Arthur S. Goldberger

1930–2009

BIOGRAPHICAL *Memoirs*

A Biographical Memoir by
Charles F. Manski

NATIONAL ACADEMY OF SCIENCES

ARTHUR S. **GOLDBERGER**

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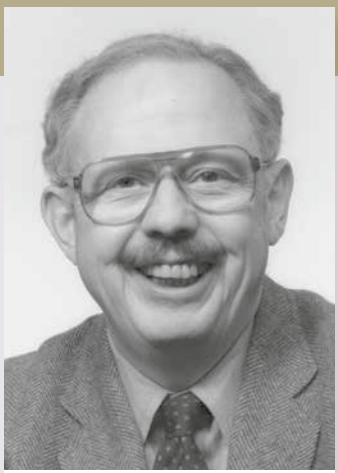

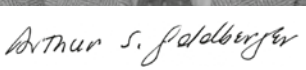

By Charles F. Manski

Arthur (Art) Goldberger was an econometrician of the highest order. Econometrics is often construed as a technical field that applies probability and statistics to economics, but in fact the field is broader, as it also embraces methodologies for empirical research in the social sciences. Goldberger's contributions to econometrics spanned both domains.

Goldberger received his B.S. in economics from New York University in 1951 and his Ph.D. in economics from the University of Michigan in 1958. In a 1989 interview in the journal *Econometric Theory*, he described how religion led him to study economics:

> *I was born and raised in Brooklyn, [New York,] in an Orthodox Jewish family, so that I studied at Hebrew school and yeshiva through age 16 or 17 and got a rigorous education to that point. Then, when I went to NYU, to the School of Commerce, my idea was to major in accounting because accounting was a profession in which you could observe the Sabbath. This was a major consideration. I didn't want to be a doctor or a lawyer, but I was looking for a profession in which I could follow religious practice. As it turned out, the accounting course was a disaster, and after two years of that I realized that I didn't want to spend my life as an accountant. I had taken a couple of economics courses during the first two years and that seemed to be the only major in the School of Commerce that would make any intellectual sense. So I backed into economics that way, with some intention to go to law school after getting an economics degree.*

After three years as an assistant professor at Stanford University, Goldberger moved to the University of Wisconsin-Madison in 1960 as an associate professor and joined

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an elite group of econometricians in the Social Systems Research Institute, which had recently formed there. He was promoted to professor in 1963, became the Harold M. Groves Professor in 1970, and was named Vilas Research Professor in 1979. He retired from Wisconsin in 1998, with emeritus status thereafter.

He subsequently remained in Madison, where he cared for his wife Iefke during the long illness that preceded her death in 2007. In the last decade of his life Goldberger remained professionally active, in part through participation in committee activities of the National Research Council. He also was a founding member of an informal salon that for years met every morning at a local café to discuss intellectual issues and politics, leavened with considerable wit. The members of the salon became close friends, who all looked in on Art frequently during the difficult illness that preceded his death on December 11, 2009.

Goldberger was elected a member of the National Academy of Sciences in 1986. Among other honors, he became: a fellow of the Econometric Society in 1964, the American Statistical Association in 1968, the American Academy of Arts and Sciences in 1977, and the American Association for the Advancement of Science in 1982; a distinguished fellow of the American Economic Association in 1987; and a foreign member of the Royal Netherlands Academy of Science in 1991.

His long association with The Netherlands began with a 1955 visit to that country's Central Planning Bureau and a 1959 visit to its Econometric Institute. These experiences turned out to be professionally formative, particularly through his work in 1959 with the research group of the Dutch econometrician Hans Theil. The 1959 visit was also fruitful personally, as Art met Iefke, a poet who tutored him in Dutch. Art and Iefke were married for almost 50 years. Their two children Nick and Nina now reside in Boulder, Colorado, and Madison, Wisconsin.

Goldberger was first known for his applied econometric work with Lawrence Klein, his mentor at Michigan, in which they developed an early macro-econometric model of the United States. This achievement led to a 1955 book coauthored with Klein and a 1959

book based on Goldberger's dissertation. However, after graduate school his attention turned toward micro-econometrics, which remained his focus throughout his subsequent career.

Goldberger's ability to see through the technicalities of econometrics to illuminate core issues became apparent early on. His 1964 textbook *Econometric Theory* was a landmark work that strongly influenced a generation of econometricians in the United States and then overseas in its several translations. The book was particularly notable for its introduction of latent variable models to a wide audience of social scientists. (The term latent variable refers to a conceptually well-defined outcome or determinant of outcomes that is unobservable by researchers.)

His 1960s-written book *Functional Form and Utility: A Review of Consumer Demand Theory* was an underground classic that circulated in manuscript for many years before it was finally published in 1987; and his 1968 book *Topics in Regression Analysi*s introduced the now-ubiquitous econometric terms "mean independence" and "analogy principle." Defining the latter, he wrote: "The analogy principle of estimation…proposes that population parameters be estimated by sample statistics which have the same property in the sample as the parameters do in the population" (p. 4).

In the early 1970s, Goldberger reached out across disciplines to achieve a beautifully clear synthesis of structural equations models in econometrics, path analysis in sociology, and factor analysis in psychology. This synthesis collectively took shape in: his 1971 article on path analysis with sociologist Robert Hauser in *Sociological Methodology*; his 1972 *Econometrica* article "Structural Equations Methods in the Social Sciences," based on his Fisher-Schultz Lecture to the Econometric Society; his 1973 book *Structural Equations Models in the Social Sciences* coauthored with sociologist Otis Dudley Duncan; and his 1975 article on the MIMIC model with statistician Karl Jöreskog in the *Journal of the American Statistical Association*. Through his program of research, Goldberger impressed on all of the social sciences the common mathematical foundations of approaches to multivariate data analysis that had previously been thought of as distinct or at most loosely related.

At the same time, he made important contributions to technical econometrics through his study of minimum distance estimation as a general approach to the estimation of structural equations models. An example was his 1971 *Econometrica* article, coauthored with statistician Ingram Olkin, which showed the numerical equivalence of maximum

likelihood and minimum distance estimation for a single structural equation in a linear simultaneous equation model.

In the latter part of the 1970s, stimulated both by scientific and ethical concerns, Goldberger studied the methodological underpinnings of human IQ outcomes, focusing his attention on the then-raging debate about the roles of genetics and environment in determining scores. He found that commonplace assertions about the relative magnitudes of genetic and environmental contributions to the population variance in IQ scores were based on misunderstandings of the latent variable models conventionally used to interpret statistical correlations between familial relationships and IQ. Goldberger argued cogently that many writers on IQ were improperly drawing the policy conclusion that educational and other social interventions cannot materially affect human outcomes.

His 1979 *Economica* article "Heritability" provided an especially clear discussion of these matters. The article began as follows:

> *When we look across a national population, we see large differences in intelligence as measured by IQ tests. To what extent are those differences the result of differences in genetic makeup, and to what extent are they the result of differences in life experience? What proportion of the variance in IQ test scores is attributable to genetic variance, and what proportion to environmental variance? This question has fascinated mankind—or at least the Anglo-American academic subspecies—for several generations. The fascination, I suppose, arises from the notion that the answer has some relevance to social policy: if IQ variance is largely genetic, then it is natural, just, and immutable; but if IQ variance is largely environmental, then it is unnatural, unjust, and easily eradicated (p. 327).*

> In the same vein, if it were shown that a large proportion of the variance in eyesight were due to genetic causes, then the Royal Commission on the Distribution of Eyeglasses might as well pack up. And if it were shown that most of the variation in rainfall is due to natural causes, then the Royal Commission on the Distribution of Umbrellas could pack up too. (p. 337).

Most of the article was a formal methodological critique explaining why the study of IQ variance does not yield findings relevant to social policy. However, its most lasting contri-

bution may be the "eyeglasses" example that Goldberger used to drive home the point in plain language. Discussing a *London Times* report of research relating genetics to earnings and drawing implications for social policy, he wrote:

> *For a more recent source we turn to the front page of The Times (13 May 1977), where under the heading 'Twins show heredity link with earnings' the social policy correspondent Neville Hodgkinson reported:*
>
> *A study of more than 2,000 pairs of twins indicates that genetic factors play a huge role in determining an individual's earning capacity.... According to some British researchers, the study provides the best evidence to date in the protracted debate over the respective contributions of genetics and environment to an individual's fate....The findings are significant for matters of social policy because of the implication that attempts to make society more equal by breaking 'cycles of disadvantage'...are likely to have much less effect than has commonly been supposed.*

Professor Hans Eysenck was so moved by the twins study that he immediately announced to Hodgkinson that it 'really tells the [Royal] Commission [on the Distribution of Income and Wealth] that they might as well pack up' (p. 337).

Commenting on Eysenck, Goldberger continued:

> *A powerful intellect was at work. In the same vein, if it were shown that a large proportion of the variance in eyesight were due to genetic causes, then the Royal Commission on the Distribution of Eyeglasses might as well pack up. And if it were shown that most of the variation in rainfall is due to natural causes, then the Royal Commission on the Distribution of Umbrellas could pack up too. (p. 337).*

This parenthetical passage, displaying Goldberger's characteristic combination of utter seriousness and devastating wit, shows the absurdity of considering heritability estimates to be policy-relevant. Goldberger concluded: "On this assessment, heritability estimates serve no worthwhile purpose" (p. 346).

During the 1970s and '80s, Goldberger contributed to the emerging econometric literature on selection bias, including "Linear Regression after Selection" in 1981 and "Abnormal Selection Bias" in 1983. In a 1982 article written with the labor economist

Glen Cain, he commented critically on the conclusions about causality made in a controversial report by James Coleman and others that touted the advantages of private over public schools. Also in the 1980s, Goldberger weighed in on the ongoing debate about the measurement of discrimination in labor markets. His work comparing the assumptions underlying the competing "direct regression" and "reverse regression" approaches did much to demystify the subject. See "Regression and Salary Discrimination" (Goldberger 1984).

In 1991, Goldberger published his highly successful graduate-level econometrics textbook *A Course in Econometrics.* This text codified the exceptionally coherent and focused approach to the teaching of econometrics that Goldberger developed in his almost 40 years at Wisconsin. The first part of the book is justly celebrated for its transparent nonparametric exposition of linear least squares estimation as an application of the analogy principle to the population problem of best linear prediction under square loss. The second, more classical, part has become iconic for its sardonic discussion of the concept of "micronumerosity," which Goldberger introduced as follows:

> *Econometrics texts devote many pages to the problem of multicollinearity in multiple regression, but they say little about the closely analogous problem of small sample size in estimating a univariate mean. Perhaps that imbalance is attributable to the lack of an exotic polysyllabic name for 'small sample size.' If so, we can remove that impediment by introducing the term micronumerosity (pp. 248–249).*

The written word cannot, however, fully capture the privilege that generations of Wisconsin Ph.D. students felt in having the opportunity to learn directly from Goldberger in class. His mastery as a teacher was legendary. Both in teaching and in research, he had the extraordinary ability to identify the simplest instance in which a particular problem or issue could be analyzed.

For readers who were not Wisconsin students or otherwise did not know Goldberger personally, perhaps the most revealing introduction to the econometrician and the man was his wonderful 1989 interview in the journal *Econometric Theory*, with the econometrician Nick Kiefer acting as interviewer. The interview is highly informative about the history of econometrics. Moreover, with Art speaking in a relaxed manner with Nick, it shows well the qualities that combined to make him a remarkable human being.

Art became very bothered when he encountered poor use of econometrics or statistics in empirical research, and he was a brutal critic in seminars and in print. His longtime colleague Robert Hauser recalls that Art could stop a muddled line of thought cold by asking, "What is the question to which this is the answer?"

I fortunately did get to know Art personally. We first met in late 1982 when I was interviewed at Wisconsin for a position there. Before then, I had known him only from his work. We initially had a cautious professional relationship, but it developed over the years into an increasingly close professional and personal one.

Early on, my relationship with Art was asymmetric, with him in the role of the stern but caring mentor. For several years, I would give him my draft papers for comments and he would edit them line-by-line, the way that a good thesis advisor does for a Ph.D. student. He was an excellent writer, and an incredible nitpicker, so I benefited greatly. At some point in the mid-1980s he told me that he had done all he could and would no longer line edit my papers, though he would still be happy to read them for substance. I never learned whether he felt that I had "graduated" from line editing or whether he had given up trying to improve my grammar and style.

From this experience, I came to understand why Art's real Ph.D. students were so deeply attached to him and revered him. It was not that Art was an easy or sympathetic teacher or advisor—much to the contrary. It was rather that he was always constructive and on-target with his comments, and that he put enormous effort into teaching and advising. I learned from him not only how to improve my own papers but, perhaps more important, how to act professionally toward my own students.

In the 1990s, our relationship became more symmetric professionally and closer personally. I felt that I was able to partially return Art's support by working with him on our jointly authored extended review of *The Bell Curve*, published in the *Journal of Economic Literature* (JEL) in 1995.

Art became very bothered when he encountered poor use of econometrics or statistics in empirical research, and he was a brutal critic in seminars and in print. His longtime colleague Robert Hauser recalls that Art could stop a muddled line of thought cold by asking, "What is the question to which this is the answer?" (Personal communication from Robert Hauser). When methodologically bad research was performed in the service

of questionable social ends, Art was not just bothered—he became outraged. When the particular subject was the empirical study of heritability, his outrage turned to holy war. The first war on heritability occurred in the 1970s. The second took place in the 1990s after the publication of the *Bell Curve*.

I agreed with Art that the *Bell Curve* was bad social science and ethically suspect as well. However, I wished that the book would just go away. Rather than make a large personal effort, along with many others, to debunk the *Bell Curve*, I would have preferred to write new papers and make positive contributions. Nevertheless, Art persuaded me that the challenge had to be met. So we both worked for several months to hone our arguments and write the *JEL* piece. In retrospect, I am proud of the result. I think we may have written the most careful and scientifically accurate critique that appeared during this sorry period for the social sciences. And I was happy to have coauthored with Art on a subject that he cared about perhaps more than any other.

After Art retired, the professional side of our relationship became less important and the personal side more so. At some point, Art became interested again in the spiritual/intellectual questions of his youth—namely, the interpretation of Jewish law. He began to send me email messages asking for the appropriate interpretation of obscure issues in the Bible, Talmud, and rabbinical texts. I was no authority on these matters, but I had a certain amount of similar training in my own youth and was able to appreciate his attraction. These exchanges had nothing to do with current religious belief for either of us. Art and I had both left religion behind long ago.
I think that he enjoyed interpreting Jewish law in the same way that he enjoyed doing crossword puzzles.

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