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## 9. H. Gregg Lewis

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On at least three occasions, colleagues and former students of H. Gregg Lewis have reflected formally on his personal qualities and his contributions to economics. In 1976 the *Journal of Political Economy* published a special issue in Lewis's honor to commemorate his retirement from the University of Chicago. This collection of research papers by fellow labor economists was prefaced by Gary Becker's one-page appreciation and a longer essay on Lewis by Albert Rees. In 1982 a brief tribute appeared in the *American Economic Review* to mark Lewis's selection as a distinguished fellow of the American Economic Association. In 1994 *The Journal of Labor Economics* published a collection of memorial essays composed shortly after Lewis's death in 1992.<sup>1</sup>

One takes away from these various pieces a consistent picture of Lewis as a person and as an economist. The authors present Lewis as a man of remarkable integrity both in his personal life and in his scholarly work. He had a strong sense of duty -- duty to his department to his students, to his fellow economists, and to the ideal of the careful and impartial scholar. As an economist, statistical theory and neoclassical economics were his tools, and he applied them meticulously and masterfully to both theoretical and empirical questions. His empirical work was especially noteworthy, marked by an intimate knowledge and judicious handling of the relevant data, and a commitment to draw only those conclusions fully warranted by statistical and theoretical considerations, regardless of their ideological or political implications.

The essayists note that at a time when labor economics was dominated by institutionalist and eclectic approaches, Lewis looked at the field through a neoclassical lens, sometimes bringing a fresh perspective to traditional topics, but more often taking up neglected questions upon which the neoclassical approach might shed light. Lewis's own published output was rather small, a fact that the authors attributed to an excessive perfectionism. He produced a few articles or

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<sup>1</sup> The relevant references are Becker 1976, Rees 1976, American Economic Association 1982, Ashenfelter 1994, Freeman 1994, McElroy 1994 and Rosen 1994.

book chapters each decade, in addition to the 1963 classic *Unionism and Relative Wages in the United States* and its 1986 sequel *Union Relative Wage Effects: A Survey*. Other potentially influential papers were circulated among friends but never published; and colleagues speak of profiting greatly from Lewis's comments in conversations, letters and referee reports.

For the most part; however, Lewis's research program was carried on in the work of his graduate students at the University of Chicago, and it is through these students that Lewis had his greatest influence on the field of labor economics. He was a member of close to a hundred doctoral committees and chairman of some thirty during his years at Chicago and Duke. He set high standards, but gave more than generously of his time to help students meet them. Under Lewis's guidance, his students applied the tools of neoclassical economics to topics including labor market discrimination, labor force participation and labor supply, the economic impact of unionism, and the economic returns to education; they continued such work on their own after receiving their degrees. Albert Rees's essay on Lewis speaks of the transformation of labor economics by Lewis's colleagues, students, and the students of his students, 'his intellectual brothers, children and grandchildren'. Rees is not alone in this sentiment. In 1976 Becker referred to Lewis as the 'founder of the "Chicago School" of labor economics'; in the 1994 memorials Orley Ashenfelter echoed the American Economic Association's 1982 tribute, calling Lewis the 'father of modern labor economics'.<sup>2</sup>

The essays in which one finds these assessments of Lewis are commemorative in nature, and for that reason might be expected to present his character and his work in the best possible light. My own examination of Lewis's published writings and of his papers and correspondence (held by the Duke University Library)<sup>3</sup> have led me to the conclusion that the picture of Lewis presented in the existing commemorative essays is essentially correct. The bulk of this essay serves simply to flesh out and substantiate that picture, looking at Lewis the man, at the nature of his work as an economic researcher, and at his relationships with students and colleagues -- relationships through which his particular approach to labor economics may have become an exemplar for many in the field. The question of the extent to which labor economics was transformed in the sixties and seventies, and the role Lewis played in that transformation, is something I have neither the space nor the historical perspective to address adequately here, but I do offer some speculations on the matter in the final section.

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<sup>2</sup> Reder's 1982 essay on Chicago economics also refers to the transformation of the field of labor economics by Lewis and his students.

<sup>3</sup> The Lewis papers are currently uncatalogued. All material cited herein is in Boxes 1 & 2, accession #92-059, H.G. Lewis papers.

## I

Harold Gregg Lewis was born in Homer, Michigan in 1914, a son of two college-educated school teachers.<sup>4</sup> He received his primary and secondary education in public schools, and upon completing high school enrolled in Port Huron Community College to study engineering. A faculty member there was impressed by Lewis's mathematical prowess, and encouraged him to attend the University of Chicago. Chicago had no engineering school, but the professor felt that Lewis's skills could be put to good use in the Department of Economics. Lewis acted on the man's advice, and received both an AB (1936) and a PhD (1947) in economics from Chicago.

Lewis was recognized early at Chicago as a precocious student part of a select group of undergraduates (including also Paul Samuelson and Herbert Simon) permitted to enrol in graduate classes.<sup>5</sup> He took courses from such Chicago luminaries as Jacob Viner, Frank Knight and Henry Simons, all of whom made a lasting impression on him. He was also influenced by Henry Schultz, for whom he served as a research assistant. Paul Douglas, who made it a practice to offer promising students co-authorship opportunities, asked Lewis to join him in preparing a study of income elasticities based on a large cross-section sample of family budgets.<sup>6</sup>

An important early association for Lewis was with Chicago statistics professor T.O. Yntema. Lewis had been an outstanding student in one of Yntema's classes, and early in 1939 Yntema invited Lewis to join US Steel's Special Economic Research Section, a group being formed to prepare material relevant to a pending Congressional investigation of the steel industry!<sup>7</sup> The assignment lasted less than a year but was an intense experience for Lewis. The group worked with the most advanced tools of statistics and economic theory, and although the subject of the work was highly controversial and of considerable policy importance, Yntema

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<sup>4</sup> The information in this and the next section, unless otherwise noted, was obtained from Lewis's vita and from interviews with his wife Julia Lewis in December 1994.

<sup>5</sup> Rosen (1994) reports Allen Wallis's recollection of Lewis as an exceptional student; Martin Bronfenbrenner, like Wallis a graduate student during Lewis's undergraduate years, shares Wallis's recollection (personal communication). A 1939 memorial to Henry Schultz by Harold Hotelling, then at Columbia University, lists Lewis as one of Schultz's promising students.

<sup>6</sup> This joint work ultimately led to two publications (Douglas and Lewis 1939, 1947).

<sup>7</sup> US Steel was preparing to testify before Congress's Temporary National Economic Committee, formed in 1938 to investigate concentration in the US economy. The TNEC's interest in the steel industry was expected to center on industry-pricing policies, in particular the basing-point pricing system and US Steel's role as coordinator of an industry-wide program to maintain 'stable prices'. With regard to the latter, US Steel hoped to produce information on the elasticity of demand for steel that would quantify the extent to which steel price inflexibility contributed to instability in the employment of steel workers.

insisted upon maintaining an atmosphere of scientific impartiality. So much did Lewis enjoy this project that when the assignment ended, he abandoned his partially completed doctoral thesis and began a new one summarizing and building upon the work the group had done on the elasticity of demand for steel.<sup>8</sup> The completion of this new dissertation was delayed by the war, during which Lewis spent two years with the War Labor Board and six months with the Army Air Force. He finally received his PhD in 1947.

By this time Lewis had already been a member of the Chicago economics faculty for eight years. The death of Henry Schultz in an automobile accident in 1938 had left the department with several courses uncovered, including an advanced statistics course. The department was divided over the question of a successor to Schultz (as it was over so many issues during this period). The idea of appointing Lewis to the position emerged as an acceptable compromise, satisfying in particular both Paul Douglas and Henry Simons.<sup>9</sup> Douglas informed Lewis of the appointment on the day of Lewis's wedding to Julia Elliot, a fellow economics student and Douglas's research assistant. Lewis took over Schultz's courses in 1939, and until 1943 was the department's 'sole representative of econometrics and of quantitative economics generally' (Patinkin 1981, p. 10).

When Lewis joined the Chicago faculty he was the youngest member of the department by more than ten years, and there was a tendency among other faculty members to burden him with administrative chores. He was appointed permanent scribe at departmental meetings, and became the unofficial 'vice chairman', performing administrative duties left behind when the actual chairman was temporarily away. In 1945 he was named departmental counselor, a job entailing administrative responsibility for both undergraduate and graduate students and programs. He quickly earned a reputation as a helpful and accessible advisor to graduate students (Patinkin 1981, pp. 10-11), and for the first time in the department's history developed a set of standardized rules for determining when doctoral candidates had actually completed their degree requirements. He retained responsibility for the department's graduate program until leaving Chicago in 1975.<sup>10</sup>

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<sup>8</sup> Mrs Lewis does not recall the topic of the abandoned dissertation, but it was related either to the income elasticity work with Douglas or to the theoretical foundations of producer price indices (see Lewis and Court 1942). At the close of the dissertation on steel, Lewis comments on the importance for economists of working on topics with policy relevance (Lewis 1947, p. 151, Box 1, Lewis papers).

<sup>9</sup> The ongoing conflicts in the Chicago economics department beginning in the mid-thirties are described in Reder (1982) pp. 10- 11.

<sup>10</sup> In 1964, Lewis's title was upgraded to Director of the Graduate Program. In 1967, as a condition of continuing in that role, he requested that his departmental duties be narrowed and formally defined, protesting against the attitude of 'let Gregg do it' that had prevailed for over twenty years (Lewis to Harberger, April 1967, Lewis papers, box 2).

Lewis reluctantly accepted additional departmental responsibilities in the mid-fifties when the University of Chicago, with funding from USAID, began a program designed to upgrade the teaching of economics in Latin America. Chilean students were to come to the University of Chicago for graduate training in economics, then return to join and revamp the faculties of economics in their own and neighboring countries. Lewis agreed to serve as coordinator of this program in 1956, and soon found that the job went beyond routine paper-shuffling, requiring service as an academic and sometimes personal advisor to the Chilean students. Lewis's official ties to Chicago's Latin American program ended in 1967, but the experience left him with strong and lasting relationships with a number of former students who rose to prominent positions in teaching and government in Latin America.

## II

Lewis is remembered as a labor economist but there is little evidence in his published work prior to 1950 of an interest in labor-related matters. After 1950, however, almost all of his own work and the bulk of the doctoral theses he supervised dealt with topics now considered part of labor economics. The reason for Lewis's change in focus is not clear, but it may be due in part to his relationship with Henry Simons. In the years following Lewis's appointment to the faculty, the teacher-student relationship between Lewis and Simons developed into a closer collegial and personal one. In terms of professional styles, however, the two men could hardly have been more different. Simons was a polemicist, outlining and defending policy proposals that grew out of a libertarian philosophy; employing vigorous prose and (sometimes loose) neoclassical reasoning to defend the free market discredit government interventions, and attack 'monopoly' in all its forms. Everything Simons wrote, Lewis once noted, was a tract (Lewis 1946). Lewis, on the other hand, pursued the ideal of the detached, objective social scientist, using precise mathematical and statistical techniques to explore narrowly defined problems of theory and estimation. Although indications are that Lewis agreed with Simons politically, he also believed in maintaining a clear distinction between the positive and the normative, and preferred to stick with positive analysis.

Lewis was profoundly affected when Simons took his own life in 1946. He penned a tribute to Simons for the *American Economic Review* (Lewis 1946), and

it seems likely that Lewis's work on unions grew out of a resolution to find a way to carry on Simons's work in his own research.<sup>11</sup> The strongest piece of evidence for this view is the article published in 1951, 'The Labor-Monopoly Problem: A Positive Program', Lewis's first on a labor topic. The article's title evoked that of Simons's 1936 book *A Positive Program for Laissez Faire*, in which Simons had identified labor unionism as one of the many manifestations of monopoly that should not be tolerated in a free society. Lewis began by noting that Simons had never outlined a policy for dealing with the problem of labor monopoly; Lewis's purpose was to fill that void. He proposed that the geographical extent of collective bargaining units be limited by law. The probable effects of the proposal were explained, and arguments were made to demonstrate its superiority over a number of then commonly-discussed alternatives.

But designing and defending policy proposals, however dispassionately, must not have fit Lewis's style or tastes, as the 1951 article was Lewis's first and last foray into explicitly normative economics. The notion of building on Simons's work, though, did not end. In his indictment of unionism Simons had identified several of its deleterious effects: the misallocation of resources resulting from the distortion of the price of labor; the increase in inequality as the unionists raised their wages at the expense of non-union workers; the unemployment effects of high union wages; the tendency for unions to become autocratic, and so on. These, Lewis realized, were things that could be comprehended and analyzed within the neoclassical model; what is more, they were in principle capable of being measured statistically. In particular, under certain circumstances the severity of the 'labor monopoly problem' could be proxied by the size of the difference between the wages of unionized workers and similar non-union workers.

Here was a set of tasks more in keeping with Lewis's talents and his conception of what economic research should be: the rigorous theoretical analysis and the empirical measurement of the impact of unionism. By 1950 he had already served on the thesis committees of two graduate students investigating the effects of unions on wages, and within a few years he was teaching a graduate course in labor economics (Rees 1976). More Chicago dissertations on the effects of unions on wages followed, and an additional intellectual problem caught Lewis's attention: the several different studies of union wage effects produced widely divergent estimates. In 1955 Lewis set for himself the task of attempting to reconcile these estimates (Lewis 1963, p. vii). It was not an unfamiliar type of

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<sup>11</sup> This suggestion comes from Mrs Lewis, who is fairly confident in its accuracy. She recalls her husband expressing other reasons for his turn to labor, but cannot recall what they were. The opinion of Reder (1982) that Lewis's interest in labor economics grew out of his association with Paul Douglas is less convincing, given that his work with Douglas had little to do with labor economics and the timing of Lewis's change in research interests towards the labor field.

project for Lewis; much of his doctoral dissertation had been devoted to reconciling or explaining the variation in previous estimates of the elasticity of demand for steel. In 1956 Lewis sought and received funding from the American Enterprise Association for research on 'The Relative Wage Effects of Unionism'.<sup>12</sup> Work on the project continued for six years, culminating in the 1963 book *Unionism and Relative Wages in the United States*.

The book surveyed and synthesized twenty studies of the relative effects of unionism on wages, that is, how much unionism raised the wage of unionized workers relative to those of non-union workers. (Lewis noted that the separate effects of unionism on the wages of union and non-union workers could not be inferred from existing data.) The centerpiece of these studies was generally a regression of the average wages of a group of workers on the proportion of the group that was unionized, using either time-series data on a single group of workers or cross-section observations of several comparable groups of workers. Such regressions would yield unbiased measures of the effect of unionism on wages only to the extent that other forces affecting wages across time or across groups were held equal, and operationalizing this *ceteris paribus* assumption was often the most troublesome aspect of the studies. Prior to running regressions the average wage figures had to be adjusted to account for differences across observations in the composition of the group and underlying supply and demand conditions. Lewis's critiques of the studies often focused on the way authors had handled this aspect of the empirical work and he sometimes provided his own corrections and re-analysis of other authors' data. He also produced new estimates of the relative wage effect of unions based on carefully constructed time series of average wages and the extent of unionism for the economy as a whole.

Lewis concluded that unionized workers earned on average 10-15 percent more than similar non-union workers, although this gap varied through time and across the labor force. It was unusual for a group of unionized workers to earn over 25 percent more than their non-union counterparts; in most industries the gap was under 5 percent. High inflation tended to lower the gap, rapid deflation to raise it. Over the period covered by the studies, the relative wage gap had been highest in the early thirties and had declined to near zero by the late forties before increasing again in the fifties.

During the period when the book was being written, Lewis also produced studies of the employment effect of unionism (Lewis 1964) and the impact of unions on interindustry wage differentials, one indicator of the effect of unions on inequality (Lewis 1962). A published lecture on 'Competitive and Monopoly Unionism' presented a rigorous theoretical analysis of the union phenomenon,

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<sup>12</sup> Contract between Lewis and the American Enterprise Association, 4/23/56, Lewis papers, box 2.

with attention to the empirical implications of the analysis, The first lines of the article stated succinctly the guiding thrust of all Lewis's union research:

many of the differences among economists in the positions they hold regarding public policy towards trade unions, as well as in their assessments of the importance of unionism as a labor market factor, stem from disagreement on the answer to this question: What is the impact of unionism on relative real wages? If we knew the answer to this question, we would surely know much about the extent to which unionism is monopolistic, the conditions that strengthen or weaken monopoly unionism, and the consequences of unionism for the distribution of wage and salary income and for the allocation of labor and other resources among uses. (Lewis 1959, p. 181)<sup>13</sup>

Whatever impetus Lewis might have received in the late forties from Simons's concerns with monopoly unionism, by the mid-fifties Lewis had redefined the problem and made it his own. Rather than inveighing against the union monopoly problem he was taking its measure with what he considered to be the tools of an impartial scientist, a step that in his mind was logically prior to that of discussing policy. His goal became the establishment of propositions about unionism that were consistent with neoclassical theory and the existing data, regardless of their relationship with any explicitly ideological or political position on unionism.<sup>14</sup>

For example, Lewis's theoretical analyses of unionism led him to conclude that *contra* Simons, unions themselves were not necessarily inconsistent with competition, and that neoclassical theory did not imply that concentration in product markets would facilitate the growth of monopoly power in the labor market (Lewis 1959). A repeated theme in his empirical work was the difficulty of making any confident assertions at all about the economic impact of unions given the existing data, and the conclusions that he was willing to draw did not cleave to any ideological line. Lewis (1962) argued that any impact of unionism on wage inequality was likely to be small. In his 1963 book he carefully examined and ultimately rejected the finding of Friedman and Kuznets (1945), famous in the lore of Chicago economics, that physicians' earnings were kept artificially high by the monopolistic practices of the American Medical Association. The American Enterprise Association, having partially funded Lewis's research into the relative wage effects of unionism and having agreed to publish a non-technical summary of his work, persistently prodded him to include material about the

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<sup>13</sup> One hears in this passage echoes of fellow Chicago economist Milton Friedman's assertion that most disagreements between economists on policy matters could be resolved through the pursuit of positive economics.

<sup>14</sup> Reder (1982) speaks generally of the shift in Chicago labor economics during the fifties and sixties from 'normative condemnation to positive analysis'; the work of Lewis and his students is cited as an important part of this shift.

inflationary impact of union wage increases. In a long correspondence with American Enterprise Association board member Gottfried Haberler, Lewis patiently explained why his results on the relative wage effects of unionism had no implications for the effect of unions on the general price level. 'It is my very sincere desire that my paper be neutral on the issue of wages and inflation', Lewis insisted in one letter; in another, 'in my judgement the evidence to date is too meager to support any strong empirical assertions on this matter'.<sup>15</sup>

Indeed, it pained Lewis to think that his results would be viewed as anything but the work of an impartial investigator. During the early sixties a series of articles in the *Journal of Political Economy* and elsewhere debated the question of whether there was a 'Chicago School' of economics with a distinctive ideological program.<sup>16</sup> In 1967 Lewis received a letter questioning some of the results reported in his 1963 book, and commenting in passing that 'the Chicago School' tended to 'belittle' the effect of unions by concentrating on particular periods in history. Lewis gave characteristically clinical responses to the writer's questions, but lashed out angrily at his reference to the 'Chicago School':

you show the utmost contempt for not only me but also my colleagues. In effect you are telling me that I am guilty of error not because of mistakes in my book ... but because I am a member of the faculty of the University of Chicago, all of whose members you label the 'Chicago School' with the clear intention that the label be derogatory.<sup>17</sup>

The fifties saw Lewis developing an interest in labor topics beyond the impact of unionism, due perhaps to his teaching of the graduate labor course or his participation in the department's labor economics workshop. Lewis pursued these interests for the most part in the context of his role as an advisor or supervisor to students writing doctoral theses. In the 1956 paper 'Hours of Work and Hours of Leisure', Lewis used the neoclassical model of the consumer's demand for leisure as a vehicle for explaining the secular decline in the average work week and for understanding other empirical regularities in labor supply behavior. The paper was presented as part of ongoing work with two Chicago graduate students. Over the next ten years, Lewis supervised or was involved with several other dissertations, all with significant empirical content, which examined labor force participation and hours of work decisions in the context of the neoclassical model (Rees 1976, pp. s6-s7). Gary Becker's famous neoclassical analysis of discrimination began

<sup>15</sup> Box 2, Lewis papers: Lewis to Haberler 12/7/62; Lewis to Haberler 11/2/62. The American Enterprise Association was also concerned with Lewis's minimization of the effect of unions on inequality.

<sup>16</sup> See, e.g., Miller (1962) and Bronfenbrenner (1962).

<sup>17</sup> Lewis to Paul Anderson, 5/4/67, box 2, Lewis papers.

as a thesis written under Lewis's supervision; according to Becker's acknowledgement Lewis 'influenced every page' of the work (Becker 1957, p. 4). Other Chicago labor theses of the fifties and sixties looked at black-white differentials in income and earnings, rates of return to education, and factors affecting the demand for labor (Rees 1976).

Lewis left the University of Chicago in 1975 to join the faculty of Duke University. His departure from Chicago was not motivated by any dissatisfaction with the department he told friends, but by the desire of himself and his wife to put down roots in a warmer climate in which they could eventually retire.<sup>18</sup> At Duke he once again became deeply involved in departmental matters, supervised several dissertations, and began writing a second book on the effect of unions on wages, *Union Relative Wage Effects: A Survey*.

While Lewis's first book synthesized the findings of twenty studies, the second, published in 1986, covered almost 200. The two decades following the appearance of Lewis's first book had seen the development of new data sets that allowed comparisons between the earnings of individual union and non-union workers, controlling for a number of other relevant individual characteristics; a few of the data sets were longitudinal, following the same groups of workers as they moved between union and non-union jobs. The new data sets provided the raw material for a host of studies re-examining Lewis's 1963 conclusions, often with the aid of recently developed econometric techniques.

The majority of the studies surveyed by Lewis in the 1986 book were based on ordinary least squares, cross-section regressions of the wages of individual workers on a variable indicating whether or not they belonged to a union along with several variables meant to control for demographic and productivity differences across workers. Lewis concluded that this 'OLS-CS' approach to estimating the relative wage effect of unionism (now termed the 'union/non-union wage gap') eliminated many of the problems associated with the comparisons between average wages of groups of workers that formed the basis of his 1963 book. A problem remained, however. One could not observe all of the factors that made one worker different from another, and some of these factors might be correlated with union status, biasing the estimated effect of union status on wages. Researchers had attempted to circumvent the problem by using more complex statistical techniques or by taking advantage of longitudinal data, but Lewis did not believe that they had succeeded. He found that the estimates produced by more elaborate statistical methods were sensitive to arbitrary changes in the economic and statistical assumptions underlying the estimation procedure. Estimates based on longitudinal data were more sensitive to measurement error than those based

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<sup>18</sup> Letter from Lewis to G. Becker, 2/17/75, Lewis papers, box 2; also McElroy (1994).

on cross-section data, and Lewis had evidence that the level of measurement error in the longitudinal data was sufficiently high to render the estimates unreliable. Though flawed, then, the OLS-CS estimates provided the best available basis for Lewis's synthesis.

After careful adjustment across studies for differences in things such as sample composition and lists of control variables, Lewis produced year by year averages of the union/non-union wage gap from 1967 to 1978, and concluded that over this period the gap had remained in the neighborhood of 15 percent. The studies of the sixties and seventies also allowed Lewis to look more carefully at variations in the wage gap across the labor force. They supported the hypothesis that the wage gap was lower for workers with more human capital, but not the broader hypothesis that unions raised relative wages for low-wage groups more than for high-wage groups.

The 1986 book was Lewis's last major research effort; appearing two years after his retirement from Duke. He remained professionally active, however, until close to his death in 1992.<sup>19</sup>

### III

From his doctoral dissertation to his final book on unionism and relative wages, three features mark Lewis's work as an economist. The first is a thoroughgoing mathematical neoclassicism: discussions of economic phenomena invariably take place within confines of a mathematical neoclassical model. The second is Lewis's empiricism, a commitment to exploring and measuring the empirical content of neoclassical theory. The third is the craftsmanlike quality of Lewis's work - careful, precise, thorough, complete - which previous writers have emphasized.<sup>20</sup>

Lewis's uncompromising neoclassicism should not be surprising, given his exposure at Chicago to the likes of Viner, Simons, Knight and Henry Schultz, but Lewis's overall research style most closely resembled that of Schultz. Of the four of Lewis's teachers just mentioned, only Schultz was an enthusiastic advocate of the mathematization of theory and of the possibilities of developing, through the use of the most sophisticated statistical tools, an empirical adjunct to neoclassical

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<sup>19</sup> Freeman (1994) provides a more thorough discussion and comparison of the two union books; McElroy (1994) chronicles Lewis's years at Duke.

<sup>20</sup> Freeman (1994) invokes the craftsman metaphor in describing Lewis, but it also appears much earlier in a letter to Lewis from Armen Alchian (I /19/59, box 2, Lewis papers) who comments that after having read Lewis's comments on Alchian's work he understands Reuben Kessel's description of Lewis as a 'craftsman'.

theory (Reder 1982). Schultz's econometric program has been described in Morgan (1990), but for our purposes it is sufficient to note that the goal of Schultz's work was to measure statistically the real-world manifestations of the parameters identified by neoclassical theory (for example, supply and demand elasticities), taking the existence and significance of those parameters as unproblematic. Of course, the preponderance of the empirical work with which Lewis is associated is in the same vein: the attempt to estimate the elasticity of demand for steel, the quest for the most reliable measures of the effect of unions on wages, and the Lewis-inspired work of estimating the income and wage elasticities of the neoclassical demand for leisure model. Also, Schultz was known for his meticulous, orderly approach to research (Reder 1982). Shortly after Schultz's death in 1938, Lewis wrote of his teacher in words that could easily be mistaken for a description of Lewis by one of his own students:

Whether in economics or statistics he began by building a mathematical or logical foundation of a theory - a model to serve as a frame of reference for further analysis ... he impressed upon students the necessity for thoroughly understanding all the premises upon which the model was built.

But he did not stop with the strict logical pattern; he proceeded to show us how we could test the assumptions underlying it, first by a priori reasoning ... and then by statistical techniques.<sup>21</sup>

The first step for Lewis in dealing with any research problem was to conceptualize it within a neoclassical model, to express it in the language of utility and production functions, costs and prices, competition or monopoly, and so on. The models were laid out mathematically, and were in most instances drawn from or patterned after those found in R.G.D. Allen's *Mathematics for Economists*.<sup>22</sup> Lewis's technique for presenting theoretical results through logarithmic differentiation of his model allowed him to express the key relationships between variables largely in terms of elasticities, cost shares and factor ratios - entities that

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<sup>21</sup> Lewis quoted in Hotelling 1939, p. 10. Reder (1982, p. 3) has argued that Lewis's work represents a continuation of the tradition of Paul Douglas at Chicago. This is a plausible claim, given Douglas's program of estimating the parameters of the Cobb-Douglas production function (a mathematically expressed neoclassical relationship), his work with Lewis on estimation of income elasticities, and his interest in labor topics. However, when interviewed, Mrs Lewis expressed the strong opinion that while Douglas provided encouragement to Lewis, it was Schultz (and T.O. Yntema) who left the greatest mark on Lewis's research style. In particular, she felt, Lewis was attracted by the care and thoroughness with which Schultz went about both his empirical and theoretical work.

<sup>22</sup> Freeman (1994) correctly notes Lewis's tendency to think about problems using the neoclassical theory of factor demand as developed in his graduate lectures on labor demand. These lectures, in turn, were based on Allen's book (Lewis to Katz 12/30/70, box 2, Lewis papers).

lent themselves to measurement, and whose magnitudes economists could meaningfully discuss even in the absence of hard statistical evidence.

Lewis explored his models thoroughly. Where others might implicitly assume that certain functions were perfectly elastic, or that a production function was homothetic and linear homogenous, or that all relevant markets were competitive, Lewis would make these assumptions explicit, discuss their plausibility, and determine consequences of their failure.<sup>23</sup> Never questioned, however, were the fundamental neoclassical assumptions such as profit maximization or utility maximization.

For Lewis, theorizing was almost always intended as an (essential) component of a larger empirical project. Sometimes the theory served to provide interpretation of an existing empirical observation (e.g., Lewis 1956), but more often the purpose of theorizing was to identify important empirical relationships to be measured and to suggest strategies for measuring them. For example, in his doctoral dissertation Lewis used neoclassical theory to establish the link between the elasticity of demand for steel and the probable impact of policies designed to increase the flexibility of steel prices. Following attempts to measure the elasticity directly (using multiple regression equations grounded in a theoretical model), Lewis turned to theory again to propose an indirect means of establishing an upper bound for the value of the elasticity of demand for steel from two other quantities of less uncertain magnitude: the elasticity of demand for products made from steel, and the share of steel in the total cost of those products. Likewise, alongside his attempts to measure directly the union wage effect (the importance of which followed from neoclassical theory) Lewis developed theoretical models intended to identify proxy variables from which the wage effect could be indirectly inferred (Lewis 1959, p. 182).

Many of Lewis's empirical conclusions rested on estimates produced by himself or others using ordinary least squares regression techniques, and his work evidences a thorough understanding of the statistical theory underlying those techniques. The apparatus of hypothesis testing that has come to be associated with the use of regression analysis in economics is not common in Lewis's work; discussions of standard errors and issues of statistical significance seldom appear. This is in part because of the tasks Lewis set for himself -- he was engaged in measurement, not theory testing. The magnitude of an empirical entity itself was of interest, not whether it differed from some hypothesized value. Also, as a synthesizer of the results of others, the basic unit of observation for Lewis was

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<sup>23</sup> A contribution in this vein is Lewis (1975), which explores in the context of a generic two-sector general equilibrium model the conditions under which the results of partial equilibrium analysis will provide a good approximation to the conclusions of general equilibrium analysis.

often the estimate, and the variation of interest was the variation across estimates produced by different researchers, rather than the sampling variation of a single estimate with which the textbook theory of inference and the procedure of hypothesis testing are concerned.

Lewis's discussions of possible bias in the estimates he produced or assessed were those of a researcher dealing with a concrete problem, and went well beyond considerations of the properties of an estimator calculated from a hypothesized random sample of generic X's and Y's. With the same precise attention to detail that marked his theoretical work, he considered the representativeness of the sample, the correspondence between theoretical concepts and empirical variables, the reliability of the data, and the likelihood of misspecification. Suspicion that another author's estimate suffered from bias because of these or other considerations might lead to an adjustment of the author's data, or even a re-analysis of the data with alternative statistical models.

A distinctive feature of Lewis's empirical work is that the evidence produced by standard statistical techniques is often coupled with, checked by, indeed sometimes subordinated to, evidence of another sort: Lewis's 'hunches' or judgements regarding the values of critical parameters of the relevant theoretical model. One example of this has already been mentioned -- Lewis's attempt to infer a range of values for the steel elasticity from reasonable guesses about the magnitudes of other model parameters. A more thorough example of Lewis's 'back of the envelope' style of empiricism is found in Lewis's comment on a study of the impact of the payroll tax provisions of the Black Lung Benefits program (Lewis 1976; Goldstein and Smith 1976). The study had used regression techniques to estimate the probable effect of the program on prices, employment and output in the coal industry. Lewis checked the estimates by setting up a partial equilibrium model of the coal industry, deriving theoretical expressions relating prices, output and employment to payroll taxes, then assigning values to the parameters of those expressions based on published sources and intuition. Lewis's answers were very close to those of the original study, but he suggested that the regression estimates were less precise than their standard errors might indicate, in part because of the sensitivity of his own estimates to changes in the values he had assumed for parameters!

These instances are just two of many in which Lewis was equally if not more willing to rely on his theory-plus-judgement estimates than on those produced by statistical techniques. And it is interesting that while Lewis's diffidence towards estimates of the latter sort was usually solidly based on considerations of statistical theory or data quality, his frequent reliance on the theory-plus-judgement estimators required an acceptance of the neoclassical model as a description of reality, an acceptance that was uncharacteristically uncritical.

A final, somewhat innovative, feature of Lewis's economics was his use of statistical theory not only as a guide to the process of estimation and measurement, but also as an adjunct to his theorizing. This probably stemmed from his desire to take neoclassical models seriously, to discover exactly what, granting a set of conventional neoclassical assumptions, one could or could not infer about observable behavior.<sup>24</sup> As a labor economist Lewis made considerable use of neoclassical models of individual choice: the labor supply decision, the labor force participation decision, the decision of whether or not to support a union, and so on. The empirical measures these models were designed to explain, generated through the use of standard statistical techniques, were of the nature of averages, pertaining to groups rather than individuals (for example, labor force participation rates and average weekly hours of work for various demographic groups). Only under rather narrow circumstances could the empirical measures be expected to correspond exactly to the theoretical parameters of individualistic models, but in Lewis's day such a correspondence was often taken for granted implicitly. Lewis, however, was not willing to do so, and he turned to statistical theory as a means of building a rigorous bridge between the implications of the theory regarding the behavior of an individual and the implications of that theory regarding group or market-level phenomena.

The Lewis approach was the now familiar one of defining the model for an individual, then capturing the possibility of heterogeneity in the group by assuming certain crucial parameters of the individualistic model to be random variables with a well-defined distribution in the group. Lewis used this strategy in his 1959 essay to determine whether what he called 'competitive unionism', devoid of monopoly power, could give rise to a union wage effect, and it is used by Becker in his dissertation where he explores the consequences of allowing 'tastes for discrimination' to differ across agents in the economy. Perhaps the archetypical application is found in Lewis's unpublished but well-circulated 1967 paper 'On Income and Substitution Effects in Labor Force Participation'. He begins with a recognition of the difference between the entities identified by theory (elasticities defined by individual utility function parameters) and the entities being measured (partial correlation coefficients between variables defined over groups). By introducing explicit assumptions about the distributions across the group of the parameters of individual utility functions, Lewis derives

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<sup>24</sup> It might be tempting to link Lewis's introduction of statistical theory (i.e., probabilism) into neoclassical models to his association with the Cowles Commission during the Commission's time at Chicago. I see no other evidence to substantiate such a link, however. Lewis understood the significance of the econometric theoretical research going on at Cowles (see Lewis 1947, pp. 129-30) but his approach to statistical modeling, his notation, and so on, do not resemble the better-known Cowles Commission work.

propositions about the relationships between these distributions and empirical estimates of labor force participation and labor supply elasticities.<sup>25</sup>

#### IV

All who have written on Lewis have singled out as his most important contribution to economics his activities as a mentor and teacher, noting both his extraordinary devotion of time and effort to these aspects of his professional life and the impact he had on the profession as a result of them. This impact, according to Rosen, was 'much greater ... than the most ambitious economists can imagine' (1994, p. 143). On Lewis's dedication to his role as a teacher there is ample evidence beyond the reflections found in the memorial essays. Despite his position at a major research university, it was Lewis's expressed opinion that the primary purpose of being on a university faculty was to teach. In his twenty-plus years as Department Counselor, his office hours for students were nine to five, five days a week. On several occasions he spent weekends with graduate students, helping them to iron out difficulties in their dissertations. Both the University of Chicago and Duke University honored him with teaching awards.<sup>26</sup>

In the Lewis papers one finds half a dozen unsolicited letters from former students, thanking him many years after the fact for his guidance and crucial assistance.<sup>27</sup> There are also letters from colleagues, written when Lewis announced his decision to leave Chicago. George Stigler opined that Lewis 'deserved a statue', as 'the Chicago miracle of turning out innumerable well trained economists' was due to him more than any other person. Harry Johnson thanked Lewis for teaching him of his 'responsibility in looking after and caring for the students and the department', while Ted Schultz noted that many of Schultz's best students had 'learned to be precise in their thinking and their work' from Lewis.<sup>28</sup>

The assertion that Lewis's devotion to teaching allowed him to have a large impact on the profession is more difficult to substantiate. The nature of the field of labor economics does appear to have changed during the sixties and seventies; to the testimony on this point by practitioners such as Rees and Rosen, one can add Ramstad's (1981) demonstration of the relative decline in the number of

<sup>25</sup> See also Lewis (1974), the early and influential exposition of the problem of sample selection bias in the estimation of labor supply equations.

<sup>26</sup> Interview, Julia Lewis.

<sup>27</sup> Cooper to Lewis 1/18/71; Cook to Lewis, 8/3/71; Cain to Lewis, 8/25/76; Herrick to Lewis, 8/26/76; Keat to Lewis, 9/3/79. Lewis wrote in response to one such expression of gratitude 'The greatest rewards we have come from our students' (Lewis to Lurie, 5/28/75). All in box 2, Lewis papers.

<sup>28</sup> Stigler to Lewis, 1/3/75; Johnson to Lewis, 2/7/75; Schultz to Lewis, 1/21/75. Box 2, Lewis papers,

institutionalist-style articles and the corresponding rise in the number of neoclassical articles in the journal literature of labor economics between the mid-fifties and the end of the sixties. The contributions to neoclassical labor economics over this period of Lewis's 'intellectual children and grandchildren', to use Rees's phrase, have been discussed in the commemorative essays, which also point out that a great deal of empirical research on labor supply and the economic impact of unions continues to be devoted to answering questions framed by Lewis in the fifties and sixties.

The remarkable impact on economics of Lewis's best-known student, Gary Becker, need not be recounted here. Although it is impossible to gauge the extent to which the nature and content of Becker's influential research was shaped by his association with Lewis, one can point to Becker's own acknowledgement of Lewis's influence on his seminal dissertation on discrimination in labor markets, and see in Becker's neoclassical modeling of family interactions, crime, and so on a reflection of Lewis's program of applying neoclassical concepts to areas of labor economics not previously comprehended in neoclassical terms. Another Lewis student Sherwin Rosen, has produced a much-cited body of theoretical literature on the employment relationship. Like Lewis, Rosen works within a neoclassical framework, exploring the consequences of relaxing certain conventional assumptions (such as those concerning the way in which labor enters the production function), and using constructs from statistical theory to build a bridge from models of individual optimization to characterizations of equilibrium in markets with heterogeneous agents.<sup>29</sup>

It is not only through research, however, that Lewis and his students might have influenced the direction of labor economics. Lewis himself had a strong and rather exclusive vision of what constituted good research in economics, with his own empirical neoclassical work reflecting this vision. In published writings he never denigrated alternative approaches to economics; indeed, he never acknowledged their existence.<sup>30</sup> In classes or discussions with colleagues, however, Lewis would occasionally reveal his opinion that non-neoclassical approaches to economic questions were not properly considered as economics at all.<sup>31</sup> Lewis frequently served as a referee for *The Journal of Political Economy* and other prestigious journals (many of his reports can be found in the Lewis papers), and in the later

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<sup>29</sup> The Lewis papers contain a long and interesting correspondence between Rosen and Lewis dealing with some of the theoretical issues later dealt with by Rosen in his seminal paper on implicit markets (Rosen 1974).

<sup>30</sup> On at least one occasion Lewis's own approach to labor economics was publicly attacked by John Dunlop (1962), who questioned the value of and motives behind the Chicago research program on the impact of unions. Lewis never responded to this attack in print.

<sup>31</sup> For example, in a graduate labor economics class in which I was a student, Lewis remarked that most labor economics in the fifties was 'not really economics at all'.

decades of his career, was often consulted when other departments were considering candidates for hiring or promotion in the field of labor economics. Not surprisingly, he used his own views on what constituted good economics as a means of judging the work of others. When hiring and promotion decisions were made by the Chicago economics department in the sixties, Lewis's general opinion on the appropriate approach to economic research was probably not a source of contention. At Duke, Lewis found less agreement on this matter. He did, however, have a notable impact on the department's hiring and promotion decisions, basing his arguments for or against particular candidates on remarkably detailed reviews of their records.<sup>32</sup> As a result, the Duke economics department had developed a noticeable 'Chicago' flavor by the early eighties.

Those of Lewis's students who moved into academic positions likewise came in their time to serve as referees, to participate in hiring decisions, and to supervise PhD students. It would be wrong to suggest that Lewis's students behaved just as Lewis would have, or that they all carried into their non-research professional responsibilities Lewis's strong commitment to promoting a particular style of neoclassical research. Given what we know about the attention which Lewis gave to his duties as a guide and advisor to graduate students, however, it would not be out of line to speculate that the intellectual affinities between Lewis and his students might be stronger than those between the typical economist and his or her advisor; or that when choosing colleagues or advising journal editors, Lewis's students have probably tended to make decisions that would have pleased their mentor. And through those decisions, they, like Lewis, have contributed to the increasingly neoclassical tone characterizing labor economics since the sixties.

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