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# Mortality Table Slope—The Discussion Goes On

by Douglas Doll

The article by Steve Cox, “Does Preferred Wear Off?” continues a discussion on mortality slope that has gone on through several articles in this newsletter. I want to recap the discussions thus far, and summarize some additional discussion that occurred at this year’s Product Development Symposium.

- August 2002. Larry Warren shows that the slope of the 1990-95 table is steeper than that of the 1970-75 table and concludes that the actuary utilizing the 1975-80 table may unwittingly be taking an aggressive posture when it comes to projecting future mortality.
- November 2002. Michael Taht notes that the 1990-95 table data is not homogeneous, because different durations represent different eras, so its slope may not be the right one. He asserts that recent improvements in underwriting can persist for a long time, although much will wear off at high attained ages.
- November 2003. Tracey Polsgrove reports on the Academy’s Illustrations Work Group analysis of late-duration mortality assumptions. She notes that using a constant low percentage of an old table (e.g., 30 percent of 1975-80) produces mortality at high attained ages that appears low compared to recent tables such as 1990-95 or RP2000. She acknowledges that there is no clear answer, but suggests that, given lack of credible data, the actuary may choose to use more conservative assumptions.
- July 2004. Steve Cox writes that, over a typical pricing horizon, the differences between preferred and residual risks are expected to persist.

The topic of mortality slope came up at least three times at the recent Product Development Symposium and its preceding seminars. In the

seminar, “The Illustration Actuary: A Professional Perspective,” Chris Shanahan gave a number of reasons why a simple flat percentage of the 1975-80 table may not be an accurate assumption:

- There has been significant population improvement since 1975-80, but the improvement varies greatly by age. The maximum improvement is in the 45-65 age group. Implications of this are less steep mortality for younger issue ages and steeper mortality for issue ages 50-65.
- To the extent improved underwriting wears off in later durations, slope may be steeper. The effect of this could vary by age and gender.
- Changing cohorts over time means that reliance on “modern” tables such as 2001 VBT also can be wrong.
- Issue ages over 70 introduce added complexity. The original 1975-80 table stopped at issue age 70, and various extensions may not be appropriate.

In the symposium itself, there were two sessions where mortality slope entered into presentations. The handouts for these sessions are available on the SOA Web site at <http://handouts.soa.org>. In the session “How’s Life? An Overview of the Permanent Life Market,” Scott Witt showed a series of graphs based on an assumption that the only homogeneity issue with the 2001 VBT table is the advent of blood testing. Adjusting for this, and assuming that preferred underwriting causes a constant percentage mortality reduction in all durations, he concluded that using a flat percentage of the 1975-80 table for issue age 65 preferred is equivalent to assuming 2 percent per year mortality improvement.

In the session “Lapse Experience,” Jay Biehl spoke on the ultimate mortality implications of lapse assumptions. His main theme was that, while in-force face amount becomes small at the end of the typical pric-

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Figure 1

Effect on Mortality Rates of Different Survivorship				
Proportion Living			Mortality Ratio	
Attained Age	Insured	Residual	Insured	Residual
75	50%	50%	80%	120%
85	26	19	85	120
95	6	2	95	120

ing horizon of 20 or 30 years, the mortality per thousand increases greatly over that time, and the present value of mortality beyond the pricing horizon can be significant. Similarly, the value of mortality for high issue ages is much larger than the face amount portion. Jay offered what he called “tidbits” of information. Here are three of them:

- Each percentage point of face amount above age 70 represents 5-10 percent of expected mortality.
- For a typical level premium product, 50 percent of the present value of premiums comes before duration 6, but 50 percent of the present value of mortality comes after duration 11.
- On a lifetime basis, for issue age 45, changing the lapse assumption in years 21+ from 5 percent to 4 percent increases the present value of premiums by less than 1 percent, but increases the present value of mortality by 8 percent.

I would like to add one more consideration to the ones described above. This pertains to mortality at very high attained ages, and is an additional argument as to why the differences between “preferred” and “residual” classes are expected to converge. The higher survivorship of the preferred class implies that the aggregate group is comprised mostly

of originally preferred risks. For example, consider a population at age 75 whose aggregate mortality is 100 percent of 1975-80 male ultimate. Split this population into 50 percent of the population preferred at 80 percent of 1975-80 and 50 percent residual at 120 percent of 1975-80. At higher attained ages, assume that the residual class maintains a ratio of 120 percent of aggregate. After taking into account the shifting proportions of these two groups due to different survivorship, we can solve for the ratios of preferred to aggregate mortality. The results are seen in Figure 1.

In Figure 1, I kept the residual mortality ratio constant. At the very high attained ages, the residual class ratios might actually decline. I have heard of studies indicating that smoker mortality is less than nonsmoker mortality in ages beginning in the 90s. The rationale for this phenomenon is that the weaker lives in the higher mortality group are “weeded out,” leaving a smaller, but stronger, group at the high attained ages. In this case, convergence would be more pronounced.

So, where does all this discussion leave us? Different persons likely will come to different conclusions. I expect the discussion will continue, and look forward to additional insights from others. □



Douglas Doll, FSA, is a consultant with Towers Perrin in Atlanta, Georgia. He can be reached at [doug.doll@tillinghast.com](mailto:doug.doll@tillinghast.com).