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Valuing retiree mortality improvements

by Michael R. Virga

The popular and the scientific press have noted the decline in pension mortality and have suggested reasons for further decreases. This article is the first in a series exploring the improvement in retiree life expectancies and ways the improvement can be incorporated into actuarial estimates of annuity and pension plan reserves. It reviews recent mortality history for two large pension systems, analyzes what effects mortality improvements have had to date (if assumed to stop as of the valuation date), and shows the trend in costs implicit in prior mortality improvements. Later articles will examine what happens to liabilities when improvements in mortality are assumed to occur after the date of valuation.

Data sources

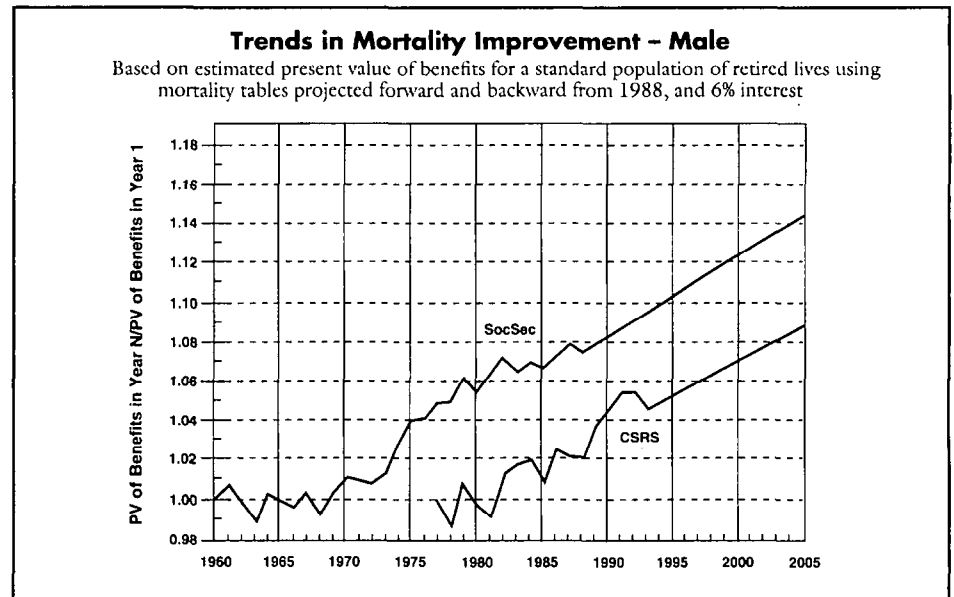
To analyze mortality experience, a large body of data reflecting actual mortality incidence must exist from consistent and reliable sources over a suitable period. Social Security and the Civil Service Retirement System mortality data meet these criteria.

Data on long-term mortality trends is published by the Office of the Actuary at the Social Security Administration, with the most recent publication being Actuarial Study No. 107. For 1960 through 1967, the Social Security age-sex specific central death rates were calculated from Vital Statistics tabulations of deaths and Census estimates of population. For 1968 through 1988, these two sources were used for ages under 65, but the Medicare records were used to calculate rates for ages 65 and over.

Mortality rates for the Civil Service Retirement System (CSRS) annuitants are available for each fiscal year 1977 through 1993 and for employees through 1990. This data covers about 2.5 million employees and more than 1 million nondisability annuitants.

Mortality trend analysis

Mortality trends can be analyzed by illustrating year-to-year changes in a



single number. One commonly used measure of the overall mortality for all ages combined is the ratio of actual to expected mortality. Another measure is changes in the value of an annuity factor. For pension valuations, a "bottom line" measure of overall mortality might be the present value of benefits for a standard population of retired lives.

Effects of mortality improvements

The accompanying graphs show the effect of changes in mortality rates on the present value of benefits for a standard population of retired lives. The group selected for this purpose was the current population of retired lives under the CSRS. Since the CSRS started in 1920, this represents a mature population of annuitants. Although the average age is 70, this population also includes some annuitants under age 60, because normal retirement under the CSRS can be as early as age 55 with 30 years service.

The base line for this analysis is a mortality table that reflects recent experience (1986-1990) for private pension plans. This table was assumed to represent mortality rates for 1988. These mortality rates were projected

backward and forward in time, using both the Social Security and Civil Service trends, creating different mortality tables for each calendar year.

To illustrate the effect of possible future trends, a projection of the Social Security mortality for 1989 through 2005 is included. This projection is based on the average mortality improvement trend for Social Security for 1968 through 1988. Also included is a projection of CSRS mortality, based on the average trend for CSRS for 1977 through 1993.

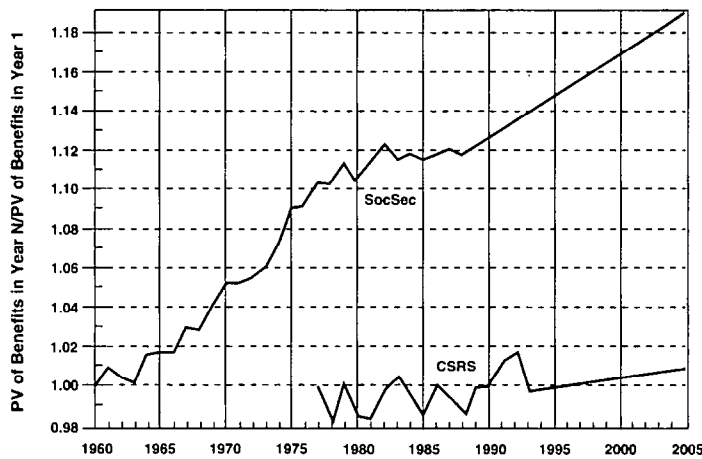
For both Social Security and CSRS, the average mortality improvement trend for each age was calculated as the complement of the exponential of the slope of the least-squares line through the logarithms of the death rates for that age. This procedure helps remove some of the seemingly random year-to-year fluctuations in determining the average trend.

Trend in costs

The present value of benefits for the standard population of retired lives was determined each year using the mortality table applicable for that year, applied on a static basis, using a 6% interest rate. Thus, they represent the

Trends in Mortality Improvement - Female

Based on estimated present value of benefits for a standard population of retired lives using mortality tables projected forward and backward from 1988, and 6% interest



value of liabilities, assuming mortality improvements and mortality rates are frozen at the point of valuation.

The numbers actually plotted on the accompanying graphs are the ratios of the present value of benefits for each year to the present value for the first year in the series, which was 1960 for Social Security and 1977 for Civil Service. Because of the different starting and ending years, only the slope is relevant when comparing trends between Social Security and CSRS.

The graph for males shows that, with the Social Security trends, the present value of benefits increases by about 8% from 1960 to 1988, due to changes in mortality. Very little mortality improvement occurred during the 1960s, with rapid improvement during the 1970s and a slower improvement rate during the 1980s. The Civil Service data for males shows a slightly higher trend than Social Security for the period from 1977 to 1988, and this higher trend continues through 1993, the last year for which there is data under CSRS.

For females, the Social Security data shows very rapid improvement in mortality during the 1960s and 1970s, with the present value of benefits increasing more than 10% during this period. The improvement continued at a slower pace during the 1980s. The Civil Service data for females

shows almost no improvement from 1977 to 1988, with some improvement in 1991 and 1992. This is offset, to some extent, by the results for 1993, which show a decrease in the present value of benefits from 1992.

The trend under CSRS after 1993, based on the CSRS experience for 1977 through 1993, is less than the trend under Social Security, based on Social Security experience for 1968 through 1988. This is especially true for females because of rapid improvement rates during the 1970s under Social Security, combined with much slower improvement rates under CSRS during the 1980s.

The projected trends in liability values are especially interesting. They show an additional increase of 5% to 6% in most scenarios by the year 2005, assuming mortality improvements follow recent trend lines and improvements are not recognized until they happen.

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Applications:

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