STATISTICS EDUCATION FOR ACTUARIES: THE SYLLABUS FRAME

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Access to the actuarial profession varies widely across countries. This causes actuaries difficulties in being recognized outside their country of origin, showing a paradox in the frame of the European Union that bans the barriers in the labor market. With the aim of solving the problem, the Groupe Consultatif Européen, a European actuarial association, has developed a Core Syllabus that states the basics of what an actuary must know wherever its origin. What we discuss here is the importance of statistics in the education of actuaries. The paper is organized as follows. After an introduction where the actuarial profession is defined and the different ways of access to it are shown, we will go through the description of the Core Syllabus, paying special attention to the contents of the statistics topics. We will go then into a description of the present situation in Spain, just before the concluding remarks.

INTRODUCTION

The actuarial profession is one of the oldest related to the economic and financial worlds. According to the *Encyclopedia of Actuarial Science* (John Wiley and Sons, Ltd, 2004), the formation in London in 1762 of the Society for Equitable Assurances on Lives and Survivorships as a mutual company, initiated a process that created a public purpose for actuaries. Gordon and Howell (1959) offer different criteria for defining a profession:

> First, the practice of a profession must rest on a systematic body of knowledge of substantial intellectual content and on the development of personal skill in the application of this knowledge to specific cases. Second, there must exist standards of professional conduct, which take precedence over the goal of personal gain, governing the professional man's relations with his clients and his fellow practitioners.

These two primary criteria have led in practice to two further ones. A profession has its own association of members, among whose functions are the enforcement of standards, the advancement and dissemination of knowledge, and, in some degree, the control of entry into the profession. Finally, there is a prescribed way of entering the profession through the enforcement of minimum standards of training and competence. Generally, the road leading to professional practice passes through the professional school and is guarded by a qualifying examination. It is of general agreement that actuarial profession meets the first of the criteria, which makes the main difference between the scientific basis on which the profession lies, and the necessary social application of this basis. The body of knowledge has always been related to several aspects of mathematics, business management, law and economics, but obviously, times have changed since those early days, and actuaries have met the challenge successfully.

The second criterion is also satisfied by the actuarial profession. There are several actuarial associations all around the world. Since 1998, and on the occasion of the 26th International Congress of Actuaries held in Birmingham, UK, the General Assembly of the International Actuarial Association (IAA) constituted itself as an association in accordance with Swiss Law; the IAA is the continuation of the "Comité Permanent des Congrès d'Actuaires" established in 1895 as an association of individuals. According to the IAA web page (http://www.actuaries.org/):

> The restructure created a single, stronger unified framework to ensure unity of direction and efficient coordination with respect to issues of a world-wide nature. The major responsibilities of the IAA, that brings together the actuaries in the respective countries and is the link between the actuaries and the actuarial associations worldwide, are now in the hand of the member associations. The IAA is the unique international organization dedicated to the research, education and development of the profession and of actuarial associations.

There are over 50 actuarial associations in four continents.

One of the main discussions in the heart of the IAA has been, since a long time ago(long time), the process of becoming an actuary. At the moment, any individual being a full member of an association represented in the IAA can become member of any of the six sections of the IAA; but, as Cole (1989) shows, there's a wide variety of forms for becoming an actuary. Basically, there are two ways: the Anglo-Saxon one, which requires an examination organized by the corresponding association; and the continental Europe and Latin American one, which just requires a university program. For instance, and according to Daykin (2002), just in Europe there are the following six ways of entering the profession:

- Professional body provides a (sets) full set of examination in Greece, Netherlands, and the UK;
- University plus professional examination in Germany, Netherlands, Sweden, Switzerland and the UK;
- Government controlled examination in Italy, Finland and Greece;
- University education only in Austria, Belgium, Denmark, Portugal, and Spain;
- Actuarial university or other university plus dissertation/jury in France; and
- Reliance on qualification routes in other countries in Ireland, Luxembourg, the Channel Islands and Cyprus.

Because of the variety of entries, the IAA Education Section reflects on its web page the aim of recommending "education guidelines and a syllabus for an internationally recognized actuarial qualification; (…) arrangements to facilitate the exchange of information about programs or opportunities for continuing professional development (CPD) available in the countries of member Associations." It also states:

> to encourage the development of internationally orientated actuaries and to consider arrangements for the build-up of a database with particular reference to CPD requirements. The IAA education guidelines and syllabus, adopted in June 1998, will require a member association to match the criteria in the syllabus in order to be granted 'full member' status, starting in 2005.

This is just what the next section is about.

THE SEARCH OF THE MUTUAL RECOGNITION IN THE ACTUARIAL FIELD

The previously shown wide variety of entries to the profession is the reason that prompted the "Groupe Consultatif" to present an ambitious project with the horizon of a mutual recognition of the profession in a boundary-free Europe. One of the pillars of the European Union lies in the freedom of movement and establishment. This remains a utopia in the actuarial profession, because neither an English one can act in Spain nor a Spanish in Germany or France. In the late nineties the "Groupe Consultatif" started a hard work that in May 2002 resulted in the last amended version of the "Core Syllabus for Actuarial Training in Europe," providing both "a tool to aid associations in reviewing their own syllabuses" and "a tool to new associations wishing to develop a syllabus" (second and third "Purposes," EACG, 2002).

With the main objective of the mutual recognition between the different professional organizations within Europe, the actuarial formation in Europe was then prepared in four stages. The first one, the Stage 0 or Preliminary Stage, includes subjects that are not specific to the actuarial science but are seen as essential. The second one, the Stage 1 or Actuarial Foundation Stage, is filled with those subjects that form the core of the actuarial science. The third one, the Stage 2 or Generalised Application Stage, includes those subjects "in which the principles and practice of actuarial techniques are developed in a variety of applications areas." And the fourth one, the Stage 3 or Country Specific and Specialist Stage, which tries to cover the specific aspects of the actuarial profession in the country the student is going to develop her career, providing a deeper knowledge in some risk management areas as well.

Subjects covered in the Stage 0 include mathematics (with the aim of providing a support in the correct understanding of some other subjects and getting some expertise in mathematical modeling), probability and statistics and stochastic processes (subjects that will be reviewed with deeper detail in the following sub-section), computing (with the horizon in mind of handling modern computing techniques), economics (with an specific attention to its links with actuarial

and financial areas), accounting and financial reports (providing an understanding of the financial statements and accounts of insurance companies and financial institutions), structures and legislative instruments of the European Union (not compulsory, but recommended as a part of an European qualification), communication skills and language skills (regarding the explanation of actuarial concepts to non actuaries and the acquisition of information in at least two languages of the European Union).

Stage 1, the Actuarial Foundation Stage, proposes to transmit (pretends the transmission of) the basis of what an actuary is. Matter of interest in the stage are financial mathematics (with the objective of providing the foundations of them and their applications to actuarial science), survival models (that will be reviewed in next sub-section), actuarial mathematics (with the aim of providing a deep knowledge in those mathematical techniques with a relevant interest to actuarial work in life and health insurance and pensions), risk mathematics and investment. Both of the latter subjects have always been of interest for actuaries, but not only of them. In the last decade, the approach between the actuarial and financial worlds is a fact. The development of elements of alternative risk transfer, for instance, both from investment banks and reinsurance companies, as stated in de Paz (2005) or Myers (1999), is just the beginning of a mutual collaboration despite of the concurrence.

The Generalised Applications Stage or Stage 2 includes the development and the application of the actuarial and financial tools acquired in the previous two in a wide variety o risks, emphasizing that an actuary can act wherever the risk is present, not just in its original field. The subjects covered are life insurance (with the aim of instilling "the ability, in simple situations, to use judgment and apply the principles of actuarial planning and control needed for the operation on sound financial lines of providers of life insurance," as EACG, 2002, p. 18, states), general insurance (with the same purpose as the previous one but related to the providers of general insurance), pensions (once again the same objective, related now to the providers of pensions) and living benefits (now related to the providers of health insurance/living benefits).

And finally, Stage 3, the Country Specific and Specialist Stage, proposes that the actuary gets the necessary skills related to the country where he or she is intending to work. Also, a deeper study of some risk topic is required to definitely achieve the training process. It is interesting to mention that the present stage is specific for each country and hence does not form part of the common core.

Review of the Statistical Contents of the Core Syllabus

Both the first and second stages take into consideration, as it should be easily understood, some kind of statistics.

In the Preliminary Stage there are two specific subjects on statistics, the Probability and Statistics and the Stochastic Processes. The first one is intended to cover the basics of a first course on probability theory and some topics on operations research. The student has to handle a wide diversity of questions from the basis of data sets, the concept of random variable, transformations and generating functions, probability distributions, sampling, central limit theorem, up to inference theory including confidence intervals, hypothesis testing and analysis of variance. Furthermore, correlation and regression analysis are also covered within the topic. On operations research, notions of decision theory and simulation methods are also required.

The Stochastic Processes (SPs) topic is also intended to provide a starting vision of the main kinds of SPs and their importance in the actuarial work. In order to do this, the course has to cover the principles of modeling, the classification of SPs, Markov chains and processes, time series analysis, Gauss-Wiener processes and simulation of SPs.

But the statistics education of an actuary doesn't stop at this preliminary stage, and the following stage, the Actuarial Foundation, presents a specific subject on our area of study, the Survival Models topic. This one covers all the aspects that an actuary should handle when facing life insurance, such as transition probabilities from one estate to another (and their estimates), the construction of a mortality table, the binomial model of mortality, the study of actual against expected experience, and heterogeneity within a population with regard to sickness and mortality, among others. Obviously, that second stage is quite more specific than the first one, but requires the basis developed in the latter one.

THE SITUATION IN SPAIN FACING THE INTRODUCTION OF THE CORE SYLLABUS

At the present moment, becoming an actuary in Spain requires two conditions. The first one, is to take the corresponding grade in Actuarial and Financial Sciences. Then the second condition is for the candidate to become a member of one of the two Spanish Associations, the "Collegi D'Actuaris de Catalunya" or the "Instituto de Actuarios Españoles." These two associations have the same area of influence, so that a member of either association may act as an actuary in the whole Spain. That means that people can study the grade in Actuarial Science and not being an actuary, just because they don't get associated; but neither of the two Professional Associations can reject anyone who has the corresponding grade (of course, there are questions of discipline that could ban acceptance). In Spain there exist three different grades: short cycle grades, with a length of three years, and that usually prepares for a fast access to the labor market; long cycle grades, between 4 and 6 years (Engineering, Mathematics, Business Administration, Law, Medicine, etc); and second cycle grades, as Actuarial and Financial Sciences. For entering a second cycle grade students must have accomplished at least a qualifying short cycle grade; those for Actuarial and Financial Sciences are the first three years of the grades in Economics or in Business Administration, or the short cycle grade in Statistics. Students with a full long cycle in Law can also enter the grade, but along with those having the short cycle grade in Statistics they should take some courses on economics, accounting, and mathematics, which are compulsory.

Here is a big difference between the U. S. and Spain: the Casualty Actuarial Society, one of the most prestigious American Associations, observes as the first skill for an actuary the "specialized math knowledge (calculus, statistics, probability)" (refer to http://www.beanactuary.org/hs/skills.cfm). In Spain, people having a full long cycle grade in Mathematics can neither enter the grade in Actuarial and Financial Sciences, nor become actuaries.

In 1999, the European Ministers of Education issued a Joint Declaration for establishing a European Higher Education Area (the so-called Bologna Declaration named after the Italian city where it was signed). According to this, by the second decade of the present century (starting 2011) all the European countries must have set in place a common higher education plan. The main reason for this is obviously the demolition of the present barriers that hinder the recognition of the different grades through the different countries so that a French doctor should then be able to act in Spain without any trouble.

But this beautiful objective will necessarily cause some problem in the case of our profession, because the Bologna Declaration does not consider the second cycle grades, as the Spanish Actuarial and Financial Sciences. These grades should be replaced by professional masters degree programs. And, at the moment, if a University decides to undertake a masters program in Actuarial Practice (or whatever the name) the second problem arises: those having this masters degree cannot enter the profession, because they don't fulfill the requisites.

At the present moment just one Spanish university offers a masters degree program according to the specifications of the Bologna Treaty; at least three others are preparing their own masters in the area of Actuarial Science. But it's just a question of time, and the present situation will change sooner or later.

Let's now fix our attention in the situation of the Spanish universities facing the conversion of their second cycle studies in Actuarial and Financial Sciences into the master, and specifically in the Statistics field. Nowadays there are 13 different universities offering the second cycle grade in Actuarial and Financial Sciences, 11 of them being public universities. According to CCO (2005), around 600 new students have entered the grade by October 2005, and by the academic year ending 2003 there had been around 1000 students taking their grade in Actuarial and Financial Sciences. The number of students may not seem very high, but the two Spanish Actuarial Associations have around 2000 members (the most important one, the "Instituto de Actuarios Españoles," with over 1500 according to its web page http://www.actuarios.org/) so the total number of students taking the grade in Actuarial Sciences is about a half of the total number of Actuaries in Spain at the present moment.

In terms of the contents of the different programs offered by the universities, it seems that at least in the field of our matter of interest almost all the objectives defined by the Core Syllabus are met. All the universities cover all the contents of the Actuarial Foundation Stage according to

the general presentation of the Survival Models topic, and they all cover all the topics of the two subjects included in the Preliminary Stage, with the exception of the simulation of stochastic processes one. The reason is that at the moment that the simulation requisite is not required for being an actuary in Spain. That means that just a minor revision and update of their present programs in Actuarial Statistics is required to meet the challenges of the mutual recognition agreement that the Core Syllabus for actuarial training in Europe looks for.

CONCLUSION

As we have tried to show in the previous paragraphs, statistics is one of the basis of the Actuarial science. Being one of the most ancient professions in the financial and economic fields, the handling of risk has always required a deep knowledge of statistics.

The present situation is that actuaries from a country within the European Union cannot act in another one. That is the reason why the Groupe Consultatif released in 2002 the *Core Syllabus for Actuarial Training in Europe*, with the mutual recognition purpose. It sets, as we have seen, the fundamentals of the knowledge an actuary must have for being recognised across the different European actuarial associations. Different topics in the statistics area are covered, and all of them are fulfilled by the Spanish universities offering the grade in Actuarial and Financial Sciences, the necessary qualification for becoming an actuary in Spain. Some minor revisions or updates should be undertaken. And, at least in our field of interest, Spanish actuaries could then act all across Europe. This obviously means that the job accomplished by those setting in place the present guidelines for the studies (dating from 1996) had the clarity of vision and the ability to discriminate between what was desired and what should be done.

The next step will be gaining the mutual recognition worldwide. The International Actuarial Association, through its Education Committee, states as its first Term of Reference "to determine whether the education system for a particular association or programme meets the standards set down in the IAA Education Guidelines" (refer to http.//www.actuaries.org). In that sense, a new version of the Core Syllabus for actuarial training in Europe should be approved by October or November 2005. According to some actuaries, some questions related to modern stochastic finances should be taken into consideration, because the IAA makes the point on them.

Whatever the future brings, today, more than ever, in an uncertain and fast changing world, statistics will help decision makers to evaluate the risks they face. And actuaries can look at the future with a smile on their face. As a professional common phrase states, "risk is our business."

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