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Some Milestones in Econometric Computing

Memories of Monroe? econometric computing in the early 1960's

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This short article describes, from a personal perspective, the state of the art of econometric computing during the transitional period of the early 1960s when desktop calculating machines and the electronic computer were both used by economists very nearly indifferently. Essentially, the choice at this time was between spending time learning to program and then employ a computer versus perhaps the same amount of time making the calculations as was done before the computer using a calculating machine.

The Monroe in the title is the Monroematic a motor-driven electrical calculating machine much faster than the manual Monroe or the Marchand. This is the calculating machine which was my constant companion and fall back when UNIVAC I failed or was shut down for replacement by UNIVAC II.

I arrived at Penn in September 1961 straight from Bombay, India having done a Masters in Economics and one year on a Ph.D. programme which was not very demanding at all. I had chosen a title of my research in the first year- International Commodity Agreements- though I had not done much else as I was busy with theatre and just having a good time on finding myself in the blissful state when I no longer had to sit any more examinations (or so I thought).

But ambition got the better of me and I applied to the University of Pennsylvania for graduate studies. I knew of Penn because C.R.Whittlesey from Penn had been the Visiting Ford Foundation Professor at Bombay in 1959–1960, my final year as M.A. student. I must have been smart [then] because I did very well on my GRE scores and Penn had given me a four year Ford Foundation Fellowship which allowed me to take three [rather than four] courses and work for the rest of the time in the Economic Research Unit. There were around ten of us Fellows- Winnie Monsood who has since been a Minister in Philippines, V.N. Murthy who now teaches in Harrisburg, George Lermer who had come from Montreal who was our local rebel, Michael Davenport from UK, Donald Wood from Seattle, who went on to work in US Government later, Paul Taubman who went on to be Professor at Penn and died tragically young [there may be one or two more]. Jerry Adams was the Unit Director and Rosemary Gallagher was the Secretary. We were located in W-32, a room in the basement of the Dietrich Building, which also housed the rest of the Department and the Wharton School.

Each of us was assigned to a senior faculty member to work on projects. I was assigned to Lawrence Klein. This was based on the topic of my choice for Bombay Ph. D. Klein wanted to build commodity models and so I was going to be part of his team. There was only one snag. I had done no Maths or Stats since my high school days. I knew no Calculus or Linear Algebra; no Statistics. This is not modesty. My ignorance was profound, but my self confidence was foolhardily overwhelming. Jerry Adams was in despair when I told him how little I knew of maths or stats. He was not reassured when I told him I would learn it fast.

This is where the Monroematic came in. Klein proceeded to meet us every week. In the very first meeting he wrote down a list of commodities he wanted to build models for and while I did not know what a model was I chose tin as I knew there was an International Tin Agreement. I was told to gather some data and make scatter diagrams. The scholarly community of W-32 came to my aid as I asked what a scatter diagram was [I kid you not.] I was pointed to Croxton and Cowden: Applied General Statistics. This was another great crutch during those early days. All this had to be done without Klein getting to know [as if he could not see my transparent ignorance!].

Klein joined this conspiracy and each week set me assignments which I had to figure out for myself. He told me to do a regression within three or four weeks. Monroematic was harnessed to the task and soon I was using the table in Klein Textbook of Econometrics which laid out the Doolittle Algorithm [6] As I had not as yet learnt much Statistics [though I was struggling with the subject in Bob Summers's course], the Doolittle was my Bible and Monroematic my weapon of model construction. Soon I could do three and even four independent variables regression whirring the Monroematic at ever increasing speed.

I soon graduated to UNIVAC I. There were cards to be punched and stacked and loaded. The UNIVAC was in a building where the Electrical Engineering Department was located and so it was a bit of a walk carrying cards which could easily slip from hands and scatter [talk of randomising!]. At the Computer Centre, there were very helpful people. One of them McGonagle was a Henry George enthusiast and his colleague whose name I forget always wore an elegant bow tie. I learnt soon to load the data and read the output. I had eventually an 18 equation model of the World Tin Economy. As I had only 14 annual observations, I was lucky that the model was recursive and I did not need simultaneous estimation [2] This was because as I was about to finish up my model estimation etc, the UNIVAC I was shut down for replacement and software was not ready for UNIVAC II.

So it was back to the Monroematic. I had of course never abandoned it. During the summer of 1962, Jerry Adams hired me at $2 an hour [since my fellowship paid me $1800 for nine months for living expenses and I needed the job]. He wanted to do a Principal Components analysis of a set of data which had to do something with advertising, I vaguely recall. It was a six variable data set and Jerry had found an article by Hotelling which gave an algorithm for extracting the latent roots of a symmetric matrix [5]. Monroematic was whirring all summer since the algorithm

is immensely time consuming and demanded a lot of speed and accuracy with the calculations. At each iteration, I had to write down the numbers and re-input them for the next iteration. Anyway it paid the rent and fed me in the summer of 1962. Jerry Adams thought he could do a eight variable extension, but that proved to be much more time consuming and so we abandoned it.

But the final estimation of the Tin model was also done on the Monroematic. Klein showed me the Adelman and Adelman article and asked me to simulate the model [1] I could not, would not tell him that there was no computer software on UNIVAC II. I was not smart enough to write such software. So the entire simulation was done on Monroematic. The model being recursive I could easily substitute equations out and reduce the number of equations to be solved to two or three. I then had to shock the system. For this I had to generate random numbers. There was then a Rand Corporation Book of Million Random Numbers and we had a copy in W 32. So I proceeded to select sets of 25 random numbers to simulate the model for 25 periods. I also had to do some policy alternative runs to show what sort of stabilisation policy would work.

For each simulation, I would divide the Normal Curve in 25 equal parts and select numbers between 1 and 25 at random and arrange them along the curve from left to right. Then came the selection of random shocks. This required another search for random numbers- flip pages of the Big Fat Book of Random Numbers. Note these numbers down and then add them to appropriate equations and solve the model.

Anyway all this was done on Monroematic while the earlier stages were carried out on UNIVAC I. Had I stayed beyond the summer of 1963, I would have got on to UNIVAC II and built larger models. But I had finished my coursework and my dissertation by July 1963. All that remained was to incorporate some corrections suggested by my Thesis Committee. Off I went to Berkeley California to work in Agricultural Economics Department where I had access to IBM 1620 within the Giannini Building and an IBM-360 on campus. I did computer simulations of the California Dairy Industry [3] This was not a Klein type macro or commodity model. It was more an industry model. I had then a superb person to write programmes. Marcus Powell Jr soon went on to become a software company director after my departure from Berkeley in July 1965.

I found for many years after in Berkeley and later in London that when better electronic equipment failed me, I could always rely on a Monroematic. When the LSE was shut due to Student troubles in 1967 and my coauthor and I needed to finish a paper in time for a Conference, we carried a Monroematic back to my flat and finished our simulation of a small six equation model of the UK economy [4] That was the last time.

References

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