Item C.5.

Economic Assumptions & Actuarial Methods

OREGON PUBLIC EMPLOYEES RETIREMENT SYSTEM

May 29, 2015

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Agenda

- Review of non-investment economic assumptions
- Long-term investment return assumption
- Actuarial methods
  - Cost allocation method
  - UAL/shortfall amortization technique
  - Rate collaring

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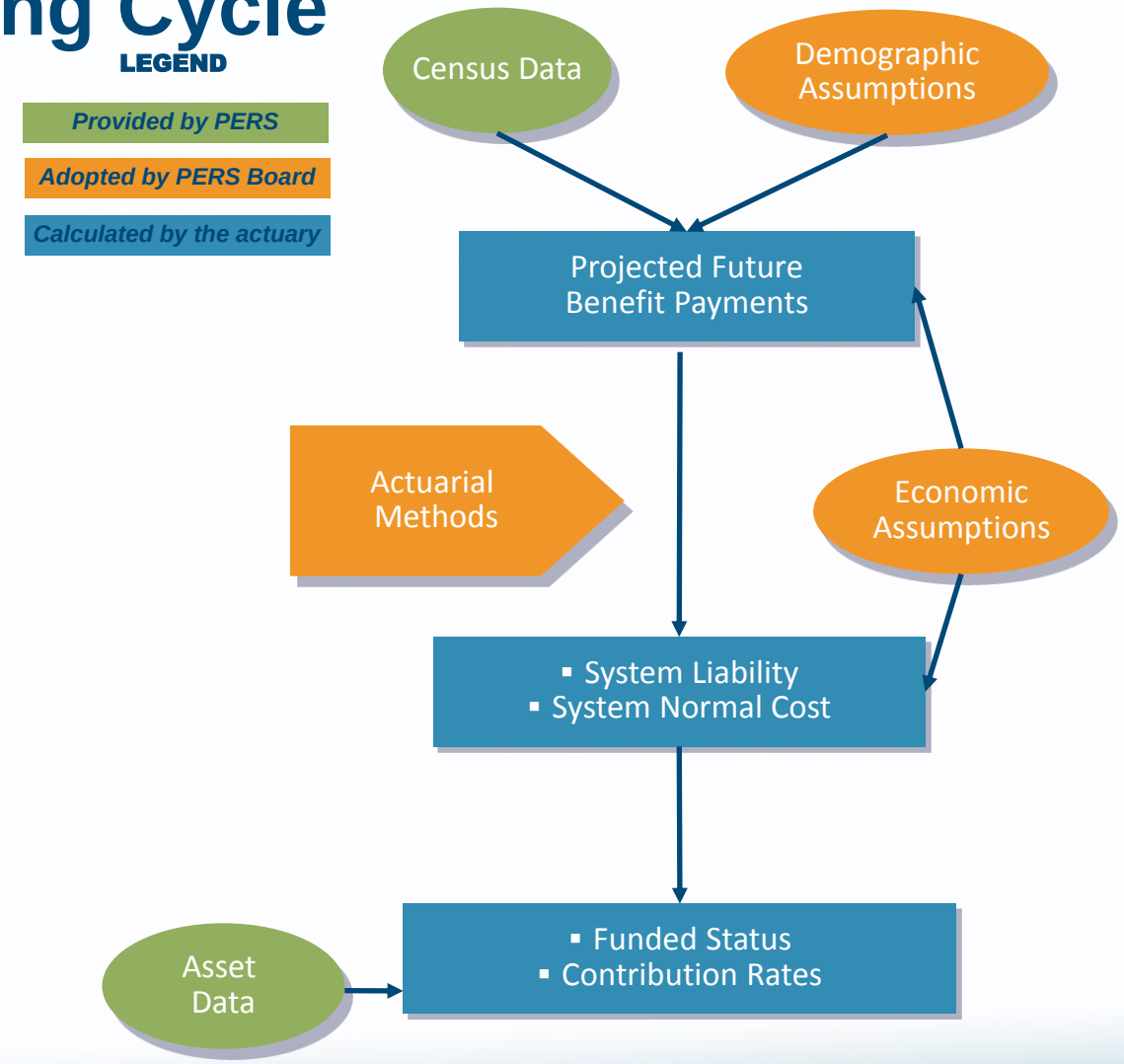
Two-Year Rate-Setting Cycle

- July 2015: Assumptions & methods adopted by Board in consultation with the actuary
- September 2015: System-wide 12/31/14 "advisory" actuarial valuation results
- November 2015: Advisory 2017-2019 employer-specific contribution rates
- July 2016: System-wide 12/31/15 "rate-setting" actuarial valuation results
- September 2016: Disclosure & adoption of employer-specific 2017-2019 contribution rates



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Objectives for Actuarial 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.

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The Fundamental Cost Equation

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

BENEFITS =

EARNINGS +

CONTRIBUTIONS

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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 expected contribution patterns

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Review of Non-Investment Economic Assumptions

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Assumptions to Be Reviewed

	12/31/2013 Valuation Actual Assumption
Inflation	2.75%
Real Wage Growth	1.00%
Payroll Growth	3.75%
Administrative Expenses:	
- OPSRP	$5.5 million
- Tier 1/ Tier 2	No explicit assumption

The Tier 1/Tier 2 administrative expense assumption was implicit, as the investment return assumption was considered to be net of Tier 1/ Tier 2 administrative expenses. Those expenses are approximately 0.05% of system Tier 1/Tier 2 assets.

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Economic Assumptions

Inflation

- The inflation assumption affects other assumptions, including payroll growth, investment return, and health care inflation
- Inflation can vary significantly over time
- Market estimates of future inflation can be derived from yields of Treasury securities and Treasury Inflation Protected Securities (TIPS)
- Social Security's current "intermediate cost" 30-year average inflation assumption is 2.54%
- **We recommend lowering the long-term inflation assumption from 2.75% to 2.50%**

Period Ending 12/31/2014	Average Inflation
10 years	2.12%
20 years	2.28%
30 years	2.71%
40 years	3.85%

As of 12/31/2014	10 Year	30 Year
Treasury Yield	2.17%	2.75%
TIPS Yield	0.49%	0.83%
Breakeven Inflation	**1.68%**	**1.92%**

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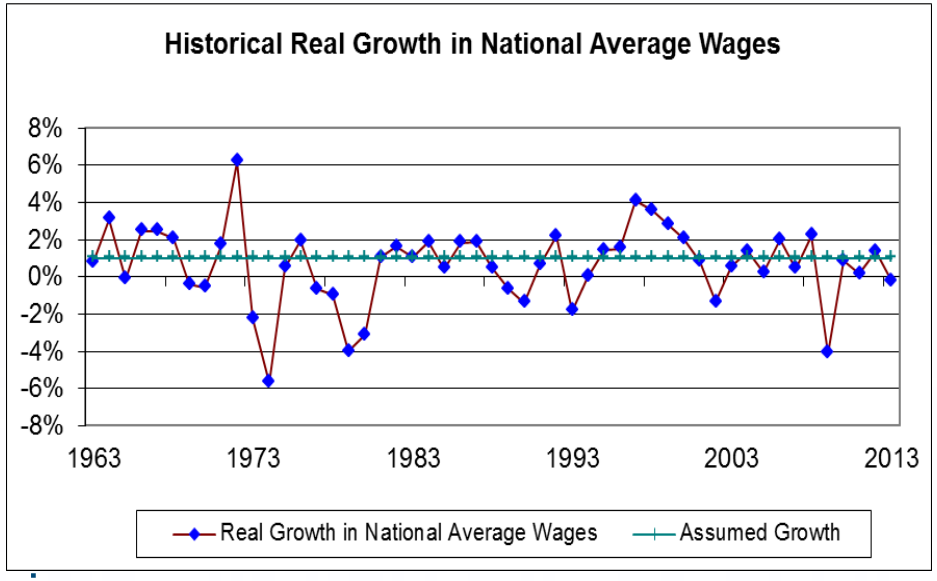
Economic Assumptions

Real Wage Growth

- An individual member's expected annual salary increase is composed of:
  - Inflation
  - Real wage growth
  - 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 1.13%
- We recommend no change to the current assumption of 1.00%



Period Ending 12/31/2014	Average Real Wage Growth
20 Years	0.97%
30 Years	0.83%
40 Years	0.40%
50 Years	0.61%

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Economic Assumptions

Payroll Growth

- Overall system payroll growth is assumed to equal the sum of:
  - Inflation
  - Real wage growth
- Based on the recommended inflation assumption of 2.50% and real wage growth of 1.00%, we recommend lowering the payroll growth assumption to 3.50%

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Economic Assumptions

Administrative Expenses

- In the past, assumed administrative expenses have been added to the normal cost for OPSRP, but not for Tier 1/Tier 2
  - OPSRP administrative expenses are significant relative to OPSRP assets, but declining over time as the asset base grows
  - Tier 1/Tier 2 administrative expenses are both less significant and more stable relative to the size of Tier 1/Tier 2 assets
  - Previously, assumed Tier 1/Tier 2 administrative expenses were addressed by setting an investment return assumption net of expenses
- New GASB standards require the long-term investment return assumption used for accounting purposes to be *gross* of administrative expenses
  - As a result, we now recommend an explicit assumption for both OPSRP and Tier 1/Tier 2

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Economic Assumptions

Administrative Expenses

- Actual administrative expenses for recent years are shown below

	Tier 1/Tier 2		OPSRP	
Year	Actual Expenses	% of Beginning of Year Assets	Actual Expenses	% of Beginning of Year Assets
2010	$22.8	0.05%	$6.1	1.37%
2011	$22.2	0.05%	$6.9	1.05%
2012	$26.4	0.06%	$5.3	0.63%
2013	$29.6	0.06%	$4.5	0.38%
2014	$30.1	0.06%	$5.0	0.30%

- Recommend assumed annual expenses for 2015 and 2016:
  - Tier 1/Tier 2: $33.0 million
  - OPSRP: $5.5 million

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Assumptions to Be Reviewed

	12/31/2013 Valuation Actual Assumption	12/31/2014 Valuation Recommended Assumption
Inflation	2.75%	2.50%
Real Wage Growth	1.00%	1.00%
Payroll Growth	3.75%	3.50%
Administrative Expenses:		
- OPSRP	$5.5 million	$5.5 million
- Tier 1/Tier 2	No explicit assumption	$33.0 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.

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Long-Term Investment Return Assumption

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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 1 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 estimated mid-to-long term employer contribution rates

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Investment Return Estimates

- To assist the Board, we developed return estimates based on capital market outlook assumptions from three sources and an industry standard mean/variance model
  - Milliman
  - Callan
  - 2014 Horizon survey of capital market assumptions (survey of 21 advisors)
- 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 results based on capital market outlook assumptions developed by Milliman's credentialed investment professionals

Details on each set of capital market outlook assumptions is in the appendix

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Investment Return Estimates

- Estimates are based on OIC's target long-term asset allocation
  - Current actual allocation differs somewhat from the target allocation
- Target allocations are under review by OIC, and could change by the PERS Board's July meeting
- Callan and Horizon estimates are calibrated over a shorter investment timeframe than Milliman's estimates
  - Also reflect lower level of assumed inflation

	Milliman	Callan	Horizon
Median Annualized Return	**7.05%**	**7.45%**	**7.32%**
Assumed Inflation	2.50%	2.30%	2.41%
Timeframe Modeled	20 years	10 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

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Effects of Lowering the Assumed Return

- A lower investment return assumption would produce higher calculated liabilities and contribution rates since liabilities are net present values, as of the valuation date, of a year-by-year benefit payment projection that stretches far into the future
  - Changing the assumption tilts the estimated balance of the fundamental cost equation between estimated future investment earnings and estimated future contributions
    - Long-term, the balance depends on actual investment earnings
  - The effect of lowering the assumed return to 7.50% is estimated as a 1.8% of payroll increase (or 3.6% at a 7.25% assumption) in the uncollared system average base employer contribution rate
- For PERS, such a change would also lower benefits for future retirements calculated under money match
  - Illustration for a hypothetical Tier 1 member shown on next slide

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Effects of Lowering the Assumed Return

- Lowering the assumption to either 7.50% or 7.25% would affect the money match calculation for a member age 59½ with a $135,000 member account balance as of 6/30/2015 as shown:

Benefit Commencement	7/1/2015	12/1/2015	1/1/2016	3/1/2016
Assumed Rate	7.75%	7.75%	7.50%	7.50%
Starting Benefit	$2,041	$2,117	$2,088	$2,119

Benefit Commencement	7/1/2015	12/1/2015	1/1/2016	6/1/2016
Assumed Rate	7.75%	7.75%	7.25%	7.25%
Starting Benefit	$2,041	$2,117	$2,043	$2,118

- At a 7.50% assumption, it would take about three months without retirement for the December 2015 initial benefit level to be reached
  - At a 7.25% assumed return, it would take about six months

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Considerations in Setting the Assumption

- In our opinion, the long-term future investment return assumption should be lowered based on the data from the investment forecasts and review of the guiding principles
- At the July meeting, we will:
  - Update our analysis if necessary for a new OIC asset allocation policy
  - Provide peer information on other large public systems' assumptions
  - Ask the Board to adopt an assumption for use in the upcoming valuation

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Actuarial Methods

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Key Actuarial Methods

	12/31/2013 Valuation Actual Assumption	12/31/2014 Valuation Recommended Assumption
Cost Allocation Method	Entry Age Normal	No change
Shortfall Amortization Method	Level percent of pay, layered fixed periods: Tier 1/Tier 2: 20 years OPSRP: 16 years RHIA/RHIPA: 10 Years	No change
Rate Collar	Limits change in based contribution rate to larger of 20% of current rate or 3.00% of payroll; Collar widens when funded status below 70%	No change

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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

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Shortfall Amortization Periods

- A key part of contribution rate calculations is amortization of Tier 1 / Tier 2 shortfalls over twenty years as a level percentage of payroll
  - As part of changes made in the prior experience study, UAL as of December 31, 2013 was re-amortized over twenty years
  - Subsequent gains or losses amortized over twenty years from the rate-setting valuations in which they are recognized
- Twenty years avoids significant negative amortization, where shortfall actually increases in the initial "pay down" years even if assumptions are met and contributions are made
  - The following slide illustrates pay down of a $14 billion shortfall over periods of 20, 25 or 30 years at current assumptions

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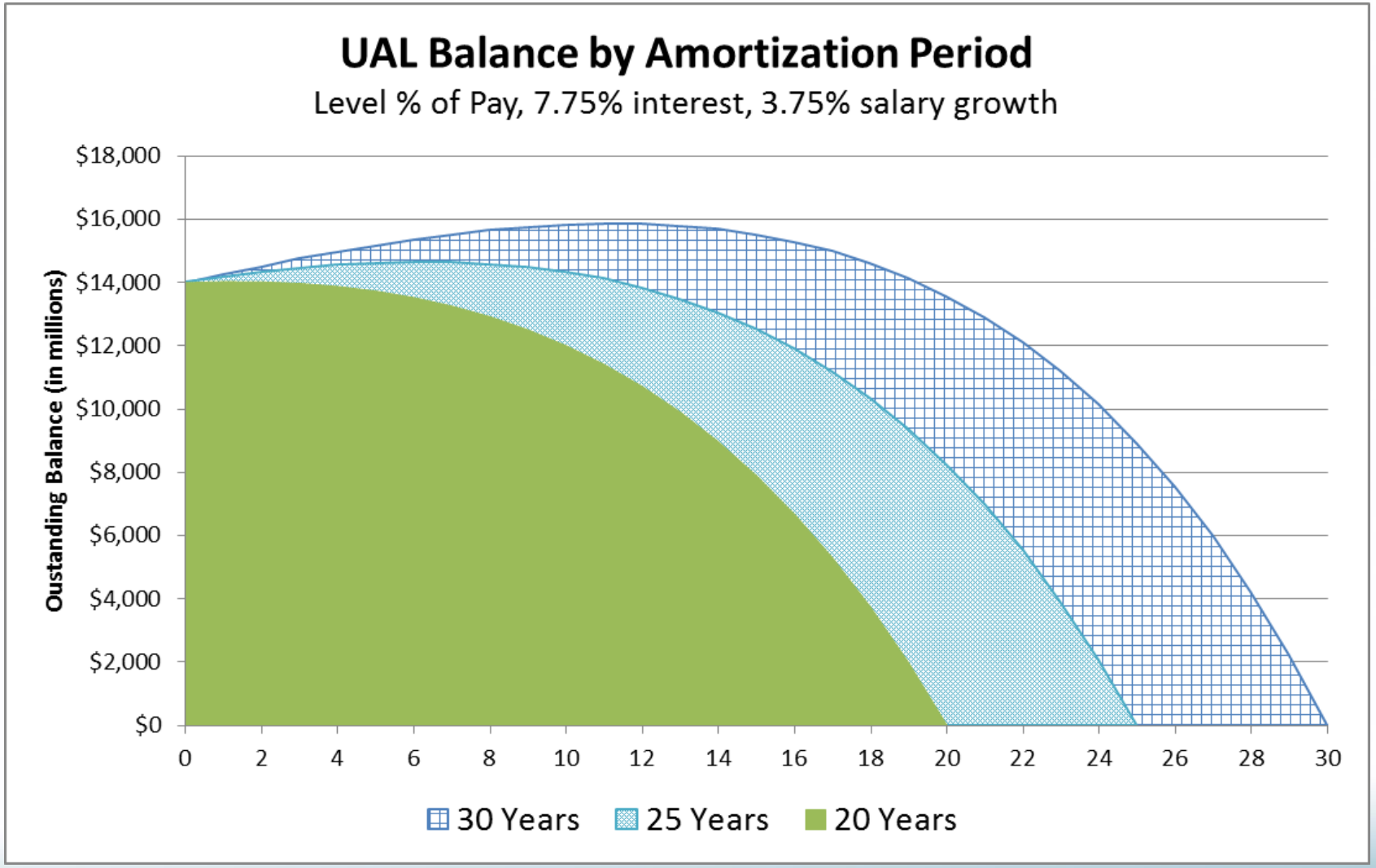
Shortfall Amortization Periods



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The Rate Collar

- In 2005, the Board adopted an employer contribution rate smoothing method called the “rate collar”
- After a major change in unfunded actuarial liability (UAL), the difference between the current contribution rate and the updated actuarially calculated rate can be large
  - The rate collar is a formulaic approach that spreads large employer contribution rate changes systematically across several biennia
- It allows employers to see both:
  - An advanced estimate of the maximum base rate change per biennium
  - The currently estimated long-term (20-year) contribution rate on a current market value of assets basis

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Rate Collaring

- The rate collar approach has three steps:
  - Calculate shortfall based on fair market asset values (excluding side accounts)
  - Calculate the actuarially determined UAL Rate based on shortfall amortization period and other key assumptions
  - Check the calculated overall rate (Normal Cost Rate plus UAL Rate) against the contribution rate currently in effect
    - If the actuarial rate change is too large, part of the calculated increase is "collared" and deferred to subsequent periods
    - The UAL Rate actually charged to employers is adjusted downward to reflect the rate collar's effects

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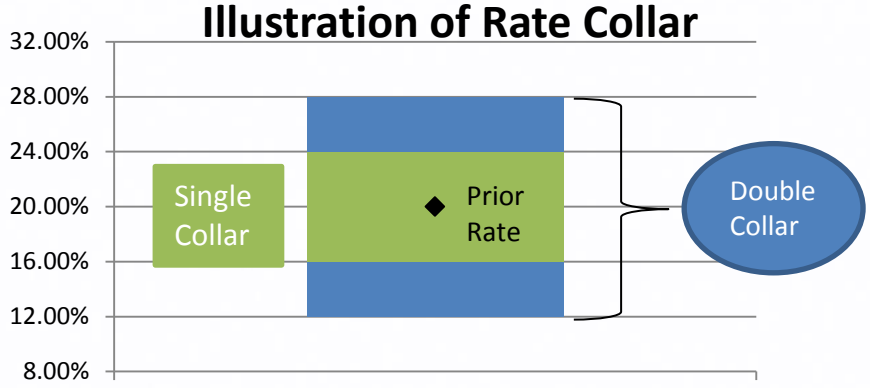
The Rate Collar's Current Design

- The maximum change typically permitted by the collar is:
  - 20% of the rate currently in effect (3% of payroll minimum collar width)
- If funded status is 60% or lower, the width of the collar doubles
  - 40% of rate currently in effect (6% of payroll minimum collar width)
- If the funded status is between 60% and 70%, the collar size is pro-rated between the initial collar and double collar level



- Collars are calculated at a rate pool level and limit the biennium to biennium increase in the UAL Rate for a given rate pool

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Agenda for July Meeting

- Review demographic assumptions
- Adopt all methods and assumptions for use in:
  - December 31, 2014 “advisory” actuarial valuation that estimates 2017-2019 contribution rates
  - December 31, 2015 “rate setting” actuarial valuation that sets recommended 2017-2019 contribution rates for PERS Board adoption

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Caveats and Disclaimers

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, 2013 ("the Valuation Report") published on September 29, 2014. 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.

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 Callan. 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.

Milliman's work product was prepared exclusively for Oregon PERS for a specific and limited purpose. It is a complex, technical analysis that assumes a high level of knowledge concerning PERS' operations, and uses PERS' data, which Milliman has not audited. It is not for the use or benefit of any third party for any purpose. To the extent that Milliman's work is not subject to disclosure under applicable public records laws, Milliman's work may not be provided to third parties without Milliman's prior written consent. Milliman does not intend to benefit or create a legal duty to any third party recipient of its work product. Any third party recipient of Milliman's work product who desires professional guidance should not rely upon Milliman's work product, but should engage qualified professionals for advice appropriate to its own specific needs.

The consultants who worked on this assignment are pension actuaries. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel. The signing actuaries are independent of the plan sponsors. 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. We are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein.

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Appendix

Actuarial Basis

Capital Market Assumptions - Milliman

For assessing the expected portfolio return under Milliman's capital market assumptions, we considered the Oregon PERS Fund to be allocated among the model's asset classes as shown below. This allocation is based on the Oregon Investment Council's Statement of Investment Objectives and Policy Framework for the Oregon PERS Fund, as revised December 3, 2014.

	Annual Arithmetic Mean	20-Year Annualized Geometric Mean	Annual Standard Deviation	Policy Allocation
US Large/Mid-Cap Equity	7.96%	6.70%	17.07%	**15.75%**
US Small Cap Equity	8.93%	6.99%	21.35%	**1.31%**
US Micro-Cap Equity	9.37%	7.01%	23.72%	**1.31%**
Non-US Developed Equity	8.34%	6.73%	19.40%	**13.13%**
Emerging Markets Equity	10.56%	7.25%	28.45%	**4.13%**
Non-US Small Cap Equity	9.01%	7.22%	20.55%	**1.88%**
Private Equity	11.60%	7.97%	30.00%	**20.00%**
US Universal Fixed Income	4.10%	4.00%	4.68%	**8.00%**
US Short-Term Bonds	3.65%	3.61%	2.74%	**8.00%**
US Bank/Leveraged Loans	5.69%	5.42%	7.82%	**3.00%**
High Yield Bonds	6.67%	6.20%	10.28%	**1.00%**
Real Estate	6.48%	5.84%	12.00%	**10.00%**
Global REITs	8.74%	6.69%	22.02%	**2.50%**
Timber	6.60%	5.85%	13.00%	**1.50%**
Farmland	7.11%	6.37%	13.00%	**1.50%**
Infrastructure	8.31%	7.13%	16.50%	**3.00%**
Commodities	6.07%	4.58%	18.40%	**1.50%**
Hedge Fund of Funds - Diversified	4.94%	4.64%	8.09%	**2.00%**
Hedge Fund Event-Driven	7.07%	6.72%	8.90%	**0.50%**
US Inflation (CPI-U)		2.50%		**N/A**
Fund Total (reflecting asset class correlations)	**7.92%**	**7.09%***	**13.76%**	**100.00%**

* Reflects 0.10% average reduction to model passive investment expenses. The model does not try to assess the actual investment expenses for active management. The model's 20-year annualized geometric median is **7.05%**.

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Appendix

Actuarial Basis

Capital Market Assumptions - Callan

For assessing the expected portfolio return under Callan's capital market assumptions, we applied the assumptions shown below provided by Callan.

	Annual Arithmetic Mean	Annual Standard Deviation	Policy Allocation	10-Year Annualized Geometric Median
Global Equity	9.5%	19.6%	**37.5%**	
Private Equity	12.0%	24.0%	**20.0%**	
Fixed Income	3.1%	3.75%	**20.0%**	
Real Assets	8.0%	15.0%	**20.0%**	
Diversifying Assets	7.0%	11.0%	**2.5%**	
Fund Total (reflecting asset class correlations)	**8.36%**	**14.07%**	**100.0%**	**7.45%**

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Appendix

Actuarial Basis

Capital Market Assumptions - Horizon

For assessing the expected portfolio return under an additional set of capital market assumptions, we applied the assumptions from the 2014 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 21 investment advisors responding to the survey.

	10-Year Annualized Geometric Mean	Annual Standard Deviation	Policy Allocation
US Equity – Large Cap	7.01%	17.48%	**15.75%**
US Equity – Small/Mid Cap	7.37%	21.11%	**5.13%**
Non-US Equity – Developed	7.41%	19.77%	**15.00%**
Non-US Equity – Emerging	8.70%	26.36%	**4.12%**
US Corporate Bonds – Core	3.46%	5.36%	**12.00%**
US Corporate Bonds – High Yield	5.51%	11.46%	**4.00%**
US Treasuries (Cash Equivalents)	2.21%	2.28%	**4.00%**
Real Estate	6.38%	13.13%	**13.00%**
Hedge Funds	5.77%	8.95%	**2.50%**
Commodities	4.50%	18.01%	**1.50%**
Infrastructure	7.71%	13.51%	**3.00%**
Private Equity	9.43%	24.82%	**20.00%**
Inflation	2.41%	2.08%	**N/A**
Fund Total (reflecting asset class correlations)	**7.40%***		**100.00%**

* 10-year annualized geometric median is **7.32%**.

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