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THE FUTURE OF THE ACTUARIAL PROFESSION BY PROFESSOR PAUL EMBRECHTS

Preamble

No matter the country nor source, being an actuary is consistently rated as one of the best jobs around. There is widespread agreement that few other occupations offer the combination of benefits that an actuarial career can offer. In almost every category, such as work environment, employment outlook, job security, growth opportunity, and salary, a career as an actuary is hard to beat (see [9]). However, recently this overall prime ranking is slipping, and more and more taken over by "Data Scientist, Statistician". This fact on its own is perhaps not that alarming, however when voices from the top echelon of the insurance industry start downplaying the important role of actuarial knowledge in favour of data science, then I do find that alarming.

An article from 2017 (see [4]) said: "Mr Wilson (Red. Mark Wilson was at the time Aviva Group Chief Executive) is focused on buying start-up firms to plug skills gaps within the business and said his need for technology specialists was now outstripping demand for traditional insurance workers." He added "The skills set we need has changed (...) I certainly don't need as many actuaries anymore and I can't hire enough data scientists." Further, "We do want to change Aviva into being a FinTech". Indeed, the actuarial profession has to get used to industry increasingly using acronyms like FinTech, InsurTech, RegTech. As part of InsurTech, modern technology like the blockchain is coming up with alternative industry models for (re)insurance products. As actuarial professionals, we cannot simply shrug off this encroachment upon our actuarial ambient environment. We have to be fully acquainted with the facts underlying the changes the actuarial profession faces going forward, and this perhaps most of all for the benefit of our main stakeholders, the policyholders that for centuries have benefited from our technical expertise and societal sense of duty.

On May 30, 2018, I gave my Farewell Lecture (see [3]) as Professor of (Insurance) Mathematics within the Department of Mathematics of the ETH Zurich, with the title "*January 31, 1953, and September 11, 2001: Living with Risk*". I took up that position, as successor of Professor Hans Bühlmann, on November 1, 1989. At the time, I received an e-mail from Jean Lemaire from the Wharton School stating: "Dear Paul, many congratulations, these are some very big shoes to step into!" Needless to say, that I was fully aware of this fact and very much reminded of it as we recently celebrated the unique career of Hans Bühlmann,





who turned 90 on January 30, 2020; see [5] and photos of Hans Bühlmann addressing the audience on that day.

More than any other actuary, Hans Bühlmann has deeply influenced our profession and this over the very long period of time of his distinguished career; we all recall his famous ASTIN Bulletin editorial [2] "Actuaries of the Third Kind?" urging the actuarial profession to increasingly use its techniques also on the asset side of the balance sheet.

However, as Bob Dylan used to sing, "The times they are a-changin'". I take the opportunity of this ASTIN editorial as well as my retirement from my ETH professorship to reflect on our profession in these changing times.

Unde venis actuarius?

Indeed, where does our profession come from? An interesting topic for an actuarial essay, a party quiz question at an actuarial society dinner, or a student examination question would be: "Who in your opinion deserves the title as first actuary and why?" Of course, as stated, in particular the "first" can never be, nor should be fully answered; nevertheless, for an editorial on the future of actuarial science, it helps to take a brief moment of time to reflect on our profession's past. An excellent text on the history of insurance is [6] written as part of the commemoration of Swiss Re's 150-years celebration in 2013; see also [11]. The comments below just give a rather personal, impressionistic picture of the very rich history of the actuarial profession. I do apologise that, because of space constraints, it is somewhat Anglo-Saxon centred. I hope that the quoted literature compensates for this.

An obvious name to be included no doubt is **John Graunt** (1620 - 1674), author of the masterly "Natural and Political Observations made upon the Bills of Mortality" from 1662.

James Dodson (1705 – 1757) and **Edward Rowe Mores** (1731 – 1778) were instrumental in the founding of The Society for Equitable Assurances on Lives and Survivorships (now commonly known as Equitable Life). The latter is credited with being the first person to use the professional title actuary in relation to insurance. Perhaps less obvious, but nevertheless sufficiently interesting for me to be included is **Jane Austen** (1775 – 1817). I quote from the abstract of the excellent article [8]: "... It presents a close study of *Sense and Sensibility*, a novel in which a number of actuarial issues are central to the plot and are presented in great detail. Finally, it suggests that Austen's own background and family life meant that actuarial issues were

important in her life and therefore reflected in her novels. This paper offers a new argument for the relevance of great literature, and it offers actuaries a new perspective from which to explore and understand the history of their profession."

On several occasions, while being professor at ETH Zurich, companies and governmental agencies would ask me for names of upcoming female actuaries. This arose in me the urge to learn more about early female actuaries and the issues that these pioneering actuaries were confronted with. According to [10], the honour of being the first female actuary should go to **Lucy Jane Wright** who was appointed actuary of Union Mutual Life in Boston in 1866. On the other hand, in the UK, **Sarah Alice Hussey**, who applied for membership in 1894, was rejected because the Institute's solicitors advised that, 'in their opinion the Council had no power to admit ladies as members'. The first woman to qualify as an actuary in the UK was **Dorothy Davis**, who qualified in 1923. For me a true actuary "avant la lettre" is **Ada Lovelace** (1815 - 1852), who became famous as first programmer for Charles Babbage's Analytical Engine. As such, she stood at the cradle of the digital age. A more recent story is told in the 2016 movie "Hidden Figures" about black female mathematicians working as computer programmers at NASA in the early 1960s at the time of the Space Race. Today I especially urge my female students to take up an actuarial profession.

Quo vadis actuarius?

I already mentioned Hans Bühlmann's famous ASTIN editorial on the Actuary of the Third Kind. This actuary stands between the First Kind (the more deterministic life actuary), the Second Kind (the more stochastic non-life actuary) and the Fourth Kind (the ERM actuary). These "Different Kinds" should not be interpreted as a reinvention of our profession ever so often; as actuaries, we do not run after every fad, but more reflect on the evolving societal conditions (demographic, technological, environmental and political) within which the actuarial profession fulfils its task. On several occasions, I have defined the **Actuary of the Fifth (final!) Kind** as "**A data driven and model guided, critical and socially responsible financial decision maker in an ever-changing world governed by uncertainty.**" The first reference to "The Fifth Kind" was made by the Singapore Actuarial Society Data Analytics Committee in 2016, stressing the need for actuaries to embrace data science. As such, the Fifth Kind is not all that distant from the etymology of the word *Actuarius* originating in the mid sixteenth century as meaning "copyist, account keeper ...", so surely someone strongly linked with and helpful in reaching business decisions based on data.

In [7] the author discusses the major challenges facing our profession going forward. They include (a) The world has become a much more uncertain place; (b) We have numerous vigorous competitors; (c) The corporate governance and transparency push is placing increasing responsibility on boards and senior managements; (d) Communication is becoming a key success factor, and (e) The actuarial vocation is growing and spreading. Though written in 2004, we surely agree that today, all of (a) - (e) remain true. Certainly, (a) has not diminished, whereas concerning (b) the situation has since become much more pronounced. The deluge of data as "The New Gold" through, e.g., social networks, crowd sourcing, cloud computing, real-time monitoring

and detection, medical (on-line or app-based) screening, and environmental monitoring is overwhelming. A web-based search of “the future of the insurance industry” will give varied crystal ball views with at the centre of each **DATA**. Of course, we should not equate “data size” to “data information”. On the other hand, one of the great achievements of our modern era, where enormous data gathering of all types across our planet together with in depth methodological modelling and simulation has achieved one of the highlights of modern science, is in weather prediction. In less than 100 years, we have moved from 1-day ahead “looking out of the window” local forecasts to almost 7-day ahead global weather predictions that are surprisingly reliable. Examples which are highly relevant for (re)insurance are in storm, e.g. hurricane and typhoon prediction. The very readable [1] gives an excellent overview of this historical development.

Modern society offers many challenges for actuaries, like supply chain insurance, crop insurance, longevity bonds, the evolving world of catastrophe insurance, pandemic bonds, innovative pension systems in a historically very low interest rate environment, as well as the always-present ILS market. Areas like personalised medicine and telematics for auto insurance are just born, drones take to the sky and robots replace humans at an increasing rate. Several (but surely not all) are driven by so-called Big Data. The only viable way forward is for actuaries to embrace data science techniques or indeed work closely together with data scientists. In its societal relevance, any insurance product offers a policyholder the relief of losses due to risks encountered. These products have to be well defined, clearly understood, marketed, regulatory agreed on, correctly priced and reserved, as well as clearly communicated. This will always call for the need of actuarial understanding. Educational institutions across the world have recognised this. An example where this symbiosis between actuarial understanding, communication and data analytic expertise plays very well is in the course [12] for actuaries at ETH Zurich. Actuaries as well as actuarial societies worldwide have taken up the Data Science gauntlet. Typical examples are the Data Science Initiative of the Swiss Association of Actuaries and the Certificate in Data Science of the IFoA.

I like to conclude with a comment concerning education. Historically, actuarial education has broadly evolved into two main, rather different approaches: a more Anglo-Saxon (or indeed former Commonwealth) based training mainly in the hands of the relevant actuarial societies, versus a Continental European one very much university based. Of course, in the latter case, monitoring through the national actuarial societies must be in place, e.g. in the EU through a curriculum worked out under the guidance of the Groupe Consultatif. This guarantees minimum professional standards but at the same time allows for sufficient educational diversity that I personally find extremely important for actuarial functions within industry and regulation. Solutions to emerging societal problems increasingly require an interdisciplinary approach. Most, if not all of such problems involve an insurance component. Consequently, the co-existence of more traditional educational platforms together with educationally diversified, university-based programmes under a broad professional guidance umbrella must be the ultimate goal. A well-functioning actuarial function will increasingly involve a diversified portfolio of available actuarial skills and educational backgrounds.

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Final thought: I very much hope that the current Actuary of the Fifth Kind, upon hearing the word “snowflake”, will think as much about the beautiful mathematical structure of a real-life snowflake as well as of a cloud data platform. In the end, I do hope that she/he will surely think of a beautiful snow-covered landscape.

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- [2] Bühlmann, H. (1989): Editorial: Actuaries of the Third Kind? *ASTIN Bulletin*, 19.
- [3] Embrechts, P. (2018): Farewell Lecture, ETH Zurich, May 30, 2018, see www.video.ethz.ch/speakers/lecture
- [4] Faulkner, D. (2017): Insurance giant Aviva targets artificial intelligence investment as it looks to the future. *Eastern Daily Press*, 29 May 2017.
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- [6] Haueter, N.-V. (2013): *A History of Insurance. 2013-2017 Swiss Re Corporate History*, Swiss Reinsurance Company, Zurich.
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- [9] Society of Actuaries (SOA) and CAS: www.beanactuary.org
- [10] Traverso, L. (2019): Five pioneering women in the actuarial profession. *Actuaries Digital*, March 5, 2019.
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