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# IN MEMORY OF JOHN DENIS SARGAN

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This issue of *Econometric Theory* is a Memorial Issue to commemorate John Denis Sargan. It brings together two of Denis Sargan's essays on econometrics, a laudation by Antoni Espasa, and three separate memorial essays written by David F. Hendry, Peter M. Robinson, and myself. Also included are some photographs of Denis Sargan and his family that were most kindly given to us by Mary Sargan for publication in this issue.

The two essays by Denis Sargan, both published here for the first time with the kind permission of Mary Sargan, were written for a general audience. The first of these is entitled "Current Problems in Econometrics—A Personal View" and is the text of the address he delivered upon receiving an honorary doctorate at University Carlos III in Madrid in February 1993. The occasion was a celebratory gathering of university dignitaries and past students of Sargan. In his address, Sargan explains the econometric approach and talks about its shortcomings, its strengths, and its prospects for the future. Sargan's address at University Carlos III was accompanied by a personal laudation delivered by Antoni Espasa, also published here for the first time, which describes and celebrates Sargan's many scientific contributions to the subject of econometrics.

The second Sargan essay included in this volume is entitled "The Development of Econometrics at LSE in the Last 30 Years." Like the first essay, this too is the text of an address given (in 1992) to a general audience at University Carlos III. It contains a fascinating personal account of the LSE from someone who was intimately involved in its emergence during the twentieth century as one of the world's great centers of econometrics. Denis speaks candidly about the LSE, its histories and transitions, those who peopled it, and its many educational and research contributions. This personal reminiscence by Denis about his 30-some years at the LSE includes some thoughtful discussion of his research, that of his students and colleagues, and the role of econometrics in public policy. It will be compelling reading to economists as well as to econometricians. Those who knew Denis, those who studied under him, and those with an interest in the history of thought will find many a new story told here for the first time. The essay will help to bring Denis's memory alive to the large community of students and scholars who came to love him for his creative genius, his generosity, and his humanity and who are so much in his debt.

This Memorial Issue includes three specially invited memorial articles written by David Hendry, Peter Robinson, and myself. These articles speak more directly of Denis's scientific contributions to education and research in econo-

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metrics, and they offer some reflections on his research from the perspective of recent developments in econometrics.

Peter Robinson's paper provides a history of the famous Tooke Chair of Economic Science and Statistics, which Denis Sargan held at the time of his retirement in 1984, and the LSE tradition in econometrics, which continues to be a strong international force in the world of econometrics. Peter's essay also analyzes a contribution that Denis made to the study of large econometric models. Denis's (1975) paper was originally published as part of a symposium on econometric modeling and was strangely unlike any of the other papers in that symposium. Denis had a fertile mathematical imagination when it came to the development of any subject, but here it was especially evident in his considering an asymptotic theory for large numbers of equations. People had begun, of course, to develop asymptotics for cases where there were large numbers of parameters (e.g., many lags in a regression), but this was the first time it had been done in the context of a growing number of equations. Sargan recognized that as more data became available, there was always more detail to explain in economic activity, especially at the macro level, where models had become progressively larger over the years, reaching many hundreds of equations by the late 1960s. The growing ambition of empirical investigators in macro modeling was ultimately to be tested by the reality of data limitations, and Sargan's essay looks precisely at the question of what might reasonably be accomplished in terms of such growth as the data set expands. Peter sets this discussion in the modern context of semiparametric modeling, where Sargan's notion of fitting a finite number of overidentified equations in an expanding system is comparable to modern semiparametric estimation of a finite dimensional parameter in the presence of an infinite dimensional nuisance function. Peter explains Sargan's construction of infeasible efficient and feasible efficient structural equation estimators, lending rigor to the development and considering also an alternate two-stage least squares procedure. The analysis and discussion demonstrate in a convincing manner how some of Sargan's early ideas and methods on large simultaneous equations systems are relevant and important in the world of 21st century econometrics, where semiparametrics are now commonplace.

David Hendry's essay studies the origins of the 'LSE approach' to empirical econometric methodology, which Sargan's research was instrumental in establishing, reaching back to Robbins's (1932) early view of the power of economic theory explanations and LSE's strong tradition in the philosophy of empirical science and Karl Popper's (1959, 1963) notion of falsification. It has long been recognized that the host of issues arising in attempts to empirically model economic activity makes systematic analysis of this subject extremely difficult. Perhaps the biggest contribution of the Sargan revolution that is explored in David's essay is that it delivered a plausible and constructive groundwork for such analysis. David provides a systematic deconstruction of Sargan's (1964) Colston Conference paper and shows how the specific ideas that underpin the LSE approach are all evident in this highly original contribution. David's

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discussion is particularly effective in revealing how the use of long-run economic theory, equilibrium correction mechanisms, and the restrictions that are implicit in autoregressive error formulations (within more general dynamic models) provides a framework for the construction of an empirical relationship that can be estimated, evaluated, and compared with other empirical formulations. In a telling empirical illustration of the methodology to annual UK wage-price inflation over 1945–1965, David revisits the Sargan empirical specification and discusses how shifts in public economic policy impact the form and the performance of equilibrium correction models. External shifts in policy make it necessary to adapt such specifications over time by (inter alia) intercept and trend adjustments in order to maintain good performance characteristics. Model adaptation over time is one area to which subsequent developments have taken the empirical methodology. Another is the use of computer automation (Hendry and Krolzig, 1999, 2001, 2002; Hoover and Perez, 1999; Phillips, 1992, 1995a, 1995b, 1996, 2003). Both developments hold promise for the future of the empirical methodology to which Denis Sargan contributed so convincingly through his early Colston paper research and his later theoretical studies of data mining and model comparison, which have only recently appeared in published form (Sargan, 2001a, 2001b).

My own essay discusses Denis's intellectual influence in econometrics, the lessons in research that his scientific papers gave us, his long-standing mentorship of doctoral students, and some of his visions for the future of econometrics. Among the many topics in econometric theory that occupied him, Denis's favorite was surely finite sample theory, as he intimated in his ET Interview (Phillips, 1985). Whether it was exact distribution theory or various types of asymptotic expansions, it is evident that this field absorbed and challenged him. Part of his vision for econometrics was that this theory could be implemented in practical empirical work to improve inferential accuracy. Denis was acutely aware of the limitations of asymptotic theory and sought to find methods that were general enough to be used in dynamic econometric model settings and conducive to programming and computer implementation. Edgeworth expansions provided a natural mechanism for achieving this goal, and his famous Walras–Bowley lecture (Sargan, 1976) set about providing the justifications and the formulas for this implementation, supplementing the idea of analytic expansions with a simulation-based approach that was originally due to the statistician George Barnard and that we now recognize as a version of the modern parametric bootstrap procedure. In a summary discussion of density expansions in the general setting that intrigued Denis, the various steps in his derivation of the Edgeworth expansion are given, revealing the simple form of the dependence of the correction terms on the statistic and the cumulants of the sample moments on which the statistic depends. As it has transpired, none of the asymptotic expansion or exact distribution methods explored by Denis have been systematically used in practical work. Asymptotic expansions have been found to be an unreliable means of improving inferential accuracy, and exact

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methods are generally of too limited applicability, rely on strong distributional assumptions, and do not extend to dynamic model settings. Nonetheless, Denis's theoretical contributions helped blaze the trail of finite sample theory in the 1970s and early 1980s, and they furnish a substantial body of results that have improved our understanding of the properties of econometric estimators and tests.

Denis had an enormous intellectual influence within the UK, both on the training of econometric theorists and on econometric practice. Outside the UK, Denis's influence was not as strong as his research accomplishments warrant. There seem to be several reasons for this. First, Denis's papers often deal with difficult topics like the distribution of full information maximum likelihood (FIML), they are not easy to read, and they require a concerted effort to get into, in addition to mathematical skills beyond those of a conventional econometrics education. His papers often do not follow a conventional mathematical track in extracting results (where all the assumptions, constructions, and proofs are clearly laid out), and the algebra is demanding and complex with long complicated expressions that easily tire less resilient readers. Second, Denis's choice of problems sometimes did not co-relate well with the immediate concerns of empirical researchers or other econometricians. Denis had his own vision of what the subject needed, and he pursued this vision with determination. It is clear, for instance, that he gave up several years in the late 1960s when he published little in order to write his long and highly innovative papers on the distribution of FIML, Gram–Charlier approximations to *t*-ratios of econometric estimators, and the estimation of stochastic differential equations. Finally, Denis's personal influence on his students and his colleagues at the LSE was enormous, and this helped to amplify his impact in the UK, in Europe, and in Australasia by way of his overseas students and the Econometric Society meetings that he regularly attended in Europe. But in North America, it is fair to say that his intellectual influence was not as strong and different traditions prevailed. A manifestation of these differences in influence and intellectual heritage is evident in the recent themed issue of the American Economic Association's *Journal of Economic Perspectives* on "Econometric Tools," which features 12 invited overview articles on different areas in econometrics. Among all of the articles in this issue there is not a single citation of Denis's work, even though he is unquestionably one of the preeminent toolmakers in econometrics in the last half century. Curiously, his work on instrumental variables (IV) and nearly unidentified models is uncited in the review article by Angrist and Krueger (2001), an oversight that reveals the perceived concerns to be different from those pursued by Denis. In their historical overview of IV methods, Angrist and Krueger remarkably do not mention the intellectual heritage of Sargan's (1958, 1959) definitive treatment of IV methods, and they proceed to discuss recent work on weak instruments without reference to Sargan's (1983) work on nearly unidentified models, the first paper with a serious consideration of the effects of near lack of identification. Such omissions are evidence of

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differences in academic tradition and differences in emphases concerning the relevance of econometric theory in applied research. It is important to view these differences in a positive way. Denis himself would be among the first to acknowledge that there is no achievable holy grail of empirical econometric methodology and, as he enjoined his audience in an after dinner retirement speech at Oxford University in 1984, the subject is all the richer if we go out and individually "do our own thing."

This Memorial Issue was conceived in 1996, following Denis's death at the early age of 72. It has taken much longer than I expected to come to fruition. But the time that has elapsed has given us the opportunity to reflect deeply on the magnitude of his contributions and intellectual influence. It is hoped that the articles published here commemorating Denis, combined with Denis's own essays on the history and future of econometrics and the London School of Economics, will be of lasting value to econometricians and historians of econometric thought. Denis Sargan was one of the leading thinkers in econometrics in the second half of the twentieth century. He is missed and loved by all who knew him. It is a comfort to know that his work and his thinking about econometrics live on in his many scientific contributions and in the strong traditions that he initiated among his students and colleagues.

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