



State of Wisconsin Investment Board

Wisconsin Retirement System 50-Year Actuarial Projection

October 2013



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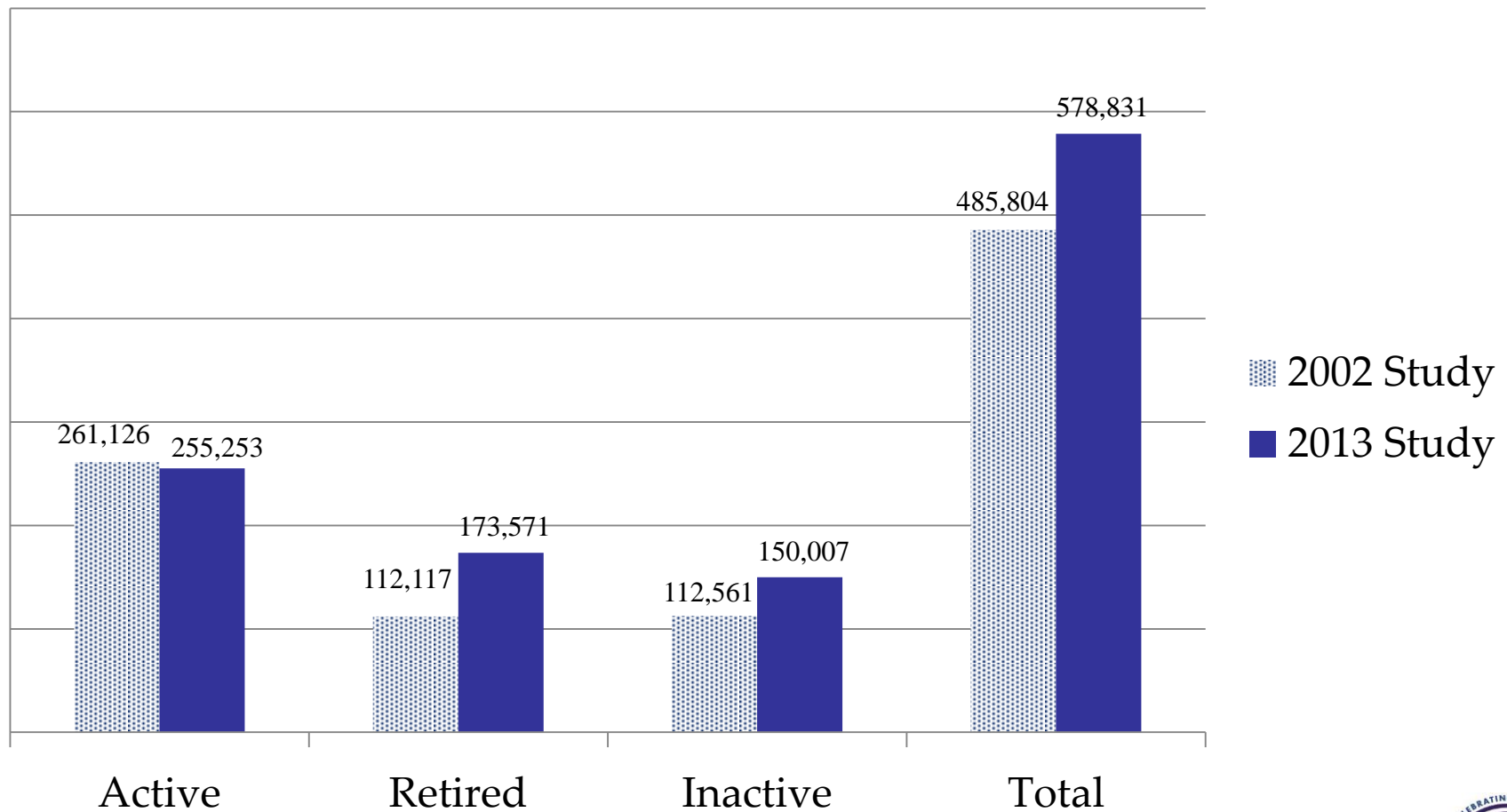


Study Objectives

- ◆ Review emerging demographic trends
- ◆ Perform stochastic projections
- ◆ Perform various deterministic projections
- ◆ Evaluate worst case scenarios
- ◆ Analyze possible changes to structure

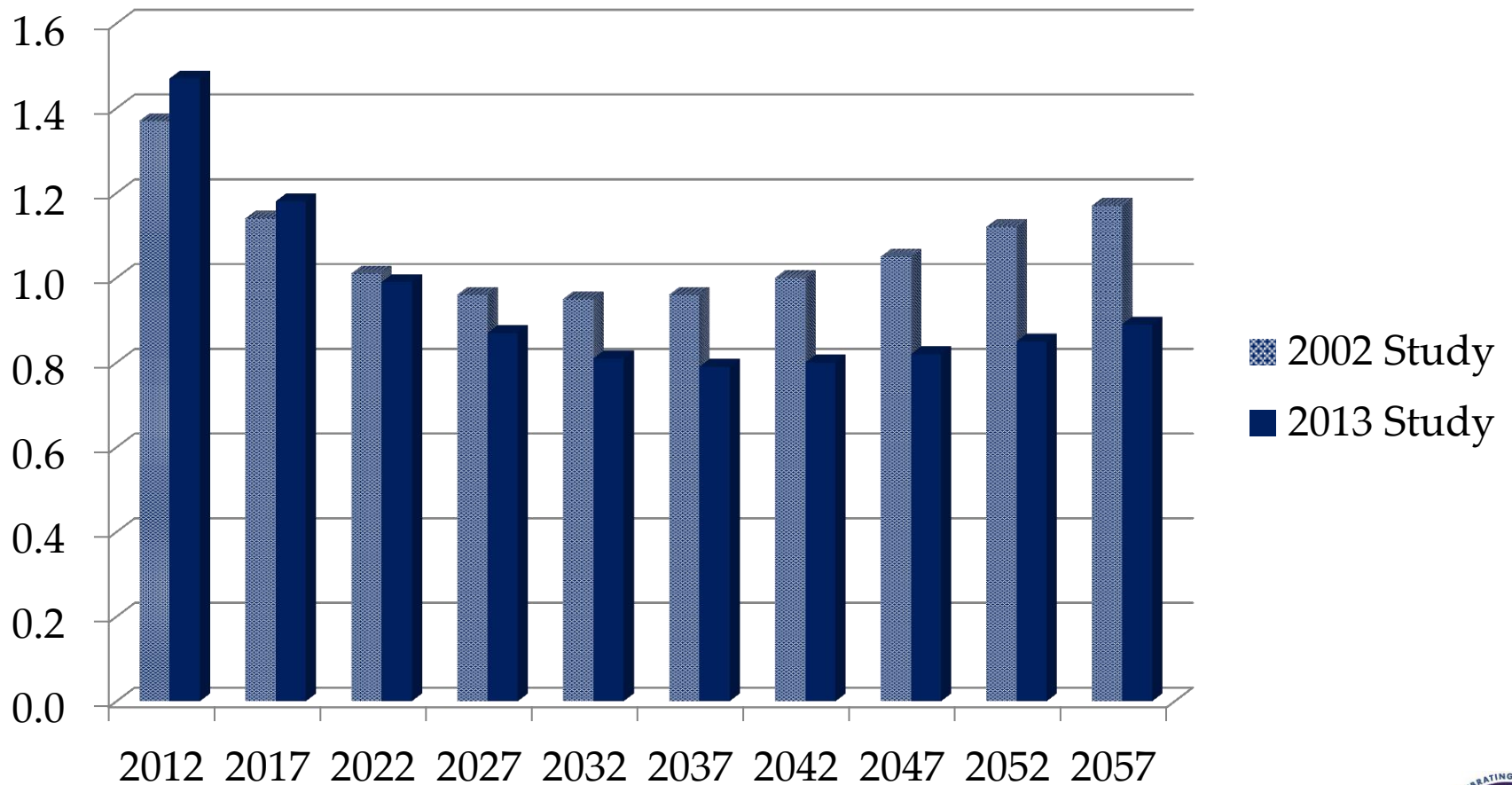


WRS Population

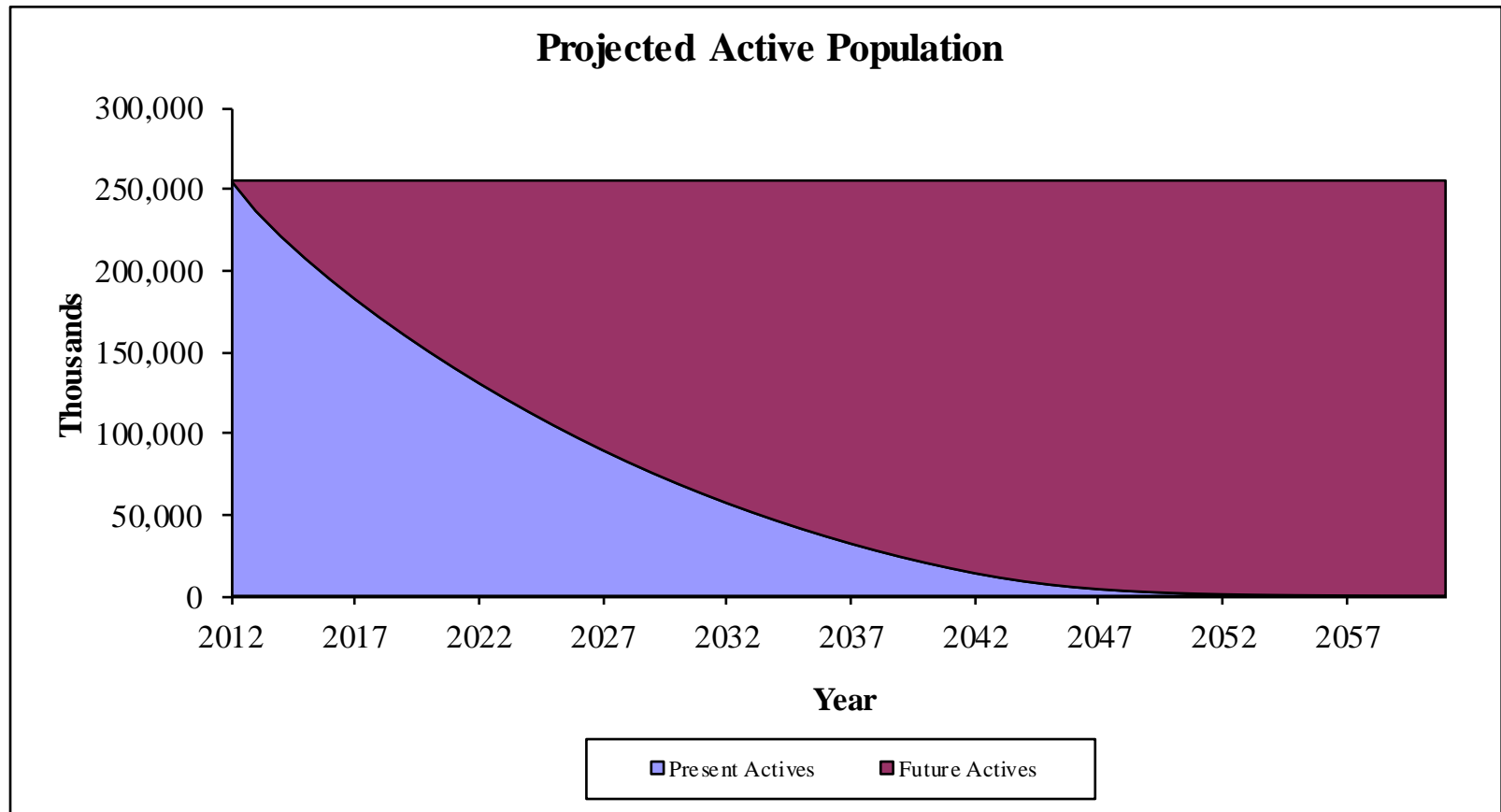




Ratio of Active Members to Retirees



Present & Future Actives

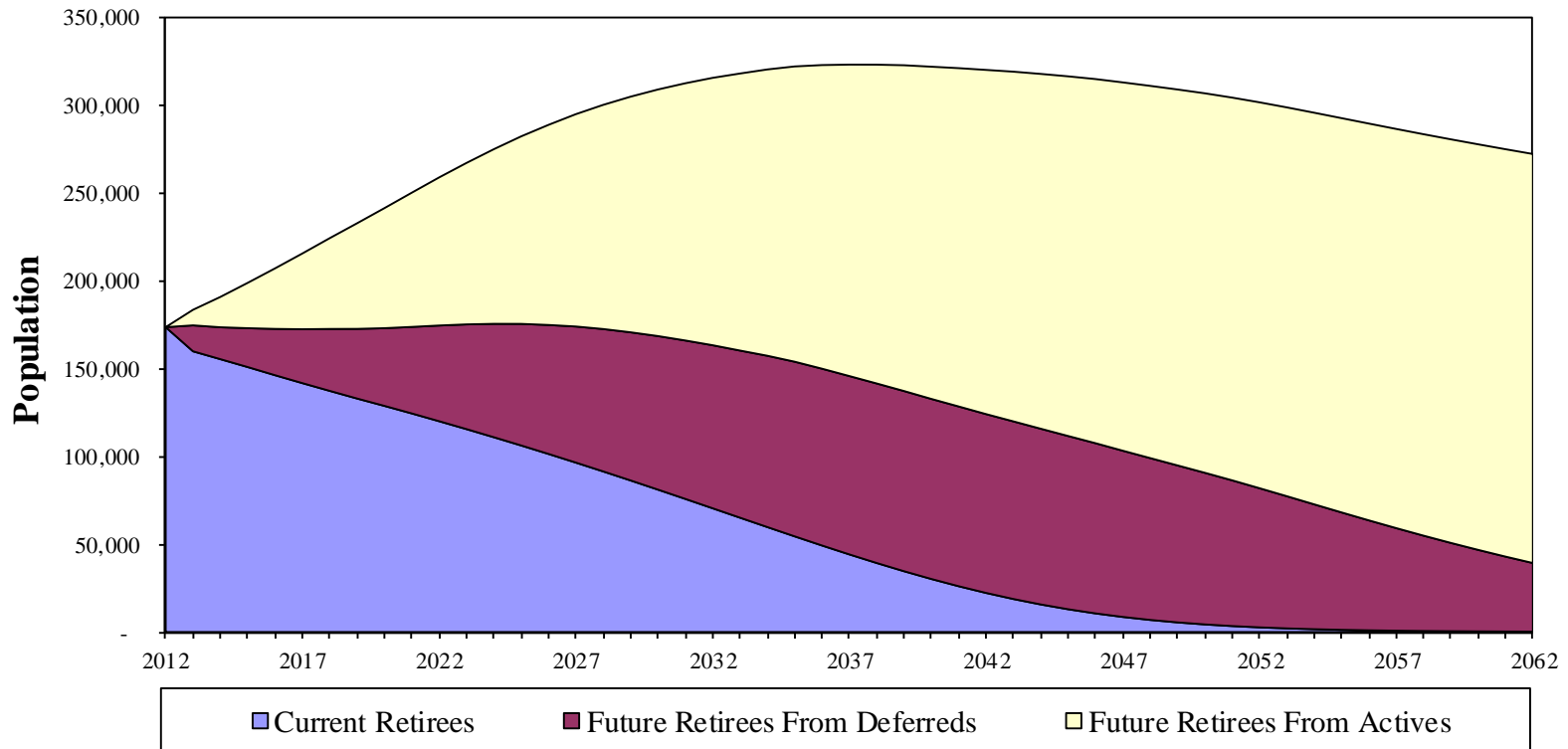


The present population has a “half life” of about 10 years.



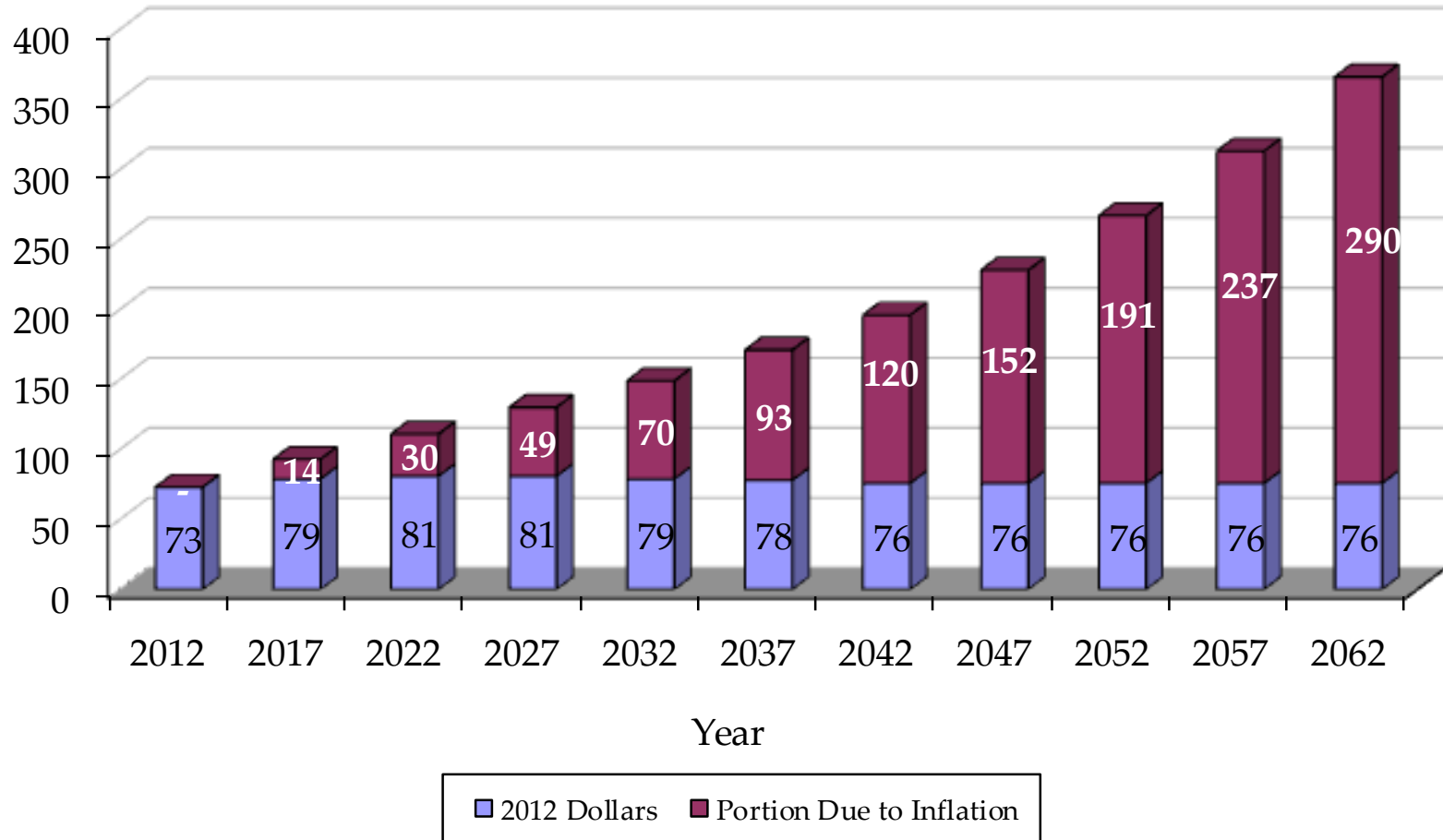
Retiree Population Present and Future

Projected Retiree Population





Projected Core Trust Fund Assets (\$Billions)





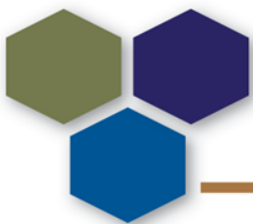
Observations

- ◆ In nominal terms, assets will increase by a factor of 4.0 during the projection period
- ◆ In real terms, assets need to grow a little to cover the peak of the baby boom retirements
- ◆ They may decline slightly after that



Observations

- ◆ A few present retirees will probably draw benefits for more than 50 years
- ◆ The number of retirees will increase by about 80% over the next 20 years
- ◆ Retiree liability will grow to about 60% of total liability
- ◆ Assets are about 6 times payroll

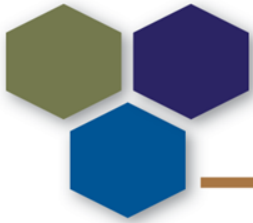


Projected Net External Cash Flow*

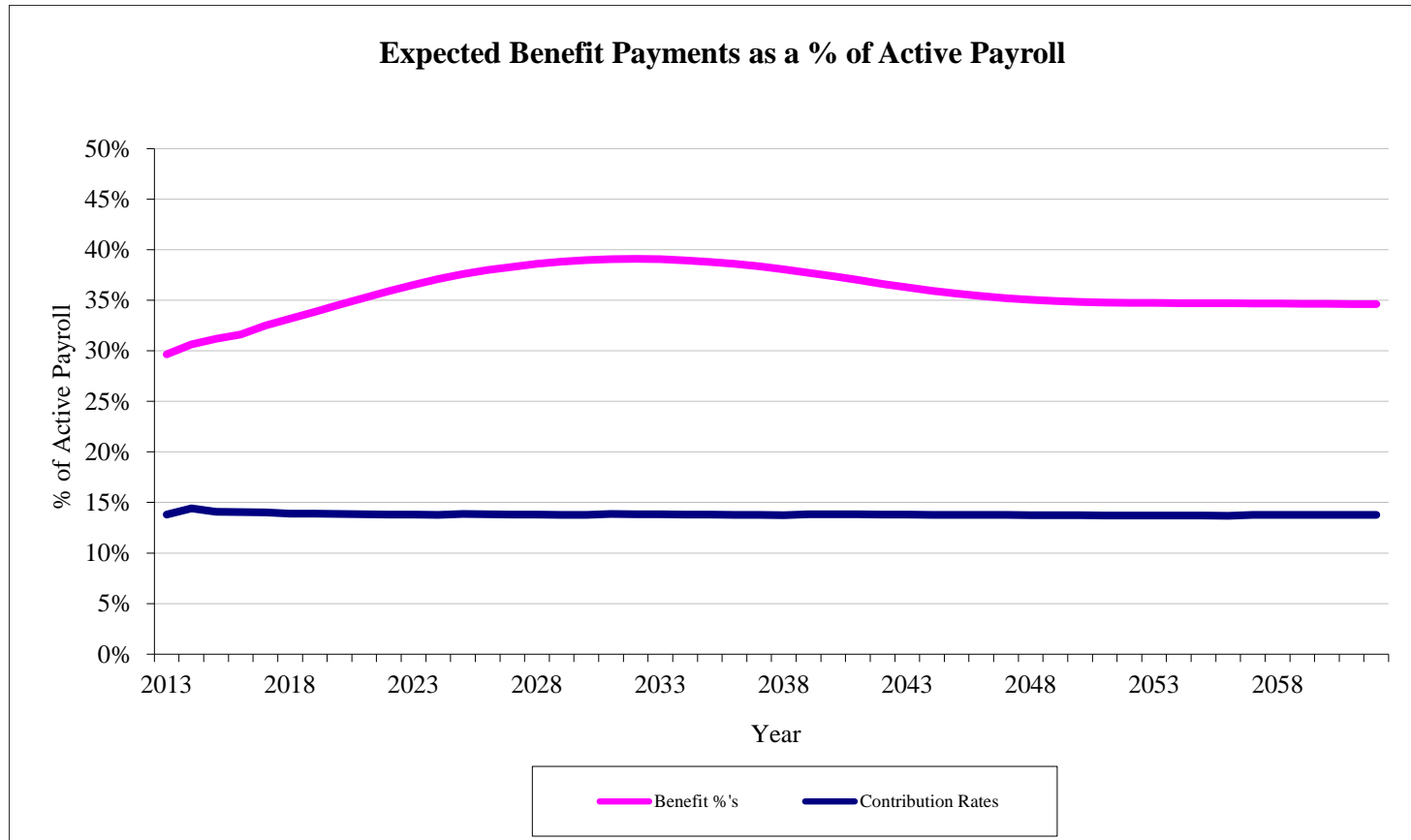
Valuation Assumptions

Year	\$ (Millions)	% of Assets
2013	\$ (1,969)	(2.7)%
2023	(4,116)	(3.7)%
2033	(6,423)	(4.3)%
2043	(7,989)	(4.1)%
2053	(10,283)	(3.8)%
2063	(14,106)	(3.8)%

**Contribution income minus benefit payout.*



Projected Contributions and Benefits as a % of Active Payroll





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 primarily due to declines in active headcount and low wage inflation
- ◆ More than 2/3rds of benefit payout will come from investment income



Stochastic Scenarios



Monte Carlo Simulations

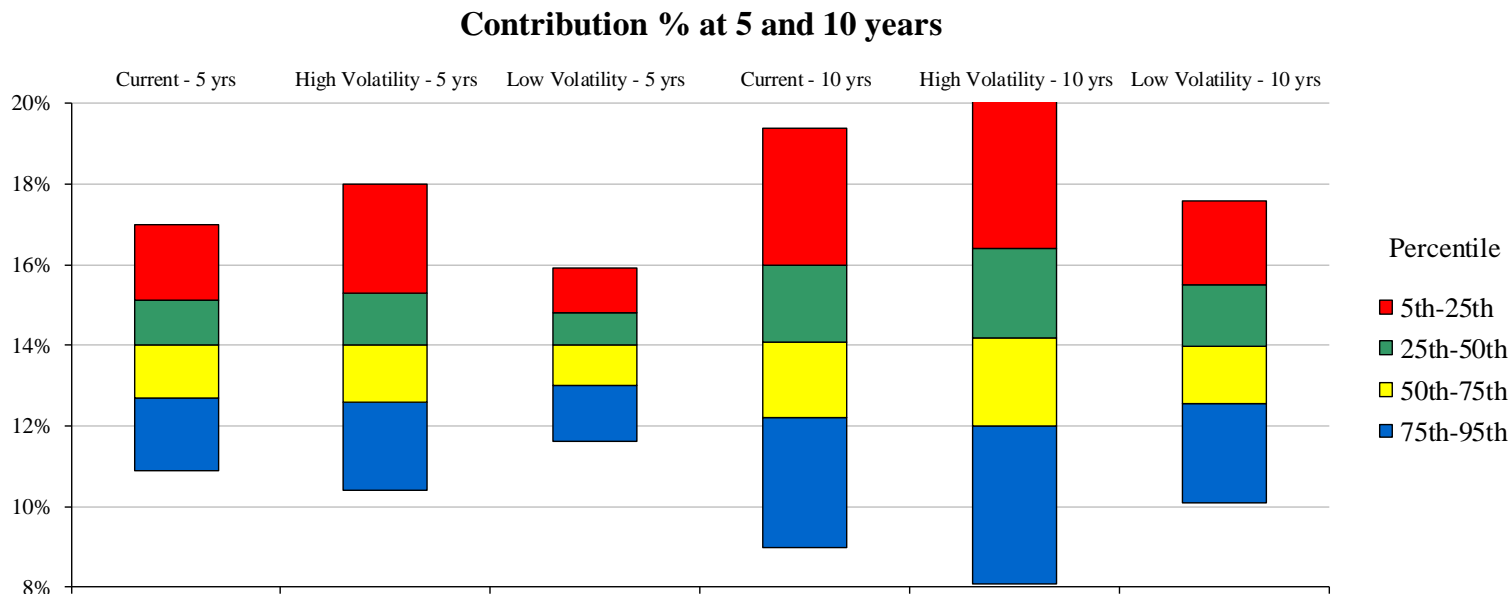
- ◆ Based on 1,000 random trials
- ◆ Assumes long-term net rate of return is 7.2%
- ◆ Assumes two sets of standard deviations
 - 12.8% - Expected volatility of Current Core Fund
 - 15.0% - High volatility scenario (Alt 1)
 - 10.0% - Low volatility scenario (Alt 2)



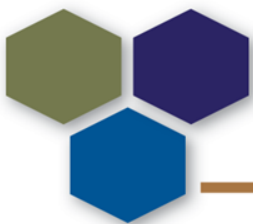
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Contribution as % of Payroll Comparison of Portfolios

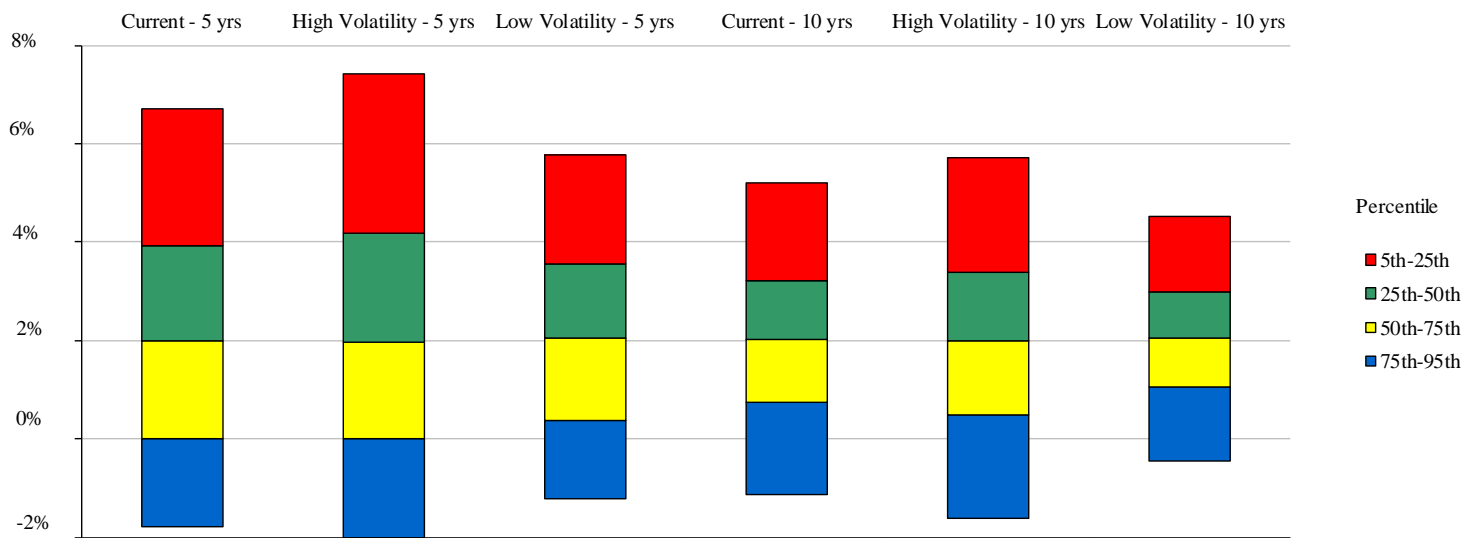


5th Percentile	17.0%	18.0%	15.9%	19.4%	20.8%	17.6%
25th Percentile	15.1	15.3	14.8	16.0	16.4	15.5
50th Percentile	14.0	14.0	14.0	14.1	14.2	14.0
75th Percentile	12.7	12.6	13.0	12.2	12.0	12.6
95th Percentile	10.9	10.4	11.6	9.0	8.1	10.1



Dividend Rates Comparison of Portfolios

Dividend % at 5 and 10 years



5th Percentile	6.7%	7.4%	5.8%	5.2%	5.7%	4.5%
25th Percentile	3.9	4.2	3.6	3.2	3.4	3.0
50th Percentile	2.0	2.0	2.1	2.0	2.0	2.1
75th Percentile	0.0	0.0	0.4	0.8	0.5	1.1
95th Percentile	(1.8)	(2.2)	(1.2)	(1.1)	(1.6)	(0.4)



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.
- ◆ The probable range of contribution rates and dividend percents narrows significantly if volatility can be reduced.



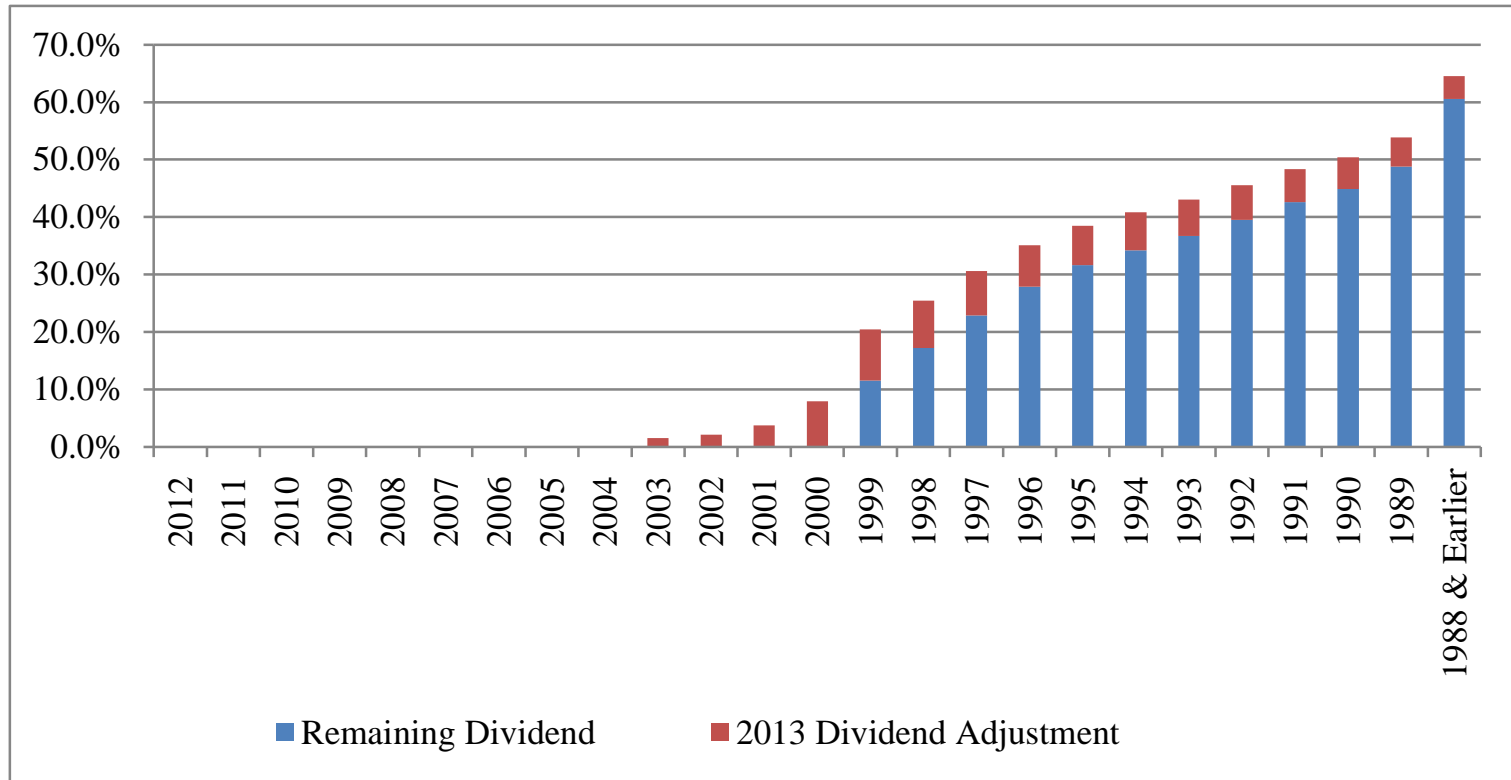
Summary – Key Points

- ◆ Market volatility over the last decade has clearly demonstrated that asset returns are not 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

Discussion of Dividend

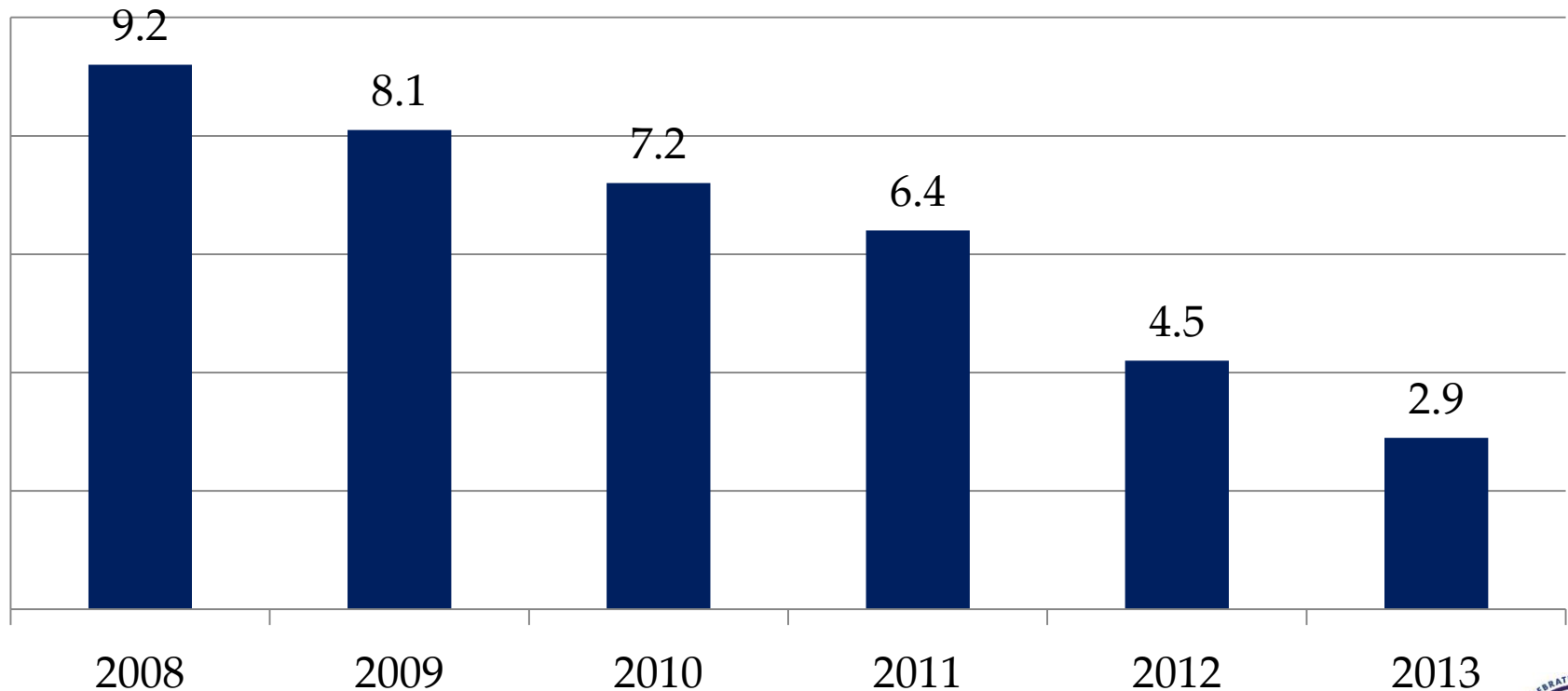


After the 2013 dividend adjustment, only members retired prior to 2000 have a dividend remaining. This situation is compounded by the fact that members who retired prior to 2000 represent a shrinking portion of the liabilities.



Discussion of Dividend

Liability for Remaining Dividend (Billions)



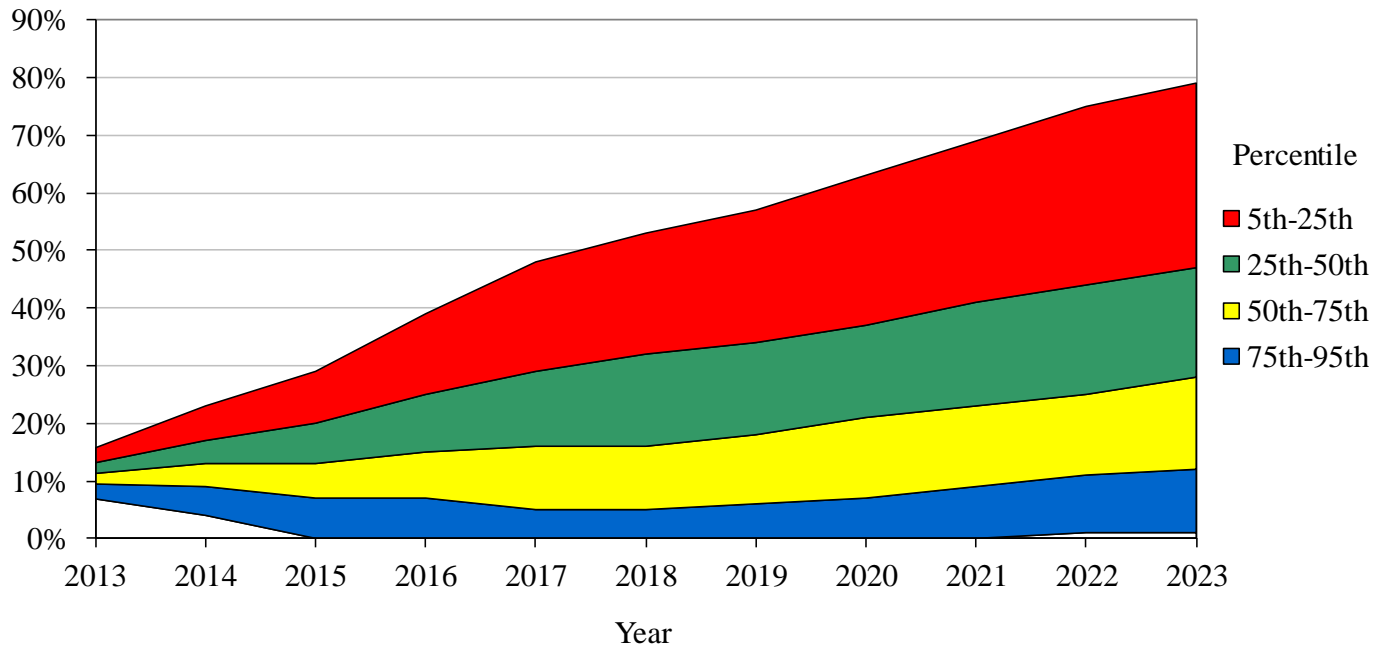


Discussion of Dividend

Probability that Dividend will be Depleted by Year

Val Date	Assuming 2013 Return of			
	7.2%	0.0%	-11.0%	-29.0%
2013	0.0%	0.0%	0.0%	0.0%
2014	0.1%	0.2%	0.3%	99.6%
2015	0.2%	0.7%	30.4%	100.0%
2016	0.8%	5.8%	51.0%	99.9%
2017	3.3%	16.0%	64.2%	99.9%
2018	6.4%	21.2%	48.4%	62.0%

Cumulative Dividend Projection



5th Percentile	15.7%	23.0%	29.0%	39.0%	48.0%	53.0%	57.0%	63.0%	69.0%	75.0%	79.1%
25th Percentile	13.1%	17.0%	20.0%	25.0%	29.0%	32.0%	34.0%	37.0%	41.0%	44.0%	47.0%
Median	11.3%	13.0%	13.0%	15.0%	16.0%	16.0%	18.0%	21.0%	23.0%	25.0%	28.0%
75th Percentile	9.4%	9.0%	7.0%	7.0%	5.0%	5.0%	6.0%	7.0%	9.0%	11.0%	12.0%
95th Percentile	6.9%	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	1.0%



Cumulative Dividend

- ◆ Dividends currently represent about 7% of total benefits
- ◆ Expected to grow to about 11% following the 2014 dividend
- ◆ To maintain purchasing power after 10 years, dividends would need to grow to about 28% of total benefits (assuming 2.5% annual inflation)



Deterministic Scenarios



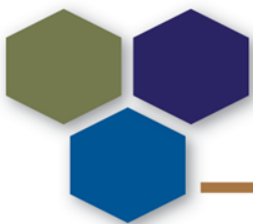
Alternate Deterministic Projections

- ◆ Initial projections based on regular valuation assumptions demonstrate patterns and provide a base on which to build.
- ◆ They do not incorporate the reality that, while often offsetting over time, significant year-to-year gains and losses will occur.
- ◆ Alternate deterministic projections illustrate the effect of specific market conditions on contribution rates and fixed annuity dividends.

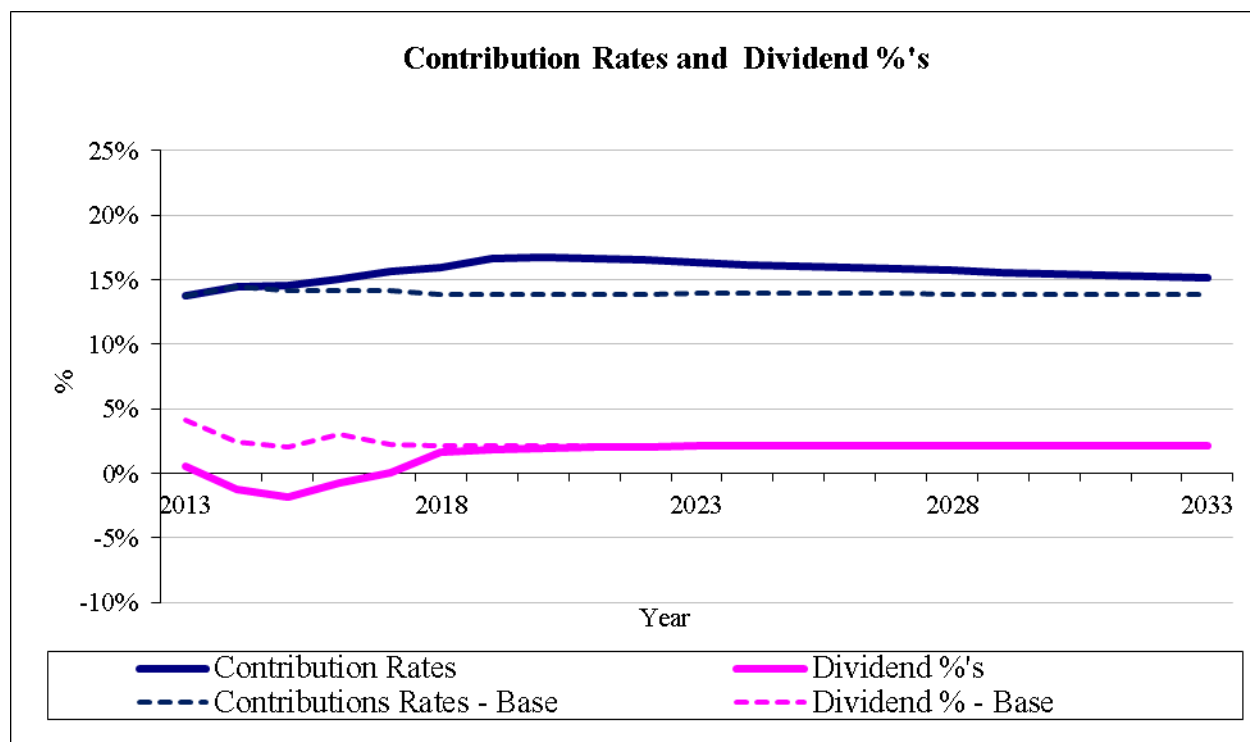


Deterministic Scenario Description

Scenario 1	Negative 11% Return in 2013
Scenario 2	Negative 18% Return in 2013
Scenario 3	Negative 29% Return in 2013
Scenarios 1-3a	20% Bounce back return in 2014
Scenarios 1-3b	Negative return occurs in 2018
Scenarios 1-3c	Assume low wage inflation after negative return



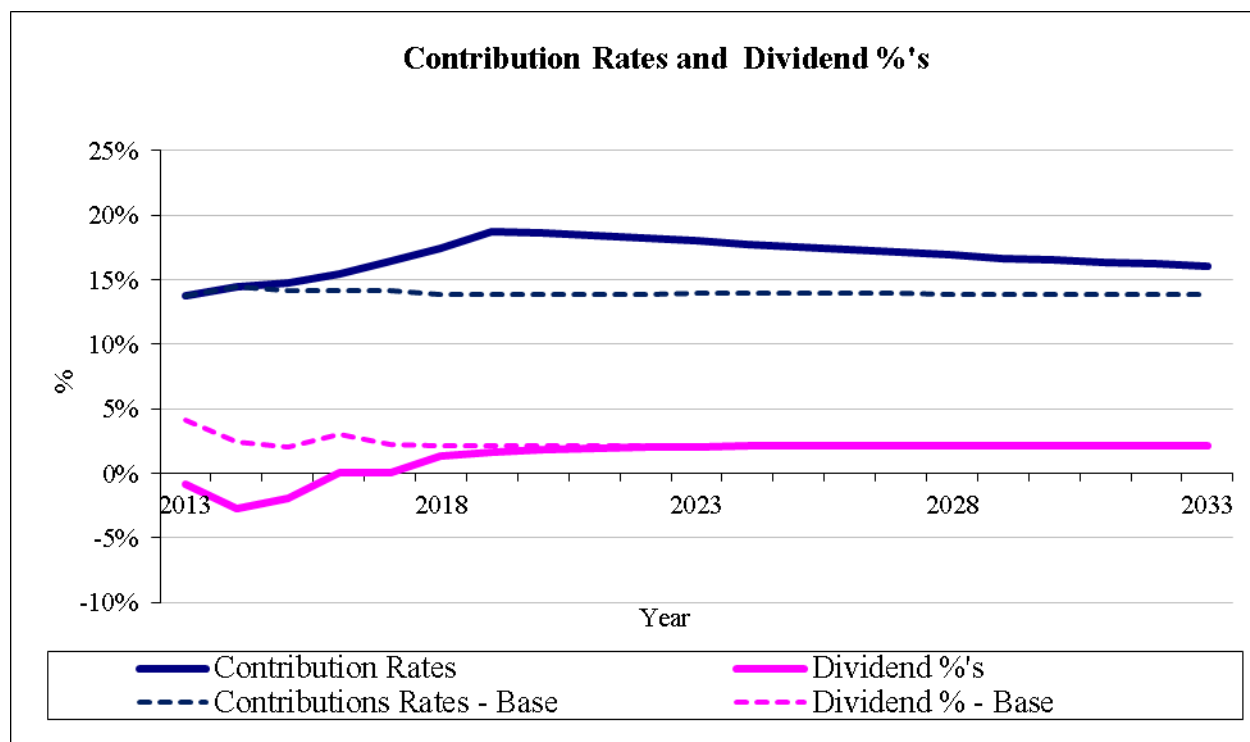
Scenario 1 – Negative 11% in 2013 Followed by 7.2% Thereafter



Dividend Base is completely depleted in year 2018



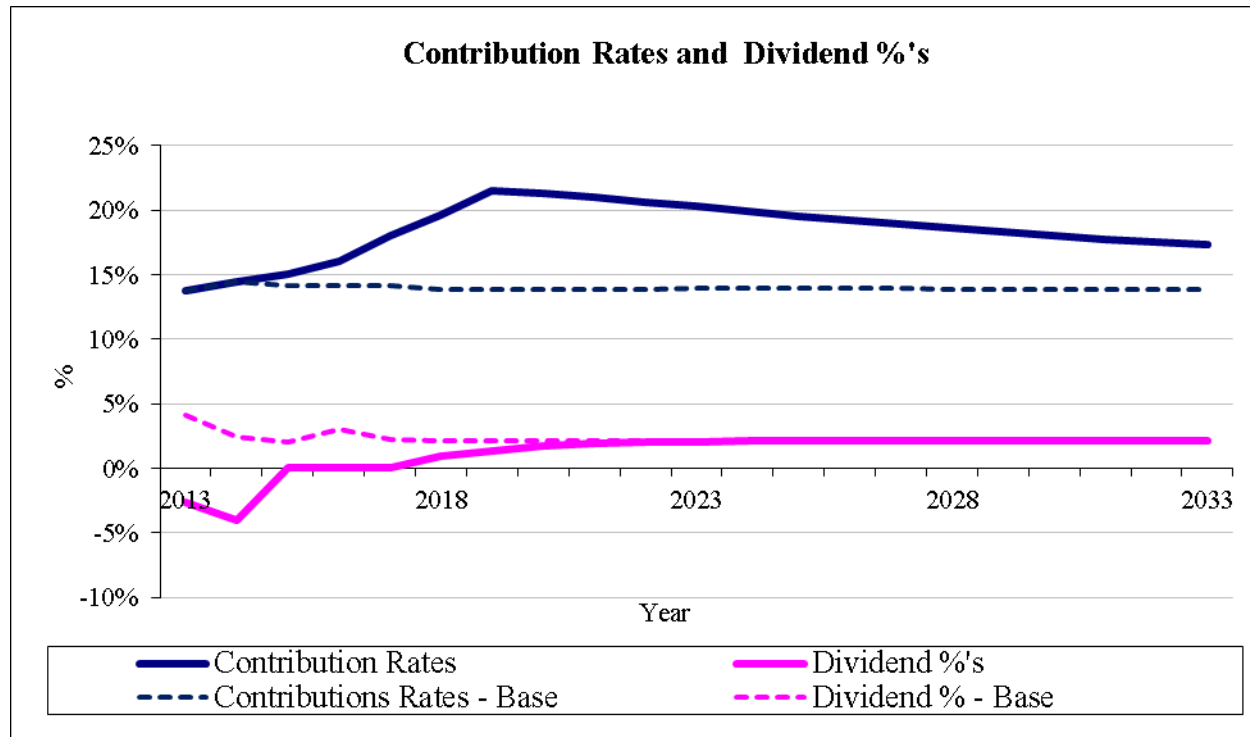
Scenario 2 – Negative 18% in 2013 Followed by 7.2% Thereafter



Dividend Base is completely depleted in year 2015



Scenario 3 – Negative 29% in 2013 Followed by 7.2% Thereafter



Dividend Base is completely depleted in year 2014

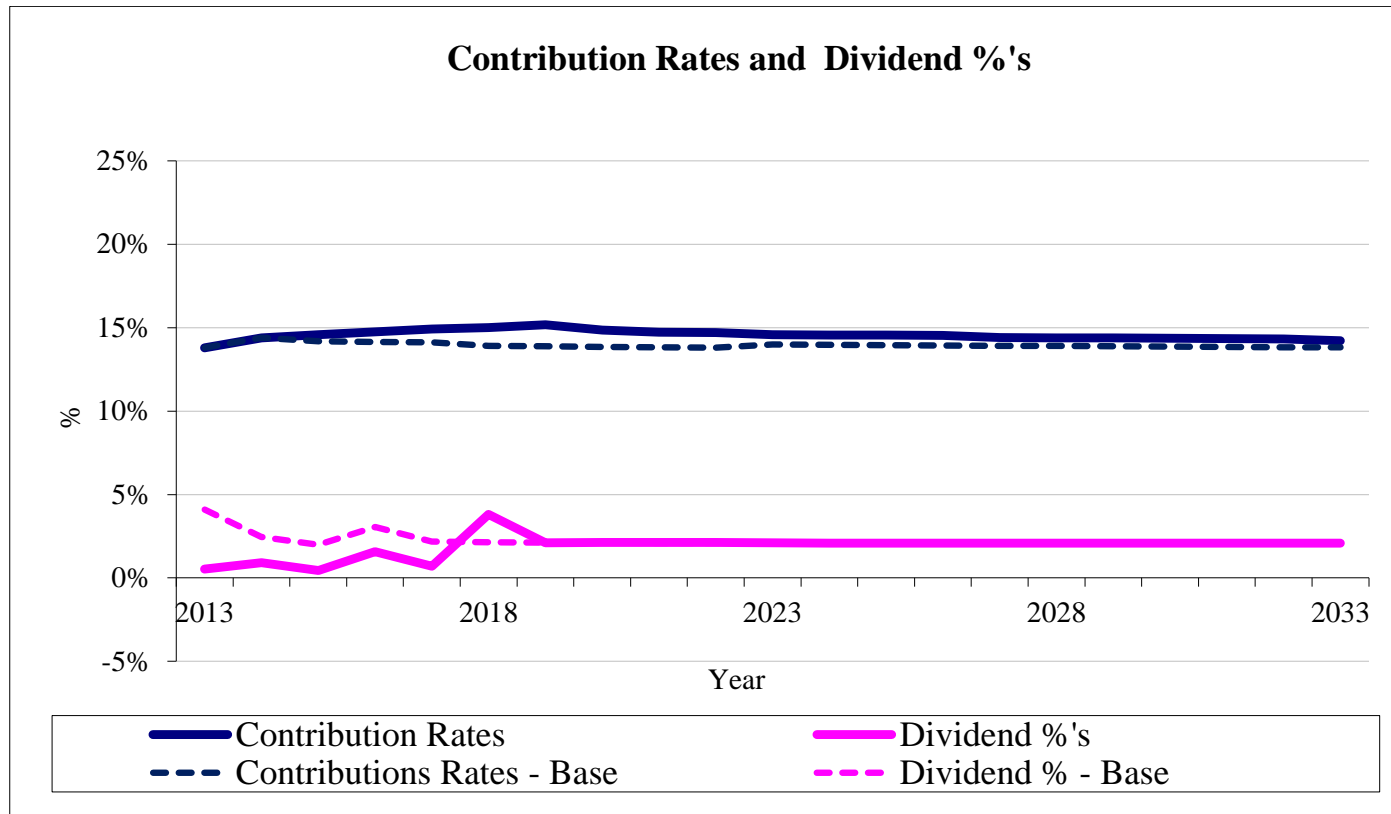


Summary of Scenarios 1 - 3

- ◆ All three scenarios would likely lead to the depletion of the dividend
- ◆ Scenarios currently assume that employer (and employee) rates would be increased to pay off unfunded retiree liabilities
- ◆ Historically, such a large negative return almost always results in some positive bounce back the following year

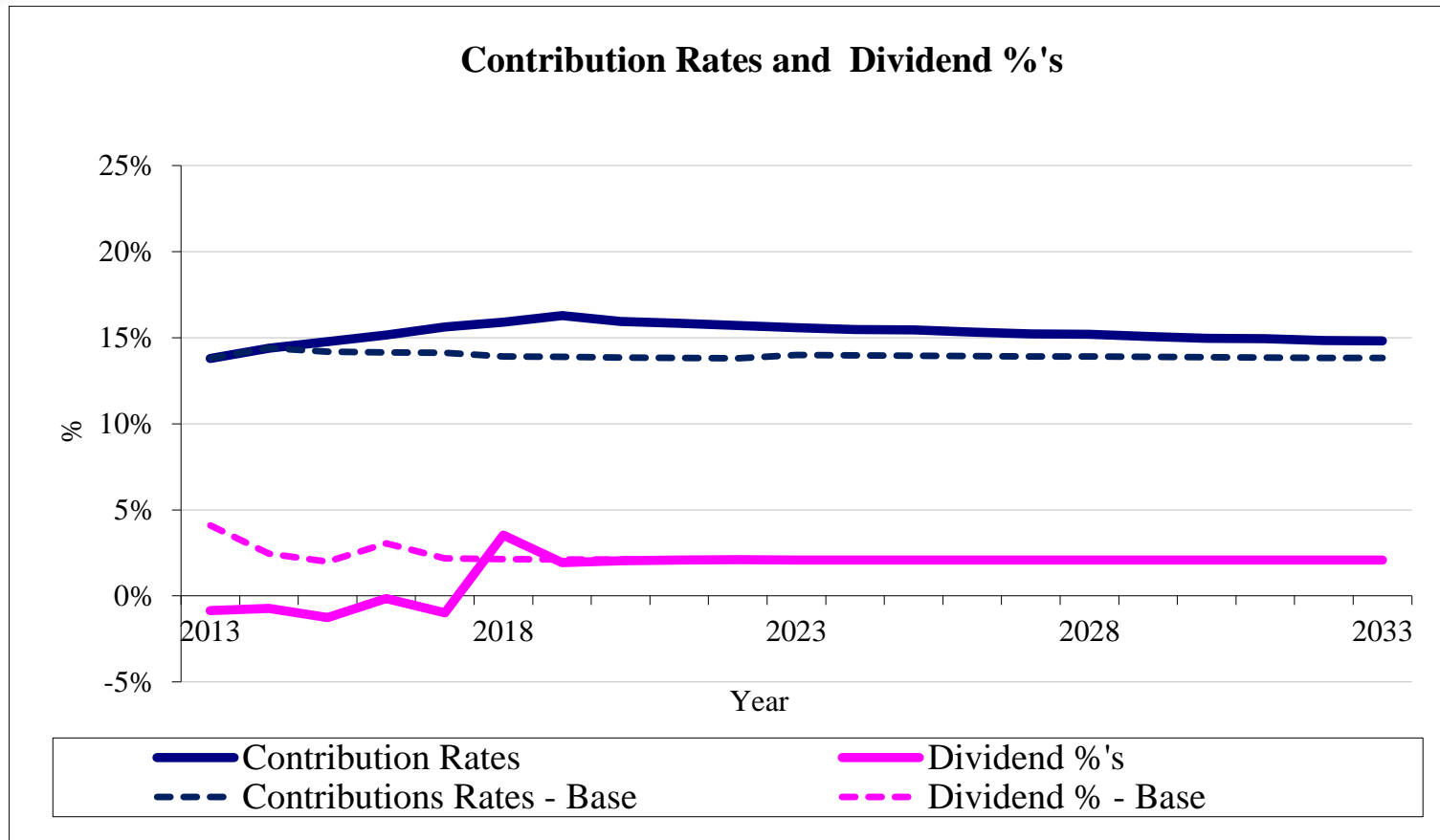


Scenario 1a –Negative 11% in 2013 with 20% Return in 2014 and 7.2% Thereafter



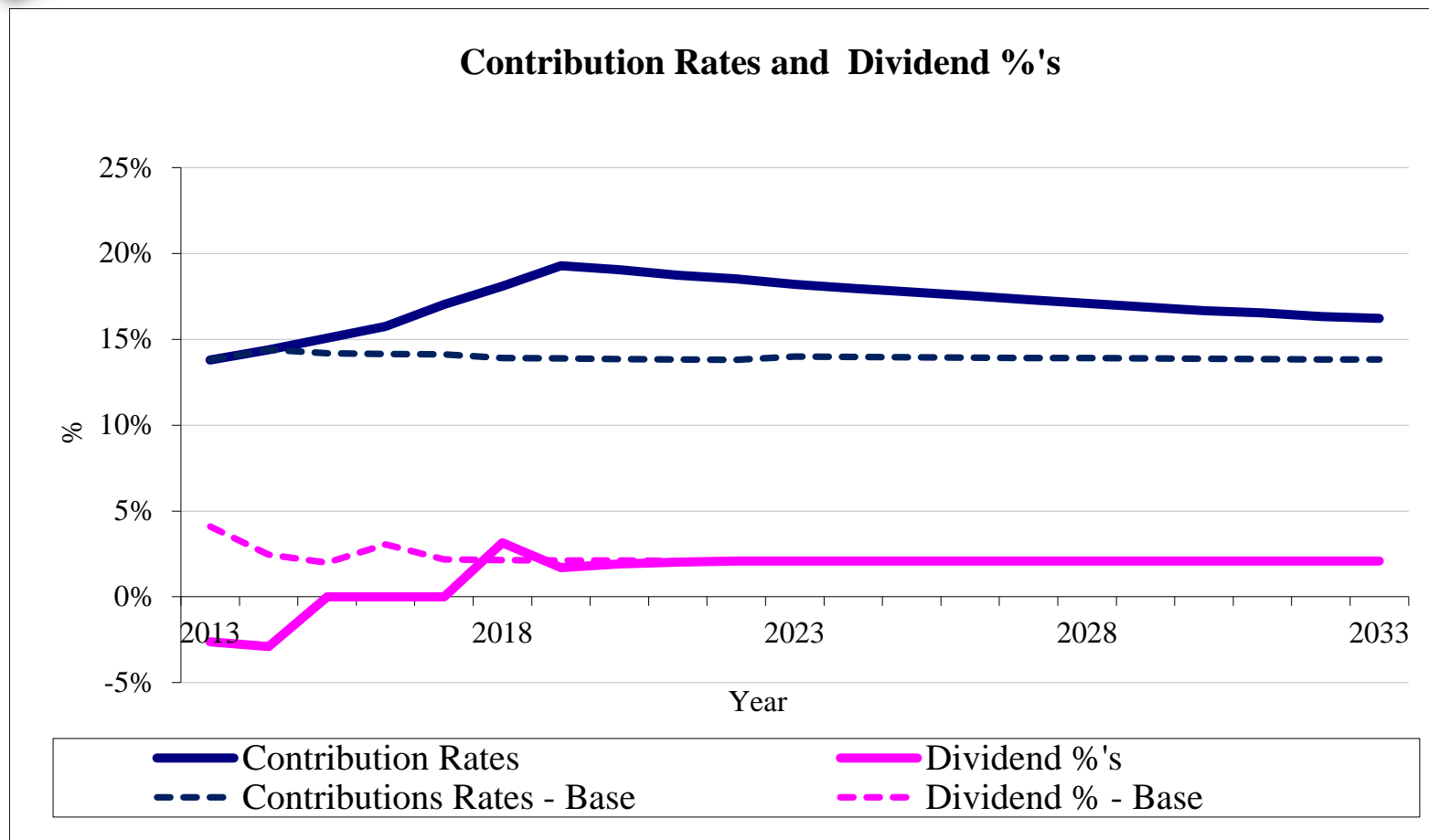
Dividend Base would not be depleted

Scenario 2a – Negative 18% in 2013 with 20% Return in 2014 and 7.2% Thereafter



Dividend Base would be depleted in year 2017

Scenario 3a – Negative 29% in 2013 with 20% Return in 2014 and 7.2% Thereafter



Dividend Base would be depleted in year 2014

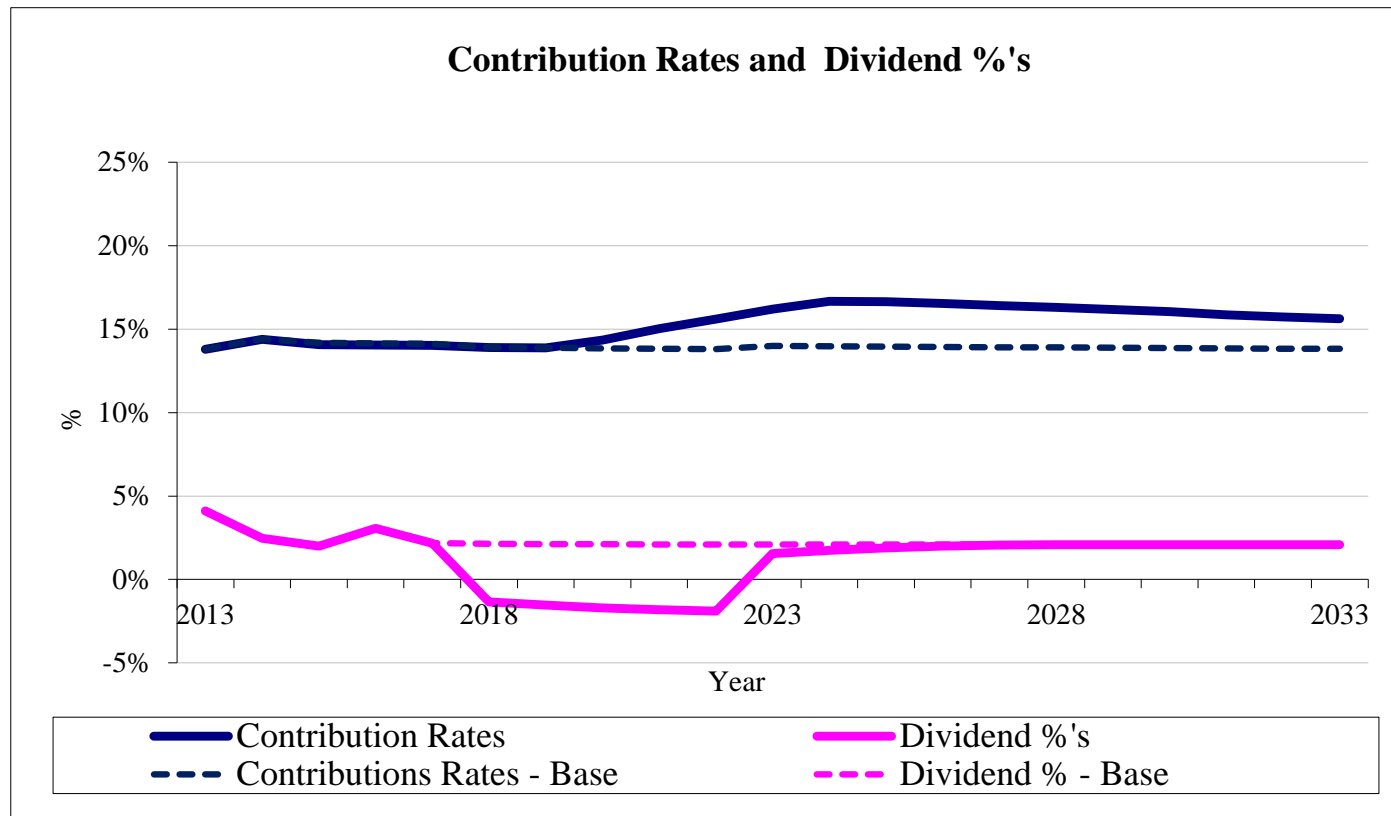


Summary of Scenarios 1a – 3a

- ◆ Scenarios 2 and 3 would still likely lead to the depletion of the dividend
- ◆ This is due to the fact that the current dividends that remain are for an older cohort of members with shorter expected lifetimes and smaller benefits
- ◆ Results might be different if large negative return was in a future year allowing a cushion to be built up



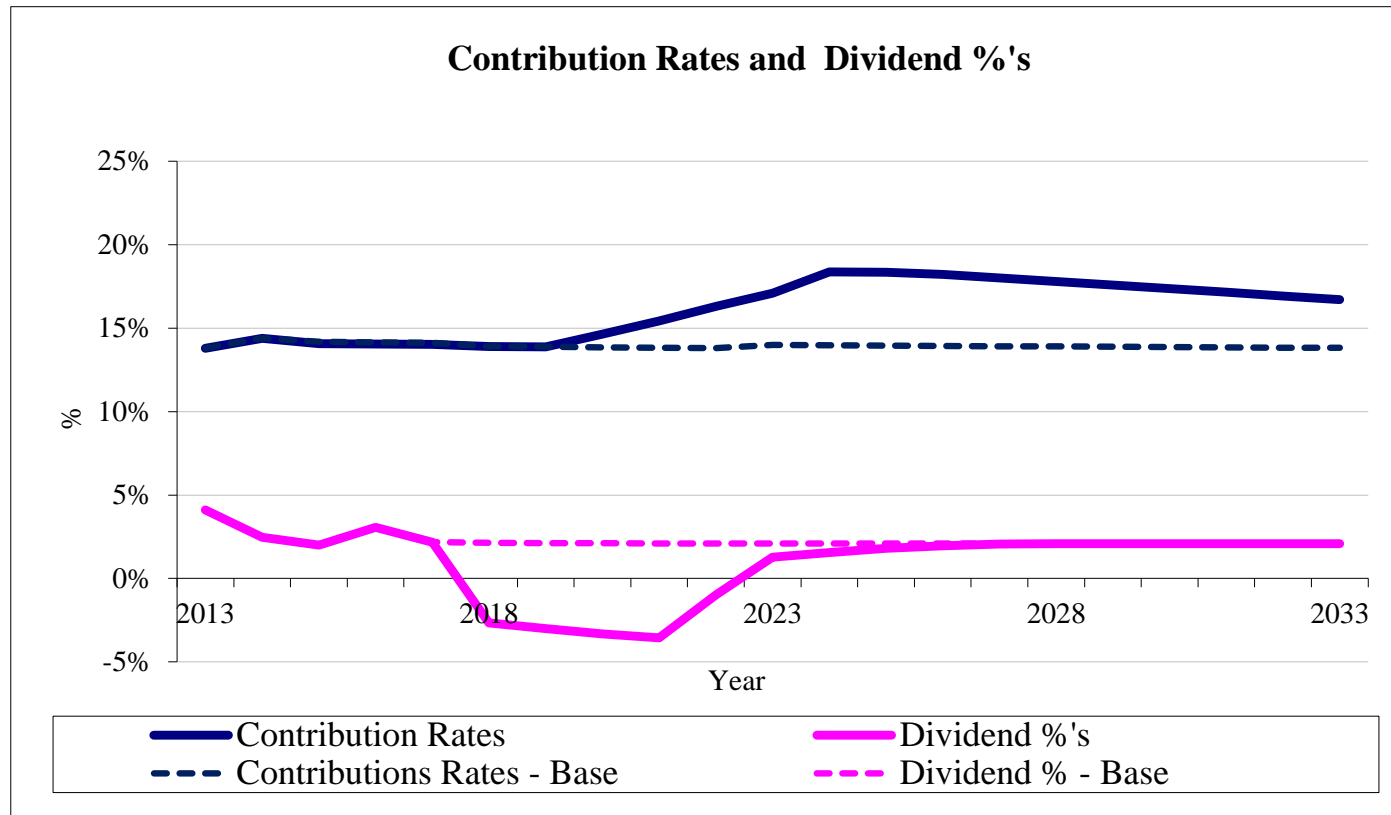
Scenario 1b – Negative 11% in 2018 Followed by 7.2% Thereafter



Dividend Base is not depleted



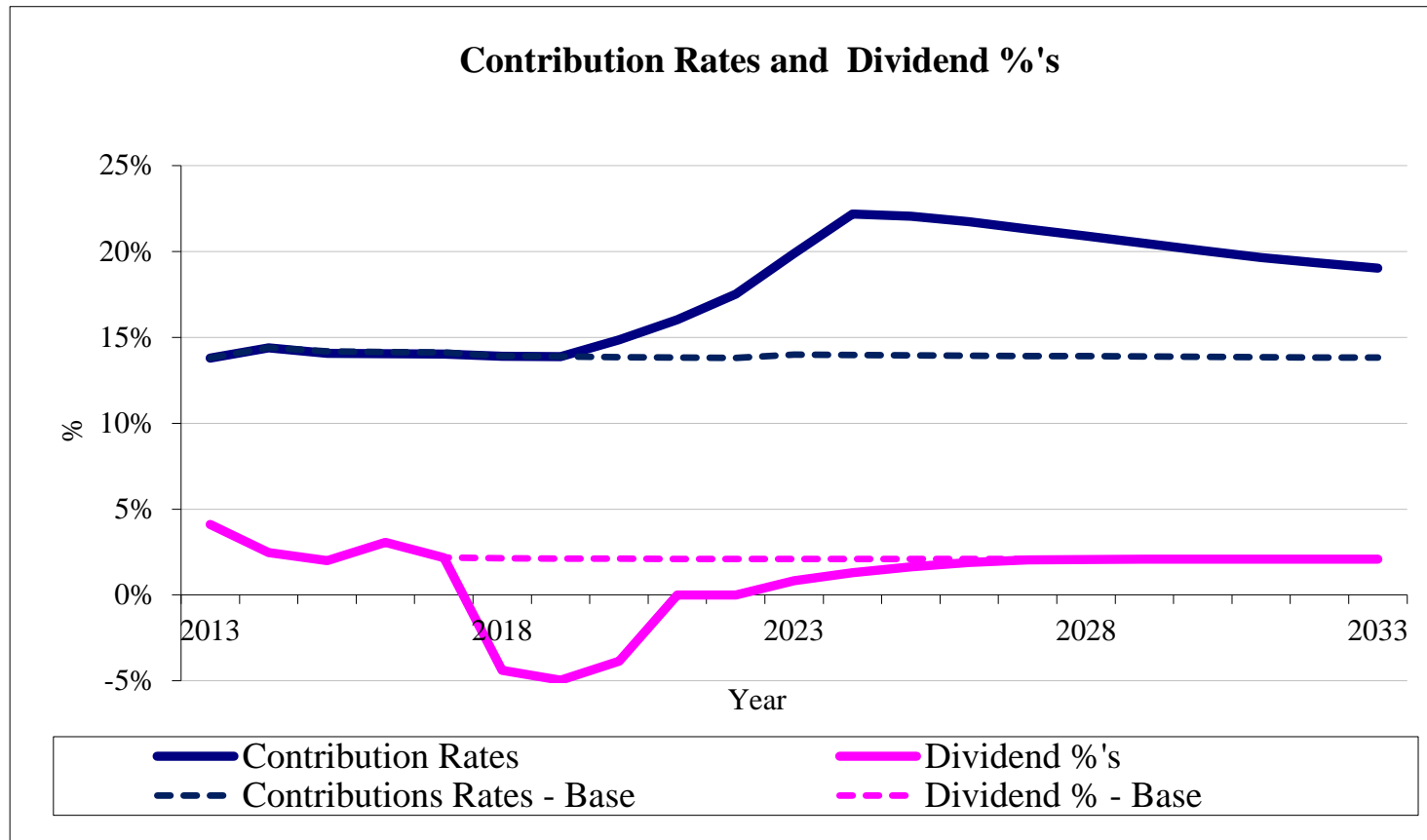
Scenario 2b – Negative 18% in 2018 Followed by 7.2% Thereafter



Dividend Base is completely depleted in year 2022



Scenario 3b – Negative 29% in 2018 Followed by 7.2% Thereafter



Dividend Base is completely depleted in year 2020

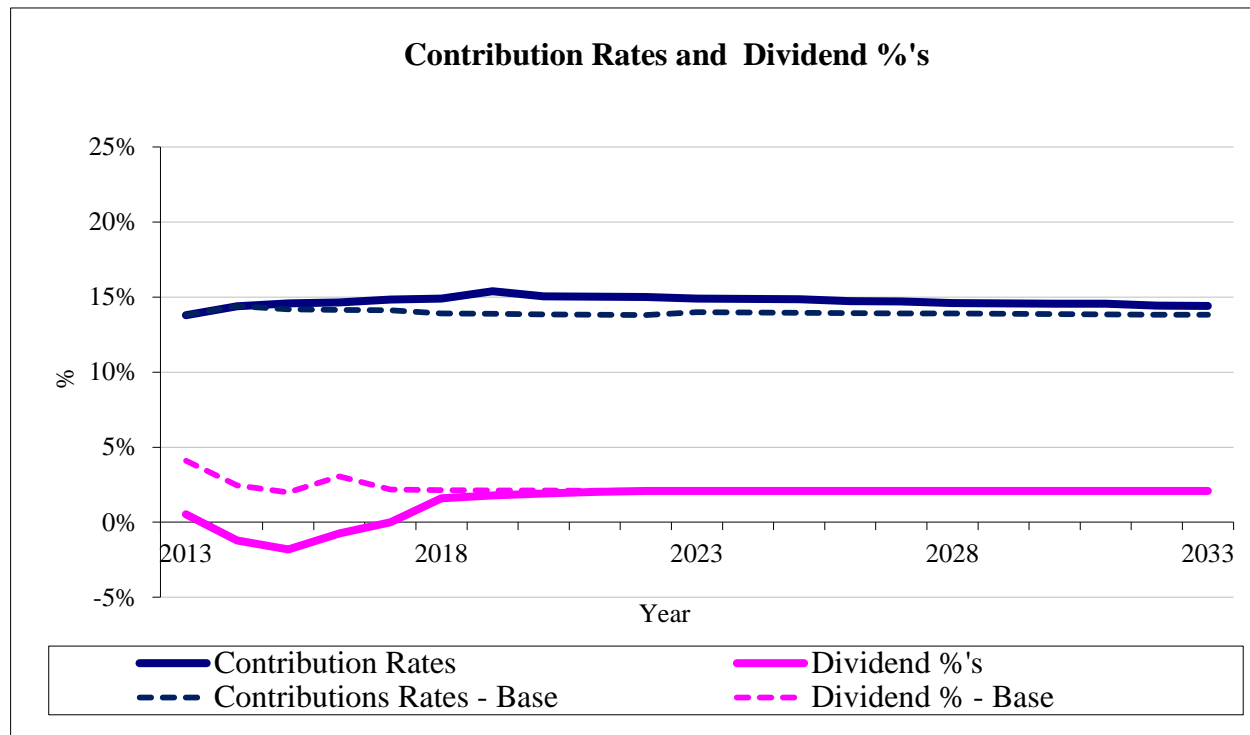


Summary of Scenarios 1b - 3b

- ◆ Scenarios 2 and 3 would still likely lead to the depletion of the dividend
- ◆ However, depletion date would be much further in the future affecting a different cohort of retirees

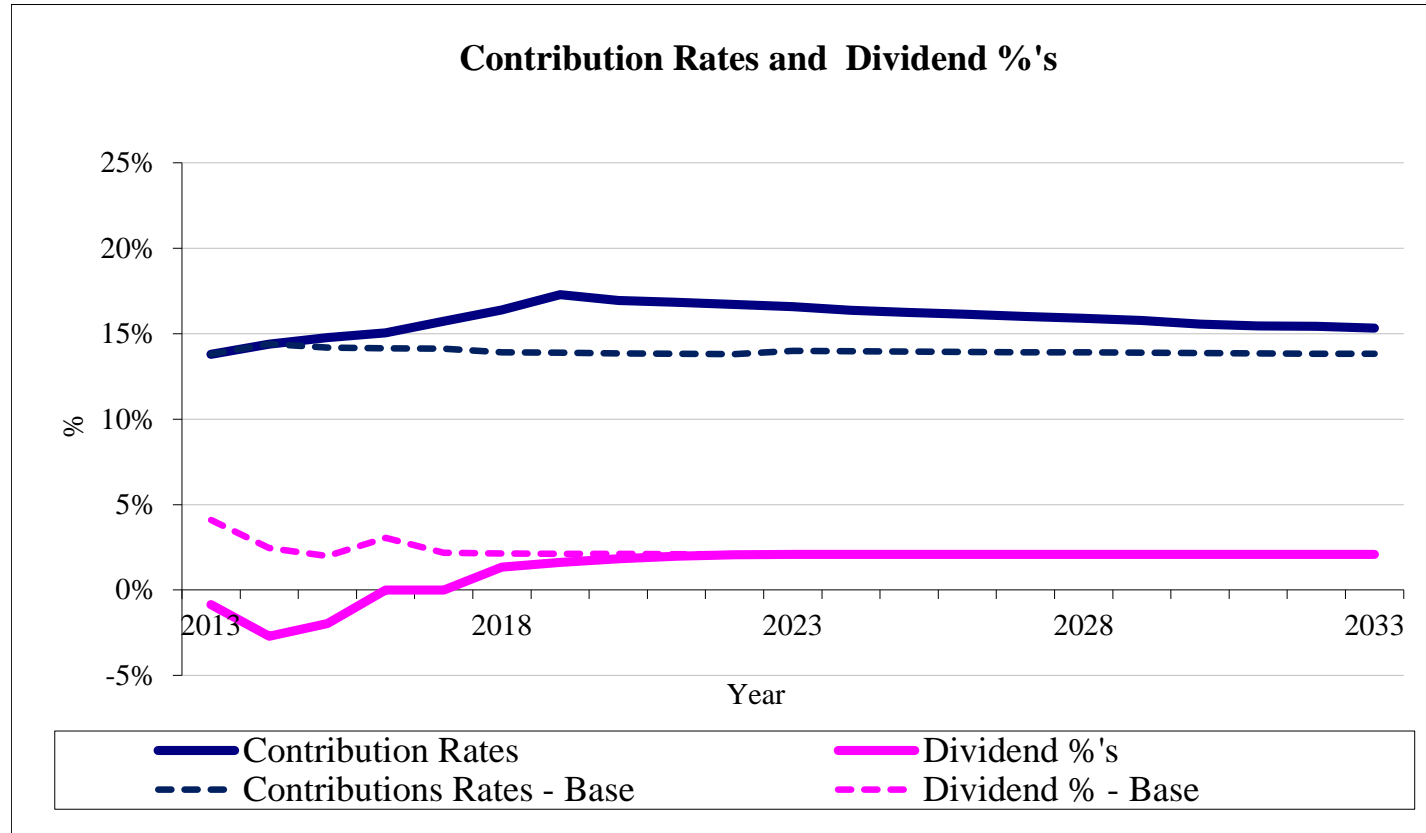


Scenario 1c –Negative 11% in 2013 Followed by Low Wage Inflation

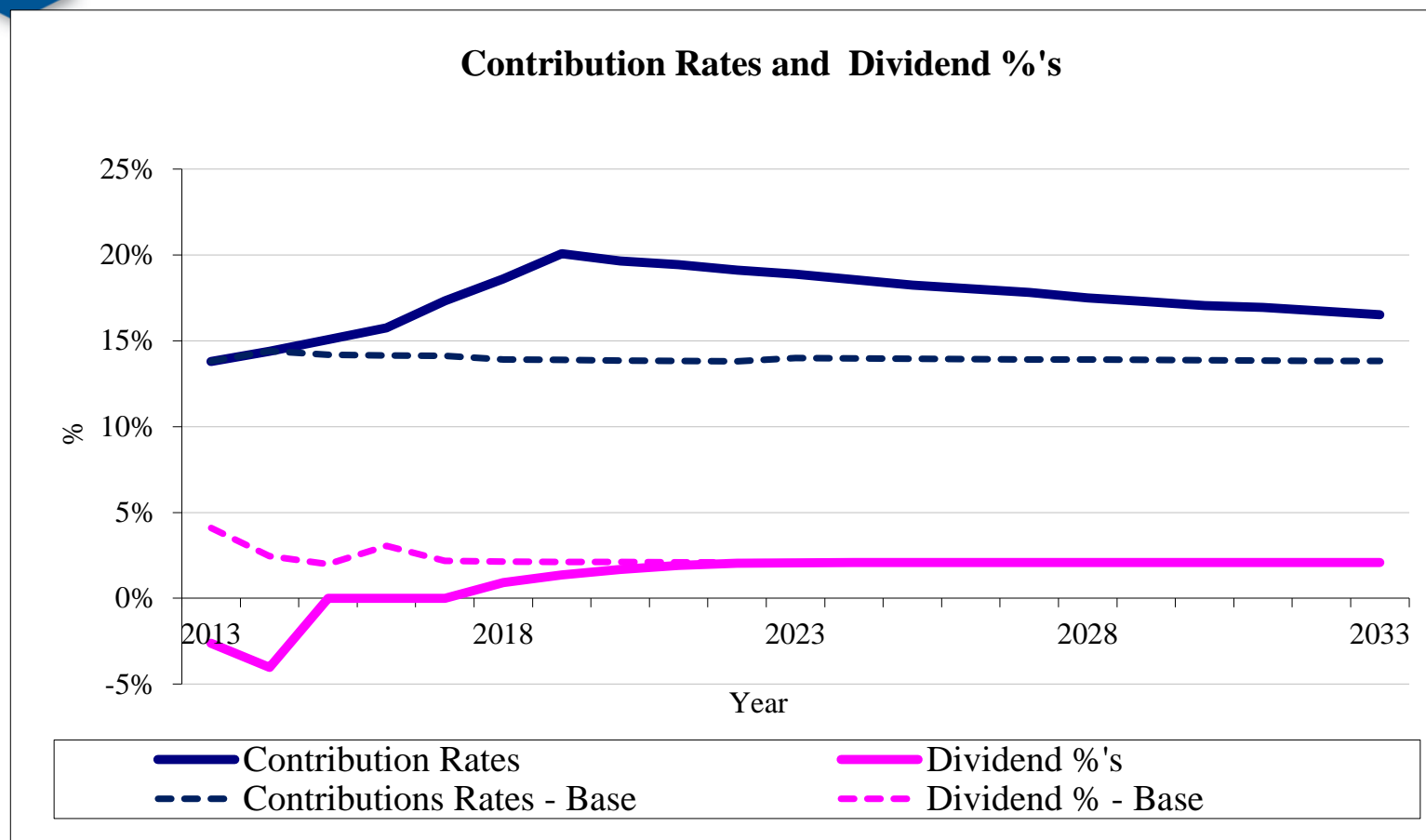




Scenario 2c –Negative 18% in 2013 Followed by Low Wage Inflation



Scenario 3c – Negative 29% in 2013 Followed by Low Wage Inflation



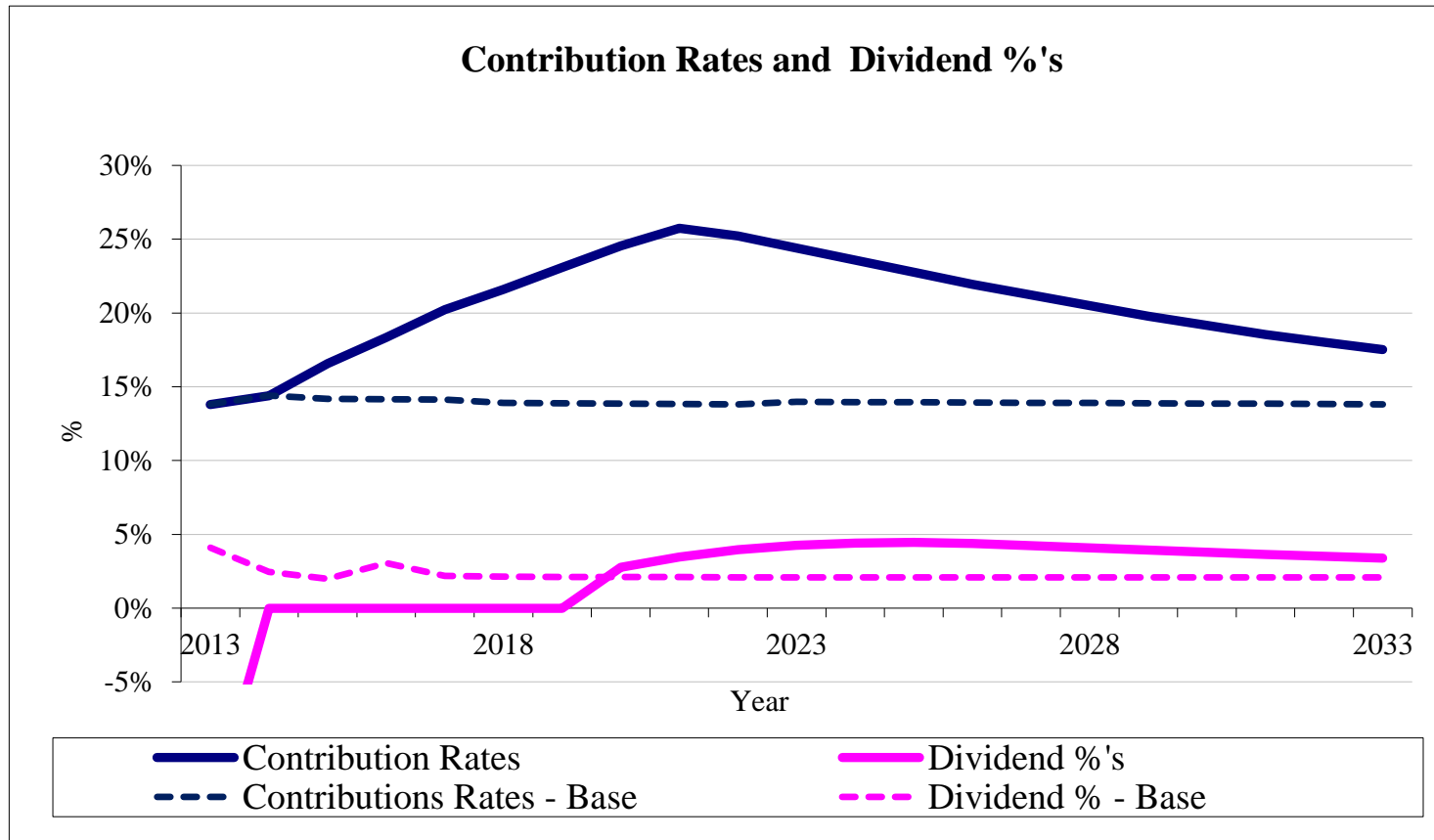


Summary of Scenarios 1c - 3c

- ◆ For scenario c, we looked at the historical salary gains following the market decline in 2008 and assumed a similar gain would occur for the first 5 years after 2013
- ◆ Lower than expected wage inflation would result in salary gains to help offset contribution increases
- ◆ Would not impact dividend base

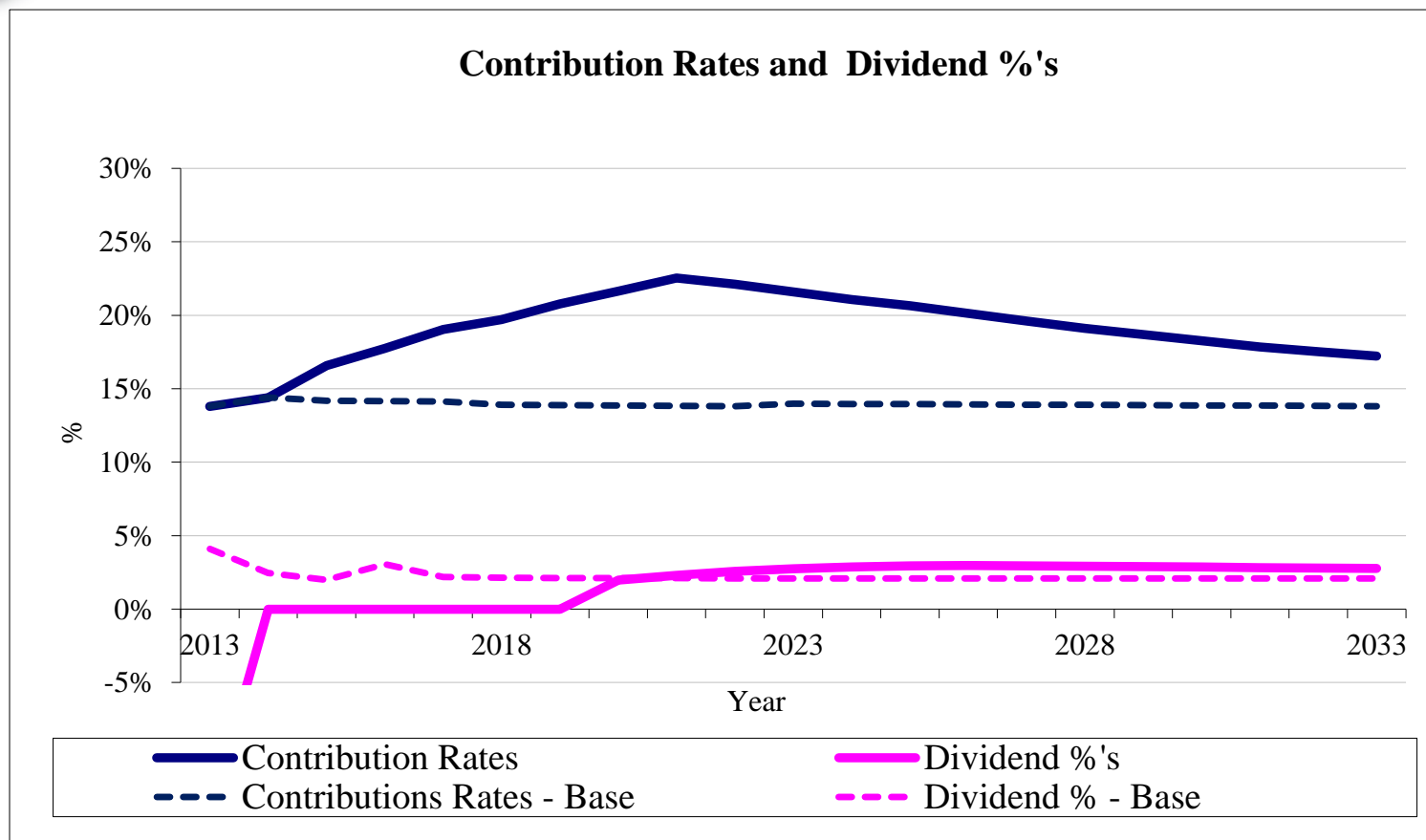


Scenario 3 (negative 29%) with 5-Year Smoothing and 20% Corridor





Scenario 3 (negative 29%) with 7-Year Smoothing and 20% Corridor





Summary of 7-Year Smoothing

- ◆ Impact of 7-year smoothing is offset by the use of 20% corridor
- ◆ Dividend is depleted in 2014 under either scenario



Target Rate of Return

- ◆ WRS assumes a 7.2% return on assets
- ◆ Statutory rate is 5.0%
- ◆ Return over 5.0% is paid in form of a dividend to retirees
- ◆ Return under 5.0% is taken back from retirees (subject to original benefit)
- ◆ Important to understand the relationship between the 7.2% and 5.0% targets



Analysis of Target Threshold

Assumed Interest Rate/Wage	Statutory Target Threshold	Expected Dividend	Retiree Liability	Funded Ratio	Contribution Rate
7.2%/3.2%	5.0%	2.1%	\$41.8B	100%	14.4%
6.2%/2.2%	5.0%	1.1%	\$41.8B	99%	14.9%
7.2%/3.2%	4.0%	3.1%	\$45.8B	92%	16.8%

Changing the assumed interest rate in conjunction with wage inflation has a minor impact on active liabilities and no impact on retiree liabilities.

Changing the target threshold rate has a major impact on both active and retiree liabilities.



Comments on Target Return

- ◆ Lowering the assumed rate and not the target rate will result in lower expected dividends for retirees
- ◆ Lowering the target rate and not the assumed rate would immediately eliminate all prior dividends
- ◆ Other options to study
 - ▶ Small changes in target rate (i.e., 0.1% change)
 - ▶ Capping positive dividends (i.e., 3.0%)
 - ▶ Combination of above

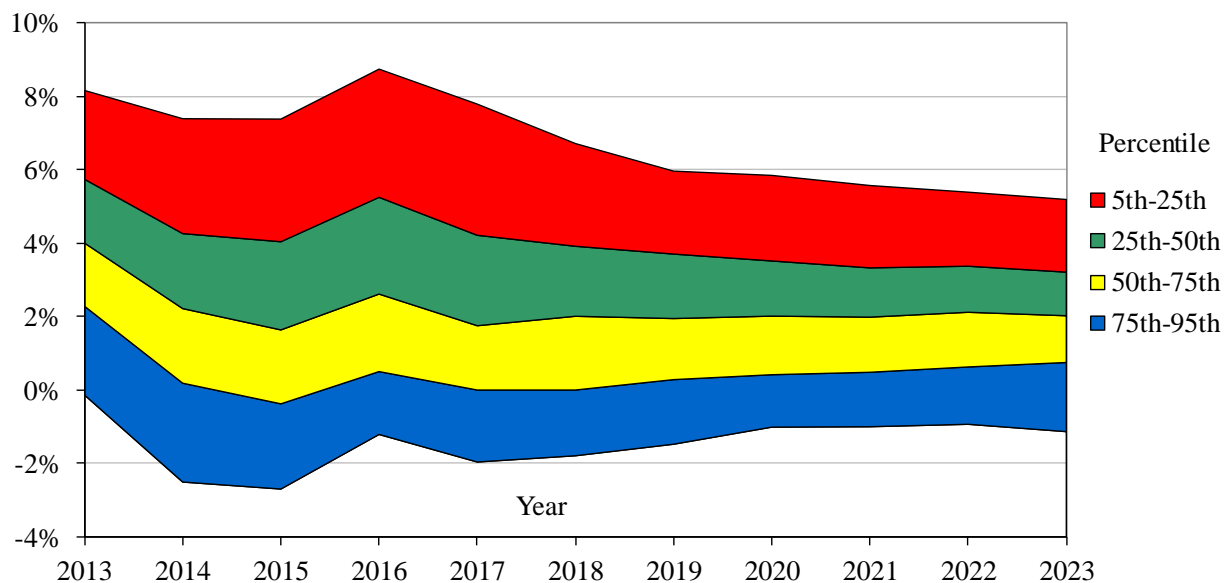


Dividend Cap with Stabilization Reserve

- ◆ Capping dividends could help build up reserve to be used in bad times
- ◆ Probability of negative dividends is reduced (more so in future years)
- ◆ If stabilization reserve became very large, would need to decide what to do with it

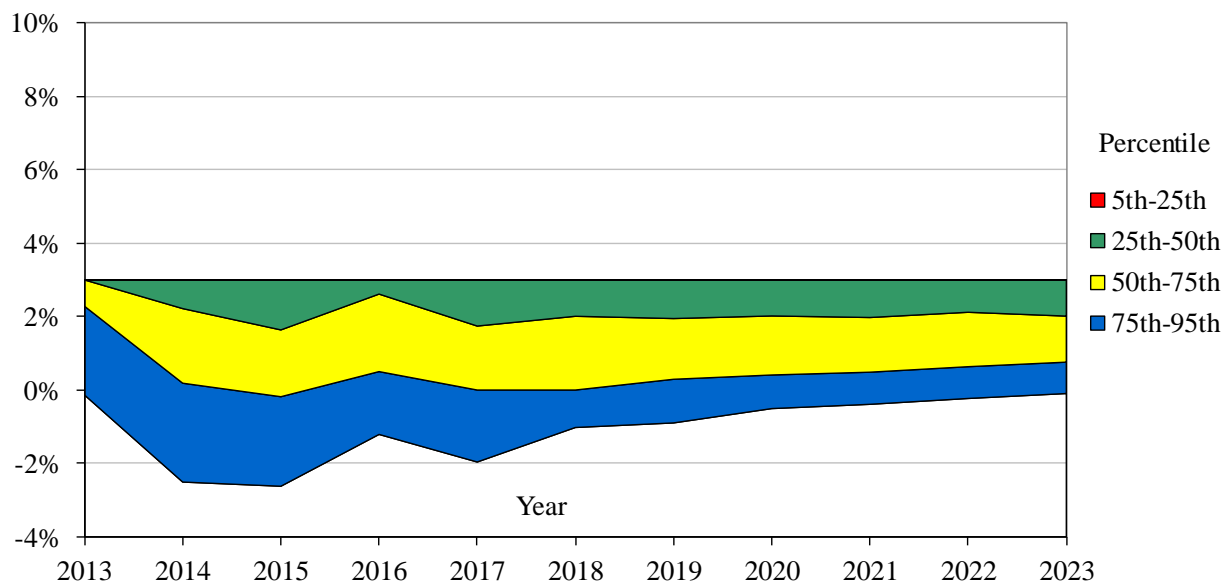


Dividend Projection without 3% Cap



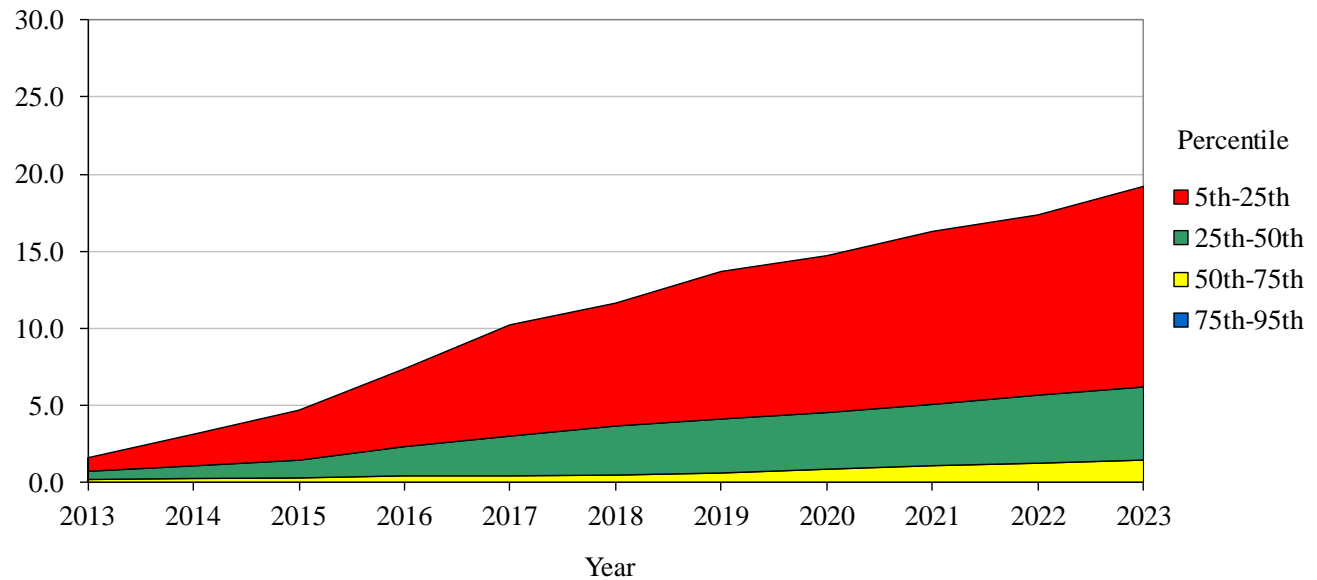
5th Percentile	8.2%	7.4%	7.4%	8.7%	7.8%	6.7%	6.0%	5.8%	5.6%	5.4%	5.2%
25th Percentile	5.7%	4.3%	4.0%	5.2%	4.2%	3.9%	3.7%	3.5%	3.3%	3.4%	3.2%
Median	4.0%	2.2%	1.6%	2.6%	1.8%	2.0%	1.9%	2.0%	2.0%	2.1%	2.0%
75th Percentile	2.3%	0.2%	-0.4%	0.5%	0.0%	0.0%	0.3%	0.4%	0.5%	0.6%	0.8%
95th Percentile	-0.1%	-2.5%	-2.7%	-1.2%	-2.0%	-1.8%	-1.5%	-1.0%	-1.0%	-0.9%	-1.1%

Dividend Projection with 3% Cap and Stabilization reserve



5th Percentile	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
25th Percentile	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Median	3.0%	2.2%	1.6%	2.6%	1.7%	2.0%	1.9%	2.0%	2.0%	2.1%	2.0%	2.0%
75th Percentile	2.3%	0.2%	-0.2%	0.5%	0.0%	0.0%	0.3%	0.4%	0.5%	0.6%	0.8%	0.8%
95th Percentile	-0.1%	-2.5%	-2.6%	-1.2%	-2.0%	-1.0%	-0.9%	-0.5%	-0.4%	-0.2%	-0.2%	-0.1%

Stabilization Reserve (in billions)



5th Percentile	1.61	3.13	4.69	7.38	10.23	11.64	13.69	14.72	16.29	17.36	19.21
25th Percentile	0.73	1.08	1.45	2.33	3.02	3.67	4.12	4.54	5.07	5.67	6.20
Median	0.20	0.27	0.30	0.44	0.44	0.49	0.62	0.87	1.10	1.26	1.46
75th Percentile	-	-	-	-	-	-	-	-	-	-	-
95th Percentile	-	-	-	-	-	-	-	-	-	-	-



Dividend Reserve Depletion

- ◆ The probability of such an event is low. Even 2008 could not produce depletion.
- ◆ But low is not zero, and there are people who believe the stock market is currently in a bubble.
- ◆ The following slides discuss potential courses of action when there is a deficit in the retiree reserve.



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



Conclusions: Deterministic Scenarios Summary

Scenario	Impact on Dividends	Comment
Large Negative 2013 Investment Return	Likely depleted within 5 years	Scenarios assume: increased contributions will pay off unfunded retiree liability
Negative 2013 with 2014 Bounce back	Still depleted within 4 years for -18% and -29% scenarios	Current dividend pool is small and short lasting
Assumed returns until 2018 Big Negative	Defers depletion 2-4 years after 2018 for -18% and -29% scenarios	Small cushion builds up until 2018
Low wage inflation environment	None	Salary gains may help offset contribution increases
Smoothing worst case return	None	Smoothing helps defer contribution increases somewhat, but mitigated by corridor



Comments and Conclusions

- ◆ 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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- ◆ This presentation shall not be construed to provide tax advice, legal advice or investment advice.



Appendix



Introduction



Funding Objectives

- ◆ Intergenerational equity with respect to plan costs
- ◆ Stable pattern of contribution rates (and dividends to retirees)
- ◆ Stable or increasing ratio of assets to accrued liabilities

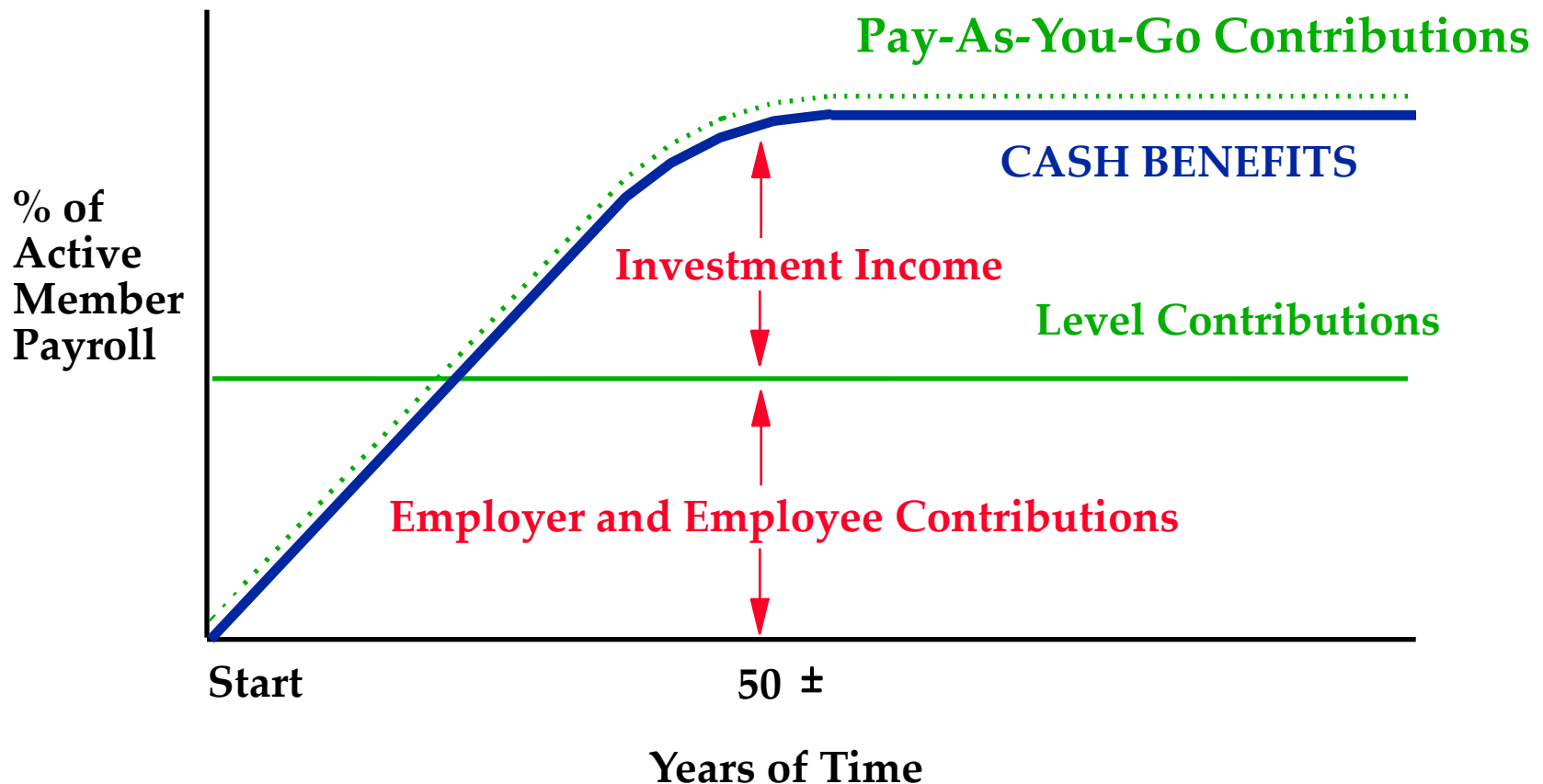


Consequences of a Soundly Financed Program as Maturity Approaches

- ◆ Funding ratio approaches 100%
- ◆ Investment income becomes the largest contributor
- ◆ Economic volatility becomes more important
- ◆ Fundamental objectives are more difficult to achieve (the “Pension Funding Paradox”)

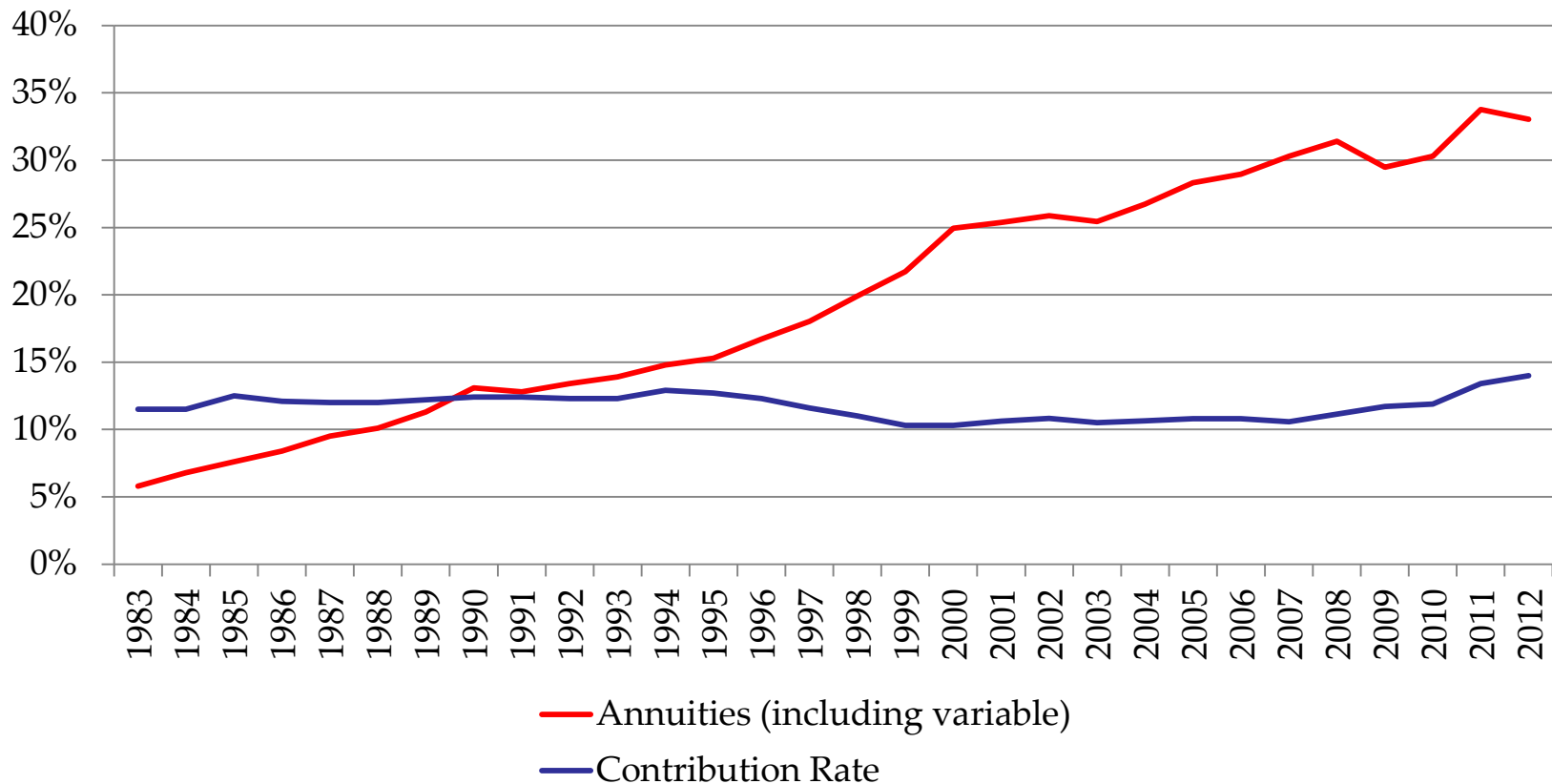


Pattern of Maturity





Historical Annuities and Contribution Rate as a % of Payroll



Annuities are expected to continue to increase as a percent of payroll for about 15 to 20 years. Increases will be paid from income on Retirement System assets.



Regular Valuation

- ◆ Quantifies commitments with present value liability calculations
- ◆ Contains an implied plan for meeting cash flows
- ◆ Doesn't disclose specifics of the plan very well



Projection

- ◆ Quantifies commitments by projecting year by year cash flows
- ◆ Demonstrates how the plan for meeting cash flows is expected to work
- ◆ Discloses emerging patterns
- ◆ Not a prediction



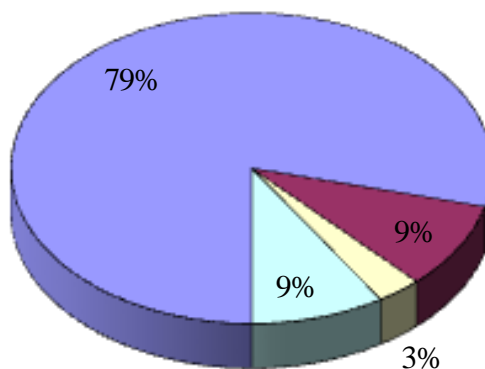
Comments

- ◆ WRS is a well funded system (100%)
- ◆ Contribution requirements have been remarkably stable
- ◆ However, events of the last decade have resulted in prior dividends being taken away. As the number of annuitants with remaining dividends decreased, the effect on individuals was magnified.
- ◆ Can this process be improved?



Expected Terminations from Active Employment for Current Active Participants

**Expected Terminations from Active Employment
for Current Active Members**



■ Retirements

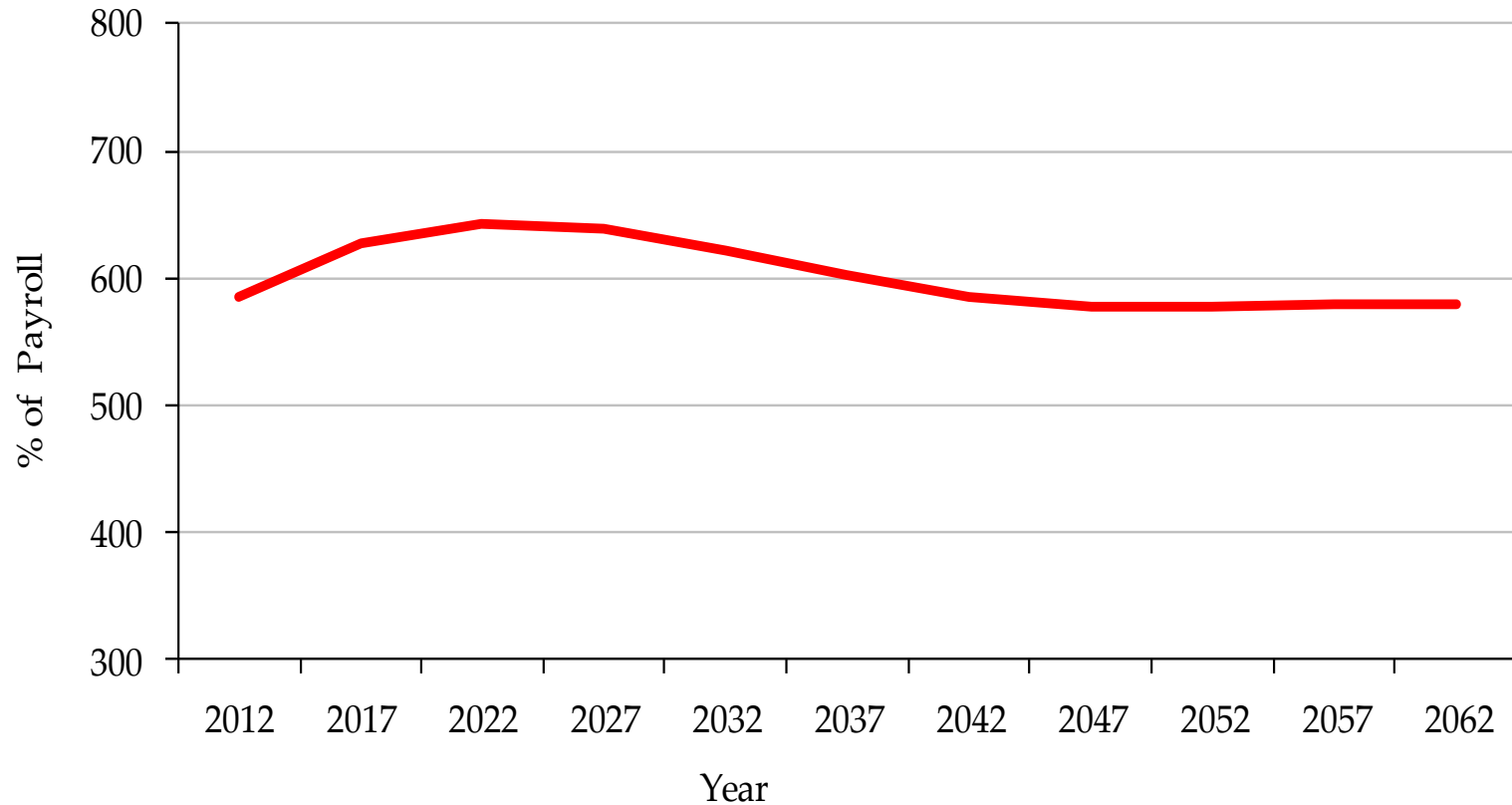
■ Non-Vested Separations

■ Death and Disabilities

■ Vested Separations



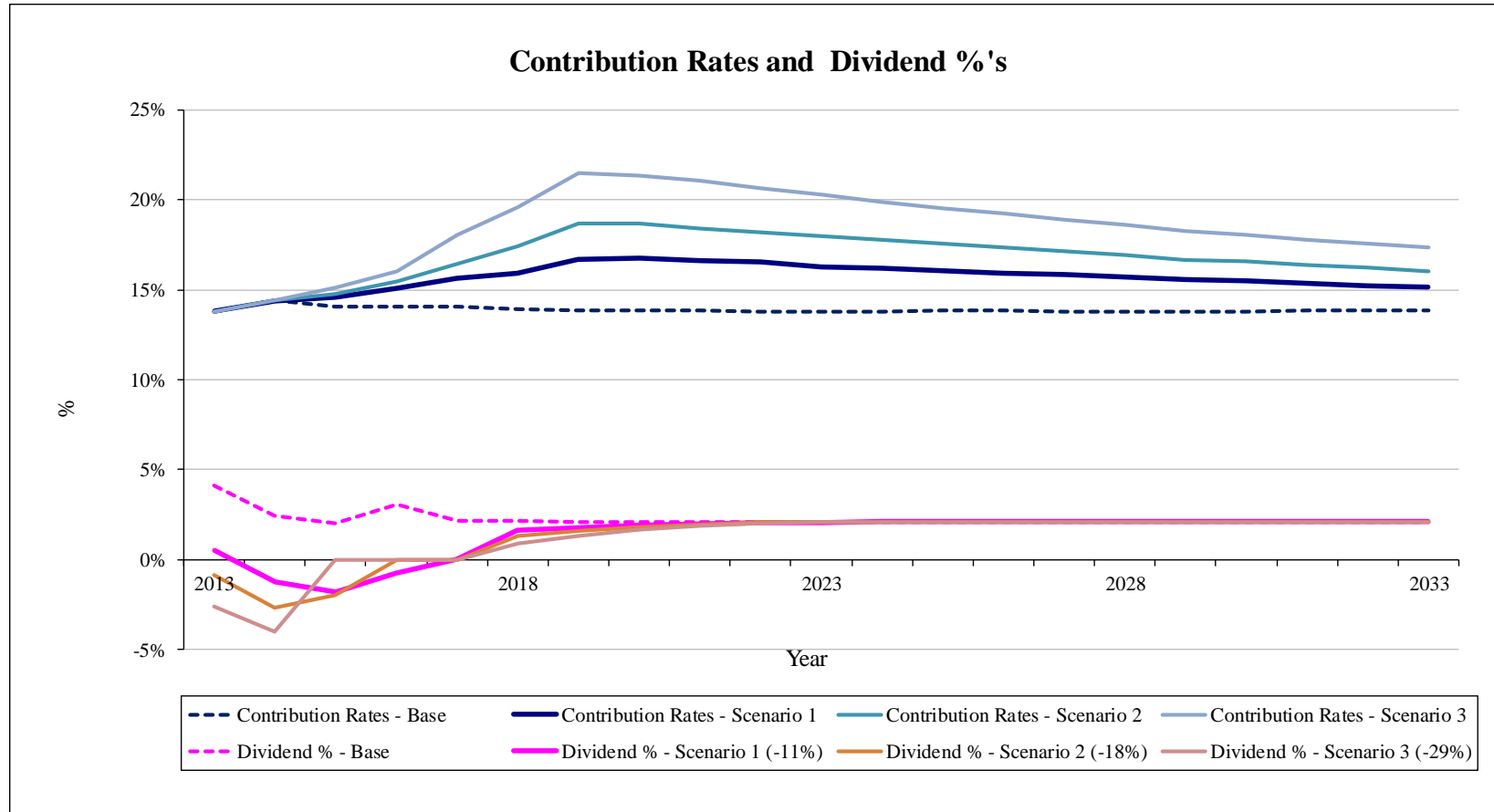
Assets as a Percent of Payroll



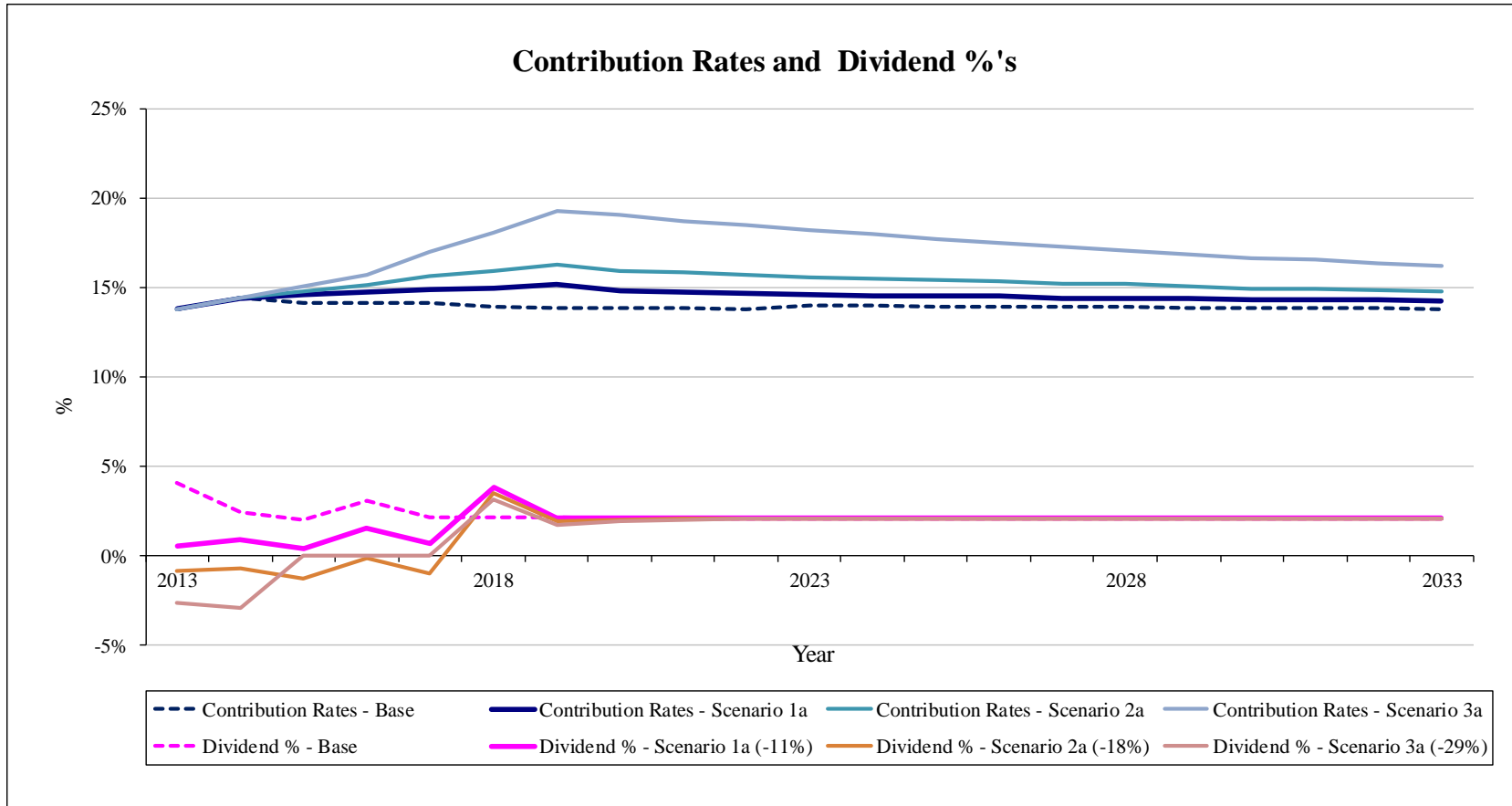


Deterministic Scenario Summary

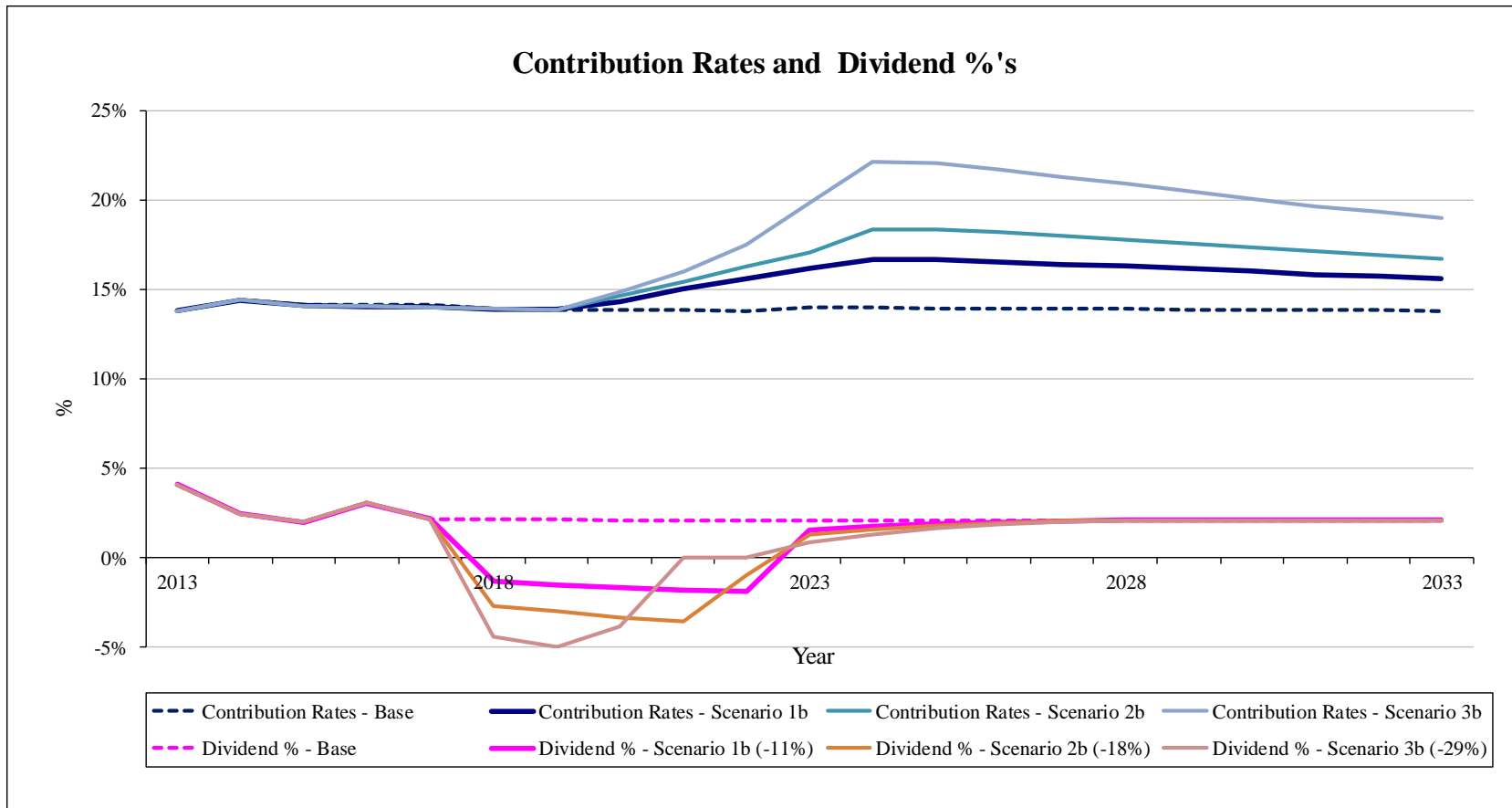
Summary of Scenarios 1 - 3



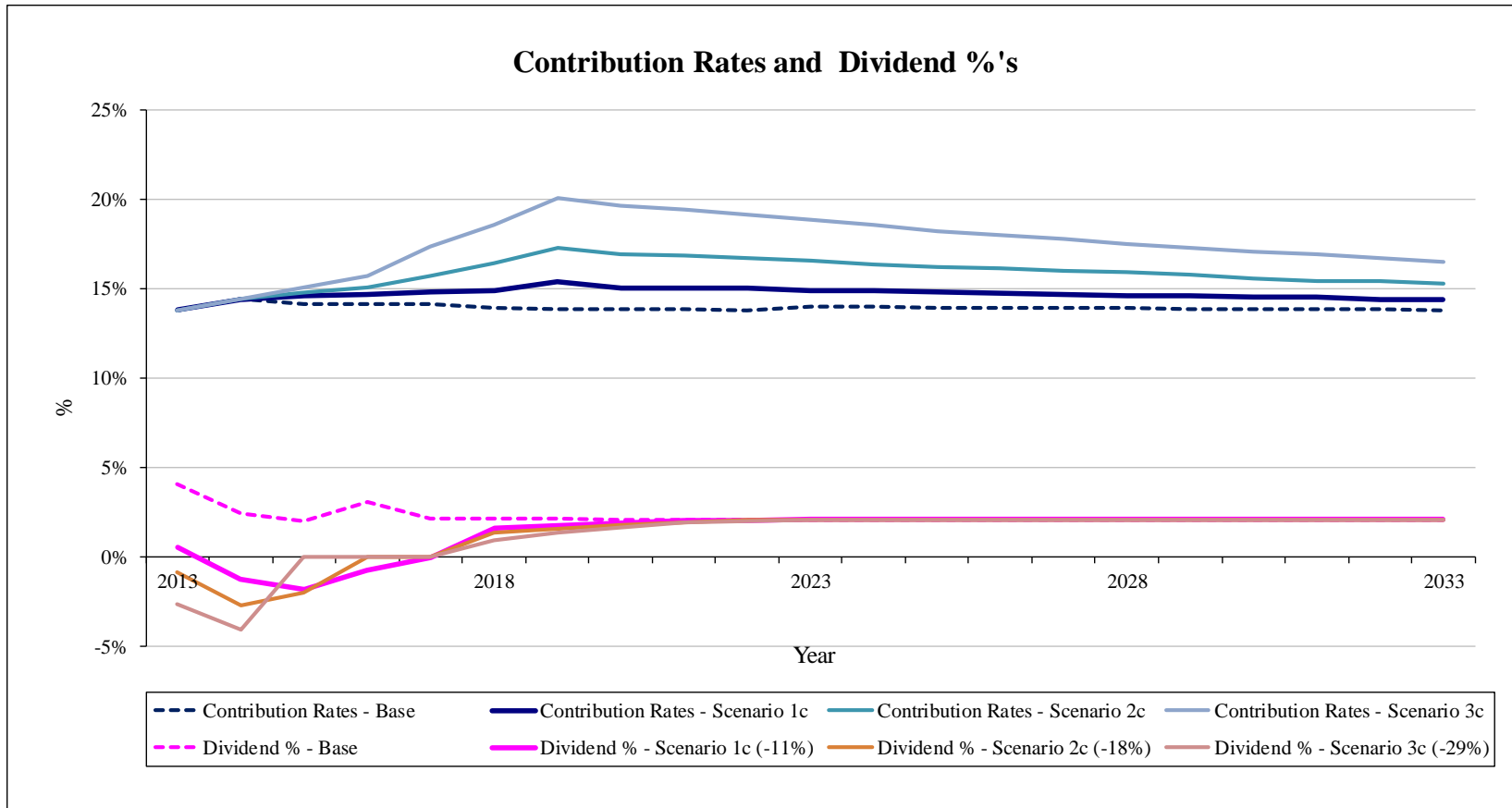
Summary of Scenarios 1a - 3a



Summary of Scenarios 1b - 3b



Summary of Scenarios 1c - 3c





Unfunded Dividend Analysis



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?



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 $2.2\% \times \$36 \text{ Billion}$, 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.



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.



Money Purchase Benefit Analysis



Percent of Active Members Assumed to Retire with Money Purchase Benefit

	Executives	Police	Fire	General
Retire at NRA	5.4%	0.4%	0.1%	10.6%
Retire at NRA +5	19.5%	2.6%	0.6%	62.7%
MP interest + 2%	12.5%	2.4%	0.1%	44.8%
MP interest – 2%	2.0%	0.4%	0.1%	2.8%
EE Contribution + 1%	8.7%	0.4%	0.1%	25.5%
EE Contribution – 1%	2.3%	0.4%	0.1%	4.3%

Results above do not include those retiring from deferred status



Effect of changes to Money purchase benefit on Active member liability

(in \$ Billions)

	Executives	Police	Fire	General
Base	0.32	5.12	1.22	40.86
MP interest + 2%	0.35	5.35	1.23	45.55
MP interest – 2%	0.31	5.04	1.22	39.10
EE Contribution + 1%	0.33	5.15	1.22	41.67
EE Contribution – 1%	0.32	5.09	1.22	40.30

Liability moves up faster than down due to members reaching formula benefit