



# Actuarial Techniques to Manage Pension Risk

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# Defining and Understanding Risk

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- ◆ A typical retirement system faces a number of risks
- ◆ In common usage, the risk most often refers to an outcome with undesirable results
  - ▶ An occurrence that gets in the way of achieving your goals
- ◆ The greatest risk facing a retirement system is its depletion of funds
  - ▶ This may create a risk for the payment of benefits
  - ▶ This, in turn, creates legal risk/litigation risk which can create an economic risk to taxpayers
- ◆ There is a risk of benefit decreases
  - ▶ Legislatures/taxpayers may opt to decrease benefits



# What Events Increase the Probability of These Risks?

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- ◆ We have seen that significant investment losses increase the probability of “ruin” in some situations
- ◆ Volatile contribution rates increase the likelihood of benefit decreases
  - ▶ As trustees, we want to avoid making permanent changes to impermanent problems
- ◆ Unsustainable costs may lead to benefit reductions
- ◆ Political backlash may also lead to benefit reductions



# Analyze a Range of Expectations

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- ◆ Many times an actuarial cost or savings analysis will be provided, along with a caveat “if all assumptions are met”
  - ▶ What if they are not?
- ◆ Deterministic cost analysis can hide an unmanageable outcome until it is too late
  - ◆ Sometimes risk can create opportunity
  - ◆ Sometime risk has a cost
- ◆ Multiple scenarios or stochastic modeling can show the good outcomes and the negative outcomes so that decision makers can manage the risk
  - ▶ Otherwise known as scenario testing or sensitivity analysis



# First Step, Assess the Risk

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- ◆ A number of tools are available for use in the valuation process that aid in managing risk
  - ▶ These tools do not hide risk, or hide results, but rather are used to provide a longer term picture of the soundness of the plan
- ◆ Using projections, modeling, and stress testing, assess the risks to the plan
  - ▶ Look for “ruin”, or unsustainable contribution rates
  - ▶ Model under a variety of economic and demographic scenarios
  - ▶ Stress test with the very volatile variables such as investment return, inflation, etc.
- ◆ The objective is to match long term funding decisions with the long term needs of the plan
  - ▶ And not to create long term solutions to short term issues



# Example:

## Modifying Asset Smoothing Methods

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- ◆ Recent investment performance has focused decision makers on smoothing methods/techniques
- ◆ Specifically, some pressure has been growing to extend smoothing periods or widen/remove corridors to lessen the impact on the short term budgets
  - ▶ Corridors increase the volatility in the contribution rate by recognizing asset gains/losses more quickly

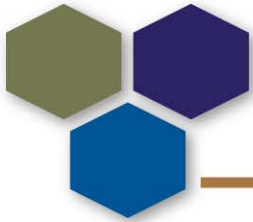


# Impact of Changing Smoothing Periods/Corridors

Client/ Smoothing Method	ARC* from Prior Valuation	ARC from Current Valuation	ARC Eliminating Corridor	ARC Extending Smoothing Period**
A: 5 Year, 20% Corridor	6.11%	8.88%	7.11%	6.63%
B: 4 Year, No Corridor	13.66%	15.02%	NA	14.17%
C: 5 Year, No Corridor	15.68%	18.19%	NA	17.97%
D: 3 Year, 20% Corridor	9.98%	12.51%	11.35%	10.14%
E: 5 Year, 20% Corridor	19.20%	27.14%	22.14%	20.93%

\*ARC: Annual Required Contribution

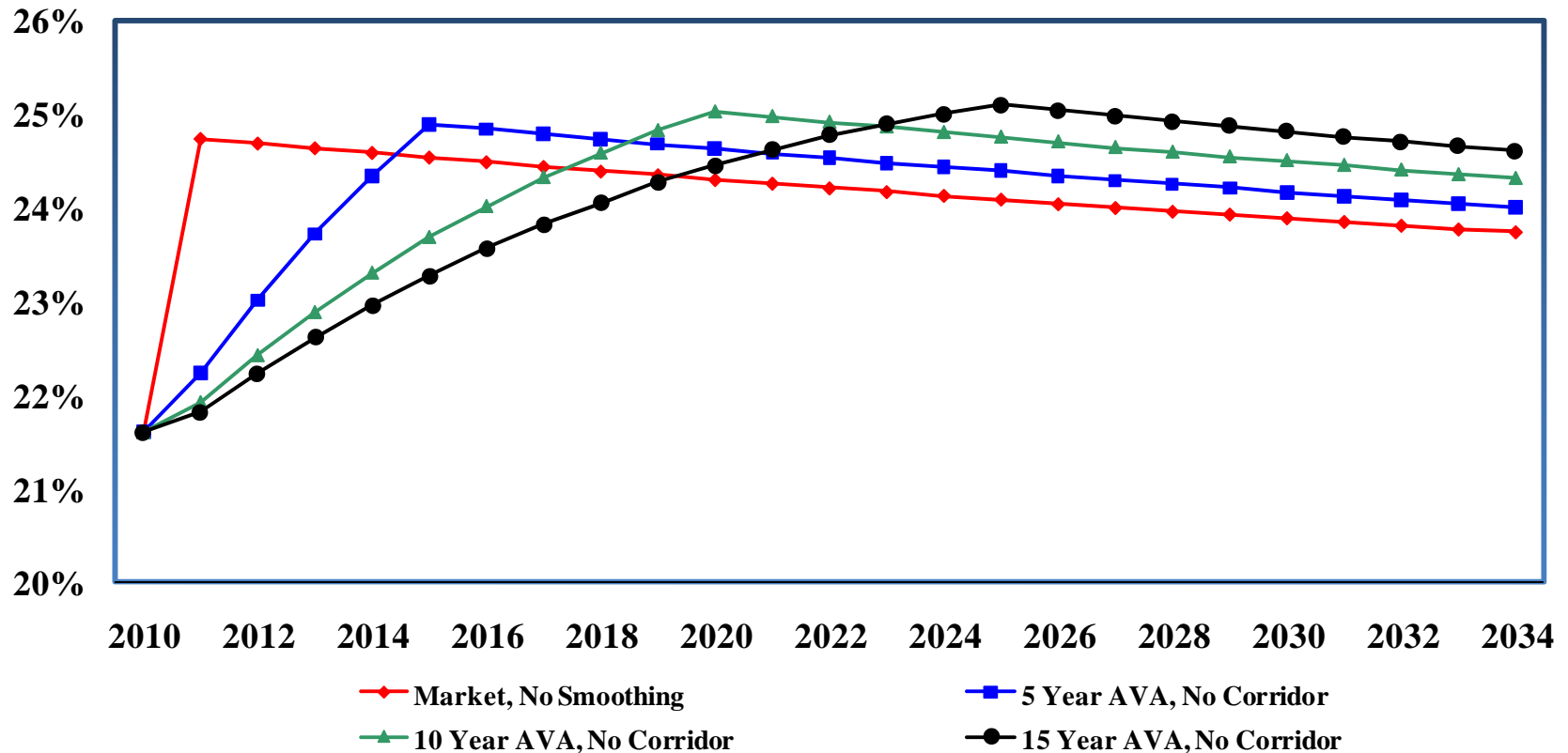
\*\* Includes Eliminating Corridor if Applicable

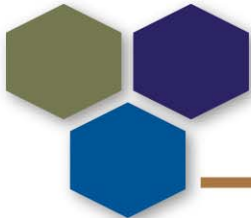


# Sample Retirement System

(-30% return in 2008, assumption exactly met each year thereafter)

## Employer Contribution Rate

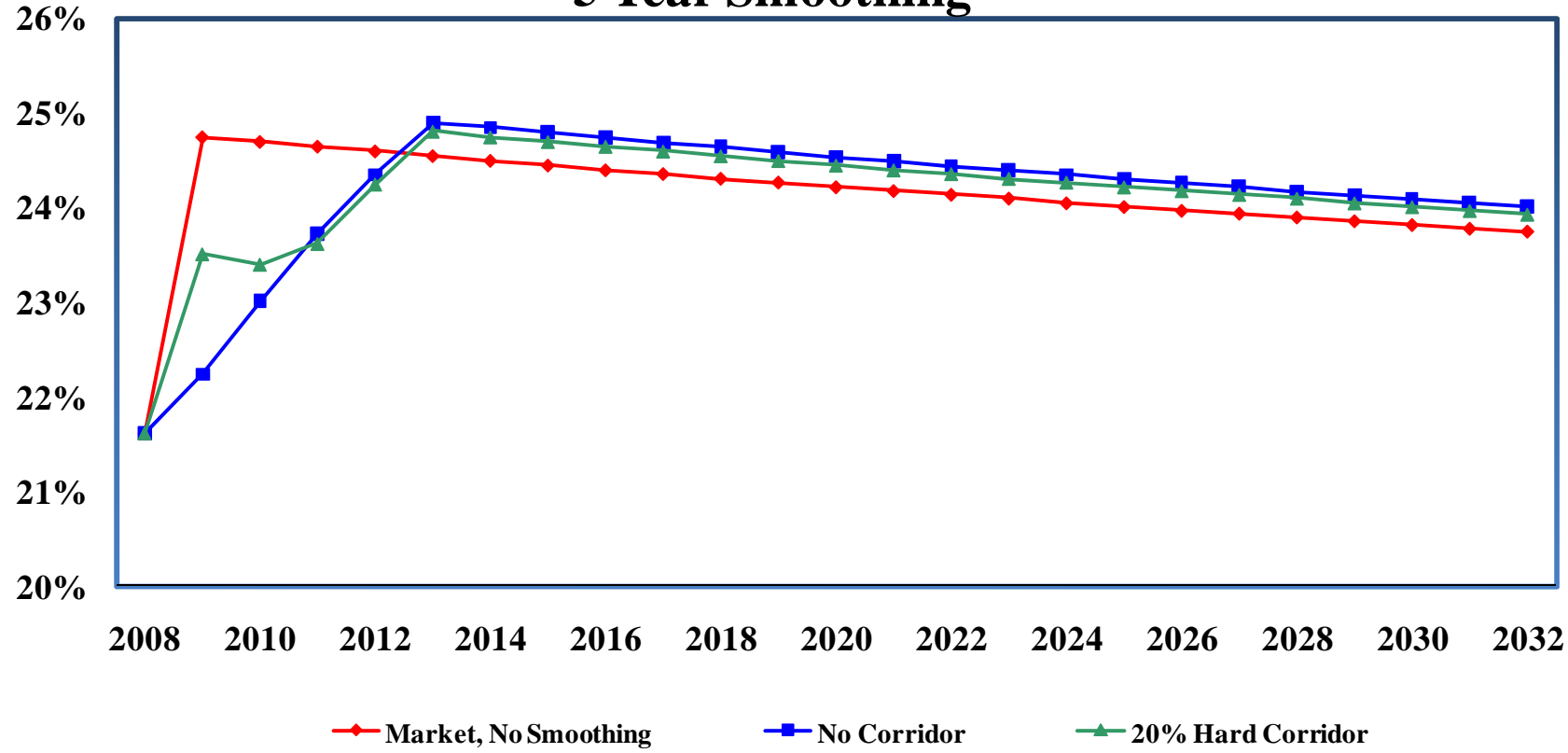




# Sample Retirement System

(-30% return in 2008, assumption exactly met each year thereafter)

## Employer Contribution Rate 5 Year Smoothing

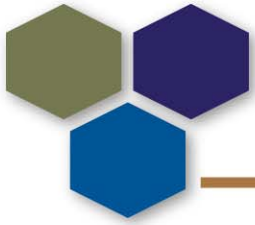




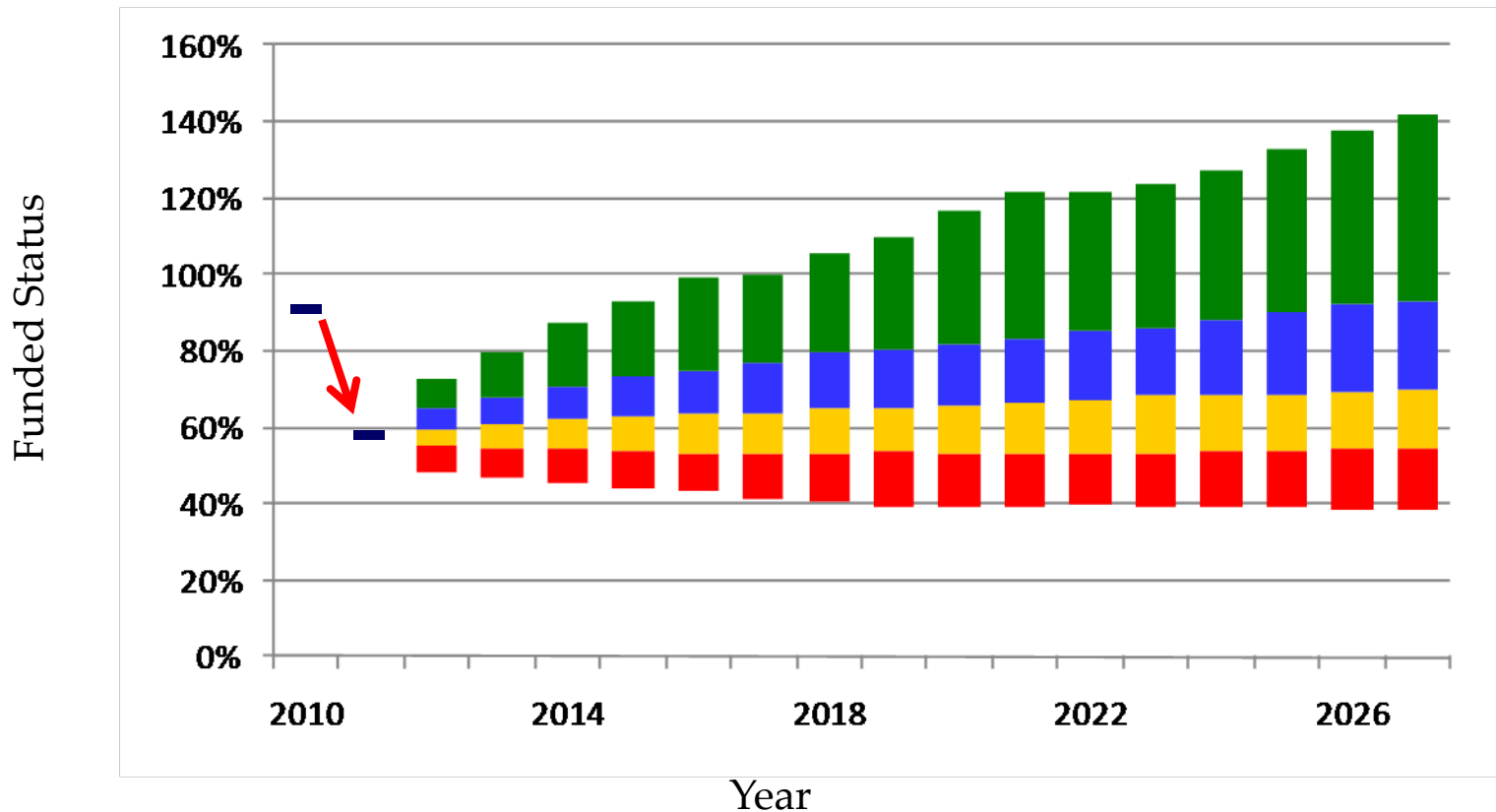
## Reward vs. Risk/Cost

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- ◆ In choosing a smoothing method, the *reward* is less volatility in the contribution rate and disclosed funded status
- ◆ The *cost*, as shown in slide 7 & 8, is higher ultimate contributions
  - Pay now or pay more later
- ◆ But what is the financial *risk*?



# Projected Funded Status Example System



■ 5<sup>th</sup> – 25<sup>th</sup> Percentile   ■ 25<sup>th</sup> – 50<sup>th</sup> Percentile   ■ 50<sup>th</sup> – 75<sup>th</sup> Percentile   ■ 75<sup>th</sup> – 95<sup>th</sup> Percentile

### Assumptions

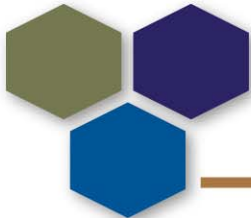
- Projected liabilities based on current assumptions
- Assumes employer contributions based on current amortization policy
- Investment returns based current capital market assumptions and asset allocation



# Volatility

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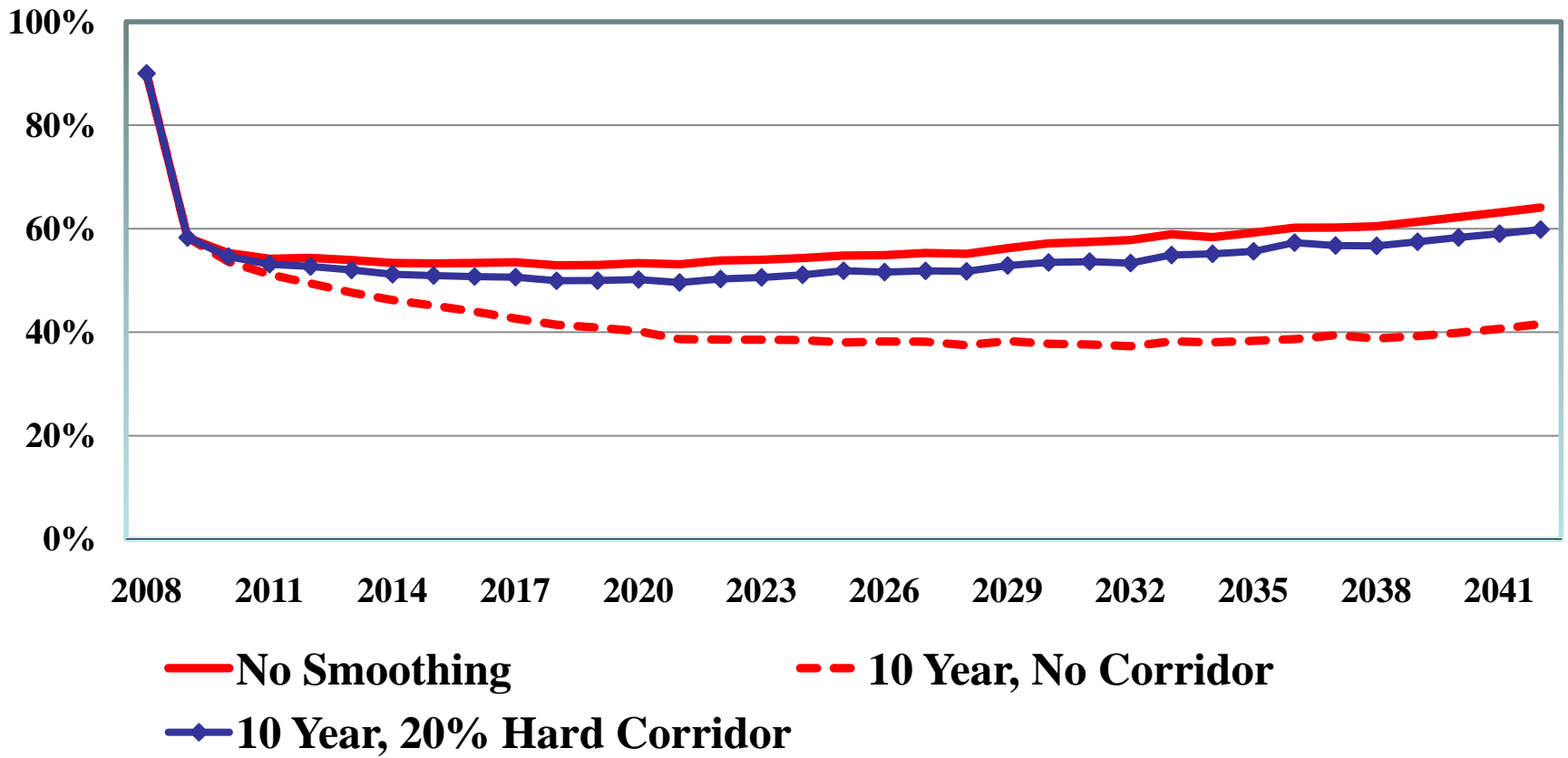
- ◆ Future investment returns are uncertain, therefore, future funding outcomes are also uncertain
- ◆ For risk management, we want to focus on downside risk, and the bottom  $\frac{1}{4}$  of possibilities
  - ▶ Red Squares
- ◆ Corridors provide some protection on the downside



# Impact of Periods/Corridors Combinations

(Sample Retirement System)

## Projected Funding Ratio based on Market Value of Assets – 75<sup>th</sup> percentiles

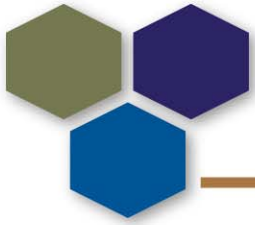




# Corridor

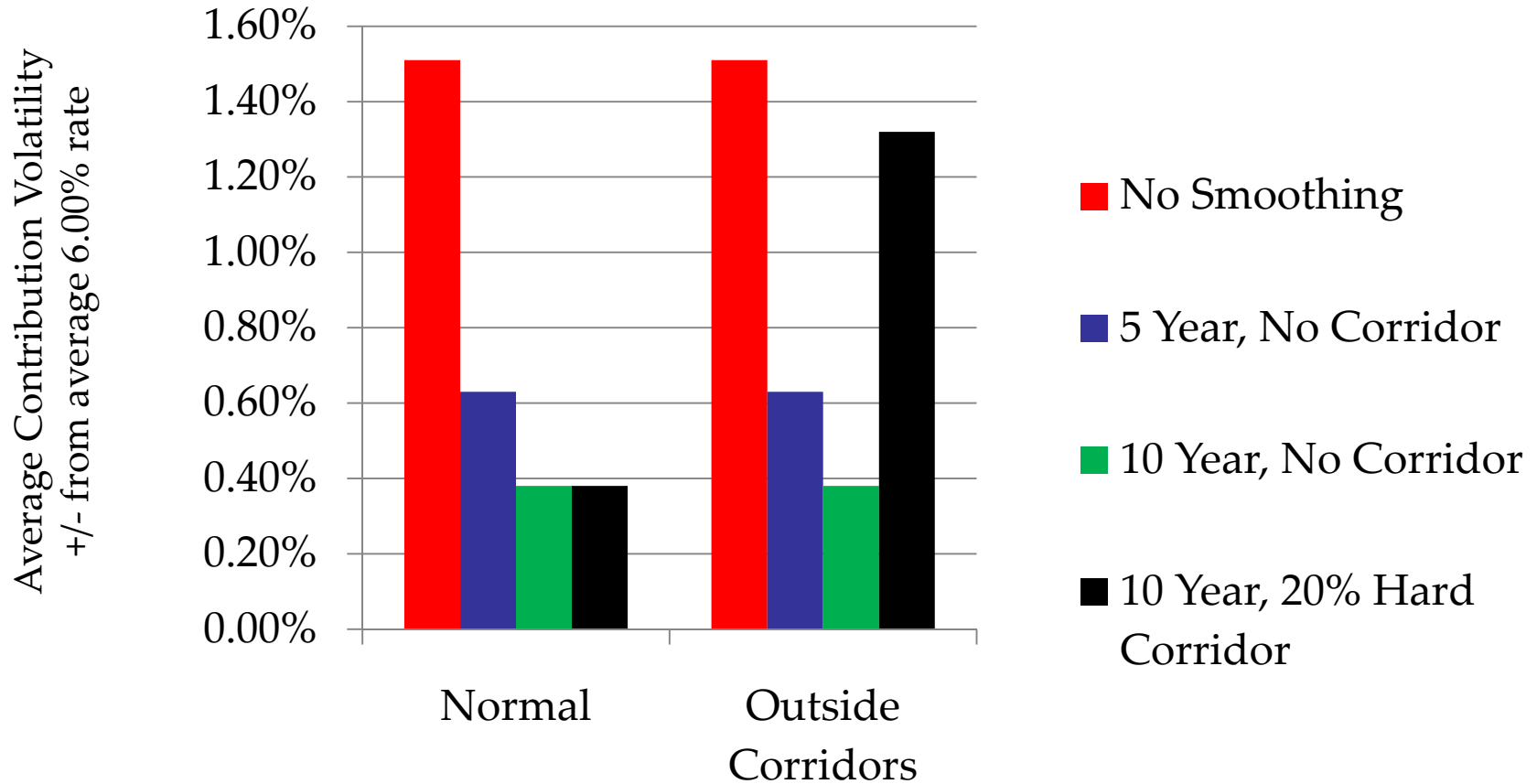
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- ◆ The Corridor clearly provides downside protection
  - ▶ Helps to manage downside risk
- ◆ However, it does so by creating spikes in the contribution requirements
  - ▶ Can the annual budget absorb these increases?
- ◆ Also has disadvantages in the years following the application of the corridor



# Projected Contribution Volatility

Sample Retirement System – Average ARC of 6.00%



#### Assumptions

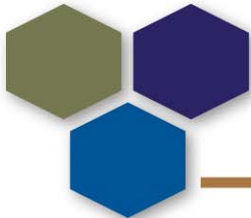
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# Is There Something In-Between?

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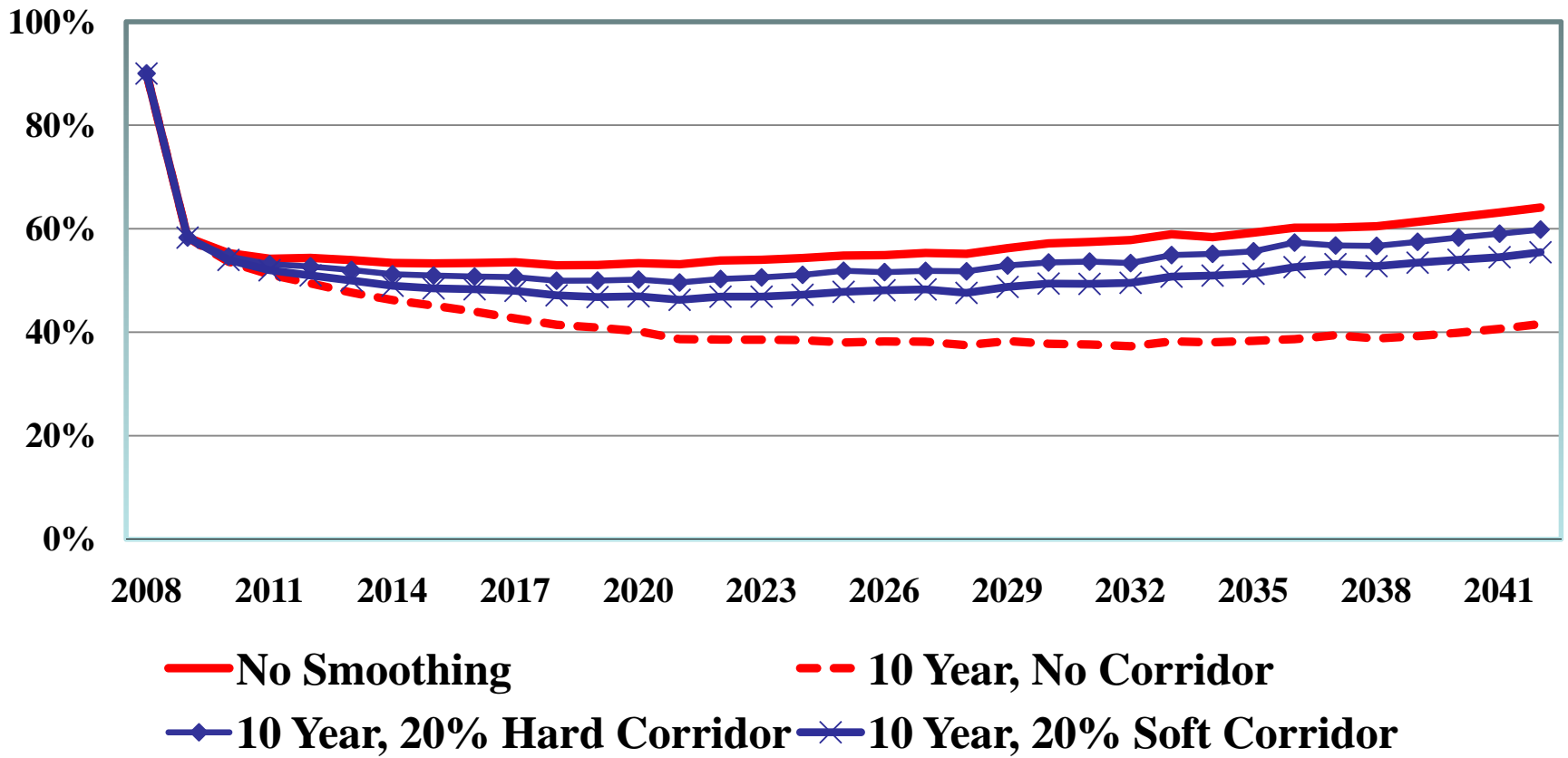
- ◆ Another alternative we have been modeling is known as a “Soft Corridor”
- ◆ A “Soft Corridor” applies a shorter smoothing period for variances outside the range, but not immediate recognition
  - ▶ For example 3 year smoothing outside the corridor
- ◆ This has been producing promising results
  - ▶ Provides downside protection
  - ▶ Provides advanced recognition
  - ▶ Lowers immediate contribution volatility
  - ▶ Eliminates most of the “bounce back” volatility

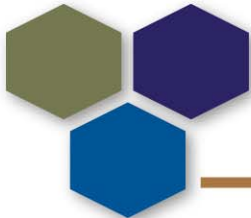


# Impact of Periods/Corridors Combinations

(Sample Retirement System)

## Projected Funding Ratio based on Market Value of Assets – 75<sup>th</sup> percentiles

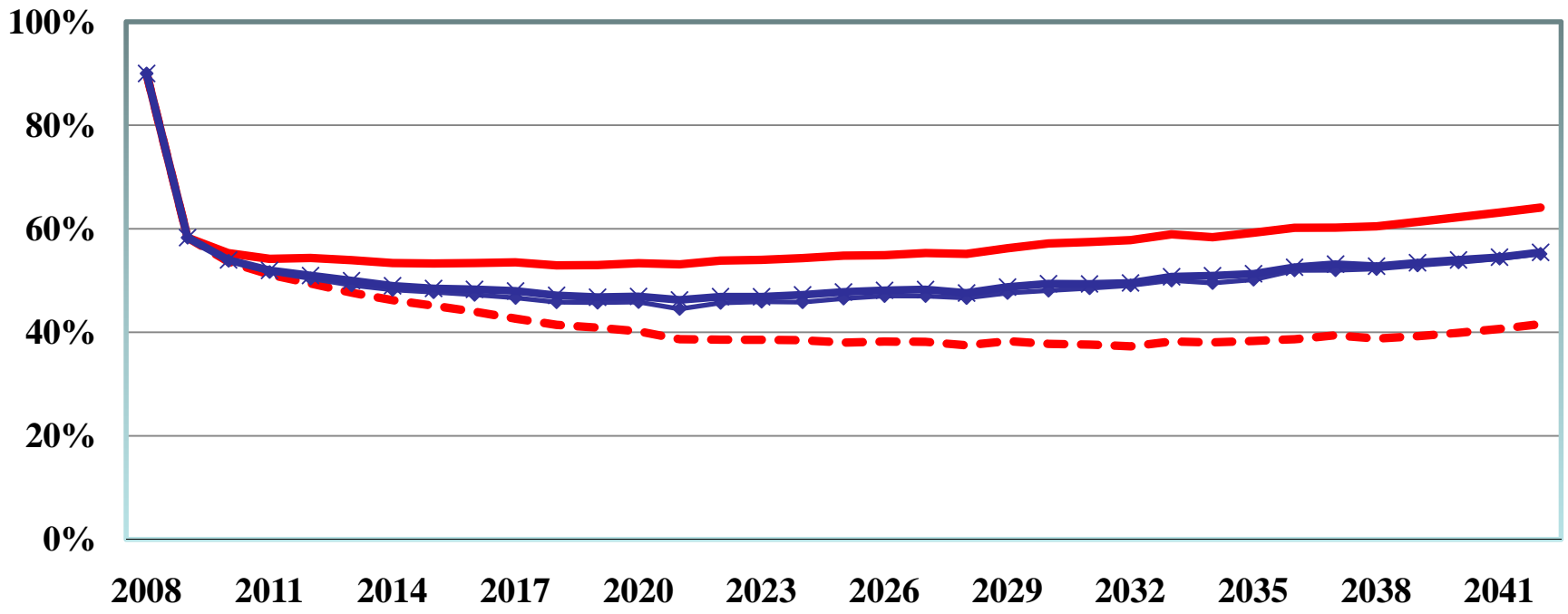




# Impact of Periods/Corridors Combinations

(Sample Retirement System)

## Projected Funding Ratio based on Market Value of Assets – 75<sup>th</sup> percentiles



- No Smoothing**
- - 10 Year, No Corridor**
- ◆— 5 Year, No Corridor**
- x— 10 Year, 20% Soft Corridor**



# Reward vs. Risk

## (Sample Retirement System)

Smoothing Period	Corridor	Average Rate Volatility (Normal)	Average Rate Volatility (At Corridor)	75 <sup>th</sup> Percentile of Funded Ratio	95 <sup>th</sup> Percentile of Funded Ratio
None	None	+/- 1.51%	+/- 1.51%	40%	31%
10 Year	20% Hard	+/- 0.38%	+/- 1.32%	38%	28%
10 Year	20% Soft	+/- 0.38%	+/- 0.85%	36%	26%
5 Year	None	+/- 0.63%	+/- 0.63%	34%	24%
10 Year	None	+/- 0.38%	+/- 0.38%	28%	17%

Using the above objective measurements, methods can be compared for their risk/reward characteristics.

A Hard corridor recognizes gains/losses outside the range immediately, a Soft corridor does not recognize gains/losses outside the range immediately, but does speed up the recognition (3 years for example).



# Other Risk Decisions

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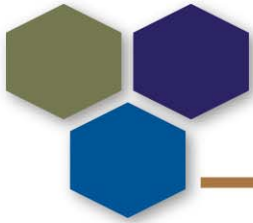
- ◆ Investment Return Assumption
- ◆ Amortization Period
  - ▶ Closed/Open Period
  - ▶ Including Gain/(Loss) Amortization
- ◆ Lag in Contribution Timing
- ◆ Contribution Corridors
  - ▶ Limits on contribution increases
- ◆ Payroll Growth Rate



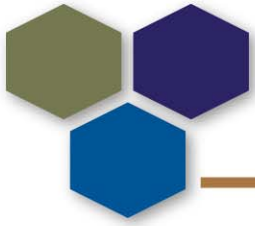
# Individual Solutions for Individual Circumstances

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- ◆ These methods and assumptions should be considered in combination to ensure the optimal strategy is used for financing the benefits provided by the pension plan
- ◆ Some considerations to include:
  - ▶ Investment policy and strategy
  - ▶ Contribution stability versus flexibility
  - ▶ The desired target funded status of the plan



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