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CONSULTING, LLC

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# Actuarial Projections Related to Sustainability



PUBLIC PENSION  
FINANCIAL FORUM

**7th Annual Conference**  
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**Senior Actuary**



# Objectives



- Review key actuarial concepts and provide suggestions on modeling.
- Provide an overview on actuarial projections related to a system's sustainability.
- Learn to identify key actuarial and modeling options.
- Develop a plan and a model to improve your system's actuarial analyses.

# What is an actuarial projection?

- Estimate of the probability and likely cost of a future event such as death, sickness, injury, disability, retirement, or loss of property.
  - Payment of money in the future that is contingent upon occurrence of future events



"Nobody uses crystal balls anymore!"

# Basic Principles



- A present value is the calculation of the amount of money required today to accumulate at an assumed rate of interest to a desired amount in the future
  - Requires an interest rate assumption
  
- An actuarial present value is a present value that also considers the expectation of the payment being made
  - Requires an interest rate assumption and probability of payment assumption

➤ Life annuity example

- Four annual \$1 payments beginning today with 10% Rate of Interest and 10% Rate of Mortality

Time	0	1	2	3
Payment	\$1.00	\$1.00	\$1.00	\$1.00
PV	\$1.00	\$0.91	\$0.83	\$0.75
Probability	1.000	0.900	0.810	0.729
Actuarial PV	\$1.00	\$0.82	\$0.67	\$0.55

- **Sum of the Actuarial PV of the four payments = \$3.04**

# Deterministic vs. Stochastic



- Deterministic projection
  - Assumptions specifically defined
    - Best guess or average
  - Scenario testing
  - Easy to understand
- Stochastic projection
  - Assumptions are not specific values, but based upon probability distributions
    - Mean, standard deviation, distribution assumption
  - Provides range and likelihood of outcomes
  - Complex

# Deterministic vs. Stochastic



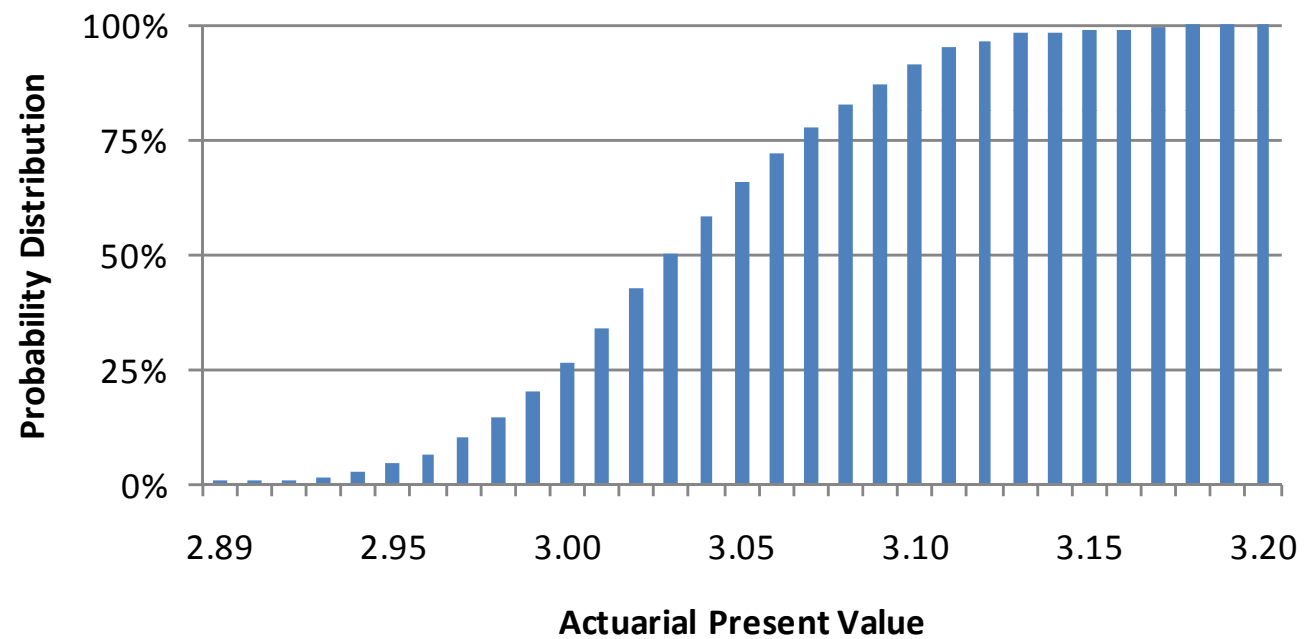
- Deterministic projection (life annuity example)
  - Assume annual rate of return is 10.0%
    - Actuarial PV = \$3.04
  - Assume annual rate of return is 11.5%
    - Actuarial PV = \$3.00
  - Assume annual rate of return is 8.5%
    - Actuarial PV = \$3.09

# Deterministic vs. Stochastic



- Stochastic projection (life annuity example)
  - Simulate annual returns assuming:
    - Mean annual rate of return is 10.0%
    - Standard deviation of annual rate of return is 2.2%
    - Annual rate of return is normally distributed
  - Run 1000 trials using simulated returns
  - Determine actuarial present value for each trial
  - Compile results

## Stochastic Projection Results



# Deterministic vs. Stochastic



- Stochastic projection results
  - Median actuarial present value is about \$3.03
    - Deterministic @ 10.0% = \$3.04
  - 25<sup>th</sup> percentile actuarial present value is about \$3.00
    - Deterministic @ 11.5% = \$3.00
  - 75<sup>th</sup> percentile actuarial present value is about \$3.07
    - Deterministic @ 8.5% = \$3.09

# Deterministic vs. Stochastic



- Deterministic modeling usually used to:
  - Calculate contribution levels
  - Show the impact of changing:
    - Actuarial methods
    - Actuarial assumptions
    - Plan eligibility/benefits
- Stochastic modeling usually used for:
  - Asset allocation
    - Real rate of return
    - Inflation
  - Sensitivity analysis

- Demographic Assumptions
  - Things that happen to people



- Known:
  - Age
  - Sex
  - Service
  - Salary
  - Occupation

- Assumed:
  - Likelihood of :
    - Retiring
    - Terminating
    - Disability
    - Death
  - Future salary increases

# Assumptions

- Economic Assumptions
  - Things that happen to money

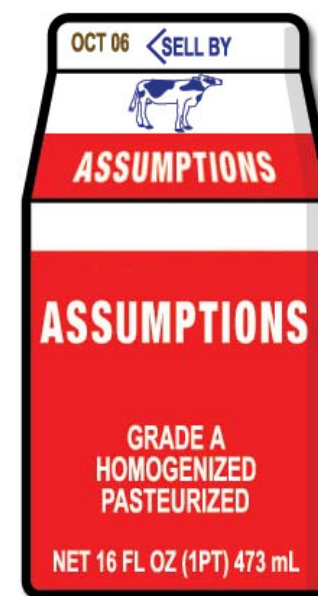


- Known:
  - Market value of assets
  - Asset allocation
  - Historical manager performance
  - Purchasing power

- Assumed:
  - Real rate of return
  - Inflation
  - Salary Increases

# Assumptions

- List them
- Give them an expiration date
  - Experience studies
    - Compare actual plan experience with actuarial assumptions used in the valuation
    - Typically done every 4 to 6 years
- Challenge them
  - What are their bases?
  - What are their underlying assumptions?
  - How may the future differ?
    - Investment rate of return
    - Salary increases
    - Mortality improvements
    - Future hiring

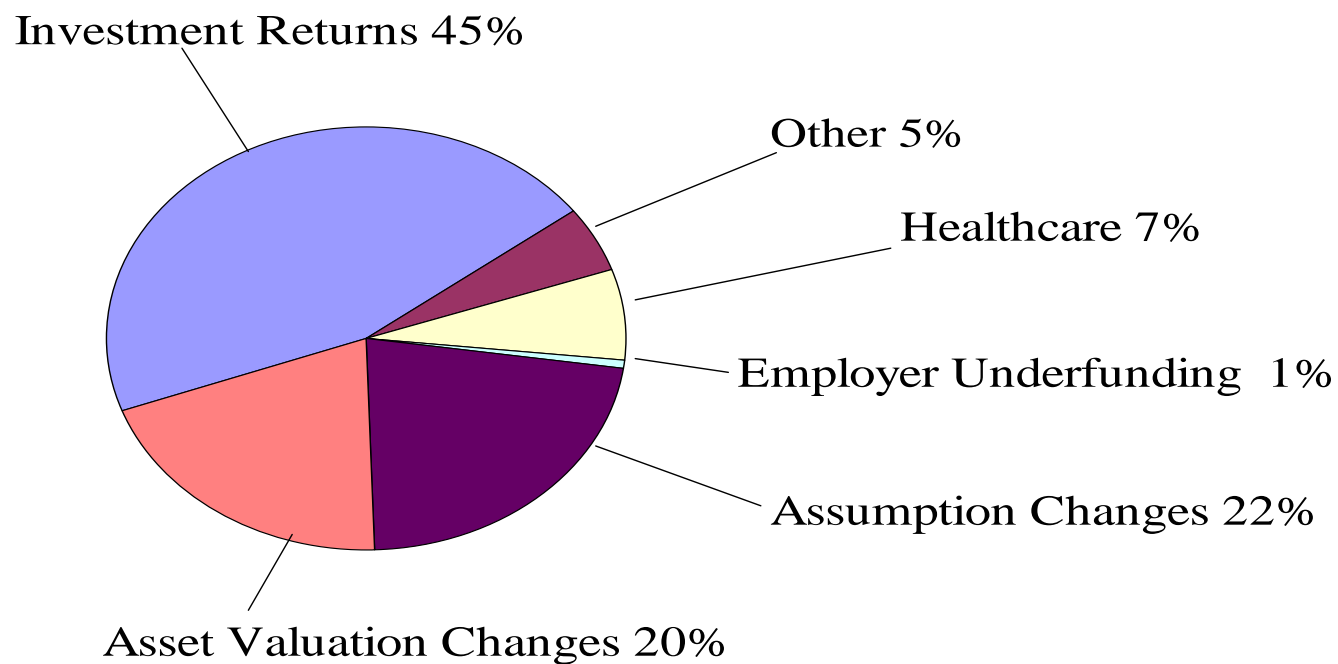


- Calculate annual required contribution rates
- Determine funded status
- Prepare GASB reporting information
- Annual actuarial valuations are a “snapshot” of the financial position on the valuation date
  - “Closed group”
    - Current active employees and beneficiaries
  - “Status Quo” conditions/assumptions
    - Best guess
  - Deterministic



- Analysis of the present financial situation
  - Analysis of past five to ten-years experience
    - Review gain/loss analysis of past reports
  - Identify probable reasons for any problems
    - Contribution shortfall
    - Significant investment losses
    - Change to benefit levels
    - Early retirements
    - Changes to actuarial methods and assumptions
    - Increasing life expectancies

## ➤ Actuarial Experience Gain/Loss Analysis



# Actuarial Valuations



## ➤ Which plan has a better funding position?

### County of Bloom

#### Schedule of Funding Progress (Dollar Amounts in Thousands)

Actuarial Valuation Date	Actuarial Value of Assets ( a )	Actuarial Accrued Liability (AAL) Entry Age ( b )	Unfunded AAL (UAAL) ( b - a )	Funded Ratio ( a / b )	Covered Payroll ( c )	UAAL as a Percentage of Covered Payroll ( ( b - a ) / c )
12/31/09	\$1,204,619	\$1,696,645	\$492,026	71.0%	\$273,863	179.7%

### City of Springfield

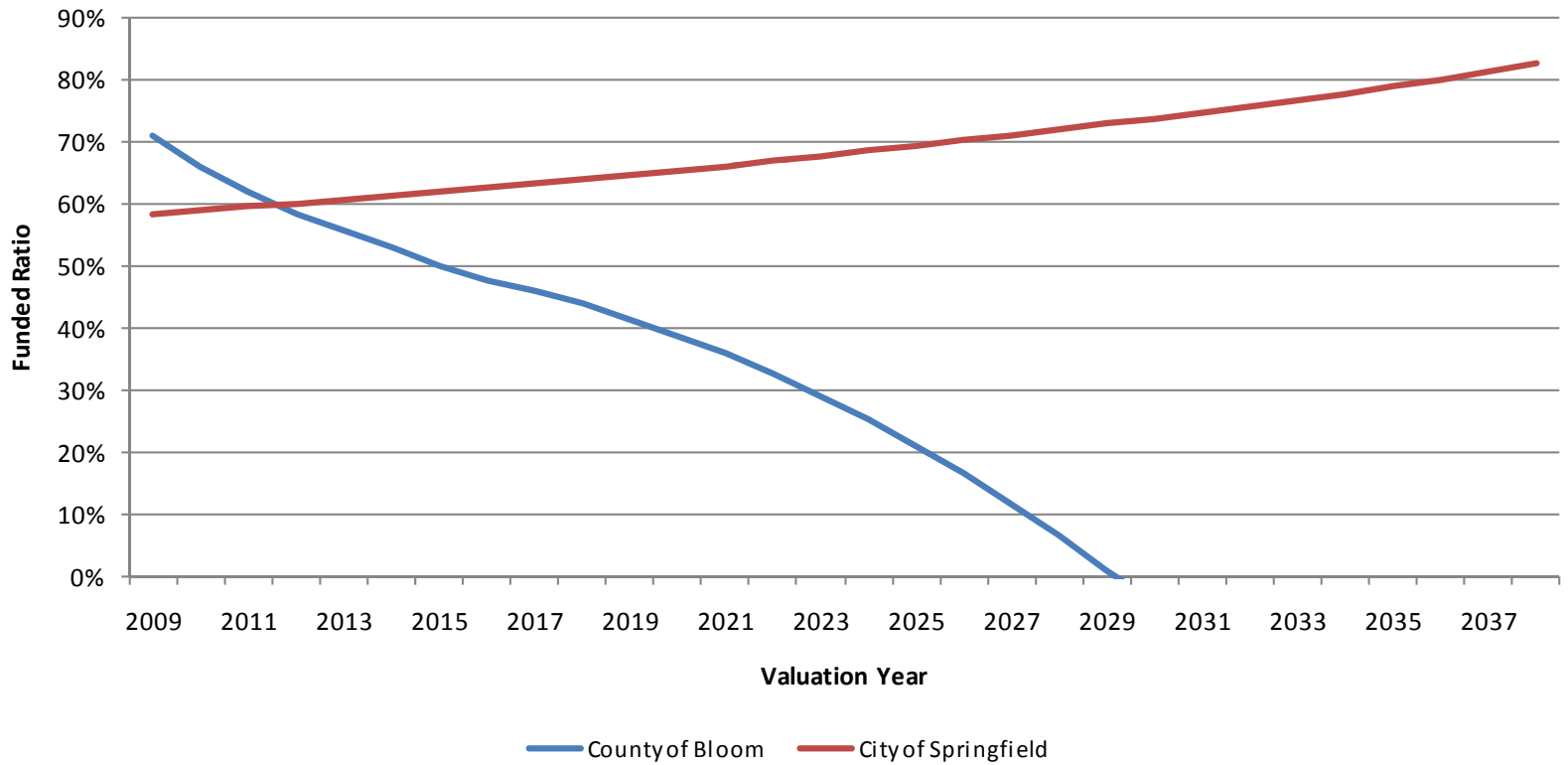
#### Schedule of Funding Progress (Dollar Amounts in Thousands)

Actuarial Valuation Date	Actuarial Value of Assets ( a )	Actuarial Accrued Liability (AAL) Entry Age ( b )	Unfunded AAL (UAAL) ( b - a )	Funded Ratio ( a / b )	Covered Payroll ( c )	UAAL as a Percentage of Covered Payroll ( ( b - a ) / c )
12/31/09	\$989,645	\$1,696,645	\$707,000	58.3%	\$273,863	258.2%

# Actuarial Projections



### 30-Year Projection of Funded Ratio



- Simulate future actuarial valuation results over a forecast period (e.g., 30 years) by “creating” future new hires and performing valuations using the projected membership
  - “Open group”
  - Impact of tiered benefit structures
- Valuation’s projected benefit payments “married” with other elements
  - Budgeted contributions
  - Expected investment earnings
  - Budgeted expenses
- Develop projected annual cash flows and resulting asset balances

- New hire assumptions
  - Active employee population growth rate
    - Over the projection period, is the number of active employees expected to grow, shrink, or stay the same?
  - Age
  - Gender
  - Salary
  - Accrued service
- May want to look at profile of recent hires

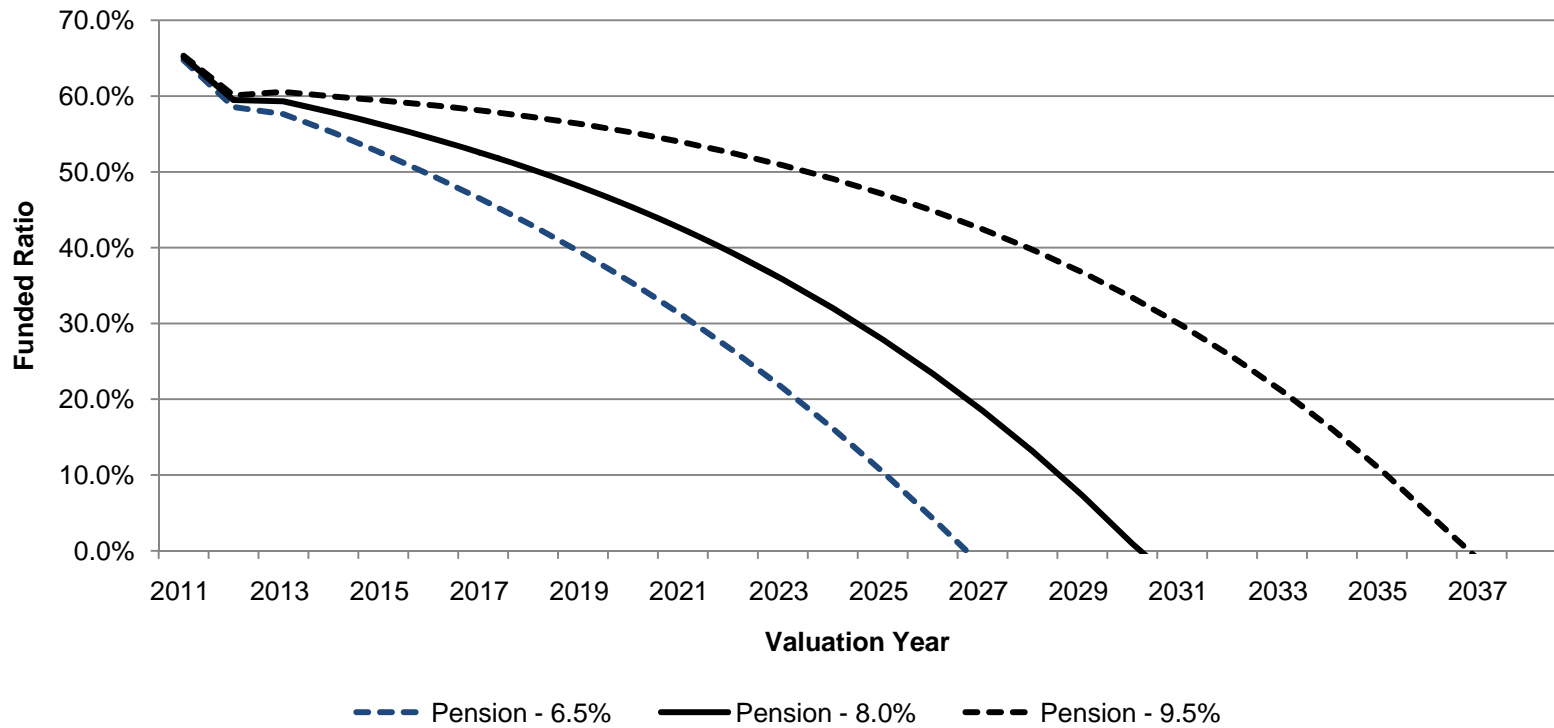
# Actuarial Projections

- The financial projections should follow a similar breakdown of revenue and expense components commonly used for the budget
  - Contributions
  - Investment Income
  - Benefits Paid
  - Expenses
- Start with financial projections under status quo conditions
  - Baseline (valuation basis)
- Goal is to chart future course

- Will demographic and economic changes be assumed to occur in accordance with the actuarial valuation assumptions?
  - Sensitivity analysis/stress testing
    - Can identify risks
    - Example: Will various investment rates of return be included to test sensitivity of the financial position due to varying rates of return?
      - Expected return
      - Optimistic return
      - Pessimistic return

## 30-Year Projection of Funded Ratio

*Liability Discount Rate of 8.00%*



- Develop an understanding of the impact of future demographic, economic, and benefit changes on the financial position of the plan. Plan sponsors can use this information to:
  - Consider changes in investment strategy
  - Consider changes in benefit levels
  - Consider changes in funding levels
  - Determine the impact/level of payment of contingent benefits
    - COLAs
  - Forecast future budget requirements
  - Risk management



# Questions?