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The Education and Training of Economics Doctorates:
Major Findings of the Executive Secretary of the American Economic Association's Commission on Graduate Education in Economics

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The author served as Executive Secretary of the American Economic Association's Commission on Graduate Education in Economics. The views expressed in this paper are those of the author; they do not necessarily reflect the views of the Commission, its members, the American Economic Association, or those organizations that funded the Commission's work.

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I. *Introduction*

Economics is what economists do. Jacob Viner[1]

Because economists for the most part do what they are trained to do, we may paraphrase Viner: What economists do is what they are trained to do in their graduate programs. While less elegant than Viner's immortal comment, this paraphrase captures the spirit of the American Economic Association's 1988 decision to sponsor a study on the content and structure of graduate education in economics. That decision led to the establishment of the Association's Commission on Graduate Education in Eco-

[1] I have not been able to track down the source of the Jacob Viner quote, which Lionel Robbins (1981) used in his Richard T. Ely lecture and described as "Jacob Viner's wisecrack." Interestingly, Viner (1991) once offered suggestions for improving graduate education in economics.

nomics (COGEE) whose purpose was to examine the content and structure of graduate education in economics, report its findings, and present whatever recommendations seemed appropriate.[2]

This paper complements the recommendations of the American Economic Association's Commission on Graduate Education in Economics (1991) by summarizing the major findings of the research and analysis sponsored by the Commission and carried out by its Executive Secretary.[3]

The materials prepared for the Commission assess content and structure from two different vantage points. One is external, focusing on how economics doctorates and their training are evaluated in the market place. The other is internal, focusing on the effectiveness of graduate education based on the informed judgments of faculty members, graduate students, and recent Ph.D.'s, as well as program information provided by graduate departments.

The links between graduate education and the labor market are illuminated by the responses of employers of Ph.D.'s, including department chairs of graduate and undergraduate departments, and also nonacademic employers in business, government, and nonprofit organizations. Other links back to undergraduate education are reflected in the responses of undergraduate majors and department chairs. With the interrelated responses from these groups it is possible to trace the progress of typical graduate students, from the senior year of undergraduate study through formal course work leading to the comprehensive examinations, on to and through the dissertation research phase, and finally to the early career experiences of recent Ph.D.'s. This approach further highlights interactions between the structure and content of graduate education in economics.

The focus of the analysis is on the 91 economics departments included in the most recent national assessment of graduate programs in economics by the National Research Council (NRC). To facilitate the analysis, the NRC rankings of these departments were used to divide them into five relatively homogenous groups called quality tiers.[4] The resulting tiers include the top 6, the next 9, the next 15, the next 18, and the remaining 43 departments.[5] These quality tiers help

[2] For a preliminary report of the Commission's work, see Hansen 1990.

[3] A full report of the surveys and other data collected, along with the special studies, is in preparation and will be published in 1992.

[4] See Lyle Jones, Gardner Lindzey and Porter E. Coggeshall 1982.

[5] The 91 ranked departments and the quality tiers to which they were assigned are listed below. Two agricultural economics programs were excluded from the 93 units included in the NRC study. Another 64 departments had awarded too few Ph.D.'s to meet the selection criteria used in the NRC study.—i.e. less than eight percent of all degrees awarded. No effort was made to survey these departments.

Tier 1: Chicago, Harvard, MIT, Princeton, Stanford, Yale

Tier 2: Columbia, Michigan, Minnesota, Northwestern, Pennsylvania, Rochester, UC-Berkeley, UCLA, UW-Madison

Tier 3: Brown, Cal-Tech, Carnegie-Mellon, Cornell, Duke, Illinois, Johns Hopkins, Maryland, Michigan State, New York Univ., North Carolina, UC-San Diego, Virginia, Virginia Polytech, Washington-Seattle

Tier 4: Boston Univ., Claremont, Florida, Iowa, Iowa State, Massachusetts, Ohio State, Pennsylvania State, Pittsburgh, Purdue, SUNY-Stony Brook, Texas A&M, Texas-Austin, UC-Davis, UC-Santa Barbara, USC, Vanderbilt, Washington-St. Louis

Tier 5: American, Arkansas, Boston College, Case Western Reserve, Cincinnati, Clark, Colorado State, Colorado, Connecticut, CUNY-Grad School, Florida State, Fordham, George Washington, Georgetown, Georgia State, Hawaii, Indiana, Kansas, Kentucky, Missouri, North Carolina State, Nebraska, New School Soc. Res., Northern Illinois, Notre Dame, Oklahoma, Oklahoma State, Oregon, Rice, Rutgers, South Carolina, Southern Illinois, Southern Methodist, SUNY-Albany, SUNY-Binghamton, Syracuse, Tulane, UC-Riverside, Utah, Washington State, Wayne State, West Virginia, Wisconsin-Milwaukee

reveal similarities and differences among doctoral programs.

Because personal visits to individual departments would have been much too expensive and time consuming, all 91 departments were asked to provide key information on programs. Subsequently, a sample of 35 departments was asked to provide more detailed information, including rosters of their faculty, graduate students, and three cohorts of recent Ph.D.'s (1977–78, 1982–83, and 1987–88) which were used to draw samples for the surveys. The departmental sample included all departments from the top two tiers; 47 percent for tier 3, 28 percent for tier 4, and 21 percent for tier 5. For other surveys, special samples were constructed of top undergraduate majors, chairs of undergraduate programs, and nonacademic employers. In all, six questionnaires were used. Survey response rates ranged from 57 to 80 percent for all but the surveys of nonacademic employers and undergraduate majors. Finally, samples of nonacademic employers in the New York City and Washington, D.C. areas were interviewed directly.[6]

This report is organized into eight sections. Section II presents a profile of graduate education in economics which focuses on its quantitative and qualitative dimensions. Section III reports the views of insiders—faculty members, graduate students, recent Ph.D.'s and others—on the need for change in the structure and content of graduate education. Section IV discusses what knowledge and skills receive attention and what levels of mathematics are used in graduate training. Section V examines what happens during the first two years of graduate training when the principal focus is on formal instruction, and then looks at the subsequent research phase of graduate training when students work on their dissertations. Section VI examines the links between undergraduate training and graduate education, while Section VII takes up the links between graduate education and the labor market. Section VIII provides a summary and the author's reflections on the findings.

II. *Profile of Graduate Training*

A. *Economics Degrees and Instruction*

The demand for academic economists and particularly new Ph.D.'s depends heavily on undergraduate and graduate enrollments (Table 1). A broad measure of the scope of economics instruction comes from data on degrees awarded in economics and agricultural economics.[7] In 1986 there were 23,796 baccalaureates, 2,496 masters degrees, and 1,018 Ph.D.'s, and most of them in economics. Despite a slowing of enrollment growth in the 1980s, the number of bachelor's degrees increased more than 40 percent from 1977 to 1986. In contrast, the numbers of masters degrees and doctorates showed little or no change. The number of doctorates awarded in economics alone also reveals no growth over the decade.[8]

[6] Survey questionnaires were mailed in March and April to samples of faculty members, graduate students, and recent Ph.D.'s, and also to samples of department chairs, undergraduate majors, and employers. The response rates were as follows: faculty, 62 percent; graduate students, 66 percent; recent Ph.D.'s, 57–62 percent for the three cohorts; academic employers, 80 percent; undergraduate program chairs, 80 percent; nonacademic employers, 45 percent; and undergraduate majors, 23 percent. The respondents appeared to be reasonably representative of the underlying population groups.

[7] The limited data on enrollment in economics courses suggest that 49 percent of all baccalaureates enroll in introductory economics course with as many as nine percent of them taking the intermediate microeconomics courses or money and banking (Clifford Adelman 1990). Overall, more than two percent of all college-level courses taken by students are in economics.

[8] As a result of the flow of new Ph.D.'s into the labor market, the number of employed doctoral economists rose by 38 percent. This growth reflects the strong demand for faculty resulting from the expansion of enrollment over this period.

TABLE 1

A PROFILE OF DOCTORAL TRAINING IN ECONOMICS: 1977 AND 1986

	1977	1986	Percent Change
Number of Degree Recipients in Economics and Agricultural Economics			
Baccalaureate	16,674	23,796	43
Masters	2,662	2,496	−6
Doctorate	983	1,018	4
Number of Doctorates Awarded			
Total	838	861	3
Percent U.S. citizens[a]	67.3	55.7	
Percent female	8.7	19.3	
Percent with BA/BS degree in economics	63.6	59.7	
Number of Graduate Students			
Total	12,063	12,830	6
Percent U.S. citizens	66.3	55.3	
Percent female	19.2	25.9	
Percent full-time	69.4	71.2	
Number of Full-time Graduate Students at Doctoral Institutions			
Total	7,946	8,789	11
1st year students	2,886	2,584	−10
Students beyond 1st year	4,994	6,205	24
Distribution of Support for Full-time Graduate Students at Doctoral Institutions			
Type of Support			
Fellowship and traineeships	1,461	1,341	−8
Research Assistant	1,151	1,043	−9
Teaching Assistant	2,032	2,719	34
Other	3,302	3,686	12
Source of Support			
Federal	586	273	−53
Institutional	3,572	4,609	29
Other	912	826	−9
Self	2,876	3,081	7
GRE Scores of Students Intending to Study Economics[b]			
Verbal	527	504	
Quantitative	607	612	
Analytical	N/A	568	
Economics	607	601	
Median years of registered time to Ph.D.	5.7	6.3	11

Sources: Lines A–C: National Science Foundation 1989.
Line D: National Research Council 1977 and 1986, Doctorate Records Project.
Line E: National Science Foundation 1985, 1988.
Line F: Educational Testing Service, various issues.
Line G: National Research Council 1977 and 1986, Doctorate Records Project.

Notes: [a] Recalculated to exclude those not reporting citizenship.
[b] The 1990 percentile score equivalents are 51, 62, 52, and 48.

What did change was the composition of degree recipients. The proportion of female degree recipients more than doubled. The proportion of degree recipients with undergraduate degrees in economics fell. More dramatic was the drop in American citizens earning doctorates in economics; by 1989, the figure had de-

clined to 47.2 percent (NRC 1990). U.S. degree recipients continued to come from essentially the same group of undergraduate institutions, namely, the major research universities and—to a lesser extent—the liberal arts colleges. Though little is known about the institutional origins of foreign students, a much larger proportion comes from Asian countries.

B. *Graduate Student Numbers, Support, Quality, and Mix*

Graduate student enrollment in economics grew relatively little over the late 1970s to the mid-1980s. In 1986 the total number of graduate students reached almost 13,000, 8,800 of whom were full-time students.

Financial resources for full-time graduate students at doctoral institutions held up reasonably well in a period when overall student support diminished. The proportions of full-time graduate students with support from fellowships, traineeships, and research assistantships remained at about 35 to 40 percent. The big change was a one-third increase in the absolute number of teaching assistantships which by 1986 financed 31 percent of all full-time students. The growth of teaching assistantships is consistent with the sizable gains in undergraduate degrees awarded. By source of support, the most dramatic change occurred in Federal support which declined by more than 50 percent; however, in 1986 only three percent of all full-time students were federally supported. Institutional support, which includes teaching assistantships and to some extent research assistantships, increased by about 30 percent.

The only available measure of what constitutes quality among graduate students is Graduate Record Examination (GRE) scores for those test takers who indicated an intention to study economics; no comparable data are published for graduate students actually enrolled in economics programs. Nonetheless, scores for the 1970s and 1980s suggest that the average quality of students intending to do graduate work in economics remained approximately constant over the past decade or more. Though the average verbal score declined slightly, closer inspection indicates this decline resulted from the increased proportion of foreign applicants with lower verbal scores. Because the quantitative and economics scores of foreign students tend to be similar to those of U.S. students, only the verbal score average is affected by the change in student mix.

A related development is the appreciable decline in the flow of American undergraduates into graduate training. As a result the number of American citizens receiving Ph.D.'s in economics dropped from over 560 in 1977 to 475 in 1987, and to 422 in 1989 (NRC 1989). Many bright undergraduates who in the past might have attended graduate school opted instead for other more lucrative careers. This decline in American graduate students has been offset by an increased flow of international students. The strong quantitative GRE scores of foreign applicants made them attractive to many economics departments, despite their relatively weaker verbal GRE scores. Thus, the overall quality of economics graduate students changed little if at all. It is conceivable, however, that the content of graduate economics shifted somewhat to accommodate the changing mix of students by emphasizing quantitative rather than verbal skills and theoretical rather than institutional knowledge.

C. *Increased Time to Complete Degree*

Another noteworthy development is the lengthened time needed to complete doctoral degrees. The median time required to complete the Ph.D. in econom-

ics increased by almost a year in the past decade, rising from 5.7 years in 1977 to 6.3 years in 1986. Recently available data for 1989 indicate a further increase to 6.5 years (NRC 1989). Because the time to complete courses and the comprehensive examinations has probably not changed, all of the increase can be associated with completing the dissertation.[9] Some of this increase no doubt reflects delays that occur because graduate students take jobs before their dissertations are completed; this was true for about half the 1977–78 economics Ph.D.'s. The somewhat weaker job market of the early 1980s and increased teaching responsibilities for graduate students may also have slowed the pace of completion. In addition, and potentially more important, academic employers have become more demanding, wanting to see substantial progress on the dissertation before consenting to job interviews.

D. *The Market for Economists*

To be effective, graduate education must attract talented undergraduates, provide them with reasonable levels of financial support, and ensure high levels of appropriate training. Yet, the overall health of graduate education depends ultimately on what happens in the "market" for new Ph.D.'s, namely, jobs available, salaries and benefits, and job satisfaction.

The condition of the market for graduate education in the United States can best be described as mixed (Table 2). Employment of Ph.D. economists rose by 38 percent over the previous decade, as a result of the consistently high levels of Ph.D. production and the strong demand for faculty fueled by rising enrollments. Average real salary levels barely increased, in line with the general weakness in academic labor markets.[10]

More unsettling, the increase in average salaries for economists lagged behind that of doctorates in related disciplines. Despite this, the level of average salaries continued to exceed that in related fields. The absence of any gain in real salaries, combined with the increased time required to complete the Ph.D., means that the economic return on investment in an economics Ph.D. declined. That decline may help explain the reduced flow of American students into graduate economics programs.

E. *Competing Disciplines and Fields*

The Commission decided that any assessment of graduate education in economics should be complemented by an examination of developments in closely related fields and programs. Many economists interested in areas such as public policy analysis, institutional labor economics and industrial relations, health economics, and law and economics have joined academic units outside of economics. Institutional labor economics moved to industrial relations institutes. Health economics has located itself in schools of medicine and public health. Law and economics programs are centered in law schools. Public policy schools have taken root as separate academic units. In addition, business schools and departments of agricultural economics have long used economists' skills and had economists on their faculties. To learn more about this possible competition, special studies were undertaken of the relationships between economics and six other related programs, the four already mentioned,

[9] Numerous reasons for this change have been offered, among them decreased federal research and fellowship support, more time spent as teaching assistants, a more demanding job market, weak institutional and personal pressures to complete the Ph.D., and more time required to master the ever-growing body of knowledge required to qualify for a doctorate (Howard Tuckman and Susan Coyle 1989).

[10] Additional information on salary trends was prepared for the Commission by June O'Neill, Baruch College.

TABLE 2

MARKET INDICATORS OF THE STATUS OF GRADUATE TRAINING IN ECONOMICS, 1977 TO 1987

	1977	1987	Percent Change
Employment of doctorates			
Total	12,970	17,837	38
Academic	8,872	11,778	33
Postdoctoral Plans of New Ph.D.s (Percentage Distribution)			
Employment	90.5	85.4	
Educational Institution	57.5	54.7	
Industry/Business	9.2	8.5	
Government	16.7	14.5	
Nonprofit	2.6	1.9	
Other and Unknown	4.4	5.8	
Postdoctoral Study	3.9	6.0	
Postdoc Status Unknown	5.6	8.6	
Firmness of Postdoctoral Plans (Percentage Distribution)			
Definite Employment or Study	76.5	71.4	
Seeking Employment or Study	18.5	20.0	
Region of Employment—Percent Foreign	16.2	19.6	
	Median Salary in Dollars		Percent Change in Real Terms
All Doctoral Economists	25,900	50,800	1
Employed by Educational Institution	25,100	48,000	2
Employed by Business & Industry	34,100	65,400	2
Employed by Federal Government	1,320	56,900	−3
Doctoral Scientists and Engineers	25,600	49,600	3
Economists	26,900	50,800	1
Physicists/Astronomers	26,500	50,500	2
Statisticians	25,100	46,700	−1
Computer Information Specialists	25,800	54,400	12
Sociologists/Anthropologists	22,200	45,300	9
Elec/Electrical Engineers	29,000	60,500	20
All Doctoral Scientists/Engineers Employed by Educational Institutions	23,700	45,900	3
Economists	25,100	48,000	2
Physicists/Astronomers	24,400	51,400	12
Mathematicians	22,600	45,400	7
Statisticians	23,500	45,000	2
Computer Specialists	24,400	49,700	9
Sociologists/Anthropologists	22,100	41,900	1
Electrical/Electronics Engineers	27,100	58,400	15

Sources: Employment and Salary Data from National Science Foundation; Employment plans from National Research Council (1977 and 1987).

plus agricultural economics and business.[11]

No strong evidence emerged on increased competition from these related fields. Agricultural economics has broadened the scope of its offerings but is not expanding its Ph.D. output. Meanwhile, programs in law and economics, health economics, and industrial relations are relatively small. Nor has there been any

[11] For topics of these special studies and who prepared them see Krueger, p. 1036.

expansion of public policy Ph.D.'s who might be viewed as good substitutes for economists, particularly in the nonacademic sector.

Business schools, by contrast, have substantially increased their doctoral production, and now award more Ph.D.'s per year than economics. Doctoral output has expanded to meet the growing demand for new faculty in business schools but is still insufficient. Thus, the likelihood is small that business schools will produce Ph.D.'s who might compete for positions in graduate economics departments; a flow in the opposite direction is more likely. By broadening economics training to include some work in finance and accounting, economics departments could help meet the demand for business school faculties, and thereby reduce the need for business schools to expand their Ph.D. programs or create new ones.[12]

The results of these special studies suggest that even though economics may be viewed as increasingly technical and less concerned with explaining real-world phenomena, these related fields are neither ready nor equipped to move into substantive areas that, while possibly neglected, are still viewed as part of the turf of economics. Were they to try, they would need to recruit doctoral economists as core personnel and then to produce Ph.D.'s who would be reasonably close substitutes for economists. Even if this happened, marketing such Ph.D.'s would be difficult because people trained outside of economics departments are typically not viewed as good substitutes for traditionally trained economists.

[12] Whether these opportunities for economics departments and their Ph.D.'s will be realized remains uncertain. If economics programs move to fill this gap, business schools may be reluctant to hire substantial numbers of new Ph.D. economists, because of the concern about the appropriateness of their training. More likely, business schools will want to strengthen their own Ph.D. programs and produce their own Ph.D.'s. In any case, the attractiveness of business schools to economics Ph.D.'s may be limited because teaching loads are higher and less emphasis is given to research. Moreover, economists may feel intellectually isolated in business schools. Might business schools instead begin producing Ph.D.'s for economics departments? This is entirely possible particularly at prestigious, private universities, which already employ many economists and produce Ph.D.'s who may be virtually indistinguishable from bona fide economics Ph.D.'s.

III. *The Structure and Content of Graduate Programs*

The most striking result to emerge from examining the descriptive brochures, course syllabi, and comprehensive Ph.D. examinations provided by departments is not their diversity but rather their great similarity. The similarity of graduate training is something many members of the profession have long suspected. Further probing of the data reveals evidence of substantial heterogeneity in the achievements of both faculty and graduate students, and of hiring patterns that reinforce the well-established reputational hierarchy of graduate programs. Evidence from the surveys shows that respondents believe there should be changes in how economics graduate students are trained.

A. *Program Descriptions*

The size and scope of graduate programs varies greatly. Based on data from the NRC study for the early 1980s, enrollments in tier 1 and 2 economics programs averaged about 130 students compared to the 50–70 range for the other tiers. Differences in annual Ph.D. output are even greater, ranging from 17–23 in the top two tiers and dropping to 5–8 for the other three tiers. On the other hand, the total number of degrees awarded differs substantially, with tier 5 programs producing 37 percent of all Ph.D.'s, followed by tiers 2 and 4 with

18 percent each, tier 3 with 15 percent, and tier 1 with 12 percent.

Departments across the tiers typically offer the full range of specialized fields. In most instances, the fields listed reflect the research interests of their diverse faculty members, which in some fields might include only a single person. Relatively few departments give any evidence in their program descriptions of a conscious decision to specialize in some subset of fields or to differentiate themselves from other departments.[13] This is puzzling, in view of economists' attachment to concepts such as specialization, comparative advantage, scale economies, and product differentiation.

Program homogeneity reveals itself in other ways. During the first year of graduate study students take essentially the same set of core courses: micro and macro theory, and econometrics.[14] The content of core graduate courses taken during the first year—micro and macro theory—is quite similar across institutions and across quality tiers. This similarity appears to reflect the substantial agreement among economists about what economics is or at least what constitutes its core. During the second year they concentrate on field courses. By the end of the second year they take their comprehensive examinations, usually completing them and any remaining courses during the third year. After this comes an extended period during which students concentrate on the dissertation.[15] The only obvious difference among these programs is in the time students require to complete their dissertations; whether these disparities pick up differences among students, faculty, or programs is difficult to ascertain.

B. *Comprehensive Examinations*

Perhaps the most telling evidence of program homogeneity emerges from a review of the comprehensive examinations, sometimes known as the preliminary or qualifying examinations.[16] Virtually all departments in the sample require at the end of the first year a written preliminary examination in theory; the notable exceptions are MIT, Berkeley, Rochester, VPI, Texas, and Boston University, which rely on course grades as evidence of a knowledge of micro and macro theory.

The content of these examinations is quite similar. The comprehensive examinations in microeconomic theory test a surprisingly similar set of topics. The major topics constituting the "canon" in-

[13] It is well known that some departments do offer a special emphasis. For example, the University of Arizona emphasizes experimental economics and George Mason University focuses on the political dimensions of economics, Michigan and Wisconsin emphasize applied economics, and Wyoming emphasizes resource economics. The New School for Social Research and the University of Massachusetts-Amherst differentiate themselves even more sharply with their orientation toward out-of-the-mainstream economics. Several departments are developing a more limited or focused sets of field offerings. For example, the University of California-Santa Cruz is developing its graduate program around international economics, and the American University has recently set up a field on the economics of gender which includes cross-disciplinary studies.

[14] The pattern is more complex in departments offering master's degrees. Master's degrees are offered most frequently in tiers 3–5 and are often a prerequisite to entry into the Ph.D. program (Robert Thornton and Jon Innes 1988).

[15] Both Howard Bowen (1953) and Nancy Ruggles (1970) comment on these similarities.

[16] The term comprehensive examination may be a misnomer. The traditional practice was to administer over a period of two days a battery of examinations covering the various required fields, which might include theory, history of thought, statistics/econometrics, and one or two applied fields. Students often spent several years preparing for these exams. Most departments have reduced the number of fields and split the examination, allowing the theory portion to be taken after the first year of courses and the field portion(s) after the second year of courses. As a consequence, these examinations are more closely tied to the courses students have just taken in theory and in their fields.

clude the utility maximizing consumer, the competitive firm, and general equilibrium. Beyond these topics, common to the vast majority of programs and to each of the tiers, several other topics appear frequently: imperfect information, uncertainty, social choice, dynamics, and game theory. Inclusion of these additional topics varies, with relatively few of them included in preliminary theory examinations at lower tier institutions. The comprehensive examinations in macroeconomic theory include a wider array of standard topics: expected discounted utility, Arrow-Debreu prices, linear rational expectations, Keynesian IS/LM, and overlapping generations.

The structure of the comprehensive examination questions and how they are posed is not only instructive but provides added evidence on homogeneity. Based on a crude taxonomy, it appears that 60 to 80 percent of all questions call for short answers, proofs, and solving problems. The latter require some mathematics to produce answers to well-defined economic situations. The remaining questions which are grouped in an "other" category call for lengthier answers that require comparing, evaluating, or producing models. They may also require responses to substantive questions that could touch on topics ranging from econometrics to economic policy.

The form of the micro and macro examination questions differ considerably. In micro examinations, more than 50 percent are problems, 25 percent are proofs, 10 percent are short answer, and what remains can be classed as "other." In macro examinations, which test a broader range of knowledge and skills, about 50 percent are problems, seven percent are short answers, one percent are proofs, and more than 40 percent are classed as "other."

C. *Quality Differences Among Departments*

The homogeneity of content and structure among ranked departments is at odds with widely recognized differences in the prestige or quality of departments. Though departments may be aware of the advantages of greater specialization, they do not differentiate themselves very much. The Ph.D.'s they produce need to fit the hiring priorities of other economics departments, most of which seem to be trying to enhance their standing by emulating the more highly-ranked departments that do not specialize and do not need to specialize in view of their size and resources.

What then differentiates departments? Differences in faculty and student quality far overshadow differences in the formal structure and content of Ph.D. programs (Table 3). Faculty members in tier 1 departments are more prolific than their counterparts, as indicated by the somewhat larger number of papers accepted for publication during the previous two years. For the other tiers there is substantial uniformity in self-reported publication rates of faculty, with no drop off in publication rates in lower tier departments. This uniformity indicates a high level of research activity.[17]

The quality of graduate students also differs. Based on information from department records on newly entering graduate students in 1987–88, undergraduate grade-point averages (UGPA) fall off slightly at each lower tier. The same pattern shows up for GRE scores. Graduate school grade-point averages (GGPA) reported by students are remarkably similiar across the tiers despite

[17] A journal quality-adjusted publication rate would probably yield sharper differences in research productivity among the tiers. Such a measure might be created by adjusting the number of publications by the citation factor developed by Stan Liebowitz and John Palmer (1984).

TABLE 3

VARIOUS MEASURES OF THE QUALITY OF PH.D. PROGRAMS BY QUALITY TIERS, SPRING 1989

Measures	All	Quality Tiers 1st	2nd	3rd	4th	5th
Faculty						
1. Annual Number of Papers Accepted for Publication Per Person for 1987 & 1988 Period	4.2	5.5	3.8	4.0	3.8	3.9
Entering U.S. Graduate Students 1987–88						
2. Undergraduate Grade Point Average	3.5	3.6	3.5	3.5	3.3	3.3
3. GRE Scores						
Verbal	—	690	627	597	570	592
Quantitative	—	767	707	699	655	684
U.S. Graduate Students Enrolled 1988–89						
4. Undergraduate GPA	3.5	3.7	3.6	3.5	3.5	3.3
5. Graduate GPA	3.5	3.5	3.5	3.5	3.5	3.6
6. GRE Scores						
Verbal	652	701	674	629	646	675
Quantitative	728	768	751	714	682	669
Analytical	732	764	738	704	687	679
Economics	727	776	742	700	630	641
Ph.D's Awarded 1983–87						
7. With Bachelor's	62%	59%	66%	68%	64%	61%
8. U.S. Citizens	54%	56%	58%	64%	51%	53%
9. Female	17%	16%	18%	19%	17%	16%
10. Median Years of Registered Time to Complete the Ph.D.	6.4	5.4	6.1	6.5	6.6	6.9

Sources: Line 1, American Economic Association, Commission on Graduate Education in Economics, Faculty Survey.
Lines 2–3, American Economic Association, Commission on Graduate Education in Economics, Department Supplemental Survey.
Lines 4–6, American Economic Association, Commission on Graduate Education in Economics, Graduate Student Survey (excludes first year students).
Lines 7–9 from Hansen 1991, Table 2.
Line 10, based on special tabulations for 1983–87 from National Research Council Doctorate Records file.

progressively higher GRE scores in higher tier programs. If GPA's measure what is learned, then student learning may be as homogeneous as the content of Ph.D. programs. If, however, GRE scores more accurately reflect student ability and achievement, then the observed grading patterns would indicate the application of different standards.

The time to complete the degree is shorter at each higher tier, with the most noticeable gap between tiers 1 and 2. These differences are consistent with both faculty and graduate student quality measures. In fact, these quality differences reflect the well-known and self-reinforcing hierarchy of departments based on reputational surveys. Departments with reputations of excellence can and do recruit the most talented faculty and

students and thereby maintain if not enhance their reputations. In an effort to increase their recognition, lower-ranked departments emulate the programs of top-ranked departments by hiring Ph.D.'s from those departments. The training these Ph.D.'s bring reinforces the already substantial homogeneity in the structure and content of graduate programs.

Evidence of these selection processes emerges from a comparison for 1987–88 of the current institutions of employment of all assistant professors to the institutions from which they received their Ph.D.'s. Tier 1 programs employed 64 percent of their own Ph.D.'s. Tier 2 programs employed 28 percent of their own Ph.D.'s, with 64 percent coming from tier 1 programs. Tier 3 programs employed 15 percent of their own Ph.D.'s, with 41 percent coming from tier 1 and another 41 percent coming from tier 2 programs. Tier 4 programs hired 11 percent of their own Ph.D.'s, with another 80 percent divided equally among tiers 1–3. Tier 5 programs hired 82 percent of their Ph.D.'s from higher tier programs. Thus, differences in faculty quality and in turn student quality are perpetuated through the selection processes in admitting graduate students and in hiring new faculty members.

D. *Need for Change?*

The Commission's survey responses reveal considerable sentiment within the economics profession for changing the structure and content of graduate training in economics. These responses resulted from asking survey recipients several variants of the question: "Do you think there is need for change in the structure and/or content of . . . your department's Ph.D. program [or in] economics Ph.D. programs generally?" This question was placed at the end of questionnaires in the hope that respondents would offer informed, well-considered judgments after having answered a long series of questions about graduate education.[18]

How much support exists for changing the structure and content of graduate Ph.D. programs? Among faculty members, 61 percent expressed support for changing the Ph.D. programs in their own departments, as compared to 30 percent who opposed change (Table 4). Among those responding yes or no, two-thirds favored change in their own or in other Ph.D. programs. The proportion of graduate students favoring change exceeded that of faculty members, with about two-thirds wanting changes in the programs in which they were enrolled. Among those responding yes or no, 80 percent favored change. Support for change among recent Ph.D.'s was weaker: 41 percent approved of the need for change in the programs from which they obtained their Ph.D.'s. Of those employed in Ph.D. granting institutions, 56 percent approved change, which is only slightly lower than for all faculty.

Part of the difference between the responses of faculty members and recent Ph.D.'s may be attributed to age. Recent Ph.D.'s are younger and more closely attuned to the current structure and content of graduate education and may be

[18] In interpreting the survey results, readers should be aware of various restrictions. First-year graduate students were excluded because they would have completed only one semester of graduate study and therefore less able to respond to the variety of concerns presented in the survey questionnaire. The faculty survey excluded newly-appointed Ph.D.'s on the grounds that they would be relatively unfamiliar with their department's graduate program. Recent Ph.D.'s from 1977–78, 1982–83, and 1987–88 were restricted to those whose addresses could be provided by their Ph.D. granting departments or were located in the Membership Directory of the American Economic Association; Ph.D.'s with non-U.S. addresses were excluded.

TABLE 4

NEED FOR CHANGE IN THE STRUCTURE AND CONTENT OF ECONOMICS PH.D. PROGRAMS

Need for Change Expressed by:	Percent Responding			Number of Responses
	Yes	No	DK/NR	
Faculty Members				
In Own Department's Program				
All	61	30	9	246
Teaching Core Theory	59	39	2	70
Pre-1970 Ph.D.	61	33	6	87
Post 1969 Ph.D.	63	28	10	149
In Ph.D. Programs Generally				
All	50	25	26	246
Teaching Core Theory				
Pre-1970 Ph.D.	57	21	22	87
Post 1969 Ph.D.	47	30	23	232
Graduate Students				
In Own Department's Program				
All	64	18	18	450
3rd–5th year	68	16	16	232
1977–78 Ph.D.'s				
In Department Awarding Ph.D.	41	39	20	123
In Current Department's Ph.D. Program	56	28	15	43
Department Chairs				
In Ph.D. Programs Generally				
Tiers 1–2 Programs	54	46	0	12
Tiers 3–5 Programs	50	47	3	36
In 4-Year Public Colleges	44	26	30	58
In Liberal Arts Colleges	68	14	18	37
Nonacademic Employers				
In Ph.D. Programs Generally	77	15	8	33

Note: Results for department chairs represent the combined responses by departments to questionnaires about their undergraduate programs and about them as employers. The responses reported here are unweighted. For information on the response rates, see footnote 6. Totals may not equal 100 because of rounding.

less interested in change. A comparison of faculty receiving their Ph.D.'s before and after 1970 reveals no difference in views about the need to change their own programs. Relatively few younger Ph.D.'s indicated any need for change in their programs generally, suggesting that faculty members may be unhappy with particular aspects of their own programs and yet be satisfied with Ph.D. programs in general.

The strongest sentiment for change in the structure and content of graduate programs came from nonacademic employers and department chairs at liberal arts colleges. By contrast, department chairs at institutions with Ph.D. programs were evenly divided in their support for change, differing only slightly from their faculty colleagues. Faculty members at top tier departments were least supportive of change whereas those at bottom tier departments were most supportive. Among graduate students,

only those at bottom tier departments exhibited any great support for change.

Because of their key role in graduate programs, it might be expected that faculty members teaching core theory courses would register greater opposition to change. They proved to be only slightly less supportive than all faculty members about the need for change. Faculty and graduate student responses by quality tier did not differ dramatically. The only noteworthy difference was that faculty teaching core theory courses in tiers 1–3 indicated less enthusiasm for change whereas those in tiers 4–5 strongly favored change. A plausible explanation is that younger faculty who graduated from higher-ranked Ph.D. programs and are now employed in the tier 4–5 programs see the need to upgrade these programs.

Faculty and graduate student respondents were also given an opportunity to comment on the need for change in their department's Ph.D. program. Virtually all respondents—90 percent or more—offered written comments. These comments not only add weight to the survey responses, but they also suggest directions for possible change.

The comments of faculty can be summarized as follows: approximately five percent want changes that call for increased rigor, a sentiment expressed most frequently by faculty at lower-ranked institutions; another 10 to 15 percent prefer the status quo but at the same time offer minor suggestions for improvement; and the remainder (about 80 percent) call for less theory and technique and more attention to applications-policy. The most frequently suggested changes include: more emphasis on the links between theory and real-world connections and applications; less emphasis on technique and more on the substance of economics; and greater emphasis on writing, acquiring research skills, and doing research.[19]

Faculty were not asked how to bring about these changes. What frequently emerged, however, was a sense of helplessness and a belief that, however desirable changes might be, they were unlikely to occur. Their view was that graduate training must respond to the direction in which the profession is currently moving even if many question the direction of that movement.

Graduate students expressed remarkably similar themes though they generally emphasized their particular concerns about content and structure rather than the broader issues mentioned by faculty members. Their comments on content dealt principally with: insufficient emphasis given to real-world problems and to empirical applications and policy issues, excessive emphasis on mathematical technique for its own sake, narrowness of content, lack of attention to economic history, and the need for more history of thought and interdisciplinary knowledge. Their comments on structure focused on the difficult transition from course work to dissertation research, the role and teaching of mathematics, and lack of faculty contact with and interest in graduate students. Some students complained about poor quality instruction in the mathematical economics courses taught in their departments even though student ratings of teaching were generally good. Comments about lack of faculty contact and interest were more surprising because this topic received no

[19] Other less frequent suggestions include: increase or decrease the amount of course work; increase or decrease the emphasis on economic history and institutions; recruit better students, particularly those who are technically equipped with mathematics (more typical at lower-ranked departments); shorten time to degree; and, shift student support by reducing the amount of teaching they do and increase the opportunities to become research assistants.

explicit attention in the survey. Many such comments reflect a considerable degree of alienation.

What emerged most strongly from the comments of both faculty and graduate students were their often eloquent expressions of concern about the direction of the discipline and the narrow training of new Ph.D.'s.

IV. *What Do Graduates Actually Learn?*

A. *Knowledge*

The purpose of graduate education is to teach students how to do research. To accomplish this it is essential to introduce students to the central body of knowledge in economics and particularly to the frontiers of economic knowledge. Before participants could be asked to describe the emphasis that is and should be given in their training to different types of economic knowledge, it was necessary to develop a system for classifying knowledge in economics. This was done by drawing on the major types of knowledge that economists use in their work and that graduate students acquire as part of their doctoral training.

Knowledge in economics can be grouped into six broad categories:

1) Economic theory (e.g., assumptions and theorems of economic behavior),
2) Econometrics (e.g., statistical theorems in economics, properties of models, and distribution theory),
3) Economic institutions and history (e.g., forms of economic association, historical economic forces),
4) Economic literature (e.g., recent and/or comprehensive histories of economic ideas and approaches),
5) Economic application and policy issues (e.g., current topics of concern in business, government and society),
6) Empirical economics (e.g., testing implications of theoretical models, estimating behavioral responses, practical analysis of data, experience with economic databases).

Survey respondents were asked to rank the relative importance in graduate education that is now given and that should be given to each type of knowledge with a 1 for "most" emphasis to a 6 for "least" emphasis. The rankings were averaged and used to indicate the relative importance given to them by respondents.[20]

Faculty members, graduate students, and Ph.D.'s exhibit substantial agreement about the relative emphasis given in graduate training to these different types of knowledge (Table 5). Economic theory leads the way, followed in order by econometrics, empirical economics, and application-policy; institutions-history and literature are at the bottom of the list. Faculty and graduate students were also asked to indicate what the relative emphasis should be. The responses show they agree about what knowledge is and what should be emphasized. This agreement spans the various quality tiers, indicating the existence of a strong consensus within the profession about the dimensions of knowledge or content.

That everyone saw eye to eye on the knowledge question does not necessarily indicate that all is well. Graduate students, for example, and even recent Ph.D.'s, may have given responses similar to those of faculty members largely because they had become thoroughly socialized to the profession. Graduate students with different views might have already left to pursue other kinds of

[20] Some ambiguity remains because two people could record similar rankings even though disagreeing with each other about how they defined their own knowledge of economics.

TABLE 5

AVERAGE RANKING OF EMPHASIS THAT IS AND SHOULD BE GIVEN TO DIFFERENT TYPES OF KNOWLEDGE IN GRADUATE ECONOMICS EDUCATION

Knowledge	Faculty		Graduate Students		1977–78 Ph.D.'s
	Is	Should Be	Is	Should Be	Is
Theory	1.5	1.3	1.5	1.5	1.3
Econometrics	2.7	2.9	2.6	3.2	2.7
Empirical	3.4	3.3	3.7	3.7	3.7
Application-Policy	3.6	3.9	3.9	3.7	3.8
Institutions-History	4.7	4.6	4.7	4.5	4.9
Literature	4.8	5.0	4.8	4.5	4.6

Note: The derivation of average rankings in the Tables 5–8 and 12 are described on page 1068.

advanced training or to enter the labor market.

1977–78 Ph.D.'s reported considerable disparities between what knowledge was emphasized in their graduate training and what is emphasized in their current jobs (Table 6). It should be noted that what knowledge was emphasized in their graduate training continues to be emphasized, as shown by the similar responses from faculty and graduate students. By contrast, the current work of recent Ph.D.'s, including those employed in departments with Ph.D. programs, requires greater attention to economic application-policy issues and to empirical economics than was provided by their own Ph.D. training. The importance given to econometrics fell off considerably. In short, the knowledge used by recent Ph.D.'s in their work does not accord closely with what either faculty members or current graduate students thought should be emphasized.

This mismatch can be viewed in two ways. If graduate education is really professional training, then a closer link might be expected between the knowledge acquired in graduate school and that used on the job. On the other hand, be-

TABLE 6

AVERAGE RANKING OF EMPHASIS THAT IS GIVEN TO DIFFERENT TYPES OF KNOWLEDGE IN GRADUATE ECONOMICS EDUCATION AND IN CURRENT JOB FOR 1977–78 PH.D.'S

Knowledge	All Ph.D.'s		Academic w/Ph.D. Program		Academic w/o Ph.D. Program		NonAcademic Employment	
	Own Training	Current Job	Own Training	Current Job	Own Training	Current Job	Own Training	Current Job
Theory	1.2	3.2	1.2	2.8	1.2	2.9	1.3	4.0
Econometrics	2.7	4.2	2.7	3.8	2.6	4.5	2.9	4.2
Institutions-History	4.9	4.3	5.0	4.5	4.9	3.8	4.9	4.5
Literature	4.6	4.6	4.7	4.7	4.2	4.2	4.7	4.8
Application-Policy	3.8	2.2	3.6	2.4	4.0	2.8	3.9	1.5
Empirical	3.7	2.3	3.8	2.4	3.9	2.5	3.4	2.0

cause graduate education and post-Ph.D. employment are separate activities, graduate training need not emphasize the knowledge that new Ph.D.'s will require in their jobs. New Ph.D.'s can acquire this knowledge as they need it, building on what they learned in graduate school. This view can be rationalized by realizing there is no way to ensure that the common body of knowledge provided in graduate school will perfectly match the knowledge demands associated with the variety of jobs taken by individual Ph.D. recipients. Whether the apparent mismatch can be minimized remains unclear.

B. *Skills*

In addition to imparting a body of knowledge, graduate training equips students with a set of skills that permits them to use their knowledge and demonstrate their ability to do what economists do. Because no systematic classification of these skills existed, a list of seven skills was developed to parallel the six types of knowledge. The seven skills are:

1) Critical judgment (e.g., analyzing ideas, reviewing literature, formulating pertinent comments),
2) Analytics (e.g., understanding and solving problems, making and analyzing logical arguments),
3) Applications (e.g., seeing practical implications of abstract ideas, analyzing real-world policies and processes),
4) Mathematics (e.g., constructing and analyzing proofs, manipulating mathematical abstractions),
5) Computation (e.g., effectively and quickly finding and manipulating relevant data sources, translating statistical theory into functioning programs),
6) Communication (e.g., speaking and writing effectively and with good style, quickly understanding spoken and written ideas of others),
7) Creativity (e.g., conceiving interesting research questions, finding new ways of analyzing topics).

As before, survey respondents were asked to rank the relative importance that is and should be given to each skill, with a rank of 1 for most important and 7 for least important. Averages of these rankings are used to describe the results.[21]

Faculty members, graduate students, and 1977–78 Ph.D.'s all agreed about the relative importance attached to these skills in graduate training (Table 7). They also agreed about the importance that should be attached to these skills. Yet substantial differences appear in the rankings based on what is versus what should be. Faculty members believed that mathematical skills should be much less important than they are and creative skills much more important, and that communication skills should be more important and computation skills less important. Graduate students had quite similar views, believing that mathematics and computation should be downgraded and creativity upgraded in importance.

Responses of recent Ph.D.'s (1977–78) reveal substantial differences in the rankings of skills important in their own Ph.D. training and the skills important in their current jobs. Their views on the latter can be interpreted as similar to the "what skills should be important" responses for faculty and graduate students. The differences are dramatic. Communication rose from the bottom to the top of the rankings. Mathematics fell from second to last place. Analytics

[21] Despite the examples given to help define each skill, the term "creativity" produced various reactions, ranging from "it's not a skill" and "it can't be taught" to the notion that because creativity is so rare, it is not comparable in any sense with the other skills.

TABLE 7

AVERAGE RANKING OF IMPORTANCE THAT IS AND SHOULD BE GIVEN TO DIFFERENT SKILLS IN GRADUATE ECONOMICS EDUCATION

	Faculty		Graduate Students		1977–78 Ph.D.'s
Skills	Is	Should Be	Is	Should Be	Is
Analytics	2.1	2.2	2.3	2.5	1.9
Mathematics	2.9	5.2	2.8	4.9	3.1
Critical Judgment	3.8	2.9	3.2	2.6	3.4
Applications	3.8	3.9	4.3	3.7	4.4
Computation	4.3	6.0	4.5	5.8	4.6
Creativity	5.3	2.6	5.2	3.3	5.0
Communication	5.5	5.0	5.5	5.0	5.4

dropped to the middle of the rankings and application received a substantial upward boost.

The mix of skills used on the job by recent Ph.D.'s corresponds more closely to the mix of skills that faculty members and graduate students think should be important in graduate education than to the mix of skills currently emphasized in graduate education. The responses of both faculty members and graduate students can be interpreted as sensing that the mix of skills needed on the job differs from the skills developed in graduate training.

To learn more about how the responses of 1977–78 Ph.D.'s might have been affected by the nature of their work, the results were tabulated by types of employers—nonacademic employment and academic employment—with the latter divided between those employed and not employed in institutions with Ph.D. programs (Table 8). As might be expected, these three groups reported only minor differences in the rankings of skills in their own Ph.D. training. By contrast, the importance of these skills differed by type of current employment. Of particular interest, economics doctorates now

TABLE 8

AVERAGE RANKING OF IMPORTANCE THAT IS GIVEN TO DIFFERENT SKILLS IN GRADUATE ECONOMICS EDUCATION AND IN CURRENT JOB FOR 1977–78 PH.D.'S

	All Ph.D.'s		Academic Ph.D. Program		Academic w/o Ph.D. Program		Nonacademic Employment	
Skills	Own Training	Current Job	Own Training	Current Job	Own Training	Current Job	Own Training	Current Job
Analytics	1.9	3.5	1.9	3.5	2.1	3.2	1.7	3.6
Mathematics	3.1	6.2	2.6	5.9	3.1	5.8	3.7	6.7
Critical Judgment	3.4	3.2	4.0	3.8	3.1	2.9	3.1	2.9
Applications	4.4	3.3	4.3	3.5	4.3	3.4	4.4	2.9
Creativity	4.6	3.6	4.6	2.4	4.8	4.4	4.5	4.2
Computation	5.0	5.5	5.1	5.7	5.1	5.7	5.0	5.2
Communication	5.4	2.7	5.4	3.2	5.5	2.5	5.4	2.4

TABLE 9

IMPORTANCE THAT IS AND SHOULD BE GIVEN TO DIFFERENT SKILLS IN DISSERTATIONS, AND QUALITY OF SKILLS POSSESSED BY NEWLY-HIRED ECONOMICS PH.D.'S, AS RANKED BY ECONOMICS FACULTY MEMBERS

	Dissertations		Newly Hired Ph.D.'s
	Percent Rating Skills as 1st, 2nd, and 3rd		
Skills	Are Represented	Should be Represented	Percent with Excellent or Good Skills
Analytics	51	53	85
Applications	46	39	56
Computation	34	4	64
Critical Judgment	31	45	60
Mathematics	36	7	85
Creativity	14	52	51
Communication	10	12	44

teaching in graduate programs ranked creativity as most important among the seven skills, followed closely by communication. They placed a high premium on creativity which is essential for people whose positions entail substantial research obligations as well as important graduate teaching responsibilities. In other academic jobs communication was ranked first, followed by analytics and critical judgment. In nonacademic positions communication led, with application and critical judgment tied for second place. The disparity between what is important in graduate training and on the job is most evident for graduate faculty.

The strength of these results leads one to wonder why the skills gap has not been narrowed by altering the structure and content of graduate programs. Is it that faculty prefer to continue doing what they have always done? Is it too difficult to shift the orientation of graduate instruction to emphasize a different mix of skills? Or does the existing ranking of skills emphasized in graduate school serve as a convenient device for screening out certain types of students even though those skills important in graduate training may be of only marginal importance to practicing economists?

The skills problem reveals itself in two other ways. Faculty members were asked how these skills are and should be represented in Ph.D. dissertations, with the percentages of respondents recorded for those who ranked the skill 1st through 3rd in importance (Table 9). Two results deserve mention. First, the skills of application and computation demonstrated in dissertations ranked considerably higher and mathematics much lower than in graduate training generally (compare Table 7). Second, the skills sought in dissertations were similar to the skills faculty members said should be emphasized in graduate training. Creativity and critical judgment scored the largest gains in what should be emphasized (relative to those skills that are currently emphasized in graduate training), while mathematics and computation registered the largest declines. In other words, the mix of skills needed for both dissertation research and subsequent employment differed from the mix of skills currently emphasized in graduate programs. Moreover, dissertations failed to score well on the skills

that recent Ph.D.'s, employed as academics in doctoral programs, claimed were most important in their current jobs. Paradoxically, dissertations were ranked best at demonstrating those skills that were least important on the job.

Faculty members were asked to evaluate, on a scale of excellent to poor, the quality of the skills possessed by recent newly hired Ph.D.'s in their departments (Table 9). Eighty-five percent of faculty respondents gave new hires excellent or good evaluations for analytics and mathematics. Slightly less than two-thirds gave similar evaluations for computation and critical judgment. On the down side, less than half of the newly-hired Ph.D.'s scored well on communication, and about half scored well on creativity and applications. It comes as no surprise that newly-hired Ph.D.'s exhibited skills very similar to those being developed among currently enrolled graduate students. The problem, of course, is that relatively few Ph.D.'s emerge with these desired skills, for the obvious reason that these skills are not emphasized in graduate training. The unanswered question is, why does this situation persist?

C. *Use of Mathematics*

Because critics contend that mathematics is used too heavily in economics, a special effort was made to learn more about the role of mathematics in graduate training. A five-category classification of mathematical competence was developed. Survey respondents were asked to indicate the level of their own mathematical skills, how much mathematics is and should be used in graduate courses, and how much mathematics is used in dissertations and in the current research of economists. The five levels of mathematics are:

1) High school mathematics only,
2) Basic calculus and linear algebra,
3) Applied mathematics, differential equations, linear programming and basic probability theory,
4) Advanced calculus, advanced algebra and stochastic processes,
5) Real and complex analysis, advanced probability theory, and topology.

To simplify the results, the levels reported in the surveys were averaged for different groups of respondents with a 5 indicating the highest level of mathematics and a 1 the lowest.[22]

Graduate students reported that the level of mathematics used in various graduate courses was about what they believed it should be, which is slightly above level 3. The responses of faculty members were quite similar. The greatest demands on mathematical skills occurred in the advanced theory and advanced econometrics courses and the least in the applied fields. Macroeconomic theory courses required a slightly higher level of mathematics than did microeconomic theory courses. Most graduate students and faculty members indicated that they approved of the level of mathematics used in these two courses. Among the small minority that wanted a change, a slight majority favored more rather than less mathematics.

The survey results also showed that the mathematics levels used in core theory and econometrics courses exceeded the levels students possessed on entry to graduate school. This deficit is most

[22] The results must be interpreted carefully. Some entering graduate students with weaker mathematical skills who were unable to cope with the mathematics or refused to do so had no doubt already dropped out of graduate training by the time the survey took place. In addition, the survey did not include the responses of undergraduates who may have been interested in graduate study but were deterred from enrolling because of the emphasis given to mathematics.

frequently remedied through special courses in mathematical economics. The size of this deficit did not seem to have affected students' views about how much mathematics should be used. Nor did many students want reductions in the mathematics requirements.

The average levels of mathematics used by graduate students in their own research and their dissertations were about the same as the levels they possessed when they entered graduate schools. Even the highest levels of mathematics graduate students reported using in their own research and dissertations remained well below the average levels used in advanced theory and econometrics courses. These levels, in turn, were only moderately higher than the average levels used in the core courses, particularly the macroeconomics core theory course. In fact, the core courses typically required more mathematics than most students used in their own research or dissertations.

Information from faculty members on student use of mathematics was similar. Faculty members reported that the average level of mathematics used in doctoral dissertations they supervised recently was very close to the average level students said they possessed when they began graduate study, and these levels were well below the levels used in the core theory courses. Naturally, considerable variation was reported in mathematics use, with index values ranging from 2.1 at the low end to 3.6 at the high end.

Recent Ph.D.'s from a decade ago also reported using lower levels of mathematics in both their dissertations and current research than contemporary students possessed when they began graduate work. Only the most recent group of Ph.D.'s from 1987–88 reported using as much mathematics in their dissertations as is possessed by current entrants into Ph.D. programs. This difference may reflect an upward shift in mathematical sophistication, as the average level of mathematics used in dissertations by recent Ph.D.'s rose from an average of 2.4 for 1977–78 Ph.D.'s to 2.8 for the 1987–88 Ph.D.'s. It should be noted, however, that recent Ph.D.'s employed in graduate departments used somewhat higher levels of mathematics in their research than did their colleagues in other employment settings, notably in nonacademic positions. Even that level is still below the average shown for the core microeconomic theory course and well below the average for the core macroeconomic theory course.

What can we conclude about the appropriate role of mathematics? No simple answer emerges. The earlier discussion of skills noted that faculty and students believed that graduate programs place too much emphasis on mathematical skills. Yet, in response to explicit questions on mathematics, graduate students reported no apparent dissatisfaction with the levels of mathematics used. Meanwhile, the reported levels of mathematics required in their courses exceeded by a considerable margin both what they possessed on entering graduate training and what they reported using in their dissertation research. Does this mean that mathematics is used in first year courses to weed out "weaker" students? Or is mathematics required so that students can master the most recent and most technical research in the leading journals, of a kind that relatively few of them will do in their dissertations or subsequent research? Whatever the explanations, more questions are raised: What is the opportunity cost of the current approach which puts so much emphasis on the use of mathematics in economics? What would the core theory courses be like if they were taught by people in the major fields whose interest in and capac-

ity to use advanced mathematics is weaker?

In another effort to probe the use of mathematics, respondents were asked to react to this statement: "Some economists believe that graduate training . . . overemphasizes mathematical and statistical tools at the expense of substance." Respondents were instructed to answer with respect to their own departments, to the departments from which they hire Ph.D.'s or those from which they obtained their own Ph.D.'s, and to the profession as a whole.

The responses indicated considerable concern that graduate training overemphasizes these tools. Among faculty members, strong or moderate agreement with this statement was expressed by 58 percent about their own departments, by 58 percent about other departments from which they hire economics Ph.D.'s, and by 61 percent about the profession as a whole. The patterns across tiers were quite similar.

Several differences in perceptions emerged. As might be expected, faculty members teaching first-year core courses were less inclined to say that mathematical and statistical tools are overemphasized, as were younger faculty members, i.e., those obtaining Ph.D.'s since 1970. Though 1977–78 Ph.D.'s were more sanguine about the situation in both their departments and the departments from which they hired new Ph.D. economists, they also believe the profession overemphasizes these tools.

1977–78 Ph.D.'s employed in departments with Ph.D. programs expressed the same view as faculty members about the overemphasis on mathematics-statistics in the profession as a whole. This is in sharp contrast to recent Ph.D.'s in non-Ph.D.-granting departments who, though less critical of an overemphasis on mathematics-statistics in the departments from which they hired new Ph.D.'s, were more critical of the profession as a whole. The views of nonacademic respondents were almost identical to those of faculty members as a group.

Both faculty and recent Ph.D. respondents believed mathematical and statistical tools were overemphasized in programs from which they hired new Ph.D.'s, and they held even stronger views about the profession as a whole. Those whose teaching required the use of mathematics were understandably most satisfied with the mathematical-statistics emphasis. Nonetheless, a majority of faculty respondents expressed concern about the overemphasis of mathematical-statistical techniques.

V. *The Sequence of Graduate Training*

A. *The First Two Years*

Tracking the progress of students through the first two years of the Ph.D. program provides further opportunities to highlight concerns about content. What emerges most clearly is the sharp separation between the instruction phase, which generally covers the first two years of graduate work, and the dissertation phase, which consumes the remaining but all important years of graduate training. It appears that relatively little attention is given in the instructional phase to developing and nurturing students' abilities to carry out independent research. Consequently, many talented students are ill-prepared to undertake their dissertation research which is an essential step to becoming creative independent researchers.

Acquiring the knowledge and skills of an economist, including a facility with mathematics, occurs largely through formal instruction in courses during the first two years of graduate study. To find out how well courses equip students for subsequent stages of their Ph.D. work, attention was given to what might be called

TABLE 10

EMPHASIS IN CORE THEORY COURSES AND FIELD COURSES

Emphasis	Percent of Graduate Students Responding True for All or Most	
	Core Theory Courses	Field Courses
Providing rigorous training in economic theory	94	62
Preparing students for preliminary examinations	68	—
Deriving implications of math models	60	63
Preparing students for field courses	49	40
Preparing students to do independent research	20	50
Using theory in empirical applications	15	45
Applying theory to real-world problems	14	50

"proficiencies." These proficiencies capture various combinations of knowledge and skills that permit graduate students to undertake the broader tasks that are necessary to complete the next stages of Ph.D. training.

A list of these proficiencies was developed to make this assessment. The resulting list ranges from relatively narrow activities such as readying students for the next steps in the formal parts of their Ph.D. programs (e.g., preparing them for field courses and for preliminary examinations), to broader activities that serve them in their dissertation research and beyond (e.g., providing rigorous training in economic theory, and using theory in empirical applications), to the still more encompassing activity of research (e.g., preparing students to carry out independent research).

To highlight the important distinction between the substantive content of core and field courses and the sequence in which these courses are taken, graduate students were asked to indicate the effectiveness of these courses. Their effectiveness was represented by the proportions who reported that all or most of their courses emphasized these proficiencies.

Core theory courses perform a variety of functions (Table 10). Virtually all graduate student respondents indicated that all or many of these courses were effective in providing rigorous training in economic theory. About two-thirds praised these courses for preparing students for preliminary or comprehensive examinations. Core courses were also given high ratings in helping students learn how to derive the implications of mathematical models. These courses performed only moderately well in preparing students for their second-year field courses. Relatively few students gave these courses high marks for their help in using theory in empirical applications, applying theory to real-world problems and, above all, preparing them to do independent research. Perhaps the development of such proficiencies was not the role of these courses. Still, closer connections might have been expected between the core theory courses, the rest of the graduate program, and what economists ultimately do.

The field courses, taken largely by second-year students, were more highly regarded than core courses. Not too surprisingly, these courses did less well in providing rigorous training in economic theory and deriving the implications of mathematical models. Field courses were more favorably viewed for what they did in applying theory to real-world problems, using theory in empirical applications, and preparing students to do independent research. Nonetheless, fewer than half the graduate students reported that all or many of their field courses used theory in empirical applications.

These results highlight the absence of

any substantial links in the structure of graduate programs. First-year courses do not connect closely with second-year courses or with the dissertation phase, and second-year courses are only loosely linked to the dissertation phase. The dissertation phase is separate and distinct from what most professional economists do once they complete their doctorates. As a result, substantial numbers of students advance to the dissertation stage without being particularly well prepared to undertake independent research and to use and apply theory in carrying out that research. Is there anything that could be done to strengthen these various links?

A different perspective came from asking students to rate the quality of their instruction. Overall, graduate students were happy with the instruction they received. Approximately two-thirds of them described the quality of instruction in their core theory and econometrics courses as excellent or good. They were even more pleased with their field courses, as evidenced by high ratings from three-fourths of the respondents. Several interpretations are possible. One is that students were relatively satisfied with what went on in the classroom even though students gave these courses, at best, mixed ratings in preparing them for later stages of their Ph.D. work. Another interpretation is that students may have been unaware of the disparity between instruction narrowly conceived in courses and learning in the broader sense of equipping them to move along toward their Ph.D.'s. Whatever the case, at least one-third of the graduate students described the instruction they received in the core theory courses as either fair or poor. This proportion seems large enough to merit some concern, particularly at lower tier institutions where the frequency of weak evaluations was greatest.

Faculty members were also asked to evaluate not what the various courses did or tried to do, but rather the proficiencies achieved by students. Faculty members were harsher than graduate students in their assessments of these proficiencies. Faculty respondents indicated that, by the time of comprehensive examinations, many students had not gained proficiency in using the knowledge and skills they had been exposed to or had developed in their courses. At the high extreme, 59 percent of faculty members indicated that all or most students were well-grounded in economic theory. This low figure contrasts with favorable views of core courses reported by graduate students, and it came as a surprise because of the strong emphasis given to theory in the core graduate courses. Faculty respondents may have interpreted this question as implying a level of understanding only theory majors could be expected to demonstrate.

Only 33 percent of faculty members believed graduate students were good at deriving economic implications of mathematical models, a considerably lower figure than might have been inferred from the graduate student responses. Even fewer, 24 percent, considered students good at applying theory to empirical applications and only 14 percent could say that, by the time students completed their comprehensive examinations, most or all of them were good at applying theory to the real world. Most disappointing of all, only 13 percent of faculty members indicated that most or all students at this stage were good at independent research.[23]

These assessments by faculty members may suggest that the program of instruc-

[23] Unlike many earlier results, some differences among quality tiers appeared. Except for the ability to apply theory, the proportions responding favorably on these proficiencies decreased noticeably in tiers 4 and 5. In the case of being well grounded in theory, it decreased in tiers 2 and 3 as well.

tion during the first two years of graduate study had a disappointingly low payoff. A pessimist might observe that not only does no research training occur but relatively few students gain the proficiencies they require to continue their doctoral work. If this view has merit, it raises questions about what meaning can be attached to completing the comprehensive examination.

B. *Early Research Experience*

The evidence presented indicates that much of the instruction and instruction-related activity in the first two years of graduate study did little to develop the research skills of graduate students. This conclusion is confirmed by the responses of graduate students when asked how the first two years of their program helped prepare them to conduct independent research at the dissertation stage. Their responses indicated that field courses were most useful, with three-quarters of the respondents saying these courses had served this purpose well or very well. Econometrics courses received a response of 60 percent, followed by studying for the comprehensive examinations with 57 percent. The core theory courses lagged with a 48 percent response. The responses of 1977–78 Ph.D.'s for field courses were virtually identical. This group also gave a strong endorsement of their core theory courses in preparing them for independent research.

Graduate students were also asked how different types of support had prepared them to conduct their dissertation research. Teaching assistantships were not highly regarded, particularly by 1977–78 Ph.D.'s. Fellowships were understandably more highly valued. Research assistantships were valued even more highly by current graduate students but were viewed less favorably by recent Ph.D.'s. What explains these differences is not clear. Could it be that research assistantships have become more valuable and core theory courses less valuable in preparing people for their research experience?

What can be said about the less systematic activity outside the classroom that might help develop research skills? Relatively few graduate students took advantage of attending any substantial number of workshops or participating in seminars during their early formative years of study. Only 30 percent of first year students attended six or more seminars, workshops, or other presentations of original research during their first year, although this number rose to 57 percent by the end of the second year. Even fewer made any oral presentations of their research. While first year graduate students might not be expected to report on much original research, the survey results show that just over one-third of the students made presentations during their second year of graduate study. Surprisingly, the percentages were not much higher in subsequent years.

The best way to learn how to do research is to do it, and the most traditional route is to start by writing research papers. By the beginning of the third year of full-time study after having taken about a dozen courses, graduate students not yet working on their dissertations indicated that they had written a total of three papers. Unfortunately, we do not know the nature of these papers, whether they were short or long, literature reviews or something more substantial, theoretical pieces or empirical studies. It seems unlikely that many were research papers, based on evidence that less than one-third of 1977–78 Ph.D. respondents had produced a paper on their dissertation topic before beginning work on their dissertations.

The small amount of paper writing signals that faculty members do not regard such activity as an integral part of instruc-

tion; or, they apparently do not have time or want to read and comment on student papers. The fact that graduate students who are in the process of being trained for research careers do so little writing may help explain why they are so poorly prepared to undertake dissertation-level research.

The low volume of predissertation research papers means that two-thirds of those who eventually completed their Ph.D.'s launched their dissertation-writing efforts withoug having had the benefit of what might be called a trial run at research. Of those who had completed a paper, less than one-third said they had submitted it or a paper on some other topic for publication. To sum up, only a small proportion of recent Ph.D.'s got off to a fast start in their research.

The absence of more research activity and training stands in contrast to faculty research activity. Faculty members reported discussing their own research in their classes, with more than half saying they did this often or very often, particularly faculty at tier 1 institutions. Eighty-six percent of faculty members reported having presented their research in some kind of departmental forum during the past year. Their volume of research activity was high, with the average faculty member reporting having submitted four papers per year to scholarly journals over the previous two years. Some kind of research environment obviously exists. We do not know enough about its quality, however, to understand what accounts for the low volume of graduate student research preparation and activity in light of the substantial amount of faculty research activity.

C. *Selecting a Dissertation Topic*

The road to the completed Ph.D. is rarely a smooth one. Graduate students experience substantial difficulty narrowing and then focusing on a dissertation topic and later converting their topic into one that can be researched and completed in timely fashion. With the lengthening time to complete the Ph.D. and the now shorter time to complete the preliminary examinations, the "black hole" of graduate training—the Ph.D. dissertation writing stage—extends to about 4.5 years.

The major difficulty seems to lie in identifying the idea for the thesis and then shaping that idea into a dissertation proposal that gains faculty approval. Based on the experience of 1977–78 Ph.D.'s, only 28 percent had settled on a topic before beginning their third year of study. Another 45 percent found a topic in their third year. This means that more than a quarter of all those who completed dissertations did not identify a topic until their fourth year or beyond. The experience of recent Ph.D.'s differed only slightly. Typically, they identified their dissertation topics in their third year. In contrast to current graduate students, considerably larger proportions of recent Ph.D.'s gave credit to their faculty advisers.

As to what motivates students to select the topics they do, students and faculty respondents agreed that the interests of students are paramount, followed by interests of major professors. Reasons such as the availability of financial support, faddishness, and prospects for publication all received much lower rankings. How do students get their ideas? Forty-two percent of graduate students already working on dissertations credited their own research, reading and/or thinking as the major source for their dissertation topics. The importance students assigned to their own efforts suggests considerable independence from faculty mentors.

The influence of faculty advisors proved to be surprisingly weak. Relatively few of the respondents credited their faculty advisors with the inspiration for their thesis topics. Instruction contributed relatively little to identifying a

research topic, with only 12 percent of the respondents citing class lectures and readings as a source of ideas. Among the one-third of these students who had been research assistants, only 20 percent reported that their research assistantship experience had been the main source of their dissertation topic.

That students relied so heavily on their own efforts raises interesting questions. Did they do this because faculty members were reluctant to suggest topics, because faculty members wanted to push more of the burden of idea-generation onto students, or because faculty were so busy with their own research they had little or no time to work with students in developing dissertation topics?

D. *Writing a Dissertation*

The main task of Ph.D. students is to demonstrate their ability to do independent research that contributes to economic knowledge. This task is daunting, so much so that upwards of one-half the students passing their comprehensive examinations never complete an acceptable doctoral dissertation.

Many obstacles confront students in producing a dissertation. About two-thirds of the students indicated they confronted one or more major obstacles, with between one- and two-thirds of this group indicating that these obstacles, ranging from academic to personal factors, hindered their progress and delayed completion of their Ph.D.'s. Of particular importance were the standard barriers: serving as a teaching or research assistant, financial problems, and family obligations. Certain structural problems also existed, among them, inadequate undergraduate preparation and poor linkages among the various elements of the graduate program. These obstacles were to be expected in light of the results reported earlier.

More pertinent, perhaps, were problems connected directly with the dissertation. On the substantive side, numerous respondents ascribed delays to the difficulty of the thesis topic, changes in their topic, and problems in obtaining needed data. On the procedural side, considerable numbers of students reported delays because of the absence of their major professors and changes in the membership of their dissertation committees. The barriers are too complex to offer hope of any simple resolution. Yet, the lack of research experience seems to be a prime source of difficulty. At least some of the barriers might be more easily overcome if students had more research experience on which to draw.

The quality of the Ph.D. dissertations in economics was not viewed as particularly impressive by faculty dissertation supervisors. When asked to characterize different dimensions of dissertations they had recently supervised (Table 11), 80 percent of faculty members agreed that all or most dissertations were good train-

TABLE 11

CHARACTERISTICS OF RECENT PH.D. DISSERTATIONS, AS DESCRIBED BY FACULTY DISSERTATION SUPERVISORS

Characteristics	Percent of Faculty Dissertation Supervisors Responding True for All or Most Dissertations
Were good training instruments	80
Applied economics to real world problems	60
Were well-grounded in economic theory	58
Offered good empirical evidence to support economic theory	50
Were well written	38
Showed clearly the economic implications of mathematical models	36
Were significant contributions to economic knowledge	21

ing instruments. Slightly more than half the faculty respondents thought that all or most dissertations applied economics to real-world problems, were well-grounded in economic theory, and offered good empirical evidence to support economic theory. Less than 40 percent said that dissertations were well written or showed clearly the economic implications of mathematical models.

Most surprising, only 21 percent agreed that most or all of these dissertations yielded significant contributions to economic knowledge. If true, this assessment is both disquieting and difficult to interpret. Though all dissertations presumably represent contributions to economic knowledge, the adjective "significant" in the survey question may have colored the responses and produced the seemingly low figure. If few dissertations in any field make significant contributions to knowledge, the figure for economics may not be so bad.

When faculty members were asked to assign responsibility for the generally low estimate of the quality of Ph.D. dissertations, 23 percent put the blame on students, 13 percent put the blame on the graduate program, and 62 percent thought both sides were at fault. Because no inquiries were made about the quality of dissertation supervision, it is difficult to say whether inadequate supervision contributed to these results. It is quite possible that faculty members, engrossed as they are in their own research and other professional activities, devote too little effort to nurturing student research at the dissertation stage, and that students fail to make effective use of faculty committee members. On the other hand, some of the evidence already presented suggests that the root of the problem goes deeper, back to the first two years of the Ph.D. programs.

The appropriate interpretation of these results describing the dissertation stage is unclear. Graduate students at higher tier programs experience many of the same difficulties as those at lower tier programs. Yet those at tier 1 departments complete their degrees one year faster than the average doctorate and one and one-half years faster than the average doctorate from a tier 5 program. What accounts for these differences? Is it the more intensive research environment, more talented students, or something else? A detailed comparison of the characteristics of individual Ph.D. programs might shed light on the reasons for these differences and suggest how the speed of completion might be increased.

VI. *Links Between Undergraduate and Graduate Education*

Criticism of graduate education in economics has also come from undergraduate faculty. The most outspoken are those at top-ranked liberal arts colleges which historically supplied graduate programs with large numbers of talented and well-prepared students, many of whom went on to become leaders in the profession. Faculty members at these colleges have decried the increasingly technical focus of graduate training in economics. They believe that it both discourages good students from applying to graduate programs in economics, and causes some of those who enroll to leave well before they obtain their degrees.[24]

To obtain a better understanding of the links between undergraduate and graduate programs in economics, two surveys were conducted, one of graduating seniors majoring in economics and another of chairs of departments with undergraduate programs.[25] Several questions used

[24] These concerns were expressed by an independent Committee of College Faculty, composed of representative of nine prestigious liberal arts colleges, and follow this article, see Hirschel Kasper, pp. 1088–1109.

[25] Only top-ranked seniors were surveyed. The selection was done by department chairs in response

TABLE 12

EMPHASIS ON KNOWLEDGE AND IMPORTANCE OF SKILLS IN GRADUATE ECONOMICS EDUCATION, AS VIEWED BY EMPLOYERS OF PH.D. ECONOMISTS

		Universities		Undergraduate Programs		
		Quality Tiers				Govt.
Knowledge	All	1–2	3–5	4-Year Public	Lib. Arts	and Bus.
Economic Theory	4.1	4.6	4.2	4.1	4.3	4.0
Econometrics	4.0	4.6	4.1	4.1	4.2	3.8
Institutions-History	2.8	2.5	2.8	3.2	2.2	2.6
Literature	3.2	3.2	3.4	3.5	2.9	3.2
Application-Policy	3.2	3.1	3.4	3.9	3.1	3.1
Empirical	3.8	3.6	3.6	3.7	4.2	3.7
Skills						
Critical Judgment	3.6	4.0	3.5	3.7	3.4	3.6
Analytics	3.8	4.3	4.0	3.8	3.7	3.8
Application	3.1	2.9	3.3	3.2	3.3	2.9
Mathematics	4.0	4.1	3.9	4.1	4.2	3.8
Computation	3.8	3.7	3.8	4.1	4.0	3.6
Communication	3.2	3.3	3.5	3.3	3.1	3.0
Creativity	3.1	3.3	3.5	3.3	2.7	3.0

in the faculty and graduate student surveys were included to highlight the difficulties students experience in making the transition from undergraduate to graduate study.

Responses from department chairs and senior undergraduate majors reveal a commonly shared view about undergraduate programs. Departments give little attention to preparing majors for graduate training; this may make sense because so few undergraduate majors indicate an interest in graduate work of any kind.[26] Most majors said they chose economics because the subject would be interesting (42 percent) or would be useful in preparing for a career (36 percent). Department chairs viewed their undergraduate program primarily as providing a useful knowledge of economic theory and, to a lesser degree, a useful knowledge of economic institutions and issues.

Undergraduate majors and department chairs did not differ noticeably in their perceptions about the relative rankings of different types of knowledge and skills in the undergraduate major (Table 12). Theory and applications-policy were ranked first and second by both groups but students reported that theory received much greater attention than applications-policy.

Undergraduate majors and department chairs also gave similar rankings to the importance of various skills in the undergraduate major, with analytics, critical judgment, and applications leading the

to instructions accompanying a request that they assist with this survey. For departments under 50 majors, the allotted four questionnaires were given to their top four students, including some planning to go on to graduate study. For larger departments the twenty questionnaires were to be given to students in the top half of their class, including some planning to do graduate work. No pretense is made as to the representativeness of the responses even within the confines of the instructions accompanying the questionnaires.

[26] Only six percent reported interest in graduate work in economics; another seven percent indicated interest in other types of graduate work.

way, in that order. At the bottom of the rankings were mathematics, computation, and creativity. The low rating for creativity is quite consistent with a major concern expressed in the Kasper report. The low emphasis on mathematics may actually contribute to the difficulties faced by new graduate students in their first year courses.

The responses reported earlier for graduate students indicated that perceptions of graduate school by both undergraduates and department chairs differed from the reality. For example, top economics majors and their department chairs agreed about what knowledge is emphasized in graduate schools, with theory, econometrics, and empirical economics leading the way for both groups. The key difference was that undergraduates expected that theory, empirical economics, and econometrics would each receive comparable emphasis. Department chairs offered a different view, ranking analytics a clear first, econometrics second, and empirical economics a distant third. These results suggest an important information gap. While the perceptions of department chairs coincided with what is emphasized in graduate school, as reported by both faculty and graduate students, the perceptions of undergraduates were off the mark.

Undergraduate students were similarly uninformed about the skills required in graduate school. They attached considerable importance to analytics and critical judgment, followed at some distance by applications and mathematics. Department chairs, like faculty and graduate students, rated analytics a strong first, mathematics second, critical judgment third. Applications was ranked next to the bottom among the seven skills. Once again, an information gap appeared.

These parallel information gaps help to explain the thrust of the Kasper report. Many new graduate students are unprepared for their first-year courses, and because their perceptions were so far off the mark, their enthusiasm for Ph.D. study is undercut. These gaps could arise for several reasons: undergraduate departments and faculty members fail to convey enough information about graduate training to their majors; the information they do convey reflects their own experience years earlier when the emphasis may have differed; and students do not understand information they get. Whatever the explanations, if Ph.D. programs hope to recruit and retain talented undergraduate students, they may have to devote more effort to informing them and undergraduate departments about the nature of graduate training.

VII. *Links Between Graduate Education and the Labor Market*

Ascertaining the views of employers about the structure and content of Ph.D. training proved to be more difficult because more than 40 percent of all new Ph.D.'s take nonacademic jobs. For this reason, the survey questionnaires sent to academic employers were also sent to a sample of nonacademic employers.[27] To supplement these responses personal interviews were held with nonacademic employers in the Washington, D.C., and New York City areas.[28]

[27] While reaching academic employers posed no serious problem, eliciting the views of nonacademic employers proved to be more complicated. Two difficulties arose: establishing a sample frame, and getting employers to respond. A sample frame was constructed by drawing on names of nonacademic organizations advertising in the American Economic Association's *Jobs for Economists*. Though several followup mailings were made to encourage responses, the response rate was not overwhelming. An effort to gather comparable information via a survey of non-U.S. employers and of U.S. trained economics Ph.D.'s did not prove fruitful because of difficulties in developing a sample frame and obtaining responses from those employers who were surveyed.

[28] To help deal with the nonresponse problem and to provide more detailed knowledge than might be

Employers were asked to rate the level of knowledge and skills possessed by recent job candidates using a continuous five-point scale, ranging from excellent (5) to adequate (3) to poor (1). Their responses differed from those provided by faculty, graduate students, and recent Ph.D.'s because of an interest in knowing more about the absolute quality of training rather than the relative ranking of different types of knowledge and skills. The results were assembled for different types of employers; for graduate programs grouped into tiers 1–2, and 3–5, for undergraduate programs separated between public and liberal arts (private) undergraduate institutions, and for nonacademic employers (business and government combined).

Employer ratings of the knowledge of Ph.D. candidates ranged from a low of 2.2 to a high of 4.6, with a median of 3.6 (Table 12). The highest rankings were given for knowledge of economic theory and econometrics (above 4), followed by empirical knowledge (3.7), application-policy issues, and also literature (3.0–3.5, which is just above adequate), and institutions and history (lagging at 2.8). Most noteworthy were the lower ratings for knowledge of institutions-history, literature, and application-policy given by employers at liberal arts colleges, especially relative to the ratings at public four-year institutions. Liberal arts college employers, by contrast, gave new Ph.D.'s much higher scores on their empirical knowledge than did any other group.

The spread in the ratings of skills, based on the same scale, was considerably narrower, from 2.7 to 4.3, with a median of 3.5. Employers gave job candidates the highest rating for mathematical skills, followed by analytical and then computational skills. Critical judgment ranked in the middle, with communications, applications, and creativity receiving the least favorable ratings (slightly above adequate). The lower average ratings for nonacademic employers indicated they were less impressed with job candidates than were academic employers. A few outliers occurred: for liberal arts colleges—the low rating given for creativity and the high ratings for analytics and critical judgment; for tier 1–2 departments and also nonacademic employers—the relatively low rating for applications; and for tier 1–2 departments—the high rating for critical judgment.[29]

The results of the interviews with nonacademic employers of economic Ph.D.'s in New York City and Washington, D.C. were consistent with the survey data. The interviews were loosely structured, generally following a prearranged sequence of questions; the overriding interest was in learning more about the strengths and weaknesses of new Ph.D.'s than in obtaining a tightly structured set of responses.

Those interviewed agreed that newly hired economists are now better trained

obtained with survey questionnaires, the Commission conducted interviews with major employers of economists in the Washington, D.C. and New York City areas. Approximately 20 employers in each area were personally interviewed and asked to respond to a series of loosely structured questions about the training of recent Ph.D.'s they had interviewed and/or hired. These results are detailed in the special studies by Laurie J. Bassi of Georgetown University, who conducted the Washington, D.C. interviews, and Matthew R. Lynde of Baruch College, who conducted the New York City interviews.

[29] With this as background, employers were then asked to compare the quality of training to that of a decade earlier. On a scale of much better (1), better (2), about the same (3), worse (4), and much worse (5), the quality of recent job candidates was judged to be about the same as it was earlier. Nonacademic employers and those from four-year public colleges and universities were least enthusiastic about the changes but the differences were not that remarkable. On the ability of new Ph.D.'s to contribute to their departments or units, respondents from top tier departments and public four-year colleges judged them to be somewhat weaker than they were a decade ago.

in technical areas such as theory and quantitative methods. New Ph.D.'s were viewed as less well trained in the fundamentals of economics, less able to carry out empirical research, not much interested in conducting policy-relevant research, and unable to communicate effectively their knowledge of economics and particularly the nature and results of their research. Employers expressed dismay that new Ph.D.'s possessed so little institutional knowledge of the economy. They also commented on their weak knowledge of economic data, its quality, and its interpretation.

Nonacademic employers urged that doctoral training give greater attention to writing and speaking skills, to the conduct of empirical research, and to the acquisition of real world knowledge and data. These suggestions came up in virtually every interview and reflected the concerns of employers who hire roughly 40 percent of Ph.D.'s produced each year. Private sector employers are concerned because they would prefer not to have to incur the substantial costs of on-the-job training to bring newly-hired economists up to speed. Employees from nonprofit research organizations were somewhat more tolerant of the inadequacies of new Ph.D.'s. Most tolerant of all were employers from government agencies who appeared to have the greatest resources and flexibility in integrating new hires into their ongoing activities.

The survey responses and the interviews with nonacademic employers offer much the same message. New Ph.D.'s are well prepared technically but limited in their ability to function effectively as professional economists, particularly in the nonacademic sector. The reason is obvious: graduate programs concentrate their efforts almost exclusively on preparing Ph.D.'s for academic, research-oriented jobs.

VIII. *Summary and Reflections*

What proved to be most surprising is how little systematic information exists on graduate education in economics and on the operation and effectiveness of individual graduate programs. In trying to elicit department responses to the Commission's questionnaires, it became apparent that numerous graduate programs had great difficulty providing what seemed to be rather basic information. While economists have taken the lead in evaluating the impact of numerous education and training programs, they seem to have given little attention to the impact of their own programs. Without a rather extensive data base, efforts to evaluate cannot be successful.

Several striking results emerge from analyzing and reflecting on the research done for the Commission. First, the content and structure of graduate programs in economics are amazingly similar, suggesting that differences among departments in what graduate students are taught and what they learn through their formal courses are relatively minor. Second, despite these similarities in structure and content, graduate programs differ considerably in their reputations, with top-ranked programs attracting the brightest graduate students, the cream of the new Ph.D. crop each year, and the most illustrious senior faculty members. At present departments do relatively little to differentiate their programs, and there is no evidence of any major reshuffling of departmental reputations.

Third, the heavy orientation of the first two years of graduate education toward formal instruction, combined with the absence of a strong research focus, means that many graduate students who can perform well in structured courses are not prepared to begin independent research. This causes them to experience

delays in settling on their dissertation topics and in completing them, and to produce dissertations of disappointing average quality. Increased outside pressure to reduce the time to complete the Ph.D. may force some restructuring of graduate programs. These pressures come at the same time that some economists believe formal instruction should be extended beyond the second year of graduate study.

Fourth, academic economics and graduate training have become increasingly preoccupied with formalism and technique, to the exclusion of studying real-world problems and issues that can be illuminated by some blend of theoretical, empirical, and institutional research. The results indicate considerable agreement that mathematics is overemphasized in graduate instruction, in part because the formal methods of mathematics are easier to teach. The results also suggest that a benefit-cost analysis might question the efficiency of having students invest so heavily in mathematical skills when so little use is made of these skills in their dissertations and later work as professional economists. This strong emphasis on formalism and technique means that many new Ph.D.'s emerge from graduate schools ill-equipped for the teaching, research, and other duties expected of them by their employers.

Fifth, the survey responses and particularly the comments provided by faculty members, graduate students, and both academic and nonacademic employers indicate deep concern about how new economists are trained and the importance of making changes in graduate education. Coming from such a wide spectrum of the profession, these expressions of concern cannot be dismissed easily. A central issue is the narrowness of the instruction and training for graduate students, the limited scope of the dissertation research that follows, and the inadequate preparation of new Ph.D.'s for their post-Ph.D. employment.

What can, should, and will be done in response to the Commission's recommendations? The answers will unfold in the coming years. Pressures to maintain the status quo are always strong, particularly if the incentive structure does not change. Since the incentive structure is unlikely to change, much depends on the lead taken by the nation's most eminent economists and their top-ranked departments. If these groups become convinced that changes are needed and take steps to effect these changes, the likelihood that other departments will follow is greatly increased. The recommendations of the Commission indicate quite clearly that changes are needed. The evidence in this report is designed to help the profession and especially faculty in graduate programs decide how to proceed in enhancing both the efficiency and effectiveness of graduate education in economics.

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