Actuarial Assumptions & Methods Part One

OREGON PUBLIC EMPLOYEES RETIREMENT SYSTEM

May 31, 2013

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Agenda

- Discussion of rate-setting components:
  - Investment return assumption
  - Cost allocation methods
  - Shortfall amortization techniques
  - Rate collaring
- Alternative rate-setting approach for consideration in July
- Review of non-investment economic assumptions
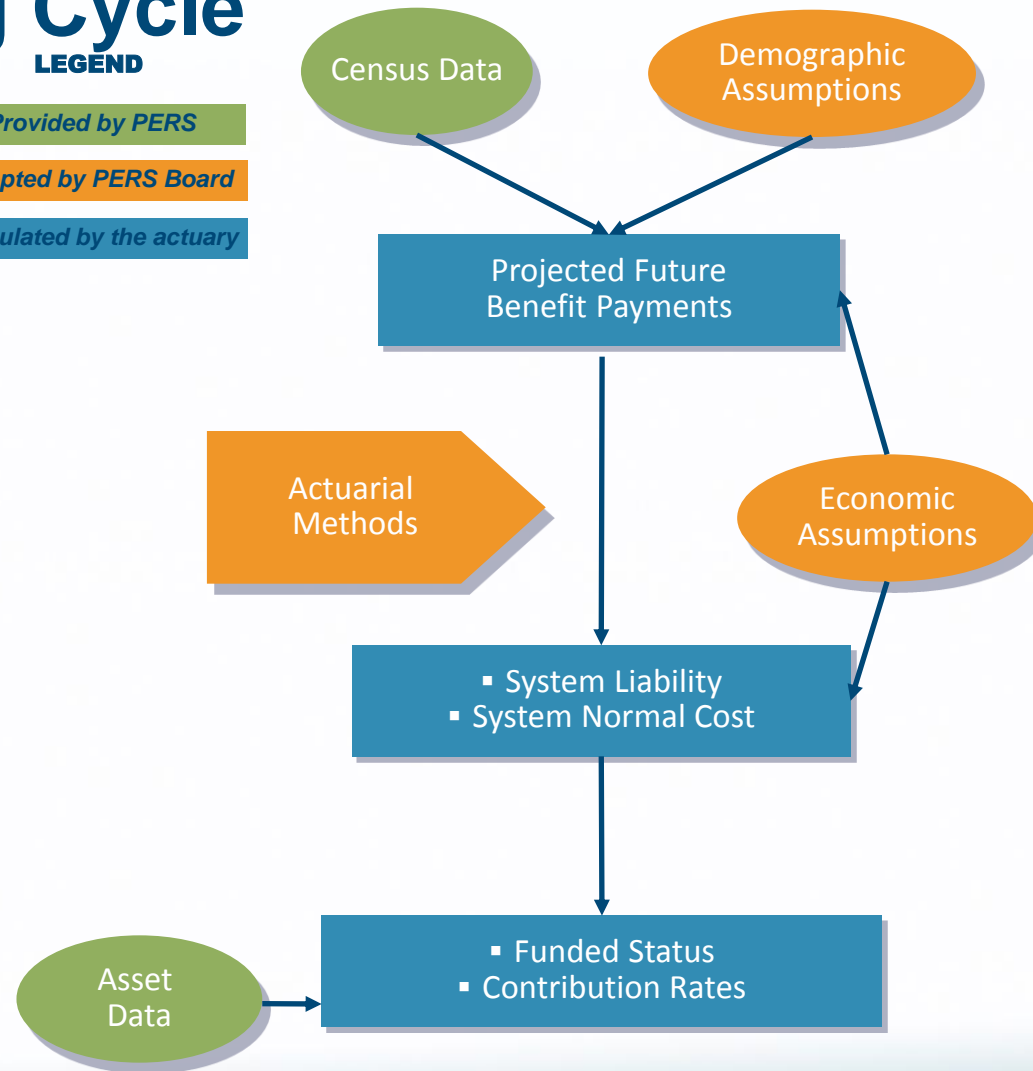
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Two-Year Rate-Setting Cycle

- July 2013: Assumptions & methods adopted by Board in consultation with the actuary

- September 2013: System-wide 12/31/12 "advisory" actuarial valuation results

- November 2013: Advisory 2015-2017 employer-specific contribution rates

- July 2014: System-wide 12/31/13 "rate-setting" actuarial valuation results

- September 2014: Disclosure & adoption of employer-specific 2015-2017 contribution rates

LEGEND

Provided by PERS
Adopted by PERS Board
Calculated by the actuary

Census Data

Demographic Assumptions

Projected Future Benefit Payments

Actuarial Methods

Economic Assumptions

- System Liability
- System Normal Cost

Asset Data

- Funded Status
- 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 investment return volatility. Overall system funding policies should seek an appropriate balance between conflicting objectives.

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Cost Equation; Governance Structure

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

> **BENEFITS = EARNINGS + CONTRIBUTIONS**

- Benefits: Plan design set by Legislature

- Earnings: Asset allocation set by Oregon Investment Council (OIC); actual returns determined by market

- Contributions: Funding, methods & assumptions set by PERS Board
  - Since contributions are the balancing item in the equation, PERS Board funding policies primarily affect the <u>timing</u> of contributions
  - Different actuarial methods and assumptions produce different expected contribution patterns

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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:
    - The actuarial accrued liability, which is a net present value
    - The 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 monthly money match benefits

> Reflecting expectations for both investment earnings and benefit levels for certain members, the assumption helps set an appropriate glide path for employer contribution rates

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Discount Rate Calculations
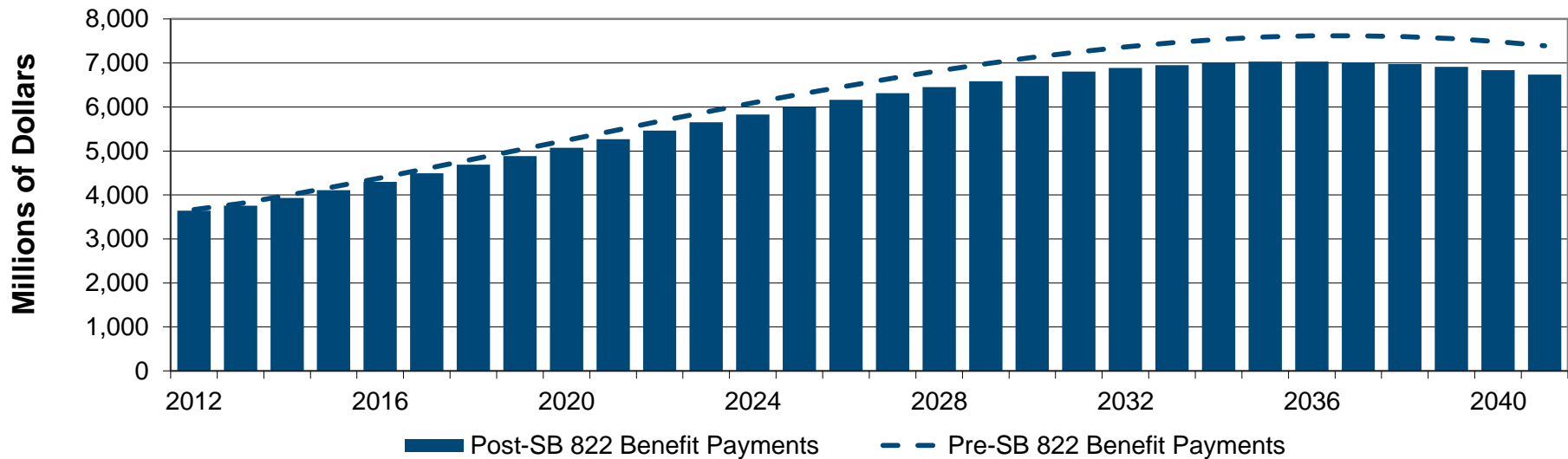
- How many assets do we need to "pay" for these projected payments <u>today</u>?

- This present day value assessment of liabilities is much more speculative than determining the value of system assets

  - When judging the sufficiency of current assets to pay future benefits, the assumption about future investment returns plays a central role

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Discount Rate Calculations

- What asset level would be needed today to fund the $7.0 billion of projected benefits payments to be made in 2033?
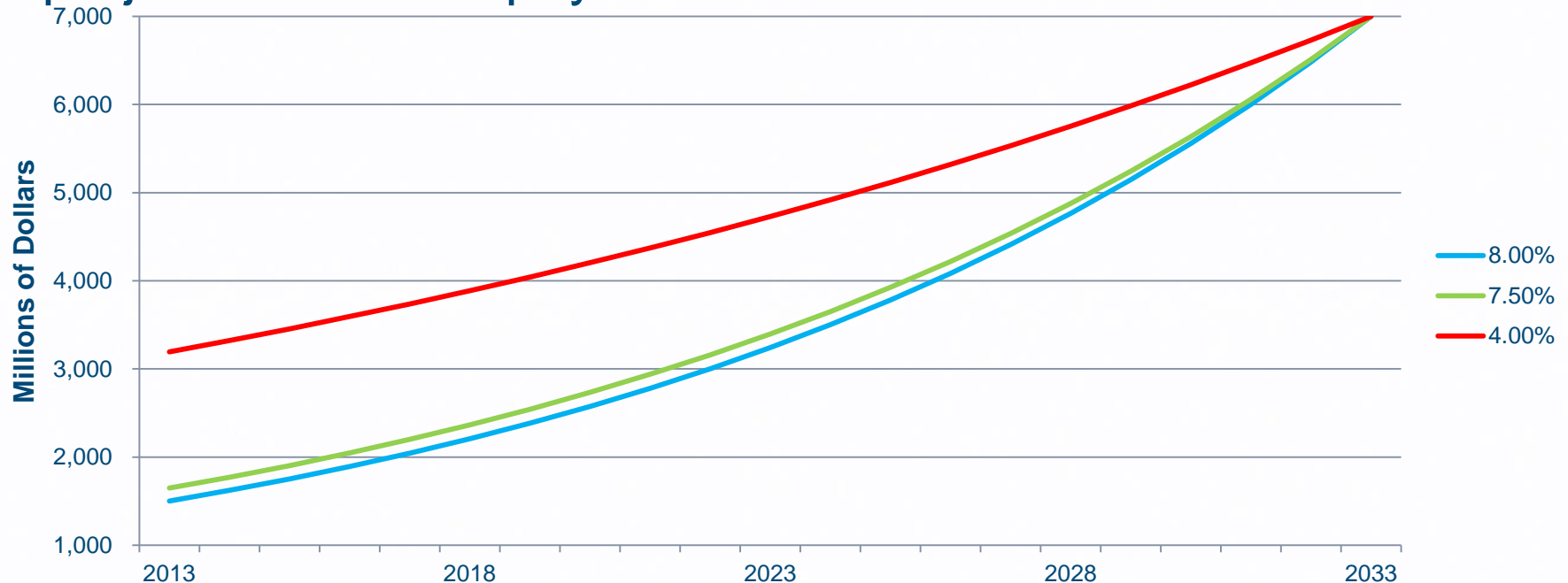
About 10% more assets would be needed today for the 2033 payments if investments earn 7.5% instead of 8.0%. If investments were to earn only 4.0%, assets needed today would be more than twice as much.

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Discount Rate Calculations

- If the 8% assumption is used but actual earnings are less by how far do we miss the mark?
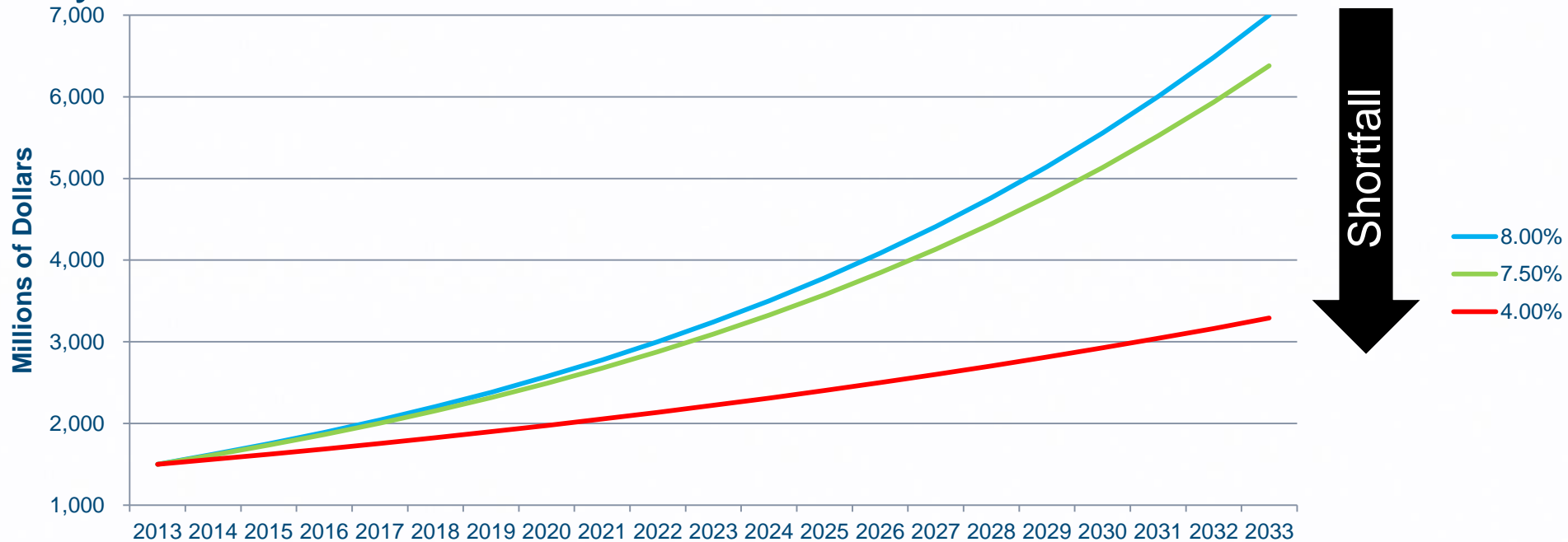
If investments actually earn 7.5%, needed assets fall $620 million short of target. If actual earnings are 4%, assets would be $3.7 billion short.

The ramifications over the long-term of missing the assumed return are significant.

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Effect of Return Assumption on Amortization

- At the 8% investment return assumption, not enough money is on hand today to fully satisfy obligations

  - This shortfall is the $16 billion UAL, or unfunded accrued liability, (excluding side accounts) in the 12/31/2011 actuarial valuation

- To address a shortfall, an installment payment plan is developed with three key components setting the payment level

  - Investment return assumption

  - Amortization period

  - Payroll growth assumption

- The installment plan is the "UAL Rate" portion of employer rates

How does changing the long-term investment return assumption affect the installment payment plan?

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Effect of Return Assumption on Amortization

- What contributions would be needed on a "20-year installment plan" to fund all 2033 projected benefits payments?
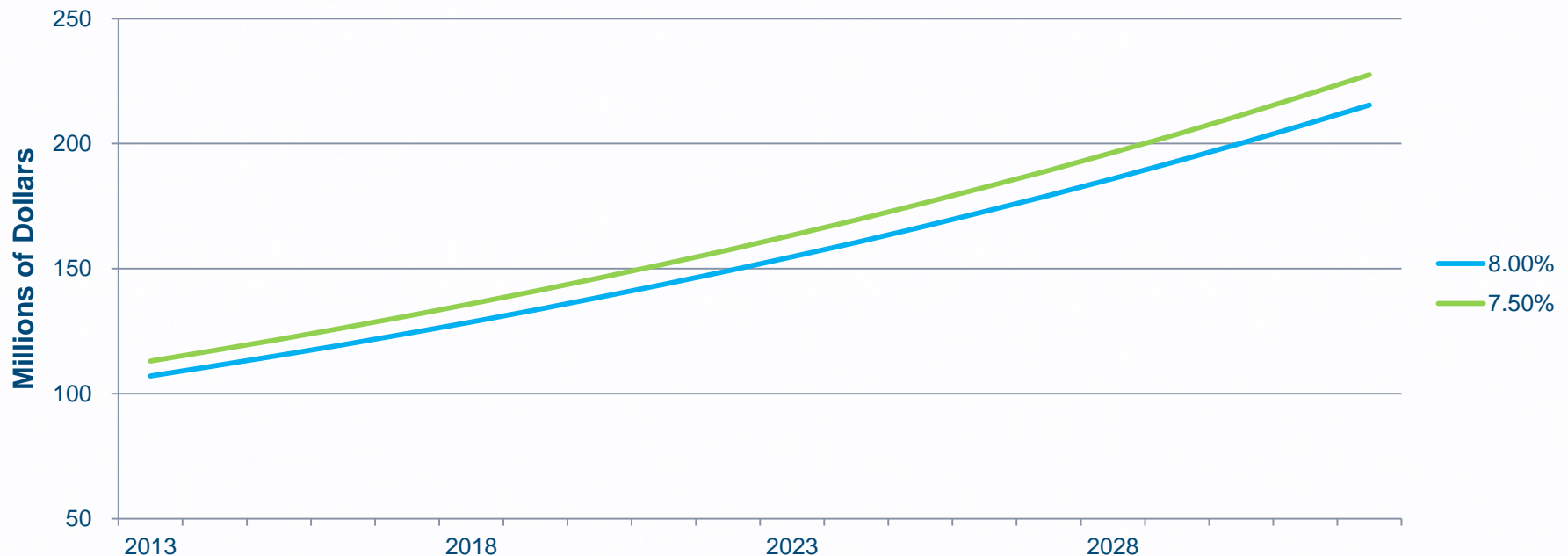
In comparing needed 20-year contribution levels, contributions should be **5% to 6% highe**r at a given shortfall level if returns are assumed at 7.5% to account for the lower anticipated investment earnings over the 20-year period.

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Setting the Return Assumption

- Since funded status is less than 100%, we are effectively using a blend of the "money on hand today" and "20-year payment plan" approaches

- Under either approach, the key question to answer is:

On average, how much will fund investments earn between now and then?

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Setting the Return Assumption

Given that we do not know what the fund will earn, how should we proceed?

- Prudently select a best estimate

- Solicit forecasts from investment professionals

- Recognize that hoping for a result does not make it happen; the assumption does not affect actual investment returns

- Don't be myopic --- the objective is to make a sound 20-year estimate, not to get a single individual year right

- Neither ignore historical results nor be 100% beholden to them

- Since actual results will vary from assumption, review the forecasts' probability ranges and consider a margin for variance

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Investment Return 20-Year Forecasts

- To assist the Board, we have 20-year annualized return forecasts from three professional advisors
  - Pension Consulting Alliance (PCA)
  - Milliman
  - Strategic Investment Solutions (SIS)
- Forecasts do not reflect any possible "alpha" due to selected managers outperforming their peers and market benchmarks
- PCA and SIS consult to the Oregon Investment Council
  - PCA and SIS provided us with their market outlook assumptions, which we placed into an industry standard mean/variance model
- Today's speakers are not credentialed investment advisors
  - We are presenting results based on market outlook assumptions developed by Milliman's credentialed investment professionals

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Investment Return 20-Year Forecasts

- Forecasts are based on OIC <u>target</u> long-term asset allocation
  - Current actual allocation differs somewhat from the target allocation
- Target allocations are under review, and could change by the PERS Board's July meeting

Percentile	PCA	Milliman	SIS
25th	4.63%	5.63%	5.45%
35th	5.48%	6.45%	6.36%
45th	6.25%	7.18%	7.19%
50th	**6.62%**	**7.54%**	**7.59%**
55th	7.00%	7.90%	7.99%
65th	7.78%	8.65%	8.82%
75th	8.65%	9.48%	9.76%

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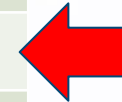
Effects of Lowering the Assumed Rate

- A lower investment return assumption would produce higher calculated liabilities and contribution rates

  - Tilts the expected balance of the fundamental cost equation from earnings to contributions

  - Effect of lowering the rate to 7.5% was previously estimated in November 2012 as a 3.0% of payroll increase in uncollared base rate
    - SB 822 decreased plan liabilities since that estimate was made
    - We now estimate an assumed rate change would likely increase uncollared base rates by 2.8% to 2.9% of payroll

- 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 Rate

- Lowering the assumed rate from 8.0% to 7.5% would affect the money match calculation for a member age 59 ½ with a $135,000 member account balance as of 6/30/2013 in the following manner

Benefit Commencement	7/1/2013	12/31/2013	1/1/2014	7/1/2014
Assumed Rate	8.00%	8.00%	7.50%	7.50%
Starting Benefit	$2,093	$2,189	$2,099	$2,194

- Assuming annuitization factors change effective 1/1/2014, it would take about six months without retirement (until July 2014) for the December 2013 initial benefit level to be reached

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Conclusion & Next Steps

- In our opinion, the long-term investment return assumption should be lowered based on the data from the investment forecasts and review of the guiding principles

> *Recommendation for July:*
> *Look at effects of change to a 7.50% assumed rate*

- At 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 make a final decision on the assumption

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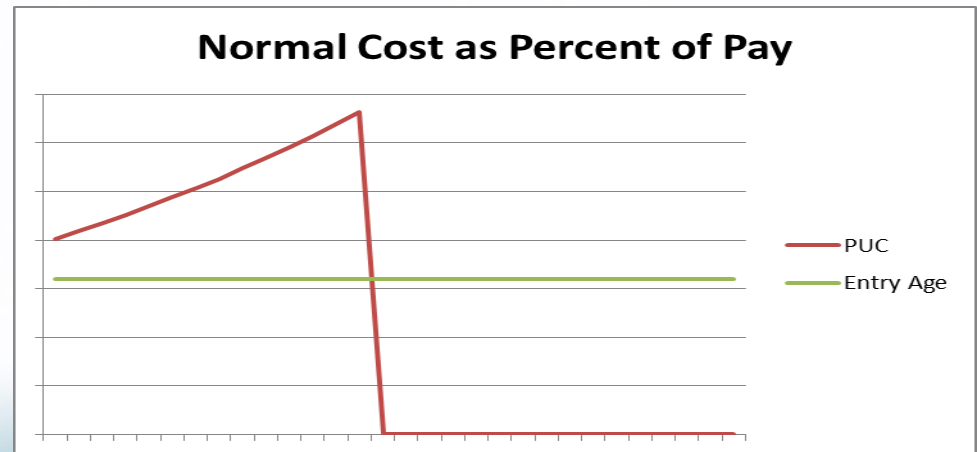
Actuarial Cost Allocation Method

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

- The two most commonly used cost allocation methods are:
  - Entry age normal (EAN)
  - Projected unit credit (PUC)

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Cost Allocation Method – Money Match

- For projected retirements under money match, the two methods have very different cost allocation patterns

- Projected unit credit (PUC) allocates the full benefit to pre-2004 service, consistent with the timing of member contributions

- Entry age normal (EAN) allocates the benefit over the full working career, even though money match benefits are tied to pre-2004 contributions

This chart illustrates the normal cost pattern as a percent of pay for a sample member projected to retire under money match

Normal Cost as Percent of Pay

PUC
Entry Age

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Cost Allocation Method – OPSRP or Full Formula

- For projected retirements under OPRSP or Tier 1/Tier 2 full formula, PUC and entry age allocate costs differently

- Both methods allocate costs over the full working career

  – Entry age remains level as percentage of payroll

  – PUC starts lower and ends higher, allocating higher benefit costs to the years closest to retirement

This chart illustrates the normal cost pattern as a percent of pay for a sample member projected to retire under OPSRP or Tier 1/Tier 2 full formula

Normal Cost as Percent of Pay

PUC
Entry Age

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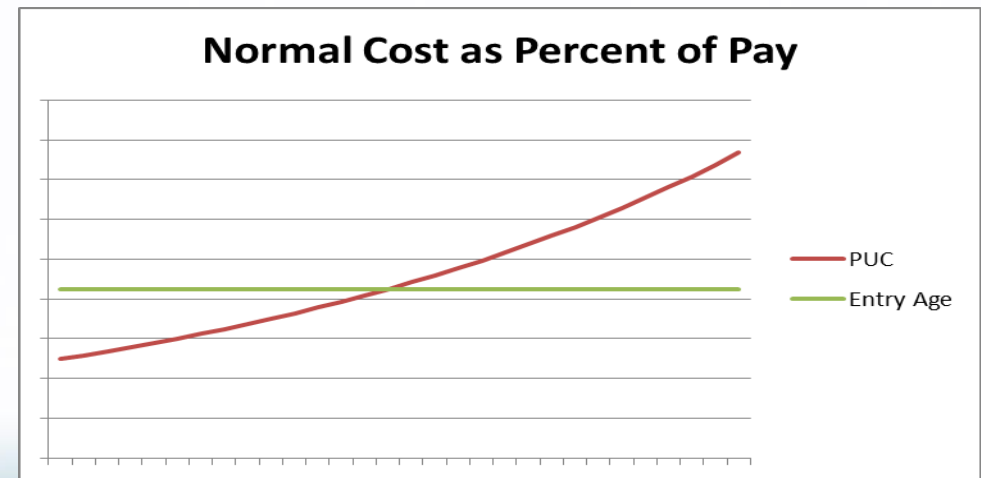
Impact of GASB Standards

- Projected unit credit (PUC) was adopted by the PERS Board in 2005

- PUC's advantages are transparency and full past service accrual of projected Money Match benefits

- PUC is also permitted under the current financial reporting standards (GASB 25 & 27)

  – This means that one set of PUC calculations can be used for both:

    • Employer contribution rate determination

    • Annual system and employer financial reporting

> New financial reporting standards (GASB 67 & 68) are replacing the current standards. The new standards will be used for the 6/30/14 system financial statement and 6/30/15 employer financial statements.

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Conclusion & Next Steps

- New GASB standards require <u>financial reporting calculations</u> are done under the entry age normal (EAN) cost allocation method

- Pros of also changing the allocation method to EAN for <u>employer contribution rate calculations</u> are:
  - A more streamlined set of actuarial calculations (e.g., only reporting a single shortfall number for the system or for a given employer)
  - Biennium to biennium stability in normal cost portion of contribution rate

- Cons of changing to EAN for contribution rate calculations are:
  - Arbitrary changes to contribution rates due to an attempt to comply with an accounting standard
  - EAN is a somewhat less transparent and more theoretical method

Recommendation for July:
Analyze a change to EAN for contribution rate calculations, with an effort to mitigate the effects of arbitrary rate changes
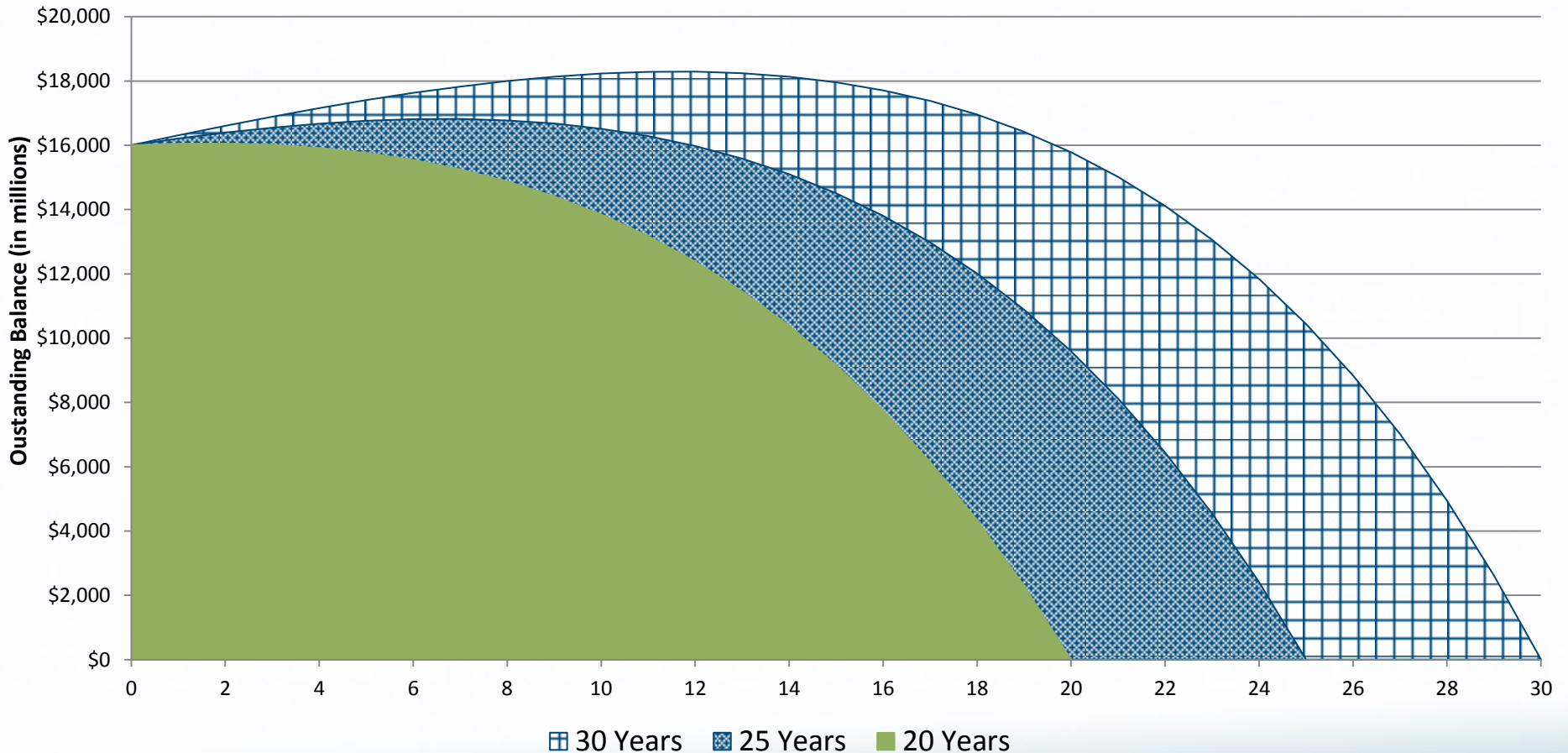
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Shortfall Amortization

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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

- 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 $16 billion shortfall over periods of 20, 25 or 30 years at current assumptions

- When combined with the rate collar technique, the large shortfall created in 2008 is being amortized in several pieces

  – 1st piece amortized in collared UAL Rate increase effective July 2011

  – 2nd piece amortized in collared UAL Rate increase scheduled for July 2013 (increase approved at September 2012 Board meeting)

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Shortfall Amortization Periods

UAL Balance by Amortization Period
Level % of Pay, 8.0% interest, 3.75% salary growth

Legend: ⊞ 30 Years · ▨ 25 Years · ▰ 20 Years

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Shortfall Amortization Periods

- Recent funding policy guidance recommends periods of twenty years or less for amortizations of most shortfall sources as a best practice

- The guidance indicates that for certain specified shortfall sources, amortizations of up to twenty-five years can be considered

  - Changes in either cost allocation method or long-term investment return assumption are two shortfall sources identified by the guidance for possible extended amortization

Recommendation for July:
Analyze amortization approaches to partially or fully mitigate the immediate rate change effects of modifications to the assumed rate and/or the cost allocation method

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Rate Collaring

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Rate Collaring

- In 2005, the Board adopted a direct rate smoothing method called the "rate collar"

- After a major downturn, if the difference between the current contribution rate and the updated actuarially calculated rate is large, the rate collar spreads the actuarially needed increases across several periods

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Rate Collaring

- The rate collar approach has three steps:
  - Calculate shortfall based on fair market asset values
  - 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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Rate Collaring

- The rate collar was stress tested in 2005 using a wide variety of potential future investment return scenarios prior to its adoption for use in 2007-2009 contribution rate calculations

- Based on rates and funded status at that time, two special features were built into the rate collar to allow for timely recovery if a bull market was followed by a major downturn
  - 3% of payroll minimum collar width
  - The collar's width doubles in the event of low funded status

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Rate Collaring

- The rate collar's design including those special feature is:
  - 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 70% 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 70% and 80%, the collar size is pro-rated between the initial collar and double collar level

Illustration of Rate Collar
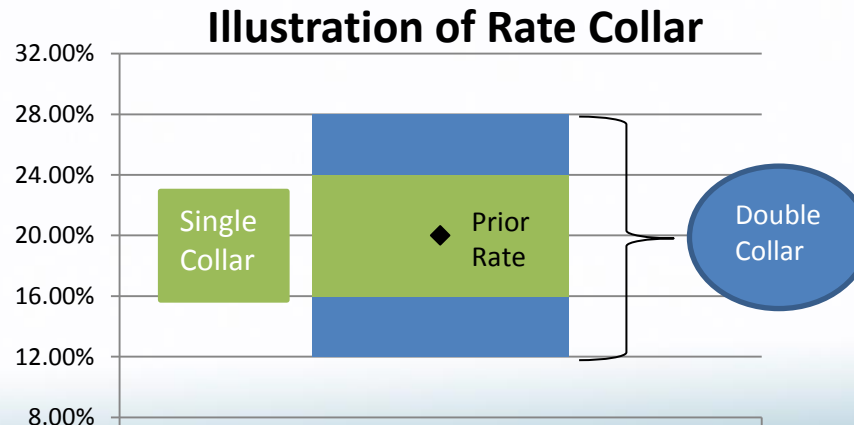
Rate Collaring

- After the rate collar was implemented, we experienced a bull market in 2006 and 2007

- The results of the last pre-downturn actuarial valuation (12/31/07), which set 2009-2011 contribution rates, were:
  - 98% funded status (excluding side accounts)
  - $1.2 billion unfunded liability (excluding side accounts)
  - Base Tier 1/Tier 2 pension contribution rate of 12.1% of payroll

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Rate Collaring

- The effects of the downturn were first reflected in the 2011-2013 rates set based on the 12/31/2009 actuarial valuation

  - Rate increases from 2009-2011 to 2011-2013 were collared around the 2009-2011 rates, which were set by the pre-downturn 12/31/2007 actuarial valuation

- The "special features" in the collar did their job, allowing an appropriate July 2011 rate increase to:

  - Prevent further funded status erosion

  - Begin to reposition the system for long-term funded status recovery with additional scheduled rate increases which were deferred by the collar

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Rate Collaring

- Our projections indicate that rate increases will likely continue over the next few biennia, with system average rates (excluding IAP contributions and before reflecting the effects of side account rate offsets) nearing 26% of payroll at median investment return forecast

  – A "double rate collar" increase at that point would be 10.4% of payroll

  – While 26% is the system average rate, the school district rate is currently 5% of payroll above the system average, so the double rate collar for school district employers would be even wider

    • Rate collars are calculated at a rate pool (or independent employer) level

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Rate Collaring

- The collar's special features were designed to allow sufficient rate increases in the event of a major downturn

  - At 12/31/2009, the system was 76% funded and the special features allowed a 4.2% of payroll system average increase

- If future experience is close to assumptions then rates will be near 26% of payroll and a "single collar" increase without the special features would be 5.2% of payroll

- Since rates are already higher and are forecast to continue to increase further, does a rate collar structure without the double collar feature allow sufficient rate increases to protect funded status?

Recommendation for July:
Analyze the impact of removing the rate collar's "double collar" feature

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Alternative Rate Setting Approach for Consideration

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Alternative Proposed Rate Setting Approach

- The assumptions and methods set this year will guide the employer rate calculations for the 2015-2017 biennium

- At the July meeting we propose to analyze the current policy versus an alternative policy with the following components:

  > *Decreased long-term investment return assumption*
  > *Liabilities calculated by entry age actuarial cost allocation method*
  > *Consider amortization approaches that can partially or fully mitigate arbitrary rate increases due to the above two items*
  > *Elimination of "double collar" feature of rate collar structure*

- The policy comparison would be a stress test under a wide variety of potential future investment return scenarios

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# Review of Non-Investment Economic Assumptions

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Assumptions to Be Reviewed

	Current Assumption	Recommended Assumption
Inflation	2.75%	No change
Real Wage Growth	1.00%	No change
Payroll Growth	3.75%	No change
OPSRP Administrative Expenses	$6.6 million	$5.5 million

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Economic Assumptions
Inflation

- The inflation assumption affects other assumptions, including payroll growth, investment return, and health care inflation

- Inflation has varied significantly over time, as shown in the chart. The median rate over the period shown is 2.97%

- Market estimates of future inflation can be derived from yields of Treasury securities and Treasury Inflation Protected Securities (TIPS)

- Social Security's current "middle of the road" long-term inflation assumption is 2.80%
  - Combined with its lower near-term assumption, it produces a 30-year average of 2.68%

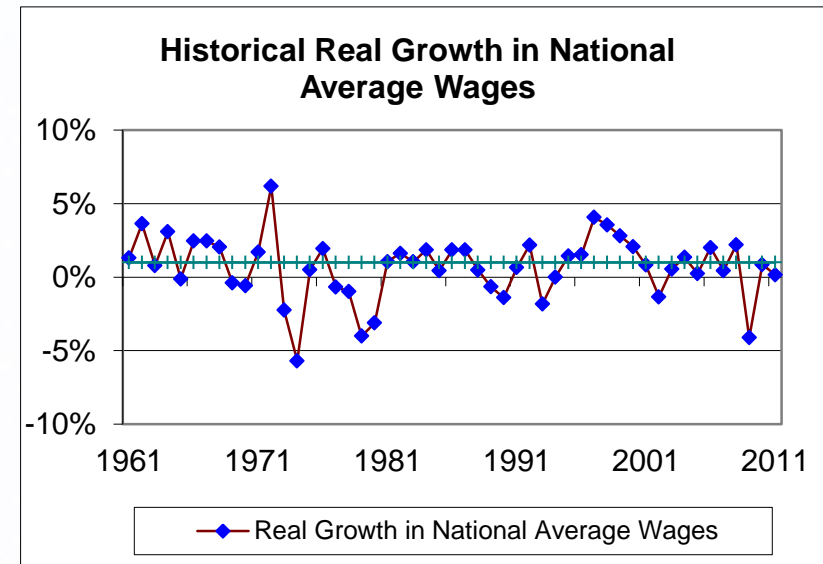- We recommend no change to the current assumption of 2.75%

Historical CPI-U
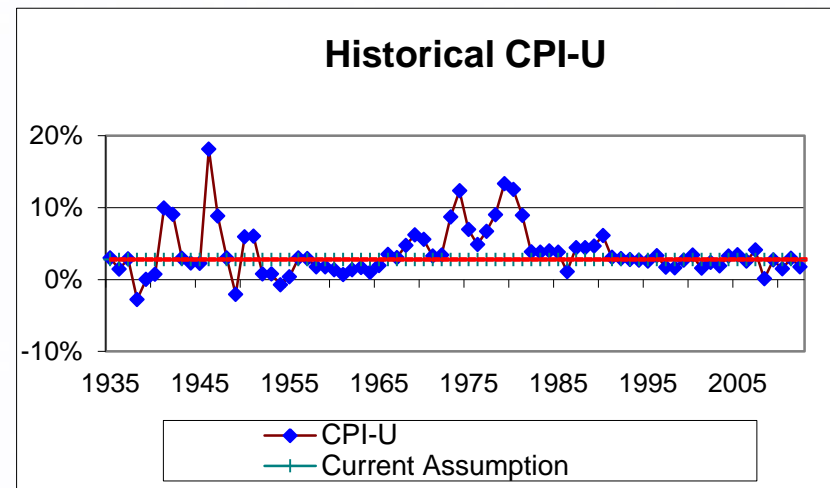
As of 12/31/2012	10-Year	30-Year
Treasury Yield	1.78%	2.95%
TIPS Yield	-0.67%	0.41%
Breakeven Inflation	**2.45%**	**2.54%**

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Economic Assumptions
Real Wage Growth

- An individual member's expected salary increase is composed of:
  - Inflation
  - Real wage growth
  - Merit/longevity wage growth

- Real wage growth represents the increase in wages above inflation for the entire group due to improvements in productivity and competitive pressures

- Social Security's long-term "middle of the road" assumption for real wage growth is 1.12%

- We recommend no change to the current assumption of 1.00%

Historical Real Growth in National Average Wages

Legend: Real Growth in National Average Wages

Period Ending 12/31/2012	Average Real Wage Growth
20 Years	0.93%
30 Years	0.88%
40 Years	0.47%
50 Years	0.67%

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Economic Assumptions
OPSRP Administrative Expenses

- OPSRP administrative expenses are significant relative to OPSRP assets
  - As OPSRP program matures, the expense level relative to assets will decline and ultimately stabilize. Until then, it is appropriate to include a specific expense assumption which is added to the OPSRP normal cost
- Our current assumption is $6.6 million per year
  - A cost allocation change in PERS policy lowered 2012 expense
- We recommend lowering the assumption to $5.5 million per year

	Actual Expense	% of Beginning of Year Assets
2009	$6.7	2.5%
2010	$6.1	1.4%
2011	$6.9	1.0%
2012	$5.3	0.6%

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Agenda for July Meeting

- Update investment return analysis for any OIC changes

- Compare financial projections under current policies and proposed alternative policies

- Review demographic assumptions

- Adopt all methods and assumptions for use in:

  - December 31, 2012 "advisory" actuarial valuation that estimates 2015-2017 contribution rates

  - December 31, 2013 "rate setting" actuarial valuation that sets recommended 2015-2017 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, 2011 ("the Valuation Report") published on October 26, 2012. 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 Strategic Investment Solutions (SIS) and Pension Consulting Alliance (PCA). 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.

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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 18, 2012.

	Annual Arithmetic Mean	30-Year Annualized Geometric Mean	Annual Standard Deviation	Policy Allocation
US Large-Cap Equity	8.60%	7.20%	17.90%	13.35%
US Mid-Cap Equity	9.38%	7.30%	22.00%	4.45%
US Small-Cap Equity	10.38%	7.45%	26.40%	2.61%
Non-US Developed Equity	8.73%	6.90%	20.55%	16.29%
Emerging Markets Equity	11.51%	7.40%	31.70%	6.30%
Private Equity	11.95%	8.26%	30.00%	16.00%
US Universal Fixed Income	4.70%	4.50%	6.50%	13.50%
US Intermediate-Term Bonds	4.23%	4.10%	5.15%	5.00%
Non-US Fixed Income	3.70%	3.19%	10.50%	1.25%
High Yield Bonds	7.21%	6.66%	11.10%	5.25%
Real Estate	7.27%	6.51%	13.00%	11.42%
Global REITs	8.41%	6.76%	19.45%	2.21%
Commodities	7.71%	6.01%	19.70%	1.12%
Hedge Funds	6.46%	6.01%	10.00%	1.25%
US Inflation (CPI-U)		2.75%	2.00%	N/A
Fund Total (reflecting asset class correlations)	**8.35%**	**7.54%***	**12.90%**	**100.00%**

* Reflects 0.12% average reduction for investment expense and 0.05% reduction for administrative expenses.

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Appendix

Actuarial Basis

Capital Market Assumptions - SIS

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

	Annual Arithmetic Mean	Annual Standard Deviation	Policy Allocation	30-Year Annualized Geometric Mean
US Large-Cap Equity	9.1%	17.5%	16.9%	
US Small-Cap Equity	9.8%	20.0%	4.2%	
Non-US Developed Equity	9.8%	20.0%	16.7%	
Emerging Markets Equity	12.2%	29.0%	5.2%	
Private Equity	14.7%	33.0%	16.0%	
US Universal Fixed Income	2.5%	5.0%	15.0%	
Bank Loans	4.4%	7.5%	5.0%	
Emerging Market Debt	4.9%	10.0%	2.5%	
High Yield Bonds	5.1%	11.0%	2.5%	
Real Estate	7.7%	18.0%	11.0%	
Absolute Return	5.4%	10.0%	1.0%	
Commodities	8.0%	30.0%	0.7%	
Infrastructure	9.1%	24.0%	1.5%	
Hard Assets	10.8%	28.0%	1.8%	
Fund Total (reflecting asset class correlations)	**8.71%**	**14.46%**	**100.0%**	**7.59%***

* Reflects 0.12% average reduction for investment expense and 0.05% reduction for administrative expenses.

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Appendix

Actuarial Basis

Capital Market Assumptions - PCA

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

	Annual Arithmetic Mean	Annual Standard Deviation	Policy Allocation	30-Year Annualized Geometric Mean
Global Equity	9.00%	18.5%	43%	
Private Equity	12.0%	26.0%	21%	
US Fixed Income	2.25%	4.5%	25%	
Real Estate	6.4%	10.0%	6%	
Real Return	5.85%	8.0%	5%	
Fund Total (reflecting asset class correlations)	**7.63%**	**13.48%**	**100.00%**	**6.62%***

* Reflects 0.12% average reduction for investment expense and 0.05% reduction for administrative expenses.

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