Article from:

Risk Management

March 2014 – Issue 29

A Principle-Based Approach to Mortality Guarantees for Life Insurance Products

By Carol Marler

HOW DOES A RISK MANAGER APPROACH THE QUESTION OF MORTALITY RISK? What are the implications for risk management of product designs which guarantee a maximum mortality charge? This article begins by describing how mortality assumptions are developed. With that as background, the impact of guarantees is considered. This article will focus on life insurance policies.

MORTALITY ASSUMPTIONS

The probability of death is 100 percent. The question is in the timing. The traditional approach to mortality assumptions for life insurance business is tied to a published table of mortality rates by age. That table, in turn, is developed from intercompany mortality studies. Other parameters may also drive the table, including (among other things) gender, tobacco use, duration since policy underwriting, time frame of the study data, and the purpose of the table. For example, in the United States, tables used for regulatory reporting are very different from the tables used for pricing or for reporting under Generally Accepted Accounting Principles.

The process of creating a mortality table is as much art as science. Often the ratios of claims to exposure are calculated for groups of ages, in order to increase the credibility of the results. Then, for practical reasons, the data is smoothed and interpolated to give results at individual ages. For most ages, much of the emphasis is placed on fitting the experience data. At the oldest ages, where insurance experience is relatively sparse, different approaches have been used, such as incorporating experience from general population and/or choosing some analytical formula that relates age to mortality rate.

Actuaries often modify the published tables to reflect features of a particular block. In considering the mortality outlook for a specific block of business, the published tables may be modified to reflect the recent mortality experience of the company in question and the underwriting approach to be used for that business. The adjustment is typically in the form of a schedule of multiples to the published table. With respect to the resulting adjusted table, there are a number of risk factors that should be considered.

STATISTICAL VARIANCE AND BASIS RISK

If the mortality rate is correctly specified for each policy, the binomial distribution may be assumed, producing a well specified metric for variance. Because of the large number of policies, it is possible to simplify the calculation by assuming either Poisson or normal distribution. In any case, the variance can be calculated directly on a seriatim basis. Determining the variance by amount requires a somewhat more complex calculation than variance by count, but in either case an exact overall variance can be computed without recourse to any simulations. The range of possible claims per period can be specified to any desired confidence level.

One issue that arises in considering variance by amount is whether to use total face amount or face amount net of reinsurance. From a risk perspective, retention limits are a form of risk mitigation, and thus the net face amount seems the correct metric to use. Mortality in excess of retention has been transformed into a different sort of risk, namely credit risk involving the reinsurer.

Another element of risk is basis risk, i.e., whether the table used to set the mortality is a correct measure for the block of business. The basis risk can be broken into two parts, first whether the mortality for the current period is properly specified, and second, whether the future trend of mortality is appropriate. Basis risk is always difficult to quantify. There is no formula for estimating the error range, and an ongoing program of monitoring the emerging experience is necessary. Actuarial judgment comes into play in deciding whether any divergence between actual and expected is merely a temporary aberration or an indication of an ongoing trend away from the previously selected assumptions.

MORTALITY IMPROVEMENT

Many companies incorporate some degree of projected mortality improvement into their schedule of mortality adjustment multiples. The larger the assumed increase, the greater the risk that actual experience will be less favorable than projected. A conservative assumption of

Carol Marler, FSA, MAAA, is a retired actuary in Indianapolis, In. She can be reached at *carol.marler@gmail.com*.

little or no improvement provides an implicit margin for this risk.

The mortality assumption by duration is intended to represent the normal effect of aging, with possible allowance for further progress in medical science to extend lifespans. Since the trajectory of advances in health care may not match these assumptions, emerging experience may vary. In addition, there is a risk of an extreme mortality shock not anticipated by historic trends.

MORTALITY SHOCKS

Commonly considered risk scenarios include pandemic disease and other catastrophic events such as terrorism or natural disasters.

Pandemic disease is considered to have a greater impact than any of the other possible events. It has been nearly 100 years since the last major influenza pandemic. In that time, medical science has made significant strides in treatment of contagious disease. Nevertheless, although the details of any future pandemic may differ from this experience, it gives a worthwhile starting point for considering how bad a pandemic might be. Also, although HIV/AIDS proved not to be catastrophic for the life insurance industry, the projections made in the early days of that epidemic can also be a useful guide to building disaster scenarios.

Whether adverse mortality comes from a gradual trend or from a catastrophic shock, how can a company respond to adverse experience?

PRODUCT DESIGN

In the case of departure from expected trend, the company may re-price new business and/or adjust its underwriting. These choices will not be helpful, however, in the case of a catastrophic shock which has already occurred.

For inforce business, it may be possible to pass along some or all of the excess mortality cost to policyholders. Product design determines the range of possible adjustments. Such actions to pass along adverse mortality experience will be undertaken with caution due to the reputation risk involved. If the excess mortality is

an industry-wide issue, it seems more likely that companies will choose to pass along the experience.

A great many traditional life products, whether permanent, renewable term, or decreasing term, do not permit the insurer to change premium rates. On participating business, companies may choose to reduce dividends to reflect adverse mortality experience. Dividends, of course, cannot be reduced below zero. So the gross premium becomes, in effect, the maximum guaranteed premium.

NON-PAR PLANS

Universal life product design allows the company to increase the current mortality charges, subject to contractual guarantees. Some term plans also provide for adjustment to current premiums, particularly in the YRT "tail" that follows the initial level premium period. Thus, we see that mortality guarantees within non-par product designs do not, in fact, increase an insurance company's mortality risk. Rather, they are an element of the feature which allows the company to decrease its risk in certain scenarios, and only act to limit the degree to which the increased risk can be passed back to policyholders.

When looked at from this perspective, the presence of an explicit mortality guarantee is associated with an option for the company to pass along adverse experience. Products without an explicit guarantee are actually more risky in that there is no provision for adjusting premiums either upward or downward. ■