Selection of Mortality Assumptions for Retirement Plan Valuations

January 2015
Background

In October 2014 the Society of Actuaries’ Retirement Plans Experience Committee (RPEC) issued reports on recent mortality experience of participants in uninsured private retirement plans, including a new set of mortality tables (RP-2014) and a new companion mortality improvement scale (MP-2014). These new mortality tables are generally intended to supersede the RP-2000 mortality tables and their associated mortality improvement projection scale, Scale AA, and are based on mortality data gathered by the Society of Actuaries (SOA) from 2004 through 2008.

The final tables released in October are essentially the same as the tables that were released in draft form in February 2014. After the draft release in February, many organizations, including employer groups, professional organizations, and benefit consulting firms, wrote comments to the SOA about their concerns with the draft tables and the data and methodology used to produce them. Although the comments were addressed by the SOA, and the wording of the final report was somewhat altered from the drafts, no changes were made to the draft tables (RP-2014 or MP-2014) for the final release in October.

This white paper reviews a number of issues related to the adoption of the new tables (RP-2014 and MP-2014) and discusses a number of general considerations in the selection of an appropriate mortality assumption for a retirement plan population.

Selection of Demographic Assumptions – In General

For actuarial work performed in the United States, the selection of actuarial assumptions is governed by Actuarial Standards of Practice promulgated by the American Academy of Actuaries. Demographic assumptions, in particular, are governed by Actuarial Standard of Practice (ASOP) 35.

ASOP 35 requires that each demographic assumption selected by an actuary be reasonable, taking into account a number of different factors. However, the ASOP recognizes that what is reasonable may not be a single best-estimate assumption. Section 3.4 specifically states, “The actuary should recognize the uncertain nature of the items for which assumptions are selected and, as a result, may consider several different assumptions equally reasonable for a given measurement.”

Applying this standard to mortality tables requires thoughtful analysis. Unless a plan’s population is very large, not enough credible data exists to develop a plan-specific assumption. Because of this, actuaries often look beyond a plan’s population to standard tables and other factors that broadly influence mortality.

The difficulty in selecting a mortality assumption is compounded by the fact that ASOP 35 requires that mortality improvement be considered, with separately stated requirements relating to adjusting from the base year of a mortality table to the valuation date and for assumed improvement beyond the valuation date. Over the past century, mortality rates have clearly improved, but that improvement has not been steady. Instead, mortality improvement has generally occurred in surges. This suggests that, while past mortality improvement experience should be considered in predicting future improvement, it should not receive undue weight in the analysis and selection of a future improvement assumption.

1Wording from version of ASOP 35 that becomes effective for measurements on or after June 30, 2015. A similar idea is expressed in the currently applicable version of ASOP 35 in Section 3.1 which states “For any given measurement, the actuary may be able to identify two or more reasonable assumptions for the same contingency.”
Selection of a Base Mortality Table

As noted above, the RP-2014 mortality tables were developed based on data from uninsured private retirement plans between 2004 and 2008. Mortality rates (probabilities of death at each age) were developed from this data and then adjusted to the year 2014. The RP-2014 tables include separate mortality tables for:

- Healthy Annuitants (who have commenced payments)
- Employees (actively at work)
- Disabled Retirees

Tables are also provided separately by “collar”: white collar versus blue collar. The collar versions of the table are intended to reflect mortality differences associated with different job characteristics – hourly versus salaried, collectively bargained versus non-collectively bargained.

Although the RP-2014 tables are intended to model mortality rates for the general uninsured retirement plan population, specific plans and employers may have factors that would make a customized table more appropriate. These factors include (but are not limited to):

- Variability in plan benefit level - The RP-2014 tables are constructed on a benefits-weighted basis and give greater weight to individuals with larger benefits. Individuals with larger benefits typically live longer. By benefit weighting the experience, the resulting table is more appropriate for modeling the liability of a pension plan that has a range of the size of benefits. However, if the benefits being valued are of a more uniform size, most typically in the case of retiree medical coverage or some union retirement plans, a head count weighted table may produce a better measure of the liability. The Society of Actuaries published a Supplement that provided alternative tables on a head count weighted basis, which may be appropriate for OPEB measurements and some pension situations.
- Proportion of the workforce that is unionized—The data underlying RP-2014 includes a greater proportion of blue-collar lives than did the data underlying RP-2000. The blue and white collar versions of the tables could be weighted to better reflect the underlying population covered by the plan.
- Geography – Certain regions of the US have historically experienced higher rates of mortality compared to other regions. This is particularly true of the southeastern and south central US.
- Industry – Certain industries experience higher rates of mortality due to factors such as strenuous physical requirements and/or unhealthy work environments.
- Socio-economic level – Lower socio-economic levels tend to experience higher mortality rates than higher socio-economic levels. Education level in particular is a predictor of mortality levels.

Many employers have specific factors, such as plan design, geography, industry, etc. that may make alternatives to the RP-2014 mortality tables appropriate.
Availability of lump sums – If a pension plan has a lump sum option, it is more likely to be used by retirees who are already sick in some fashion, leaving the individuals remaining in the plan (and plan experience) healthier and likely to live longer than otherwise. As lump sums have become relatively common, the data underlying RP-2014 probably already reflects some of this self-selection. On the other hand, a plan that does not offer lump sums might anticipate somewhat higher mortality and a lower rate of mortality improvement than the overall universe of self-insured plans, since it continues to cover the impaired lives.

Use of customized mortality tables based on any of these or other pertinent factors would best be supported by a broad-based study of the mortality effects of those factors/characteristics and should be applied only to participants who share those characteristics. For example, the U.S. Census Bureau publishes statistics that provide life expectancy information by state. Such information could be used to customize a mortality table to the plan’s population reflecting the differences in life expectancy in the geographic location of the employer. However, such adjustment should reflect the proportion of retirees who have moved from the area where they had worked.

In some cases, a plan’s or employee group’s actual mortality experience over recent years may suggest that an adjustment to or an alternative to RP-2014 may be appropriate. If an adjustment to the RP-2014 tables is determined to be appropriate, one method of making that adjustment is to blend actual plan experience with the mortality rates contained in the RP-2014 tables. This would normally be done by incorporating a measurement of the credibility of a plan’s actual experience based on the size of the plan’s population. The adjustment can be made on a table wide basis, or on portions of the table (for example males and females separately or combined, all ages versus only ages less than 65). Experience should be measured on a group that is expected, based on actuarial judgment, to have homogeneous characteristics. Thus for example male steel factory workers experience should not typically be combined with female office workers even if they work in that same factory building.

Selection of a Future Mortality Improvement Assumption

Mortality improvement during the 20th century is well-documented. Recognizing this and the fact that many experts have different expectations about the degree to which mortality rates will continue to improve, a number of different mortality improvement projection scales have been developed and used over the years. These improvement projection scales include:

- Scale AA – Originally developed by the SOA to project mortality improvement for the GAM-94 tables, this scale has been used in recent years to forecast improvement for the RP-2000 tables. It is the improvement scale used by the IRS (along with RP-2000) to develop mortality tables used for determining tax-qualified plan contributions. In September 2012, the RPEC published a paper on mortality improvement and stated that the actual rates of observed improvement since 2000 “differed from that anticipated by Scale AA”. In particular, the RPEC’s study found that “Scale AA rates were lower than the actual mortality improvement rates for most ages over 55”. Experts have many different viewpoints about future mortality improvement. Although virtually all agree that mortality experience will continue to improve, how much it will improve is subject to much debate.
• Scale BB – As a result of the RPEC’s study on mortality improvement, a new projection scale, Scale BB, was released with the September 2012 paper. Scale BB was intended by RPEC to be an interim improvement scale until the completion of the RP-2014/MP-2014 study. The materials published included a two-dimensional table (with rates of improvement varying by age and calendar year) and a simplified one-dimensional table (with rates of improvement varying by age only).

• MP-2014 – Using the same conceptual framework as was used to develop Scale BB, the RPEC released MP-2014 as a companion to the RP-2014 mortality tables. It reflects additional data above that which had been used in constructing Scale BB and verified the basic conclusion that mortality has been improving faster than assumed by Scale AA. In its report, RPEC stated that “Scale MP-2014 represents the Committee’s [RPEC’s] current best estimate of future mortality improvement in the United States.” MP-2014 is based on U.S. Social Security system experience. Mortality improvement for specific retirement plan and employee populations potentially may be better modeled by alternative projection models.

• Buck Modified Projection Scale – This scale is based on the RPEC_2014 model, which is the same methodology used for the development of the MP-2014 projection scale. However, it uses different parameters on certain subjective issues than were used in constructing Scale MP-2014. The Buck Modified Projection Scale trends to an ultimate mortality improvement rate of 0.75% at most ages (rather than the ultimate improvement rate of 1.0% under the MP-2014 table). The ultimate mortality improvement is reached over a period of 15 years from 2007, the end of the smoothed historic data used in constructing Scale MP-2014. The table puts equal weight on age/period and cohort interpolations, as was used in constructing Scale MP-2014. The 0.75% ultimate level is reduced after age 85 to 0.60% at age 95, then to 0.0% by age 115. This table was constructed to provide a reasonable projection scale for use by employers who believe that future mortality improvement will be substantially lower than current levels. The parameters used in the construction of this table were based on the mortality improvement forecasts from the SSA as well as analyses conducted by various organizations in recent years.

• Social Security Administration Models – Although not published as a formal projection scale, the US Social Security Administration uses models to forecast future mortality improvement based on their extensive study of the general population over the decades since Social Security was first implemented. These models may be applicable to uninsured retirement plans, with due consideration given to how mortality experience for retirement plan participants may differ from the experience of the general working population.
While MP-2014 is the most recent Society of Actuaries-published pension mortality improvement projection scale and reflects the RPEC’s best estimate of future mortality improvement, there are many factors to consider that may suggest a scale that reflects a different level of improvement, including any of the scales listed above, would be more appropriate in some cases. These factors include:

- Actual plan experience, especially for very large plans and when compared to underlying data used to develop MP-2014.
- The wide array of opinions about future mortality improvement among experts.
- More recent mortality improvement analysis performed by the Social Security Administration (SSA), especially since their data set is large and reflects many decades of mortality experience. Specifically:
  - The Long Range Demographic Assumptions for the 2014 Trustees Report, published by the office of the Chief Actuary, Social Security Administration2 ("SSA Demographic Assumptions Report") states that, "Projections of mortality improvement are subject to uncertainty that is possibly greater than any other variable used in Trustee’s assumptions." The report also notes that, “Only after considering how future conditions will differ from the past can we speculate about future mortality improvement.”
  - The SSA Demographic Assumptions Report also notes that many factors are responsible for the acceleration of U.S. population mortality improvements in the past decades, including increased medical knowledge, increased availability of health care services, and improvements in sanitation and nutrition. However, the SSA’s Office of the Chief Actuary believes that effects from these developments have been diminishing.
  - The Office of the Chief Actuary of SSA believes there will be a trend toward slower mortality reduction in the future. In particular, the SSA Demographic Assumptions Report states that slowing improvements are due to expectations of external factors including increased negative side effects from invasive surgical procedures, decreased air quality, and increased prevalence of obesity and diabetes.
  - The SSA’s 2013 and 2014 Trustee’s Report used an improvement rate that averaged to 0.73% as their intermediate assumption basis, or best estimate basis, based on the SSA’s most recently completed study. In addition, to indicate the sensitivity of results to variations in assumptions, the analysis included low and high cost scenarios that reflected respectively lower and higher improvement in future mortality rates.3
  - In developing MP-2014, RPEC used the most recent Social Security data set that was then available (as of 2009) and came to a different conclusion than SSA about the level of future mortality improvement. This indicates that experts can arrive at different reasonable assumptions using the same underlying data. Different conclusions are even more likely when differing periods of data are considered. We note that SSA experience for the ages which affect pension liabilities most (e.g. ages in the 60’s through early 80’s) indicates lower levels of mortality improvement in the years 2008 through 2010 than in the years 2005 through 2007.


Experts have come to different conclusions about future mortality improvement based on the same data. This indicates that multiple projection scenarios can be reasonable.
• The rates of improvement assumed by MP-2014 after 2007 are heavily influenced by a recent period of substantial improvement in the early 2000s. As noted, Social Security data available through 2010 generally shows a lower rate of improvement for 2008-2010 than is assumed by MP-2014. This recent slow-down in improvement was not reflected in the SOA’s recommendations. Moreover, this data is consistent with a shorter period to the ultimate lower rates of improvement than has been assumed by the SOA.

• Rates of mortality improvement have varied greatly during different time periods, indicating that actual improvement has been inconsistent and difficult to predict based on historical experience. For example, the SSA reported overall average age-adjusted improvement from 1900 to 2010 for ages over 65 was 0.78%, with periods as high as 1.77% (from 1968 to 1982) and as low as 0.19% (from 1954 to 1968).

• Medical breakthroughs that cannot be currently predicted may have the effect of creating mortality improvement surges at various points of time in the future.

• For the past several decades during which the actual mortality improvements that are the foundation of MP-2014 have occurred, U.S. health-care costs have been growing faster than the U.S. economy as a whole resulting in a continuously increasing share of GDP. This trend is not sustainable and the efforts to slow the growth of health-care costs, which have already begun, are likely to result in lower rates of mortality improvement than have been achieved in recent years.

Conclusion

The selection of a reasonable mortality assumption requires careful consideration and thoughtful analysis, both with respect to the selection of a base table of mortality rates and with respect to the choice of an improvement scale. Although RPEC has specifically endorsed the use of RP-2014 and MP-2014, other alternatives, as outlined in this paper, currently exist. These alternatives include using mortality rates based on broad population characteristics (geography, industry, etc.) or actual plan experience, and future improvement rates based on a thorough analysis of underlying data and trends. Plan and population specific factors should be carefully analyzed, both quantitatively and qualitatively, to arrive at an assumption(s) that is reasonably expected to predict the actual experience of the modeled population.
Appendix I

Graphical Comparison of Mortality Projection Rates

Mortality Projection Rates
Buck Modified Scale vs OASDI (SSA)
Age 65 Male

Mortality Projection Rates
Buck Modified Scale vs OASDI (SSA)
Age 65 Female
Appendix I

Graphical Comparison of Mortality Projection Rates

Mortality Projection Rates
Buck Modified Scale vs OASDI (SSA)
Age 85 Male

Mortality Projection Rates
Buck Modified Scale vs OASDI (SSA)
Age 85 Female
## Appendix II

### Comparison of Future Lifetime and Annuity Values

**MP-2014 versus Buck Modified Scale (using RP-2014)**

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### Males

### Females

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