On August 9, 2011, SCOR SE, a global reinsurer with offices in more than 31 countries, acquired substantially all of the life reinsurance business, operations and staff of Transamerica Reinsurance, the life reinsurance division of the AEGON companies. The business of Transamerica Reinsurance will now be conducted through the SCOR Global Life companies, and Transamerica Reinsurance is no longer affiliated with the AEGON companies.

While articles, treaties and some historic materials may continue to bear the name Transamerica, AEGON is no longer producing new reinsurance business.

Archive Materials

Useful Tools for Assessing Claims Fluctuation

Reprinted from the July 2010 Messenger newsletter

By David Wylde, FSA, MAAA, CLU, ChFC Research Actuary

As a research actuary, I sometimes am asked if the statistics used in my work have any basis in the real world. Or, in other words, how does applied statistical theory stack up against experience?

A case in point is year-to-year death claims analysis – where actual claims often deviate from expected. These claims deviations can be simply the result of statistical variance about the mean, or they may indicate the need to revise expectations. To demonstrate the statistics used in determining whether a change in expected claims is warranted, we incorporate proprietary database experience into an experiment comparing historical claims variance against theoretical predictions.

The Theory

In my series of articles on credibility theory (in the March, July and October 2008 issues of The Messenger) I indicated that mortality can be thought of as a binomial process, where the number of claims in any given calendar year follows a binomial distribution with an easily calculated mean and variance. The standard deviation, which is the square root of the variance, is a measure of the inherent claim count random variability.

To determine the theoretical variance, we simply need the size of the population (n) and their average mortality rate (q). From these two values, we calculate the mean claim count \( [n \times q] \) and the variance \( [n \times q \times (1-q)] \).

For this article, we recognize another layer of complexity by considering the random variation in claim size as well as claim count. This is needed because the total dollar amount of benefit payments in any given year depends not only on how many policyholders die but also on their respective policy face amounts. Combining these two random variables produces what is called a compound Poisson distribution.
The Experiment
For this experiment, we examined mortality experience from a closed block of reinsured level premium term policies issued from 2000 through 2003. Our expected mortality basis was the Society of Actuaries 2001 Valuation Basic Table.

To measure this block’s actual annual mortality variance, we evaluated annual mortality experience from 2004, 2005, 2006 and 2007 as a proxy for four independent and identical mortality events. The standard deviation of the claim amounts from these four trials then could be compared to the value predicted by the compound Poisson distribution. In order to capture as many data points as possible, we compared the actual versus theoretical values from 38 independent client studies. Figure 1 presents the raw results from one of these studies.

Figure 1 - Actual versus expected values for a sample client study, derived from our proprietary Transamerica Experience Database (TED)

Since we did not repeat the exact same mortality event four times, we adjusted claim counts and amounts to normalize for exposure and other cohort differences for the different exposure years. We used exposure year changes in expected claim count and amount to normalize actual claim count and amount.

The actual claim counts and amounts were adjusted by the ratio of the expected values for the given exposure year to the 2004 expected values. For example, we adjusted the 391 claims in 2005 by the factor (517/586) to arrive at the 345 claims used in the experiment.

In a compound Poisson model, we can approximate the increase in variance due to random fluctuations in average claim size by analyzing the distribution of face amounts in a closed block. The factor arrived at during this analysis is then applied to the claim amount variance calculated from simple binomial theory.

We determined this severity factor for each of our 38 studies, since each client has a unique distribution of face amounts. The factors ranged from a high of 2.46 to a low of 1.43 and averaged around 1.92.

Figure 2 shows one study’s final results after the normalization and severity factor processes. The adjusted actual standard deviation is simply the standard deviation of the four adjusted actual claim amounts. The theoretical standard deviation is the adjusted actual mean amount divided by the square root of the adjusted actual mean count times the square root of the severity factor.

Figure 2 - Claims data after adjustment for normalization and severity. This information allows for more accurate trend analysis and year-by-year comparisons of claims information.

The Results
Figure 3 compares the actual versus predicted results for all 38 studies. If our predictions were absolutely perfect, all of the data points would fall along the diagonal line and would produce a correlation coefficient of 100 percent.
In reality, the data shows a correlation of around 75 percent, which indicates a very strong linear relationship. In other words, we can safely use our compound Poisson model to explain how much of the annual variation in total claim payments is likely due to random chance.

**Using the Model**
Understanding when mortality results are outside the bounds of reasonably possible outcomes can help senior management decide when resources should be delegated to further investigation. Appropriate confidence intervals can be created around annual expected mortality experience.

Then, if actual experience is outside, for example, a two standard deviation interval, we would know that there was only a five percent chance that this was due solely to random fluctuation. The need for additional research could be triggered by this threshold.