In the firing line: actuarial educators and education

by

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Abstract

Professional actuarial courses are not designed to fit into the framework of university study, and yet it is through degrees in actuarial science that a large number of students currently enter the profession.

Constrained to deliver the maximum number of professional actuarial courses, such degrees tend to poor pedagogy and a shallow coverage of several fields. This article recommends that professional actuarial bodies discontinue undergraduate level teaching in favour of more advanced specialist courses, and that undergraduate actuarial science degrees be restructured. Discussion is placed in the context of the areas of expertise expected of actuaries, and a final section considers possible future directions for actuarial education in New Zealand.

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1 Introduction

Amidst the constant clamour for increasing quantitative skills in the financial sector and beyond, one aims to increase, or at least maintain, the quantitative capabilities of the actuarial profession.

The current structure of professional actuarial exams is not conducive to achieving this aim. The actuarial profession should discontinue teaching undergraduate level material; and undergraduate actuarial science degrees designed primarily to teach a large number of basic actuarial courses should be fundamentally refigured. As currently constituted, such degrees do little to advance the core competencies, quantitative or otherwise, of the actuarial profession.

To call for the abolition of a large chunk of the actuarial profession’s current teaching activities is a brave call, of course, given the strongly entrenched nature of the education system within the profession. Nevertheless the rationalisation of the educational millstone would free resources within the professional bodies to run more advanced courses of material in which actuaries have a comparative advantage, courses in which actuaries would be keen to become involved, and which would be popular within and outside the profession.

Far from diluting academic standards of the profession, standards would be enhanced by focusing upon the profession’s core strengths. The actuarial profession is ill-equipped to mimic the educational role of universities. Maintaining high standards for the profession in designated higher level areas of expertise should not require a comprehensive educational effort at lower levels, when that lower level material is readily available to be taught elsewhere. What is needed is careful supervision of the accreditation processes for the subject matter not taught in-house.

If recommending the abolition of the lowest level professional actuarial exams is a brave call, how much braver again to propose radical alterations to undergraduate actuarial science degrees? Such degrees are highly sought after,
and frequently accept only top students. As presently structured, however, there is little doubt that pedagogically these degrees are suboptimal in many respects, and a poor foundation upon which to base a profession.

In Continental Europe entry into the actuarial profession is also by university study, but the profession on the Continent is far more mathematically inclined than the UK profession. The North American actuarial bodies have broadly attempted to steer a middle course between these diametrically opposed actuarial traditions. This paper considers primarily the education of actuaries within the UK system, i.e. broadly speaking in the former British colonies, and which follow the UK exams, at least to tier 1 level.

Some background to the current situation in which actuarial education is placed is charted in §2 of the paper, while §§3 and 4 are devoted to discussions of professional actuarial papers and actuarial science degrees respectively. In §5 we adumbrate basic areas of expertise that an actuary should possess, delineating those which should be taught by the profession; and a conclusion follows a discussion of actuarial education in New Zealand.

## 2 Historical overview

Thirty or forty years ago it was the norm for an intending actuary to work with an insurance company upon leaving school and study for the actuarial exams part-time over a period of years. The paradigm then changed to taking a degree with a large mathematics or quantitative component, upon completion of which one commenced working with an insurance company and studied for the actuarial exams ab initio. The situation has changed again, and many younger actuaries have now completed actuarial science degrees offering many exemptions from professional examinations. They enter an actuarial traineeship with little maturity and scant real-world knowledge of insurance and finance, but having passed several tier 1 professional exams.

The teaching of actuarial science at universities is not a recent phenomenon.
In the UK such teaching dates from at least the 1940s, and possibly earlier, when the Actuarial Tuition Service taught occasional classes at the London School of Economics. The teaching of actuarial science degrees at universities is now widespread, and has become in the former English colonies at least the most common conduit into the profession.

The shift from teaching actuarial science from within the profession to teaching it in universities did not however greatly alter the nature of the product offered. Professional actuarial papers were and are still designed to be taught by correspondence, on a stand-alone basis. And whether taught by the profession itself or vicariously through the universities, the nature of the product remains standardised. The first tier actuarial courses are offered within undergraduate degrees, graduate diplomas and masters degrees, as well as on a one-off basis. This in itself bespeaks some ambiguity as to the level at which these courses ”sit”.

Studying at university is very different from studying while working full-time. The emphasis in university education should be on the overall learning package, in which one course is considered in the context of the overall achievement in an area of knowledge, and progression in one’s overall abilities as one completes a degree.

3 Professional actuarial papers

Ostensibly the actuarial professional courses constantly adapt to changing circumstances, with three overhauls of the exam structure over the last dozen years, and more such reconstructions over the preceding decades for those actuaries with longer memories. Although the material in the exams was in each case rearranged, and changes were dignified by an altered nomenclature, the nature of the professional educative process was not radically changed by such relabellings.

From the professional bodies’ viewpoint, assessment of actuarial courses
solely on the basis of a three hour exam was desirable, not least because actuarial exams were offered worldwide, and needed to be standardised as much as possible for administrative practicality. Moreover, each paper had to be as self contained as possible, again because students of varied backgrounds were taking these exams, and taking them in different orders. There was an attempt to give a thorough coverage in the exams of whatever topics actuaries might conceivably need, as well as a few others that one would hardly anticipate ever using, and alter that list as little as possible over time. Every few years the professional exams were restructured; but the overall content of the first tier exams did not change much.

Actuarial courses are not particularly well designed from an educational viewpoint, and only partially because of the impracticality of using any form of internal assessment. Coherence and flow are sometimes poor, with an idiosyncratic mixture of topics, often combining elementary and more advanced topics in the one course. An example is CT8, making the traverse from elementary finance theory to a quite selective representation of more advanced modelling areas in finance. While there is some coherence in the subject matter of CT8, the breadth of coverage simply means that the more advanced topics are not treated in any depth. The earlier subject matter should be covered in second year finance, the latter material should be covered in depth at honours level and above.

As a second example, not only does CT6 have poor coherence and flow, one could also make exactly the same criticism of its predecessors in the melting pot of actuarial course realignments in recent years, viz. A6 and I6. Some of the material is at a fairly technical level, and it is difficult to fit CT6 into an honours level course. The ebb and flow of topics into and out of this course over the years gives one the impression that it is the dumping ground for material which did not fit easily anywhere else; although in fairness to those designing this course, there is much material in this course that actuaries should know.

As a final example, CT1 does not have enough technical difficulty and content to fit in anywhere easily in the university curriculum. It sits rather uneasily with elementary finance courses at say second year level, and is not really
suitable for teaching at a higher level.

Comments above notwithstanding, most of the material in the first stage actuarial exams lies at an undergraduate level of technicality from a university viewpoint, so that in theory there is little problem in devolving such teaching to the universities. But the extent of devolution must depend on the nature of the particular course. Mainstream academic material in statistics, finance, economics and accounting should not be taught by actuaries: a student with good passes in two third year statistics university courses could for instance be expected to be familiar with most of the topics covered within the tier 1 statistics and probability courses, or to be able to pick up anything unfamiliar from those courses relatively quickly.

Where the more advanced actuarial courses depend on such mainstream subject matter, the underlying material should be assumed known, and it could if thought desirable be covered in a technical note made available freely through the professional bodies. Nor should mathematics per se be taught by the profession: if a student has passed a third year mathematical statistics course with a good grade, his mathematical strength may be assumed to suffice for further actuarial study.

Intending actuaries would undergo an accreditation process ensuring that they have solid grades in approved university courses, say to two third year courses in each of statistics and finance, and to one second year course in each of macroeconomics, microeconomics and accounting. Passes in those courses could be expected at a high level, possibly a B+ average or better. Accreditation will need to be all the more carefully done, because there will be no absolute benchmark against which to judge courses, whereas at the moment courses run by the professional bodies act as benchmarks.

While tier 1 exams may be pitched at an undergraduate level of difficulty, that is not to say that universities are likely to teach all of the topics therein. Basic topics like compound interest and life contingencies, with their idiosyncratic topics and notation, could possibly still be taught by the profession; but a more appealing alternative is simply to make this material available as technical notes for those taking higher level actuarial courses. The same
applies to other individual topics not typically taught within universities other than in actuarial science degrees.

The discontinuance of much or all of the professional bodies’ teaching of undergraduate university level material would have far-reaching ramifications. Comparability with educational programmes of other actuarial professional bodies would certainly be impacted, and in particular convergence of the UK, Australian and North American qualifications. While it is believed that Solvency 2 will not impose as homogeneous a structure on insurance regulation in the different countries of the EU as the second Basel accord is doing for regulation of banks, how far the new directive will recommend or impose uniform educational processes for actuaries in the EU is unknown. To the extent to which the actuary remains in an official position certifying solvency of insurance companies, actuarial certification will need to be on a common basis throughout the EU.

A less desirable impact of the changes to the educational process proposed in this paper could be to students in developing countries, who can currently sit for actuarial exams independently of going to university. It may not be feasible, whether for reasons of cost or distance, for such students to go to university, let alone to a university which is accredited in the above actuarial sense. Even in the developed world, students unable to go to prestigious universities may find it more difficult to enter the profession. Such changes may well make the profession more elitist, depending to some extent on how the accreditation process is handled. Conversely, discontinuance of actuarial science degrees may prove to be a levelling influence, in that students who do well in say a Science or Arts degree are not put at a disadvantage vis-a-vis those aspiring to enter the profession through an actuarial science degree.

4 Actuarial science degrees

Conscious of the need to preserve comparability between those students who study at university and those who study while working as actuarial trainees,
professional bodies closely supervise actuarial courses taught at universities. Syllabi in the university courses are closely monitored; assessment is heavily biased towards a three hour final exam; setting and marking of exam papers are closely supervised by external actuarial assessors; and exemption from the corresponding actuarial professional paper is granted only on the basis of a sufficiently high grade in the university course, and typically only for a 2 or 3 year period following completion of that course.

As a result, the typical undergraduate actuarial science degree is narrow pedagogically, crammed with preliminary courses in several disciplines and the maximum number of actuarial courses, and offering little opportunity for study of arts/science courses of a broadening nature. Graduates in actuarial science may gain a large number of exemptions, but they tend to be jacks and jills of several trades and masters of none. They know a reasonable amount of mathematics, statistics, finance and investment, economics, computing and accounting, but they have not delved deeply into any of those areas, nor are they well equipped for higher studies in any of those disciplines. Restricting intake to the brightest students mitigates the problem; but cleverness does not of itself make for maturity and powers of lateral thinking. University should be a broadening, enjoyable experience of learning and maturing, and we do the profession no service to allow undergraduate actuarial science degrees as presently structured to become the principal mode of entry into the profession.

From the other side of the student/lecturer divide, the supply of actuaries with thorough practical knowledge of the insurance and financial sectors on the one hand, and strong academic research potential on the other, is limited. Adding to this the requirement that staff have an aptitude for teaching makes for some difficulty in recruitment.

With the standardised academic product within a degree designed to squeeze the maximum number of exemptions from 3 years of study, actuarial lecturers need to generalise, and it is not easy to develop strengths to build up a publications record, on which advancement at university primarily depends. Partly because of the proliferation and long history of directly vocational law and accountancy courses at universities, teachers in those areas tend to
be more specialised and to have found publishing niches in areas proximate to those in which they teach; and there has built up over time a good supply of professionals who successfully combine teaching, academic publishing and contact with industry. These advantages are yet to accrue in actuarial science.

Undergraduate degrees in actuarial science should be restructured, aiming to bring students to solid third year level in mathematics, statistics and/or finance, or at least two of these areas, depending on the students’ preferences. Optional courses chosen from English/arts/science subject areas should be encouraged. As lower level teaching is phased out by the actuarial profession, there will be less incentive to continue teaching undergraduate actuarial degrees as presently constituted.

Restructuring of undergraduate actuarial science degrees along these lines would give graduate diplomas in actuarial science an enhanced role, partly to give students sufficient background to take professionally taught higher level courses such as those in category 5 of the list in the next section, and partly to teach some of those higher level courses. Honours degrees are less suitable for this purpose: what is required is a general upskilling, not further intensive study in one field.

5 Desirable areas of expertise for actuaries

There are broadly speaking five areas in which actuaries could be expected to have some expertise.

1. mathematics, especially
   (a) advanced calculus
   (b) linear algebra
2. statistics, at third year level
(a) applied statistics
(b) probability, mathematical statistics

3. finance
(a) basic finance, at second/third year level
   (i) finance theory
   (ii) corporate finance
(b) more advanced financial mathematics
   (i) stochastic processes, Ito calculus
   (ii) financial engineering
   (iii) fixed income modelling
   (iv) derivatives

4. economics and accounting, at second year level say
(a) macroeconomics
(b) microeconomics
(c) accounting

5. more general, often less quantitative areas
(a) risk management
   (i) generic
   (ii) financial
(b) institutional finance
   (i) trends in insurance, banking and securities regulation
   (ii) convergence in finance sector
   (iii) ART, securitisation, risk transfer, sub-prime crisis
   (iv) legislation: IFRS, Sarbanes Oxley, internal/external auditing;
       other compliance areas
(c) insurance
   (i) life
   (ii) general
(iii) reinsurance
(d) pensions
(e) investment expertise
(f) management expertise

While the profession has a keen interest in actuaries possessing a solid skill set from the first four areas, teaching of those areas should be devolved to universities or other outside bodies. It is in the fifth category that actuaries’ comparative advantage lies; and professional qualification should in major part be via solid passes in two or three of those subject areas.

Final qualification as an actuary could depend on a thesis, possibly as part of a masters degree in actuarial science, written under joint university/professional supervision, and defended publicly. During their research, intending actuaries should present a public lecture concerning their findings. Alternatively the higher degree could come after qualifying as an actuary, in the nature of CPD.

6 Actuarial education in New Zealand

The New Zealand Society of Actuaries and the life insurance industry in New Zealand supported the financial mathematics programme at Victoria University of Wellington (VUW) for 6 years from 1989, withdrawing their funding when the shortage of actuaries in the 1980s eased. It was clear that the fall in demand was not simply the downturn of a cycle, but represented a major shift in actuarial employment opportunities away from pensions and life insurance, among other factors.

In the absence of further outside support, the actuarial component of the financial mathematics programme at VUW diminished, with the emphasis in the programme shifting to risk management and insurance studies, and
financial mathematics considered more generally and at a higher mathematical level. The last actuarial course at VUW has recently been discontinued, so that there are currently no professional actuarial courses offered at New Zealand universities.

Comprehensive actuarial programmes, on the other hand, are available in four universities in Australia, with further universities vying with each other to set up such programmes. How desirable and feasible is it for New Zealand to attempt to emulate the Australian model of actuarial education?

Even in the absence of change in the professional bodies’ offering lower level courses, and despite the reservations expressed elsewhere in this paper, a case can be made for setting up an undergraduate actuarial science degree in New Zealand along the lines of existing degrees in Australia. Arguments for this course of action turn on the points that demand for actuaries in Asia and Eastern Europe is strong, and not likely to diminish soon; and with current student numbers, that actuarial science degrees are excellent money-spinners.

The contrary arguments are however also compelling. The financial burden of setting up an actuarial science degree in New Zealand is substantial, and would need to be shouldered collectively by the profession, the finance and insurance sectors and government, inter alia. The return from setting up such a degree would moreover not be forthcoming for some years, even assuming student numbers hold up. But it is not guaranteed that student numbers in actuarial science will remain high in the medium term.

Much recent student demand for education in Australia and New Zealand has come from Asia, principally from China. Despite growth in student numbers world wide forecast for the short-term future (e.g. Economist (2005b)), it is by no means certain that the large numbers of chinese students coming to Australia and New Zealand for study will be maintained.

China is in a race to develop prestigious universities at home, partly to provide top class education internally and partly to staunch the flow of chinese students going abroad to study, although the process is in its infancy, and
being developed for the moment in collaboration with western universities (Economist (2005a)). There are also firm indications from current university enrolments in New Zealand that the number of chinese students is falling.

Whether the current actuarial education framework alters or not in the medium term, for New Zealand in the short term it is probably more feasible to aim at setting up a specialised actuarial science graduate diploma rather than an undergraduate degree. Besides the reduced cost, diplomas can be taught in conjunction with existing advanced quantitative courses in financial mathematics and finance. Diplomas are also less susceptible than three year degrees to the professional bodies altering the content of the professional examinations at relatively short notice. A yet cheaper approach would be to offer actuarial courses through a diploma and masters degree combination in a cognate area, such as in the financial mathematics programme at VUW.

But there seems little likelihood of either initiative going ahead with the Australian Institute’s insistence that an actuarial programme at university be either all or nothing: all of the tier 1 courses must be offered, or none at all. This requirement, plus further conditions laid down for the teaching of actuarial courses at university, means that offering actuarial courses through stand-alone diploma/masters degree programmes of any sort are in the short term at least impracticable.

7 Conclusion

Professional bodies need to concentrate on their core strengths, and deal more effectively with a financial sector which has been turned on its head in the last 15 years, with hugely increased emphasis on enterprise risk management and the regulatory environment; capital markets being used to a far greater extent and to increasingly diverse purpose, especially with derivative securities and risk transfer; intensive scrutiny of corporate governance in the wake of Enron, Worldcom and the subprime crisis; an extraordinary concentration of key areas of the financial sector through mergers and acquisitions;
and an economic environment in which the largest economy in the world has not experienced a depression for some 13 or 14 years, despite running very large public sector and balance of payments deficits for some years. In this intensely interesting and challenging economic and financial environment, the actuarial profession has much to offer. But delivery of what it has to offer suffers because of the distraction of teaching low level courses to intending actuaries.

Problems arising from a model of actuarial education which has not fundamentally altered for some decades are obvious; and the profession needs to think about altering that model very substantially.

References

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