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An Interview With David Wilkie

A. D. Wilkie, CBE, FFA, FIA, FSS, FIMA, Hon D Sc, Hon D Math, is chairman of InQA Limited.

Note from David Wilkie: These comments should not be taken as a careful actuarial autobiography, but rather as random thoughts stimulated by the questions, which, as will be seen, are not always appropriate to me. I would need to ask myself a different set of questions, but for the present purpose everyone replying needs to be asked the same set.

Q: Tell us about your background. How did you enter the actuarial profession?

A: I became aware of the actuarial profession through two routes. First, I went to Rugby School, a traditional English "public" school. I specialized in mathematics and my maths master, H. P. Sparling, had a relative, Phil Sparling, who was an actuary (and still is, though he is quite elderly). H. P. recommend an actuarial career to his mathematical students.

Second, in my teens my parents took me and my brother on holiday to Rosemarkie, where they met J. B. Dow (and his family), who was then Secretary of Standard Life, later General Manager (CEO in modern terminology) and later President and also Gold Medal recipient of the Faculty of Actuaries. So, my parents knew about actuaries too.

I was fortunate to get entry to Cambridge University when I was just 17 (in 1951), so I had a year available before going there, and I spent that year as an actuarial student (of the Faculty) at the Scottish Widows Fund in Edinburgh, starting on the actuarial examinations. I thus went to university with my eyes on an actuarial career, and could amuse myself at university, studying successively mathematics, economics and English in my three years—a very odd course, but interesting. Then I had two years of National Service, and during all these years I did more of the Faculty examinations, so when I went back to the Scottish Widows I was able to qualify quite quickly.

Then I realized that I knew rather little statistics, and since the Institute of Actuaries at that time had a specialized advanced statistics examination, I studied for it and passed it and the other necessary (lesser standard) examinations a year later, so I became an FIA as well as an FFA.

Q: Did you work in the insurance industry before entering academia? If yes, what prompted you to move into academia?

A: I spent my career working in insurance companies (Scottish Widows, Swiss Re and Standard Life) and then a consultancy (R. Watsons), and have never been formally employed by a university. But in the early 1980s, I was asked by Professor Jimmy Gray if I could teach at Heriot-Watt University part time, and he arranged with Standard Life that I could be seconded for two half days a week to the Actuarial Mathematics Department at Heriot-Watt. I gave lectures there in Financial Economics. This stopped when I moved from Edinburgh to Watsons in Reigate (south of London) in 1985, but I was honored by Heriot-Watt in being made a visiting professor.

When I reached an age when Watsons thought I should retire, but I did not, I approached my friends at Heriot-Watt, John McCutcheon and Howard Waters, to see if we could arrange something, so for a number of years I was a visiting professor and also a research consultant, visiting Edinburgh about one week per month, discussing some research and mainly supervising Ph.D. students.

Q: What challenges did you encounter upon entering the actuarial profession?

A: The first few years as an actuarial student, I learned how to do many calculations that are now done better by computer, calculating premium rates, surrender values, and so on. I also

studied for and passed the examinations. This was as any other student at the time.

However, as soon as I qualified, I was given a new job, to introduce Flexowriters into the office. These were electric typewriters controlled by "programs" on punched paper tape and used to produce policy documents and various record cards with the same data on them, thus reducing typing and transcription errors. These have long since been superseded by computer records. The next job was to learn how to write programs for the new electronic computer, a Ferranti Pegasus, which I took to as a duck to water. But I then went to Switzerland for a spell with Swiss Re in Zurich, then moved back to Standard Life, and continued with programming for the same (shared) computer. This was useful, because we used machine language, and I learned how operating systems, compilers and link editors had to work.

Later the office moved on to an IBM mainframe, on which Cobol and Fortran were available as well as machine language. I joined the British Computer Society, read *The Computer Journal*, and discovered a lot of mathematical things that could easily be done with computers, but were almost too much trouble to do clerically. This proved useful too.

Q: What motivated you to go into academia and/or research?

A: I had had no interest in doing research, as such, through a Ph.D. But I found myself on actuarial committees—first the Continuous Mortality Investigation (CMI) Committee (a joint committee of the Institute of Actuaries and the Faculty)—where we were faced with the desirability of producing new graduated life tables. Rodney Barnett, the then-secretary, had shown how one could minimize the value of chi-squared, but this, clerically, was very laborious. I saw how one could easily do it with a computer, and I wrote a program to that effect, using the Nelder-Mead Simplex method[1] to do the optimization. But then, remembering my statistics, I saw that maximizing the log likelihood might be a better option, and (if one assumed normality) was very similar. If one assumed a Poisson distribution of deaths, one got a different, but similar, result. In due course, along with John McCutcheon, then at Heriot-Watt, and David Forfar, who, with John, was also on the CMI Committee, a paper on graduation was produced.[2]

By then I had been moved from the computer department of Standard Life to become economics research manager, in charge of a new group of economists whose role was to advise the investment department on the general economic situation, and I found myself appointed to the Joint Investment Committee of the Institute and the Faculty, responsible mainly for the FT-Actuaries (later FTSE-Actuaries) indices. The Edinburgh side took on the fixed-interest indices. I could readily see how to write the computer programs to do these indices, including calculating redemption yields on individual bonds and fitting a curve to these redemption yields (again using Nelder-Mead). The new indices, using my program, started in *The Financial Times* at the end of 1976.

> Planning for financial savings, both personally and through institutions, will always remain part of a free economic society.

A short while after I had been appointed economics research manager of Standard Life, I met my friend Sydney Benjamin, whom I had first met when he was working for Ferranti Computers and I was learning how to program their Pegasus computer. I mentioned my new role and he said, "What is the point? It is all random anyway." From him, I took this as a serious remark and first investigated the ideas of random walks and efficient markets, and then considered the implications for insurance company investment of these ideas.

About this time, Sydney produced the notorious (and unpublished) paper at the Institute of Actuaries on maturity guarantees in unit linked life assurance. He had used the empirical distribution of past annual returns on shares and done Monte Carlo simulation to estimate the distribution of the cost of these guarantees. A revised version of his paper appeared among the papers presented to the International Congress of Actuaries in Tokyo in 1976. I did not like using the empirical distribution from the past, because it meant that no future simulated observation could be outside the past range, bigger then the biggest so far, or smaller than the smallest so far, so I fitted a normal distribution to the same data, thus allowing infinite range, and used that in a similar paper for the same Congress. Both were published in the Transactions of that ICA.[3,4]

In due course, this led to us both being appointed to the Maturity Guarantees Working Party (MGWP), which reported in 1980.[5,6] It had been observed by one member of that working party that if the past data was an example of a random walk, then it was a very straight one, and this led us to the idea that share prices might best be modelled by treating the share dividend index as a random walk, and fitting an autoregressive model to dividend yield, thus getting a model for share prices. Alistair Stalker, then of Standard Life, described this as "a drunken stagger about a random walk." In the long run, this model produced smaller fluctuations in simulated share prices than the pure

random walk model, so the guarantees might cost less, which was obviously an advantage to the relevant companies.

In the discussion of the MGWP paper at the Faculty, George Gwilt suggest that dividends might well be influenced by inflation. I took this to heart and included retail (consumer) prices in my further investigations. For the investments of an insurance company, fixed interest stocks, especially long-term ones, were also important, so I included in my data the yields on Consols, representing long-term rates, and Bank Rate, representing short-term ones. I used these because the data was available for a very long period from the 18th century.

A statistical development about this time that affected things was the publication in 1970 of Box & Jenkins' book *Time Series Analysis*,[7] which became well known in the early 1970s. Sydney Benjamin organized lectures on the subject, and I studied the book thoroughly. Later I got Standard Life to commission some work by Gwilym Jenkins' firm on my data, and since it was in Lancaster, the town where I was brought up and where my mother still lived (my father had died in 1969), this was convenient. I did meet Gwilym Jenkins once, but he was quite ill by then and died not much later. My main contact was with Gordon Macleod, his second-in-command, and he produced the first version of what I later adapted to become the first version of the Wilkie model.

The next challenge was in a working party of the Faculty chaired by A. P. (Tony) Limb on life office valuation methods. For this I developed what later became known as "the Wilkie model," which appeared in paper in 1984, presented a few weeks after the working part report, but not published till 1986.[8,9] I have spent quite a lot of time since then updating, extending and revising that model, and I am still doing so along with a younger colleague, formerly a research student at Heriot Watt, Şule Şahin.[10–16]

One can see from this story that all my research was directed toward the practical problems of life offices, getting new usable mortality tables, getting usable fixed interest indices, and reserving allowing for the stochastic nature of investments. Little of it was motivated by research for the sake of research.

Although there are different topics in all this research, they are all connected by applying statistical or mathematical models to the data, and then optimizing the parameters by the same techniques (usually Nelder-Mead). I could do this more easily through my programming experience.

Q: Who was an influential person in your professional life, and why?

A: You can see that Sydney Benjamin, who sadly died in 1992, was a significant influence, especially on my research thinking.

Earlier than this, when I was in Standard Life in the 1960s, there was no staff canteen, so we went out for lunch. I often chose a tearoom a little along George Street in Edinburgh, above the Edinburgh Bookshop (long since disappeared), and I often found Ernest Bromfield there. He was then the secretary of Standard Life (second in command to J. B. Dow), and he seemed happy to chat to a much younger colleague, perhaps to find out what younger actuaries might be thinking. From him I learnt quite a lot about the problems of senior management (in so far as he could discuss them with me) and about their attitudes. Sadly, he died in 1969 while also serving as president of the Faculty of Actuaries.

Another influential person was Jimmy Gray, an actuary who had been teaching at St. Andrews University and was then appointed to be professor of the new Department of Actuarial Statistics at Heriot-Watt University in Edinburgh. As part of my research activities at Standard Life, I attended seminars at Heriot-Watt and got to know him and John McCutcheon particularly. It was Jimmy Gray who suggested that I might like to teach part time at Heriot-Watt and made arrangements with Standard Life for my secondment.

Another actuary who had influence in a similar way was John Martin, whom I had met on the Groupe Consultatif, the small body that coordinated the actuarial profession within the European Union and was their channel to the European Commission. He was one of the two representatives from the Institute of Actuaries, and I was one from the Faculty. John was senior partner at R. Watsons consulting actuaries in Reigate (a small town in Surrey, south of London), now part of Willis Towers Watson. He had at times wondered whether I would like to join a consultancy, and when I was considering a move away from Standard Life, I approached him and in due course joined Watsons and moved to Reigate. That reduced my contacts with Heriot-Watt, which I took up again many years later.

Yet another person who has had influence is my wife, Patricia Wilkie. She did an undergraduate degree at Edinburgh University when our children were big enough, though still young, and she followed this up with research at Edinburgh, Stirling & Glasgow, and St. George's Medical School in London. In the course of all this, she got a Ph.D. I did not learn about actuarial things from her, but I did learn a great deal about doing serious academic research—at a minor level, things like the overall structure, doing a literature search, referencing correctly—but much more than this, and more than I could get from the interesting, but not always very professionally produced, actuarial papers. Each of us attended conferences that the other went to, so we both got to experience different types of conference arrangements. She has also been very supportive of my research, as I hope I have been of hers.

There is a place also for pure research, following up an idea that has sprung from the practical research, but that does not help directly with the solution.

Q: What is your personal philosophy with regard to teaching and/or research?

A: As noted, my research has been motivated by wishing to find ways of solving practical problems using the best available mathematical, statistical and actuarial tools for that.

A very good example of practical research is to be found in Ptolemy's *Almagest*, written circa 150 A.D. There is a section in Book I, about 10 pages in my English edition, in which he derives from first principles using Euclidian geometry and calculates what is in effect a table of sines of angles, at one-quarter degree intervals, accurate to about six decimal places. He derives what one can recognize as the familiar sin(A + B) and sin(A – B) formulae, cos(x) in terms of cos(2x), and the result that, if $x > y$ and both are small, $\sin(x) / \sin(y) < x / y$. In effect, he develops trigonometry about 500 years before it was invented in India, and he does this because he needs the numbers later on in his astronomical calculations. Incidentally, Ptolemy is nowadays regarded as all wrong because he assumed a stationary central earth, but he solved—very well, not perfectly—the rather hard problem of the motions of sun, moon, planets and stars as observed by someone fixed on the earth. He was a very good astronomer and mathematician.

There is a place also for pure research, following up an idea that has sprung from the practical research, but that does not help directly with the solution. A problem in, for example, risk theory is that there is quite lot of interesting mathematics that can be done, and many researchers do it. But realistic insurance liabilities are so varied and complicated that tidy analytical mathematical solutions are not possible, and one must resort to simulations. There is a lot one could do to research the methodology of simulating, but this does not seem to appeal so much to academic researchers in the actuarial and statistical fields. Perhaps more research in this area should be done.

I have too little experience of undergraduate teaching to comment on teaching. My own experience is that I have always found mathematics, if clearly explained from a starting point that I know about, completely obvious. I may find an unfamiliar field unintelligible, but then I realize that I need to go back to the start and learn about it from the beginning, which I may or may not be inclined to do. I do not readily understand why someone should find any mathematics difficult, though I know that plenty do, so I think that I would not be good at teaching them.

Many different skills are needed in teaching and in research. I believe I am seen by some practicing actuaries as far too theoretical, yet I see myself as very practical. There are theoretical pure mathematicians; their work may be used by theoretical mathematical statisticians. I use their methods and results in my research, and I try to explain carefully all the steps I have taken. This may well be too complicated for the practicing actuary who just wished to use some tools, so it may require an intermediary to rewrite my papers, omitting the lengthy justifications, and giving only the results. It is like a chain; at each stage one person uses the ideas on his/her left and passes them on, suitably transformed, to the next person on the right.

Q: Thinking back on your career, what are your biggest accomplishments? Any disappointments? Any memories or moments that stand out above the rest?

A: Obviously the "Wilkie model" must come as the top achievement. It has become quite well known in actuarial circles, but not among financial economists, which is rather a pity, because our latest papers show how the random walk models proposed by Nobel prize-winner Fama can be reconciled with the mean-reverting models proposed by Nobel prize-winner Schiller.[17] It seems rather amusing that two academic financial economists holding totally opposite views could get Nobel prizes for economics in the same year.

However, I believe I have also contributed a bit to mortality table construction and multiple state models through my work with the CMI. I have also contributed a bit to investment index construction over the years. I remember ringing up Jack Plymen, then chairman of the FT-Actuaries Indices Committee, and suggesting what later became the "xd adjustment," which records the actual income received on an index rather than the current "yield," which may omit things like special dividends and, so, be misleading about the actual results. A small, but I think useful, addition.

Q: What might someone be surprised to know about you?

A: When I was at Cambridge, I joined the University Air Squadron and learned how to fly Chipmunks, small training planes. I then had to do two years of National Service, so I went into the RAF as a trainee pilot, training first on Provosts and then Vampires, early jet fighters, and ending up with my pilot's "wings." It is tremendously exciting flying a very powerful little airplane about the sky on one's own. I am proud of having done this, because all my actuarial achievements have been based in my ability in mathematics and programming and are an obvious development of these skills. But I was hopeless at ballgames and most sports, though not too bad at swimming, and being able to do a more physical thing like flying fast airplanes was for me a special achievement.

Q: How do you see the future of actuarial science in your country?

A: I am rather out of touch now with what actuaries are doing either in life insurance or in pension funds, though in recent years they have made progress in general insurance, and the academic side has grown. The profession, in the U.K., has grown a lot in numbers in recent years, and also in several overseas countries. I don't know whether there will be enough for them to do in the traditional fields. In the 19th century, friendly societies were an important part of actuarial work in the U.K., and they diminished in importance as pension funds grew. Planning for financial savings, both personally and through institutions, will always remain part of a free economic society, so I suppose that actuaries will always be needed by those institutions, whatever they are, and perhaps as expert personal financial advisers too.

Q: What would you advise someone considering entering the actuarial profession?

A: You need to be very competent at mathematics, but you only need to know a bit, not all of it, so a full pure maths degrees is not necessary. You need to know and understand a good bit of mathematical statistics, and to have a good understanding of programming and what it can do, and can't do, even if you don't do a lot of programming yourself. You also need a lot of good business common sense, and an ability to explain things simply and carefully to those who have less specialized knowledge than you have. Nothing in actuarial work is too difficult to explain to a willing and intelligent listener. If you have these abilities, you should enjoy actuarial work, and good luck to you.

I would also advise any student starting at university (of the right sort where this is possible) to include some arts course, music (many actuaries are musical), history, art, literature, another language—something to broaden your outlook. It might even be a non-central science course, like geology or botany. I had a curious academic progress at university, ending up with a degree in English. I am now sorry I had not learnt more mathematics at that time, but I am not at all sorry to have studied English literature at that level.

Q: As you know, actuarial education has become mainstream and is taught in many universities worldwide. As you reflect on your career, are there any closing comments (or advice) that you may want to pass on to current (especially younger) actuarial science faculty at large?

A: This gives me an opportunity to make two comments. First, I see far too may papers by academics, younger and older, who use total return models of investment, wholly ignoring tax and expenses. This may be because they have no practical experience of investment, personally or professionally. But for any personal investor or investment institution, the tax position is vitally important, and many things are done with tax in mind. Further, the expenses of buying and selling have to always be considered. Taxation depends on the country, the date, the institution or the individual, and is generally complicated, but to ignore it won't do. There is usually tax on income, perhaps at different rates on dividend income and bond interest, and often capital gains tax on sales. One should use models where taxation could be allowed for if needed, rather than those where it can't.

Second, in recent years a number of firms in the U.K. and the USA have been offering Economic Scenario Generators (ESGs), but the publication of papers on these has almost ground to a halt. I have understood that many of these were based originally on the Wilkie model, and on other published interest rate models, but I would be surprised and disappointed if the providers had not made improvements in these. Yet nothing is published. I appreciate that there are aspects of commercial confidentiality, but this is no way to advance in a scientific field, where any new ideas should be exposed to comment, criticism and possible improvement from knowledgeable others. I do not know how the clients, or the regulators, can assess the quality and reliability of these ESGs when there is so much secrecy about them. ■

ENDNOTES

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17 Supra notes 12–14.