Actuarial Statistics - The American Perspective

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1. Introduction

For the purposes of this paper "American" means the United States and Canada; the development of the actuarial profession and the nature of actuarial education have been similar in the two countries. The early history of American actuarial education indicates that the current system of education and examination by the professional bodies with limited university involvement evolved by necessity and has remained fairly stable because as a whole the profession has viewed itself as successful.

However, in recent years, actuaries have perceived themselves as being vulnerable to losing both personnel and duties to other professions such as accounting and finance. In this paper three alternatives (not necessarily exclusive) will be suggested that may enhance the quality of American actuarial education and thereby increase the profession both in prestige and numbers.

2. The history of American actuarial education

The material in this section is taken from Moorhead (1989) and Trowbridge (1975). Formal actuarial education began in 1896 when the American Society of Actuaries began administering examinations for membership. Shortly thereafter, texts and study materials began being produced and by 1909 an education committee (to oversee syllabus matters) was created to augment the examination committee. To the present day, the majority of American actuaries have been educated by self-study followed by examination.

The first formal university courses were begun in the 1905-1915 period. Moorhead (1989, p.297) characterised them as being created by the "... pioneering enthusiasm of some mathematics professor inspired by recognising that few careers other

than teaching or actuarial science could give livelihoods to mathematicians." These programmes (at the Universities of Iowa, Manitoba, Michigan and Toronto) were established in the mathematics departments.

The next wave of programmes were founded in the 1950s and were sponsored by regional interests for the purposes of supplying actuarial talent. Most were in schools of business but followed the same model as the pioneering programmes: a set of courses were created that matched the syllabus for the first n examinations of the Society of Actuaries (the successor to the American Society of Actuaries). Students would then take additional courses in mathematics or business to satisfy the requirements of the college in which the programme was located. Many of these programmes also offered an MS degree, but the content was virtually identical to that of the undergraduate major. The MS was available so that individuals who already possessed a BS degree could receive academic credit for studying actuarial science. A PhD was not available although several individuals wrote actuarially oriented dissertations while getting the PhD in related areas such as statistics or mathematics.

In the past fifteen years a lesser type of university programme has evolved. These have no courses covering actuarial topics such as financial mathematics, risk theory, and life contingencies, nor are there faculty members with actuarial training. These programmes also provide courses that match the examination syllabus, but only through examination m ($< n$), where m is the last examination with purely mathematical content. (At the present time there are five such examinations: Calculus (with linear algebra), Probability and Statistics, Applied Probability, Operations Research, and Numerical Analysis.)

Finally, a third kind of programme has emerged in the past decade. The University of Waterloo offers a complete academic programme in the same sense that other fields have taken for granted. They offer MS and PhD degrees that are clear advances beyond the previous level. Nine of their faculty are members of one or more actuarial society. They also have become leaders in the education of Canadian actuaries rather than followers.

Let me reiterate that from the beginning the place of education for American actuaries was not within a university curriculum. Approximately three-quarters of the actuaries do not hold degrees in the subject and all of the actuaries learned the material beyond examination n through self-study using a syllabus and education materials prepared by the professional organisations.

A final note. Throughout this discussion I have ignored the Casualty Actuarial Society. They have given a separate set of examinations since their founding in 1914. Very few universities offer courses in Casualty Mathematics that would be comparable to the Life Contingencies courses taught at all of the programmes that grant degrees in actuarial science.

3. Dissatisfaction with the current model

There has been displeasure with the current self-study/examination model almost from the beginning. A look at four recent Society of Actuaries Presidential Addresses indicates the extent of the concern. Trowbridge (1975) states "Actuaries like to think of themselves as members of a learned profession" but then points out that most actuaries

have no formal education in actuarial science and no emphasis is placed on academic degrees. He goes on to note that this atypical relationship hurts the profession by lowering our public image, limiting the development of actuarial knowledge, and having practitioners spending too much time engaging in the training of actuaries.

Barnhart (1979) echoes these comments by noting that professional fellowship does not carry the same weight with the public as an academic degree.

The title of Richard Robertson's (1986) presidential address "The Sad State of Actuarial Education in the US" sums up this point of view. He notes that a directed programme of study in an academic environment must be more effective than self-study.

Corbett's (1988) theme was that we are not preparing actuaries for the unstructured environment in which their work is now being done. Our current system favours those who are skilled at memorisation and solving multiple choice problems. It also favours those whose skills are essentially quantitative.

The most recent look at the current system was done by Cole (1989). He notes that the education and examination system attempts to do many things at once, including recruiting, selection of members, legitimisation of the profession, maintenance of standards, and education. His point is that by meeting these other objectives, the education is not optimal. Excellence includes thinking well and performing challenging tasks. Multiple choice tests check one's ability to determine an answer already determined by someone else. While a major benefit of the current system is the apprenticeship nature of the training (almost everyone works full-time while completing their examination-based education) the examinations bear little relation to the job of being an actuary. Individual, independent work is stressed; pure thought and symbol manipulation are emphasised; and generalised learning is accentuated.

4. Suggestions

Suggestions put forth over the years have been remarkably similar. They have been either a call for eliminating the early examinations or involving the universities more heavily in providing this part of the actuaries' education.

The proponents of eliminating the early examinations (mathematics, statistics, and economics) provide a number of reasons. They include: (1) Universities can do a much better job of educating people in technical matters. The profession should only examine for determining the right to practice (Corbett, 1988). (2) The later examinations require this knowledge. Those who did not learn it will be exposed at that time. (3) Those who elect an actuarial career long after studying mathematics and statistics may well know enough to be an actuary, but will not choose to devote the necessary time to study for the rigorous early examinations.

Opponents have argued that: (1) The early examinations inform people of their ability to be actuaries without forcing them to spend time learning actuarial science. (2) The examinations themselves are a test of will, determination, and ability to organise; all are desirable qualities.

A lesser step is to waive the examinations for those who have passed courses at accredited universities. There have been two serious proposals along these lines. The first, entitled the "Alternate Route" was discussed from 1969 through 1977. (For a sample of the discussion see Garber et al. (1971).) Graduates of accredited university

programmes in actuarial science could earn an Associate designation by passing a single, comprehensive examination. Proponents cited the greater diversity in education that would result, the earlier adoption of new knowledge, and the transfer of some of the educational burden to the colleges. Opponents feared a lowering of standards.

The second proposal was part of a package entitled "Future Education Methods" that was discussed from 1985 through 1989. (See Education and Examination Committee (1987) for details.) Rather than accrediting college programmes, specific courses at universities would be accredited and students earning a minimum grade or above would receive credit for the corresponding examination. Once again the argument was made that the knowledge would be validated by success on later examinations. The goal was to improve education by allowing the use of case-studies, computers, and the enhancements that occur only in a classroom setting. Opponents once again cited lack of uniformity and a lowering of standards. The membership of the Society of Actuaries was split on this proposal and it was abandoned.

5. Summary and recommendations

Historically, actuarial science has been nearly non-existent in the curriculum of American universities. The education of American actuaries has been conducted by a system of self-study and examination controlled by the various professional organisations. While a number of universities offer programmes in actuarial science, their primary purpose has been to expedite the examination progress of those students fortunate enough to have selected an actuarial career early in their lives and to have discovered one of these fairly rare programmes.

It is clear that even though the professional leadership has not been satisfied with this arrangement, it has enjoyed a strong and continuous support by the membership. Part of this may be due to an attitude of "It was good enough (and hard enough) for me so it should be good enough (and at least as hard) for you". More seriously, there is also the feeling that the actuarial profession has unique attributes that are best served by the current approach.

My personal view is that the system is no longer serving the profession as we would like. We need to move the process toward one that attracts the best potential actuaries and as well prepares them for a career that is likely to be far from the narrow, technical job for which many of us were trained. This can be accomplished with three, complementary, actions:

(i) Eliminate examining and qualifying students on the subjects of calculus, linear algebra, numerical analysis, operations research, and economics. Instead, do not allow individuals to attempt the subsequent examinations without evidence that they have studied these subjects. This will provide the necessary warning. For those employers who have relied on the early examinations as a screening device, a qualifying examination could be constructed. It would also give prospective actuaries an indication of their potential.

(ii) Encourage universities to offer one or two semester introductions to actuarial science as electives in the insurance, mathematics, or statistics majors. This course would include the mathematics of finance, life contingencies and risk

theory. It would be a prime recruiting device for the profession and would attract many students who might not have considered a major in the subject. The actuarial societies could construct the ideal syllabus for the course much as the mathematical associations do.

(iii) Create meaningful MS programmes in actuarial science. Rather than being second BS degrees, have them build on solid mathematics and statistics foundations to explore actuarial mathematics in detail. These must be supported by the actuarial profession if not financially, at least morally, by encouraging the best students to participate in these programmes rather than luring them into working at the earliest possible age.

Perhaps the best part of this proposal is that it satisfies both sides of the manager/technician debate. Spending the minimum amount of undergraduate time on specific actuarial subjects will allow more time for the liberal arts, writing, speaking, and general business. On the other hand, a true graduate programme will provide the advanced technical knowledge that is becoming more and more important.

The proposals given above would retain about 75% of the current examination system. Further reductions are clearly unattainable at this time and are just not worth contemplating. Also, the number of actuaries required is far more than universities can currently provide, so alternative (that is, the traditional route) methods must continue for some time.

6. Comment on Norberg

Nothing in this paper should be construed as contradicting the position put forth by Professor Norberg. I hope we all take for granted that actuarial science is a worthy discipline with considerable intellectual content and there should be university programmes devoted to its preservation and enhancement. On the other hand, the job description of the actuary is broad enough to encompass a wide range of activities and it is equally clear that universities can serve a valuable role by training individuals for these tasks. As American actuarial education has concentrated on this latter role, I have chosen to concentrate my remarks in that direction.

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