

PROCEEDINGS

November 10, 11, 12, 1985

PRESIDENTIAL ADDRESS—NOVEMBER 12, 1985
ANALYSIS AND SYNTHESIS

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THE ACTUARIAL METHOD

I would like to preface my comments on the *actuarial method* by quoting from the July-August, 1981 *Harvard Business Review*. In his "letter from the editor" column, Mr. Kenneth Andrews writes:

"Many teachers and students find quantitative techniques and theoretical models easier to teach, intellectually fascinating, beguilingly self-contained, rigorous, and capable of being memorized and quickly applied, widely if not wisely. They forget to insist that for the most part only trivial management problems are neatly structured and quantifiable. All modeling and quantitative analysis directed at a decision are only preludes to subjective judgment. Vision then must transcend technique."

This quote neatly sums up the problem of those who look to canned methods for the solution of their business problems.

We're all familiar with the *scientific method*. One of the key aspects of the scientific method is that it can be applied with predictable outcomes. For example, two parts of hydrogen combined with one part oxygen, under certain conditions, will yield water plus some amount of heat. This process can be repeated at will, by anyone, with identical results. Today I'd like to explore the *actuarial method* in an attempt to obtain a perspective on the nature of actuarial practice: how much art and how much science.

Broadly speaking, given a specific actuarial question, the actuary goes through a number of steps in formulating an answer. For example, the actuary:

- determines the universe of available data that may be relevant,
- selects the types of data to be used,
- makes a number of assumptions,
- adjusts the data to recognize the special conditions associated with the specific problem (deseasonalizing historical data, projecting to recognize future cost changes, etc.),
- synthesizes the data with the aid of mathematical methods and judgment to produce a mathematical response to the question, and
- interprets the numerical result in the context of the original problem.

This sequence of activities, measured strictly against the criteria of the scientific method, would clearly render the actuarial method not a scientific method. If not a scientific method, then what is it?

A close examination of the steps listed above reveals two key points:

- Within the actuarial method, there are several applications of the scientific method. For example, all the mathematical computations, trend methods, deseasonalizations of data, etc., are 100% scientific exercises.
- The various applications of the scientific method are preceded by, connected together with, and followed by a host of applications of judgment.

At the risk of greatly oversimplifying, I could describe the actuarial method as *a process which consists of a number of scientific applications embedded in a collection of judgments*. In this sense, the actuarial method is neither pure art nor pure science; it is a synthesis. And different actuarial problems require different proportions of art and science. If the art-science mix is placed on a continuum where pure art is set at 0 and pure science is set at 100, then estimating next year's pure premium for the auto collision coverage would be closer to 100; but estimating next year's medical malpractice pure premium would be closer to 0.

Not infrequently two actuaries have produced vastly different answers to the same actuarial problem. For example, at a public hearing on medical malpractice rates, the rate level indications as calculated by two actuaries were more than 200 points apart (an *increase* of 210 percent vs. a *decrease* of 5 percent). If one assumes that the scientific methods used were correctly applied, then the entire difference is attributable to the judgmental aspects of the actuaries' work.

A corollary question is, "To what should the buyer of actuarial services be entitled in terms of the standards that govern the selection and application of those judgments?" Not an easy question to answer; but answer it we must.

FULL DISCLOSURE

My view is that the buyer of actuarial services is entitled to *full disclosure* of the judgments made by the actuary in arriving at a solution to an actuarial problem. Although the precise meaning of full disclosure remains to be worked out, my idea of full disclosure consists of two aspects:

- disclosure of assumptions, judgments, interim conclusions, and whatever else influences the outcome by more than some preselected tolerance, and
- sensitivity analyses sufficient to illustrate the operation of these judgments.

In this manner, the buyer should be able to observe the pressure points governing the process and appreciate their relative impacts on the final outcome. If the buyer has a (rational or irrational) basis for differing with the actuary on any of the disclosed items, then the buyer would be free to make alterations to those judgments and accept the consequences.

One example might illustrate what I have in mind. Suppose an actuary, enroute to a conclusion, needed to select a trend line to be fitted to historical data. The disclosure and sensitivity analyses might include the following:

- Number of points actually used in deriving the line of best fit. Outline the rationale for this choice and demonstrate the effect of selecting fewer or more points on the final answer.
- Historical points omitted from the historical data. Outline the rationale for this choice and demonstrate the effect of restoring those points on the final answer.
- Seasonal adjustments. Outline the rationale for any seasonal adjustments and demonstrate the effect of "no seasonal adjustment" on the final answer.
- Tempering the projection of the line of best fit. Outline the rationale for tempering and demonstrate the effects of "no tempering," or other magnitudes of tempering, on the final answer.

And there are several others: type of line used (straight, exponential), length of period used (month, quarter, year), type of observations used (12 months moving averages, discrete time measurements), and so on.

One of the key ingredients of a profession is the existence of observed standards of practice. The actuarial profession needs rigorous standards of

practice in order to accelerate the effort to obtain legal recognition. Also one can hear the footsteps of actuarial malpractice (to a few actuaries, it has already arrived). Adopting a universal standard of full disclosure accompanied by relevant sensitivity analyses can only strengthen the profession by separating fact from opinion in presenting the actuarial work product.

I should also note that all actuaries are included within the scope of my comments: actuaries who sell their skills to one client (employees) as well as actuaries who sell their skills to many clients (consultants).

Whenever I think of standards of practice, my mental reflexes tend to deal in terms of what is permitted and what is prohibited. And that reminds me of a wonderful quote from former FCC chairman, Newton Minow, on the results of his study of the legal systems of European countries:

“In Germany, under the law everything is prohibited except that which is permitted. In France, under the law everything is permitted except that which is prohibited. In the Soviet Union, everything is prohibited, including that which is permitted. And in Italy, under the law everything is permitted, especially that which is prohibited.”

It is important to be aware not only of the need for full disclosure, but of the implication of its absence.

The buyer of the actuarial product, a priori, does not know how to separate actuarial art from science, actuarial fact from opinion, and mathematical wizardry from pedantic applications of formulas. All of these ingredients may be mixed well, carefully packaged, and eloquently presented; without full disclosure, the buyer of the actuarial product is completely at the mercy of the actuary. This is an unnecessary jeopardy for both the actuary and the buyer of the work product. The actuary, if operating with professional integrity, has absolutely nothing to fear from exposing the assumptions and judgments that went into the final work product. The worst possible outcome is that the buyer can exercise his or her own judgment (instead of the actuary's) if he or she so desires. The point here is that failure to disclose the assumptions and judgments along with appropriate sensitivity analyses renders the actuarial work product incomplete.

ACTUARIAL CHALLENGES

Over the years a number of questions have lingered in my mind that, I believe, the actuary is particularly well suited to answer. Let me share some of these problems with you.

Functions of surplus.

What are the functions that surplus serves? Some functions are readily apparent: to provide a cushion for absorbing adverse investment fluctuations, to provide a cushion for absorbing the collective risk assumed by the insurer, to provide a cushion for absorbing adverse reserve fluctuations. And I can think of several others. The challenge is to define an exhaustive set of the functions of surplus.

How much surplus?

Having defined the functions of surplus, the next question is how much surplus is needed to support each function and how much surplus is needed to support all the functions combined? Interestingly enough, the only rule that has emerged over the years that is remotely related to this question has been the Kenney rule. Can we do better? I believe we can. The challenge is to devise a general model that uses a number of insurer measures as input and yields a range for required surplus as output.

Risk classification index.

We all know the extremes of risk classification for rating purposes. On one extreme we have the individual risk rate and on the other we have the average rate for the total subject risk population. Classification plans attempt to group risks somewhere in between. Is there an index that describes exactly where a risk classification plan falls between the two extremes? I believe there is. The challenge is to define such an index—to be used for management purposes as well as an aid to enlightened regulation of business.

Confidence intervals for loss reserves.

Loss reserves are stated as point estimates. This fact, we all recognize, is only part of the story. Every reserve estimate has a corresponding confidence interval, albeit one that is usually not known or, if known, not stated. The challenge is to define a general model for determining loss reserves confidence intervals so that a reserve is always stated as a point estimate together with a corresponding confidence interval.

Present value ratemaking.

With very few exceptions, ratemaking formulas generally use calendar/accident year loss ratio methods. The propriety and elegance of present value ratemaking can hardly be overstated. The challenge is to come up with a

generalized model for making rates using present value methods that recognizes the peculiar characteristics of casualty insurance.

Sampling.

Much of our industry manages its affairs by using 100% samples. With few exceptions, sampling has not found its way onto center stage of actuarial science. The challenge here is to develop small sample models to derive answers to the two classic actuarial problems: ratemaking and reserving.

Solvency tests.

The current NAIC tests are, at best, pragmatic tests, lacking a sound theoretical basis. The challenge is to develop a set of actuarial tests of solvency that have a sound theoretical basis, not just empirical observation. There can be no overestimation of the value such a set of tests would have on a number of different fronts.

Inflation sensitive exposure bases.

With inflation already very much a part of the world economic fabric, the need for inflation sensitive exposure bases grows more acute on a daily basis. The problem has been substantially solved for property exposures. But for liability exposures the problem lingers. The result is a constantly recurring gap between the true rate and the rate actually in effect, causing insurers to engage in an endless game of catch-up. The challenge is to find a set of inflation sensitive exposure bases for liability exposures.

I invite each of you to reflect on these questions, to pick out a small part of anyone of them and adopt it. Let your mind engulf it, understand it, feel it, stalk it, own it, and then, ultimately, subdue it. And when you have thus solved it, write a paper and share it with us. Writing a paper is precisely the single most powerful method we have to expand the horizons of actuarial science. And I extend this invitation to each of you, whether an Associate, a new Fellow, or a thirty-year Fellow.

I am sure you have observed that all of the questions I have posed lie within a traditional insurance framework. The applicability of the actuarial method to areas outside the traditional insurance framework has been expanding. I will cite two examples. One is the rapidly growing involvement of actuaries in the field of risk management. Another is that one of our members has made it his life's work to extend actuarial applications to any question involving a contingency and a consequent transfer of money. My judgment is that these applica-

tions will continue to grow and will occupy a larger and larger proportion of our membership. My invitation to you in this regard is be alert to such opportunities to expand our horizons. Eventually we will likely have to amend and broaden the statement of objectives of the Casualty Actuarial Society.

PROFESSIONALISM

In *The Fountainhead*, Ayn Rand writes: "Throughout the centuries there were men who took first steps down new roads armed with nothing but their own vision."

Our founders had a vision in 1914. They saw a need. And they formed (what later became) the Casualty Actuarial Society for the purpose of meeting that need.

Over the years the CAS has grown in both numbers and stature. It continues to serve a useful purpose; and incidentally, that purpose has grown over time (as evidenced by the expansion in 1961 of the statement of objectives of the CAS). And, as I suggested earlier, our purpose will grow even more in the future.

The CAS today enjoys a very fine reputation. We are known as a learned association of professionals with rigorous entry requirements. The value of the education our members receive enroute to Fellowship is continually demonstrated by the incredible variety of functions actuaries are called upon to perform—as employees and as consultants.

I submit to you that the life force of our reputation derives from two sources, one from within and one from without:

- The contributions from within derive from those who write papers, develop the *Syllabus*, construct and grade examinations, put our programs together, serve on our program panels and workshops, publish our periodicals, question and challenge conventional wisdom, and otherwise conduct the business of the CAS.
- The contributions from without are accomplished by making sure that all the work we do is of uniformly high quality and by making sure that we conduct our business lives with impeccable professional integrity.

History gives us many accounts of great organizations that faltered because of complacency. They looked too much to past success and too little to current opportunities. The CAS, in order to continue to thrive and meet its objectives, requires each of us to contribute to each of the sources of its life force.

Every talent we have, every ability we possess, every skill we have acquired is a gift. It is a gift entrusted to us to put to good use. Also, it is well to remember, whether we are consciously aware of it or not, that in the course of achieving every success we have experienced, someone helped us.

Today you belong to a healthy, vibrant, and forward looking organization. In a very direct way, it has helped you. I'd like to ask you to ask yourselves the following question:

"Is the Casualty Actuarial Society better and stronger for having me as a member?"

If we are the fulfillment of the vision of our founders and if we are to continue to keep the torch lit, your answer to this question must be a resounding yes. Your mission is to make sure the answer to this question will always be yes.