

A Conversation with Jianqing Fan

Yang Feng and Xin Tong

Jianqing Fan is Frederick L. Moore Professor of Finance at Bendheim Center for Finance, Chairman of Department of Operations Research and Financial Engineering, and Director of Committee of Statistical Studies at Princeton University, where he also directs both financial econometrics and statistics labs. He was the past president of the Institute of Mathematical Statistics and International Chinese Statistical Association. He is co-editing *Journal of Econometrics* and *Econometrical Journal*, and is an associate editor of *Econometrica* and *The Journal of American Statistical Association*, and was the co-editor of *The Annals of Statistics* and an editor of *Probability Theory and Related Fields*. After receiving his Ph.D. from the University of California at Berkeley, he has been appointed as assistant, associate, and full professor at the University of North Carolina at Chapel Hill (1989-2003), professor at the University of California at Los Angeles (1997-2000), professor and chairman at Chinese University of Hong Kong (2000-2003), and professor at the Princeton University (2003--). His published work on statistics, economics and finance has been recognized by the 2000 COPSS Presidents' Award, the 2007 Morningside Gold Medal of Applied Mathematics, ICSA Distinguished Achievement Award in 2008, Guggenheim Fellow in 2009, the inaugural ICSA Pao-Lu Hsu Award in 2012, and election to Academician of Academia Sinica and fellow of American Associations for Advancement of Science, Institute of Mathematical Statistics, and American Statistical Association.

On Nov 23rd, 2012, in Sherred Hall at Princeton University, Jianqing Fan was interviewed by his former students Yang Feng and Xin Tong. The transcript of this interview is presented below.

Early Life/Education (Before Phd)

Interviewers: Thanks for agreeing to have this interview. Let's start from your childhood. You grew up in a special period of China. Can you briefly describe your life before college? Any interesting experience?

Fan: Well, this was a long time ago. It is very difficult to recollect. You are right; I was raised during the cultural revolution. At that time, most places did not value education. We did not even think about what to do after high school. As for college,

few people had the luck, or even thought about it, since strong recommendations (based on non-academic factors) were needed. But I was fortunate to graduate two years after the end of cultural revolution, and took the college entrance exam.

Interviewers: When did you find out you were gifted in mathematics?

Fan: I would never say that I'm gifted in mathematics. But interestingly, people always puzzle why I was usually better than others when taking exams. When we went to school, we did not have any homework. One of the teachers was my neighbor, and he speculated that I paid more attention than other kids, which was probably not true, as I still have trouble concentrating during seminars. In any case, I have never associated myself with anything like gifted.

Interviewers: For college, were there other options besides Fudan?

Fan: This is actually a very interesting question. Math and Fudan could be one realization of a random walk. I could have applied for Peking or Tsinghua University. But spending all my fifteen years in the south, Beijing was way too cold for me, and most people including my family were too poor to buy necessary clothing. I heard that people in the north eat only grains rather than rice. Also, Beijing is very far from home (Fujian province). These are the three main reasons (I did not go to Beijing). And just like many other kids, I was inspired by the magics of physics. One wish was to go to National University of Defense Technology, hoping to make some significant impact. But people told me my family background was not good enough (to be politically trustworthy). We didn't have much information like today. Math, physics, and chemistry were the default choices for top students. In addition, Shanghai was way advanced than remaining parts of the country. So I ended up in Fudan studying mathematics.

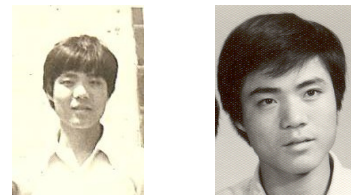


Figure 1: Jianqing at 18 in Fudan and at 22 in Chinese Academy of Science.

Interviewers: In retrospect, you were in the college class that is perhaps the best in recent Chinese history. How did this collection of highly intellectual people interact? What kind of impact did they have on you?

Fan: The Chinese colleges in my time were far more selective than they are now. There were only 20 people admitted by Fudan in my year from Fujian Province, and 3 of them majored in mathematics. Many people believe "If you want to walk far, walk together". This is true for our class. Everybody studied extremely hard back then, because the opportunity was very precious to come by. The lights of the dorm were shutdown at 9:30pm everyday. We would then went out on the streets and continued our reading under street lights. This certainly lay down a good knowledge foundation. Most people studied this hard throughout the four years. For me, I didn't study as much after the first year. I lost my interest in pure math, had concentration problems, and got hungry easily (before meal time). Thus, I did not attend most of classes after the first year and usually spent only the last one or two weeks before the final exams to pick materials taught in a semester. Believe it or not, I usually did well on final exams. Fortunately, the midterms and homework assignments did not count towards overall grades. People definitely have positive influence on each other; I remain good friends to many of my classmates. We were also lucky, being one of the first groups of college students after the cultural revolution. There was a generation gap, which gave us more room to grow as well as more opportunities. So selection bias, joint efforts and good timing are important factors of the success of our class.

Interviewers: Why did you decide to switch to statistics? Who influenced your decision most?

Fan: I chose math (as opposed to physics or chemistry), partly because there was a math fever at that time due to the overwhelming publicity of Jingrun Chen and his work on Goldbach's conjecture. Mathematicians were celebrities of sciences, and I was asked by my uncle, the most knowledgeable person in my extended family, to study math in college. Later, however, I thought math was too abstract for my own interest. I like to use math to understand the phenomena of the universe and to summarize and predict human activities. Even though I was a pure math major in undergraduate, I studied a lot of applied math subjects, like linear programming, statistics, PDE, and control theory. I indulged myself in things that interest me so much that I did not have a plan for the next step in my career. After the Chinese's New Year in my senior year, I met my

friend on the train back to Shanghai. Somehow he convinced me to take the graduate school entrance exam which he has been preparing for a year, perhaps because I was too young to think about taking a job. Then I signed up for the exam, which was only two months away. Math exam includes not only various subjects in math but also politics, which requires a lot of efforts to prepare. For statistics, they were testing on mathematical analysis, linear algebra, probability and statistics, which demand more on common sense and mathematical maturity, rather than specialized knowledge. Time limit combined with my interest led to the choice of probability and statistics, so that I don't have to prepare the more abstract subjects such as topology.

Interviewers: Were there someone you wanted to work with in the Chinese Academy of Science?

Fan: When I filed my application for graduate school, not really. The information was very limited, and we didn't have the internet, for example. Now you can easily do a research on the people from different research institutes. Back then, we can only rely on the reputation of an institution. Since I was not particularly interested in pure math, I chose naturally statistics in the Institute of Applied Mathematics of the Chinese Academy of Science, without the knowledge of who would be my advisor.

Interviewers: Was your first teaching experience during your master education? How was it like?

Fan: Yes, that was great experience. I loved it. Actually, many of my students in that course are now leaders in the Chinese Census of Bureau. The course I taught was "Sample Survey", which was about the basic skills required to collect and analyze data. It was not a course that a typical university would teach; even nowadays, many universities don't offer it. They asked me to teach it since nobody wanted to. I was told to use the book "Sampling Techniques" written by Prof. Cochran. I taught mainly on Saturdays and I had a very good time. Many students were of my age (22 years old), for example, Gang Li (currently at UCLA) and Jianxin Pan (currently at University of Manchester). I was very nervous, so I asked my teacher Yimin Pan to sit with me during the first lecture. He sat there to make sure I was respected by the students. After a while, I became friends with a number of students in this class. What I did not tell them was the fact that I learned Sample Survey for the first time while teaching them. After this course, I taught in a summer school organized by Prof. Kaitai Fang on the topic "Directional Data". Again, it was an area which I didn't know anything before. Prof. Fang gave me a book based on which I was supposed

to make lecture notes. Within only two or three months, I read the book, and wrote out 550 pages in my own understanding in Chinese.

Ph.D. and Early Career

Interviewers: You chose Berkeley to pursue your Ph.D. Was there anything that attracted you?

Fan: Again, you have to keep in mind there was no internet and we had very limited information. The only thing we had was Library of Beijing. I looked up the ranking of universities in the US. Berkeley ranked uniformly among the top in math, physics, chemistry for graduate school. I applied for Berkeley, Stanford, Wisconsin and a few others. At the time, other than they ranked on top, I didn't really know much. At Stanford, I knew a few people like T.W. Anderson and Ingram Olkin. It was a tough choice. Anyway, it was the decision I made and I would never regret. I think Berkeley treated me extremely well. I received fellowship each year, which was very difficult for continuing students. In addition to the summer support, I even got winter support because quite a few professors would like to support me financially.

Interviewers: That was certainly a memorable time. But what made you stand out among so many excellent graduate students?

Fan: When I went to Berkeley, I was better prepared than most of the cohort, because I took a three-year master program. I skipped the first course of theoretical statistics and instead took Le Cam's asymptotic statistics in the first semester. In addition, I took probability from Jim Pitman. At the end of the course, he gave us a take-home exam for a week, which contains very hard problems. I think I did very well. Since then, I was always asked to TA for probability theory and I did it for more than one semester.

Interviewers: Did you consider switching to probability?

Fan: Not really. I like it very much, but my interest in the more applied area never changed. By then, it became clear to me that statistics has more direct applications.

Interviewers: How did you choose the first few research topics at Berkeley?

Fan: In the first year, I understood most classes well. But I lost my interest in the topic of multivariate analysis which I worked on during my master education and could not find a new area to work with. It was very difficult to switch to a new area without advisor's guidance. So I didn't do any research

and only took courses in my first year. I admired those students who had problems to work on in the first year. My first two research topics emerged after David Donoho and Peter Bickel became my advisors. In the third semester, I was Donoho's TA for time series. He was extremely busy, just like he is today, probably busier because he had a young son. I felt very lucky David agreed to work with me at the beginning of the fourth semester. There was some nice results on estimating linear functionals, then David asked me to see whether I can do something about nonlinear functionals such as quadratic functionals. It took me several months to completely solve the optimal rate of convergence. Much efforts were spent on matching the upper bound with the lower bound. At approximately the same time, Peter Bickel asked me to read a paper by Raymond Carroll and Peter Hall on deconvolution. I forgot what he told me exactly, but I did get some new results which were published in the *Annals of Statistics*. Both papers turned out to be frequently cited, and Carroll and Hall became my friends. Through these two papers, I picked up a few techniques and established my taste of good problems.

Interviewers: After you completed these projects, were you ready to graduate?

Fan: I had my first daughter in the fourth semester at Berkeley. At her one-month party, someone told me there was an opening at Stanford and encouraged me to apply. That initialized the idea of applying for an academic job even though my research just started a few months ago. So I graduated in three years. In retrospect, I should have stayed for one more year. I do believe one year makes a lot of difference.

Interviewers: Did you ever consider about industry jobs? Why UNC?

Fan: Actually, in the summer after my second year at Berkeley, IBM offered me a summer internship in San Jose. Berkeley also provided summer support for me. I thought there was not huge financial incentive to work in an unknown territory. In retrospect, I should have taken the internship. Working in an unfamiliar zone often yields unanticipated surprises. Honestly, I did not know how to find an industry job, but academic jobs were advertised on the *IMS bulletin* and *Amstat News* as they are today. Therefore, I took an easy route and applied for several universities that were ranked high in statistics. I was the first candidate interviewed at UNC, and it gave me an offer before Thanksgiving right after my interview.

Interviewers: Did you have any struggles as an assis-

tant professor?

Fan: That's universal, right? My first two grant applications were rejected and so were my early versions of the papers. Certainly, it was not very encouraging. In addition, I also struggled to find problems interesting enough to convince myself to work on. Luckily after a while, I became interested in nonparametric regression, which was the sources of my works in local polynomial regression.

Mid-career to Now

Interviewers: Can you share a bit on your experience at the Chinese University of Hong Kong?

Fan: I went to the Chinese University of Hong Kong for two reasons. One is that Wing Wong just went back to Hong Kong and tried to built a strong statistics hub in Hong Kong, which had a lot of resources including research grants back then. I was first invited there as a visitor for a semester to see whether I like there, and then for another year right afterwards. I like Hong Kong because people with my culture can easily adapt, and Hong Kong is beautiful. The dean of the faculty of science knew me very well after the two visits. The Asian financial crisis in 1997-98 made the dean there think that the faculty should launch a risk management science program and I got involved with the design. That was also the beginning of my research in finance. So when the (Statistics) department launched a new risk management program in 2000 and needed to a person to spearhead the efforts, I was appointed as the chair of the department.



Figure 2: Jianqing Fan receiving the COPSS award from Marvin Zelen (left), Chair of COPSS, and Don Ylvisaker (right), Chair of the selection committee for 2000.

Interviewers: When you decided to branch out to

new areas, what kind of criterion did you use to select problems?

Fan: You two are doing well yourselves on this. For me I think in general, I easily get bored myself with a single topic. I want to branch out to learn how statistics can be used in other fields and then confront new problems that lead to the revision of the techniques I am familiar with. I was constantly searching for new topics to find problems with great social importance. As long as the problem is sufficiently important and complex, there are always rooms for innovation. There is of course a learning curve for each new area, but rewards outweigh risks. In general, as long as the problems are important and complex enough, chartering into new territories always leads to exciting discoveries.

Interviewers: You are recognized as perhaps the most versatile statistician. What's your comment on this?

Fan: I am flattered. But I just wanted to see what new fundamental insights that I can provide and what new techniques that I can invent. I do not wish to put myself in a box.



Figure 3: Jianqing in 2002 in Hong Kong.

Interviewers: Looking back, among all your papers, is there a personal favorite?

Fan: That's difficult since we tend to get amnesia on the historical significance of the papers. In addition, there are so many different areas and different directions. Citation counts give you some ideas, but I don't completely believe in citations or ignore them. I could easily pick 20 papers that I am happy with, but that can be simply due to the enthusiasm of an author.

Interviewers: In your career up to now, was there any part you would do differently?

Fan: I think yes. First, for whatever reasons, I have

been always over occupied by professional obligations and students. I could have written a few papers more clearly. Taking my 2001 paper on high-dimensional statistics as an example. I should have spent more time to explain things more clearly in the paper and to pick up a number of low-hanging fruits; I could have coined a better name like folded-concave penalty that I like to call it now, instead of "non-concave penalty". Also, I should have made better connections with LASSO via local linear approximations.

Interviewers: Do you have any advice to the new generation of statisticians?

Fan: The common difficulty is to find interesting and important research problems. A good opportunity for today's new researchers is to look out for application driven problems. You often find that the off-the-shelf tools are incapable of solving problems at hand. In most cases, existing statistical methodology needs to be adjusted or completely revised to suit a specific application and new theory should be developed. A great ability would be that after reading three to five papers, one is able to come up with a sensible problem to work on. I believe if you keep reading other people's works and talk with scientists in other fields, you will have many interesting problems to work with.

Interviewers: How do you balance advising, chairing, editorial, and other obligations?

Fan: Over the years, I always think of myself as the captain of a leaking boat in the ocean. The only way to keep it afloat is to get water out fast when it comes in. Plus, this boat should sail for a good destiny. It is very difficult, and I end up taxing on my sleep time and hobby. But, I like to work with students, participate in academic meetings, and do professional services. These give my life a purpose --- there is no time to be down. Raising students is probably the most challenging and time-consuming part. Everyone is different, and I tried my best to unleash everyone's potential. Plus, people are writing more papers nowadays than the time I graduated. I would not be able to find any job myself using today's standard, because my first paper was published two years after I received my Ph.D.

Interviewers: How do you choose students?

Fan: All professors want to work with motivated and strong students. I look for most promising students, but I also admit students who need my help. Moreover, I try to diversify the student body as much as I can.

Interviewers: What is your group size now?

Fan: I now have 12 Ph.D. students plus 4 postdocs, and it keeps growing over the last several years. Re-

member if you take 4 students in a year, they will remain in your book for 3 to 4 years.

Organizational

Interviewers: You were hired by Princeton as a statistician. After you chaired the committee of statistical studies at Princeton, did you feel much obligation to bring statistics back to prime at Princeton, like the old days?

Fan: For this, maybe we need to tell a little bit of history of statistics at Princeton. The statistics department at Princeton had a glorious past, but it was closed in 1985 unfortunately, after disagreement within the department and the retirement of John Tukey. After that, there was an interdepartmental committee of statistical studies, which was formed to continue statistical education. In the next two decades, since there is no statistics department, many departments (at Princeton) developed their own statistical courses. The committee didn't function very much before I joined Princeton. I was actually not hired to revive Statistics; rather, I was hired as a statistician who knows some finance. The department of Operations Research & Financial Engineering (ORFE) thought it needed some statistical component. I believe that the department could grow better when more investments are put in statistics and data science. We have now recruited four people in ORFE already after my arrival. Moreover, Computer Science department and Institute for Integrative Genomics also hired new statisticians.

Interviewers: Have you been taking an active role in integrating the statistical components across campus?

Fan: Yes, and I hope I will be able to play a more active role down the road. Over the years, I am thinking of a statistical center on campus to put ourselves organized and more visible. With the help of my graduate students, I put together the course listing related to statistics on the web of committee of statistical studies. As of statistics research, we are currently reemerging in a new form, meaning that each of us has an area of interest, like machine learning, finance, big data, genomics, and social sciences. Taking ORFE for example, we always hear talks in completely different areas with diverse applications. In the future, the statistics and machine learning center can host all related faculty.

Interviewers: Princeton has been a role model for other institutions. As a statistician, do you feel there is any downside for not having a statistics department?



Figure 4: Princeton's Statistics Lab in 2008.

Fan: Certainly it has some negative impact. When there is no statistics department, it is hard to find the statistical components within the university for people from outside. The current state of not having a statistical department is unfortunate and should not be an example for other universities to follow. However, the on-going efforts on statistics and machine learning can set a role model for the future of statistics and data science.

Interviewers: Nowadays, there are more and more Chinese statisticians making great academic achievements. Can you comment on this phenomenon? How do you see their future contribution in modernizing China?

Fan: Statisticians of Chinese origin have made great contributions to Statistics. Otherwise, American universities would not have an edge in statistics over other parts of the world. Suppose, for example, we take all the Chinese statisticians away, statistics at US will not have much advantage over UK. In addition, many Chinese statisticians are young, and their contributions are still yet to come. I guess the peak of the population of Chinese statisticians will be probably be 20 years later. On the other hand, statistics departments should make more efforts in diversifying the graduate student body. It will be helpful for the statistics profession in the long run. Each year, a lot of statisticians visit China, meeting with the colleagues in China, attending the international conferences organized in China. This

greatly shortens the time for statisticians in China to catch up with the current research frontiers. In addition, a lot of them teach summer courses in China, which is very beneficial for students and young researchers. To make greater impacts on society, statisticians in general should talk more to other disciplines, including industry, and make efforts to solve problems of high social impacts.

Future Plans

Interviewers: Is there a blueprint for the next 10, 20 or 30 years?

Fan: Wow, let me think. 20 years is hardest for me to predict. After 30 years, I hope I can retire (Laugh). In the next 10 years, I think I will continue my research agenda, especially on the big data paradigm. The data science plays a more prominent role in this century and it stimulates a lot of research on new statistical tools. I hope that in the next 10 years, there will be a good statistics/machine learning/-data science center at Princeton University. But this requires a lot of efforts from many people, besides tremendous support from the university. I believe as technology evolves, statistics will play a more and more important role. It will be very important for us to learn the ability of handle big data. I hope after 10 years when you visit Princeton, there will be a very visible statistical identity. In addition, since I am currently the chairman of ORFE depart-

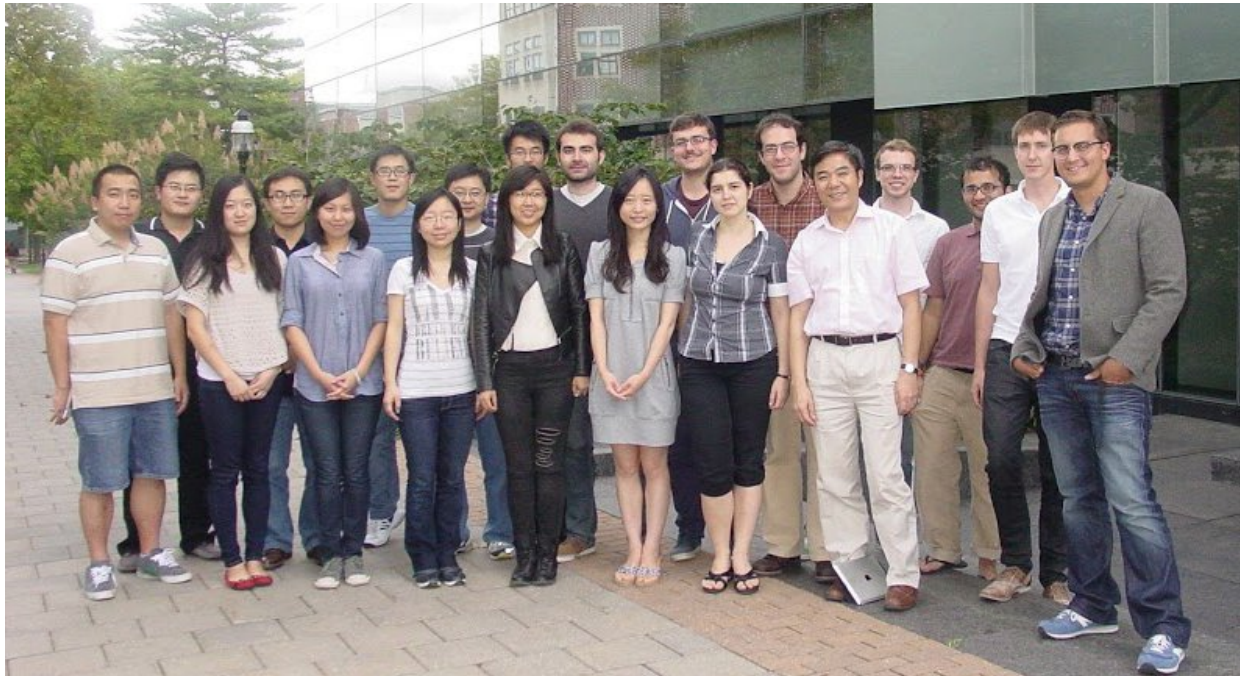


Figure 5: Princeton's Statistics Lab in 2012.

ment, I should say a few words about the department. ORFE is a very interesting analytic centered department. It focuses on quantitative tools to manage physical and financial resources. In review of the big data movement, I am hoping that the department will be bigger and more people in statistics, probability and optimization will be hired. The department is geared towards a good direction now. In 10 years, many junior people we hire today will become major players in the profession.

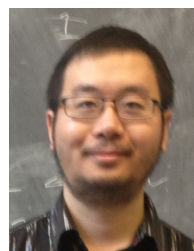
Interviewers: Is there any other department from other universities you would like ORFE to become?
Fan: Academic excellence is our ultimate goal and the label is not important. I think it will be great if there is a big umbrella that covers all quantitative science, from statistics, applied mathematics, and operations research to optimization, stochastic modeling, and data science. This will allow us cross-fertilize these quantitative sciences and confront better the qualitative challenges from science and humanities.

Trivia

1. Jianqing invites all his students and postdocs to his home from time to time.
2. Jianqing travels over 100K miles every year to attend conferences and give seminar talks.



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