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OBITUARY

Arnold Zellner

Arnold Zellner, a pioneering econometrician and Bayesian statistician, died August 11, 2010. He was born in Brooklyn, New York, on January 2, 1927.

After undergraduate work in physics at Harvard, Arnold received his Ph.D. in econometrics from Berkeley in 1957. He held appointments at the University of Washington and the University of Wisconsin before moving to the University of Chicago in 1966. At Chicago he held the H.G.B. Alexander Foundation Professorship at the Booth School of Business from 1984 until becoming emeritus in 1996. He was recognized worldwide for his contributions, receiving four honorary doctoral degrees and holding the presidency of the American Statistical Association and the International Society for Bayesian Analysis. Arnold was a fellow of both the Econometic Society and the American Statistical Association.

Arnold started his career working on systems of equations. By viewing a system of regression equations as one stacked regression, he introduced a generalized least squares approach to estimation of the system. His 1962 article on what he termed "Seemingly Unrelated" regressions (SUR) is his most-cited article. In joint work with Henri Theil, that article was closely followed by application to systems of equations with endogenous right-hand-side variables, which became known as "three-stage least squares."

Arnold's work on systems of equations involved a close study of the multivariate analysis literature where exact or finite sample results become increasingly difficult beyond the multivariate normal problem and associated linear systems of equations. This interest in finite-sample results contributed to his attraction to Bayesian analysis where exact results are possible.

Arnold's interest in Bayesian methods began in the early 1960s while he was on the faculty at the University of Wisconsin. A group of economists and statisticians (including George Tiao from the statistics department) conducted an informal seminar on Sir Harold Jeffreys' *The Theory of Probability*. Arnold was particularly impressed with Jeffreys' "practical" approach to Bayesian inference. Jeffreys was interested in the relationship between classical and Bayesian approaches and, particularly, in the problem of specifying a "reference" prior that would facilitate closer connection between the two approaches.

Arnold's research program in Bayesian methods culminated in his classic 1971 book, *An Introduction to Bayesian Econometrics*. This modestly titled volume provides Bayesian solutions to many important econometrics topics including regression, errors in the variables, and autoregressive models. Arnold also developed Bayes Factors and Posterior Odds calculations for regression hypotheses.

Important Bayesian work by Arnold includes his 1976 JASA paper on regression models with multivariate t errors and his work on "Bayesian Estimation with Asymmetric Loss Functions" (JASA 1986). In much work in the statistics literature, loss functions are chosen on the basis of mathematical tractability. One of the principal advantages of the Bayesian approach is that it is a unified framework that treats estimation as a special case of decision theory. Decision theory is only meaningful to the extent that the loss function captures the relevant features of the decision context. In many decision contexts, the loss function is undoubtedly not symmetric. The 1986 paper introduces a new family of loss functions that are linear on one side and exponential on the other. This family of loss functions has seen wide application.

Estimation for high dimensional regression and other related systems continues to be an important topic in both econometrics and statistics. Estimators with some sort of shrinkage or penalty property can often be given a Bayesian interpretation. Arnold's contribution to this literature is the g-prior which specifies a prior in regression models that is a scaled version of the information matrix. Arnold's work anticipated more recent work on minimally informative priors by Kass (1995).

Arnold also had a strong interest in time series models. His work with Franz Palm in the *Journal of Econometrics* (1994) showed the relationship between the specification of simultaneous equations models and multivariate time series models. He was also keenly interested in improving the manner in which government statistics were adjusted for seasonality, organizing a highly influential conference on this topic in 1976.

No review of Arnold's career would be complete without mention of his service and commitment to the profession. He founded both the *Journal of Econometrics* and the *Journal of Business and Economic Statistics,* established two highly

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successful NBER-NSF seminar series, helped found the International Society for Bayesian Analysis, and chaired more than 30 dissertation committees in econometrics, economics, statistics, and finance. His boundless energy was born of a fundamentally optimistic view of scholarship. Arnold felt that rapid progress was possible in econometrics and statistics and he placed his bets accordingly.

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