TOPICS IN IDENTIFICATION, LIMITED DEPENDENT VARIABLES, PARTIAL OBSERVABILITY, EXPERIMENTATION, AND FLEXIBLE MODELING: PART A

ADVANCES IN ECONOMETRICS

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ADVANCES IN ECONOMETRICS VOLUME 40, PART A

TOPICS IN IDENTIFICATION, LIMITED DEPENDENT VARIABLES, PARTIAL OBSERVABILITY, EXPERIMENTATION, AND FLEXIBLE MODELING: PART A

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FOREWORD TO PART A

Volume 40 of *Advances in Econometrics* focuses on methods with particular themes surrounding identification, limited dependent variables, partial observability, experimentation, and flexible modeling. The volume contains both Bayesian and classical contributions to theory and application, and is intended to honor the scholarship of our friend and colleague, Professor Dale J. Poirier.

Assembly of Volume 40 began with a conference at the University of California, Irvine, on June 8–10, 2018. The event served the dual purpose of celebrating Dale's contributions on the occasion of his retirement and showcasing papers that would be considered for possible publication. The volume took shape in the months that followed and reflected a large and diverse set of theoretical, modeling, computational, and applied developments. Some chapters addressed foundational and methodological issues, while others provided important modeling advances or delved into stimulating new topics in modern empirical research. As a consequence, we expect that the volume will be of significant interest to a wide audience and will have lasting impact on future work.

The final volume – one of the largest in the *Advances in Econometrics* series – contains 23 separate chapters that are split thematically into two parts. Part A presents novel contributions to the analysis of time series and panel data with applications in macroeconomics, finance, cognitive science, neuroscience, and labor economics. Part B examines innovations in stochastic frontier analysis, nonparametric and semiparametric modeling and estimation, A/B experiments, and quantile regression. We hope that this clustering of relevant chapters would expose readers to a wider variety of methodological approaches and applications and would facilitate extensions to new settings.

Part A of the volume begins with an interview with Dale Poirier. In this initial chapter, Dale describes his early years and family background, college experiences, and various professional appointments. He comments on a myriad of issues, including frequentist reasoning, objective Bayes, Big Data, and events leading to his text, *Intermediate Statistics and Econometrics: A Comparative Approach*, which students and colleagues sometimes affectionately refer to as "The Purple Monster."

Gary Koop and Luca Onorante tackle a problem in nowcasting, or short-term forecasting of macroeconomic variables. They seek to determine if Google data can be used to improve the forecasting of common macroeconomic US series, such as inflation and unemployment, but do so in novel ways: they allow the Google variables to enter the models in a time-varying fashion and also allow the probability of including explanatory variables to depend on the Google data, which they term "Google probabilities." They apply these methods to forecast nine different US series. They find that, generally, the inclusion of

Google data in the models tends to improve forecasting performance, and the inclusion of Google data through model probabilities is generally (though not always) the preferred way of using that data.

A chapter by Fulya Ozcan employs state-of-the-art graphical modeling and text processing to uncover latent overlapping communities of Reddit's newsfeed users. High-frequency social media data are employed to draw linkages between user reaction to news and short-term exchange rates. The hierarchical mixture model developed in the chapter clusters the communities and detects their opinions (sentiment), which is then shown to be useful in forecasting exchange rate fluctuations. The chapter describes how estimation of the model parameters can proceed by Markov-chain Monte-Carlo simulation.

Percy K. Mistry and Michael D. Lee present a generative psychological model of dynamic violent behavior, and use it to analyze data on the incidence of Israeli and Palestinian fatalities in the Second Intifada. The modeling provides interpretable structural constructs that offer important insights into the dynamics of the conflict. Due to the analytical intractability of the model, Bayesian inference is made possible by computational methods. The authors demonstrate that their model is descriptively and predictively accurate and helps explain retailatory and repetitive violence in terms of meaningful cognitive processes for each side of the conflict.

The work of Zhe Yu, Raquel Prado, Steven C. Cramer, Erin B. Quinlan, and Hernando Ombao presents Bayesian methodology for modeling local activation and global connectivity using data on magnetic resonance signals in the brain. The approach simultaneously models activation of different brain regions, estimates region-specific hemodynamic response functions, and employs Bayesian vector autoregressions to model connectivity. Spike and slab priors are employed to address variable selection and help determine significant connectivities in networks. Evidence from a simulation study reveals the advantages of the proposed approach, while an application to a stroke study finds different connectivity patterns for task and rest conditions in certain regions of the brain.

Timothy Cogley and Richard Startz provide a procedure for dealing with an important problem in time-series analysis. In particular, it has been well known that in the presence of near-root cancellation of the AR and MA components of ARMA models, standard estimation methods have tended to produce spuriously accurate estimates, even though in reality the coefficients are only weakly identified. The chapter supplies a Bayesian model averaging procedure that avoids such spurious inference and performs well without much additional computation in both well-identified and weakly-identified settings. The procedure is recommended for routine adoption in both Bayesian and frequentist analyses of ARMA models because of its ability to guard against the possibility of spurious results, while leading to agreement with traditional estimates in cases when weak identification is not a problem.

Md. Nazmul Ahsan and Jean-Marie Dufour consider estimation of a stochastic volatility (SV) model. They exploit an ARMA representation of the SV model, yielding a small number of moment conditions and the possibility of estimation via GMM. The resulting ARMA-SV estimator of Ahsan and Dufour is computationally convenient, as it is available in closed-form, while also being highly efficient. Simulation experiments are conducted to compare the ARMA-SV estimators performance with a variety of alternatives, including MCMC-based Bayesian approaches. Results suggest that not only does the ARMA-SV estimator offer considerable computational advantages, but it often offers greater precision than its competitors. The chapter concludes with an application involve three stock price return series, from Coca-Cola, Walmart, and Ford.

In a contribution to the rapidly evolving adaptive learning literature in macroeconomics, Eric Gaus and Srikanth Ramamurthy propose a novel approach to the modeling of expectation formation and learning in models with time-varying parameters. In particular, the chapter examines a new endogenous gain scheme in which the gain sequence is driven by changes in agents' coefficient estimates. The approach is compared and contrasted with exisitng methods. Simulation evidence and an empirical example involving a New Keynesian model demonstrate that the proposed method can offer superior forecasting ability compared to existing alternatives, particularly for inflation data.

A novel approach for checking the sensitivity of predictive modeling to prior hyperparameters is presented by Joshua C. C. Chan, Liana Jacobi and Dan Zhu. In the context of popular vector autoregression models, they develop a general method, based on automatic differentiation, that examines point and interval sensitivity to the prior hyperparameters. While the importance of sensitivity analysis in general, or in predictive VAR modeling in particular, can hardly be overstated, such analysis is rarely part of current practice. Following a discussion of the theory, the approach is implemented as an automatic way to assess the robustness of the forecasts in an application to US data. The application shows that prior sensitivity in both point and density forecasts can be an issue for the VAR coefficients, but this is less so for the intercepts and the error covariance matrix.

Bai Huang, Tae-Hwy Lee, and Aman Ullah consider estimation of a panel model and suggest a Stein-type shrinkage estimator. Specifically, they consider an estimator that is a weighted combination of the OLS fixed-effect estimator and Pesaran's (2006) common correlated effects pooled (CCEP) estimator, where the value of Hausman's (1978) statistic informs the weights. They show, under some conditions, that the shrinkage estimator has smaller risk than the CCEP estimator, and also demonstrate that the shrinkage estimator has smaller asymptotic risk than the conventional fixed effects estimator unless endogeneity is very weak. The performance of the method is illustrated in Monte-Carlo experiments and an application involving a panel of house prices.

Gary J. Cornwall, Jeffrey A. Mills, Beau A. Sauley, and Huibin Weng introduce a new out-of-sample Granger causality testing procedure. The methods introduced combine k-fold cross-validation techniques with Markov-Chain Monte-Carlo (MCMC) techniques to perform out-of-sample testing. They demonstrate power improvements of their out-of-sample tests relative to conventional F-tests, while also demonstrating often similar in-sample performance of their procedure relative to F-testing. The chapter concludes with an application of their methods to the Phillips curve, where they find insufficient evidence to reject the null hypothesis of no Granger causality in both pre- and post-1984 samples.

Theodore F. Figinski, Alicia Lloro, and Philip Li also address issues in panel data modeling, as these authors reexamine the effect of compulsory schooling laws on both educational attainment and labor market earnings. Specifically, using new and rich data, they examine the impact such laws have had on educational attainment of both young and older workers. Using hierarchical Bayesian models, they find that such laws appear to have little effect on educational outcomes of younger workers. In addition, while compulsory schooling legislation does seem to have had an effect on educational attainment for older workers, there is little evidence pointing toward an overall effect on the earnings of these workers.

The tribute to Dale Poirier's work continues with Part B of the volume, which offers a different sampling of topics including important contributions to stochastic frontier analysis, nonparametric and semiparametric modeling and estimation, A/B experiments, and quantile regression. The volume then concludes with a brief comment by Dale.

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Ivan Jeliazkov
Justin L. Tobias

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AN INTERVIEW WITH DALE POIRIER

Ivan Jeliazkov[a] and Justin L. Tobias[b]

[a]*University of California, United States*
[b]*Purdue University, United States*

IJ and JT: *Dale, thank you very much for agreeing to take part in this interview for Advances in Econometrics, Volume 40. It is an honor for us to have this opportunity, particularly since we both had the privilege of having you as a senior*

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colleague and mentor while we were still Assistant Professors. We will be forever grateful for your positive impact on our professional careers.

In the course of this interview, we hope to learn more about your background, how you became interested in econometrics and Bayesian econometrics in particular, and your thoughts on current practice in the profession and, perhaps, its future.

1. BACKGROUND AND ACADEMIC CAREER

IJ and JT: *Why don't you start by telling us a little about young Dale Poirier? What were his interests and was he always serious about education? What was your family environment like?*

DJP: My prior was born September 7, 1948, in Cleveland, Ohio. My first memorable data point was that the Tribe (a.k.a. among non-locals as the Cleveland Indians) won the World Series at the end of my first month of life. I updated my relatively non-informative, but proper, prior to get my posterior predictive probability of the Tribe winning in 1949, and sequentially every year since. Needless to say, this annual process has led me to not be overly optimistic for 2019.

My parents, John and Adele, came from families comprising 12 siblings. I was the only child. My mother, born in Chicago, had eight years of education and my father, born in Canada, I believe was the only one of my 10 aunts and uncles to graduate from high school. In the Cleveland neighborhood in which I grew up my first six years, some neighbors did not have indoor plumbing and had an "outhouse" in their back yard. The house in which I began updating my early prior beliefs burned down about 40 years ago and was never rebuilt, is approximately one mile from the home of famed kidnaper Ariel Castro.

My family moved to the suburb Parma when I started the first grade and I lived there throughout high school. I went to the Catholic elementary school St Francis de Sales (which has since closed) and a Catholic, then all-boys, Padua Franciscan High School, which today is an excellent academic institution, but as a member of the second class of a new institution, provided limited academic challenges. There were four ethnic groups in my early environment: people whose (1) family names ended in "ski" (i.e., Polish), (2) family names ended in "sky" (i.e., Ukrainian), (3) family names which originally ended in "ski" or "sky" but whose families dropped the syllable in the hope of better assimilation, and (4) me. The first day of high school my home room teacher during roll call mispronounced my French−Canadian family name and I corrected him, to which he replied "Frenchy, eh?" Imagine that today in our politically correct world. I was not a good student and barely made the top 25th percentile of my graduating class of size 157. I believe that I am the only person in my class to get a PhD.

IJ and JT: *With all of that in mind, what made you decide to follow the college path?*

Fig. 1. A Bayesian in the Making.

DJP: The high school I attended was brand new; I was in its second graduating class. It was a Catholic school, relatively close to home, and it was college-prep. At that time, if you didn't go to college, you were going to Vietnam, so that essentially made the decision for me.

IJ and JT: *Tell us a little about your undergraduate studies.*

DJP: Upon graduating from high school in 1966, I enrolled at Ohio University (OU) in Athens, Ohio. Athens County is in the foot hills of Appalachia. The television show *Sixty Minutes* once described it as the poorest county in the United States. OU was known as a "party" school.

I roomed with two friends from high school in a small dorm room, intended for two students, but which was made to house the three of us in a triple bunk-bed due to the enrollment explosion of the 1960s. The best known former (one semester) student at OU was the actor Paul Newman, whose poster wearing an OU shirt hung on the walls of rooms of many students.

OU is not a research university. I began as a math major. In my first midterm, I was taking a chemistry course to fulfill a physical science requirement, but I failed miserably with a score of 37 out of 100 points. In 1966, as I mentioned before, the reward for a young male who flunked out of university was a free trip, and all living expenses, to Vietnam. I suddenly became a serious student.

The calculus course I was taking at the time was taught by Mr. Yamada. He was notorious for being the hardest person in the math department, and I just happened to be assigned to his section. I ended up acing the course and everyone who found out about that was very impressed. So that really made me want to continue on with mathematics.

IJ and JT: *So, at that point you realized your talent in mathematics, and presumably the faculty encouraged you to continue developing that?*

DJP: Yes. In my sophomore year, I took a small honors course in Economics from Richard Vedder who had a major impact on my career. (Justin, in case you don't know, Richard once debated with your thesis advisor Jim Heckman on *Sixty Minutes*.) My class somehow convinced Richard to organize a 1968 summer program in Italy. We paired up with other OU students studying Renaissance art. I also took a readings course on the European Common Market. After the program ended, I spent a month hitchhiking across Europe. I was unsuccessful getting a ride to Prague (the Prague Spring of 1968 was a popular event) and instead took a train to Berlin. I was in East Berlin the day the Soviet Union invaded Czechoslovakia. Sometimes, poor decisions can be rewarded. In short, I grew up about ten years that summer.

In my third undergraduate year, I was admitted to graduate school. The graduate courses I took earned me credit for my both bachelors and masters degrees in mathematics. Despite academic success I did not fall into the right academic boxes for scholarships so I spent my first two summers as a parking lot attendant and working in a warehouse. In my third summer, I schemed the system to get a work–study position at the university. But I had to find someone to hire me. I went to the math department basically as a freebie. One of my math lecturers – we didn't have many teachers with PhDs – employed me for the first half of the summer as a Fortran programmer for his work in number theory. In the second half, the math department asked me to teach a pre-calculus course. I was scared to death the first day of class. Most of the students were older than me. I can still remember walking into that class shaking. Fortunately, students came up asking me to sign some paperwork for enrolling in the class. That settled me down and I proceeded to give a lecture. The rest is history.

Let me mention a couple of memories from my time at OU. In my third year, I took a microeconomics course using the text by Armen Alchian. It was taught by a young professor Doug Adie with a PhD from the University of Chicago, but it was not a Chicago price theory course. Rather, it was very calculus oriented involving differentiating and solving first-order conditions. The presentation was way over the heads of most students. I sat in the front row and pointed out Doug's occasional errors in the algebra he presented on the board. In the back row, sitting next to a friend of mine was Mike Schmidt who subsequently became a Hall of Fame third baseman for the Philadelphia Phillies. Mike was constantly asking my friend: "Who is that guy in the front row?" I think that guy got a better grade in the course than Mike Schmidt, but I know he didn't make more money than Mike Schmidt.

Despite participating in OU's well-deserved reputation as a party school, I did pursue the academic side of things as well. I spent a lot of time wandering down the rows of our small library and finding gems like Tjalling Koopman's Three Essays on the State of Economic Science. That book is what really got me interested in economics. But I was a math major at the time. A math instructor in topology asked me why I was taking his course but wanted to go to grad school in economics. I responded by giving an out-of-class lecture to him and an another instructor on Koopman's Robinson Crusoe man and separating hyperplanes. They loved it.

At OU, I took one three-quarter statistics course – there was no statistics department and so this was a baby mathematical statistics course taught by a mathematician with no empirical component. It was held at 3:00 p.m. MWF. Because of the "party school" nature of OU, Friday afternoons mostly involved getting a good seat in a bar for Friday night. To this day whenever I encounter something I don't understand in statistics, I conclude it must have been taught on one of those Friday afternoons.

My fourth year at OU was fairly traumatic. It began with me planning to apply for a PhD program in economics. I was completing a bachelors and masters degrees in mathematics and half a masters in economics. But in the beginning of 1970, there was the first draft lottery and my birthday earned me the number eight in the draft. I tore up all my applications to top departments and only submitted my application to Wisconsin which had no application fee. I was accepted but I couldn't attend because of the looming draft. In the Spring 1970 quarter, the killings of students at an OU sister school, Kent State, led to protests and the closing of OU with about a month to go in the spring quarter. I was in a dilemma because only the undergraduate programs closed, but not the graduate programs. I was in both. Furthermore, given the undergraduate program was closed, I no longer had a deferment and so the draft board was coming. Fortunately, my graduate instructors allowed me to leave.

I accepted a job at Pratt & Whitney Aircraft in East Hartford, Connecticut as an analytical engineer in an attempt to get a job deferment working for a defense company. That is where I learned about spline functions. I was there for only a couple of months because with the help of my father, who tracked down my deceased doctor's records in the basement of the anti-war attorney who handled his estate back in Cleveland, I was able to prove I had been diagnosed with asthma after the age of puberty. Hence, I flunked my physical. It was late summer, I quit my job, and I contacted OU which admitted me so I could finish two quarters and get my masters in economics. I then applied to all those top schools whose applications I tore up the year before and once again Wisconsin. Only Wisconsin accepted me.

IJ and JT: *What made you decide to pursue graduate school rather than other options? Once at Wisconsin, did you know you wanted to study econometrics right away, or did you acquire a taste for that particular field of study during the program?*

Fig. 2. Dale and Colleagues inside Bunhill Fields Cemetery, 2005.

DJP: Before accepting Wisconsin's offer (which was my only option) I visited and talked with I. J. Schoenberg and Arthur Goldberger. Schoenberg is the "Father of Splines," who worked at the Army Mathematics Research Center at which there was a famous anti-war bombing in 1970, and he seemed honored that someone in Economics was interested in the topic. I only met once with him. Arthur Goldberger was the star of the Economics department and when I interviewed with him I told him that I wanted to do econometrics thesis using spline functions. He discouraged me from enrolling. Two years later, he signed my thesis.

Starting at Wisconsin in the Fall of 1971, I decided to forego mathematical economics and instead pursue econometrics. My first class in econometrics was with Dennis Aigner, my future thesis advisor. Dennis was coming back from a sabbatical at CORE and was really pumped up with his research. Goldberger was on sabbatical and so Dennis was teaching the advanced econometrics sequence. There were only two other first-year students in the course with me. Dennis of course can be an intimidating to students, if for no other reason than his height. He announced this was a full year (two semester) course. For students not majoring in econometrics (which was virtually everyone else), there would be six tests. For those majoring in econometrics, there would only be five tests required, but you also had to publish a paper. I took Dennis seriously and began writing my paper in the first semester. This resulted in my first publication "Piecewise Regression Using Cubic Splines", which was the lead article in the September 1973 issue of *JASA*.

In my second year, I passed the econometrics comprehensive exam which at the time was a rare thing. Some of the students who later had successful careers as econometricians avoided the exam – it was that scary. There were not many courses that interested me that year. I did not really develop an interest in Economics until later. That year, I took two statistics courses: the only Bayesian course I ever took by George Tiao and a time series course by George Box using his new Box-Jenkins text. From Tiao, I learned how to interpret a confidence interval correctly. Remember, I had already passed my econometrics comprehensive exam. But I really didn't understand sampling distributions. I think many students never do. To do so, I believe you need to learn at least two different ways of looking at things. That is why my textbook has the subtitle *A Comparative Approach*. Graduate students at UCI are exposed to both Bayesian and frequentist viewpoints from the very first econometrics course. During this second year, I began working as a research assistant for Harold Watts on the New Jersey Negative Income Tax Experiment at the Institute for Poverty Analysis. I was also writing papers on spline functions which later resulted in the parameterization of the treatment in the New Jersey Experiment.

IJ and JT: *When you entered the job market, was your focus completely on the academic side or did you consider employment in industry? What was the market for econometrics like at that time, and how do you think it compares to the econometrics market we see today?*

DJP: I was definitely only interested in the academic side. I am not sure how strong the job market in econometrics was that year relative to now, because I became a professor without going on the job market. Let me explain.

In planning for my third year, Dennis suggested I apply for a fellowship at CORE, thinking I would have a good chance of getting one. I learned late in the second semester that I didn't get the fellowship. Dennis said he would make some calls. He called George Judge at Illinois to see if they were looking for anybody. Illinois had a last-minute resignation of an econometrician, so they invited me to visit campus. Their semester was over and I didn't even give a seminar. The Chair talked to me and made an offer, US$12,000. It seemed like a million.

But the problem was I didn't have a thesis as such, just a bunch of spline papers, some of which, besides the *JASA* paper, were accepted for publication. There was also the problem I was research assistant on the negative income tax experiment. Furthermore, I had agreed to teach the mathematics for economists course for incoming Wisconsin PhD students later in the summer.

Somehow between June and August of 1973, I managed to do all of these and defended my thesis in August. Later that month, I went to the European Meeting of the Econometric Society in Oslo to present my *JASA* paper. As a just completed second-year graduate student, I was once again shaking before my presentation. Upon my arrival at Illinois in September 1973, I was congratulated by the Chair for my just published lead article in *JASA*, but at the same time, he told me *JASA* was not one of the eight journals that "counted" for the department.

When I accepted the Illinois offer I told them I was going to go on the market that year because I had not done so before. I think the market didn't know what to make of me. My Wisconsin classmates were in their third year. I already had a tenure-track position. How did I do that without going on the market? And what are these spline things economists had never heard about? I got some interviews from top schools that had rejected my graduate student applications three years before, but the only offer I got was from SUNY Buffalo. Illinois raised my salary slightly and I agreed to stay. But I couldn't take Champaign-Urbana. I went back on the market the next year, got some attention, and collected offers from Carnegie Mellon, Pennsylvania, and Toronto. I was attracted by cosmopolitan Toronto, and to everybody's surprise, I went there as an untenured Associate Professor – the same year as my classmates were on the market for assistant professorships. As my Bayesian interest grew I realized my professional mistake of not going to Carnegie Mellon, but for me at the time, Pittsburgh was too much like Cleveland.

I arrived in Toronto in July 1975, and in August, we hosted the Third World Conference of the Econometric Society. As a local organizer, I was invited to a small dinner and sat across the table from Tjalling Koopmans and Leonid Kantorovich. Two months later, they won the Nobel prize.

IJ and JT: *Your career took a warmer turn in 1999, and led you to your current position at UC Irvine. What attracted you to Southern California, and how did and does the environment at UCI compare to Toronto?*

DJP: California's population is slightly larger than Canada's. The University of Toronto is Canada's premier university in the most populous city and province. As a result, it gets great students. California has many excellent research universities, both public and private, and so UC Irvine has a lot of competition in getting students. So, there was a notable drop off in quality at both the undergraduate and graduate levels. The Department of Economics at Toronto was huge, say around 65–70, and UC Irvine's department was very small at the

Fig. 3. Dale at Bayes' Grave.