Wisconsin Retirement System

Dividends and Downside Investment Risk

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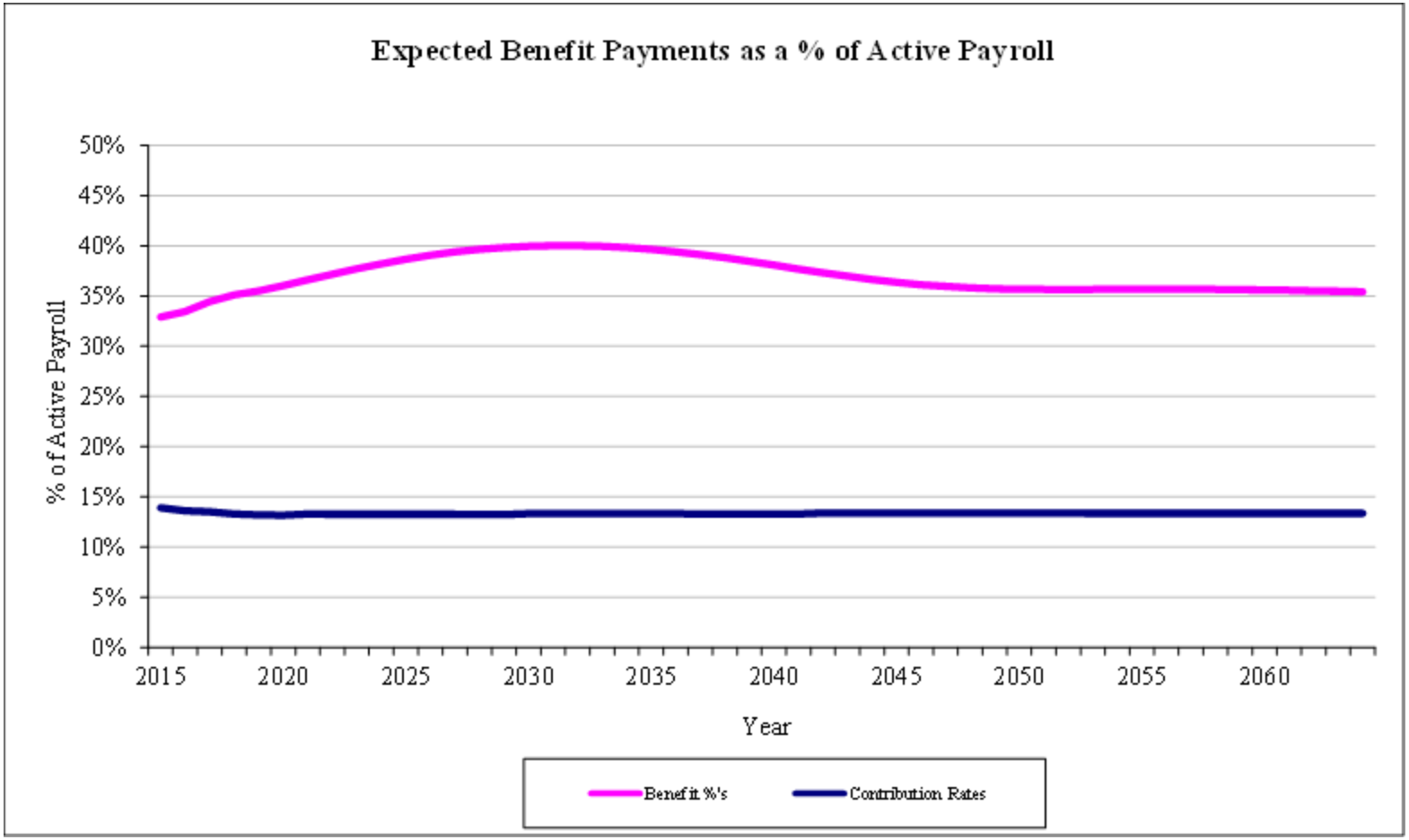
Study Objectives

- Review emerging demographic trends
- Perform stochastic projections
- Perform various deterministic projections
- Evaluate worst case scenarios
- Investigate probability of depleting the dividend reserve
- Investigate probable range of contribution rates

Projected Contributions and Benefits as a % of Active Payroll



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Comments

- Liquidity needs (i.e., contributions less benefits) increase to over 4% of fund assets
- Benefit payout peaks at about 40% of payroll – more than 3 times the level of contribution income
- Benefits as % of payroll have increased more than expected primarily due to declines in active headcount and low wage inflation
- More than 2/3^{rds} of benefit payout will come from investment return

Stochastic Scenarios

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Monte Carlo Simulations

- Based on 10,000 random trials
- Valuation Assumptions held constant
- Assumes seven sets of expected return/standard deviations

  Scenario 1 - 5.0%/9.3%
  Scenario 2 - 6.0%/11.9%
  Scenario 3 - 7.0%/15.9%
  Scenario 4 - 7.2%/16.8%
  Scenario 5 - 8.0%/20.6%
  Scenario 6 - 9.0%/25.9%
  Scenario 7 - 10.0%/32.3%

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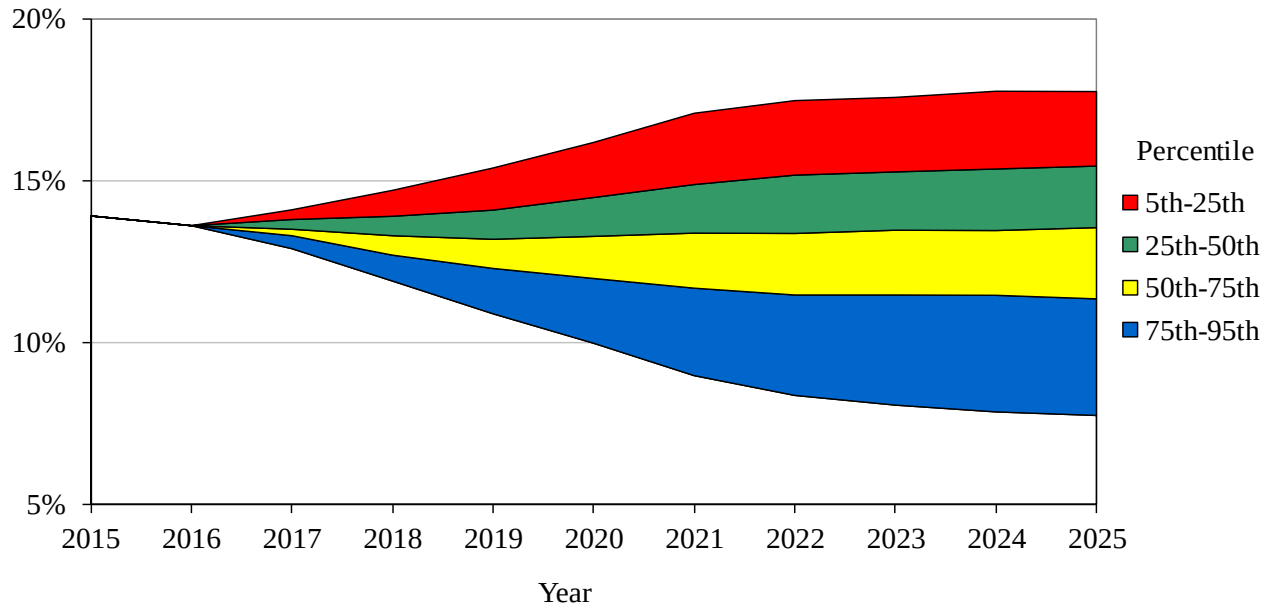
Contribution as a % of Payroll
Scenario 4 – 7.2%ER,16.8%SD



5th Percentile	13.9%	13.6%	14.1%	14.7%	15.4%	16.2%	17.1%	17.5%	17.6%	17.8%	17.7%
25th Percentile	13.9%	13.6%	13.8%	13.9%	14.1%	14.5%	14.9%	15.2%	15.3%	15.4%	15.4%
Median	13.9%	13.6%	13.5%	13.3%	13.2%	13.3%	13.4%	13.4%	13.5%	13.5%	13.5%
75th Percentile	13.9%	13.6%	13.3%	12.7%	12.3%	12.0%	11.7%	11.5%	11.5%	11.5%	11.3%
95th Percentile	13.9%	13.6%	12.9%	11.9%	10.9%	10.0%	9.0%	8.4%	8.1%	7.9%	7.7%

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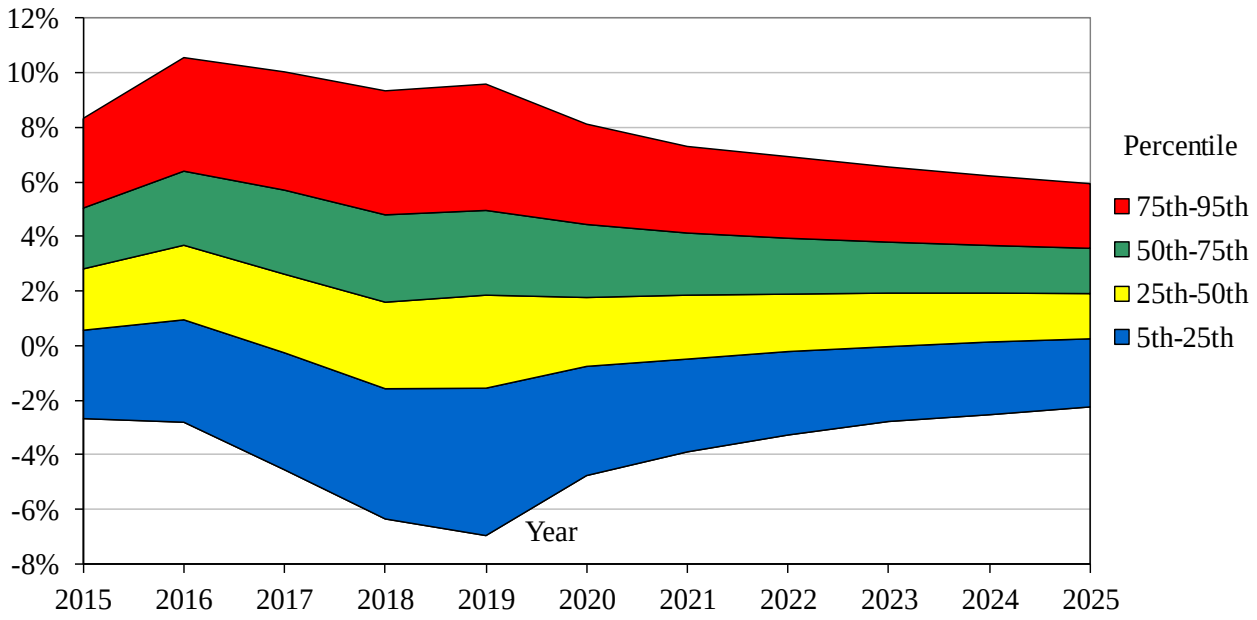
Dividend Rates
Scenario 4 – 7.2%ER,16.8%SD



5th Percentile	-2.7%	-2.8%	-4.6%	-6.4%	-7.0%	-4.8%	-3.9%	-3.3%	-2.8%	-2.5%	-2.2%
25th Percentile	0.6%	0.9%	-0.3%	-1.6%	-1.6%	-0.8%	-0.5%	-0.2%	0.0%	0.1%	0.2%
Median	2.8%	3.7%	2.6%	1.6%	1.8%	1.8%	1.8%	1.9%	1.9%	1.9%	1.9%
75th Percentile	5.0%	6.4%	5.7%	4.8%	5.0%	4.4%	4.1%	3.9%	3.8%	3.7%	3.6%
95th Percentile	8.3%	10.6%	10.0%	9.3%	9.6%	8.1%	7.3%	6.9%	6.5%	6.2%	5.9%

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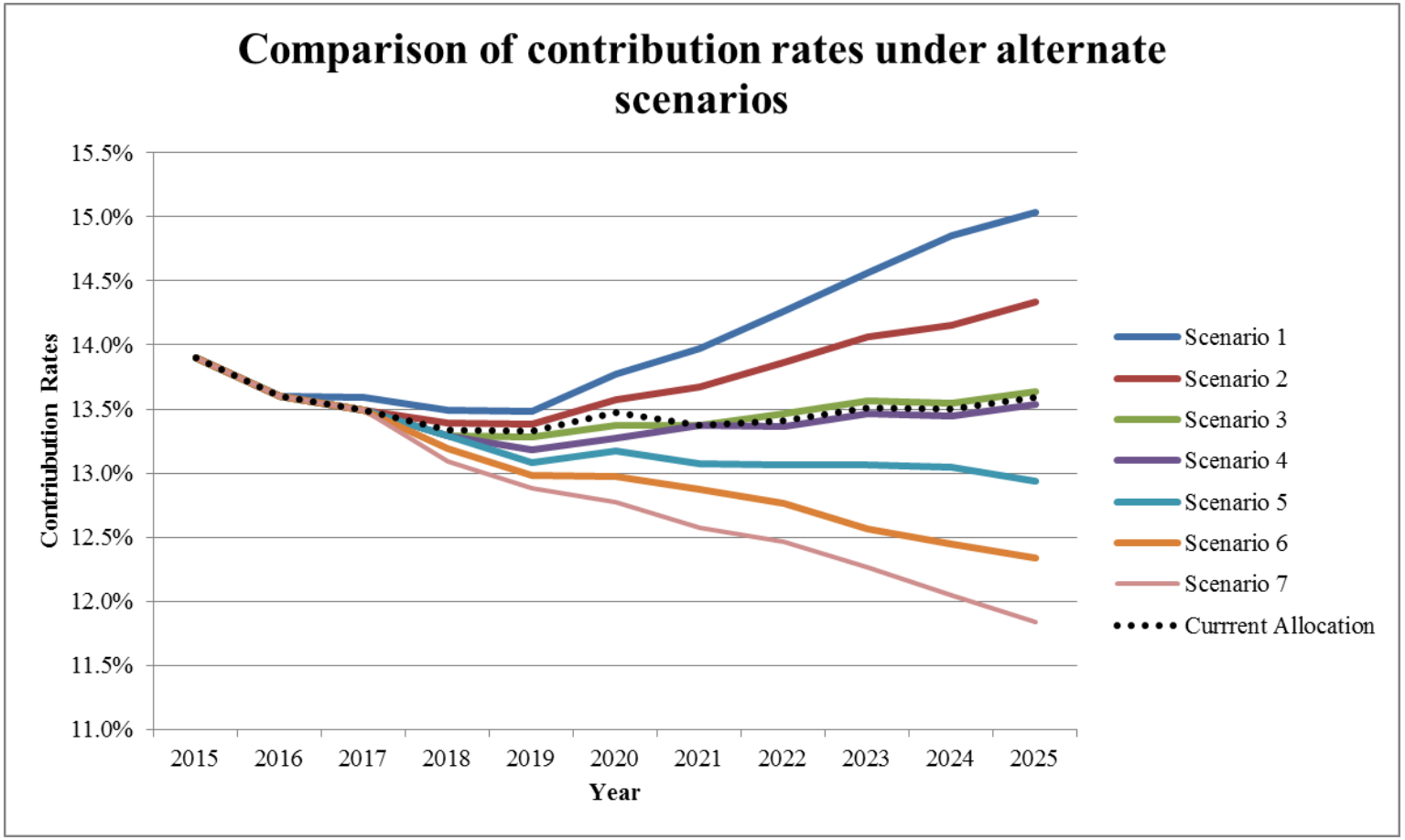
Contribution rate summary under alternate scenarios - median



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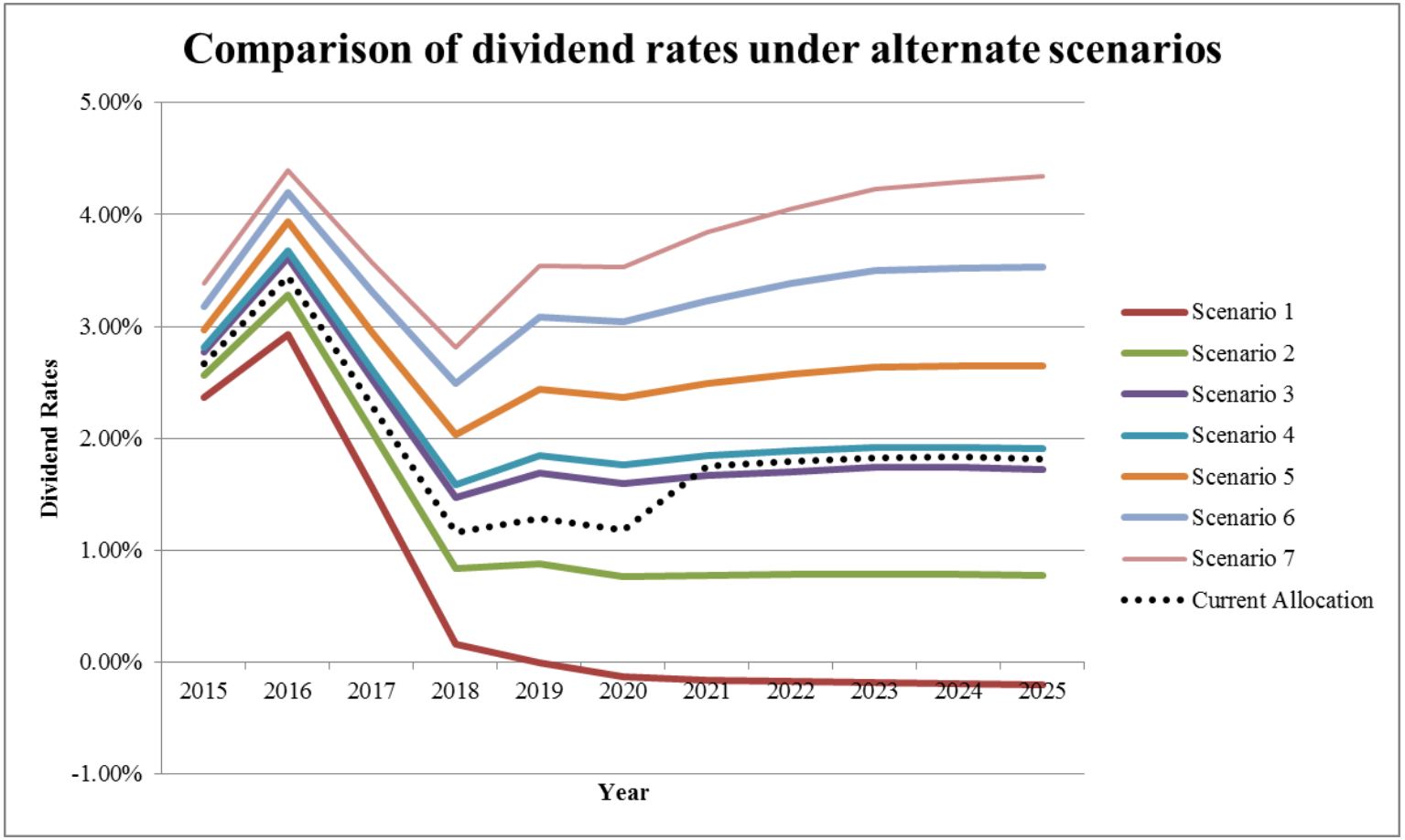

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Comments on Monte Carlo Simulations

- Based on normal market fluctuations, there is a wide range of probable outcomes – even if the long-term average rate of return is exactly as assumed
- Market returns of last decade have been volatile asset returns may not be normally distributed.
- Maturing plans such as WRS are increasingly exposed to the effects of market volatility.
- The unique benefit structure of WRS enables it to deal with volatility to an extent not feasible in most public sector retirement systems.

Dividend Discussion

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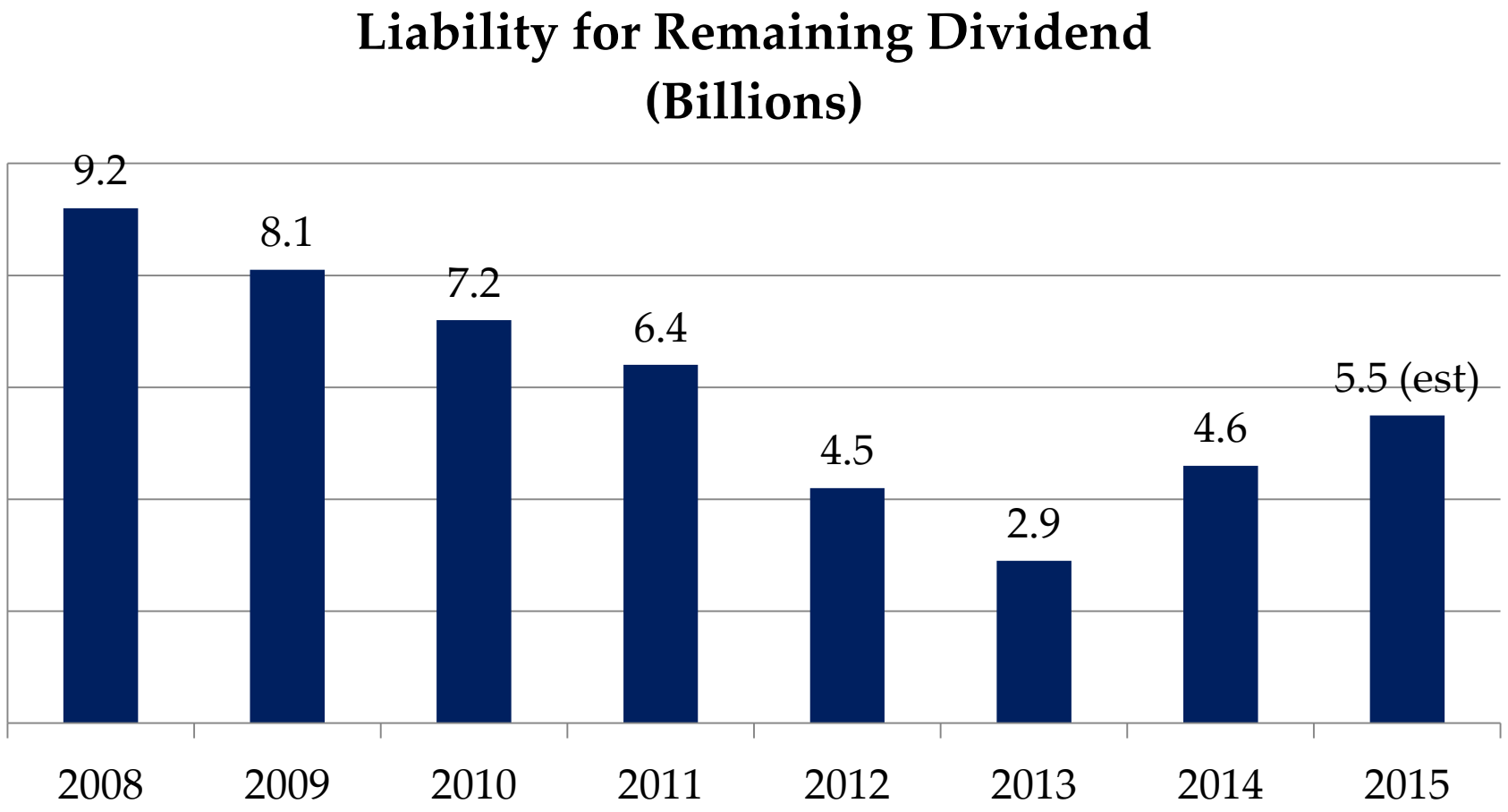
Dividend Discussion

- As of December 31, 2014, the total retiree liability was about $47.1 billion.
- Of the $47.1 billion, about $4.6 billion (or 11%) is attributable to dividends with the remaining $42.5 billion attributable to the current floor benefit.
- While retirees cannot fall below the floor benefit, it is possible the asset pool could fall below this level.
- Returns above 5% will help increase the 11% dividend pool and returns below 5% will erode it.
- Dividend erosion is not uniform – people who retired a long time ago lose a larger share of their current benefit than more recent retirees

Discussion of Dividend



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Discussion of Dividend

Probability that Dividend will be Depleted by Year

	Expected ROR	Standard Deviation	Year				
			1	5	10	20	50
1	5.0%	9.3%	0.0%	4.3%	11.4%	18.3%	30.5%
2	6.0%	11.9%	0.0%	7.9%	11.1%	8.3%	3.2%
3	7.0%	15.9%	0.0%	12.0%	12.2%	6.1%	0.8%
4	7.2%	16.8%	0.0%	12.8%	12.6%	6.0%	0.7%
5	8.0%	20.6%	0.1%	15.9%	14.0%	5.9%	0.5%
6	9.0%	25.9%	0.4%	19.7%	16.4%	6.8%	0.5%
7	10.0%	32.3%	1.4%	23.2%	19.7%	8.7%	0.8%

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Discussion of Dividend

Probability of Negative Dividend by Year

	Expected ROR	Standard Deviation	Year				
			1	5	10	20	50
1	5.0%	9.3%	7.9%	50.2%	56.0%	54.9%	54.4%
2	6.0%	11.9%	13.8%	40.6%	34.0%	30.1%	30.1%
3	7.0%	15.9%	18.9%	36.6%	24.6%	19.8%	20.5%
4	7.2%	16.8%	19.8%	36.1%	23.4%	18.9%	19.5%
5	8.0%	20.6%	23.5%	35.2%	20.9%	16.1%	16.8%
6	9.0%	25.9%	26.7%	35.4%	19.5%	14.8%	15.5%
7	10.0%	32.3%	29.6%	36.6%	20.0%	15.0%	16.0%

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Discussion of Dividend

Worst Case Scenario of Cumulative Dividend Percent (% of Floor Benefit that is funded)

	Expected ROR	Standard Deviation	Year				
			1	5	10	20	50
1	5.0%	9.3%	109%	93%	85%	80%	68%
2	6.0%	11.9%	109%	86%	79%	81%	86%
3	7.0%	15.9%	107%	77%	72%	78%	105%
4	7.2%	16.8%	106%	75%	70%	77%	108%
5	8.0%	20.6%	105%	66%	61%	72%	118%
6	9.0%	25.9%	102%	54%	49%	62%	124%
7	10.0%	32.3%	99%	40%	34%	46%	115%

Worst Case Scenario based on 1st Percentile (i.e. 1% probability)

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Dividend Observations

- The low risk scenarios are actually risky in the sense that, for example, 5% expected return has much higher chance of dividend depletion in later years than higher risk scenarios
- Must balance short and long term volatility
- Consider probability of dividend depletion
- Consider level of worst case scenario that is acceptable

Combination of all Scenarios

				2025 Results						Worst Case
			Leverage	Contribution Rates			Dividend Rates			Retiree FS
	ROR	StdDev	Ratio	Better	Median	Worse	Better	Median	Worse	
1	5.0%	9.3%	1.00	12.6%	15.0%	17.1%	1.8%	-0.2%	-2.3%	68% in year 50
2	6.0%	11.9%	1.03	10.6%	14.3%	17.3%	3.6%	0.8%	-2.2%	79% in year 10
3	7.0%	15.9%	1.38	8.3%	13.6%	17.6%	5.5%	1.7%	-2.2%	72% in year 10
4	7.2%	16.8%	1.46	7.7%	13.5%	17.7%	5.9%	1.9%	-2.2%	70% in year 10
5	8.0%	20.6%	1.78	5.5%	12.9%	18.2%	7.6%	2.6%	-2.5%	61% in year 10
6	9.0%	25.9%	2.25	2.1%	12.3%	19.0%	9.8%	3.5%	-2.9%	49% in year 10
7	10.0%	32.3%	2.80	0.0%	11.8%	20.8%	12.2%	4.3%	-3.7%	34% in year 10

At least with respect to the 2025 outcome, there is a much narrower range on the worse results than on the better results, indicating a potential justification for risk above the minimum illustrated. After scenario 4, the worse results degrade at a high rate. Also the worst case scenario for the retiree dividend pool fall below 70% for scenarios 1, 5, 6 and 7. So do 2, 3, and 4 comprise a "Goldilocks Zone?"

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2013 Observations

- WRS is still a maturing system
- Dividend base for retirees has declined rapidly and is very close to being depleted
- 2013 and 2014 are pivotal years to rebuild the dividend base to a broader cohort of retirees
- Few systems can withstand another '2008' market year in the near future without large increases in contributions
- Continue to investigate strategies to reduce downside risk – may involve a statutory change

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2015 Observations

- 2013 and 2014 results helped rebuild the dividend base somewhat
- 2015 investment results might reduce some of that cushion depending on measured return at December 31
- High expected return/volatility scenarios appear to result in nearer term dividend risk
- Low expected return/volatility scenarios appear to result in longer term dividend risk
- Target 'Goldilocks zone' that provides for positive return with appropriate downside protection

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Disclaimers

- This presentation shall not be construed to provide tax advice, legal advice or investment advice.
- Readers are cautioned to examine original source materials and to consult with subject matter experts before making decisions related to the subject matter of this presentation.
- This presentation expresses the views of the authors and does not necessarily express the views of Gabriel, Roeder, Smith & Company.

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Dividend Reserve Depletion – What to Do?

Approach	Theory	Impact on Dividends	Who Bears Cost?
Do Nothing	"Short Term" deficit will be made up by future Investment Return > 5%	No dividends paid until the "deficit" has been filled	Current and near retirees
Let Depletion Flow Through EAR	Fully fund retiree reserve with special reserve transfer, paid over EAR financing period	Dividends may resume very quickly	Participants and employers
Special Amortization	Amortize deficit over 5 years, charge interest at 5% credit (retiree reserve earnings) > 5%	No dividends paid until the "deficit" has been filled	Participants and employers

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Unfunded Dividend Analysis

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Do Nothing

- This course of action assumes that the deficit is a short-term phenomenon that will be made up by investment gains above 5% in the future.
- No dividends would be paid until the "deficit" has been filled.
- This method applies the full cost of the loss to present and near-term future retirees.
- Of course, the conditions that produced the deficit probably affected employer and participant contributions anyway.

Let It Flow Through the EAR

- This method fully funds the retiree reserve with a special reserve transfer.
- The deficit is thereby transferred to the active reserves and is financed over the EAR financing period.
- The method transfers almost the entire cost of the deficit to participants and employers.
- Dividends might resume very rapidly in such a circumstance, perhaps even the next year.

Special Amortization

- Set up a 5-year amortization of the deficit.
- Will affect both participant and employer rates.
- Charge the deficit with 5% interest.
- Credit the deficit with employer and participant amortization contributions and earnings on the retiree reserve above 5%.
- No dividends paid until deficit is paid off.
- This method shifts a portion, but not all of the cost back to employers and active participants.

Deficit Analysis

- Suppose the retiree core fund initially has $40 billion in assets and liabilities and
- The entire dividend reserve has previously been used up and
- At the end of the year the fund has $36 billion in assets and $40 billion in liabilities and
- Going forward all assets earn 7.2%
- How long will it take the assets to catch back up to the liabilities?

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Deficit Analysis

- In this case, the fund would have $36 billion in assets earnings 7.2% each year, 2.2% more than required interest.
- So, an annual payment of 2.2% x $36 billion, which is $720 Million, could be applied to the $4 billion deficit.
- Of course, the deficit is also a debt bearing interest at 5%.
- The payoff schedule looks like this.

Deficit Payoff Schedule

Year	Beginning Balance	Interest (5%)	Payment	Ending Balance
1	$ 4,000	$ 200	$ 792	$ 3,408
2	3,408	170	792	2,786
3	2,786	139	792	2,134
4	2,134	107	792	1,448
5	1,448	72	792	729
6	729	36	792	(27)

In this example, the deficit would be extinguished during the sixth year

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Discussion

- The payoff schedule is perhaps oversimplified.
- It assumes that reserve transfers and regular interest on the existing reserve assets covers benefit payments from the reserve.
- But for deficits on the order of 10%, it might not be too far off.

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More Discussion

- If there were a 25% deficit, a similar calculation would suggest potential payoff in 30 years.
- That might be true, but the assumptions become questionable over such a time horizon.
- More sophisticated modeling would be required to provide a reliable answer.