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GUEST EDITORIAL

MATHEMATICS: CURSE OR BLESSING?

By H. Schmidli

It is an honour for me to write this guest editorial for Annals of Actuarial Science. Seeing the list of past guest editors, I also feel that it is a curse. How could I meet the standards my predecessors have set? It therefore seems to me to be best to write about the only thing I know: mathematics.

A well-known saying is: there are three kinds of mathematicians; those who can count and those who cannot. In any case, there are only two kinds of people. The majority of people hate mathematics. Telling people that I am a mathematician, I often hear: "I never understood mathematics." Some people even are proud not to know mathematics. Some even think that the world would be better without mathematicians. They are not aware that mathematics plays a crucial role for almost all our modern comforts of daily life, like mobile phones, computers or modern cars. The second kind of people love mathematics. And actuaries should belong to this second category. Like a student of a Danish university once said: "Mathematics makes you high." If you think about a problem for a long time, finding the solution gives you a feeling of happiness. Hence, mathematicians do not need to take narcotics or to practise risky types of sports.

One of the reasons that mathematicians often are misunderstood is that people do not know what mathematics is. Mathematics is often confounded with calculus. Since a popular method to learn calculus used to be by drill, mathematics is not the pupils' favourite topic. You have to learn and train mathematics at least one week before an exam. This opposes the pupil's behaviour to learn for a test the evening before.

People cannot imagine why mathematics could be interesting. This is the reason why mathematicians are considered to be strange. According to my experience, you find, like for any other profession, all kinds of people among mathematicians. Of course, also strange people. People then point to these strange mathematicians and say: "Typically, a mathematician!" This is a good example of adverse selection. Another reason for the bad reputation of mathematicians is due to the people applying mathematics. They often uncritically apply statistical methods and say that the result is "according to the mathematical model". Common sense may tell you immediately that the prediction is not realistic. And even if everything has been done correctly, the newspapers never write about the confidence interval or the prediction error. If the prediction does not hold, mathematicians are blamed. I am

wondering why nobody thinks that meteorologists are strange people. Or if you see the nonsense journalists write, why are they considered to be normal people?

That the work of actuaries is not really appreciated by people is only partly due to the mathematics they apply. People think that actuaries are responsible for the "too large" premia they have to pay for the insurance contracts or for the "too small" pensions they receive. As people with a good knowledge of mathematics, actuaries know that their calculations are correct. Doing miscalculations on purpose, would be against the professional ethic code and could end in excluding a member from the association. And random mistakes would be corrected by the market very quickly. Moreover, it should be mentioned that most problems with insurance companies lie in the contract or the legislation. So we could hold lawyers responsible for all the problems with insurance companies.

Mathematics is the main tool of an actuary. However, in most actuarial associations there are from time to time discussions on the usefulness of mathematics in the actuarial profession. Even in countries where you only can become an actuary if you have a mathematical degree, members do not agree on how much credit points in mathematics are needed to be able to work as an actuary. The argument often used is, that mathematics hardly plays a role in the daily work. In the beginning of my work in Copenhagen — the only place in Denmark where actuaries are educated — I experienced several times the following. When I met actuaries from a particular provider of life and pension products, they criticised our actuarial program. They said that we provide a too theoretical education, and young actuaries have to learn on the job all essentials of a life actuary. I told them, that we do not educate actuaries who immediately can work in a specific company, but actuaries who are able to solve the problems that may turn up in ten years' time. The criticism stopped after 2001, when this particular pension company almost got insolvent. That financial investments are risky, our students learnt in their courses.

For many years, ruin theory was considered to be nonsense. One argument against was that the number of claims in a portfolio is not Poisson distributed and that the process is not stationary. The availability of more complicated models in the literature was overlooked. Another argument against was, that the surplus cannot tend to infinity and that the size of the portfolio, claim size distribution as well as premia, will change with time. Since the topic usually is taught by mathematicians, they have to be blamed for not making it clear to their students that ruin theory is a technical tool only. The probability of ultimate ruin has nothing to do with the probability of default of a company but is a measure for the risk. In my opinion, ruin theory is one of the most beautiful topics actuarial students have to learn. Using elegant arguments, one gets a quite deep understanding of the

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theory of stochastic processes. Since Solvency II will use the Value-at-Risk, some sort of ruin probabilities have to find its way back into actuarial textbooks.

Financial mathematics is the story of a big success of mathematics. When it was recognised that arbitrage-free pricing is closely connected to the theory of martingales, it turned out that all the necessary theory already existed. Mathematicians had developed the whole theory without any real-life applications in mind. At first sight, it seemed as though actuaries did not have to learn the new financial theories. However, large gains on the financial market made the life insurance market less attractive to investors. It was necessary to introduce unit-linked life insurance products. These modern life insurance products could not be handled by the investment department only. Nowadays, Black–Scholes theory belongs to the core syllabus in any actuarial education.

For a long time, it seemed that more advanced mathematics does not find its way into non-life insurance. Calculation of the empirical mean and variance, maybe also skewness, seemed to be sufficient to price risks and to calculate the reserves. A series of natural catastrophes at the beginning of the nineties, however, showed that the classical methods were not enough. It became then general practise to apply "extreme value theory." I should also mention, that of course some actuaries had used extreme value theory already for a long time before it became standard. Since it was recognised that an extreme event could ruin the whole insurance world, ideas came up to transfer insurance risks to the financial market; i.e., to securitise large risks. Again, almost over night more mathematics found its way into actuarial practise.

At the moment, even more financial mathematics is on the way into the daily life of an actuary because of the Solvency II rules. In order to lower the minimal capital requirements, more complicated models have to be introduced and to be calibrated. More and more non-traditional subjects are required to run an insurance company. The actuarial profession has this time reacted quickly to the change of the environment. Actuarial societies have started to provide education for enterprise risk managers. I am sure that this will lead to a success. Actuaries namely have two advantages over ordinary people: they are experts on handling risk and they know mathematics. It is possible, that in the near future, every actuary will also become a finance and enterprise risk manager.

We do not know what the future brings. In any case, if we want to cope with the future problems like global warming, lack of water, etc, I am sure that the mathematical skills of actuaries together with their economical understanding will be the key to treat these problems from an insurance perspective. Therefore, I see mathematics as a blessing. However, I doubt that this will be recognised globally.

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