8.

Actuarial Methods & Assumptions

8.1-1 Actuarial Handbook for Trustees

Arizona State Retirement System Actuarial Handbook for Trustees

The enclosed handbook was written for the trustees of the Arizona State Retirement System and covers most aspects of the Actuary and his role in a pension fund's operations and planning.

Important topics covered include:

What is an Actuary?
What can Actuaries do for pension plans?
What are Actuarial Cost Methods?
What are Actuarial Assumptions?
What is an Actuarial Experience Study?
How can an Actuary help with Plan Administration?
What are Actuarial Forecasts?
How can an Actuary Help with Plan Design?

In addition, you will find a glossary of terms at the end of the Actuarial Handbook.

The Handbook will open in a new window by clicking in this box.

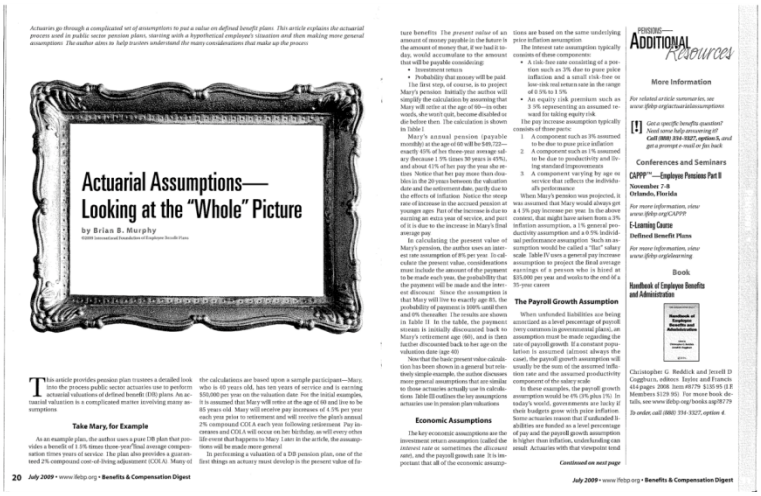
8.2-1 Actuarial Assumptions

Article by Brian Murphy

The enclosed article by Brian Murphy appeared in the July 2009 issue of "Benefits and Compensation Digest" and includes important information on

Economic Assumptions
Payroll Growth Assumptions
Demographic Assumptions
Retirement Assumption
Death After Retirement
Unfunded Liabilities with Time Lag

The Article will open in a new window by clicking in this box.



Actuarial Assumptions—
Looking at the "Whole" Picture

by Brian B. Murphy

Actuaries go through a complicated set of assumptions to put a value on defined benefit plans. This article explains the actuarial process used in public sector pension plans, starting with a hypothetical employee's situation and then making more general assumptions. The author aims to help trustees understand the many considerations that make up the process

This article provides pension plan trustees a detailed look into the process public sector actuaries use to perform actuarial valuations of defined benefit (DB) plans. An actuarial valuation is a complicated matter involving many assumptions

Take Mary, for Example

As an example plan, the author uses a pure DB plan that provides a benefit of 1.5% times three-year final average compensation times years of service. The plan also provides a guaranteed 2% compound cost-of-living adjustment (COLA). Many of the calculations are based upon a sample participant—Mary, who is 40 years old, has ten years of service and is earning $50,000 per year on the valuation date. For the initial examples, it is assumed that Mary will retire at the age of 60 and live to be 85 years old. Mary will receive pay increases of 4.5% per year each year prior to retirement and will receive the plan's annual 2% compound COLA each year following retirement. Pay increases and COLA will occur on her birthday, as will every other life event that happens to Mary. Later in the article, the assumptions will be made more general

In performing a valuation of a DB pension plan, one of the first things an actuary must develop is the present value of future benefits. The *present value* of an amount of money payable in the future is the amount of money that, if we had it today, would accumulate to the amount that will be payable considering:

- Investment return
- Probability that money will be paid

The first step, of course, is to project Mary's pension. Initially the author will simplify the calculation by assuming that Mary will retire at the age of 60—in other words, she won't quit, become disabled or die before then. The calculation is shown in Table I

Mary's annual pension (payable monthly) at the age of 60 will be $48,722—exactly 45% of her three-year average salary (because 1.5% times 30 years is 45%), and about 61% of her pay the year she retires. Notice that her pay more than doubles in the 20 years between the valuation date and the retirement date, partly due to the effects of inflation. Notice the steep rate of increase in the accrued pension of younger ages. Part of the increase is due to earning an extra year of service, and part of it is due to the increase in Mary's final average pay

In calculating the present value of Mary's pension, the author uses an interest rate assumption of 8% per year. To calculate the present value, considerations must include the amount of the payment to be made each year, the probability that the payment will be made and the interest discount. Since the assumption is that Mary will live to exactly age 85, the probability of payment is 100% until then and 0% thereafter. The results are shown in Table II. In the table, the payment stream is initially discounted back to Mary's retirement age (60), and is then further discounted back to her age on the valuation date (age 40)

Now that the basic present value calculation has been shown in a general but relatively simple example, the author discusses more general assumptions that are similar to those actuaries actually use in calculations. Table III outlines the key assumptions actuaries use in pension plan valuations

Economic Assumptions

The key economic assumptions are the investment return assumption (called the *interest rate* or sometimes the *discount rate*), and the payroll growth rate. It is important that all of the economic assumptions are based on the same underlying price inflation assumption

The interest rate assumption typically consists of three components:

- A risk-free rate consisting of a position such as 3% due to pure price inflation and a small risk-free or low-risk real return rate in the range of 0.5% to 1.5%
- An equity risk premium such as 3.5% representing an assumed reward for taking equity risk

The pay increase assumption typically consists of three parts:

1. A component such as 3% assumed to be due to pure price inflation
2. A component such as 1% assumed to be due to productivity and living standard improvement
3. A component varying by age or service that reflects the individual's performance

When Mary's pension was projected, it was assumed that Mary would always get a 4.5% pay increase per year. In the above context, that might have arisen from a 3% inflation assumption, a 1% general productivity assumption and a 0.5% individual performance assumption. Such an assumption would be called a "flat" salary scale. Table IV uses a general pay increase assumption to project the final average earnings of a person who is hired at $35,000 per year and works to the end of a 35-year career

The Payroll Growth Assumption

When unfunded liabilities are being amortized as a level percentage of payroll (very common in governmental plans), an assumption must be made regarding the rate of payroll growth. If a constant population is assumed (almost always the case), the payroll growth assumption will usually be the sum of the assumed inflation rate and the assumed productivity component of the salary scale

In these examples, the payroll growth assumption would be 4% (3% plus 1%). In today's world, governments are lucky if their budgets grow with price inflation. Some actuaries reason that if unfunded liabilities are funded as a level percentage of pay and the payroll growth assumption is higher than inflation, underfunding can result. Actuaries with that viewpoint tend

Continued on next page

PENSIONS— ADDITIONAL Resources

More Information

For related article summaries, see www.ifebp.org/actuarialassumptions

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Christopher G. Reddick and Jerrell D. Coggburn, editors. Taylor and Francis. 414 pages. 2008. Item #8179. $130.95 (I.F.E.B. Members $129.95). For more book details, see www.ifebp.org/books.asp?8179

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8.3-1 Actuarial Methods and Assumptions

In establishing a retirement plan, a public employer is promising to pay benefits that will come due in the future. Generally these benefits can be paid in one of two ways: either "pay-as-you-go", or through some form of reserve funding.

Under the "pay-as-you-go" method, the monies required to pay retirement benefits are obtained when the benefits come due to current retirees. This approach invariably results in contribution rates, which increase, as a percent of active member payroll, over time.

Under a reserve funding method, contributions are made toward the present value of the benefits being earned by active employees. Those contributions, together with investment income, are intended to accumulate sufficient assets to cover the benefit obligations by the time employees retire. Under a reserve funding approach, contribution rates are often expected to be a level or declining percent of payroll over time.

8.3-2 Actuarial Methods and Assumptions

Actuarial Valuation Methods

When funds for employee benefits are accumulated on a reserve-funding basis, actuarial valuations are used to compute the contributions required to fund the long-term value of the benefits. Using assumptions about employee demographics, rates of investment return, and increases in employee compensation, the actuary calculates the contributions necessary for the orderly accumulation of assets needed to pay benefits when due.

8.3-3 Actuarial Methods and Assumptions

Actuarial Valuation Methods
Actuaries use different actuarial methods to calculate the contributions required to fund the plan. A prior survey conducted by the GFOA indicated that four funding methods were commonly used by public retirement plans:

Entry Age
Aggregate
Frozen Entry Age
Projected Unit Credit

Although all of the above methods will result in sufficient assets becoming available to meet benefit payments over the long run, the different methods are likely to result in different patterns of contributions over the intermediate period.

8.3-4 Actuarial Methods and Assumptions

Actuarial Valuation Methods

These may be important to an employer, since some patterns offer greater consistency in contributions from year to year.

The majority of the PPCC respondents used the entry age actuarial method. 66 percent of the respondent systems used the entry age method, nine percent used the projected unit credit method, seven percent used the aggregate method, seven percent used the frozen entry age method, and the remainder used various other actuarial methods.

In general, respondents administered by state governments were somewhat more likely to use the entry age method than respondents administered by local governments. Eighty-two percent of the systems administered by state governments used the entry age method, compared with 53 percent of the local systems. It is also interesting to note that 11 percent of the respondents administered by local governments used the projected unit credit method.

8.3-5 Actuarial Methods and Assumptions

Actuarial Valuation Frequency

The frequency with which the actuarial valuations are conducted is important to the proper funding of a retirement plan. Since valuations are based on assumptions which may change over time, the calculated contributions may not be accurate if the assumptions are not periodically updated. The majority of respondents indicated that they conducted actuarial valuations annually.

78 percent conducted actuarial valuations every year; 13 percent every two years; 3 percent every three years; and 2 percent every four or more years. All told, 91 percent of the respondents conducted actuarial valuations at least every two years. Smaller systems, systems in the Northeast and West, and systems administered by local governments were somewhat less likely to conduct annual valuations than their counterparts. On the other hand, systems serving teachers and other school employees were somewhat more likely to perform annual valuations. However, these differences essentially disappear when the frequency of the valuation is extended to two years.

8.3-6 Actuarial Methods and Assumptions

Actuarial Assumptions Regarding Investment Return

The assumptions used by actuaries to calculate the funding requirements of the PERS play an important role in determining the amount of the computed contributions. Because it is impossible to know the future, a variety of assumptions must be made concerning rates of investment return, pay increases, withdrawal from employment, and mortality. Of these, the assumptions regarding investment return and salary increase are especially critical, since even small changes in these assumptions can result in large changes to computed contributions.

The mean actuarial assumption regarding the investment rate of return for all systems was 7.76 percent. As asset size increases, so does the assumed rate of return. On average, systems with assets of less than $100 million assumed annual returns of 7.64 percent while systems with $10 billion or more assumed returns of 7.91 percent. It is interesting to note that, while these differences are statistically significant, they are also very narrow, amounting to only 27 basis points on average between the larger and smaller systems.

Actuarial Assumptions Regarding Salary Increase

In addition to assumptions about the long-term rates of return on investments, systems must also establish assumptions about the long-term rate of growth in employees' salaries. These assumptions usually include estimates of increases due to merit and seniority as well as inflation, although the survey respondents often did not show these components separately.

Assumed salary increases (including both merit and inflationary increases) ranged over a wide scale, with two-thirds of the respondents reporting values between' 5.0 and 7.0 percent. Exhibit IV-4 shows the distribution of assumptions regarding salary increases, which averaged 5.93 percent for all systems. As with investment return, the values for the smaller systems were lower than for the larger systems. On average, respondent systems with less than 1,000 members assumed rates of salary increase of 5.89 percent, while systems with 100,000 members or more assumed salary increases of 6.46 percent.

It should be noted that these figures include both inflation and merit/step increases. Although not all systems disaggregated their salary assumptions into these various Subcomponents, the analysis of the systems that did indicates that the assumptions about inflation averaged 5.01 percent.

Conclusions

The majority of respondents accumulated the monies necessary to pay retirement benefits through a reserve funding method which, in most cases, was based on the entry age cost method. Actuarial valuations were carried out frequently, usually on an annual basis, and over 90 percent of the respondents performed actuarial valuations at least every two years.

The average assumed investment rate of return was 7.76 percent, and the average assumed rate of total salary increase was 5.93 percent. The average assumed rate of inflation was 5.01 percent for the respondents who reported this assumption separately.

8.4-1 GFOA Recommended Practices

The enclosed information is an excerpt from the GFOA (Government Finance Officers Association) web site and describes the GFOA recommended best practices for diligent and responsible management of a pension fund plan.

Click here to open the article in a new window