses amortize to December 31, 2027.	No change

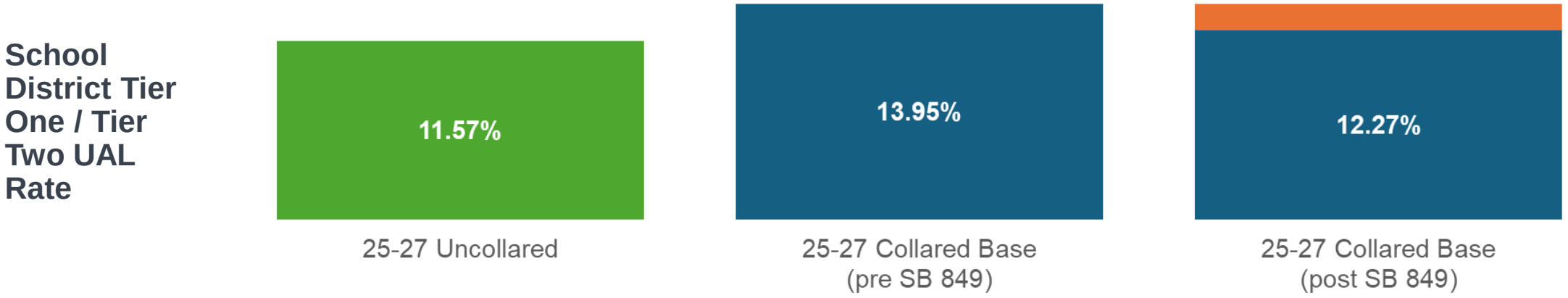
SB 849's Effect on 27-29 Tier One/Tier Two UAL Rate (UALR)

- 27-29 School District UALR will be calculated in the December 31, 2025 actuarial valuation
  - That valuation's methods are set by decisions in this year's experience study
- 27-29 Uncollared UALR will continue to be calculated as the pure actuarial rate
- 27-29 Collared Base UALR methodology is a PERS Board policy decision
  - The policy decision is where to set the floor for 27-29 Collared Base UALR



Reflecting SB 849's Effect in 27-29 UALR

- The 25-27 Collared Base UALR sets a floor for the 27-29 Collared Base UALR
  - 27-29 Collared Base UALR is highly unlikely to decrease below the floor
  - **The floor could be either 12.27% of payroll or 13.95% of payroll** (policy choice)
    - 12.27% is the actual 25-27 UALR contribution of school district employers
    - 13.95% is the combined 25-27 amortization contribution of employers and the SDULF
    - Either floor is above the most recently calculated pure actuarial (i.e., uncollared) rate
    - 27-29 Collared Base UALR can be up 3% of payroll above the floor if necessary



Agenda for July Meeting

- Review demographic assumptions
  - Member-specific assumptions based on study of recent PERS experience
- Adopt all methods and assumptions for use in:
  - 12/31/2024 actuarial valuation with advisory 2027-2029 contribution rates
  - 12/31/2025 actuarial valuation with 2027-2029 contribution rates proposed for adoption

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Appendix

Certification

This presentation discusses actuarial methods and assumptions for use in the valuation of the Oregon Public Employees Retirement System ("PERS" or "the System"). For the most recent complete actuarial valuation results, including cautions regarding the limitations of use of valuation calculations, please refer to our formal Actuarial Valuation Report as of December 31, 2023 ("the Valuation Report") published on September 14, 2024. The Valuation Report, including all supporting information regarding data, assumptions, methods, and provisions, is incorporated by reference into this presentation. The statements of reliance and limitations on the use of this material is reflected in the actuarial report and still apply to this presentation. The Valuation Report, along with prior presentations to the PERS Board, including the December 2024 and March 2025 presentations to the PERS Board should be referenced for additional detail on the data, assumptions, methods, and plan provisions underlying this presentation.

In preparing this presentation, we relied, without audit, on information (some oral and some in writing) supplied by the System's staff as well as capital market expectations provided by Meketa, capital market information published by Horizon Actuarial Services, and information presented to the Oregon Investment Council. This information includes, but is not limited to, statutory provisions, employee data, and financial information. We found this information to be reasonably consistent and comparable with information used for other purposes. The results depend on the integrity of this information. If any of this information is inaccurate or incomplete our results may be different and our calculations may need to be revised.

In assessing the Milliman capital market expectations presented in this report, per Actuarial Standards of Practice we disclose reliance upon a model developed by Milliman colleagues who are credentialed investment professionals with expertise in capital outlook modeling.

All costs, liabilities, rates of interest, and other factors for the System have been determined on the basis of actuarial assumptions and methods which in our professional opinion are individually reasonable (taking into account the experience of the System and reasonable expectations); and which, in combination, offer a reasonable estimate of anticipated experience affecting the System. The valuation results were developed using models intended for valuations that use standard actuarial techniques. We have reviewed the models, including their inputs, calculations, and outputs for consistency, reasonableness, and appropriateness to the intended purpose and in compliance with generally accepted actuarial practice and relevant actuarial standards of practice. We have incorporated other sources of economic data in assessing the reasonableness of the assumptions. Reliance on other experts is reflected in Milliman's capital market assumptions and in Milliman's expected return model, both of which are developed by credentialed investment consultants. We have also considered the System's investment policy, capital market assumptions, and the expected return analysis provided by the System's investment consultant in our assessment of the investment return assumption.

Certification

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law. Due to the limited scope of our assignment, we did not perform an analysis of the potential range of future measurements. Our annual financial modeling presentation to the PERS Board should be referenced for additional analysis of the potential variation in future measurements. The PERS Board has the final decision regarding the assumptions used in the actuarial valuation.

The calculations in this report have been made on a basis consistent with our understanding of the plan provisions described in the appendix of the Valuation Report. Determinations for purposes other than meeting these requirements may be significantly different from the results contained in this report. Accordingly, additional determinations may be needed for other purposes.

Milliman's work is prepared solely for the internal business use of the Oregon Public Employees Retirement System. Milliman does not intend to benefit or create a legal duty to any third-party recipient of its work product.

No third-party recipient of Milliman's work product should rely upon Milliman's work product. Such recipients should engage qualified professionals for advice appropriate to their own specific needs.

The consultants who worked on this assignment are actuaries. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel.

The signing actuaries are independent of the System. We are not aware of any relationship that would impair the objectivity of our work.

On the basis of the foregoing, we hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board and the *Code of Professional Conduct* and *Qualification Standards for Actuaries Issuing Statements of Actuarial Opinion in the United States* published by the American Academy of Actuaries. We are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein.

Appendix

Capital Market Outlook

- Capital market outlooks change over time in response to changing market conditions
  - Milliman outlook updated every six months
  - Recent changes and key factors shown below for Milliman model of PERS asset allocation
  - Outlooks shown reflect Milliman's real return outlook at each date combined with a 2.50% inflation assumption as of 12/31/2018 and a 2.40% inflation assumption as of 12/31/2020

Milliman 20-year outlook	12/31/2018	12/31/2020	12/31/2022	12/31/2024
Median Annualized Return	**6.87%**	**6.27%**	**7.46%**	**7.39%**
Global Equity	6.99%	5.85%	7.07%	6.63%
Private Equity	8.33%	7.71%	8.83%	8.38%
US Core Fixed Income	4.07%	2.73%	4.50%	4.61%
Real Estate	5.55%	5.66%	5.83%	6.69%

Asset category returns shown above are 20-year annualized geometric mean returns and reflect reduction for assumed investment management expenses

Appendix
Actuarial Basis

Capital Market Assumptions - Milliman

For this purpose, we considered the Oregon PERS Fund to be allocated among the model's asset classes as shown below. This allocation is based on input provided by Meketa (OIC's primary consultant) and reflects changes to the OIC's target allocation for the Oregon PERS fund adopted at the January 25, 2023 OIC meeting.

Reflects Milliman's capital market assumptions as of December 31, 2024.

	Annual Arithmetic Mean	20-Year Annualized Geometric Mean	Annual Standard Deviation	Policy Allocation
Global Equity	8.18%	6.63%	18.30%	27.500%
Private Equity	12.46%	8.38%	30.00%	25.500%
Real Estate	8.00%	6.69%	16.79%	12.250%
US Core Fixed Income	4.70%	4.61%	4.44%	25.000%
Hedge Fund – Macro	5.78%	5.52%	6.11%	5.625%
Hedge Fund – Equity Hedge	6.87%	6.01%	11.81%	0.625%
Hedge Fund – Multistrategy	6.36%	5.90%	8.74%	1.250%
Infrastructure	8.13%	6.75%	17.18%	1.500%
Master Limited Partnerships	8.89%	5.62%	26.46%	0.750%
US Inflation (CPI-U)	2.32%	2.31%	1.46%	**N/A**
Fund Total (reflecting asset class correlations)	**8.22%**	**7.43%***	**13.48%**	**100.00%**

* The model's 20-year annualized geometric median is **7.39%**.

Appendix
Actuarial Basis

Capital Market Assumptions – Horizon Survey

For assessing the expected portfolio return under an additional set of capital market assumptions, we applied the assumptions from the 2024 Survey of Capital Market Assumptions published by Horizon Actuarial Services, LLC. According to the survey report, the 10-year return assumptions shown below represent an average of the expectations for 41 investment advisors responding to the survey.

	10-Year Annualized Geometric Mean	Annual Standard Deviation	Policy Allocation
US Equity – Large Cap	6.46%	16.52%	**12.375%**
Non-US Equity – Developed	7.08%	18.06%	**12.375%**
Non-US Equity – Emerging	7.70%	23.61%	**2.750%**
US Corporate Bonds – Core	4.93%	5.90%	**25.000%**
Real Estate	6.06%	16.61%	**12.250%**
Hedge Funds	5.90%	8.03%	**7.500%**
Infrastructure	7.26%	16.02%	**2.250%**
Private Equity	9.09%	22.57%	**25.500%**
Inflation	2.42%		**N/A**
Fund Total (reflecting asset class correlations)	**7.49%***	**12.10%**	**100.00%**

* 10-year annualized geometric median is **7.43%**.

System-Average Weighted Total* Pension-Only Rates

2009-2011 rates set **prior to economic downturn**

2011-2013 rates first to reflect **-27%** return in 2008 and **+19%** in 2009

2013-2015 shown before (dotted line) and after (solid line) **legislated changes**

2015-2017 set **pre-*Moro*** reflecting 2012 (**+14.3%**) & 2013 (**+15.6%**) returns, first **decrease in assumed return**

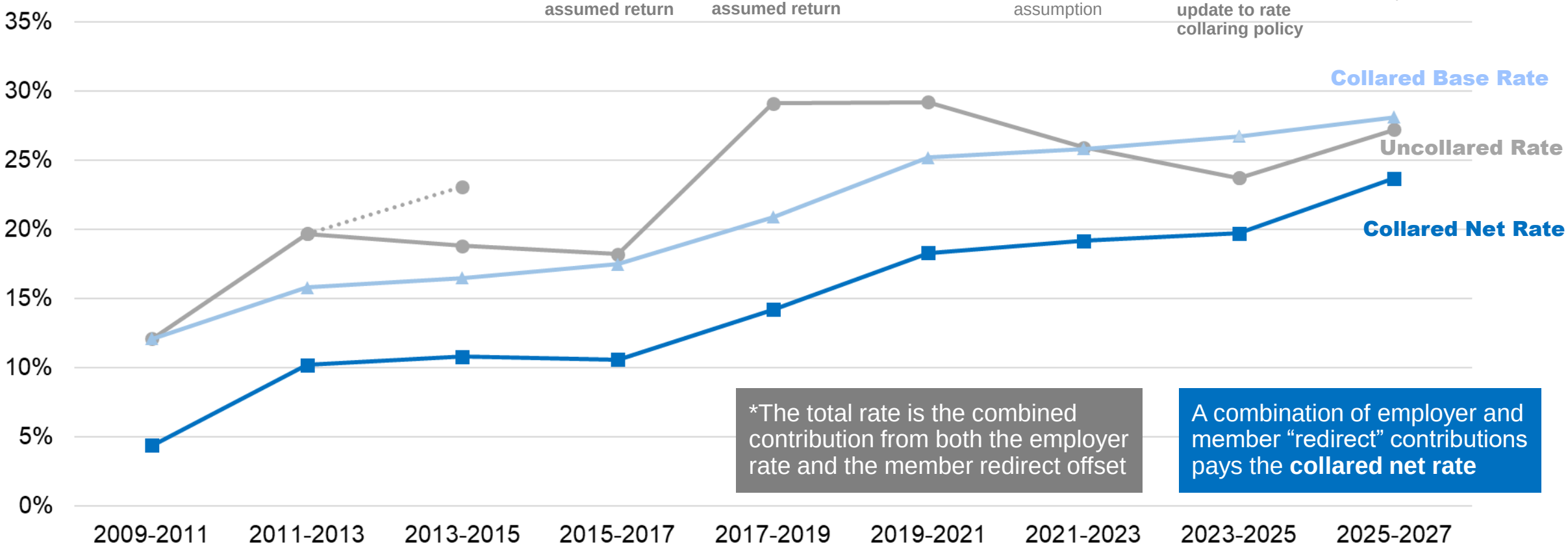
2017-2019 set **post-*Moro***, reflecting 2015 return (**+2.1%**) and second **decrease in assumed return**

2019-2021 reflects **+15.4%** return in 2017 and third **decrease in assumed return**

2021-2023 rates reflect **mandated reamortization of Tier One/Tier Two UAL**, biennial returns near assumption

2023-2025 rates reflect 2021 actual return of **+20.05%,** a fourth **decrease in assumed return** and an **update to rate collaring policy**

2025-2027 rates reflect 2022 return of **-1.55%** and higher salary increase assumptions



*The total rate is the combined contribution from both the employer rate and the member redirect offset

A combination of employer and member "redirect" contributions pays the **collared net rate**

Assumed Return:	8.00%	8.00%	8.00%	7.75%	7.50%	7.20%	7.20%	6.90%	6.90%

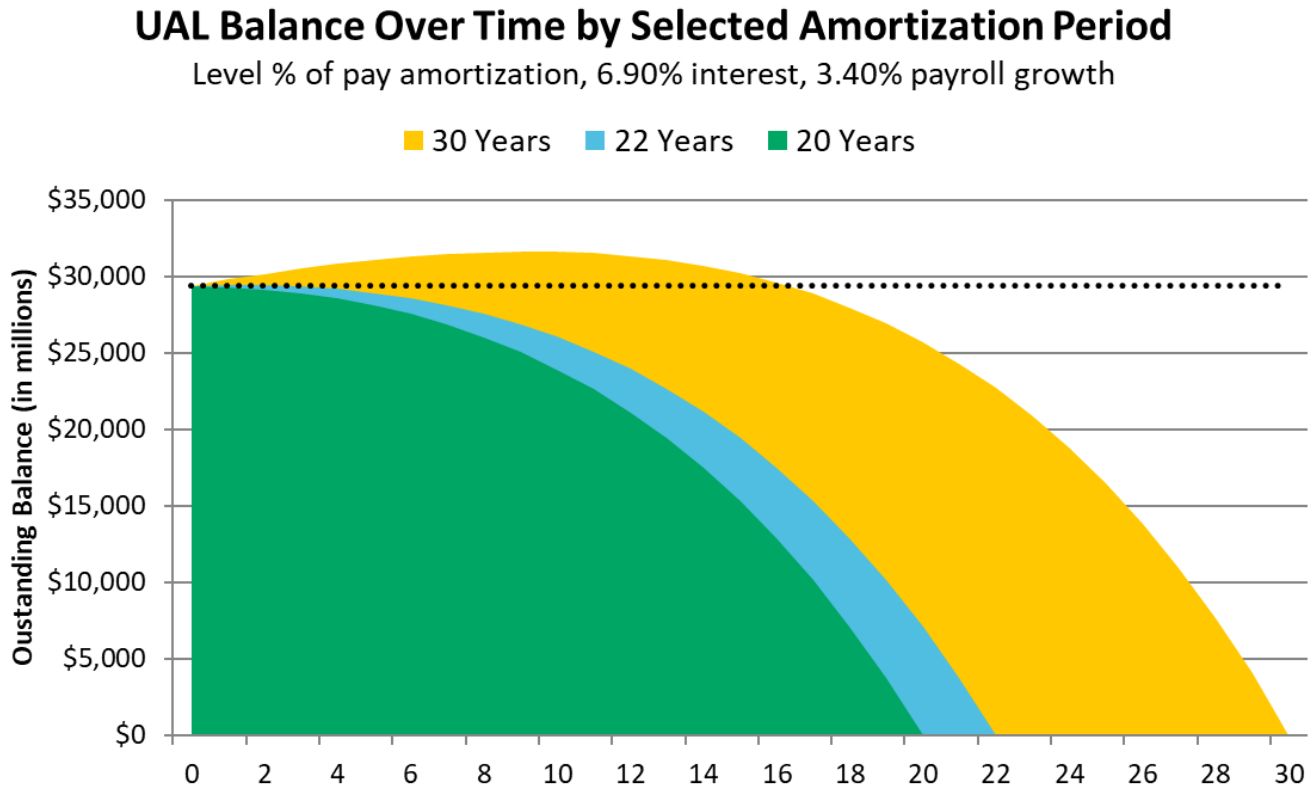
Cost Allocation Method

- Rates are calculated to pre-fund retirement benefits during a member's working career if all assumptions are met
- The present-day value of projected future benefits allocated to a particular working year is the Normal Cost
- The present-day value of projected future benefits allocated to prior years is the Accrued Liability
- The division between past, current & future service is done through use of an actuarial cost allocation method
- PERS currently uses GASB-compliant cost allocation method of Entry Age Normal (EAN)
  - We recommend no change to the cost allocation method

Shortfall Amortization Periods

- A key part of contribution rate calculations is amortization of Tier One / Tier Two shortfalls over twenty years as a level percentage of payroll
  - As required by Senate Bill 1049, Tier One/Tier Two UAL as of December 31, 2019 was re-amortized over 22 years
  - Prior to that, Board policy has been to amortize gains or losses in separate layers over 20 years from the rate-setting valuations in which the gain or loss was first recognized
- Twenty years avoids significant negative amortization, where unamortized shortfall materially increases in the initial “pay down” years even if actual investment returns match assumptions and contributions are made
  - The following slide illustrates amortization as a level percentage of projected payroll of a $29.4 billion shortfall over periods of 20, 22 or 30 years

Remaining Balances for 20-, 22-, & 30-Year Amortizations

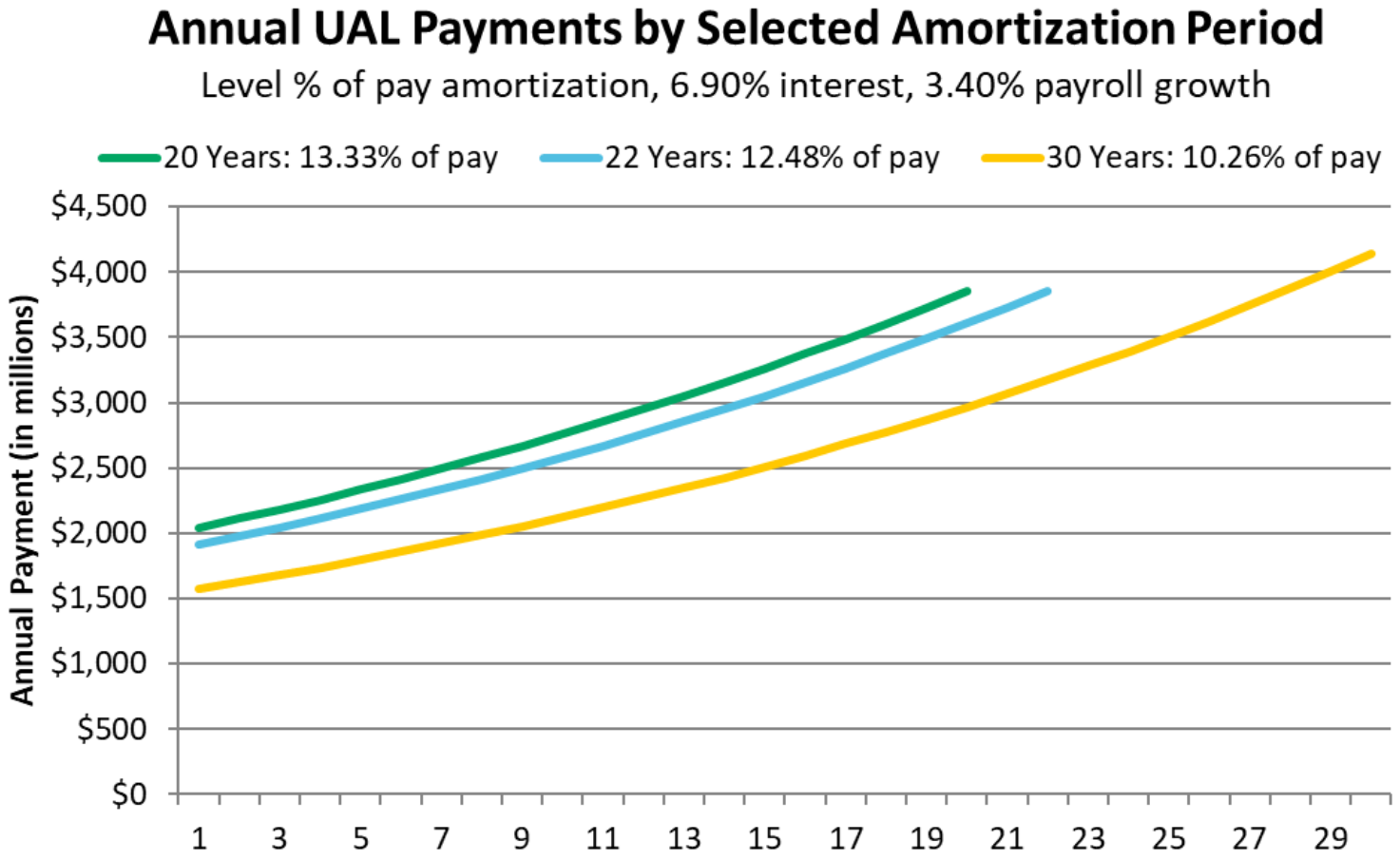


Current ongoing policy

- Tier One / Tier Two: **20 years**
- OPSRP: **16 years**

- **Why 20 years or less?** If actual experience matches the assumption…
  - with 22 years zero progress is made in decreasing the initial UAL until year 3
  - with 30 years the UAL has increased by about 8% after the first decade, and zero progress is made in decreasing the initial UAL until year 17

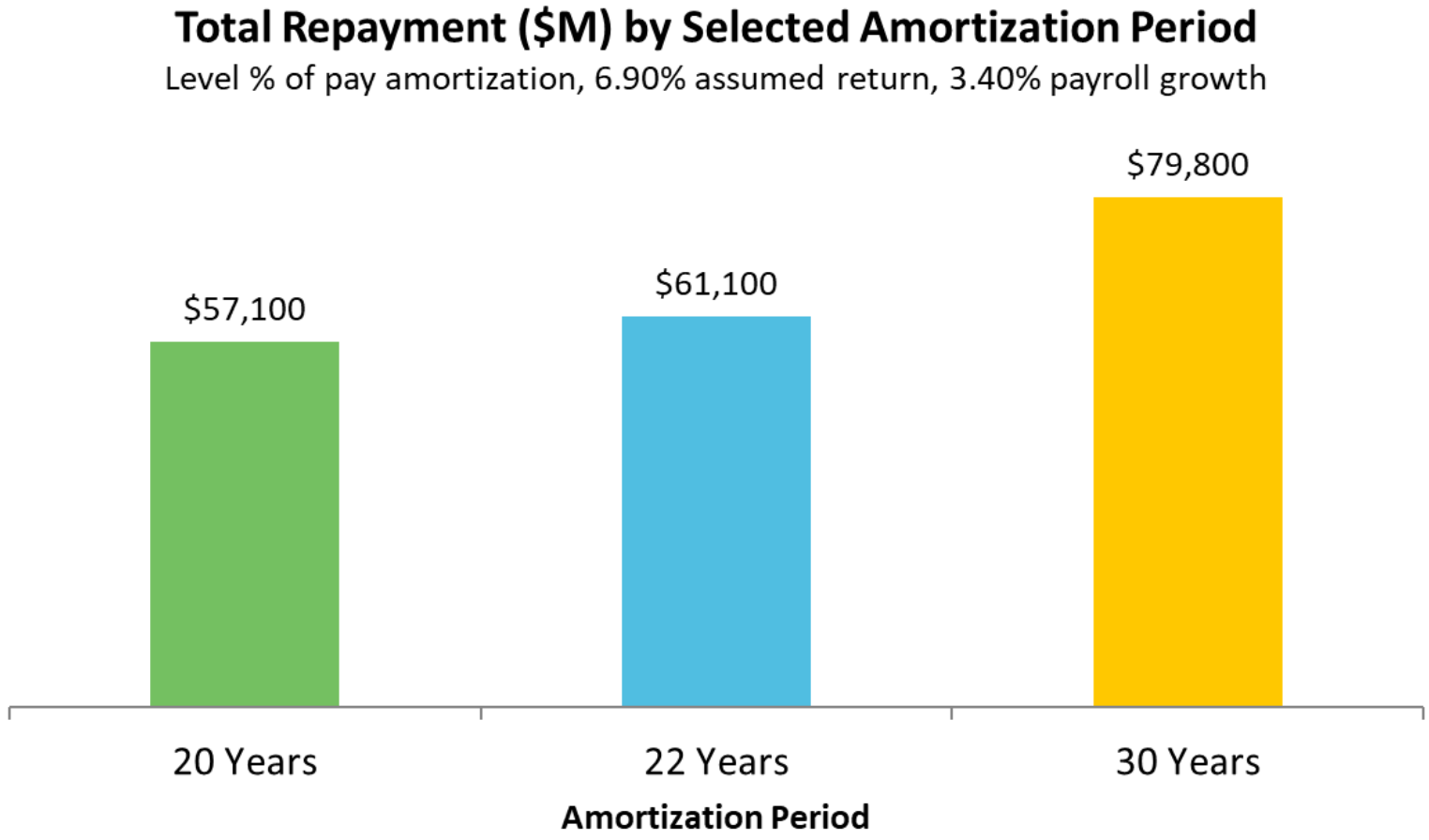
Illustration of UAL Amortization Periods



Current policy

- Tier One / Tier Two: **20 years**
- OPSRP: **16 years**

Illustration of UAL Amortization Periods



Current policy

- Tier One / Tier Two: **20 years**
- OPSRP: **16 years**

This illustrates total amortization payments for a $29.4 billion shortfall over periods of 20, 22 or 30 years

Contribution Lag Adjustment

Our recommendation is:

UAL Rate calculation

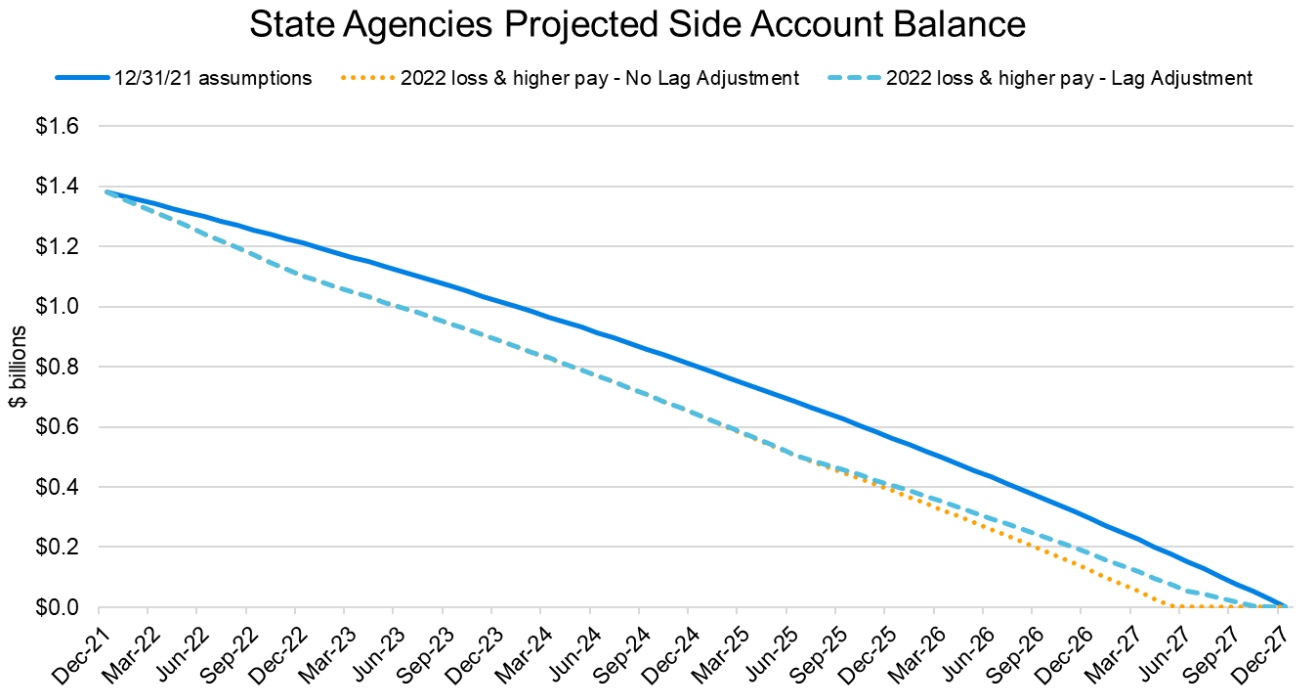
- Do not apply a contribution lag adjustment to the rates, as doing so would harm guiding objective of transparency without significantly improving any other objectives
  - Current contribution calculation process is laid out so all employers can follow their calculations, and has been consistently applied over time
    - Lag adjustment would be comparatively hard to illustrate and follow within the reports
    - UAL layers are established every rate-setting valuation for all rate pools (OPSRP, SLGRP, School Districts, plus 120+ Independent employer for Tier One/Tier Two); all would be affected by a change, which makes the communication challenge more difficult
  - Absence of an adjustment is not biased and not expected to significantly affect long-term rates

Side Account and Pre-SLGRP adjustments

- Continue to apply an adjustment for the lag period
- Unlike the UAL Rate, balances have a fixed expiration and do not have new layers
  - Adding lag adjustment can improve tail management enough to warrant the added complexity

Side Account Amortizations

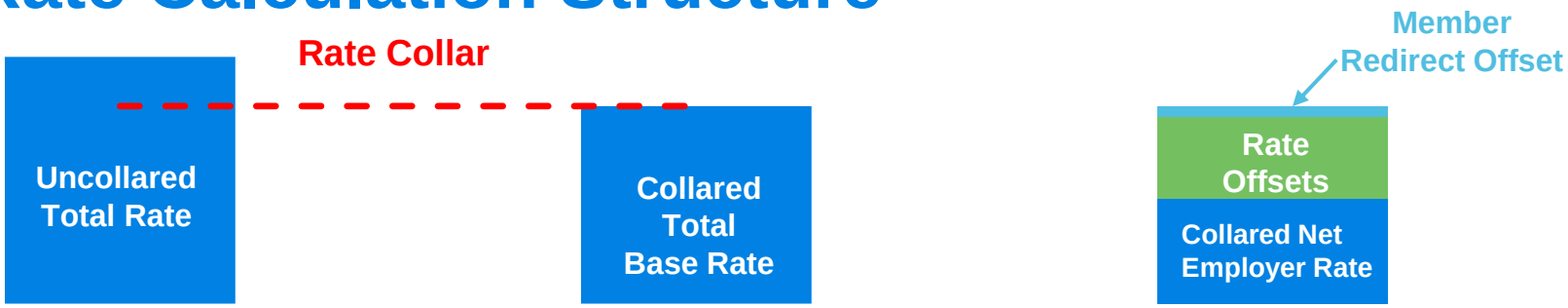
- **Methodology:**
  - Continue calculating the offset through December 31 of the established period
  - Apply adjustment to reflect 18-month lag before a new offset takes effect
  - PERS staff to manage final months of rate offsets for expiring accounts
    - Rate offset will “turn off” prior to scheduled December 31 if account balance is depleted (monthly contribution rate increases to compensate)



Pre-SLGRP Amortizations

- The December 31, 2025 valuation is the final rate-setting valuation in which a Pre-SLGRP amortization expiring December 31, 2027 would be reflected
  - Sets the contributions rates for July 1, 2027 – June 30, 2029
- **Methodology:**
  - Calculate the contribution rate adjustment to run to the end of the relevant biennial rate-setting period (will run through June 30, which is 18 months later than the current approach of amortizing to the nominal December 31 end date)
    - Allows the effect of expiring amounts to be handled in the normal course of biennial rate updates
  - Add adjustment to reflect 18-month lag before new rate adjustment takes effect
  - For contributing employers with a December 31, 2027, transition liability/surplus expiration, rate adjustments will be eliminated July 1, 2029, regardless of whether actual payroll experience in the final months draws the transition amount to zero
  - If large payroll increases resulted in transition amounts hitting zero in a valuation prior to scheduled end period, the rate adjustment would be eliminated (continuation of current practice)
  - Work with PERS to determine approach for employers with no current payroll / contributions

Overview of Rate Calculation Structure

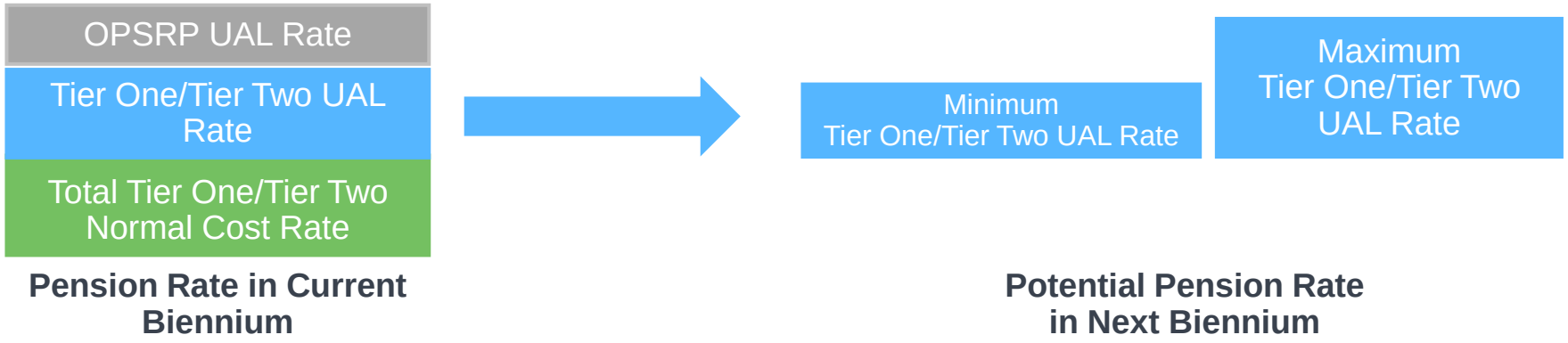


- The ***uncollared total rate*** is the theoretical contribution rate to reach 100% funded status over a specified amortization period if:
  - Contributions at that rate started on the actuarial valuation date, and
  - Actual future experience mirrors the actuarial valuation's assumptions, and
  - The normal cost rate does not change in subsequent years
- The rate collar sets a biennium's ***collared total base rate***, limiting the base rate change for a single biennium when there is a large change in the uncollared rate
- ***Member redirect offset*** reflects estimated portion of collared total base rate paid by redirected member contributions
- Employers pay the ***collared net employer rate***, which reflects the member redirect offset and any rate offset adjustments from:
  - Side account rate offsets for employers with side accounts
  - SLGRP charges/offsets (e.g., Transition Liability/Surplus)

Rate Collar Design

- Rate collar focuses on the biennium-to-biennium change in the UAL Rate component
  - Normal Cost Rate component is always paid in full and is not subject to a rate collar limitation
- The maximum biennium to biennium change in UAL Rate permitted by the rate collar is:
  - **SLGRP and School District Pools Tier One/Tier Two UAL Rates**: 3% of pay
  - **OPSRP UAL rate**: 1% of pay
  - **Tier One/Tier Two UAL Rates of Independent Employers**: greater of 4% of pay or 1/3rd of the difference between the collared and uncollared Tier One/Tier Two UAL Rates at the last rate-setting valuation
- UAL Rate is not allowed to decrease at all unless funded status excluding side accounts is at least 87%, and a full collar width decrease is not allowed unless funded status is at least 90%

Illustration of Rate Collar for Tier One/Tier Two UAL Rate



Retirement System Risks

- Oregon PERS, like all defined benefit systems, is subject to various risks that will affect future system liabilities and contribution requirements, including:
  - **Investment risk**: the potential that investment returns will be different than assumed
  - **Demographic risks**: the potential that mortality experience, retirement behavior, or other demographic experience for the system membership will be different than assumed
  - **Contribution risk**: the potential that actual future contributions will be materially different than expected, for example if there are material changes in the system's covered payroll
- The results of an actuarial valuation are based on one set of reasonable assumptions, but it is almost certain that future experience will not exactly match the assumptions.
- Further discussion of system risks and historical information regarding system experience are shown in our annual actuarial valuations. In addition, our annual financial modeling presentation to the PERS Board illustrates future outcomes under a wide range of future scenarios reflecting variation in key risk factors.