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SPRINGBOARD FOR DISCUSSION

Basil Xavier, ASA

Basil Xavier, ASA 1981, worked in Los Angeles for his entire career, mostly with Mercer or its predecessor organizations. He was a thoughtful actuary who made several contributions to the *Pension Section News* including the following article that appeared in June of 1990. He died in 2003.

An essay on the measurement of the reasonableness of each individual non-economic actuarial assumption.

OBRA 1987 mandated that the test of 'reasonableness" must now be applied to each individual actuarial assumption, rather than to the assumptions in the aggregate.

The stage appears to be set whereby our actuarial assumptions will be under closer scrutiny and challenged. As actuaries it behooves us to discuss what "reasonableness" means before some artificial standard is foisted on us.

Despite the fact that non-economic assumptions are usually developed by considering the experience of the actual *number* of participants decrementing under the various assumptions, there appears to be a tendency to want to consider actuarial gain and loss as a measure of deviation of expected from the actual for each individual assumption using the analysis of gain and loss by source.

There have been several classic papers on analysis of gain and loss by source (notably Throwbridge, Dreher, Lynch and Anderson). Each of these papers breaks down the total gain and loss by source, but there is enough difference in the methodology so that the allocation by source is unique depending on the paper involved.

Aside from this variance, however, there is another critical factor to consider that is fundamental to all methods of gain and loss analysis by source that should invalidate this method as a quantitative measure of the "reasonableness" of each individual noneconomic actuarial assumption.

In a multiple decrement situation, a participant is expected to decrement fractionally in all decrements. Let's clarify this statement by means of an example. Suppose at age x the mortality rate is 0.1, the withdrawal rate is 0.2 and the retirement rate is 0.5. This means that during the year of age x we expect 1/10 of the participants to die, 1/5 of the participants to withdraw from the plan and 1/2 of the participants to retire. The real world however, is not as creative, and decrementing has to be by whole numbers, or not at all. In other words, there is a fundamental difference between our mathematical model and the real world.

Members of Pension Section Council are available to explain the Retirement 20/20 initiative to your local actuarial club or any other interested group. If you'd like to arrange for a presentation - either in person or via Web cast - please contact Ann Gineo at *agineo@segalco.com*. Ann is a member of Pension Section Council and leader of the Retirement 20/20 Communication and Outreach subgroup.

Before we proceed further, let us define the following terms that will assist in this discussion:

Now, let us quote Dreher: “the actuarial gain equals (a) excess of net actual release of liability over the release predicted by the valuation basis, plus (b) the excess of expected disbursements over actual disbursements.”

Using the symbols we have defined, Dieher’s definition can be succinctly written as follows:

Having laid the groundwork let us return to our participant age x Let us assume that he actually dies during the year of age x. The gain attributable to the death decrement is

This shows that the gain allocated to the death decrement depends on the total expected release of liability; in other words, it is dependent on all the other decrement assumptions as well as the death decrement assumption. Also, all the benefits of the plan, not only the death benefits, contribute to the gain attributable to the death decrement.

Analogous analyses can be developed assuming the participant withdraws,

retires, or survives to age x+1. It should be pointed out that even If we define G^d as

and reassign the balance of the gain to the respective other decrements, we cannot escape the fact that the rates in a multiple decrement situation are *dependent* variables, that is  of the form  , where the  are dependent on the other actuarial assumptions in the multiple decrements table. Changing any of the other decrements would change  .

A quote from Anderson's paper may be revealing. He says that "it is important to realize that the designation of some portion of equation (39) 'the equation of Total Gain' as 'gain from mortality' or the like is fairly arbitrary...."

So, what good is an analysis of gain and loss by source? It is designed to allocate the total gain to the various decrements in order to obtain a valuable insight into the causes of the gain, even though the allocation of some portions of the gain may be fairly arbitrary due to the nature of dependent variables.

When assumptions can be considered reasonable in the aggregate this arbitrary allocation does not present a problem.

Using analysis of gain and loss by source as quantitative measure of the deviation of expected from actual for each individual actuarial assumption in isolation is a dubious proposition at best. The notion of each individual assumption being "reasonable" in it's own right while operating in a multidecrement environment is intriguing. A more precise definition of what "individually reasonable" reaIly means must be forthcoming before we can attempt to apply a quantitative measure.

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