Journal of Economic Literature
Vol. XXXV (September 1997), pp. 1347–1373

Teaching Economics to Undergraduates

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Parts of this draft were prepared though the support of the Universities of Adelaide, Melbourne, and South Australia, provided while Becker was on leave from Indiana University during the fall 1995. Constructive criticism on earlier drafts was provided by Robin Bartlett, William Baumol, Suzanne Becker, Stephen Buckles, George Bredon, Paul Grimes, Robert Highsmith, Hirschel Kasper, Peter Kennedy, Mark Maier, Joan Middendorf, Michael Salemi, Phillip Saunders, John Siegfried, Rosalind Springsteen, Myra Strober, and Michael Watts. T. Aldrich Finegan, Maier, and Siegfried contributed helpful data leads. Sue Becker and Julie Marker provided research assistance. Finally, special thanks are owed to W. Lee Hansen, William Walstad, and the anonymous referees who helped me to focus on the key issues.

UNFLATTERING CRITIQUES of college teaching appear regularly in books with titles such as *Profscam*, *Impostors in the Temple*, and *The Fall of the Ivory Tower*. Martin Anderson's (1992) *Impostors in the Temple* singles out economists as particularly contemptuous of teaching. Yet, a notable number of economists are concerned about the teaching of undergraduate economics, and as this article shows, contribute greatly to its development and evaluation. At the same time, many economists are not keeping up with educational changes in their discipline and their institutions.

Economics is now a discipline dominated by teaching jobs. Over the past 20 years, approximately 70 percent of all new jobs advertised in the AEA Job Openings for Economists (JOE), have been in academe,[1] with an increasing proportion of those jobs at graduate degree granting institutions (Figure 1). As the higher education industry moved from one dominated by four-year liberal arts colleges to graduate degree-granting institutions, all faculties to some degree may have lost sight of their obligation to teach undergraduates. In economics, however, the effect may have been more pronounced. Unlike other social scientists, economists may have had the luxury to ignore undergraduates as enrollments in economics rose in the 1980s. But now faced with declining numbers, academic economists must give more consideration to how they teach.

This article provides a summary of the evidence on teaching economics to undergraduates. It describes what economists are doing in classrooms, and discusses the consequences of their fail-

[1] The AEA initiated Job Openings for Economists (JOE) in 1975. Although Elton Hinshaw (1975, p. 489) stated that participation was good from the start, variations in the 1975 and 1976 data may reflect a start-up phenomenon that involves more than simple random sampling error. The 1977 through 1996 mean number of new jobs per year in academe is 1,192, while it is 489 for nonacademic jobs.

Figure 1. Ratio of College to University Jobs in Economics

ure to do more. It reviews what the research on teaching economics has to offer classroom teachers and considers alternative measures of educational outputs. Extensive consideration is given to nonlecture teaching methods that are more prevalent in other disciplines.

I. *The Teaching Environment*

The founders of the American Economic Association demonstrated an interest in the teaching of economics principles but not all of its subsequent leaders have shared a commitment to that mission. As colleges expanded into graduate education, economists lost sight of the importance of undergraduate courses and the way they are taught. In contrast with other disciplines that have moved to a broad teaching repertoire, economics continues to be taught by the lecture method in all undergraduate courses.

A. *Institutional Change*

Between 1970 and 1994 the proportion of baccalaureate degree-granting colleges in the Carnegie Classification (1994) decreased from 53.4 percent to 45.4 percent of the total number of baccalaureate and advanced-degree-granting institutions. The proportion of each of the three Carnegie types of post-baccalaureate institutions increased, with the research category rising from 6.8 percent to 8.9 percent of the total and the proportions of doctorate and master's degree granting institutions increasing as well (Table 1). Consistent with these trends in higher education, but more dramatic, is the shift in the type of institutions advertizing in JOE. In the last 20 years, the ratio of job openings in "four-year colleges" to those classified as "universities with graduate programs" plummeted from about 8 in 10, to 4 in 10 (Figure 1). Academic jobs in economics are dispro-

TABLE 1
CLASSIFICATION OF POSTSECONDARY EDUCATIONAL INSTITUTIONS
(NUMBER OF INSTITUTIONS/PROPORTION OF SUBTOTAL)

	1970	1976	1987	1994
Research	92	98	104	125
	6.81%	7.20%	7.54%	8.92%
Doctorate	81	86	109	111
	6.0%	6.32%	7.90%	7.92%
Masters'	456	594	595	529
	33.78%	43.64%	43.12%	37.73%
BS/BA	721	583	572	637
	53.41%	42.84%	41.45%	45.44%
Subtotal	1,350	1,361	1,380	1,402
Associate	1,063	1,146	1,367	1,471
Total	2,413	2,507	2,747	2,873

Source: Carnegie Foundation for the Advancement of Teaching (Various Editions).

portionately opening in graduate degree-granting institutions.

The "upward" movement of a department and institution on the degree ladder or a mere name change such as from the College of Saint Thomas to the University of Saint Thomas, carries with it an implied shift from a liberal arts orientation to a graduate or professional school orientation. Faculty members face real or perceived change to a research emphasis, even though their make-ups may have changed little,[2] and the bulk of their work continues to be the teaching of undergraduates. Policy makers see this movement as a Malthusian cycle in which competition for funds to build their research prestige leads institutions to use their own resources to subsidize research (Roger Geiger and Irwin Feller 1995). Between 1970 and 1994, for example, the proportion of research and development expenditures financed by own-institution resources increased from 10.41 percent to 18.21 percent while external state and federal support fell (Table 2). Changes in accounting procedures over this period preclude tracking internal funds to establish the source of reallocation, but the dichotomization of higher education into "graduate education and research" versus "undergraduate education,"[3] by Rothschild and White (1993) for example, suggests that

[2] Ronald Ehrenberg, Kasper, and Daniel Rees (1991) found that the rate of retention of faculty members between 1972 and 1989 averaged about 85 percent for assistant professors, 93 percent for associate professors, and 92 percent for professors.

[3] Michael Rothschild and Lawrence White (1993) dismiss the idea that undergraduate education subsidizes graduate education and research with the argument that an industry with joint production at some institutions and single production at others would not be sustainable; that we observe this industry implies that there are no subsidies. Although the logic (if A, then B; thus, not B implies not A) is valid, Rothschild and White's premise (A) is a compound event: if institutions of higher education faced the same regulations, and if they all produced the same undergraduate product, and if students and their parents had accurate information, and if firms were free to enter, . . ., and if undergraduate education subsidizes graduate education, then undergraduate institutions and joint graduate and undergraduate institutions would not coexist. Existence of the different types of producers implies only that at least one of the many premises is wrong.

TABLE 2
R&D EXPENDITURES AT UNIVERSITIES AND COLLEGES, BY SOURCE OF FUNDS: SELECTED FISCAL YEARS
(DOLLARS IN MILLIONS/PROPORTION OF TOTAL)

Fiscal Year	Total	Federal Government	State and Local Government	Private Industry	Institutional Self-Funding	Other Sources
1970	2,335	1,647	219	61	243	165
		70.54%	9.38%	2.61%	10.41%	7.07%
1976	3,729	2,512	364	123	446	285
		67.36%	9.76%	3.30%	11.96%	7.64%
1987	12,153	7,343	1,023	790	2,168	828
		60.42%	8.42%	6.50%	17.84%	6.81%
1994	21,081	12,661	1,562	1,430	3,838	1,590
		60.06%	7.41%	6.78%	18.21%	7.54%

Source: National Science Foundation. *Survey of Scientific and Engineering Expenditures at Universities and Colleges.* Fiscal Year 1994. Table B–1.

undergraduate education was not on the receiving end. In the quest for prestige it seems unlikely that faculties in economics disregard assertions, such as that found in White (1995), that there is an inverse relationship between the ranking of graduate economics departments and the amount of attention those departments give to the development and assessment of teaching.

Economics faculties at some liberal arts colleges now perceive a need to demonstrate they behave like faculties with graduate programs, with an unprecedented two articles in the *Journal of Economic Education* providing rankings of these colleges by number and placement of publications (Howard Bodenhorn forthcoming; James Hartley and Michael Robinson forthcoming). It appears that younger liberal arts faculty members in particular are attempting to establish publication records like those at the better graduate schools, reflecting a change in emphasis within these departments (Bodenhorn forthcoming). Although they are still called liberal arts, the mission of many of these colleges has changed with the introduction of business schools, law schools, and small graduate programs (David Breneman 1994, p.12).

Finally, as traditional four-year colleges established graduate programs, and faculties at the remaining liberal arts colleges tried to emulate graduate faculties, the number of two-year community colleges classified by the Carnegie Foundation expanded from 1,063 institutions in 1970 to 1,471 in 1994 (Table 1). But community colleges do not embrace or are not embraced by the majority of economists associated with the AEA, as indicated by the AEA's elimination of this classification from JOE in 1982. The growth in community colleges implies a growth in the demand for college teaching of economics that is being ignored by the AEA.

B. *Economists and Their Organizations*

The first AEA standing Committee on Economic Education was appointed in 1953. Its successors have been active, with sessions at the AEA annual meetings and papers appearing regularly in the *American Economic Review Proceedings*. To avoid direct AEA sponsor-

ship in the delivery of programs, the AEA Committee on Economic Education linked with the National (formerly Joint) Council on Economic Education (a nonprofit organization receiving support from all sectors of the economy). In addition to implementing pre-college programs, in the 1960s the AEA committee and NCEE developed a nationally normed test of micro and macroeconomics principles: The *Test of Understanding of College Economics* (TUCE), now in its third edition (Saunders 1991). The *Journal of Economic Education* was established to provide a channel of communication for research work and related publishable material in economic education, primarily at the undergraduate level. In 1973, the AEA committee and NCEE initiated a teacher training program for graduate students and new instructors, with the 1992–1994 offering involving 236 participants from 180 colleges and universities (Salemi, Saunders, and Walstad 1996). These on-going activities, as well as timely but fixed-term initiatives, have been central to the program planning of the AEA Committee on Economic Education.

The various ventures of the AEA into education have not always been met with applause. Those opposed to AEA educational activities point to the AEA Certificate of Incorporation (1989) objectives, which call for "the encouragement of economic research" but include no reference to the encouragement of economic education. George Stigler, as a past AEA president and member of the AEA Executive Committee, was most strident in promoting the view that teaching is akin to pontification, and thus contrary to "the encouragement of perfect freedom of economic discussion," another AEA objective. Unlike the publishing of journals, programs aimed at teaching were seen as an endorsement of the ideas expressed by participants.

In contrast to the AEA, the American History Association's annual meeting program states "The Program Committee has asked commentators in all sessions to address the implications of the papers being given not only for research but also for teaching" (AHA 110th Annual Meeting, Atlanta, January 4–7, 1996, p. 18). A dedicated section in the program identified 27 sessions and events that dealt with the teaching of history, including a separate reception for two-year college faculty. On the quantitative side, the American Statistics Association has a long record of concern for teaching but yet President Lynne Billard (1996, p. 9), after describing a report she had done on the role of statistical societies in education, encouraged more ASA involvement in education:

> It is doubtful that many of us would dispute the need for an association to become involved in such activities though we might well have differing views as to how these can be best effected . . . I draw our attention to two more general issues, ones in which we as an association, could and should perhaps become involved, specifically, the quality of instruction, and statistics as part of a core curriculum.

Scholars in other disciplines that experienced enrollment declines in the 1980s are doing likewise. Economists are noticeably absent from groups formed to advance college teaching. For instance, of more than 1,000 individuals listed in the Directory of Cooperative Learning Practitioners in Higher Education only a dozen or so are economists. Typically only three or four economists are among the 200 attendees at the International Society for Exploring Teaching Alternatives. Only two of the 100 scholars involved in the prestigious Harvard Assessment Semi-

TABLE 3
TEACHING METHODS, EXAMPLES, ASSIGNMENTS, AND CLASS SIZE

	Median (and Mean) Responses by University Type				
	Research	Doctorate Granting	Masters	Liberal Arts	Associate Institutions
Introductory					
Lecture Time	83(78)%	83(68)%	83(73)%	83(72)%	83(73)%
Guest Lectures	0(3)%	0(3)%	0(3)%	0(2)%	0(3)%
Class Time Use of					
Chalkboard[a]	83(60)%	83(65)%	83(68)%	83(57)%	83(65)%
Overhead[b]	6(28)%	0(17)%	6(25)%	6(17)%	22(30)%
Computer labs	0(3)%	0(5)%	0(6)%	0(4)%	0(4)%
Coop learning	0(8)%	6(15)%	6(16)%	0(11)%	6(19)%
Examples from					
Literature	0(9)%	6(8)%	6(11)%	6(5)%	6(15)%
Sports	6(11)%	6(11)%	6(11)%	6(11)%	6(21)%
Assigned Materials					
Textbooks	83(78)%	83(75)%	83(77)%	83(74)%	83(73)%
Workbooks	6(36)%	6(31)%	22(35)%	22(32)%	22(37)%
Class notes[c]	6(30)%	6(33)%	6(30)%	6(26)%	22(37)%
Problem sets[c]	50(48)%	22(37)%	22(38)%	22(34)%	22(29)%
Popular press	22(25)%	22(33)%	6(28)%	22(24)%	22(30)%
Academic pubs.	0(3)%	0(3)%	0(5)%	0(3)%	0(4)%
Class Size	100(162)	30(31)	40(45)	45(67)	30(30)
Number[d]	100	96	120	77	60
Theory					
Lecture Time	83(74)%	83(66)%	83(73)%	83(74)%	83(83)%
Guest Lectures	0(2)%	0(3)%	0(2)%	0(2)%	6(6)%
Class Time Use of					
Chalkboard[a]	83(71)%	83(65)%	83(71)%	83(69)%	83(83)%
Overhead[b]	6(16)%	0(15)%	6(16)%	0(7)%	6(6)%
Computer labs	0(4)%	0(12)%	0(6)%	0(4)%	0(0)%
Coop learning	0(10)%	6(20)%	6(13)%	0(9)%	22(22)%
Examples from					
Literature	0(7)%	0(6)%	6(11)%	6(4)%	6(6)%
Sports	6(8)%	6(8)%	6(8)%	6(9)%	22(22)%
Assigned Materials					
Textbooks	83(76)%	83(77)%	83(74)%	83(77)%	22(22)%
Workbooks	6(25)%	6(27)%	6(22)%	6(24)%	0(0)%
Class notes[c]	14(31)%	6(32)%	6(24)%	6(22)%	83(83)%
Problem sets[c]	50(52)%	22(37)%	22(39)%	22(39)%	6(6)%
Popular press	6(25)%	22(33)%	6(24)%	6(18)%	50(50)%
Academic pubs.	6(12)%	6(16)%	6(12)%	0(10)%	6(6)%
Class Size	40(50)	20(20)	25(24)	30(30)	5(5)
Number[d]	103	70	98	59	2

TABLE 3 (*Cont.*)
TEACHING METHODS, EXAMPLES, ASSIGNMENTS, AND CLASS SIZE

	Median (and Mean) Responses by University Type				
	Research	Doctorate Granting	Masters	Liberal Arts	Associate Institutions
Statistics/Econometrics					
Lecture Time	83(79)%	83(73)%	83(71)%	83(67)%	83(83)%
Guest Lectures	0(0)%	0(2)%	0(1)%	0(0)%	0(2)%
Class Time Use of					
Chalkboard[a]	83(66)%	83(70)%	83(69)%	83(64)%	83(83)%
Overhead[b]	6(23)%	0(10)%	6(20)%	0(7)%	0(2)%
Computer lab	22(34)%	22(29)%	22(34)%	22(30)%	6(11)%
Coop learning	0(15)%	6(23)%	6(22)%	0(10)%	22(35)%
Examples from					
Literature	0(2)%	0(3)%	0(7)%	0(5)%	6(4)%
Sports	6(7)%	6(10)%	6(9)%	6(9)%	6(11)%
Assigned Materials					
Textbooks	83(80)%	83(75)%	83(75)%	83(69)%	83(83)%
Workbooks	0(16)%	0(18)%	0(15)%	0(22)%	50(44)%
Class notes[c]	6(31)%	6(33)%	22(34)%	22(33)%	83(83)%
Problem sets[c]	83(64)%	50(46)%	50(51)%	50(50)%	6(18)%
Popular press	0(9)%	0(11)%	0(10)%	0(9)%	0(7)%
Academic pubs.	0(19)%	0(9)%	0(7)%	3(14)%	0(0)%
Class Size	30(37)	19(20)	25(25)	22(23)	25(22)
Number[d]	52	35	61	37	4
Upper Division					
Lecture Time	83(74)%	50(61)%	83(68)%	83(68)%	83(83)%
Guest Lectures	0(4)%	6(6)%	6(6)%	6(5)%	3(3)%
Class Time Use of					
Chalkboard[a]	83(68)%	83(62)%	83(62)%	83(65)%	83(83)%
Overhead[b]	6(19)%	0(10)%	6(17)%	0(11)%	3(3)%
Computer labs	0(7)%	0(8)%	0(8)%	0(7)%	0(0)%
Coop learning	0(11)%	6(20)%	6(18)%	6(19)%	25(25)%
Examples from					
Literature	0(7)%	6(6)%	6(9)%	6(7)%	28(28)%
Sports	6(7)%	6(8)%	6(8)%	6(8)%	36(36)%
Assigned Materials					
Textbooks	83(68)%	83(70)%	83(72)%	83(70)%	53(53)%
Workbooks	0(16)%	0(10)%	0(20)%	0(11)%	42(42)%
Class notes[c]	6(31)%	6(30)%	6(26)%	6(23)%	42(42)%
Problem sets[c]	50(43)%	6(28)%	22(33)%	22(33)%	3(3)%
Popular press	22(28)%	22(34)%	22(29)%	6(26)%	53(53)%
Academic pubs.	22(41)%	22(33)%	6(25)%	22(31)%	3(3)%
Class Size	30(35)	15(18)	20(20)	20(26)	15(14)
Number[d]	159	87	108	85	4

a. Written during class only b. Prepared acetates only
c. Instructor prepared d. Number providing class size information

nars taught economics (both in Harvard's Kennedy School of Government; neither were faculty members in the Department of Economics, and only one had a Ph.D. in economics). Scholars from the arts, education, humanities, other social sciences, and natural and earth sciences from many institutions participated in the Harvard Assessment Seminars.[4] As much of the rest of higher education implements new approaches to teaching, traditional economists may be stuck in the rut of doing to undergraduates what their instructors did to them. In response students may be voting with their feet when they abandon economics.[5]

C. *Teaching Practices*

The manner in which economics has been and continues to be taught to undergraduates is documented in national surveys (Becker and Watts 1996; Siegfried et al. 1996; Cynthia Benzing and Paul Christ 1997). The 625 respondents to the Becker and Watts survey are typical, showing the representative U.S. undergraduate economics teacher to be a male (83 percent) Caucasian (89 percent), with a Ph.D. degree (86 percent). At research universities the teaching load averages two courses per semester, whereas it is three courses per semester at doctoral, master's, and liberal arts institutions, and five courses per semester at associate degree-granting institutions.

Becker and Watts' survey of teaching methods in four types of undergraduate courses (introductory, intermediate theory, statistics and econometrics, and upper-division field courses), for five abridged Carnegie classifications is presented in Table 3. The picture of an economist lecturing to a class, while he writes on the chalkboard and assigns reading from a textbook, appears accurate for all courses and all institutions, with only a minor caveat for upper-division courses at doctorate institutions, where the median instructor spends less than 83 percent of class time lecturing. It is also only in these upper-division courses at doctorate, master's, and liberal arts institutions that guest lectures are used to any degree. Stigler's view of an academic economist as sole preacher is supported by survey data.

Cooperative learning techniques in which students work together in the classroom are noticeably absent in all economics courses at research universities where the largest classes tend to be employed. Curiously, while much is written on the use of computers in the teaching of economics, and conference sessions devoted to education technology are well attended, computer labs are used notably only in the teaching of statistics and econometrics. Whether this lack of newer instructional methods is primarily because of low instructor demand or inadequate facilities supplied by the institutions is unknown. Regardless of the reason, however, it is consistent with a passive learning environment that does not engage students. In contrast, class discussion and other forms of active learning, and not extensive lecturing, are now the most prominent forms of instruction used across the rest of higher education (Linda Sax et al. 1996, p. 13).

[4] According to Siegfried et al. (1991, p. 207), economists give scant attention to placing their discipline within the broader liberal arts curriculum. Grimes and James Niss (1991) state that business faculty want to reduce required economics courses because the courses are not integrated with the business curriculum. Then for whom are economics courses offered and to what curriculum are they tied?

[5] If resources are not tied to enrollments to some degree, there is no incentive for an academic unit to care about students. Even if resources are tied to enrollments, however, there is a principal-agent problem. A faculty member can decrease his or her work load by weeding students out of a course. This principal-agent problem is addressed by monitoring withdrawals.

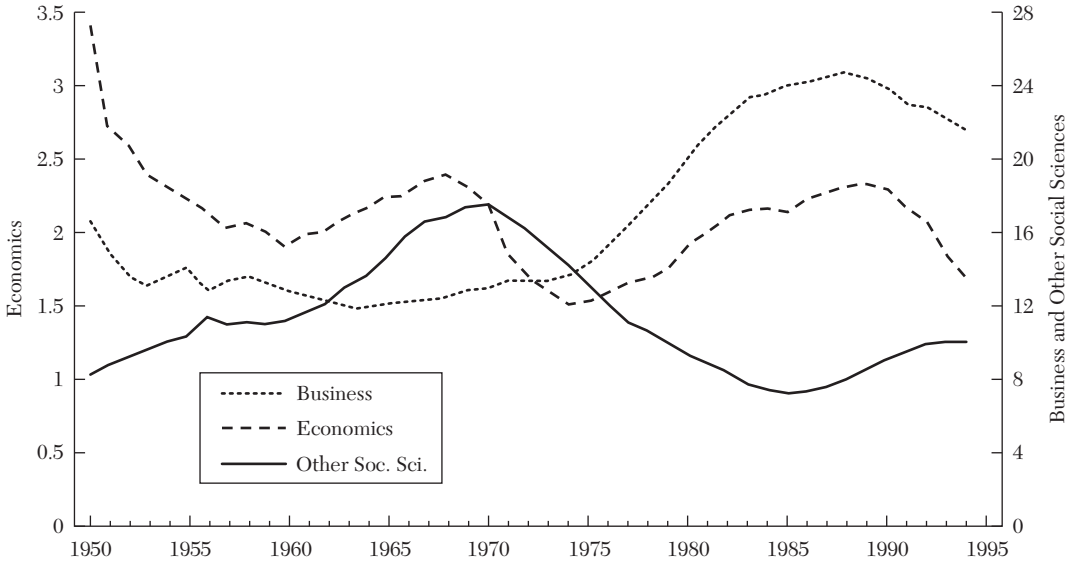

Figure 2. Percentage of All Bachelor's Degrees Awarded by Field, 1950-1994

Source: Willis and Pieper (1996) and National Center for Education Statistics (1995 and 1996).

II. *Number of Majors in Economics*

National data on degrees granted are available from the government but individual course enrollments and numbers of majors are not. The proportion of baccalaureate degrees awarded in economics fell in the 1950s, from approximately 3.5 percent to 1.8 percent (as read from the left-hand vertical axis, Figure 2). This proportion rose in the 1960s only to fall again in the early 1970s, hitting a low of 1.5 percent of all degrees granted in 1975. It resumed its upward climb reaching 2.4 percent in the late 1980s but has been falling since. Robert Margo and Siegfried (1996) note that after excluding the pre-1955 period, there is no trend in the relative number of economics degrees awarded. They speculate that self-equilibrating mechanisms induce the mean share of economics degrees to a steady state 2.2 percent of all undergraduate degrees awarded. This alleged stability, however, may be the consequence of a floor effect. As the ratio of economics to total bachelor's degrees approaches zero or some unknown small value, it must turn up or lead to retrenchments and closings of departments of economics.

A pure noise explanation of the intertemporal behavior of economics majors aside, an explanation of the recent trend in economics majors is often tied to the number of degrees awarded in business. In the late 1980s, when the proportion of economics degrees was at a relative high, the proportion of business degrees was also at a high of about 25 percent of all bachelor's degrees granted but the proportion of bachelor's degrees awarded in the other social sciences was at a low of 7 percent (as read from the right-hand axis in Figure 2).

The perceived association of the number of degrees awarded in business

and the other social sciences is now the focus of attention. Detailed micro data from the University of North Carolina supports the idea that much of the swing in economics majors since 1980 reflects an increase and subsequent decline in the popularity of undergraduate business studies (Salemi and Carlie Eubanks 1996).[6] When demand for business degrees increased in the 1970s and early 1980s and business schools raised grade point and course requirements, many excluded students elected economics as a second best major. The decline in student demand for business in the 1990s brought a reduction in business school entrance requirements and a decrease in those electing economics as a major. Although the other social sciences gained students, no one discipline stands out as a particular recipient (Rachel Willis and Paul Pieper 1996).

To some extent choice of major and even elective courses are based on rates of return. Unfortunately, time series do not exist on lifetime earning prospects associated with alternative courses of study. We do have a snapshot of earnings of 215,000 persons who reported having a bachelor's or more advanced degree in the 1990 decennial census (Daniel Hecker 1995, p. 4). In the 25–34 year age group, for example, men holding bachelor's degrees in economics have median earnings 3 percent higher than the overall average; by ages 35–44 it is 14 percent higher. For women in the 25–34 year age group, holders of economics bachelor's degrees earn 13 percent more than the average; by ages 35–44 they earn 53 percent more than the average. The median earnings of both men and women economics bachelor's degree holders are higher than bachelor's degree holders in general business and the other social sciences. Unless there were dramatic changes in the distribution of salaries over time, for which data are unavailable, the relative high return to an economics major cannot explain the downturn in the number majoring in economics. Furthermore, other than making economics majors more attractive to prospective employers little can be done about external labor market forces that determine compensation packages.

III. *Changing the Teaching/Learning Environment to Attract Students*

The influence of teaching skills on enrollments in economics is dismissed with the observation that faculty turnover is slow (Willis and Pieper 1996): those teaching in 1994 are much the same as those who taught in 1990. This argument, however, assumes that faculty members do not change their ways in accordance with incentives. Yet, when confronted with falling enrollments and declining resources, faculties do consider assigning higher grades, expecting less rigor, and provid-

[6] Salemi and Eubanks (1996) do not differentiate among economics degrees offered by different units in universities. Siegfried et al. (1991, p. 198) state that "administratively departments of economics are divided among colleges of arts and sciences (65 percent), schools of business (30 percent), and a few other administrative units." The number of bachelor degrees awarded in business economics is small, hitting a high of 3,779 degrees in the 1991/92 school year, and then falling to 3,454 degrees in 1993/94, roughly its 1987/88 level. If there is little difference in what is required of students to earn a degree in economics and business economics (Siegfried et al. 1991), then what students do for a major cannot be an explanation of the difference in trends. I devote no more time to differences in administrative units, although an interesting line of inquiry would be an exploration of effects of having multiple units within the same university offering competing degrees in economics. For example, the work of David Brasfield et al. (1996) suggests that economics departments that do not face competition from a business program at the same institution are at more risk for losing majors.

ing more options to students. Better means of instruction should also be considered.

A. *Grades*

Economics is among the lower-grading departments; thus, economists have room to inflate grades to buy students. But will higher grades attract students to economics? The answer is a qualified yes. Simulations show that starting from the position of a relatively lower-grading department, inflating grades in the introductory course to resemble those in higher-grading departments will lead to students taking one or more courses beyond the introductory course, provided other departments do not respond in kind (Richard Sabot and John Wakeman-Linn 1991).

Grades seem particularly important to the persistence of female students (Gordon Anderson, Dwayne Benjamin, and Melvyn Fuss 1994; Karen Dynan and Cecilia Rouse forthcoming). Jane Horvath, Barbara Beaudin, and Sheila Wright (1992) estimate that the probability of persisting from the first introductory course to the second is 16 percent higher for male students with a B grade than for women with a B grade. This result is consistent with conventional wisdom within education that female students are more self-critical than their male counterparts and that women's satisfaction with the academic experience is more closely tied to grades than it is for men.[7] When compared to men, women require stronger cues and more reassurance to persist in the study of economics.

[7] Richard Light (1990, p. 20) acknowledges that for women satisfaction with a specific course is more closely tied to grades than it is for men, but then reports that women's overall satisfaction with the entire college experience is less tied to grades than is the case for men.

Attempting to attract and retain students with grades is an individual instructor and institutional decision that goes beyond the scope of this paper. It is worth noting, however, that grade distributions can be altered without increasing mean measured grade inflation—for example, increasing the proportion of Bs, by assigning this higher grade to those who previously would have been given a B– or C+, and at the same time increasing the proportion of Ds, by assigning lower grades to those who previously would have been given a C– or D+, may encourage those we want to continue while discouraging the others with little or no change in the average grade.

B. *Requirements*

An often heard assertion is that increasing the mathematics requirement in economics produced a dramatic change in the mix of students taking courses and majoring in economics (Kasper et al. 1991; Kasper 1996). If there was a move to more mathematical rigor in economics relative to the requirements in other related disciplines, then the number of students in economics may have fallen with the increased mathematics requirements.

Information available from the College Board annual surveys of the admission criteria of colleges and universities shows that mathematics requirements have been increasing generally. From 1986 to 1992, for example, the percentage of the 1,562 post-secondary institutions that had high school mathematics requirements or recommendations for admission increased from 69 percent to 83 percent, and the average number of high school units of mathematics required or recommended rose from 2.6 to 2.7. Furthermore, student mathematics skills, as measured by either the mean ACT or SAT, were unchanged in

the late 1980s and early 1990s when the number of economics majors rose and then fell. A steep decrease in mean ACT math score occurred between 1970 and 1983, when it fell from a high of 20 in 1967 to a low of 16.9 in 1983 (National Center for Educational Statistics *Digest of Education Statistics*, 1995, Table 130). A similar plunge is evident in SAT scores between 1970 and 1984. Yet, between 1970 and 1983 the share of economics majors fell and then rose (Figure 2).

Although students may be able to handle the mathematics of economics, it may be that they do not see its relevance. The liberal arts education is to be a broadening experience but the incorporation of mathematics into economics tends to be a narrowing experience that focuses on the technical skills of the theorist (Bradley Bateman 1992).[8] On the other hand, some students may be attracted to economics as a place to apply their mathematics skills. For example, minors and elective courses in economics have been created and are succeeding in appealing to the mathematical aptitudes of engineering and science students, bringing significant increases in both theory and field course enrollments and no decrease in the number of traditional economics majors (Brasfield et al. 1996; Gregory Gelles and Walter Johnson 1994). The effect of changes in the level of mathematical rigor expected of economics students may be school specific. On balance, however, incremental changes in requirements cannot be expected to produce dramatic changes in majors or course enrollments.

[8] Becker (1990) and Strober, Allen Cook, and Kasi Fuller (forthcoming) argue that the symbolic logic used in economics may hinder some students with good backgrounds in high school mathematics because the conventions used in algebra and geometry appear contrary to those in economics.

C. *Class Size*

Research universities appear to finance their relatively low teaching loads (averaging two courses per semester) through larger class sizes (Table 3). Respondents from research universities teach larger classes across the four types of courses, with mean class size in introductory courses of 162 students, compared with average class sizes of 45 and 67 in master's and liberal arts institutions and 30 at both doctoral and associate degree-granting institutions. Siegfried et al. (1996, p. 189), on the other hand, report "Average class size across both macro and micro is about thirty in two-year colleges, thirty-five in liberal arts colleges, forty-five in comprehensive (master's) universities, and around sixty in research and doctoral institutions." Either respondents to the Becker and Watts survey exaggerate class sizes, or the Siegfried et al. data set does not include many large classes or misses many students in large classes. The latter conclusion seems likely because the Siegfried et al. data set, assembled as part of the norming of the TUCE III, required volunteering instructors to incur higher costs of administering and managing the term-long data collection process in larger classes.[9] The cost of completing the

[9] Class sizes in Siegfried et al. (1996) were calculated as the mean number of pretests and posttests obtained in the norming of TUCE III. Results were stratified by consolidating the Carnegie research and doctoral universities into one group, with the remaining three groups (master's, liberal arts, and associate) kept separate. Becker and Watts used the less aggregated Carnegie categories of "research" and "doctoral" level institutions. But combining the research and doctoral respondents of the Becker and Watts sample gives a mean introductory class size of 98 students, which is still above the 60 in the "research and doctorate" category in the TUCE III data. Even at the liberal arts institutions, the Becker and Watts mean introductory class size of 67 far exceeds the mean class size of 35 students for four-year colleges in the TUCE III data set.

Becker and Watts survey was the same for teachers of large and small classes. Thus, their finding of large class sizes at both research universities and liberal arts colleges is credible.

Class size is important because it affords instructors the opportunity to try different teaching methods. As Wilbert McKeachie (1990, p. 190) stated in a review of the class-size literature,

> It seems plausible that the effect of class size on learning depends on what the teacher does . . . in larger classes, faculty members typically require less written work and spend more time lecturing and less in discussion . . . Lecture tends to be at least equal to, and often more effective than, discussion for immediate recall of factual knowledge on a course examination, but discussion tends to be superior for long-term retention.

Although Benzing and Christ (1997) report that a large proportion of economists responding to their survey believe students learn more in small classes, economists show no tendencies to select teaching strategies based on course type or class size. If we expect students to learn more in one type of class versus another, we have to vary instructional methods to fit the class.

D. *Instruction*

The "Report of the Commission on Graduate Education in Economics" calls for bringing "real-world issues into the classroom" (Anne Krueger et al. 1991). Yet, the commission's assumed instructional mode is lecture. It concludes that the lack of emphasis on exposition skills is at least in part "a judgment that the appropriate style of professional communication is something (graduate) students can figure out for themselves by watching their teachers" (p. 1049). The report of a committee of economics faculty members from prestigious liberal arts colleges in the United States (Kasper et al. 1991) emphasizes the need for graduate students to have breadth in content coverage to become good teachers of undergraduates but gave no attention to the need for breadth and training in teaching methods.

In contrast to these reports of economists, education psychologists, and instruction specialists appear united on one important influence on student performance and desire to continue a subject's study: the need for active student involvement with classmates in the learning process (David Johnson, Roger Johnson, and Karl Smith 1991; Alexander Astin 1993). Although evidence from pre-posttest analyses is lacking, for reasons to be discussed, survey results indicate the importance of academic support groups especially when it comes to persistence.[10]

(1) *Learning with Group Activities*. Both alumni and senior class respondents to the Harvard Assessment Seminars survey said the key to academic success is closely linking the academic work to another person or group (Light 1992). Respondents had two recommendations:

First, and unanimously recommended, freshman should take small classes that require in-class interaction. The student-teacher ratio is the most important constraint in the teaching and learning process because two-way communication becomes increasingly difficult as class size increases (Sherwin Rosen 1987). In small classes, each student has an opportunity to get to know and communicate with the teacher. Equally important, according to education psychologists, is for each student to have an opportunity to get to know sev-

[10] When negative evidence on the effect of cooperative learning strategies is found, as seen in Astin (1993, p. 197), the findings are dismissed as possibly the results of poorly designed group projects and are designated as issues for future study.

eral others who share at least one thing in common: the course.

Second, the majority of respondents to the Harvard surveys recommended students form small study groups. They identified the need for both in- and out-of-class study groups, with activities that permit students to work together on structured learning tasks—what is known as cooperative learning. Out-of-class study group activities can take many forms. For large enrollment introductory classes, students can be divided into groups of five or six, with each group responsible for finding its own time and place to meet. Some instructors even arrange to meet or have an assistant meet with these groups of individuals, although resource constraints make this option difficult to implement except for small classes.[11] For in-class groups in larger classes, instructors can use the "think, pair, share" activity in which students are required to think about a question posed by the instructor; compare, discuss, and refine their answers with neighboring students; and share their team's responses with the class if asked to by the instructor. The think, pair, share activity requires only a few minutes, but provides a break in standard lectures by involving students and it allows instructors to assess quickly, and on a regular basis, what students are learning. Diane Keenan and Maier (1995) describe many cooperative learning activities that can be used in the teaching of economics.

Technology can complement traditional classroom activities. But unless computers and other high-tech systems can replace the instructor and support personnel their introduction always adds to the cost of instruction. Replacing the instructor with technology that adapts to the needs of individual learners is a dream that no instructional developer has come close to achieving. Light (1990, p. 9), however, claims that students who work in small groups, even when interacting with high-tech equipment, learn more than students who work alone. Research shows no great breakthrough in the use of technology in the educational process. Physical capital may be a poor substitute for human capital in education.[12]

There is a free-rider problem inherent in cooperative learning that Bartlett (1995) solves with an innovative grading method that works in smaller classes where students get to know each other. Students are given the option of forming groups or not. Bartlett uses a random-number process to choose one member of the group to take the exam or make the presentation, and the grade earned by the student is assigned to all members of the group. This creates incentives for all members of the group to be sure that everyone is well prepared because no one knows in advance who will represent the group. Kathleen McKinney and Mary Graham-Buxton

[11] National survey results show that in general "group-oriented teaching methods are most likely to be used by younger faculty" (Sax et al. 1996, p. 13). Whether older professors or younger graduate student assistants do better at encouraging small group formation in economics classes is unknown. Early work in economic education suggests that there is no difference in their ability to produce student learning. Watts and Gerald Lynch (1989), however, tell us that undergraduate students of nonnative-English speaking graduate student instructors do worse on final exams than students of instructors whose first language is English. Unfortunately, all of this work with exam scores suffers from the modeling, estimation, and testing problems discussed in this article.

[12] Rosen (1987) observed that no major innovation in education has occurred since the printing press made inexpensive book publication possible. That higher education is a major contributor to technological advances elsewhere in the economy but yet cannot capitalize on this technology in teaching is ironic. The Internet and software such as WinEcon may lead to changes in educational practices but it is too early to say anything about the effectiveness and efficiency of these computer tools in teaching economics.

(1993) describe an alternative solution to the free-rider problem in a large enrollment introductory sociology course. Each student is required to complete a work-sheet demonstrating preparation before being permitted to participate in the group activity. Students must participate to get credit toward the course grade.

(2) *Learning with Individual Activities*. Cooperative classroom learning experiences can require large blocks of time and not all students like to get engaged in group activities. To transmit factual information and demonstrate mathematical and graphical constructions, the lecture and blackboard may be the desired delivery mode. Cooperative learning advocates (such as D. Johnson, R. Johnson, and K. Smith 1991, pp. 38–40) seem to ignore that as long as decisions outside the classroom are made on an individually competitive basis, students may choose to perform individually in the learning environment as well. Instructors in economics cannot rely on cooperative learning alone; they need to be able to employ alternative teaching strategies—strategies that can keep students actively involved, with both practice and feedback. In this regard, the conclusion of Siegfried and Rendigs Fels (1979) still holds: "Different students learn economics in different ways. The best teaching strategy provides alternative learning methods" (p. 953). Many of these alternative methods are described in Becker and Watts (1995).

Based on observations of one hundred chemistry lectures, Alex Johnstone and Frederick Percival (1976) report that students have a noticeable behavior change (a lapse in attention) about 10 to 18 minutes into a lecture, with lapses becoming more frequent as time passes. Thus they recommend a varied approach, periodically involving students in an activity closely tied to the lecture material. After discussing a theoretical point, for example, an instructor can ask students to construct a corollary, think of applications, or offer an example question.

Another method that forces students into action, and also provides continuous daily feedback, is the "minute paper." Typically assigned in the last minutes of each class when maintaining student attention is difficult,[13] each student is required to respond to two questions: (1) What was the most important thing you learned in class today? (2) What question is unanswered? Although answers may or may not be graded, these written responses can be used to monitor comprehension as well as attendance and focus the discussion in the following class period. The one-minute paper provides an incentive for attendance and participation, in contrast with a passive attendance mandate.

Variations on the minute paper are numerous and can lead to longer writing assignments. The use of computers to provide quick feedback in large introductory economics courses dates back to the 1960s. Computerized experimental economics projects and computer simulations are also successful in getting large numbers of students involved on an individualized basis with little instructional time required after the initial investment (Arlington Williams and James Walker 1993).

Contrary to the notion that students prefer courses where they can work in their own way and at their own pace with relatively few quizzes, short pa-

[13] The idea of monitoring the process of education from the start of a course to its termination, and monitoring students from the day they enter to the day they graduate, fits well with the industrial model of total quality management. John Chizmar (1994) and Hansen (1993) discuss and apply TQM in the teaching of economics.

pers, or other means of feedback, "the large majority of students are sure they learn significantly more when courses are highly structured, with relatively many quizzes and assignments to hand in" (Light 1990, p. 5), even if students dislike such frequent evaluation at the time (p. 32). Students stress that regular evaluation during a well-organized course enables them to plan their work more than a few days in advance. They also like quick turnaround from the instructor, and prefer structured assessment routines in which they have the ability to revise and make changes before receiving a final grade.

At all types of institutions and in all types of courses, instructors prepare class notes for students (Table 3). Instructor-supplied graphs may be beneficial for students who do not know how to draw graphs, but students who draw graphs accurately on their own perform better on the end-of-period economics exam than those who do not. Elchanan Cohn and Sharon Cohn (1994) speculate that those better at drawing who do their own graphs have an advantage because they listen, draw graphs, and review their own work, whereas the others only listen and review the instructor's work. Periodically collecting and reviewing students' classroom notebooks is an assessment device that encourages students to take this classroom activity seriously and provides information on what students are attending to in class.

Note taking and graph drawing are stepping stones to activities that require student involvement. If nothing else, they force students to attend class, assuming class notes are not available elsewhere. Instructor-supplied class notes and handouts are treated by students as substitutes for attendance (E. Cohn, S. Cohn, and James Bradley 1995). Contrary to earlier studies, recent studies (Garey Durden and Larry Ellis 1995; David Romer 1993; Kang Park and Peter Kerr 1990) show that class attendance does matter for various forms of academic achievement that go beyond what a student can cram for right before the final exam. Attendance may not matter when achievement is measured by multiple-choice questions, but it does matter when written communication skills are assessed. If classes involve only lectures on textbook-type content, then end-of-course multiple-choice tests can be mastered by students who do not attend classes. If students are actively engaged in discussion, in projects, and have periodic assessment, then attendance and participation are critical.

E. *Educating Economists*

There is only one national program designed specifically to help economists move from the lecture mode to alternative teaching methods: the Teacher Training Programs periodically conducted by the AEA Committee on Economic Education. With only a few hundred economists participating in occasional program offerings, however, it is going to take a long time to acquaint a noticeable fraction of the AEA members with alternative teaching methods via this program. Even for individual graduate departments running their own programs as offshoots, the attitude appears to be that there are only "some incidental benefits for the graduate instructors' current (undergraduate) students" (White 1995, p. 83).

How the graduate student teacher's current students could be viewed as getting only "incidental benefits" is peculiar, and may simply be more evidence that undergraduate education in economics is unsatisfactory because of the poor training and the wrong signals given to graduate students. There is no

credible test score evidence in the economic education literature on the optimal way to teach graduate students and faculty members to be teachers. The benefit of programs aimed at an instructor's current students, however, seems preferable to programs aimed at future students. Furthermore, there is likely no better way to document future teaching potential than to provide evidence of current teaching practices and student outcomes.

IV. *Measuring the Outcome of the Teaching and Learning Process*

Although the above section calls for the use of varied and active teaching and learning methods, specific methods better than lecturing and writing on the chalkboard for teaching economics have not been identified with traditional test score comparisons between control and experimental groups. This is not to say that the lecture method is the best way to teach economics. Quite the contrary, the problem is with the tests and other instruments used for the assessment of teaching/learning experiments.

A. *Test Scores*

Fels set the stage for quantitative analysis of teaching techniques with his 1969 presidential address to the Southern Economic Association, "Hard Research on a Soft Subject: Hypothesis Testing in Economic Education." He expressed a need for a production function analysis of teaching techniques, where a test score or change in test scores is related to student, instructor, and environment or institutional variables (Siegfried and Fels 1979).

Much of the published research on teaching college economics uses performance on the *Test of Understanding of College Economics* as the outcome of a course of study. Throughout its three editions, the TUCE has been a two-part, multiple-choice test of micro and macroeconomics. It is intended to measure more than recall, with over two-thirds of the 33 questions on each of the micro and macro-tests designed to assess student aptitude in applying economics to solving problems as found in introductory two-semester micro and macroeconomics courses of study (Saunders 1991).

In a common production function study, the TUCE is used to test each student's knowledge of economics at the beginning and end of a course. A change score for each student is calculated as the difference between his or her pretest (beginning) and posttest (end) scores. The TUCE scores, or the change scores, are assumed to be produced by human capital inputs (SAT or ACT scores, initial knowledge of economics or some other subject, grade points, previous courses of study), utilization measures (time spent by student or teacher in given activities), and technology, environment, or mode of delivery (lectures, group work, computer use). Of all the variations considered by researchers since 1968, the only consistently significant and meaningful explanatory variables of post-TUCE scores are pre-aptitude measures such as pre-TUCE and SAT/ACT scores. The policy implications could not be more clear: to produce students who are highly knowledgeable in economics, start with those who already have a high aptitude.[14]

[14] Given the importance of pre-course aptitude measures, and the need to tailor instruction to the individual student, it is curious that faculty members at many colleges and universities have allowed registrars to block their access to student records for instructional purposes. As Nan Maxwell and Jane Lopus (1994) report, students are less than accurate in providing information about their backgrounds. Thus, using student self-reported data in regressions will always involve

This input-output approach has four problems. First, production functions are only one part of a student's decision making system. Observed production inputs are not exogenous but are determined within this system. Second, data loss and the resulting prospect for sample selection bias in the standard pre-posttest design are substantial, with 20 to 40 percent of those who took the pretest no longer enrolled at the time of the posttest. Third, from probability and statistical theory, we know that failure to reject the null hypothesis does not imply its acceptance. That an experimental teaching method shows no statistically significant improvement over the lecture does not imply that it is not better. Finally, and possibly most important, education is a multi-product output that cannot be reflected in a single multiple-choice test score. These problems with the production function mind set are being addressed by economic education researchers.

(1) *Student Decision Making Framework*. There are models that provide microeconomic theoretical rationales for why researchers fail to find consistent evidence of the superiority of one teaching technique over another in the production of learning in economics. Becker (1982) constructs a model in which a student maximizes the utility of different forms of knowledge, current consumption, and expected future income. This utility maximization is subject to a time constraint, the production relationships that enable the student to acquire knowledge and consumption, and the manner in which the different forms of knowledge are measured and enter into future income. The shadow prices of knowledge reflect opportunity costs generated by the time constraint, production functions, and uncertain future income.

The Becker model shows that improved teaching technology that enables students to more efficiently convert study time in economics classes into economic knowledge need not result in any change in student desire for more economics knowledge.[15] The time savings from the more efficient pedagogy in the economics course may be invested by the student in the acquisition of knowledge in other subjects or may be used for market work or leisure. The shadow prices of the different forms of knowledge in equilibrium with the marginal utility of each form of knowledge, leisure, and future income determine student choices. It is not just a production function relationship that gives rise to a certain mix of inputs being combined to produce a given output. Observed student study times, learning in other subjects, student opinions on satisfaction with a given course of study, and similar student input measures that are used to explain knowledge and learning of economics are, in fact, endogenous.

The model makes explicit how rewards for knowledge in economics relative to other subject knowledge enter a student's decision making. It also calls attention to the accuracy with which student knowledge is measured and the behavioral implications of the student's position in the distribution of that knowledge. Researchers working with the TUCE III data find, for example, that students do not take the test seri-

problems of errors in variables. Salemi and George Tauchen (1987) discuss other forms of errors in variables problems encountered in the estimation of standard single-equation learning models.

[15] The word "knowledge" is used here to represent a stock measure of student achievement; it can be replaced with any educational outcome produced by the student with various forms of study time and technology, as measured at a single point in time.

ously when it does not count in the course grade. Yet, many educators continue to overlook the effect of incentives on measured student performance.

In assessing the influence of incentives, it must be recognized that the market for new graduates need not place a value on student learning in the same way it values the final attainment of knowledge. The unquestioned use of value-added (change score) models in economic education research ignores the fact that students, teachers, and employers do not place the same value on pre- and post-course knowledge. The beliefs of an instructor, a test design committee, or an entire faculty about the importance of certain forms of knowledge and intellectual skills are not always consistent with what students desire, and what employers desire and pay for the bundle of knowledge and skills embodied in the graduate who studies economics versus some other subject.

(2) *Data Loss and Sample Selection*. A sizable proportion of students who enroll in economics courses subsequently withdraw, never completing the end of course evaluation or final exam. A classic study of the difference between pretest and posttest scores to assess "value added" in these courses excludes all who dropped. The process that determines which students quit between the pretest and the posttest is likely related to the process that determines test scores. Becker, John Powers, and Saunders (1996) provide probit model estimates showing, all else equal, that individual students with higher pre-TUCE scores are more prone to persist with the course than those with lower scores.

The timing of withdrawal is related to many of the same variables that determine test scores (G. Anderson, Benjamin, and Fuss 1994). For example, taking high school calculus and economics contributed greatly to a student's desire to complete the entire two-semester college economics course. However, more experienced students were more likely to drop sooner; they did not stick around if they saw "the handwriting on the wall." Consistent with these results, Stratford Douglas and Joseph Sulock (1995) conclude that prior experience with economics, accounting, and mathematics, as well as class attendance, all increase the probability of a student completing an economics course. They also show how correction for self-selection out of the course influenced the production function relationship between the standard input measures and the course grades of those who stayed, even though the course drop rate was only 12 percent. Becker and Walstad (1990) reveal yet another source of selection bias when test scores are to be explained; if test administration is voluntary, teachers who observe that their average class score is low on the pretest may not administer the posttest.

Missing observations on key explanatory variables can also devastate a large data set. Data on students are obtained typically from the students themselves even though students err greatly in the data they self-report (Maxwell and Lopus 1994). Using the TUCE III microeconomics data set, Becker, Powers, and Saunders (1996) show that studies including only those students who provide data on themselves and take both the pretest and posttest are suspect in assessing the contribution of class size in student learning, unless explicit account is taken of the sample selection problems caused by the large amounts of missing data on excluded students. Test score results gleaned from the TUCE III data set are sensitive to the

model specification and data lost because of the variables employed. Because there is no unique way to undo the censoring that is associated with missing student data, any conclusion drawn only from students who provide data must be viewed with skepticism.

In the absence of perfect randomized experiments, selection problems at some point in the sampling process can always be identified. But should we care if we cannot teach a subject to the uninterested and unwilling? We are always going to be teaching to self-selected individuals, so why should our experiments not reflect the actual conditions under which we work? Why worry about what does not apply?[16] On the other hand, if building enrollment is important, then the previously uninterested students are the ones that must be attracted. We need to understand the selection process in choosing and persisting in courses, as well as in measuring learning.

(3) *Testing for the Learning Effect of Instructional Variables.* Recent economics of education literature advances the notion that instructional variables are unimportant in explaining student learning (Eric Hanushek 1991).[17] In concluding that certain instructional variables are insignificant in explaining student test scores, researchers accept the null hypothesis of no average effect in the populations. Statisticians cringe at the idea of "accepting the null hypothesis." The null hypothesis of no learning effect can never be accepted for there is always another hypothesized value, in the direction of the alternative hypothesis, that cannot be rejected with the same sample data. The Type II error inherent in accepting the null hypothesis is well known but largely ignored by researchers in education and economics alike.

The power of the test (ability to reject the null hypothesis) can always be raised by increasing the sample size. Thus, if statistical significance is the criterion for a successful instructional method, then ever larger sample sizes will "deliver the goods." Statistical significance of an instructional method might be demonstrated with a sufficiently large sample, but the difference in change scores will likely be trivial on multiple-choice tests of 25 to 40 items (the number of questions typically required to demonstrate a valid and reliable test that able students can complete in a 50 to 75 minute period).[18] Differences of only a few correct answers in pretest and posttest comparisons of control and experimental group

[16] James Heckman and Jeffrey Smith (1995) call attention to the difficulty in constructing a counterfactual situation for an alternative instructional method when participation is voluntary or randomly assigned. Without a counterfactual situation (i.e., what would have happened if these same people were in the control group), it is impossible to do assessment.

[17] David Card and Alan Krueger (1996) report a consistency across studies showing the importance of school quality on a student's subsequent earnings. They recognize that tests can be administered easily at any time in the education process and thus provide a cheap tool for monitoring programs. In recognition of time lag for measuring earnings effects, they recommend the use of dropout rates as an alternative to test scores for immediate and ongoing program assessment. After all, unless students finish their programs, they cannot enjoy the potential economic benefits.

[18] Replication and aggregation across studies is one way to achieve larger sample sizes, but Jessica Utts (1991) demonstrates the folly of such meta-analyses. Recently, for example, Larry Hedges, Richard Lane, and Rob Greenwald (1994a, 1994b) use a meta-analysis involving an aggregation of p-values to cast doubt on Hanushek's assertion regarding the relevance of expenditure on instructional methods in generating test scores. A case-by-case review of their presentation of Hanushek's data, however, suggests that the focal point of much discussion in education, the teacher/pupil ratio (or class size), is irrelevant in explaining student performance when measured by test scores. It appears to be the aggregation method employed that is producing the results of Hedges et al.

results are the rule, not the exception, even after adjusting for sample selection.

In summary, the use of the educational production functions with test scores as the only output measure is too narrow. Pre-and posttest, single-equation specifications, with potentially endogenous regressors, simply may not be able to capture the differences that we are trying to produce with diverse teaching methods. Adjustments for sample selection problems are needed but even after these adjustments with large samples, failure to reject the null hypothesis of no instructional effect may point more to deficiencies in the multiple-choice test outcome measure or application of the classical experimental design than to the failure of the alternative instructional method under scrutiny.

B. *Other Student Outcomes*

An economics major typically begins with two introductory courses that emphasize the principles of micro and macroeconomics courses (taken primarily by students who are fulfilling requirements for other majors). Economics majors then take two intermediate courses in micro and macroeconomics, a course in statistics/econometrics, and some field courses (Siegfried et al. 1991). One set of proficiencies that students should gain in the completion of the economics major includes gaining access to current economic knowledge, displaying command of that knowledge, displaying the ability to draw on that knowledge, using economic knowledge to explore issues, and creating new knowledge (Hansen 1986).

Hansen's proficiencies demonstrate a belief, likely shared by most economists, that courses in economics contribute more to student development than what is measured by paper and pencil tests. Although there have been attempts to turn these proficiencies into measurable outcomes other than test scores (James McCoy, Don Chamberlain, and Rob Seay 1994), multiple-choice, short-answer, and essay questions form the basis for grades, with the majority of instructors in introductory courses putting a 50 percent weight on multiple-choice test scores in assigning grades (Becker and Watts 1996). Term papers and short papers are seldom assigned and used in course grading. Lack of structured writing assignments that lead to larger papers is unfortunate given survey results at the University of Wisconsin showing that jobs held by former undergraduate economics majors require well-developed written and oral communication skills, some sense for quantitative relationships, and ability to complete large projects and work with others (Hansen 1993, p. 264). The need for communication skills and interaction with others is also made clear in the Harvard Assessment Seminars survey results that "of all the skills students say they want to strengthen, writing is mentioned three times more than any other" (Light 1992, p. 8).

Because of resource constraints, instructors of large enrollment introductory courses claim they have little recourse but to use multiple-choice tests for the majority of grading. They cannot engage large numbers of students in big writing projects. Curiously, these large classes are also detrimental to student persistence: the larger the initial class size, the more likely a student will withdraw from an introductory economics course (Becker, Powers, and Saunders 1996). Obviously, those who cannot complete introductory courses are not going to take more courses in economics. In small upper-division economics courses instructors argue against allocating time to foster written and oral

communication skills because of a belief that these skills are not emphasized on the standardized exams used for admission to professional and graduate schools.

Training to succeed in standardized multiple-choice tests requires a different kind of college environment than is the case with other cognitive and affective outcomes (Astin 1993, p. 221). Performance on standardized tests increases in highly competitive environments in which test-taking skills are emphasized. But this does not say that engaging students in writing, editing, and revision will not benefit them on the verbal portion of the GRE as well as assist them in later large-scale writing projects. The question we should address is: How do our tests and other activities relate to what students should be able to do as a result of studying economics?

In measuring student learning in economics, instructors often distinguish between classroom multiple-choice (fixed response), and essay or short-answer (construct-response) questions. But do these different forms of time-constrained testing capture different dimensions of student performance or are they measuring essentially the same thing? Other than possible gender differences, research suggests little difference between what is measured by fixed and construct-response tests, especially when the cost of valid construction and reliable scoring is considered (Benjamin Greene 1997; Walstad and Becker 1994; Keith Lumsden and Alex Scott 1987).[19] But this research along with faculty debates about the merits of multiple-choice versus essay exams misses the broader spectrum of educational outcomes students are to achieve and the way in which they are achieved. Research needs to move beyond simple measures of knowledge to consider what leads to student persistence during a course, into another course, or into a major, and what skills students need for future performance in the workplace.

C. *Student Evaluations of Teaching*

Instructor success is typically judged not by the student learning outcomes but by student evaluation questionnaires administered at the end of courses. Because student interest and motivation are important for academic performance and persistence, their perceptions about the effectiveness of the course and the quality of instruction are worthy of consideration.

Instructional units often design their own systems for student evaluations of instructors. Psychometricians and instructional specialists tell us, however, that only properly prepared student evaluation instruments and procedures are valid and reliable measures of teaching (McKeachie 1990, pp. 195–96). The two most widely acknowledged student-rating systems, for which national norms exist, are the Student Instructional Report (SIR), from the Educational Testing Service, and the Instructional Development and Effec-

[19] Common wisdom in education is that women do not do as well as men on more quantitative material assessed by time-constrained, multiple-choice tests, although within economic education differences in course performance are believed to depend on whether the posttest or change score is used as the dependent variable (Siegfried and Fels 1979). By the end of the college career, however, a gap between men and women is still evident. Of the 5,815 men and 2,164 women electing to take the GRE Subject Test in Economics between 1989 and 1993, men averaged 651 and women averaged 603 on this time-constrained, multiple-choice test, according to Mary Hirschfeld, Robert Moore, and Eleanor Brown (1995). Even after adjusting for GPA, SAT scores, and math background, the male-female gap persists. Female students may lack confidence when it comes to test taking in economics for they are more likely than males to drop a course before taking an exam (Greene 1997).

tiveness Assessment system (IDEA), from Kansas State University's Center for Faculty Evaluation and Development. These two systems are designed to provide information on student perception of teaching effectiveness of the instructor, the educational value of the course, and how much students believe they learned.

Dennis Aigner and Frederick Thum's (1986) study of student evaluation of economics classes at the University of Southern California lends support to the educational psychologists' argument that students appreciate an instructor's clarity in exposition, ability to get students actively involved in class discussions, and willingness to accept student ideas. Instructor-student interaction variables that can be controlled by the instructor greatly influence the ratings given by students.

Critics cite studies from a variety of disciplines, such as that of Philip Abrami, Sylvia d'Apollonia, and Peter Cohen (1990), and those in economics, such as Edward Gramlich and Glen Greenlee (1993), and the Aigner and Thum study, to support claims that teachers can buy higher student ratings by giving higher grades. If this is true, however, the effect is generally regarded as slight. For example, Richard Stratton, Steven Myers, and Randall King (1994) suggest that introducing student evaluations leads to an initial increase in grades of about 11 percent, but that this increase is followed by stabilization and then possible decrease, after adjusting for student changes in learning.

Students are known to treat the disciplines differently in awarding course evaluations; yet, differences in average discipline scores are often overlooked in making comparisons. Economics is one of the disciplines that is consistently at the bottom of both course and instructor effectiveness scales for the 45 disciplines in the SIR and IDEA national data base (William Cashin 1990). We do not know why disciplines are rated differently by students, although for economics it may be that student evaluations cannot fully reflect the contribution of individual teacher skills to student learning of economics (Watts and William Bosshardt 1991). The use of student evaluations as a measure of teaching must take into account that a student's willingness to provide an evaluation is endogenous to the teaching-learning process (Becker, Powers, and Saunders 1996). Because 20 to 40 percent of students do not complete evaluations, sample selection problems must be considered in analyzing and interpreting student evaluations of instructors, courses, and teaching methods.[20] Although student evaluations cannot be disregarded, they should not be viewed as the single best measure of teaching; other outcome measures (course withdrawal rates, cognitive learning, continuation into other economics courses, and career success) must be considered.

V. *Conclusion*

The thrust of my thesis could be wrong: The movement of liberal arts colleges to master's and doctorate-granting institutions may not have worked against their undergraduate programs. Teaching methods may not influence enrollments and majors in economics. The current mix of teaching methods, with an almost exclusive emphasis on lecture, chalkboard, and textbook, and paper and pencil exams may

[20] Over time a poor teacher's student evaluation scores may rise, with fewer withdrawals, because informed students learn to avoid this teacher in the first place. This dynamic form of selection is difficult to spot without years of data in which students are free to choose instructors.

be the optimal way to teach economics. Teaching methods that get students actively involved in the learning process may be a waste of time. It may be that those single-equation pre-posttest studies, from which some have concluded that instruction methods are irrelevant, are correct. But as long as students are able to vote with their feet, and there are attractive alternative courses and majors, academic economists are foolish to ignore the cost of a Type II error in accepting the status quo.

To increase enrollments in introductory courses, enhance persistence within these courses, and augment the number of majors, a move to smaller class sizes is supported by the literature. Small classes, in which students are actively engaged in the learning process, through discussion and small-group activities, encourage persistence and appear to be conducive to learning, especially if combined with rapid feedback and positive reinforcement. Unlike lectures for which class notes can be reproduced, student involvement in classroom activities requires attendance. Even for large enrollment introductory courses, where small sections may not be possible, teaching methods other than lecture can be employed. From an efficiency standpoint some may argue that the actual size of the classroom is less important than what is done to engage students, but without knowing the value of the educational outputs efficiency is difficult to define. The critical point for either small or large classes, however, is student participation. To engage students, instructors must give up the comfortable position of 10 to 14 weeks of lecture, with graphs and equations following in an orderly progression that students are expected to simply reproduce on exams.

The granting of higher grades may contribute to persistence especially for women, if only in the short run, for such a strategy is dependent on the response of other units within an institution and maybe even among institutions. There is little empirical evidence that lowering mathematics requirements will increase enrollments. Students with stronger mathematics backgrounds, however, are more likely to persist in the study of economics.

Instead of thinking only of value added with a pre-posttest mind set, or end-of-term student evaluations of instructors, economists must consider other outcome measures that directly affect both their students' persistence and their own survival as academicians. The numerous research questions that arise once we move beyond a simple pre-posttest analysis have been addressed by Becker et al. (1991), as well as others, so I deliberately avoid repeating them here. To assist practitioners in their search for better teaching methods, economic education researchers must consider the sample selection problems inherent in pre-post assessment, and adequately model the student and instructor decision making process. In the absence of these advances in research, however, it may be a costly mistake to conclude that instructional methods do not matter simply because they have not been shown to influence multiple-choice test scores in single-equation regressions with endogenous regressors.

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