

ACTUARIAL SCIENCE 101

AICPA

National Governmental Accounting
and Auditing Update

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AGENDA

Role of the actuary

Key actuarial terms

Actuarial valuation
components

Assumption development

Actuarial Standards Board



Role of the Actuary



What does an actuary do?

An actuary is a business professional who analyzes the financial consequences of risk. Actuaries use mathematics, statistics and financial theory to study uncertain future events, especially those of concern to insurance and pension programs. They evaluate the likelihood of those events, design creative ways to reduce the likelihood and decrease the impact of adverse events that actually do occur.

-- SOA website

Employee Benefits Actuaries work with:

- Benefit plan provisions
 - benefit formulas
 - eligibility requirements
- Data
 - participant census
 - health claims data
- Actuarial assumptions
 - demographic
 - economic
- Actuarial cost methods

Key Actuarial Terms



Annual Accrual

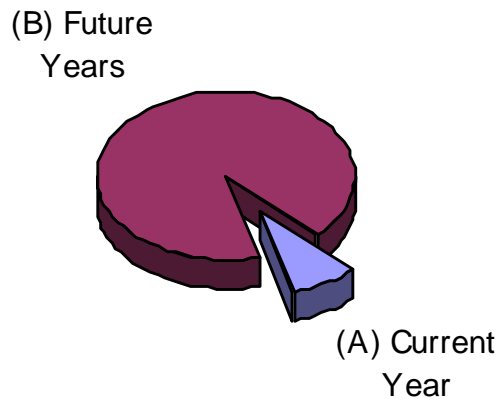
- Typically called Normal Cost or Service Cost
- The present value of the retirement benefits that an active employee is expected to earn a right to in the upcoming year
- Only applies to active employees
- Gross Normal Cost defined by plan benefits
 - Employee Normal Cost based on mandatory contributions, if any
 - Net Employer Normal Cost = gross less employee

Liability

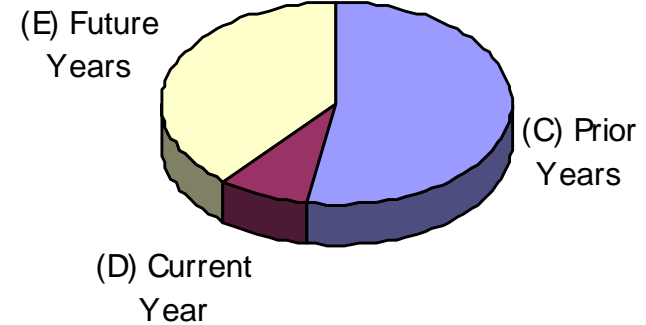
- Several different measurements and names, most common:
 - Present Value of Future Benefits
 - Actuarial Accrued Liability
 - Expected Postretirement Benefit Obligation
 - Accumulated Postretirement Benefit Obligation
- Applies to active employees, deferred vesteds, retirees and beneficiaries

Liability & Annual Accrual

Retired Members



Active Members

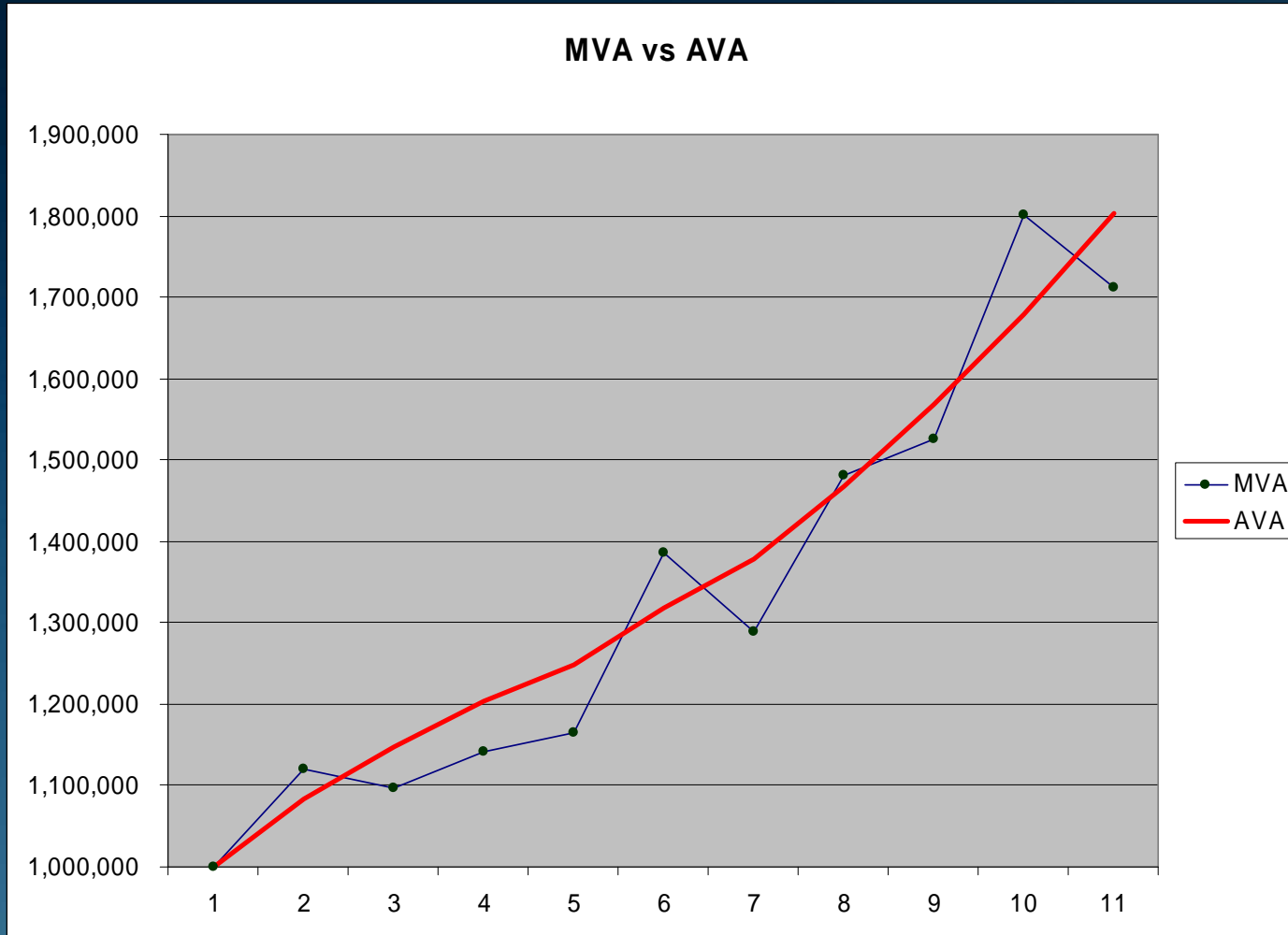


- Present Value of Future Benefits = A + B + C + D + E
- Actuarial Accrued Liability = A + B + C
- Normal Cost = D

Plan Assets

- Assets in trust for the payment of retirement benefits
- Different measurements
 - Fair value of assets
 - Market value of assets
 - Actuarial value of assets
- Asset smoothing

Asset smoothing



Unfunded Liability

- Liability less assets
- To be funded and/or accounted for in an orderly fashion over a reasonable/mandated time period
 - Level percentage of payroll
 - Level dollar

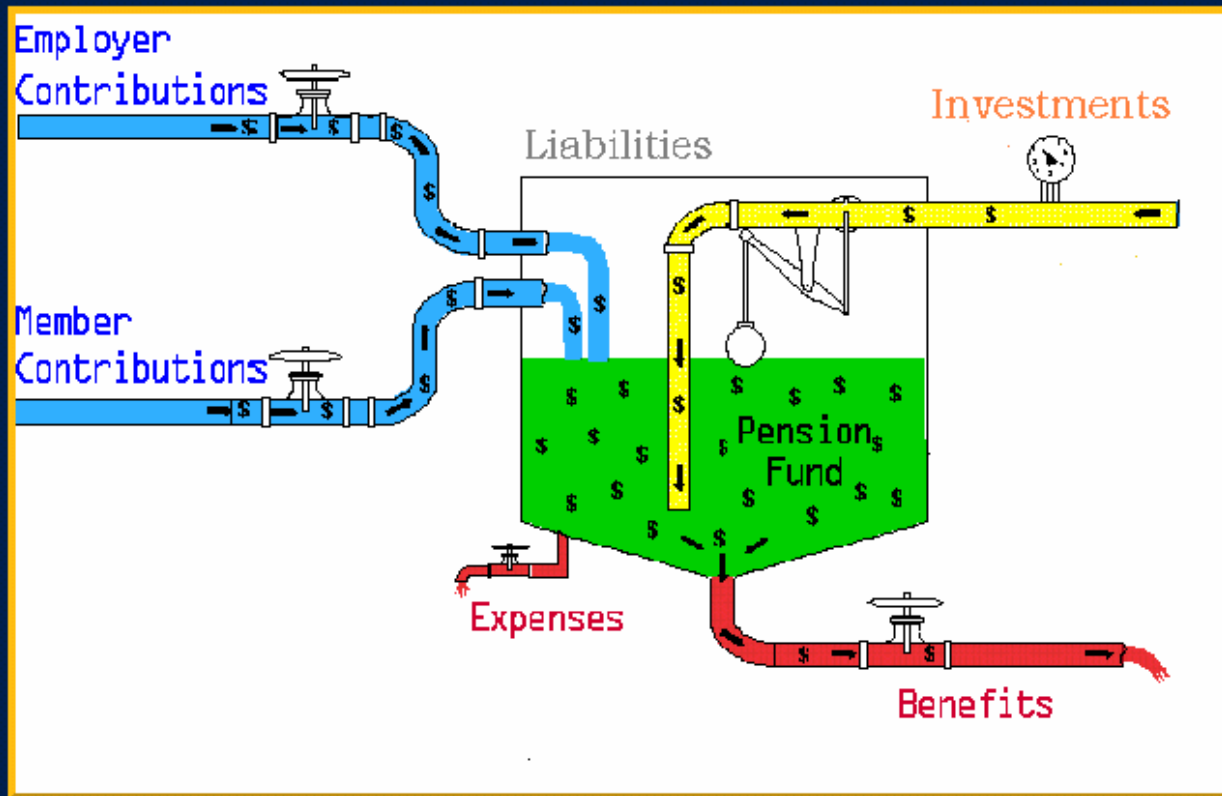
Actuarial Valuation Components



Purpose of an Actuarial Valuation

- Orderly and adequate funding methodology
- Current year required contribution
- Disclose plan's financial condition
- Information for financial statements
- Review of plan experience versus assumptions

Actuarial balance



The Harvard Business Review 1965

Valuation Inputs

- Data
- Assumptions
- Plan provisions
- Cost method

Census data

- Very important! Needs updates for each valuation.
- Characteristics of population (age, gender, service, etc.) will drive plan experience and impact liability
- Study historic census data to assist in assumption development

Census data – active employees

- Date of birth (age)
 - Impacts withdrawal, retirement and mortality
 - Determines eligibility and benefit changes
- Date of hire (service)
 - Impacts withdrawal and retirement
 - Impacts pension benefit amount
- Earnings
 - Impacts Final Average Earnings
 - Used to allocate costs under EAN method

Census data – inactive employees

■ Date of retirement

- Impacts retirement assumption for actives
- Determines benefit changes
- Type of retirement (service, disabled) impacts mortality

■ Benefit amount and option

- Actual amount used once retired
- Form of payment determines duration and potential changes
- Beneficiary information also needed

Assumptions - Demographic

■ Withdrawal rates

- Likelihood member will leave prior to retirement eligibility
- Heavily dependent on member's service
- May have a vested benefit to commence later
- May receive a refund of contributions

■ Retirement rates

- Heavily dependent on plan-specific eligibility requirements
- Function of age and service

Assumptions - Demographic

■ Mortality rates

- Impacts duration of benefits to be paid
- Allow for future improvements in mortality
 - Static projection
 - Generational projection

■ Merit salary increase rates

- Increases in excess of inflation and general productivity growth can be plan specific

■ Covered dependents

- Particularly important for retiree healthcare valuation

Assumptions - Economic

■ Investment return

- Determines amount of future benefit payments to be paid from cash contributions versus income

■ Inflation

- Underlies several economic and demographic assumptions

■ Cost of living increase

- Function of inflation
- Incorporates plan provisions

Assumptions – Retiree Health specific

■ Per capita claims costs

- Expected gross claims generated by each member
- Function of:
 - Benefit provisions
 - Age/gender
 - Member/dependent
 - Geography

■ Health cost inflation

- Increasing well in excess of general inflation
- Society of Actuaries long-term projection model
- Start higher and grade down over time

Per Capita Claims Costs versus Premium

| Implicit Rate Subsidy | | |
|-----------------------|-------------------------------|---------------|
| | <u>Average Medical Claims</u> | |
| <u>Age</u> | <u>Male</u> | <u>Female</u> |
| <25 | \$800 | \$2,000 |
| 40-45 | \$1,700 | \$2,400 |
| 55-59 | \$4,200 | \$4,000 |
| 60-64 | \$5,600 | \$5,000 |
| “Premium” | \$3,000 | |

Plan Provisions

- Eligibility requirements for benefits
 - Age
 - Service
- Amount of benefit
 - % * Final Average Pay * years of service
 - \$ * years of service
 - Healthcare benefits
 - Life insurance
- Member contributions

Actuarial Cost Methods

- Discount all future net employer cash flows to determine present value of all future benefits
- Cost method is used to allocate present value to past service, current year and future years
- Base contribution on:
 - Normal cost – current year's accrual
 - Amortization of past service liability to the extent under or overfunded

Actuarial Cost Methods

- Several methods exist, with different allocation patterns
- Most common methods:
 - Unit Credit (projected or traditional)
 - Entry Age Normal
 - Aggregate
 - Frozen Initial Liability
- Allocation is a budgeting tool
- Ultimate cost known only when last benefit has been paid out

Actuarial Cost Methods

- Entry Age Normal popular for governmental pension plans
- Concept is that (barring gains and losses) a fixed percentage of pay contributed during a member's career will accumulate sufficient funds by retirement to pay for all benefits in retirement
- Helpful for budgeting

Assumption Development



Assumption Development

- Generally desire unbiased assumptions
 - As likely to have an actuarial gain as to have an actuarial loss (we expect gains and losses)
 - Specific guidance on assumption setting provided in Actuarial Standards of Practice
- Experience study
 - Detailed review of specific plan experience over multi-year period
 - Compare experience to current assumptions
 - Consider special events occurring during study period
 - Adjust assumptions to reflect new experience

Assumption Development

- Economic assumptions
 - Asset allocation impacts expected return
 - Benefit design impacts health inflation
- Demographic assumptions
 - Retirement eligibility provisions impact commencement of benefit payments
 - Many factors impact salary increases and terminations

Actuarial Gains and Losses

- Simplified example - Economic
 - 1/1/20XX asset value = \$1,000,000
 - Assumed rate of return = 7.5%
 - Expected 1/1/20XX+1 asset value = \$1,075,000
 - Actual 1/1/20XX+1 asset value = \$1,090,000
 - Actuarial gain of \$15,000
 - Decreases the unfunded actuarial liability

Actuarial Gains and Losses

- Simplified example - Demographic
 - 100 retirees, \$12,000 each in benefits
 - 1/1/20XX liability = \$12,000,000
 - Expect 5 deaths during year
 - Expected 1/1/20XX+1 liability = \$11,172,000
 - Actual 1/1/20XX+1 liability = \$11,525,000 due to 3 deaths during year
 - Actuarial loss of \$353,000
 - Increases the unfunded liability

Actuarial Standards Board



About the Actuarial Standards Board

The Actuarial Standards Board (ASB) establishes and improves standards of actuarial practice. These Actuarial Standards of Practice (ASOPs) identify what the actuary should consider, document, and disclose when performing an actuarial assignment. The ASB's goal is to set standards for appropriate practice for the U.S.

-- ASB website

About the Actuarial Standards Board

When creating or revising an ASOP the ASB:

- 1. reviews and evaluates current and emerging practices;*
- 2. determines appropriate guidance;*
- 3. publishes an exposure draft to obtain input from actuaries and other interested parties;*
- 4. considers all comments received; and publishes a final standard or another exposure draft.*

--ASB website

Most Relevant ASOPs

- ASOP 4 – Measuring Pension Obligations
- ASOP 6 – Measuring Retiree Group Benefit Obligations
- ASOP 23 – Data Quality
- ASOP 27 – Selection of Economic Assumptions for Measuring Pension Obligations
- ASOP 35 – Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations
- ASOP 41 – Actuarial Communications

Questions?

