



Understanding Actuarial Assumptions

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Most public defined benefit retirement plans engage an actuary to perform an annual actuarial valuation. The actuarial valuation presents the plan's funding requirements calculated in accordance with the plan's funding policy. Performing an actuarial valuation is a complex process which involves extensive data requirements and various assumptions. In order to fund pension benefits, several projections about future events are developed based on "actuarial assumptions." The selection of those assumptions is a critical part of the actuarial valuation process. Properly chosen assumptions can help stakeholders understand the plan's financial condition and can help to ensure future sustainability.

In order to perform the valuation, the actuary needs data regarding the following:

- Retired and non-retired plan participants;
- Retirement plan provisions; and
- Retirement plan assets.

The actuary produces the actuarial valuation using computer programs and specialized actuarial techniques that apply assumptions about the future to the above data. The results of the actuarial work include measurements of the plan's funded status, its future contribution needs, and other typical actuarial information. In addition, the actuary usually provides the actuarial portion of information needed for financial reporting.

What Are Actuarial Assumptions?

There are two broad categories of actuarial

assumptions:

1. **Demographic assumptions** which are related to a pension plan's membership such as future rates of retirement, turnover, disability and death before and after retirement; and
2. **Economic assumptions** which are related to other factors such as future rates of investment return, inflation, payroll growth, and pay increases among individual plan participants.

The actuary also makes other more minor assumptions including, but not limited to: rates of marriage, rates of benefit option elections, etc.

How Are Actuarial Assumptions Determined?

It is important that assumptions be carefully chosen and continually monitored because the choice of assumptions can have a dramatic effect on the results of the valuation and, therefore, on the funding of the plan. The assumption selection process is guided by certain Actuarial Standards of Practice or "ASOPs."

- **ASOP No. 35** (*Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*) governs the selection of demographic assumptions;
- **ASOP No. 27** (*Selection of Economic Assumptions for Measuring Pension Obligations*) governs the selection of economic assumptions; and



- **ASOP No. 4** (*Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*) is a general standard covering the measurement of pension obligations.

All of these ASOPs are being revised at the time of this writing. Information regarding the Actuarial Standards of Practice can be found at: <http://www.actuarialstandardsboard.org/standards-of-practice/>

Someone once jokingly said that actuaries are like race car drivers who steer by looking in the rear view mirror, implying that actuarial assumptions are based solely on past behavior projected into the future. That is not true, though. Actuarial assumptions are intended to be forward-looking estimates of expectations for future behavior, and their development must reflect that intention. It is true that actuaries consider historical information when developing actuarial assumptions, but they also consider current trends, external conditions, and future projections.

For a public pension plan, an actuary may perform an actuarial experience study to review the differences between the plan's assumed and actual experience over multiple years. The study can help analyze related trends and can serve as the basis for recommending assumption changes, if necessary.



What Is an Experience Study?

An "Experience Study" is the process by which actuaries develop new assumptions or adjust existing assumptions. The studies are based upon a review of data, emerging trends, and future expectations. Experience studies are typically performed every three to five years, although some plans (particularly smaller plans) may perform them less frequently. Actuarial standards require that the actuarial assumptions used in a valuation be reasonable at the time the valuation is performed. The shorter the period between experience studies, the less likely it is that the actuary will need to modify assumptions between studies.

How Are Demographic Assumptions Developed?

When developing demographic assumptions, the actuary first tallies up rates of retirement, death, disability, turnover, etc. that occurred during the "experience period." Commonly, the experience period is a three- or five-year period preceding the experience study, as discussed above. Initial "crude" rates may be tallied by age, service, gender, occupation, etc. In the past, actuaries usually tallied rates in terms of pure headcounts of people. For example, the actuary would develop a ratio consisting of the number of people age 40 who terminated employment divided by the total number of people age 40. That ratio would be called "the crude rate of employment termination at age 40."

Some actuaries today use a "liability weighted" approach to assumption development. With a liability weighted approach, the crude rate of termination at age 40 would be calculated as the ratio of the liabilities of the 40-year-olds who quit divided by the total liabilities of all 40-year-olds. The approach can make a difference because the total liability of people who quit, die, retire, or become disabled may affect the plan's finances to a greater degree than the number of people who do so. If a person with a liability of \$100,000 quits, that has a much larger effect on the



plan than if a different person with a liability of \$25,000 quits. Using liability weighting instead of headcount ratios takes that different effect into account.

The actuary may also review observed rates for similar groups, rates that were observed for the group in question in prior studies, or so called “standard tables.” In some cases, there are also external conditions that are relevant and may need further consideration, such as:

- Is a recession exerting a short-term effect on turnover rates?
- Is there an impending curtailment of a retiree health care plan that may affect retirement rates?

An experience study will usually result in adjusted rates of retirement, turnover, disability, mortality, etc. to be used in future valuations.

Mortality

Mortality rates and, in particular, mortality rates after retirement have received increased attention in recent years, arguably because liabilities today are much more heavily weighted toward retirees than they were in the past. For example, it is not uncommon for close to 60% of a plan’s liabilities to be liabilities for current retirees and beneficiaries. Such a ratio would have been rare 30 years ago.

It is well known that mortality rates have been declining, or in other words, life expectancies have been increasing for many years. Increasing life expectancy is a very important trend, and one that actuaries cannot overlook, particularly as plans mature and the number of retirees increases relative to the number of active members. In the past, actuaries would account for this trend by assuming mortality rates that are somewhat lower than those observed in the experience study, but that would not be assumed

to improve from that point. Today, the practice is shifting toward the use of “fully generational” mortality tables. In a fully generational mortality table, the mortality rates for a person depend on the person’s year of birth, age and gender.

The following chart was developed based upon the RP-2014 (Total Dataset adjusted back to 2006) mortality table and the MP-2018 projection scale, both of which were produced by the Society of Actuaries.

Chart 1					
Years of Future Life Expectancy of a 65-Year-Old					
Year of Birth	1955	1965	1975	1985	1995
Year Turn Age 65	2020	2030	2040	2050	2060
Male	20.74	21.54	22.38	23.21	24.04
Female	22.74	23.52	24.34	25.15	25.95

Notice that life expectancy at age 65 increases by a little less than a year for each later decade of birth. The chart indicates that a male born in 1955 will have a life expectancy at age 65 (in 2020) of 20.74 years. A male born 10 years later will have a life expectancy at age 65 of 21.54 years. Female life expectancies at age 65 are approximately two years greater than male life expectancies for all illustrated years of birth. If the table is correct, and that will only be known about 100 years from now, the need for the fully generational technique is clear. An actuary who bases the mortality assumption solely on the life expectancy of people born in 1955 would be understating plan liabilities for younger people by 10% or so.

Many plans are too small to develop a mortality table based solely on plan experience. The practice in such plans is to base mortality assumptions heavily on standard tables with standard projection scales, such as illustrated above. Depending on the size of the plan, there may be a “credibility” adjustment that takes into account a portion of the plan’s mortality experience.



How Are Economic Assumptions Developed?

When developing economic assumptions, the actuary may start by looking at the past, but the actuary knows that past performance is not indicative of future results. Consequently, the actuary will also look to estimates of future economic conditions inherent in current market data, expert opinions, investment consultant expectations, etc.

Inflation

An inflation assumption usually forms the foundation for the development of other economic assumptions. Bond investors, for example, expect yields that at least offset inflation and that provide some real return. Workers expect wages to increase at least as fast as prices, and hopefully faster.

When developing an inflation assumption, actuaries consider various forward-looking expectations, such as those developed by the Congressional Budget Office, the Quarterly Survey of Professional Forecasters, various Federal Reserve Banks, the excess yield of non-indexed Treasuries over indexed Treasuries, the Social Security Trustees Report, etc. At the time of this writing, those forecasts are primarily in the 2% to 2.5% range. The 2018 Social Security Trustees Report provides a range for the inflation assumption from 2% to 3.2%, with an intermediate expectation of 2.6%.

Payroll Growth

In the late 1970s, prices rose faster than payroll, but historical statistics show that payroll increases tend to outpace price increases in the range of about 0.5% to 1.0%, on average. While most people expect a positive relationship between the two rates to continue, the amount by which it may do so is uncertain. The 2018 Social Security Trustees Report provides a range of about 0.6% to 1.8% for the difference, with an intermediate assumption of 1.2%. This assumption is important in plans that use level percent-of-payroll

funding of unfunded actuarial accrued liabilities.

Investment Return

Today, almost all of the attention is on the assumed rate of investment return, but we could not really discuss investment return without considering inflation and payroll growth first. Typically, the investment return assumption contains two components: 1) inflation (defined above); and 2) the real rate of return. The real rate of return is the return on investment after adjusting for inflation. The total of these two components is known as the nominal return rate.

On the following page, Chart 2 gives approximate return information over various time periods on a sample portfolio that is invested with 60% in common stock, 15% in corporate bonds, 15% in government bonds and 10% in Treasury Bills (T-Bills).

Focusing only on the total column, and looking only at the past, it would be easy to say that the top half of the chart provides support for a return assumption in the 8% area, particularly if the 30+ year time horizons are considered. However, when looking at the bottom half of the chart, it appears that the longer term returns were influenced by extraordinary returns for the 1980s and 1990s (the period during which the baby boomers became a significant driving force in the economy) which may or may not recur. Is it wise to fund a retirement plan by assuming that the 1990s will happen again? On the other hand, the bottom half of the chart also includes the influence of the tech bubble in the early 2000s and the 2008 financial crisis as well as the high inflation environment of the 1970s. Will any of those happen again?

Because of the historical volatility of investment return, it is particularly important to consider forward-looking expectations of professional investment consulting firms when developing the investment return assumption. For the most common asset allocations



Chart 2					
Time Period	Total ¹	Portfolio Return		Risk Free Rate (T-Bills)	
		Inflation Portion	Real Portion		
Returns for Long Periods					
2008-2017	8.1%	1.6%	6.4%	0.30%	
1998-2017	7.3%	2.1%	5.1%	1.90%	
1988-2017	9.8%	2.6%	7.0%	3.10%	
1978-2017	10.6%	3.5%	6.9%	4.60%	
1968-2017	9.4%	4.0%	5.2%	4.80%	
Returns by 10-Year Periods					
2008-2017	8.1%	1.6%	6.4%	0.30%	
1998-2007	6.5%	2.7%	3.7%	3.50%	
1988-1997	14.8%	3.4%	11.0%	5.40%	
1978-1987	13.2%	6.4%	6.4%	9.20%	
1968-1977	4.7%	6.2%	-1.4%	5.70%	

today, most of those firms would be looking for 10- to 20-year returns ranging from 6.5% to 7.5%. The returns at the upper end of the spectrum would require a more aggressive asset allocation than those at the lower end. In response to the current investment environment, many public funds have lowered their return expectations. According to the most recent National Association of State Retirement Administrators (NASRA) Public Fund Survey, the median investment return expectation that was 8% a decade ago is below 7.5% today.²

Conclusion

Actuarial assumptions are intended to be forward-looking expectations of future results, not just rote extrapolations of the past into the future. The experience study is the process by which those assumptions are selected. Currently, the experience study process is becoming much more exacting than it was in the past, possibly in response to plan liabilities being much larger and much more heavily weighted

toward retirees than they were previously. At the same time, actuarial standards are being tightened.

Further, liability weighting for demographic assumptions and fully generational versions of mortality tables are becoming more common today than they were in the past. Economic assumptions are being heavily affected by the current low interest rate/ low inflation rate environment, leading many plans to reduce their investment return assumption.

Reasonable actuarial assumptions are very important for a plan's well-being. Out-of-date assumptions are of questionable validity and can potentially do great harm to a plan, causing decisions about the future to be based on out-of-date expectations. If your plan has not had an experience study recently, or if you are concerned about the validity of the assumptions, discuss them with your actuary. It matters.

¹Typically, the inflation portion and the real portion of the return do not add to the total, especially when inflation is high. As an example, in the first row, the formula for the real portion is $1.081/1.016=1.064$ or 6.4% real return.

²<https://www.nasra.org/publicfundsurvey>



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