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ABSTRACT

This report presents findings from a study that investigated trends in graduate student enrollments, financial support, and job placements for new doctoral graduates over a recent 6-year period. The purpose was to access some of the impacts that declining financial support for graduate students and recent labor market difficulties for Ph.D's have had on graduate departments. Findings indicate: (1) In the majority of disciplines studied, the result was a general stability in the percentage distribution of graduate enrollments among quality categories over this period of adjustment. (2) The cutbacks in federal support for graduate students have had a larger absolute impact on the highest rated departments because they are the largest departments and have the most federally supported students, but these departments have not suffered disproportionately relative to the others. (3) Private universities enrolled a slightly smaller proportion of graduate students in the fields under study in FY 1973 than in FY 1968, but the highest rated graduate departments in private institutions actually increased their proportion of enrollments relative to comparably rated public departments. Additional findings and statistical data are included. (MJM)

Graduate School Adjustments to the "New Depression" in Higher Education

DAVID W. BRENEMAN
Staff Director
National Board on Graduate Education

With a Commentary by the

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Foreword

The National Board on Graduate Education (NBGE) was established in 1971 by the Conference Board of Associated Research Councils* to provide a means for thorough analysis of graduate education today and of its relation to American society in the future. In partial fulfillment of that task, three NBGE reports with recommendations have been published to date, and further Board reports are planned.

In addition to the NBGE reports, several authored reports have been prepared under the auspices of the Board and published in a separate technical report series. One of the purposes of the technical reports is to provide additional information to NBGE that may, in some instances, undergird NBGE policy recommendations. This report, *Graduate School Adjustments to the "New Depression" in Higher Education*, by David W. Breneman, is the third publication in that series.

The present report presents findings from a study that investigated trends in graduate student enrollments, financial support, and job placements for new doctoral graduates over a recent 6-year period. The purpose was to assess some of the impacts that declining financial support for graduate students and recent labor market difficulties for Ph.D.'s have had on graduate departments. Statistical analyses of these trends were supplemented by site visits to fourteen universities.

* Composed of the American Council on Education, the Social Science Research Council, the American Council of Learned Societies, and the National Research Council.

Because this report is the culmination of a major NBGE-sponsored research project on a subject of considerable interest, the Board prepared its own commentary on the findings. Written as a free-standing document, the Board's interpretive commentary on the study has been included as a supplement to the technical report.

The study was financed by a grant from the Ford Foundation. The views expressed in the technical report are those of the author, and do not necessarily reflect the views of the Ford Foundation, the Conference Board of Associated Research Councils, or NBGE.

We believe that this study will be of interest to those concerned with the strength and effectiveness of graduate education.

DAVID D. HENRY, *Chairman*
National Board on Graduate Education

December 1974

Preface

The idea for this study grew out of a recognition early in the life of the National Board on Graduate Education (NBGE) that far too little was known about the adjustments occurring within graduate schools in response to the major economic changes of recent years in the graduate education environment. In particular, little was known about how graduate education, when viewed as a *system*, was developing, although it was known that several of the leading universities were reducing graduate enrollments at the same time that doctoral programs were being established in the newer universities, and that recent federal policy of sharply curtailed support for graduate students was thought by many to be related to these developments. The magnitude of these trends was not known, however, nor were the causal factors well understood.

Several other questions about the adjustment process of graduate schools to the "new depression" in higher education had arisen in Board discussions. In disciplines where graduate enrollment was falling—was this largely a student response, either to declining labor market prospects or to reduced financial support, or were departments curtailing enrollments in the face of continued high application rates? Given the declining labor market for new Ph.D.'s, how were the graduates in different disciplines and from different quality universities faring? Were substantial changes occurring in doctoral programs to reflect the declining academic market and the need to place larger numbers of doctorates in nonacademic positions? What changes were being made in graduate student financial support, and were departments

increasingly allocating grants and assistantships on the basis of financial need to stretch the diminished support funds farther? The present report contains information bearing on each of these questions.

It should also be noted that there are a number of important question that the study did not explore. The most significant of these are listed in Chapter 1, under the heading "Limitations of the Study." That section should be read carefully, for it will help the reader to keep the report in proper perspective.

This study would not have been possible without the assistance of a large number of people. Sharon Bush, Staff Associate of NBGE, helped in the formulation of the study design, participated in all of the site visits, and was an excellent critic of the first draft of the report. Henry Resnikoff, Mary Compagnucci, and Christine Naczkowski provided valuable research and computer programming assistance at various stages of the study. Mark Nixon, Administrative Assistant of NBGE, made all travel arrangements, handled the administrative details associated with the project, and assisted in numerous ways in the preparation of the manuscript.

I am endebted to Douglas Chapin of the National Science Foundation for bringing the invaluable NSF Graduate Student Support surveys to my attention, and to Richard Berry and Penny Foster of the Division of Science Resources Studies, National Science Foundation, for assistance in acquiring, processing, and interpreting the data contained in those surveys.

The assistance of graduate deans and faculty members at the 14 site visit institutions was essential to the study, and we deeply appreciate the time that these individuals took from their busy schedules to meet with us. The insights gained from these visits were critically important in interpreting the statistical data.

The report benefited greatly from the comments and suggestions of NBGE members and from several other individuals who critiqued the early drafts. In particular, I was fortunate to have the opportunity to present some of the findings to the annual meeting of the Association of Graduate Schools in October 1974. The comments at the meeting were very helpful, as were the follow-up letters we received from several of those present. I should hasten to add that all of the suggestions received were not incorporated into the report, and any errors of fact or of interpretation that remain are the sole responsibility of the author.

Financial support for the study was provided by The Ford Foundation, and we appreciate their contribution to the total program of NBGE activities. Other principal supporters of NBGE, including the Carnegie Corporation of New York, the Andrew W. Mellon Foundation, and the National Science Foundation, helped make the study possible by providing essential support for the Board's operation.

Finally, the report could not have been published without the excellent typing of Marcia Morrow of the NBGE staff, and the editorial assistance of Donna Shipley of the National Academy of Sciences. The general adminis-

trative support provided to NBGE by the National Research Council's Commission on Human Resources, under the direction of William C. Kelly, was also essential.

DAVID W. BRENEMAN, *Staff Director*
National Board on Graduate Education

December 1974

National Board on Graduate Education

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Commentary of the National Board on Graduate Education

INTRODUCTION

The years since the late 1960's have been marked by rapid and extreme changes in the external environment of graduate education. The labor market for new Ph.D.'s in many fields shifted suddenly from conditions of excessive demand to excessive supply, and the rapid turnaround in federal policy toward support for graduate students and for research, combined with the continued expansion of new doctoral programs, created much concern about the future strength and development of graduate education. The absence of coordination among federal agencies, state agencies and the universities in setting policies caused many observers to fear that the adjustment process from a period of rapid growth and expanding resources to one of slower growth and more restricted resources would be perverse and socially detrimental, resulting in a redistribution of resources from higher quality to more marginal programs and institutions. This concern was understandable, for there was no reason to assume that the rapid shifts in public policy toward graduate education would be anything but unsettling and extremely damaging to the vitality of graduate education.

Given these disturbing trends and the widespread recognition that graduate education was facing a dramatically changed environment, the staff was asked to investigate how graduate education has fared since the late 1960's. The recently completed report by David W. Breneman, Staff Director of the Board, addresses several aspects of this topic. The study examines reactions of individual graduate departments to the recent changes in public policy and

reduced growth, as well as aggregate trends in enrollments, student support and Ph.D. production in 14 academic disciplines. Site visits at several universities made it possible to supplement the statistical analyses through interviews with faculty in five representative disciplines (English, chemistry, psychology, economics, and electrical engineering) and with graduate deans. (Because of data limitations, no biological science discipline was included in the study.)

PRINCIPAL FINDINGS OF THE STUDY

The principal findings of the report were that—

1. Data on the institutional distribution of full-time graduate enrollments in 13 of the 14 science and engineering disciplines studied for academic years 1967–1968 through 1972–1973 do not support the widely held view that a major shift in doctoral enrollments from higher to lower rated programs[1] has occurred in recent years. In several disciplines some leading departments did reduce enrollments in the early 1970's, but this appears to have been a one-time downward adjustment rather than the beginning of a trend. Although many of the newer doctoral departments did continue to expand over the period under study, their growth rate dropped significantly in later years. The result, in the disciplines studied, was a general stability in the percentage distribution of graduate enrollments among departments of differing quality over this period of adjustment.

2. The cutbacks in federal support for graduate students have had a larger *absolute* impact on the American Council on Education (ACE) highest rated departments because they are the largest departments and have the most federally supported students, but these departments have not suffered *disproportionately* relative to the others. Federal support for graduate students, although much diminished, was slightly more concentrated in leading departments in FY 1973 than in FY 1968.

3. The doctoral programs that are facing a genuine crisis of survival are located primarily in the smaller, less prestigious departments, often in poorly financed private universities and in the lesser-known public institutions.

4. The financial stress and changing labor market conditions experienced by departments in the "Arts and Sciences" disciplines have not stimulated many major program changes. Rather, most departments visited in the course of this study seem to be following a conservative, "enclave" strategy designed to maintain the status quo. During the site visits little evidence was observed of leadership on the part of graduate faculty or administrators in

[1] Graduate programs were compared nationally in the 1969 American Council on Education survey of graduate program quality—K Roose and C. Andersen. *A Rating of Graduate Programs* (Washington, D.C.: American Council on Education 1970).

pressing for a re-examination of the goals and purposes of the various graduate programs.

5. In those fields where doctoral enrollments have declined (chemistry, engineering, physics—the physical sciences generally), a drop in the number of qualified applicants based, in part, on discouraging labor market information seems as significant a cause, if not more significant, than the decline in fellowships and traineeships.

6. There is a clear differentiation in the labor markets served by the country's universities. Ph.D. recipients from the leading departments receive most of the new university positions, and are, as a group, generally experiencing the least difficulty in job placement. Because the labor market is stratified, however, by both type of employer and geography, many graduates from the less prestigious departments have found employment while some graduates from the leading departments continue to search.

7. Potential graduate students in the humanities and social sciences are less responsive as a group to labor market considerations in their decision making than are potential students in the physical sciences and engineering. In spite of the bleak employment outlook facing new Ph.D.'s in the humanities and in many social sciences, applications in those graduate fields have remained strong, while there has been a pronounced drop in both applications and enrollments in the physical sciences and in engineering.

8. Statistical data suggest that a number of the newer doctoral programs that were not included in the 1969 ACE survey of graduate program quality[2] have attained characteristics typical of reasonably high-rated departments.

9. The majority of departments continue to allocate funds to support graduate students on the basis of academic merit rather than financial need.

INTERPRETATION BY THE NATIONAL BOARD ON GRADUATE EDUCATION

Before commenting on the specific findings reported above, some general observations on the process of change and adjustment in graduate education are necessary to place this study in context. First, any consideration of how graduate education can be strengthened must be based on a clear understanding of the diverse pressures facing individual disciplines. In much of the public debate, graduate education is described in monolithic terms. Discussion often centers on how a particular action, such as cutbacks in federal fellowships and traineeships, will affect graduate education, without specifying whether the discussion refers to master's or doctoral level education, whether the focus is on research or professional training, or whether the argument is limited to the physical or social sciences or to the humanities.

[2] Roose and Andersen, *op. cit.*

Graduate education consists of a wide spectrum of opportunities for advanced education, with varying emphases, processes, faculty and student interests and qualifications. Thus, the "new depression" in higher education should not be expected to affect graduate education uniformly, nor will aggregate national statistics tell us very much about the dynamics of change unless these fine-grained distinctions are made.

Secondly, the pressures felt by individual graduate departments may be very different from those felt by the graduate school as a whole or by the total university. This study focuses on the academic department and examines it as the basic production unit of graduate education, rather than taking the entire institution as a model. It tells us which pressures have had a significant impact at the departmental level and which have been buffered or simply not felt, given the incentives and forces that operate in departments. While this approach was essential for a sharply focused inquiry about graduate programs, it necessarily excluded much information that would be required for a comprehensive assessment of the adjustments made by universities to the financial stress of recent years. In particular, the study is not (and was not intended to be) a detailed investigation of the financial status of the universities.

Thirdly, in relating this study to the circumstances of an individual university, it must be remembered that graduate faculty are strongly oriented toward their individual disciplines, and departmental behavior is highly responsive to various forms of competition among departments in the same discipline. Departments compete for graduate students, for research funds, and for placement of their graduates. If a department is faring well in this competition, it tends to be more independent of institutional authority. On the other hand, if a department has a low level of extramural funding and declining enrollments, it becomes more susceptible to institutional control over its activities—perhaps losing faculty positions, space, and student support funds. In this study it was observed that very little direct influence could be exerted by the central administration of an institution upon the behavior of a strong, competitive department, indicating—paradoxically—that the intellectually strongest departments are the least susceptible to change from pressures within the university. Those most able to expand disciplinary boundaries and to help establish new and intellectually responsible graduate programs are often not inclined to do so.

Turning to specific findings summarized above, we believe that the data for the 14 disciplines show that the actual redistribution of graduate enrollments among departments of varying quality has been much less pronounced in recent years than many have thought. This does not mean that enrollments in doctoral programs are now distributed in a socially optimal fashion. Particularly in those fields where doctoral enrollments have declined, we doubt that the roughly proportional drop in enrollments across all quality categories of departments represents the most efficient or effective use of

society's resources applied to doctoral level education. When established programs of high quality are not enrolled to capacity, it makes little sense to start new doctoral programs or to expand existing programs of unknown quality.

Furthermore, the fact that a major shift in the distribution of doctoral enrollments from higher to lower rated programs did not occur between the years 1967–1968 through 1972–1973 does not rule out the possibility that such shifts may occur in the future. Much will depend on the policy decisions made by federal and state government agencies and by the universities, including the one concerning the amount of institutional resources devoted to maintaining graduate programs. The understanding of how these complex decisions will interact is still too limited to provide much confidence in predictions; however, we do agree with the study's finding that the major financial crisis for graduate programs is occurring in the smaller and less prestigious programs in poorly financed private universities and in lesser-known public institutions. In the absence of large-scale intervention by governmental bodies or private philanthropy, it is likely that some of these newer or weaker programs will be forced to close during the next decade.

We are less surprised by the finding that the cutbacks in federal support for graduate students have not had a disproportionate effect on the highest-quality departments since federal support for graduate students was never as highly concentrated as many have thought. Only a small proportion of total federal fellowships and traineeships were awarded directly to students in the 1960's; the bulk of federal student support funds were distributed to the institutions, which in turn awarded them to their own applicants. As the cutbacks occurred, departments at all quality levels suffered losses. As with the previous issue of enrollment shifts, some of the assertions made about the disproportionate effects of federal cutbacks on the leading departments have been exaggerated; however, this does not mean that recent federal policy toward graduate student support has been socially optimal. It must be remembered that the finding refers only to the *relative* impact of cutbacks, and not to the *absolute* situation in any single university. Although each department may have lost federal support for students in roughly proportional terms, this tells us nothing about the absolute reduction in program effectiveness or social outcome that the cuts may have produced in individual departments. Furthermore, in a time of reduced federal support for graduate education, we believe that from society's point of view, an optimal federal policy should produce a *greater* concentration of the remaining funds in departments with the strongest graduate programs. This belief explains the presence of a competitive element in each of the recommendations in the Board's report, *Federal Policy Alternatives Toward Graduate Education*,[3]

[3] National Board on Graduate Education. *Federal Policy Alternatives Toward Graduate Education* (Washington, D.C.: National Academy of Sciences, 1974).

for federal support of graduate students, research, and institutional programs in the national interest.

We have discussed earlier some of the reasons why the financial stress and changing labor market conditions of recent years have not yet resulted in major program changes in doctoral programs in the older, established disciplines included in this study. In times of scarcity, there is a tendency for strong departments in established disciplines to withdraw from intellectual activities that fall outside of established disciplinary boundaries. Whether this is perverse from a societal point of view depends on the coverage achieved by existing disciplines and the potential quality of the new disciplinary and interdisciplinary programs foregone. This topic is so fundamental to the nature and purposes of graduate education that it requires discussion in much greater depth than this brief commentary will allow. This subject will be given high priority in the Board's final report where the findings of the present study will be integrated with related investigations by the National Board and other research groups to produce specific recommendations.

The observation that potential graduate students, particularly in the physical sciences, respond to labor market information as well as to the availability of fellowship and traineeship support, suggests that in the future federal policy toward graduate student support should be focused less on the *number* of graduate students enrolled and more on *who* those students are and *where* they are enrolled. The form in which federal support for graduate students is provided is likely to have a greater impact on the distribution of students among departments than on the total number enrolled.

The differentiation in labor markets served by the country's universities is closely related to the earlier point on change in graduate programs. Clearly, each graduate department in the country should be actively evaluating its programs in light of the placement of its graduates. We believe that the differentiation in placement opportunities is a strength, rather than a problem, for graduate education and are convinced that a greater and more explicit differentiation of function among the various graduate programs is needed. The country is not likely to support at the desired level of excellence over 250 universities producing research scholars in the traditional disciplines.

The continuing enrollment pressure experienced by many graduate programs in the humanities and social sciences poses a dilemma for many universities. There is little doubt that new Ph.D.'s in the humanities and in many social science fields will face increasing employment difficulties in the academic sector for at least the next fifteen years, and the number of students seeking admission to doctoral programs in these fields is far in excess of the number who will be able to obtain academic employment. Many departments are struggling with the decision whether to reduce graduate enrollments in these fields in response to labor market forecasts, and if so, how far to reduce them. We reaffirm our commitment to the principle of free and informed student choice, discussed in our report *Doctorate Manpower*

Forecasts and Policy,[4] and encourage academic departments to provide their graduate applicants with detailed information on employment prospects and on the placement experience of the department's recent graduates. Some graduate departments are already doing this but many are not; we believe departments have a clear responsibility to provide this information to every applicant. Qualified students who wish to enroll in spite of this information should not have the opportunity to undertake graduate work foreclosed solely on the basis of labor market forecasts.

In light of the finding that a number of doctoral programs begun in the 1960's but not included in the 1969 ACE quality survey[5] appear to have attained substantial quality, we recommend that the survey be repeated promptly with whatever methodological improvements recent research would suggest.[6] In spite of the shortcomings in such a survey, particularly as regards inadequate coverage, it provides one of the few benchmarks available for the study of quality and distribution of doctoral programs within the system as a whole. Because the existing reports are used in making various decisions about graduate education, the survey should be updated to record the changes that have occurred in the last five years.

The finding that most departments continue to allocate financial aid on the basis of academic merit rather than financial need raises a number of difficult and controversial issues. The argument in favor of using financial need is that, in a time of diminished resources for graduate student support, the use of a need criterion will make possible the broadest access to graduate programs from a given supply of support dollars. This principle is well-established at the undergraduate level and increasingly accepted in such professional programs as law and medicine. In graduate programs in "Arts and Sciences" disciplines, however, it has been customary to provide fellowship support on the basis of academic merit in the belief that this represents a social investment in a highly talented segment of the population.

There are several complications in applying a financial need criterion at the graduate level. Many students are supported primarily by teaching and research assistantships for which they receive payment in return for service. In many instances the teaching and research experience that graduate students gain from these appointments is an extremely valuable part of the graduate experience and the strict application of a need criterion in allocating these assistantships would unfairly penalize the student able to pay his or

[4] National Board on Graduate Education. *Doctorate Manpower Forecasts and Policy* (Washington, D.C.: National Academy of Sciences, 1973).

[5] Roose and Andersen. *op. cit.*

[6] A forthcoming evaluative study of the NSF Science Development Program conducted under the auspices of the National Board on Graduate Education provides detailed information on specific objective correlates of the ACE reputational surveys. See David E. Drew, *Science Development: An Evaluation Study* (Washington, D.C.: National Academy of Sciences, forthcoming).

her own way. Furthermore, the university has an obligation to select students for these positions who have the necessary skills to fulfill the job requirements satisfactorily. Because work is required, the stipends paid are analogous to a salary and cannot be adjusted up or down on the basis of the student's need.

Secondly, there is no consensus on the issue of whether a graduate student's parents should be expected to make a financial contribution to his or her graduate education. Most graduate students are legally independent and reluctant to request financial support from parents for graduate study. The development of an effective need criterion, however, will require that parents' income be considered, although considerable disagreement on philosophical grounds remains. Nonetheless, a large number of graduate students *do* receive parental assistance.

Thirdly, we anticipate that the federal government will continue to identify those areas of research and advanced education that in the national interest require the stimulus of federal funds for rapid development of the knowledge and trained manpower. Federal fellowships and traineeships are appropriate and often necessary methods for stimulating the rapid growth of a new area of investigation, and the effective use of grants for recruitment purposes will often require that considerations of financial need be waived.

Finally, there is division of opinion as to whether tax money, much of it supplied by "needy" citizens, should be used for awards to students who are not required to establish financial need. Some would question, further, whether the family obligations of married students should be used in determining "need" for tax-supported assistance.

These factors make it clear that a single, uniform practice in awarding graduate student financial aid is not likely to be achieved, nor would such uniformity necessarily be desirable. The various forms of financial aid available to graduate students must meet a variety of objectives in addition to access, and thus cannot be distributed solely on the basis of student financial need. (This applies particularly to aid not funded from public sources.) We do believe, however, that the trend is toward greater concern for access at the graduate level, and that consideration of financial need will grow in importance. Graduate departments that still rely exclusively on academic merit in the awarding of aid would be well advised to develop procedures for taking need into account where particular cases call for such procedures.

CONCLUDING OBSERVATIONS

We stress two important considerations that go beyond the scope or intent of the present study. First, the investigation focused on a 6-year transitional period for graduate education, and its findings were properly limited to changes during that period. There are undoubtedly long-run consequences

of the abrupt shifts in public policy toward graduate education that the present study could not detect. For example, the general stability noted in the distribution of enrollments and resources may reflect more the inertia or slow motion in these complex organizations than any more fundamental, underlying cause. This possibility points to the need for a continuous monitoring and assessment of the issues investigated in this project.

Secondly, quality graduate education involves many subtle factors that are not easily captured by quantitative techniques. Many knowledgeable observers believe that severe damage to the quality of graduate education and research is occurring in dimensions not included in this study. There is a point at which cutbacks in equipment, building and building repairs, support personnel, library acquisitions, travel, and seminar, colloquia, and other discretionary funds will necessarily reduce the level of intellectual activities of faculties and students. Thus, not only have new programs and innovations (other than reorganizations, reshuffling and renaming of old programs) been curtailed, but many programs have been cut back or have even been eliminated. For reasons such as these, detailed investigation of this country's current and prospective ability to conduct scientific and scholarly research should have the highest research priority.

1 Introduction

PURPOSE OF THIS STUDY

A turning point in the fortunes of graduate education and research occurred in the late 1960's, a period marked by a sharp drop in financial support for graduate students and research and by the first signs that the booming labor market for new Ph.D.'s was ending. The number of graduate students supported on federal fellowships and traineeships peaked in fiscal 1968 at 51,500, falling to 42,500 in fiscal 1969, and an estimated 6,600 by fiscal 1974.[1] Having grown at an average annual rate of 15 percent during much of the 1960's, federal support for research in universities declined absolutely in constant dollar terms in fiscal 1969.[2] Problems in the doctorate labor market surfaced in 1969–1970 as financially pressed colleges and universities slowed their rate of hiring and as nonacademic demand for Ph.D.'s declined in response to economic recession and the decline in research and development (R&D) expenditures.[3] Several outstanding universities publicly announced their decisions to cut graduate enrollments, giving rise to a fear that the adjustment process of the graduate schools to the "new depression" in higher education would produce perverse and socially undesirable results.

[1] National Board on Graduate Education, *Federal Policy Alternatives toward Graduate Education* (Washington, D.C.: National Academy of Sciences, 1974), p. 33.

[2] *Ibid.*, p. 32.

[3] See Richard B. Freeman and David W. Breneman, *Forecasting the Ph.D. Labor Market: Pitfalls for Policy* (Washington, D.C.: National Academy of Sciences, 1974), pp. 3–14, for a summary of these trends.

By March, 1973, the U.S. Department of Health, Education, and Welfare (HEW) Task Force on Graduate Education, chaired by Frank Newman, announced that "Graduate education in the United States is in trouble,"[4] arguing that one of the major problems was a "Gresham's Law of Ph.D. Enrollments," which was producing continued growth in low-quality institutions at the expense of high-quality programs.[5] This theme was echoed in the press ("Elite Graduate Schools Face Financial Troubles," *Wash. Post*, March 26, 1973, A-1.) and in the first report of the National Board on Graduate Education (1972):

> Recent reductions in federal and private support for graduate education appear to have had a relatively greater adverse impact on the "prestigious" graduate institutions, causing many of these schools to reduce new graduate enrollments with subsequent redistribution of graduate students to the less developed schools; these developments suggest the need to investigate whether the average quality of graduate education is being affected adversely.[6]

Against this somber background, the National Board on Graduate Education undertook a major report on federal policy toward graduate education, subsequently published in January 1974.[7] That report dealt in great detail with aggregate trends in federal expenditures for research, graduate student, and institutional support, but the authors and Board members realized while preparing the report that too little was known about the impacts of federal cutbacks and the declining labor market on individual universities and academic disciplines. Were the leading departments suffering disproportionately from the events of the past five years? Were graduate enrollments declining in certain fields (physics, chemistry, engineering) because of departmental decisions to cut back, because of reduced financial support for students, or because of fewer student applications in response to the deteriorating job market? Were the universities responding to hard times with innovative new programs, or were the cutbacks strengthening parochial tendencies? The present study was designed, in part, to address such questions and provide insight into the process of adjustment to a period of slow (or no) growth for graduate education. Because the study examines "Gresham's Law of Ph.D. Enrollments" in detail, a few words explaining that hypothesis will be helpful.

[4] U.S. Department of Health, Education, and Welfare, *Report on Higher Education: The Federal Role—Graduate Education*, Frank Newman, Task Force Chairman (Washington, D.C.: U.S. Government Printing Office, 1973), p. 1.

[5] *Ibid.*, p. 14.

[6] National Board on Graduate Education, *Graduate Education: Purposes, Problems and Potential* (Washington, D.C.: National Academy of Sciences, 1972), p. 12.

[7] National Board on Graduate Education, *Federal Policy Alternatives*, *op. cit.*

To the best of our knowledge, a precise description of the presumed causal mechanism underlying the "Gresham's Law" hypothesis has not been stated, but the following assertions have been present in the discussion:

1. Federal funding is of primary importance as a source of support for graduate students and for university-based research, and these funds are heavily concentrated in the leading institutions. As federal cutbacks occur, therefore, the leading institutions necessarily suffer the greatest financial loss, and have even suffered disproportionately.
2. As fellowship funds are reduced, teaching assistantships become of increased importance as a source of graduate student suppor . Because these assistantships are more broadly distributed than fellowship funds, this change puts the leading departments at a disadvantage in the competition for graduate enrollments.
3. Private universities have a disproportionately large number of the "high quality" departments, and these institutions have been harder hit than the public universities by cutbacks in federal support of graduate education. In particular, the most severe graduate enrollment reductions have occurred in the leading private university departments.
4. Most graduate students are unwilling or unable to finance the costs of graduate education if they are admitted without financial support by a leading department, and therefore will opt for a lower quality program that offers financial support.
5. There has been a long term decline in the proportion of degrees granted by the outstanding universities, and this trend is likely to continue.

Much of the data reported in Chapter 2 bears on these assertions, and provides some insight into the quantitative significance of the suggested trends.

The study has two parts—a series of statistical analyses of departmental trends in graduate enrollments, student support, Ph.D. production, and job placement in several academic disciplines for the 6-year period, fiscal years FY 1968–FY 1973,[8] and a discussion of the findings from site visits at a diverse group of 14 universities.[9] The graduate dean and representatives of the departments of chemistry, economics, electrical engineering, English, and psychology were visited at each university in order to help us understand and interpret the statistical trends. The report ends with a brief summary of

[8] Throughout this study data are reported on a fiscal year basis to ensure comparability among sources; however, the reader should note that fiscal years FY 1968–FY 1973 correspond most closely to academic years 1967–1968 through 1972–1973.

[9] The universities were: Catholic University; University of Pittsburgh; University of Tennessee, Knoxville; University of Cincinnati; University of Wisconsin, Madison; Kansas State University; Tufts University; Tulane University; University of Arizona; Stanford University; University of California, Berkeley; State University of New York at Buffalo; Cornell University; and University of Northern Colorado.

the principal findings and a discussion of the implications of the study both for public policy and for future research.

LIMITATIONS OF THE STUDY

It is important to note at the outset several of the limitations of the study. Perhaps most importantly, the study is not a comprehensive examination of the financial status of universities. We did not collect income and expenditure figures, nor did we meet with university presidents, provosts, or financial vice presidents while on the site visits. The academic department is the basic unit of analysis, and we were interested primarily in specific measurable trends in the graduate programs, with a stress on comparisons of various trends across departments within each of several disciplines. Consequently, our analyses indicate how academic departments within one group of institutions have fared with respect to another group, but not how any university or group of universities has fared absolutely.

Secondly, the study did not attempt to assess absolute changes that may have occurred in recent years in the quality of graduate education or research conducted in the nation's universities. A systematic examination of that complex subject, including an analysis of the impact on quality caused by recent financial stress, was simply beyond the scope of the project.[10] We did receive opinions from several faculty members during the site visits, but their comments varied widely and did not yield a consistent picture of perceived trends in the quality of graduate education. Given this divergence of opinion, we were reluctant to speculate on the topic. In conducting the study, we used the American Council on Education (ACE) ratings of graduate program faculty as our measure of departmental quality,[11] and did not attempt any *ad hoc* adjustments of those published ratings.

A third limitation is that we examined traditional academic disciplines rather than newer, more professionally oriented or interdisciplinary fields where one might expect greater ferment and change. Our comments on the actual program changes that we observed during the site visits and conclusions regarding the departments' openness to change should not, therefore, be extrapolated to all of graduate education. We were limited by the available statistical data to clearly defined disciplines, but we were also particularly interested in determining whether the changing environment of graduate education had produced noteworthy changes in the more traditional disciplines.

We were further restricted by time and budget to existing data sources,

[10] A forthcoming National Board on Graduate Education report on an evaluation study of the NSF Science Development Program provides an example of assessment techniques required to evaluate changes in graduate program quality.

[11] Kenneth D. Roose and Charles J. Andersen, *A Rating of Graduate Programs* (Washington, D.C.: American Council on Education, 1970).

and Ph.D. programs exclusively. Although the principal sources we used are rich with information, this did limit our coverage of institutions and disciplines. In particular, we did not include data on part-time students or on enrollments in universities offering the master's as the highest degree. The next section of this chapter will describe the data sources and their limitations in greater detail.

Finally, the site visits at 14 universities were designed to provide insight into the causal forces underlying the statistical trends reported and should not, therefore, be interpreted as a scientifically selected sample of institutions from which conclusions about the population universe can be drawn. The 14 universities were selected from the 130 institutions included in the previously mentioned ACE rating of graduate program faculty and, with only a few exceptions, each university visited had a rated Ph.D. program in each of the five fields examined. Within that constraint, we selected universities that would provide diversity by quality and prestige level, by geographic location, and by type of control (public private). Although we do not draw inferences from the data reported for those 14 universities to the total university sector, the site visits were very important in forming our views regarding interpretation of the statistical information.

DATA SOURCES

The principal sources used in this study were—

1. National Science Foundation (NSF) annual surveys of graduate student support, FY 1968–FY 1973. Aggregate statistics from these surveys have been published by NSF under the titles *Graduate Student Support and Manpower Resources in Graduate Science Education*, and *Graduate Science Education, Student Support and Postdoctorals*. The surveys were begun in 1966 as part of the NSF traineeship program; with the end of the traineeship program in 1972, a decision was made to continue the survey under the direction of the NSF Division of Science Resources Studies. The original data tapes were used in this study.[12]

2. National Research Council Doctorate Records File, FY 1968–FY 1973. This file contains a record of all doctorate recipients from U.S. universities since 1920 and extensive survey data since 1958; it is prepared annually from a survey of earned doctorates administered by the graduate schools of each Ph.D.-granting university. The survey form is filled out by the student at the completion of the doctoral program and contains biographical information as well as information on immediate post-graduation plans.[13]

3. American Council on Education, *A Rating of Graduate Programs,*

[12] A sample questionnaire from this survey is included in Appendix B of this report.
[13] A sample survey form is contained in Appendix C.

(prepared by Kenneth Roose and C. J. Andersen, and referred to hereafter as the Roose–Andersen report). This rating survey covered 130 universities and a numerical score was given to each department that was rated on the quality of its graduate faculty within those universities. The original data tape from this survey was obtained and merged with the tapes of the other two principal data sources.

4. United States Office of Education, enrollments for advanced degrees. Published data was used for the aggregate enrollment trends in the field of English, since the NSF data source does not include the humanities.

5. Data on enrollments, degrees granted, job placements, and student support provided by some of the departments on the site visits. This information is included when applicable in the section discussing site visit findings.

In order to address the set of questions regarding trends in graduate enrollments and student support by discipline and by quality of program, a subset of departments that had completed the NSF surveys every year over the 6-year period, FY 1968–FY 1973, was selected. This yielded a set of 1201 doctorate-granting departments covering 14 disciplines[14] for which comparable data were available over this period. Tables were then produced which allow us to examine various trends in this matched cohort of departments.

Two factors forced our limitation to 1201 departments and 14 disciplines. First, the NSF surveys are restricted to fields of NSF concern, including the physical and biological sciences, engineering, and most social sciences; no comparable survey exists for the humanities disciplines. Secondly, within each discipline we further categorized departments by the ACE Roose–Andersen quality rating, and included a discipline only if we had data over the 6 years for a substantial proportion of the departments rated in each category.[15] We were unable to include any biological science in the study because a very high proportion of those departments had failed to turn in one or more of the annual survey forms. The 14 disciplines that are included in the aggregate statistical tables provide good representation of the physical sciences, social sciences, and engineering fields,[16] and we know of no reason to assume that patterns in the biological sciences or in the humanities would differ significantly from the covered fields. That possibility exists, however, and must be left as an open issue which cannot be adequately addressed with existing data.

[14] The 14 disciplines are: anthropology, chemical engineering, chemistry, civil engineering, economics, electrical engineering, geography, geology, mathematics, mechanical engineering, physics, political science, psychology, and sociology.

[15] The numbers of departments in each of the 14 disciplines included in our analyses are contained in Appendix D of this report.

[16] In FY 1971, the 1201 departments included on the NSF tape produced 92 percent of the 11,267 Ph.D. degrees awarded in these 14 fields. In that year, 32,113 Ph.D. degrees were awarded in all disciplines, so the 14 fields included in this study represent approximately 35 percent of the universe of doctoral level education.

2 Statistical Trends in Graduate Education, FY 1968–FY 1973

The information presented in this chapter differs from earlier studies[17] in that the focus is on academic departments within each of several disciplines rather than upon entire universities. We chose this approach because one of our central variables was graduate program quality,[18] and this must necessarily be assessed department by department at the graduate level. Distin-

[17] U.S. Department of Health, Education, and Welfare, *Report on Higher Education: The Federal Role—Graduate Education, op. cit.*; Charles V. Kidd, "Shifts in Doctorate Output: History and Outlook," *Science* 179:538–543 (February 9, 1973).

[18] The rating of graduate faculty published by the American Council on Education in 1970 (the "Roose–Andersen report") was used throughout this study as the measure of departmental quality. This type of reputational survey has sparked considerable controversy, with critics objecting to the subjective, peer-review nature of the ratings and to the single-dimensional rank ordering of departments that is produced. While this type of rating system can be misused, e.g., by potential graduate students who put undue stress on slight differences in rank ordering, we believe it is appropriate, even essential, for the type of policy-related research undertaken here. Several studies, including the National Science Board's report, *Graduate Education: Parameters for Public Policy* (Washington, D.C.: U.S. Government Printing Office, 1969), and NRGE's forthcoming report on an evaluation study of the Science Development Program, have shown that the ratings do correlate rather closely with a number of objective indicators of quality such as faculty publications, research funding, and Ph.D. production. Also, in the present study, departments have been aggregated into several groups, thereby minimizing the effects of small differences in numerical scores between any two departments. To avoid cumbersome phrases, the term "high-rated" will be used interchangeably throughout with "high-quality"; however, the reader should remember that quality has been defined solely in terms of the American Council on Education ratings.

guished universities may have some weak departments, and less renowned institutions often have individual departments of recognized excellence. Consequently, the study's focus required analysis of enrollment and student support trends by discipline rather than by university.

TRENDS IN GRADUATE ENROLLMENT

Tables 1–6 present information on first year and total full-time graduate enrollments in six disciplines[19] over the period FY 1968–FY 1973 with departments classified by Roose–Andersen ratings.[20] The data were taken from the NSF surveys described in Chapter 1, and do not include all graduate departments in each rated category, although coverage is very high.[21] These data allow us to trace enrollment trends within the same set of departments over a period of years marked by substantial cutbacks in federal support for graduate students and by a deteriorating labor market for new Ph.D.'s. The tables also include the proportion of total graduate enrollment accounted for by the departments in each Roose–Andersen quality category within this matched subset of departments.

The most striking observation is the relative stability of the enrollment distribution among Roose–Andersen categories in these disciplines over the 6-year period. In five of the six fields (psychology being the exception) total full-time graduate enrollment declined between FY 1968 and FY 1973, but large shifts in the percentage distribution of enrollments among the departments generally did not occur. In economics, electrical engineering, and mathematics, the top-rated departments (4.0–5.0) enrolled a slightly higher proportion of students in FY 1973 than in FY 1968; in physics and chemistry, the highest rated departments enrolled approximately the same proportion; while, in psychology, the top rated departments did show a pronounced decline from 11.0 to 7.4 percent in proportion of total full-time enrollment. (In the 14 fields for which similar data were available, psychol-

[19] In addition to the four site visit fields that are covered by the NSF survey (chemistry, economics, electrical engineering, and psychology), data for physics and mathematics are also presented in several sections of this report. These two fields were included because the NSF surveys covered a large proportion of these departments. See Appendix D.

[20] The highest possible score was 5.0; the lowest possible, 0.0. In the following tables, therefore, departments rated 4.0–5.0 are the highest rated, those scoring 3.0–3.9, the next highest rated, and so forth, to the lowest rated group scoring 0.0–1.4. Doctorate-granting departments not included in the survey are the non-rated departments.

[21] For the Roose–Andersen rated departments, the data include 98.4 percent of the chemistry departments, 76.9 percent of the economics departments, 96.5 percent of the physics departments, 89.7 percent of the electrical engineering departments, 91.2 percent of the mathematics departments, and 80.9 percent of the pyschology departments. The coverage of non-rated departments is not as complete, but is over 75 percent in most disciplines. See Appendix D for detailed information.

TABLE 1 Full-time Graduate Enrollment in 168 Doctorate-Granting Chemistry Departments, by Quality Category and Year

Roose–Andersen Rating	Enrollment, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
First-year full-time						
4.0–5.0	607	577	613	484	434	423
	16.3	**16.8**	**17.7**	**15.2**	**15.0**	**15.9**
3.0–3.9	1,014	961	922	829	752	688
	27.3	**28.0**	**26.7**	**26.0**	**26.0**	**25.8**
2.5–2.9	532	495	542	473	453	392
	14.3	**14.4**	**15.7**	**14.8**	**15.7**	**14.7**
2.0–2.4	486	389	398	390	382	345
	13.1	**11.3**	**11.5**	**12.2**	**13.2**	**12.9**
1.5–1.9	423	356	400	395	311	272
	11.4	**10.4**	**11.6**	**12.4**	**10.8**	**10.2**
0.0–1.4	162	124	118	144	121	125
	4.4	**3.6**	**3.4**	**4.5**	**4.2**	**4.7**
Not rated	495	531	465	476	438	422
	13.3	**15.5**	**13.4**	**14.9**	**15.2**	**15.8**
TOTAL	3,719	3,433	3,458	3,191	2,891	2,667
Total full-time						
4.0–5.0	2,359	2,368	2,308	2,151	2,012	1,905
	17.4	**17.3**	**17.5**	**17.1**	**16.8**	**17.1**
3.0–3.9	4,005	3,955	3,749	3,461	3,246	3,101
	29.6	**28.8**	**28.4**	**27.5**	**27.1**	**27.8**
2.5–2.9	2,034	2,086	1,982	1,937	1,840	1,667
	15.0	**15.2**	**15.0**	**15.4**	**15.3**	**14.9**
2.0–2.4	1,699	1,677	1,594	1,539	1,513	1,370
	12.5	**12.2**	**12.1**	**12.2**	**12.6**	**12.3**
1.5–1.9	1,498	1,522	1,460	1,459	1,366	1,185
	11.1	**11.1**	**11.1**	**11.6**	**11.4**	**10.6**
0.0–1.4	516	510	486	478	470	456
	3.8	**3.7**	**3.7**	**3.8**	**3.9**	**4.1**
Not rated	1,435	1,602	1,615	1,553	1,551	1,467
	10.6	**11.7**	**12.2**	**12.3**	**12.9**	**13.2**
TOTAL	13,546	13,720	13,194	12,578	11,998	11,151

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

ogy was the only discipline to display a marked decline in the proportion enrolled in highest rated departments. One explanation for this unique trend in psychology will be discussed later in this chapter.)

In none of the above six fields have the low-rated departments (0.0–1.9) significantly increased their proportion of total enrollments within the matched cohorts. (Psychology showed the largest increase in the low-rated

TABLE 2 Full-time Graduate Enrollment in 80 Doctorate-Granting Economics Departments, by Quality Category and Year

Roose–Andersen Rating	Enrollment, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
First-year full-time						
4.0–5.0	184	183	207	169	174	164
	9.4	**9.5**	**10.7**	**9.3**	**10.2**	**10.3**
3.0–3.9	479	355	401	396	338	333
	24.5	**18.4**	**20.8**	**21.7**	**19.7**	**20.9**
2.5–2.9	303	327	296	300	275	259
	15.5	**17.0**	**15.3**	**16.5**	**16.1**	**16.3**
2.0–2.4	308	302	321	313	246	238
	15.7	**15.7**	**16.6**	**17.2**	**14.4**	**15.0**
1.5–1.9	257	222	218	208	262	251
	13.1	**11.5**	**11.3**	**11.4**	**15.3**	**15.8**
0.0–1.4	258	267	235	210	235	177
	13.2	**13.8**	**12.2**	**11.5**	**13.7**	**11.1**
Not rated	167	272	252	227	183	168
	8.5	**14.1**	**13.1**	**12.5**	**10.7**	**10.6**
TOTAL	1,956	1,928	1,930	1,823	1,713	1,590
Total full-time						
4.0–5.0	592	594	617	592	581	605
	10.9	**10.8**	**11.0**	**10.8**	**11.2**	**12.1**
3.0–3.9	1,433	1,305	1,267	1,284	1,173	1,142
	26.4	**23.7**	**22.7**	**23.5**	**22.6**	**22.9**
2.5–2.9	944	894	923	860	870	868
	17.4	**16.3**	**16.5**	**15.8**	**16.8**	**17.4**
2.0–2.4	890	904	891	906	793	720
	16.4	**16.4**	**15.9**	**16.6**	**15.3**	**14.5**
1.5–1.9	621	598	633	592	704	673
	11.4	**10.9**	**11.3**	**10.8**	**13.6**	**13.5**
0.0–1.4	648	682	723	621	660	535
	11.9	**12.4**	**12.9**	**11.4**	**12.7**	**10.7**
Not rated	303	523	536	604	408	438
	5.6	**9.5**	**9.6**	**11.1**	**7.9**	**8.8**
TOTAL	5,431	5,500	5,590	5,459	5,189	4,981

[a] *Number of students* is the first figure given, followed by the *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

departments, from 18.9 percent in FY 1968 to 20.3 percent in FY 1973). In the five fields where enrollments have declined nationally, the drop occurred in the low-rated departments in approximately the same proportion as in the highest rated departments, although in some instances with a lag of one or two years.

TABLE 3 Full-time Graduate Enrollment in 95 Doctorate-Granting Electrical Engineering Departments, by Quality Category and Year

Roose–Andersen Rating	Enrollment, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
First-year full-time						
4.0–5.0	704	624	594	655	680	709
	21.7	**22.3**	**21.0**	**22.9**	**24.9**	**26.7**
3.0–3.9	1,079	879	959	832	699	775
	33.3	**31.4**	**33.9**	**29.1**	**25.6**	**29.1**
2.5–2.9	394	389	366	388	349	341
	12.1	**13.9**	**13.0**	**13.6**	**12.8**	**12.8**
2.0–2.4	298	267	269	272	295	168
	9.2	**9.5**	**9.5**	**9.5**	**10.8**	**6.3**
1.5–1.9	299	254	240	246	230	234
	9.2	**9.1**	**8.5**	**8.6**	**8.4**	**8.8**
0.0–1.4	42	46	66	60	82	34
	1.3	**1.6**	**2.3**	**2.1**	**3.0**	**1.3**
Not rated	427	339	331	404	391	399
	13.2	**12.1**	**11.7**	**14.1**	**14.3**	**15.0**
TOTAL	3,243	2,798	2,825	2,857	2,726	2,660
Total full-time						
4.0–5.0	1,736	1,716	1,571	1,671	1,754	1,703
	23.4	**23.6**	**21.8**	**22.9**	**24.7**	**25.3**
3.0–3.9	2,763	2,626	2,618	2,434	2,183	2,125
	37.2	**36.1**	**36.4**	**33.4**	**30.7**	**31.6**
2.5–2.9	903	940	905	895	844	778
	12.2	**12.9**	**12.6**	**12.3**	**11.9**	**11.6**
2.0–2.4	617	617	636	711	751	588
	8.3	**8.5**	**8.8**	**9.8**	**10.6**	**8.7**
1.5–1.9	565	524	530	519	484	520
	7.6	**7.2**	**7.4**	**7.1**	**6.8**	**7.7**
0.0–1.4	76	91	112	111	142	114
	1.0	**1.3**	**1.6**	**1.5**	**2.0**	**1.7**
Not rated	760	751	819	950	946	897
	10.2	**10.3**	**11.4**	**13.0**	**13.3**	**13.3**
TOTAL	7,420	7,265	7,191	7,291	7,104	6,725

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

Physics represents an interesting example of this lag phenomenon. In FY 1968, the highest rated departments enrolled 18.3 percent of the first-year full-time enrollments. These departments reacted strongly in FY 1971, cutting their entering classes by over 30 percent and reducing their proportion of first-year enrollments to 14.6 percent. In the succeeding two years, the top departments stabilized and expanded their entering classes slightly, while

the decline hit lower-rated departments (for example, those rated 1.5–2.4) in FY 1973, thereby returning the highest rated departments to the same proportion of first-year enrollments (18.3 percent) in FY 1973 that they had in FY 1968. Because first-year physics enrollments declined from 2,736 to 1,808 over this period in the departments included in this matched cohort, enrollments in the highest rated departments were down in FY 1973 by

TABLE 4 Full-time Graduate Enrollment in 120 Doctorate-Granting Mathematics Departments, by Quality Category and Year

Roose–Andersen Rating	Enrollment, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
First-year full-time						
4.0–5.0	311	299	337	360	282	292
	10.0	**10.2**	**11.3**	**12.5**	**11.4**	**12.8**
3.0–3.9	687	636	676	594	482	426
	22.1	**21.8**	**22.7**	**20.6**	**19.4**	**18.6**
2.5–2.9	573	547	622	535	502	411
	18.4	**18.7**	**20.8**	**18.6**	**20.2**	**18.0**
2.0–2.4	559	495	496	506	477	359
	18.0	**17.0**	**16.6**	**17.6**	**19.2**	**15.7**
1.5–1.9	252	221	247	257	189	230
	8.1	**7.6**	**8.3**	**8.9**	**7.6**	**10.0**
0.0–1.4	337	280	233	295	217	219
	10.8	**9.6**	**7.8**	**10.2**	**8.7**	**9.6**
Not rated	387	440	373	336	334	352
	12.5	**15.1**	**12.5**	**11.7**	**13.5**	**15.4**
TOTAL	3,106	2,918	2,984	2,883	2,483	2,289
Total full-time						
4.0–5.0	1,219	1,161	1,096	1,131	1,043	1,070
	13.6	**13.0**	**12.9**	**13.4**	**13.4**	**14.7**
3.0–3.9	1,886	1,976	1,845	1,732	1,579	1,507
	21.1	**22.1**	**21.7**	**20.5**	**20.3**	**20.7**
2.5–2.9	1,555	1,538	1,596	1,487	1,445	1,283
	17.4	**17.2**	**18.8**	**17.6**	**18.6**	**17.6**
2.0–2.4	1,674	1,570	1,546	1,502	1,371	1,206
	18.7	**17.6**	**18.2**	**17.8**	**17.6**	**16.6**
1.5–1.9	764	737	720	745	626	572
	8.5	**8.3**	**8.5**	**8.8**	**8.1**	**7.9**
0.0–1.4	789	772	693	769	634	595
	8.8	**8.6**	**8.2**	**9.1**	**8.2**	**8.2**
Not rated	1,071	1,178	997	1,071	1,072	1,051
	12.0	**13.2**	**11.7**	**12.7**	**13.8**	**14.4**
TOTAL	8,958	8,932	8,493	8,437	7,770	7,284

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

approximately 33 percent, matching the decline in total first-year enrollments; however, relative enrollment proportions had not shifted greatly.

It is worth noting that had one observed only the first 4 years of this 6-year sequence, a very different projection might have been made. Extrapolating from the period FY 1968–FY 1971, one might have invoked a "Gresham's Law of Ph.D. Enrollments" to describe the apparent course of events. The

TABLE 5 Full-time Graduate Enrollment in 146 Doctorate-Granting Physics Departments, by Quality Category and Year

Roose–Andersen Rating	Enrollment, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
First-year full-time						
4.0–5.0	501	417	470	315	315	331
	18.3	**16.0**	**18.2**	**14.6**	**15.9**	**18.3**
3.0–3.9	692	735	634	513	426	418
	25.3	**28.2**	**24.6**	**23.8**	**21.5**	**23.1**
2.5–2.9	476	429	479	358	327	311
	17.4	**16.4**	**18.6**	**16.6**	**16.5**	**17.2**
2.0–2.4	294	264	282	247	245	199
	10.7	**10.1**	**10.9**	**11.5**	**12.4**	**11.0**
1.5–1.9	209	201	197	204	193	122
	7.6	**7.7**	**7.6**	**9.5**	**9.7**	**6.7**
0.0–1.4	170	141	143	137	112	126
	6.2	**5.4**	**5.6**	**6.4**	**5.7**	**7.0**
Not rated	394	422	371	380	363	301
	14.4	**16.2**	**14.4**	**17.6**	**18.3**	**16.6**
TOTAL	2,736	2,609	2,576	2,154	1,981	1,808
Total full-time						
4.0–5.0	2,106	2,059	1,998	1,855	1,691	1,593
	19.1	**18.4**	**18.7**	**18.5**	**18.4**	**19.1**
3.0–3.9	2,896	2,906	2,727	2,462	2,294	2,028
	26.2	**26.0**	**25.5**	**24.6**	**24.9**	**24.3**
2.5–2.9	2,083	2,100	1,974	1,747	1,551	1,448
	18.9	**18.8**	**18.5**	**17.5**	**16.8**	**17.4**
2.0–2.4	1,191	1,207	1,191	1,058	942	813
	10.8	**10.8**	**11.2**	**10.6**	**10.2**	**9.7**
1.5–1.9	973	947	877	877	767	640
	8.8	**8.5**	**8.2**	**8.8**	**8.3**	**7.7**
0.0–1.4	564	576	552	580	544	529
	5.1	**5.2**	**5.2**	**5.8**	**5.9**	**6.3**
Not rated	1,230	1,368	1,362	1,432	1,421	1,289
	11.1	**12.3**	**12.8**	**14.3**	**15.4**	**15.5**
TOTAL	11,043	11,163	10,681	10,011	9,210	8,340

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.

SOURCE: Data from NSF Graduate Student Support Surveys.

TABLE 6 Full-time Graduate Enrollments in 110 Doctorate-Granting Psychology Departments, by Quality Category and Year

Roose–Andersen Rating	Enrollment, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
First-year full-time						
4.0–5.0	219	188	239	195	199	187
	8.0	**6.7**	**8.1**	**6.9**	**7.0**	**6.6**
3.0–3.9	750	709	729	624	639	654
	27.3	**25.4**	**24.6**	**22.2**	**22.4**	**23.1**
2.5–2.9	339	350	364	378	356	361
	12.3	**12.6**	**12.3**	**13.4**	**12.5**	**12.8**
2.0–2.4	593	614	616	628	664	580
	21.6	**22.0**	**20.8**	**22.3**	**23.2**	**20.5**
1.5–1.9	407	355	460	411	445	385
	14.8	**12.7**	**15.5**	**14.6**	**15.6**	**13.6**
0.0–1.4	142	190	193	204	213	195
	5.2	**6.8**	**6.5**	**7.2**	**7.5**	**6.9**
Not rated	295	380	364	375	341	467
	10.7	**13.6**	**12.3**	**13.3**	**11.9**	**16.5**
TOTAL	2,745	2,786	2,965	2,815	2,857	2,829
Total full-time						
4.0–5.0	938	887	884	812	819	781
	11.0	**9.6**	**9.0**	**8.2**	**7.9**	**7.4**
3.0–3.9	2,143	2,297	2,480	2,429	2,487	2,553
	25.2	**24.8**	**25.3**	**24.6**	**24.0**	**24.1**
2.5–2.9	1,129	1,178	1,325	1,412	1,490	1,425
	13.3	**12.7**	**13.5**	**14.3**	**14.4**	**13.4**
2.0–2.4	1,745	1,934	2,052	1,941	2,146	2,194
	20.5	**20.9**	**20.9**	**19.6**	**20.7**	**20.7**
1.5–1.9	1,181	1,219	1,341	1,485	1,597	1,573
	13.9	**13.2**	**13.7**	**15.0**	**15.4**	**14.8**
0.0–1.4	425	560	556	540	593	585
	5.0	**6.0**	**5.7**	**5.5**	**5.7**	**5.5**
Not rated	931	1,189	1,157	1,271	1,212	1,484
	11.0	**12.8**	**11.8**	**12.9**	**11.7**	**14.0**
TOTAL	8,492	9,264	9,795	9,890	10,344	10,595

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

period 1970–1971 appears not to have been the beginning of a trend, however, but rather a period of major, one-time adjustments by many of the leading universities in reaction to the cutbacks in research and fellowship support, the growing awareness of serious financial distress, the deteriorating labor market for Ph.D.'s, and the general uncertainty created by the sudden end of the era of rapid growth. Having adjusted graduate enrollments down-

ward quickly and dramatically, the leading physics departments consolidated their positions at lower enrollment levels, while successive years exacted their toll in reduced enrollments in the lower rated departments.

Since the enrollment trends in the 14 disciplines covered in this report were roughly similar, the data for the 14 fields were aggregated by Roose–Andersen categories into one consolidated table, i.e., the figures for the 4.0–5.0 rated departments in all 14 fields were added together, as were the figures for the 3.0–3.9 departments, and so forth. This allowed us to examine trends in high-rated, low-rated, and non-rated departments in a single table, rather than in 14 separate tables, one for each discipline. The numbers of departments included in each category following this consolidation are reported in Table 7.

Because the academic quality of the 260 non-rated graduate departments is uncertain, enrollment analyses of the aggregated data were performed both including and excluding the non-rated departments. (Some of the reasons why the non-rated departments cannot be assumed to be uniformly low in quality are discussed subsequently.) The first analysis examines whether there have been any decisive shifts in graduate enrollments among the Roose–Andersen rated departments only, excluding the 260 non-rated departments. Since the bulk of Ph.D. production in these 14 fields is accounted for by the rated departments in the 130 institutions included in the Roose–Andersen survey, shifts in graduate enrollments among the rated categories will shed light on one important aspect of the systemwide adjustment of graduate schools to the economic distress of the last five years.

Table 8 presents first-year full-time and total full-time graduate enrollments for the 941 rated departments in the 14 fields for which we have matched data. First-year enrollments in these rated departments fell in total from 23,323 in FY 1968 to 19,149 in FY 1973, a drop of nearly 18 percent. The enrollment decline was shared by all six rated categories as each group

TABLE 7 Number of Departments in Each Quality Category, for Data Reported in Subsequent Tables (14 disciplines)

Roose–Andersen Rating	No. Departments	Percent of Total
4.0–5.0	92	7.6
3.0–3.9	201	16.7
2.5–2.9	174	14.5
2.0–2.4	210	17.5
1.5–1.9	153	12.7
0.0–1.4	111	9.2
Not rated	260	21.6
TOTAL	1201	100

SOURCE: Data from NSF Graduate Student Support Surveys.

TABLE 8 Full-time Graduate Enrollment in 941 Doctorate-Granting Departments, by Quality Category and Year (14 disciplines)

Roose–Andersen Rating	Enrollment, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
First-year full-time						
4.0–5.0	4,316	4,037	4,311	3,899	3,828	3,916
	18.5	**18.6**	**19.0**	**18.1**	**18.7**	**20.5**
3.0–3.9	6,817	6,188	6,340	5,887	5,473	5,176
	29.2	**28.6**	**28.0**	**27.4**	**26.7**	**27.0**
2.5–2.9	4,159	4,031	4,125	4,040	3,808	3,454
	17.8	**18.6**	**18.2**	**18.8**	**18.6**	**18.0**
2.0–2.4	3,952	3,819	4,035	3,908	3,783	3,405
	16.9	**17.6**	**17.8**	**18.2**	**18.4**	**17.8**
1.5–1.9	2,714	2,283	2,546	2,461	2,400	2,158
	11.6	**10.5**	**11.2**	**11.4**	**11.7**	**11.3**
0.0–1.4	1,365	1,300	1,263	1,305	1,221	1,040
	5.9	**6.0**	**5.7**	**6.1**	**6.0**	**5.4**
TOTAL	23,323	21,658	22,640	21,500	20,518	19,149
Total full-time						
4.0–5.0	14,297	14,181	13,901	13,513	13,062	13,020
	20.0	**19.7**	**19.4**	**19.3**	**19.3**	**20.1**
3.0–3.9	21,566	21,654	21,263	20,361	19,456	18,564
	30.1	**30.1**	**29.6**	**29.1**	**28.7**	**28.7**
2.5–2.9	12,719	12,868	12,779	12,605	12,251	11,496
	17.8	**17.9**	**17.8**	**18.0**	**18.1**	**17.8**
2.0–2.4	11,869	12,123	12,490	12,032	11,897	11,184
	16.6	**16.9**	**17.4**	**17.2**	**17.5**	**17.3**
1.5–1.9	7,560	7,359	7,514	7,669	7,568	7,146
	10.6	**10.2**	**10.5**	**11.0**	**11.2**	**11.1**
0.0–1.4	3,549	3,755	3,782	3,762	3,601	3,231
	5.0	**5.2**	**5.3**	**5.4**	**5.3**	**5.0**
TOTAL	71,560	71,940	71,729	69,942	67,835	64,641

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

enrolled fewer first year students at the end of the 6-year period. Although there were some shifts in the distribution of enrollments among quality categories over time, the enrollment proportions were generally stable. (For example, the top two groups enrolled virtually the same proportion of first-year students in FY 1968 and in FY 1973, with the declining enrollment proportion in the 3.0–3.9-rated departments offset by the relative increase in proportion enrolled in the 4.0–5.0-rated departments.)

Total full-time enrollments in these 941 departments also declined, from 71,560 in FY 1968 to 64,641 in FY 1973, a drop of nearly 10 percent. Enrollments in each of the six rated categories were also down, indicating

that no single category of rated departments had continued to expand while others contracted. The largest percentage decline occurred in the 201 departments rated 3.0–3.9; these departments enrolled approximately 3,000 fewer students in FY 1973 than in FY 1968, a 14-percent reduction that represented an average decline of 15 students per department. The 2.0–2.4 and 1.5–1.9-rated departments were the two groups to increase their enrollment proportion slightly. The overriding impression to be drawn from Table 8, however, is the remarkable stability in enrollment proportions among quality-rated departments in these 14 disciplines over this 6-year period of dramatic change in the environment of graduate education.

In discussing the significance of enrollment reductions, an important factor to be considered is the great diversity in the size of graduate departments in various quality groups. The average department size in FY 1973 by Roose–Andersen category is reported in Table 9. Because of their much larger graduate enrollments, the higher rated departments have greater flexibility in adjusting enrollments downward without severely disrupting either the graduate program or the department's functioning. A cut of 15 percent in a large department will still allow most graduate seminars to be held, will leave sufficient numbers of graduate students to serve as teaching and research assistants, and may in some cases improve the educational experience of the graduate students. When a department has on average only 30 graduate students, however, this downward flexibility is lost, and any further reduction in graduate enrollments is likely to threaten the existence of the program, or at least to force major changes in departmental functioning. For that reason, the cutbacks in federal support, the loss of National Defense Education Act (NDEA) fellowships and NSF traineeships, and the declining graduate applicant pools in several fields pose a more serious threat to the continued existence of the smaller and qualitatively weaker programs than to the larger and stronger programs.

Table 10 introduces enrollment data for 260 departments in the 14 fields that were not rated in the Roose–Andersen survey and for which we have

TABLE 9 Average Number of Full-Time Graduate Students Enrolled, by Quality Category (14 disciplines, 1201 departments, FY 1973)

Roose–Andersen Rating	No. Enrolled
4.0–50	141
3.0–3.9	92
2.5–2.9	66
2.0–2.4	53
1.5–1.9	47
0.0–1 4	30
Not rated	38

SOURCE: Tables 7 and 8.

data for the 6-year period from the NSF surveys.[22] The addition of the non-rated departments does not reverse the aggregate decline in first-year enrollments, for these 260 departments were basically stable over the 6-year period at an enrollment level of approximately 3400 first-year students per

[22] Appendix D discusses the coverage of non-rated departments.

TABLE 10 Full-time Graduate Enrollment in 1201 Doctorate-Granting Departments, by Quality Category and Year (14 disciplines)

Roose–Andersen Rating	Enrollment, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
First-year full-time						
4.0–5.0	4,316	4,037	4,311	3,899	3,828	3,916
	16.2	**16.0**	**16.5**	**15.6**	**16.0**	**17.4**
3.0–3.9	6,817	6,183	6,340	5,887	5,478	5,176
	25.5	**24.6**	**24.3**	**23.6**	**22.9**	**23.0**
2.5–2.9	4,159	4,031	4,125	4,040	3,808	3,454
	15.6	**16.0**	**15.8**	**16.2**	**16.0**	**15.4**
2.0–2.4	3,952	3,819	4,035	3,908	3,783	3,405
	14.8	**15.2**	**15.5**	**15.6**	**15.8**	**15.2**
1.5–1.9	2,714	2,283	2,546	2,461	2,400	2,158
	10.2	**9.1**	**9.8**	**9.9**	**10.1**	**9.6**
0.0–1.4	1,365	1,300	1,283	1,305	1,221	1,040
	5.1	**5.2**	**4.9**	**5.2**	**5.1**	**4.6**
Not rated	3,369	3,532	3,429	3,473	3,353	3,320
	12.6	**14.0**	**13.2**	**13.9**	**14.0**	**14.8**
TOTAL	26,692	25,190	26,069	24,973	23,871	22,469
Total full-time						
4.0–5.0	14,297	14,181	13,901	13,513	13,062	13,020
	17.9	**17.4**	**17.1**	**16.9**	**16.8**	**17.5**
3.0–3.9	21,566	21,654	21,263	20,361	19,456	18,564
	27.1	**26.6**	**26.2**	**25.5**	**25.1**	**24.9**
2.5–2.9	12,719	12,868	12,779	12,605	12,251	11,496
	16.0	**15.8**	**15.7**	**15.8**	**15.8**	**15.4**
2.0–2.4	11,869	12,123	12,490	12,032	11,897	11,184
	14.9	**14.9**	**15.4**	**15.0**	**15.3**	**15.0**
1.5–1.9	7,560	7,359	7,514	7,669	7,568	7,146
	9.5	**9.1**	**9.2**	**9.6**	**9.7**	**9.6**
0.0–1.4	3,549	3,755	3,782	3,762	3,601	3,231
	4.5	**4.6**	**4.7**	**4.7**	**4.6**	**4.3**
Not rated	8,132	9,344	9,522	10,051	9,826	9,830
	10.2	**11.5**	**11.7**	**12.6**	**12.7**	**13.2**
TOTAL	79,692	81,284	81,251	79,993	77,661	74,471

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

year. Since first-year enrollments declined in the other six categories, the share of the non-rated departments increased from 12.6 percent in FY 1968 to 14.8 percent in FY 1973. The highest rated departments also increased their proportionate share, while the 3.0–3.9-rated departments had the largest relative decline.

Turning to total full-time graduate enrollments, we note that the 260 non-rated departments increased enrollments absolutely over the 6-year period by 1,700 students—a 21 percent increase—and their proportion of total enrollment grew from 10 to 13 percent. Enrollment in these departments peaked in FY 1971, declining modestly to an apparently stable level in the two subsequent years. In FY 1973, these departments enrolled an average of 38 students, more than the lowest rated departments (0.0–1.4) where the average was 30. Since the non-rated departments were the only group to increase graduate enrollments over the 6-year period, it is important to examine them with some care. In particular, should they be viewed as lower in quality than all of the rated departments?

The answer is almost certainly negative. For one thing, over 35 percent of these 260 non-rated departments in the 14 disciplines are in universities that were rated in other fields by Roose–Andersen, i.e., these are not all departments in new doctorate-granting institutions.[23] Secondly, the non-rated universities include such schools as the State University of New York (SUNY)-Stony Brook; University of California at Irvine, at Santa Barbara, and at Santa Cruz; Dartmouth; and the City University of New York Graduate Center. Were the ACE quality survey repeated today, some of the departments in these universities would undoubtedly be given relatively high ratings. The fact that average graduate enrollment in the non-rated departments was higher than in the lowest rated departments tends to support this view, since average enrollment size is correlated positively with the quality ratings. It would be worth updating the ACE quality ratings, if for no other reason than to clarify the status of the heterogeneous group of departments that are currently non-rated.

Although several of the non-rated departments would undoubtedly be given acceptable ratings were the survey repeated, it is unlikely that many would be rated 3.0 or above. Consequently, it is worth examining the proportion of full time enrollments in the 3.0–5.0-rated departments with the non-rated enrollments included. The figures are reported in Table 11 (calculated from Table 10).

Within these 1201 matched departments, the proportion enrolled in 3.0–5.0 departments declined steadily until FY 1972, and increased slightly in

[23] To have been included in the Roose–Andersen survey, an institution must have awarded at least 100 doctorates in two or more disciplines in the most recent 10-year period for which data were available. Once a university was included in the survey universe, a department was included if it had awarded at least one doctorate in that 10-year period.

TABLE 11 Proportion of Total Full-Time Graduate Enrollment in Departments Quality-Rated 3.0–5.0, by Year (14 disciplines)

Roose–Andersen Rating	Percent Enrollment, by Fiscal Year					
	1968	1969	1970	1971	1972	1973
3.0–5.0	45.0	44.0	43.3	42.4	41.9	42.4

SOURCE: Table 10.

FY 1973. Until data for two or three more years are available, we will not know whether the declining proportion in high-rated departments has been reversed, stabilized, or only temporarily interrupted; however, these figures hardly support the claim that a qualitative crisis has occurred in the distribution of graduate students among departments.

An analysis of these enrollment data in terms of public and private university departments is contained in Appendix A, but the principal findings can be summarized here. Of the 1201 departments, 39 percent are in private universities, and these departments did enroll a smaller proportion of graduate students in FY 1973 than in FY 1968, a decline from 36 to 34 percent in total full-time enrollments. The highest-rated (4.0–5.0) private university departments, however, actually increased their proportion of enrollments slightly relative to public university departments in the 4.0–5.0 category, and the percentage of total full-time enrollments in the highest-rated private university departments in these 14 disciplines declined only slightly from 9.0 percent in FY 1968 to 8.9 percent in FY 1973. Contrary to widely held belief, the "Gresham's Law" hypothesis is not supported by analysis based on a private/public differential for these 14 disciplines.

Given the financial shock that hit graduate education in the late 1960's, an insightful observer should have been able to predict what the data in this section suggest. Faced with increasing financial uncertainty, the large, established departments, both public and private, cut back enrollments initially, while the newer, developing institutions maintained their growth trajectories into the early 1970's, stabilizing at levels sufficient to sustain graduate programs. This initial transition to a period of slower growth is now largely over, and subsequent trends in enrollments will depend primarily on the degree to which support funds for graduate education and research are concentrated or dispersed and on the rate at which new doctoral programs are created.

TRENDS IN TYPE OF GRADUATE STUDENT FINANCIAL SUPPORT

Fellowships and traineeships, teaching assitantships, and research assistantships are four of the principal methods used to support graduate students,

and the number and distribution of these forms of support undoubtedly have an effect on the size and distribution of graduate enrollments. During the 1960's the federal government was the main source of funds for fellowships, traineeships, and research assistantships, although state and institutional funds, as well as private philanthropy, were (and are) important. Teaching assistantships, on the other hand, are funded almost exclusively by state governments in the public universities and by institutional funds in the private universities.

As mentioned in the first chapter, a major change in federal policy in the late 1960's resulted in a phase-out of virtually all federal fellowships and traineeships, and this has been advanced as one of the major arguments in support of the "Gresham's Law" hypothesis. Table 12 presents data on federal fellowships and traineeships from the NSF graduate student support surveys, aggregated over the 14 disciplines for the 1201 departments contained in our matched cohort. Over the 6-year period, federal fellowships and traineeships in these departments declined by approximately 50 percent, from 18,016 to 8,897. What stands out in Table 12, however, is the evenness of the decline across quality categories; the distribution of awards was little changed in FY 1973 over FY 1968. Departments in the two highest rated categories increased their proportion of the declining total slightly, while the 2.5–2.9-rated departments lost somewhat more than proportionately,

TABLE 12 Graduate Students Receiving Federal Fellowships and Traineeships by Quality Category and Year (1201 departments, 14 disciplines)

Roose–Andersen Rating	Federal Fellowship Enrollment by Fiscal Year[a]					
	1968	1969	1970	1971	1972	1973
4.0–5.0	3,652	3,545	3,200	2,977	2,347	1,871
	20.3	**20.2**	**20.8**	**21.7**	**19.9**	**21.0**
3.0–3.9	4,913	4,774	4,206	3,847	3,400	2,573
	27.3	**27.2**	**27.3**	**28.0**	**28.8**	**28.9**
2.5–2.9	2,942	2,851	2,286	2,093	1,782	1,273
	16.3	**16.2**	**14.9**	**15.2**	**15.1**	**14.3**
2.0–2.4	2,677	2,571	2,286	1,941	1,757	1,352
	14.9	**14.6**	**14.9**	**14.1**	**14.9**	**15.2**
1.5–1.9	1,590	1,631	1,355	1,122	1,044	791
	8.8	**9.3**	**8.8**	**8.2**	**8.8**	**8.9**
0.0–1.4	613	586	524	499	410	283
	3.4	**3.3**	**3.4**	**3.6**	**3.5**	**3.2**
Not rated	1,629	1,599	1,525	1,263	1,071	754
	9.0	**9.1**	**9.9**	**9.2**	**9.1**	**8.5**
TOTAL	18,016	17,557	15,382	13,742	11,811	8,897

[a] *Number of students* is the first figure in each cell, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.

SOURCE: Data from NSF Graduate Student Support Surveys.

but these shifts were minor. The leading departments have not suffered a disproportionate loss of federal fellowships and traineeships, although they have experienced a greater absolute loss per department—declining from an average of 40 awards per department in FY 1968 to 20 in FY 1973. By comparison, the 1.5–1.9-rated departments declined from an average of 10 awards per department to 5 over this same period. Because the absolute loss in the leading departments was much larger, one can understand why attention has been focused on the plight of these departments. In the much smaller and generally lower rated departments, however, the *relative* impact of the loss of federal fellowships and traineeships has been just as great.

Table 13 reports the distribution of fellowships and traineeships from all sources—federal, state, private, and university's own funds. The total decline from 25,173 to 15,759 is roughly the same as the drop in fellowships and traineeships from federal sources, indicating stability in the number of such awards from other sources. As the table shows, departments in the two highest rated categories increased their proportion of the declining total from 51 to 55 percent.

Trends in the numbers of research assistantships are reported in Table 14. Total numbers are down from 16,952 to 14,882, a drop of 12 percent over the six years. This reflects, in part, the reduction in federal expenditures for R&D in universities that occurred in FY 1969 and continued (in constant dollar terms) for three subsequent years. Each category of departments

TABLE 13 Graduate Students Receiving Fellowships and Traineeships by Quality Category and Year (1201 departments, 14 disciplines)

Roose–Andersen Rating	Fellowship Enrollment, by Fiscal Year[a]					
	1968	1969	1970	1971	1972	1973
4.0–5.0	5,654	5,478	5,273	4,960	4,330	3,945
	22.5	**21.9**	**22.7**	**23.2**	**22.6**	**25.0**
3.0–3.9	7,151	7,211	6,873	6,445	5,916	4,758
	28.4	**28.8**	**29.6**	**30.1**	**30.9**	**30.2**
2.5–2.9	3,844	3,828	3,25·	3,071	2,648	2,070
	15.3	**15.3**	**14.0**	**14.3**	**13.8**	**13.1**
2.0–2.4	3,563	3,443	3,157	2,775	2,563	2,055
	14.2	**13.8**	**13.6**	**13.0**	**13.4**	**13.0**
1.5–1.9	2,045	2,033	1,795	1,564	1,429	1,169
	8.1	**8.1**	**7.7**	**7.3**	**7.5**	**7.4**
0.0–1.4	868	840	818	771	676	509
	3.4	**3.4**	**3.5**	**3.6**	**3.5**	**3.2**
Not rated	2,048	2,189	2,019	1,837	1,609	1,253
	8.1	**8.7**	**8.7**	**8.6**	**8.4**	**8.0**
TOTAL	25,173	25,022	23,189	21,423	19,171	15,759

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.

SOURCE: Data from NSF Graduate Student Support Surveys.

TABLE 14 Graduate Students Receiving Research Assistantships, by Quality Category and Year (1201 departments, 14 disciplines)

Roose–Andersen Rating	RA Enrollment, by Fiscal Year[a]					
	1968	1969	1970	1971	1972	1973
4.0–5.0	3,890	3,721	3,733	3,490	3,316	3,376
	22.9	**22.3**	**22.6**	**21.9**	**22.2**	**22.7**
3.0–3.9	5,330	5,166	4,909	4,584	4,290	4,350
	31.4	**31.0**	**29.7**	**28.8**	**28.7**	**29.2**
2.5–2.9	2,864	2,747	2,780	2,660	2,455	2,432
	16.9	**16.5**	**16.8**	**16.7**	**16.4**	**16.3**
2.0–2.4	1,915	1,964	1,909	1,753	1,650	1,696
	11.3	**11.8**	**11.5**	**11.0**	**11.0**	**11.4**
1.5–1.9	1,117	1,118	1,062	1,103	1,006	944
	6.6	**6.7**	**6.4**	**6.9**	**6.7**	**6.3**
0.0–1.4	373	379	401	380	340	335
	2.2	**2.3**	**2.4**	**2.4**	**2.3**	**2.3**
Not rated	1,463	1,596	1,751	1,963	1,909	1,749
	8.6	**9.6**	**10.6**	**12.3**	**12.8**	**11.8**
TOTAL	16,952	16,691	16,545	15,933	14,966	14,882

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

shows a drop except the non-rated group, which continued increasing until FY 1971 and had roughly 300 more assistantships (one per department on average) in FY 1973 than in FY 1968. The biggest loss occurred in the 3.0–3.9-rated group, with approximately 1,000 fewer assistantships (an average loss of five per department) at the end of the 6-year period. The 293 departments in the top two groups still had over 50 percent of the research assistantships, however, in the last year covered by these data.

Trends in the distribution of teaching assistantships are presented in Table 15. Of the three principal types of student support, teaching assistantships showed the only growth, increasing by 8 percent from 20,444 to 22,190. The non-rated departments, with an increase of approximately 1,000 assistantships (an average of 4 per department), were the major gainers, reflecting the continued growth in undergraduate enrollments (and hence the need for teaching assistants) in many of the newer universities. As the enrollment in these institutions stabilizes, the growth in teaching assistant (TA) positions will slow or cease, and the distribution of these positions among universities should become relatively stable, shifting only as undergraduate enrollments shift.

Of all the factors examined thus far that bear on the "Gresham's Law" hypothesis, the rapid and disproportionate growth of teaching assistantships in the non-rated departments is the strongest evidence supporting that view. If higher education were expected to continue growing at the rate experi-

TABLE 15 Graduate Students Receiving Teaching Assistantships, by Quality Category and Year (1201 departments, 14 disciplines)

Roose–Andersen Rating	TA Enrollment, by Fiscal Year[a]					
	1968	1969	1970	1971	1972	1973
4.0–5.0	2,336	2,477	2,403	2,353	2,043	2,250
	11.4	**11.7**	**11.2**	**10.5**	**9.3**	**10.1**
3.0–3.9	4,715	4,828	4,956	5,055	5,020	5,027
	23.1	**22.8**	**23.0**	**22.5**	**22.7**	**22.7**
2.5–2.9	3,522	3,638	3,621	3,807	3,658	3,686
	17.2	**17.2**	**16.8**	**16.9**	**16.6**	**16.6**
2.0–2.4	3,708	3,793	3,871	4,008	3,909	3,824
	18.1	**17.9**	**18.0**	**17.8**	**17.7**	**17.2**
1.5–1.9	2,240	2,205	2,278	2,477	2,479	2,401
	11.0	**10.4**	**10.6**	**11.0**	**11.2**	**10.8**
0.0–1.4	1,264	1,273	1,266	1,400	1,416	1,360
	6.2	**6.0**	**5.9**	**6.2**	**6.4**	**6.1**
Not rated	2,659	2,988	3,152	3,390	3,558	3,642
	13.0	**14.1**	**14.6**	**15.1**	**16.1**	**16.4**
TOTAL	20,444	21,202	21,547	22,490	22,083	22,190

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

enced during the 1960's, the "Gresham's Law" scenario would be compelling, since the newer universities would be the principal beneficiaries of such growth and their graduate departments would continue to gain teaching assistantships. The onset of a prolonged period of slow (or no) growth, however, renders that prospect unlikely and casts doubt on the long run validity of the hypothesis.

Table 16 compares the average number of students receiving one of these principal types of financial support in the highest rated, lowest rated, and non-rated departments in FY 1973, the last year covered by these data. The

TABLE 16 Average Number of Fellowships and Traineeships, Research Assistantships, and Teaching Assistantships Per Department For Three Quality Categories (14 disciplines, FY 1973)

Type of Support	Average No. per Department, by Roose–Andersen Rating		
	4.0–5.0	0.0–1.4	Not rated
Fellowships and traineeships	42.9	4.6	4.8
Research assistantships	36.7	3.0	6.7
Teaching assistantships	24.5	12.3	14.0
TOTAL	104.1	19.9	25.5

SOURCE: Data from NSF Graduate Student Support Surveys.

table helps to put our discussion in perspective, because it shows that in FY 1973 the leading departments controlled on average over 5 times as many graduate student support positions as the lowest rated departments and over 4 times as many as the non-rated departments. Although these differentials may fall in subsequent years, it is well to keep these order-of-magnitude differences in mind when assessing extreme claims that the leading departments have been seriously threatened by newer, lower-quality departments.

Appendix A contains tables showing how private university departments in our cohort have fared on each of the major types of support relative to the public universities. The data indicate that the private university departments did not lose ground over this period relative to their public university peer departments in terms of the number of fellowships and teaching and research assistantships they can offer. The relative standing of public and private departments in our matched cohort is virtually the same in FY 1973 as it was six years earlier. The "Gresham's Law" hypothesis, if it is interpreted in public/private terms, is not supported by these analyses.

TRENDS IN SOURCE OF SUPPORT FOR GRADUATE STUDENTS

The NSF graduate student support survey also classifies support by source, including federal, institutional and state government funds, and self, loans, and family. Tables 17, 18, and 19 report the number of students supported from each of these sources by quality group over the 6-year period under review for the 1201 departments in our matched cohort. In total, federally supported students declined by 35 percent, from 31,865 to 20,781; those receiving support from the institutions or from state governments increased by 8 percent, from 28,486 to 30,783; and self-support (including loans and family sources) increased by 46 percent, from 11,645 to 16,978.

All quality groups shared in the decline of federal support for students in roughly proportional terms. The highest rated and the non-rated departments each increased their proportion slightly, while the other groups were either stable or had modestly declining percentages. The relative concentration of federal funds in the leading departments stands out, for the 3.0–5.0-rated departments received over 50 percent of the federal sources of student support in each of the six years.[24]

[24] I am indebted to Dr. Bernard Khoury, Associate Executive Secretary of the Association of American Universities, for pointing out that if the data on federal support (Table 17) are normalized by the number of students enrolled in each category (Table 8), one discovers an *inverse* "Gresham's Law of Federal Support." The percentage of students with federal support fell 22 percent between 1968 and 1973 in 4.0–5.0-rated departments; 25 percent in 3.0–3.9-rated departments; 32 percent in 2.5–2.9-rated departments; 34 percent in 2.0–2.4-rated departments; 40 percent in 1.5–1.9-rated departments; and 33 percent in 0.0–1.4-rated departments.

TABLE 17 Graduate Students Whose Primary Source of Financial Support was the Federal Government, by Quality Category and Year (1201 departments, 14 disciplines)

Roose–Andersen Rating	Federally Supported Enrollment, by Fiscal Year[a]					
	1968	1969	1970	1971	1972	1973
4.0–5.0	6,912	6,742	6,488	6,042	5,255	4,884
	21.7	**21.7**	**22.6**	**22.7**	**22.3**	**23.5**
3.0–3.9	9,432	9,131	8,362	7,694	6,899	6,077
	29.6	**29.4**	**29.2**	**28.9**	**29.2**	**29.2**
2.5–2.9	5,406	5,130	4,407	4,278	3,769	3,302
	17.0	**16.5**	**15.4**	**16.1**	**16.0**	**15.9**
2.0–2.4	4,149	3,976	3,678	3,213	2,899	2,584
	13.0	**12.8**	**12.8**	**12.1**	**12.3**	**12.4**
1.5–1.9	2,558	2,487	2,180	1,946	1,722	1,454
	8.0	**8.0**	**7.6**	**7.3**	**7.3**	**7.0**
0.0–1.4	853	882	841	764	689	519
	2.7	**2.8**	**2.9**	**2.9**	**2.9**	**2.5**
Not rated	2,555	2,676	2,711	2,663	2,365	1,961
	8.0	**8.6**	**9.5**	**10.0**	**10.0**	**9.4**
TOTAL	31,865	31,024	28,667	26,600	23,598	20,781

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

TABLE 18 Graduate Students Whose Primary Source of Financial Support was University or State Funds, by Quality Category and Year (1201 departments, 14 disciplines)

Roose–Andersen Rating	University and State Supported Enrollment, by Fiscal Year[a]					
	1968	1969	1970	1971	1972	1973
4.0–5.0	3,879	3,992	3,892	3,904	3,534	3,947
	13.6	**13.3**	**12.7**	**12.5**	**11.5**	**12.8**
3.0–3.9	7,014	7,390	7,436	7,367	7,224	7,174
	24.6	**24.6**	**24.2**	**23.5**	**23.5**	**23.3**
2.5–2.9	4,616	4,905	5,101	5,021	4,950	4,806
	16.2	**16.3**	**16.6**	**16.0**	**16.1**	**15.6**
2.0–2.4	4,918	5,146	5,348	5,354	5,361	5,087
	17.3	**17.1**	**17.4**	**17.1**	**17.4**	**16.5**
1.5–1.9	2,855	2,953	3,058	3,307	3,211	3,115
	10.0	**9.8**	**9.9**	**10.6**	**10.5**	**10.1**
0.0–1.4	1,643	1,623	1,704	1,781	1,741	1,779
	5.8	**5.4**	**5.5**	**5.7**	**5.7**	**5.8**
Not rated	3,561	4,080	4,226	4,562	4,705	4,875
	12.5	**13.6**	**13.7**	**14.6**	**15.3**	**15.8**
TOTAL	28,486	30,099	30,765	31,296	30,726	30,783

[a] *Number of students* is the first figure given followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

Table 19 Graduate Students Whose Primary Source of Financial Support was Loans, or Family, by Quality Category and Year (1201 departments, 14 disciplines)

Roose–Andersen Rating	Self-Supported Enrollment, by Fiscal Year[a]					
	1968	1969	1970	1971	1972	1973
4.0–5.0	1,486	1,682	1,671	1,811	2,674	2,814
	12.8	**12.7**	**11.1**	**12.0**	**15.8**	**16.6**
3.0–3.9	2,945	2,971	3,358	3,050	3,288	3,470
	25.3	**22.5**	**22.3**	**20.2**	**19.4**	**20.4**
2.5–2.9	1,663	1,855	2,337	2,403	2,724	2,615
	14.3	**14.0**	**15.6**	**15.9**	**16.1**	**15.4**
2.0–2.4	1,843	2,163	2,652	2,549	2,821	2,731
	15.8	**16.4**	**17.6**	**16.9**	**16.7**	**16.1**
1.5–1.9	1,566	1,469	1,842	2,062	2,221	2,126
	13.4	**11.1**	**12.3**	**13.7**	**13.1**	**12.5**
0.0–1.4	667	1,049	1,060	963	978	774
	5.7	**7.9**	**7.1**	**6.4**	**5.8**	**4.6**
Not rated	1,473	2,027	2,108	2,240	2,216	2,448
	12.6	**15.3**	**14.0**	**14.9**	**13.1**	**14.4**
TOTAL	11,645	13,216	15,028	15,078	16,922	16,978

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

By comparison, institutional and state sources of student support are not as concentrated in the leading departments, reflecting in large measure the broader distribution of teaching assistantships that follow undergraduate enrollment trends. As Table 18 indicates, the percentage distribution of these funds by quality group has not changed much over the six years, although the largest absolute gains were made by the non-rated departments, with the increase in teaching assistantships that we noted earlier accounting for most of this gain. Tables 17 and 18 highlight the growing importance of state and institutional funds for student support relative to federal sources, suggesting that greater attention should be focused in the future on the distributional effects of state policies toward support of graduate education.

Table 19 reports trends in student self-support, including an unknown number of students receiving support from the G.I. Bill. (Because funds under the G.I. Bill are disbursed directly to students, the number of students receiving this support is generally not included in departmental records, the source of this survey.) The top two groups of departments display very different trends, about which we can only speculate. As other forms of support declined, the leading (4.0–5.0) departments roughly doubled the number of self-supported students, increasing their proportion of the total number of self-supported students from 12.8 to 16.6 percent. The 3.0–3.9-rated

departments increased their numbers of self-supported students by a much smaller amount (an average increase per department of less than three students), and as a consequence reduced their proportion of all self-financed students from 25.3 to 20.4 percent. The fact that the 3.0–3.9-rated departments did not expand proportionately the number of self-supported students helps to explain why these departments fell in total enrollments more than any other group (See Table 10). The question remains, however, why these departments should behave in a unique fashion.

Examining the data on self-support by a public/private breakdown reveals that the divergent trends can be traced to the private university departments. The 56 private university departments rated 4.0–5.0 more than doubled their self-financed students from 537 in FY 1968 to 1118 in FY 1973, while the 105 private departments rated 3.0–3.9 were unchanged (1141 in FY 1968 *vs.* 1142 in FY 1973), and actually declined to a low of 857 in FY 1971. One hypothesis that could explain this diverse pattern assumes that student decision making rather than differences in departmental behavior is the cause. Under this hypothesis, students competing for admission in the national market for graduate school might rationally decide to attend one of the four or five top-rated departments even if it meant paying their own way. By comparison, a good department, rated fifteenth or twentieth in the discipline, does not have the equivalent drawing power for an equally large or ambitious applicant pool, and the higher cost private universities in this quality range would be at a particular disadvantage. Rather than borrow several thousand dollars to attend a twentieth-ranked private university, a student may rationally conclude that he or she will do just as well by attending a thirtieth-ranked department that offers a teaching assistantship. We cannot confirm this hypothesis with the data in hand, but it is a plausible explanation of the distinctive experience of the 3.0–3.9-rated private departments. (And it is, if correct, a "Gresham's Law" process operating at one distinct level in the system of graduate departments.)

With respect to federal, institutional, and state sources of student support, there were no exceptional or noteworthy trend differences between public and private departments. The private departments enrolled an essentially stable 40 percent of the students supported from federal sources and an equally stable 29 percent of the students supported from institutional and state sources. Furthermore, there were no significant shifts between public and private departments within the various quality categories. We have already discussed the diverse trends in self-support found in the 4.0–5.0 and 3.0–3.9-rated private departments; the only other noteworthy trend in self-support shows up in the lowest rated (0.0–1.4) private departments, which enrolled over 200 fewer self-financed students in FY 1973 than in FY 1970, corresponding to an equally large enrollment decline in these departments over the same period. As other sources of support declined, the low-rated private departments were evidently unable to expand the number of students

able or willing to pay their own way, and hence lost enrollment. We observed several examples of this problem during the site visits.

TRENDS IN FOREIGN STUDENT ENROLLMENTS

Table 20 reports on first-year and total full-time foreign graduate enroll-

TABLE 20 Foreign Full-time Graduate Students, by Quality Category and Year (1201 departments, 14 disciplines)

Roose--Andersen Rating	Foreign Enrollment, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
First-year full-time						
4.0–5.0	900	959	1,047	969	897	927
	19.6	**19.0**	**18.7**	**18.6**	**18.9**	**21.1**
3.0–3.9	1,094	1,150	1,299	1,212	1,040	1,020
	23.8	**22.8**	**23.2**	**23.2**	**21.9**	**23.2**
2.5–2.9	678	826	910	838	795	680
	14.8	**16.4**	**16.2**	**16.1**	**16.7**	**15.5**
2.0–2.4	675	768	798	788	732	595
	14.7	**15.2**	**14.2**	**15.1**	**15.4**	**13.5**
1.5–1.9	462	386	527	466	418	374
	10.1	**7.7**	**9.4**	**8.9**	**8.8**	**8.5**
0.0–1.4	179	165	168	164	155	144
	3.9	**3.3**	**3.0**	**3.1**	**3.3**	**3.3**
Not rated	602	784	852	777	717	656
	13.1	**15.6**	**15.2**	**14.9**	**15.1**	**14.9**
TOTAL	4,590	5,038	5,601	5,214	4,754	4,396
Total full-time						
4.0–5.0	2,761	2,876	3,071	3,162	3,106	3,002
	21.3	**20.0**	**19.0**	**19.1**	**19.3**	**19.9**
3.0–3.9	3,505	3,844	4,217	4,220	3,914	3,686
	27.0	**26.7**	**26.1**	**25.5**	**24.3**	**24.5**
2.5–2.9	2,022	2,264	2,555	2,641	2,659	2,494
	15.6	**15.7**	**15.8**	**15.9**	**16.5**	**16.6**
2.0–2.4	1,854	2,072	2,367	2,439	2,443	2,121
	14.3	**14.4**	**14.6**	**14.7**	**15.2**	**14.1**
1.5–1.9	1,092	1,125	1,306	1,361	1,350	1,312
	8.4	**7.8**	**8.1**	**8.2**	**8.4**	**8.7**
0.0–1.4	454	501	534	548	556	491
	3.5	**3.5**	**3.3**	**3.3**	**3.5**	**3.3**
Not rated	1,281	1,724	2,111	2,194	2,069	1,952
	9.9	**12.0**	**13.1**	**13.2**	**12.8**	**13.0**
TOTAL	12,969	14,406	16,161	16,565	16,102	15,058

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

ments for the aggregated fourteen disciplines from the NSF student support surveys.[25] First-year foreign enrollments rose until FY 1970, and declined steadily in the subsequent three years. No particular trends in first-year foreign enrollments are apparent among the several quality categories; each group roughly follows the pattern of the total, rising at first and then falling. A similar pattern of increase and then decline is evident in total full-time foreign enrollments, although with a lag of one year relative to first-year enrollments. Foreign enrollments as a percentage of first-year and of total enrollment in the 14 disciplines over the six years are reported in Table 21.

Returning to Table 20 to examine trends in total full-time foreign enrollments, the relative decline in the top two quality groups is worth noting, as is the proportionate increase in the non-rated departments. In fact, foreign students accounted for roughly 40 percent of the increase in graduate enrollments that occurred in the non-rated departments over the six years. Thus, an important part of the changing enrollment pattern that gave rise to the "Gresham's Law" hypothesis can be traced to differential shifts in foreign graduate enrollments. In subsequent sections of this report we will examine the even greater variation in foreign student enrollment trends by discipline.

TRENDS IN Ph.D. PRODUCTION

The remaining analyses in this section are drawn from the Doctorate Records File maintained by the National Research Council. This file contains complete coverage of all Ph.D.'s awarded by U.S. universities, so we are able to report data for the field of English, the humanities discipline included in the site visits, in addition to the science and social science fields covered by NSF data. Since the data are complete for all Ph.D.-granting institutions in each year, we are no longer limited to a matched cohort of departments, but

[25] The only data on student characteristics available over all six years from these surveys are foreign vs. U.S. citizens. Data on enrollment by sex was included for the first time in FY 1973, while questions on racial or ethnic origin have never been asked.

TABLE 21 Percentage of Full-time Graduate Enrollments that Are Foreign, by Year (14 disciplines, 1201 departments

Fiscal Year	First-Year Full-Time	Total Full-Times
1968	17.2	16.3
1969	20.0	17.7
1970	21.5	19.9
1971	20.9	20.7
1972	19.9	20.7
1973	19.6	20.2

SOURCE: Data from NSF Graduate Student Support Surveys.

can present data for all departments in each rated category and for all non-rated departments as well.

Tables 22-28 contain data on Ph.D. production by rated categories for the period FY 1968–FY 1973 in seven major disciplines—the five site visit fields plus physics and mathematics. What stands out in virtually each of the seven fields is a marked decline in the proportion of Ph.D.'s produced by the two top-rated groups (3.0–5.0-rated departments) and a sharp increase in the proportion produced by the non-rated departments. Here is striking evidence of a "Gresham's Law" type of shift in Ph.D. *production*, but consider what these data imply about the timing of the associated shift in enrollments. If it takes five years on average to produce a Ph.D., then the significant shift in enrollment distribution underlying these changed Ph.D. proportions occurred between FY 1964 and FY 1969, during the "Golden Years" of rapid expansion and growth in new doctoral programs. This was the period marked by President Johnson's Executive Order of September 13, 1965,[26] which asserted that every region of the country should be served by excellent graduate schools, and was also the time of the NSF Science Development Program, which provided over $230 million in development grants

[26] U.S. Congress. Senate. Committee on Government Operations. *Equitable Distribution of R&D Funds by Government Agencies*, Hearing before the Subcommittee on Government Research, 90th Congr., 1st sess. (Washington, D.C.: U.S. Government Printing Office, 1967).

TABLE 22 Chemistry Doctorates Produced, by Quality Category and Year

Roose–Andersen Rating	Chem Doctorates, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
4.0–5.0	378	405	406	405	355	338
	21.1	**20.7**	**18.2**	**18.4**	**17.7**	**18.3**
3.0–3.9	555	547	665	654	574	487
	31.0	**28.0**	**29.8**	**29.7**	**28.5**	**26.3**
2.5–2.9	290	329	367	346	327	302
	16.2	**16.8**	**16.4**	**15.7**	**16.3**	**16.3**
2.0–2.4	228	282	275	257	266	233
	12.7	**14.4**	**12.3**	**11.7**	**13.2**	**12.6**
1.5–1.9	155	165	233	195	176	194
	8.6	**8.4**	**10.4**	**8.8**	**8.8**	**10.5**
0.0–1.4	55	76	93	92	76	70
	3.1	**3.9**	**4.2**	**4.2**	**3.8**	**3.8**
Not rated	131	149	196	256	237	225
	7.3	**7.6**	**8.8**	**11.6**	**11.8**	**12.2**
TOTAL	1,792	1,953	2,235	2,205	2,011	1,849

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NRC Doctorate Records File.

TABLE 23 Economics Doctorates Produced, by Quality Category and Year

Roose–Andersen Rating	Econ Doctorates, by Fiscal Year[a]					
	1968	1969	1970	1971	1972	1973
4.0–5.0	143	128	139	134	164	137
	19.2	**18.1**	**16.3**	**16.3**	**18.3**	**14.6**
3.0–3.9	180	179	221	179	219	224
	24.1	**25.4**	**25.9**	**21.8**	**24.5**	**23.9**
2.5–2.9	122	106	136	118	113	122
	16.4	**15.0**	**15.9**	**14.4**	**12.6**	**13.0**
2.0–2.4	114	104	98	130	136	178
	15.3	**14.7**	**11.5**	**15.8**	**15.2**	**19.0**
1.5–1.9	80	80	126	100	92	97
	10.7	**11.3**	**14.8**	**12.2**	**10.3**	**10.3**
0.0–1.4	89	83	101	107	100	108
	11.9	**11.8**	**11.8**	**13.0**	**11.2**	**11.5**
Not rated	18	26	32	53	71	72
	2.4	**3.7**	**3.8**	**6.5**	**7.9**	**7.7**
TOTAL	746	706	853	821	895	938

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NRC Doctorate Records File.

TABLE 24 Electrical Engineering Doctorates Produced, by Quality Category and Year

Roose–Andersen Rating	Elec Engineering Doctorates, by Fiscal Year[a]					
	1968	1969	1970	1971	1972	1973
4.0–5.0	130	165	134	146	161	133
	21.5	**23.8**	**19.0**	**19.6**	**23.3**	**19.8**
3.0–3.9	259	279	291	263	240	214
	42.7	**40.3**	**41.2**	**35.3**	**34.8**	**31.8**
2.5–2.9	74	63	78	99	81	82
	12.2	**9.1**	**11.0**	**13.3**	**11.7**	**12.2**
2.0–2.4	72	74	80	79	69	70
	11.9	**10.7**	**11.3**	**10.6**	**10.0**	**10.4**
1.5–1.9	38	56	64	59	41	57
	6.3	**8.1**	**9.1**	**7.9**	**5.9**	**8.5**
0.0–1.4	9	8	9	12	13	12
	1.5	**1.2**	**1.3**	**1.6**	**1.9**	**1.8**
Not rated	24	48	50	87	85	105
	4.0	**6.9**	**7.1**	**11.7**	**12.3**	**15.6**
TOTAL	606	693	706	745	690	673

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NRC Doctorate Records File.

TABLE 25 Mathematics Doctorates Produced, by Quality Category and Year

Roose–Andersen Rating	Math Doctorates, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
4.0–5.0	221	234	272	248	234	230
	26.3	**23.1**	**23.9**	**21.7**	**20.7**	**21.6**
3.0–3.9	208	229	265	273	269	288
	24.8	**22.6**	**23.2**	**23.9**	**23.8**	**27.0**
2.5–2.9	111	143	212	186	161	152
	13.2	**14.1**	**18.6**	**16.3**	**14.2**	**14.3**
2.0–2.4	148	190	161	181	169	151
	17.6	**18.7**	**14.1**	**15.9**	**15.0**	**14.2**
1.5–1.9	59	63	63	47	68	73
	7.0	**6.2**	**5.5**	**4.1**	**6.0**	**6.8**
0.0–1.4	59	79	92	104	90	64
	7.0	**7.8**	**8.1**	**9.1**	**8.0**	**6.0**
Not rated	34	77	75	102	139	108
	4.0	**7.6**	**6.6**	**8.9**	**12.3**	**10.1**
TOTAL	840	1,015	1,140	1,141	1,130	1,066

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NRC Doctorate Records File.

TABLE 26 Physics Doctorates Produced, by Quality Category and Year

Roose–Andersen Rating	Physics Doctorates, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
4.0–5.0	342	334	344	396	341	333
	25.6	**24.9**	**22.3**	**24.4**	**22.6**	**22.8**
3.0–3.9	379	353	422	407	389	365
	28.4	**26.3**	**27.3**	**25.0**	**25.8**	**25.0**
2.5–2.9	247	277	279	301	245	235
	18.5	**20.6**	**18.1**	**18.5**	**16.3**	**16.1**
2.0–2.4	127	136	165	172	165	148
	9.5	**10.1**	**10.7**	**10.6**	**11.0**	**10.1**
1.5–1.9	114	92	145	145	143	128
	8.5	**6.9**	**9.4**	**8.9**	**9.5**	**8.8**
0.0–14	59	58	88	58	61	69
	4.4	**4.3**	**5.7**	**3.6**	**4.1**	**4.7**
Not rated	66	92	101	146	162	181
	4.9	**6.9**	**6.5**	**9.0**	**10.8**	**12.4**
TOTAL	1,334	1,342	1,544	1,625	1,506	1,459

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NRC Doctorate Records File.

TABLE 27 Psychology Doctorates Produced, by Quality Category and Year

Roose–Andersen Rating	Psych Doctorates, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
4.0–5.0	127	173	192	234	208	175
	8.7	**9.9**	**10.2**	**11.0**	**9.2**	**7.2**
3.0–3.9	527	540	557	626	620	694
	36.0	**30.8**	**29.5**	**29.5**	**27.4**	**28.4**
2.5–2.9	205	245	271	249	268	284
	14.0	**14.0**	**14.4**	**11.7**	**11.8**	**11.6**
2.0–2.4	272	357	384	401	460	485
	18.6	**20.3**	**20.3**	**18.9**	**20.3**	**19.8**
1.5–1.9	209	222	199	240	252	246
	14.3	**12.6**	**10.5**	**11.3**	**11.1**	**10.1**
0.0–1.4	72	87	94	102	117	133
	4.9	**5.0**	**5.0**	**4.8**	**5.2**	**5.4**
Not rated	52	132	191	272	337	427
	3.6	**7.5**	**10.1**	**12.8**	**14.9**	**17.5**
TOTAL	1,464	1,756	1,888	2,124	2,262	2,444

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NRC Doctorate Records File.

TABLE 28 English Doctorates Produced, by Quality Category and Year

Roose–Andersen Rating	English Doctorates, by Fiscal Year[a] 1968	1969	1970	1971	1972	1973
4.0–5.0	206	180	179	195	206	198
	22.2	**17.5**	**16.3**	**15.7**	**15.1**	**14.0**
3.0–3.9	343	411	438	477	473	552
	36.9	**40.1**	**39.9**	**38.3**	**34.7**	**39.1**
2.5–2.9	95	77	91	135	142	140
	10.2	**7.5**	**8.3**	**10.9**	**10.4**	**9.9**
2.0–2.4	171	189	189	204	244	246
	18.4	**18.4**	**17.2**	**16.4**	**17.9**	**17.4**
1.5–1.9	59	82	80	95	118	92
	6.4	**8.0**	**7.3**	**7.6**	**8.7**	**6.5**
0.0–1.4	28	36	34	47	58	51
	3.0	**3.5**	**3.1**	**3.8**	**4.3**	**3.6**
Not rated	27	51	86	91	122	133
	2.9	**5.0**	**7.8**	**7.3**	**9.0**	**9.4**
TOTAL	929	1,026	1,097	1,244	1,363	1,412

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students enrolled in that quality grouping in that year.
SOURCE: Data from NRC Doctorate Records File.

for universities and departments ranked below the "Top Twenty." One might argue that the "Gresham's Law of Ph.D. Enrollments" was much more a phenomenon of the expansionary period of graduate education than of its more recent slow growth phase.

As a very rough index of the rapid growth that occurred in the non-rated departments in the 1960's, the proportion of total full-time enrollments in FY 1968 in the 260 non-rated departments (Tables 1–6) can be compared with the proportion of Ph.D. output from non-rated departments in FY 1968 (Tables 22–27). In these six fields (we do not have comparable enrollment figures for English), the non-rated departments enrolled between 10 and 12 percent of the total full-time students in FY 1968, but accounted for only 2–4 percent of Ph.D. output. This is clear evidence of a rapid enrollment build-up during the early and middle 1960's that had not yet resulted in many degrees produced. In contrast, by FY 1973 the proportion of Ph.D. production in the non-rated departments was very nearly equal to the proportion of total full-time enrollments. (These ratios for the six fields are reported in Table 29.) The fact that enrollment/degree ratios are approaching 1.0 by FY 1973 suggests that the initial "pipe-line" effect is nearly over, and that the rapid increase in proportion of Ph.D. production in the non-rated departments will slow to a rate approximating the increase in proportion of doctoral enrollments in non-rated departments. Although the number and average size of non-rated departments may continue to grow during the 1970's, the growth rate will surely be considerably lower than in the 1960's.

TABLE 29 Ratio of Percent Total Full-Time Graduate Enrollment to Percent Ph.D. Production in Non-Rated Departments (260 non-rated departments, FY 1968 and FY 1973)

Discipline	Fiscal Year 1968	1973
Chemistry	$\frac{10.6}{7.3} = 1.5$	$\frac{13.2}{12.2} = 1.1$
Economics	$\frac{5.6}{2.4} = 2.3$	$\frac{8.8}{7.7} = 1.1$
Electrical engineering	$\frac{10.2}{4.0} = 2.6$	$\frac{13.3}{15.6} = 0.9$
Mathematics	$\frac{12.0}{4.0} = 3.0$	$\frac{14.4}{10.1} = 1.4$
Physics	$\frac{11.1}{3.6} = 2.3$	$\frac{15.5}{12.4} = 1.2$
Psychology	$\frac{11.0}{4.9} = 3.1$	$\frac{14.0}{17.5} = 0.8$

SOURCE: Data from Tables 1-6 and Tables 22–27.

TRENDS IN Ph.D. JOB PLACEMENT

The Doctorate Records File contains detailed information on the employment plans of new Ph.D.'s, which allows one to observe changing trends in placements by departments within each Roose–Andersen quality grouping. In addition, the number of students who are actively seeking work at receipt of the degree but who have no specific employment prospects can be determined. While this is not a true measure of unemployment, it is a good index of employment difficulty and hence of changing labor market conditions.

The proportion of new Ph.D.'s who reported no specific employment prospects[27] at receipt of degree in the five site visit fields or each year during the period FY 1968–FY 1973 are reported in Table 30. The marked increase in this proportion over the 6-year period is graphic evidence of the deteriorating labor market for new Ph.D.'s. The differences among the five fields are also noteworthy, with economics showing significantly less labor market difficulty than the other fields. Note also that the proportion experiencing employment difficulty continues to rise in English and psychology, but has declined in the last two years in electrical engineering and in the last year in chemistry. These trends are consistent with departmental reports on the site visits; both chemistry and electrical engineering departments thought that the worst time had passed, with industrial demand for their graduates increasing, while placement was becoming a growing concern in psychology departments and a matter of desperation in the field of English. (Most English departments reported a dramatic worsening of the market in FY 1974, suggesting that the number of graduates with no specific employment prospects should increase substantially by the time of the FY 1974 survey.) The low proportion in economics is also consistent with our site visit findings, for we found little evidence of serious placement problems in that field.

[27] The Doctorate Records File survey form is contained in Appendix C; Table 30 reports the number who checked Box 2 in Question R.

TABLE 30 Proportion of New Ph.D. Recipients Reporting No Specific Employment Prospects at Receipt of the Degree, by Discipline and Year (5 disciplines)

	Percent, by Fiscal Year					
Discipline	1968	1969	1970	1971	1972	1973
Chemistry	4.5	7.8	11.4	15.2	18.9	17.2
Economics	3.1	3 3	4.6	6.1	6.3	6.4
Electrical engineering	7.1	10.7	11.6	19.6	18.4	15.0
English	3.9	7.9	9.3	13.2	15.5	21.5
Psychology	6.1	8.0	8.8	10.0	12.3	13.6

SOURCE: Data from NRC Doctorate Records File.

Table 31 examines the same survey question (the number of students indicating no specific employment prospects at receipt of degree) by Roose–Andersen categories in the five fields in FY 1973.

Several generalizations about the operation of the Ph.D. labor market are suggested by the data in this table. First, graduates of the highest rated departments (4.0–5.0) experienced less labor market difficulty than any other group. Second, although job placement tends to be more of a problem the lower the departmental rating, the progression is by no means uniform; in every field but economics, for example, the 3.0–3.9-rated departments experienced more placement difficulty than at least one group rated lower. This suggests that the doctorate labor market is not simply one large, national market, but rather that it is stratified into submarkets that are to some degree non-competing. In particular, one might hypothesize that the 3.0–3.9-rated departments are competing in roughly the same market with the 4.0–5.0-rated departments, but less successfully, while the lower-rated departments are serving regional markets as well as different employment situations. Subsequent data on placements will bear on this hypothesis.

Finally, the table shows that in none of the five fields have the graduates of the non-rated departments experienced the greatest difficulty in job placement. This is just one more indication of the heterogeneous nature of the departments in that category.

The Doctorate Records File survey also collects detailed information on the post-graduation plans of new Ph.D.'s who report that they will be employed or are undertaking postdoctoral study. We have organized the responses of those who indicated definite plans by type of post-graduation employment (including postdoctoral study) and by Roose–Andersen category of Ph.D.-producing department. By contrasting the post-graduation employment distribution in FY 1968 with that in FY 1973, we gain further insight into the

TABLE 31 Proportion of New Ph.D. Recipients Reporting No Specific Employment Prospects at Receipt of Degree, by Quality Category of Awarding Department (5 disciplines, FY 1973)

Department Roose–Andersen Rating	Percent, by Discipline				
	Chem	Econ	Elec Engr	English	Psych
4.0–5.0	12.1	3.6	8.3	16.1	11.4
3.0–3.9	17.2	4.9	14.5	22.8	14.8
2.5–2.9	13.6	5.7	21.9	17.1	11.3
2.0–2.4	17.2	6.2	18.6	21.5	16.7
1.5–1.9	26.3	7.2	10.5	23.9	12.2
0.0–1.4	20.0	11.1	25.0	29.4	12.0
Not rated	20.1	9.7	18.1	24.1	11.7
TOTAL	17.2	6.4	15.0	21.5	13.6

SOURCE: Data from NRC Doctorate Records File.

functioning of the labor market. The principal findings of this analysis are presented below for each of the site visit fields.[28]

English

The job market in this field remains almost exclusively academic. In FY 1968, 91 percent of the 858 new Ph.D.'s with definite employment plans had jobs in colleges and universities; by FY 1973, the figure had declined only slightly to 85 percent. The only other sizable category—foreign employment—accounted for approximately 6 percent of the jobs in FY 1968 and in FY 1973.

In FY 1968, 31 percent of the Ph.D.'s were placed in one of the Roose–Andersen rated university departments, and this figure declined to 24 percent in FY 1973. Very few new Ph.D.'s receive job offers from departments rated higher than their own (in FY 1973, only 13 percent of the new Ph.D.'s employed by rated departments moved to a higher rated department); because of this, a larger proportion of the graduates of top-rated departments take jobs in other Ph.D.-producing programs. The proportion of new graduates in each category taking positions in other rated English departments in FY 1973 is listed in Table 32. The low-rated departments are clearly not producing Ph.D.'s for other doctorate-producing departments; if a different type of degree program, such as the Doctor of Arts, should be developed for educating 4-year and 2-year college teachers, then, based on their placements, the lower rated departments should be at the forefront with such programs. Note also that the non-rated departments placed 17 percent of their graduates in rated departments, a higher proportion than any of the

[28] The tables from which the following data were taken were too cumbersome to reproduce in this report.

TABLE 32 Proportion of English Ph.D.'s Accepting First Jobs in Quality-Rated University Departments, by Quality Category of Awarding Department, Fiscal Year 1973

Department Roose–Andersen Rating	Percent Graduates Placed in Rated Departments
4.0–5.0	40.3
3.0–3.9	26.2
2.5–2.9	27.2
2.0–2.4	14.9
1.5–1.9	11.9
0.0–1.4	5.8
Not rated	17.3
TOTAL	24.1

SOURCE: Data from NRC Doctorate Records File.

three lowest rated groups. This is further evidence that some of the non-rated departments are producing Ph.D.'s with substantial research potential.

The heavy reliance of English and other humanities departments on academic placements, coupled with the dire forecasts of declining academic demand through the 1980's, means that these disciplines are going to face a prolonged period of severe labor market difficulty. We will examine some of the adjustments departments have made to this situation in the chapter on site visits.

Chemistry

The market for Ph.D. chemists is much more diverse and dynamic than the market for scholar–teachers in the humanities, as Table 33 demonstrates. Academic employment directly out of graduate school is much less common in chemistry than in a field such as English, and the proportion of new Ph.D.'s in such positions declined from 21 percent in FY 1968 to 15 percent in FY 1973. Postdoctoral positions jumped from 28 to 49 percent over the same period, while industrial placement declined steadily from 38 percent in FY 1968 to a low of 13 percent in FY 1972, rebounding to 21 percent in FY 1973. Foreign employment rose steadily until FY 1972, then dropped back to 8 percent in FY 1973, moving inversely with the changing U.S. industrial market over these years.

The increase in postdoctoral appointments to almost half of all new graduates reflects several factors. For those students aspiring to a university faculty position, a postdoctoral appointment has become almost mandatory, and would be accepted by such students in preference to most industrial jobs. The declining market in industry also forced many new graduates to accept postdoctoral positions as the only available opening. Many professors responded to the available supply of new Ph.D.'s by shifting support in their

TABLE 33 Distribution of First Positions Accepted by New Ph.D's in Chemistry, by Employment Category and Year

Type of Placement	First Position Distribution, by Fiscal Year (%)					
	1968	1969	1970	1971	1972	1973
Academic	20.6	20.3	18.0	17.7	19.8	15.2
Postdoctoral study	27.9	29.5	33.8	38.4	46.2	48.6
Industry	37.8	36.5	33.7	25.3	13.3	20.9
Foreign	5.8	6.7	7.0	11.0	11.2	7.9
Government	2.8	5.1	4.7	4.8	6.9	5.2
Other	5.1	1.9	2.8	2.8	2.6	2.2
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Data from NRC Doctorate Records File.

project grants from predoctoral research assistants to full-time postdoctoral students, thereby expanding the number of postdoctoral positions. (This response helps to equilibrate the labor market, for it operates to contract the supply of new Ph.D.'s by reducing support for graduate students, and on the demand side it increases the number of openings for recent graduates.) Finally, some departments that could not recruit the desired number of new Ph.D. candidates combined two teaching assistant salaries into one full-time salary of roughly $8,000 and hired recent Ph.D.'s as teaching postdoctorals. In short, the postdoctoral appointment has become very diverse, ranging from highly coveted opportunities to work under eminent scientists to thinly disguised and poorly paid teaching appointments. Above all, the position has provided a temporary "holding pattern" for many new Ph.D.'s during the period of greatest market difficulty.

Turning to differences in placement patterns by Roose–Andersen categories, several features point to different orientations in the interests or job possibilities that are available to graduates of the various departments. In both FY 1968 and FY 1973, the top-rated departments (3.0–5.0) tended to place a higher proportion of their students in postdoctoral positions and a lower proportion in industry relative to the lower rated departments. For example, in FY 1973 over 50 percent of the graduates from the top two groups accepted postdoctoral appointments, while the proportion fell to 36 percent from the 0.0–1.4-rated departments. Industrial placement increased steadily from 18 percent of the graduates of 4.0–5.0-rated departments to 26 percent of those from 0.0–1.4-rated departments. The non-rated departments, by contrast, placed 46 percent in postdoctoral positions and 22 percent in industry, falling roughly between the extremes of highest and lowest rated departments.

These figures confirm the stronger academic research orientation of students and faculty in the leading departments. Industrial placement is still viewed by many faculty in the top departments as appropriate for their less-gifted graduates. This attitude does not appear to have hurt the highest rated departments, however, for the statistics on employment prospects reported earlier (Table 31) show that graduates of the 4.0–5.0-rated departments have experienced significantly less labor market difficulty than any other group of chemistry graduates.

Economics

Although one might expect to find Ph.D. economists employed in a wide range of positions, the majority of new graduates accept academic appointments. In FY 1968, 64 percent of the new doctorates were employed by U.S. colleges and universities, declining moderately to 57 percent by FY 1973. Reflecting the large number of foreign students enrolled for graduate degrees in economics (over 25 percent of total enrollments), employment in

foreign countries is next in importance, accounting for 17 percent of new placements in both FY 1968 and FY 1973. Very few postdoctoral positions are available in this discipline (28 individuals reported such appointments in FY 1973), and the remainder of new graduates are sprinkled through government (9 percent), nonprofit firms other than colleges and universities (4 percent), industry (5 percent), and self-employed (4 percent). These figures, reported for FY 1973, have varied only slightly over the 6-year period under consideration, with each nonacademic category up by 1–2 percent.

We recall from Table 30 that, of the five site visit fields, graduates in economics had by far the least employment difficulty. What accounts for this? First, relative to several fields, the rate of increase in Ph.D. production in economics during the 6-year period was not very great, 26 percent, compared to 52 percent in English and 67 percent in psychology. Secondly, economics did not have an experience analogous to the sharp drop in industrial employment that afflicted chemistry, engineering, and physics during the 1970–1971 recession. Third, through much of the 1960's and into the 1970's there was a growing interest in the social sciences—particularly the quantitative disciplines, such as economics—and the field benefited from the development of such related areas as operations research, management science, and public policy analysis. Finally, since the majority of new Ph.D. graduates prefer academic employment and have been able to attain such positions, the nonacademic market has not yet been saturated.

Looking at placement patterns by the Roose–Andersen rating of the producing institutions reveals the familiar market differentiation we observed in the field of English. In FY 1973, the 4.0–5.0-rated departments placed 43 percent of their graduates in rated universities, and only 15 percent in all other types of academic institutions. By contrast, the 0.0–1.4 rated departments placed 58 percent of their graduates in the non-rated universities, colleges, and junior colleges, and only 15 percent in rated universities. The lower rated departments tended to place higher percentages of their students in government positions, but there were no significant differences by Roose–Andersen rating in the patterns of other types of nonacademic employment. On the basis of these recent employment patterns, one can understand why the highest rated departments maintain their emphasis on traditional Ph.D. education, oriented toward subsequent university employment; the more serious question must be raised in the lower rated departments that clearly are not serving such a market.

Psychology

As was pointed out earlier, psychology has been one of the most rapidly growing fields in recent years; between FY 1968 and FY 1973, the number of new Ph.D.'s for whom we have placement data increased by roughly 50 percent (from 1,324 to 1,971). Accompanying, and perhaps contributing to

this rapid growth rate, initial jo cements cover a wide range of employers, reflecting the diversity of terests and subdivisions within the field. In addition to general experimental psychology, with its orientation toward research and academic employment, programs in clinical psychology and counseling produce Ph.D. practitioners who are employed in hospitals, community mental health centers, schoo and business firms, as well as a substantial number who enter independent private practice. In many departments, the experimental psychologists and the clinical psychologists coexist uneasily, and, in a few universities, such as the University of Illinois, a separate degree—the Doctor of Psychology—is awarded to those in the clinical program.

Colleges and universities remain the largest employers of new Ph.D.'s, hiring 49 percent of new graduates in FY 1968 and 42 percent in FY 1973. The proportion accepting postdoctoral appointments has been remarkably stable over the six years at approximately 13 percent, as have the proportions in industry (4 percent) and the self-employed (6 percent). Foreign employment has accounted for 3–5 percent of new Ph.D.'s each year, while government (local, state, and federal) has increased steadily from 14 to 19 percent. In spite of the large increase in Ph.D. production, the employment distribution of new graduates has been relatively stable during the period under study.

Placement patterns by Roose–Andersen categories of producing institutions display several distinct features. The proportion of FY 1973 graduates who accepted academic positions was highest in the 4.0–5.0-rated departments (57 percent), and the proportion declined steadily by Roose–Andersen category to a low of 25 percent in the 0.0–1.4-rated departments. The only deviation from this pattern was the non-rated group, which placed 35 percent in colleges and universities (Table 34). The proportion of graduates employed by local, state, or federal government agencies also shows a distinct trend by Roose–Andersen category (Table 34), rising steadily from 6 percent in the highest rated departments to 38 percent in the lowest rated group, with the non-rated departments falling in the middle of the range. With other forms of placement (postdoctoral positions, industry, nonprofit, foreign, and self-employment) there were no significant variations in the employment pattern by Roose–Andersen grouping.

In most fields the highest-rated departments tend to place the largest percentage of students in academic positions, and psychology is no exception. However, a second factor underlies the trend differences of Table 34. In our discussions with faculty on the site visits, we learned that many of the highest rated psychology departments do not offer the clinical option, emphasizing instead the research-oriented subfields of general and experimental psychology. By contrast, in many of the lower rated departments, the clinical program is dominant. To a considerable degree, therefore, the place-

TABLE 34 Proportion of New Ph.D.'s in Psychology Accepting Academic and Governmental Employment, by Quality Category of Awarding Department, Fiscal Year 1973

Department Roose–Andersen Rating	Placement of New Ph.D.'s (%)	
	Academic	Local, State, and Federal Government
4.0–5.0	57	6
3.0–3.9	51	13
2.5–2.9	41	21
2.0–2.4	41	23
1.5–1.9	34	26
0.0–1.4	25	38
Not rated	35	20

SOURCE: Data from NRC Doctorate Records File.

ment patterns of Table 34 reflect differences in educational programs and in career orientation among the Roose–Andersen groupings.

These differences in departmental orientation also help to explain the unique trend in graduate enrollments in psychology departments, noted earlier in this chapter in connection with Table 6. We saw that psychology differed from other fields being studied in that there had been a pronounced enrollment shift over the 6-year period from the leading to the lower rated departments. From the site visits we learned that the great majority of applicants wanted to enter clinical programs, while the experimental programs were experiencing many of the same problems of declining research support and a diminished academic labor market that typify other scientific fields. The enrollment shifts, therefore, can be explained to a considerable degree by the different programs stressed by departments in the various Roose–Andersen categories. More specific details will be presented in the chapter on site visits.

Electrical Engineering

Industrial placement dominates the market for Ph.D.'s in electrical engineering, accounting for 40 percent or more of the first jobs taken in each of the six years. In FY 1968, a time of relatively strong academic demand, 30 percent of first placements were on college and university faculties, while 45 percent were in industry; in FY 1973, academic placements had shrunk to 19 percent, but industry still absorbed 43 percent. The relative stability of industrial demand for electrical engineers over the six years is in sharp contrast to the experience of chemists, where a sharp decline occurred. We are unable to provide a full explanation of this difference, but some speculative comments can be offered.

First, a simple scale factor may explain much of the difference; approximately three times as many Ph.D.'s were awarded in chemistry each year than were awarded in electrical engineering. Consequently, in FY 1968 the 38 percent of new chemistry Ph.D.'s placed in industry represented 628 placements, while the comparable figure for electrical engineering, 45 percent, represented 245 placements. A detailed analysis of the industries that hire doctorates in electrical engineering, together with an examination of the number and size of firms in each industry, might reveal that the 200-300 new hires in electrical engineering each year represent a basic minimum demand, which allows each firm to keep abreast of new research findings and techniques developed in the universities.

A related factor is the relative newness of the Ph.D. in electrical engineering by comparison with chemistry. Doctoral programs in chemistry are among the oldest in the country, while the doctorate in engineering is to a considerable extent a post-World War II phenomenon. This suggests that the ratio of the stock of employed Ph.D.'s to the annual flow of new doctorates will be higher in chemistry than in electrical engineering and may help to explain why there can be a greater variation in annual hiring by employers of chemistry Ph.D.'s.

Finally, the site visits indicated that the working relationships between many engineering departments and industry were much closer than is the case in chemistry. Many engineering faculty have spent a substantial part of their careers in industry, and know the educational needs of that market well. By contrast, industrial placement is still viewed by many chemistry professors as suitable only for poorer students, an attitude that is much less prevalent among engineering faculty. Although difficult to document, these attitudinal differences may contribute marginally to the explanation of the less volatile industrial market for new engineering Ph.D.'s.

As mentioned earlier, academic placement accounted for 31 percent of the first jobs in electrical engineering in FY 1968, and this had declined to 19 percent by FY 1973. Postdoctoral appointments are not as common in electrical engineering as in many scientific disciplines; only 22 new doctorates reported such positions in FY 1968 (4 percent), the number rising to 57 (10 percent) in FY 1973. Government employment (10 percent), foreign employment (11 percent), and work for nonprofit organizations (4 percent) round out the FY 1973 placement pattern.

Although only 11 percent of the FY 1973 Ph.D.'s accepted foreign employment (and this figure is up from 5 percent in FY 1968), over 30 percent of the graduate enrollment in electrical engineering departments is accounted for by foreign students.[29] Apparently a sizeable number of the foreign students in this field remain in this country after graduation, and many appear

[29] Data from the National Science Foundation student support surveys.

to have been able to secure satisfactory employment thus far. A separate and detailed study of financial support and job placement for foreign graduate students would be particularly useful in the interpretation of trends in fields such as engineering where they represent a significant share of total enrollment.

3 Site Visits

During the months of March–June 1974, we made site visits to 14 universities as part of this study.[30] These visits allowed us to probe behind the aggregate statistical trend data in order to understand more fully the dynamic processes that were producing the trends. For example, in disciplines where enrollment was falling, we wanted to know whether this was a result of student decisions not to apply or of departmental decisions to cut back program size; we were also interested in the effects of reduced financial support and the impacts of the declining labor market on enrollment trends. We also wished to investigate whether the changing fortunes of graduate education in recent years had led to significant program change in the graduate curricula of the various departments. And, of course, we were interested in the similarities and differences in adjustment in a diverse set of universities.

The universities were chosen to provide diversity along several dimensions: program quality as measured by the Roose–Andersen survey; type of control (public/private); geographic location; and new *vs.* established programs. The Roose–Andersen ratings of the departments in each of the five site visit fields are listed in Table 35 without identifying the departments by name; as the table indicates, the site visit departments provided representation of virtually all quality groups.

The site visits were conducted in the following manner. A 2-page description of the method and purposes of the study was sent in advance to the

[30] The universities are identified in footnote 9, page 12.

TABLE 35 Quality Ratings of Site Visit Departments (5 disciplines)

Chemistry	Electrical Engineering	Economics	Psychology	English
4.7	4.7	4.3	4.6	4.6
4.7	4.6	3.8	4.4	4.0
4.0	3.5	3.7	3.9	3.8
4.0	3.3	3.0	3.3	3.7
2.9	2.8	2.4	2.9	3.4
2.5	2.1	2.0	2.7	2.2
2.5	2.1	1.7	2.3	2.1
2.2	1.6	1.6	2.3	2.0
2.2	1.6	1.4	2.2	1.9
2.1	1.5	1.1	2.1	1.8
2.0	1.5	0.9	2.0	1.7
1.9	NR	0.7	2.0	1.4
1.8	NR	0.5	1.9	NR
NR	NR	NR	NR	NR

SOURCE: Unpublished Roose-Andersen survey data.

graduate dean at each university, who in turn circulated it to each of the five department chairmen or to the faculty member in charge of the graduate program committee. We did not request data from the departments, although several voluntarily supplied some; instead, we brought with us to the interviews six years' data on the individual department's enrollments, forms and sources of student support, Ph.D. production, and job placements for its graduates.[31] Our visits usually began with an hour's discussion with the graduate dean, followed by 1-hour interviews with one or more faculty members in the departmental office. The individuals interviewed usually included the chairman and/or the head of the graduate committee; in several instances, we talked with as many as four or five faculty members in a single department. We used the data we had brought as a stimulus to discussion, and sought explanations for whatever patterns were unique or noteworthy in a given department's data. We did not, however, force the interviews to follow a set pattern, finding instead that the topics raised spontaneously by departmental representatives were often of greatest value.

Some of the insights gained from the site visits have been incorporated into the interpretation of the statistical trends discussed in Chapter 2. In this section we will focus on additional aspects of the adjustment process that we gleaned from the site visits, and which are less amenable to quantitative treatment. The discussion will be organized around the 5 disciplines rather than the 14 universities.

[31] These data came from the National Science Foundation surveys of graduate student support, the National Research Council Doctorate Records File, and the U.S. Office of Education Higher Education General Information Survey (HEGIS) reports.

CHEMISTRY

Declining graduate enrollment in this field (see Table 1) is the dominant economic fact that worries and causes difficulties for most chemistry departments. Perhaps more than in any other field, graduate students are essential to the functioning of chemistry departments; the economy of the department is largely built around them. Graduate teaching assistants are essential to staff the large numbers of undergraduate laboratory sections, and graduate research assistants are equally essential to the production of faculty research. A drop in graduate enrollments, therefore, is keenly felt as a hardship by the department and by individual faculty members, and is strongly resisted by most departments.

What, then, accounts for the enrollment decline? Among the departments we visited, only two had adopted an explicit departmental policy of reduced enrollment, based on the diminished labor market prospects and declining financial support available to students. Although the enrollment decline does coincide with reduced student support, the majority of faculty we interviewed believe that the decline is a student response to the widely publicized labor market difficulties of Ph.D. chemists in the early 1970's. In fact, most departments are receiving fewer applications than in past years, indicating that students simply are not applying either for admission or for financial support. The departments' need for students plus the declining applicant pool has resulted in intense competition for students. The leading departments compete not just for numbers but for the limited pool of the most able applicants; this competition takes the form of steadily rising stipend offers and, in some cases, subsidized trips to visit the campus for the best candidates. The lower quality departments are in competition primarily on a numbers basis just to get their share of reasonably competent students. Some of the lower rated departments we visited did not have as many students as they wanted or could have supported, and were clearly applicant-limited.

An overview of the changes in student support in chemistry from FY 1968 to FY 1973 is useful background for this discussion. Table 36 reports student support data drawn from the matched departments covered by the NSF surveys. Between FY 1968 and FY 1973 fellowships, traineeships, and research assistantships declined, while teaching assistantships were up—a pattern common to the aggregated data examined in Chapter 2. The federal government has declined markedly as a source of support for chemistry students, with some of the slack picked up from institutional funds; particularly noteworthy, however, is the small proportion of students on self-support, both in FY 1968 (4 percent) and in FY 1973 (6 percent). This is consistent with the comment we received in many departments that potential chemistry students simply will not enroll unless they receive financial support; however, it is unlikely that increased support unaccompanied by improved labor

TABLE 36 Change in Type and Source of Full-time Graduate Student Support in 168 Doctorate-Granting Chemistry Departments, FY 1968–FY 1973

Student Support	Chem Support Recipients, by Fiscal Year[a] 1968	1973	Percent Change
Type of Support			
Fellowship and traineeship	3,846	1,798	−53
	28	16	
Research assistantship	3,770	3,047	−19
	28	27	
Teaching assistantship	5,170	5,404	+ 5
	38	49	
Other	760	902	+19
	6	8	
TOTAL	13,546	11,151	−18
Source of Support			
Federal	6,108	3,843	−43
	45	31	
Institution or State government	5,892	6,305	+ 7
	44	57	
Self, loans, family	526	695	+32
	4	6	
Other	1,020	668	−35
	7	6	
TOTAL	13,546	11,151	−18

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students receiving that form of support in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

market prospects will increase total enrollments by much. (Were more portable fellowships awarded, enrollments would probably shift to those higher rated departments willing and able to expand.)

One of the significant economic responses departments have made over the last six years has been the substitutions of postdoctoral appointments for predoctoral research and teaching assistantships. The limited pool of predoctoral applicants coupled with growing supplies of new Ph.D.'s seeking employment made this an obvious and understandable shift. Several departments also pointed out that the relative costs of the two forms of labor had changed to favor the appointment of postdoctorates; a half-time research assistant who is less experienced might cost a faculty member's grant $5,000–$6,000 (more if the grant had to cover tuition), while a more experienced, full-time postdoctorate could be hired for $8,000–$9,000. Virtually every department mentioned a shift in faculty research proposals from predoctoral to postdoctoral support, which explains some of the decline in

research assistantships evident in Table 36. One professor was very worried that this trend, if carried to its logical conclusion, would result in separate research institutes divorced from graduate and undergraduate education and staffed entirely by faculty and postdoctorates.

We also encountered a similar substitution occurring in one of the lower rated departments. In this instance, the department could not attract a sufficient number of doctoral students, and therefore combined teaching assistant stipends into a single salary of approximately $7500 and hired postdoctorates to cover the lab sections formerly conducted by graduate students. In their spare time, these teaching–research fellows could engage in research, but the time for this was very limited by comparison with a normal postdoctoral position. This repackaging of graduate support into postdoctoral stipends is further evidence that total graduate enrollment in this field has not been support-limited.

This last conclusion must be tempered by the observation that the virtual elimination of federal fellowships and traineeships has left chemistry departments heavily dependent on teaching and research assistantships for student support. Research funds had held steady or increased in most of the leading departments that we visited, while a substantial increase in undergraduate chemistry enrollments in recent years had provided most departments with additional teaching assistantships. Should either of these forms of support fall off significantly, however, most departments would be hard pressed to maintain graduate enrollments at current levels.

Of the 14 departments visited, the lowest rated departments clearly were experiencing the greatest stress in terms of both reduced resources and enrollments. The Ph.D. program in one low-rated department had been slated for elimination by the administration, and the department was desperately petitioning for a 3-year probationary period, during which time it hoped to become self-supporting. That department had entered a vicious circle, with falling undergraduate and graduate enrollments leading to loss of faculty (down from 14 to 10) and loss of research grants. A second low-rated department was having similar difficulty, having lost three faculty positions (from 16 to 13), a decline of external grant funds from $250,000 to $100,000, and fewer graduate students. In this case, undergraduate enrollments had gone up considerably, but the loss of faculty and graduate students was forcing the teaching load up and making it harder for the faculty to write good research proposals. The possibility of both these departments losing their Ph.D. programs is not hard to foresee, and this would accurately be interpreted as simple economic pressures eliminating the marginal departments.

By comparison, the leading departments that we visited were experiencing some pressures, but hardly as severe as those in the lower rated groups. The top two departments had had stable enrollments over the 6-year period and were still supporting all of their students. Increased teaching and re-

search asisstantships had offset the loss of fellowships, and external research funds had climbed steadily (although inflation was keeping the dollar volume roughly constant in real terms). One of these department chairmen could honestly report that the phrase "new depression in higher education" had no meaning for him, while the other clearly believed that the financial situation was tenuous and could turn against the department at any time.

The principal complaint of middle-rated departments was the shortage of graduate students; the graduate student–faculty ratio had fallen too low for optimal functioning in these departments. The productivity of research groups can be severely diminished if the professor does not have a balanced grouping of new doctoral students, advanced students, and postdoctorates, with replacements ready as individuals leave the group. An improvement in the Ph.D. labor market and increased research funding were seen as the highest priority needs by these departments.

We found little evidence of programmatic change in the departments visited. Some of the lower-rated departments were stressing analytical chemistry, which has low research prestige but does provide skills in demand by industry. Most of the departments are encouraging somewhat broader course work in order to give their graduates greater flexibility in the job market. One new program that we encountered was an applied master's program in forensic chemistry. This program was proving immensely popular with the more career-oriented students of today, but the department's reaction was one of irritation, for the master's program was seen as competition for potential doctoral students.

ENGLISH

Our dominant impression from the 14 site visits to English departments was the mood of despair that seems to have gripped these departments. Job placements for Ph.D.'s in English have been difficult since 1970; however, the labor market had taken a qualitatively sharp turn for the worse in 1974, and the departmental representatives we visited were very upset by the placement experience of their current crop of candidates. Statistics from a few of the departments indicate the severity of the problem (these data were collected in April–May, 1974, near the end of the normal recruiting period):

- A well-rated public university department with 40 candidates in the market had placed 12.
- A high-rated private department had placed 7 out of 21 of its current graduates. The department was assisting over 60 individuals in job search, including former students who had not received tenure on the first job, and had placed only 15.

• A high-rated private department with 35 students seeking jobs had placed 13; of the 18 white males seeking positions, only 3 had been placed.

• A high-rated public department with 50 graduates on the market had placed only 11, and several of these were 1-year, terminal appointments.

Some of these job seekers will find positions later in the year, and others will withdraw from the market until next year, but many will have to settle for nonacademic employment. This steadily deteriorating job situation, with no early end in sight, is the principal cause of the depressed spirits one currently finds in most English departments (and, we suspect, in many other humanities departments).

In this connection, the response of potential new graduate students is particularly interesting. Unlike the field of chemistry, where the labor market downturn prompted a fall-off in applications to graduate school, in English the application rate at most departments remains strong. A few of the departments we visted are sending very discouraging letters to individuals who inquire about graduate study, describing recent labor market experience and indicating that there can be no guarantee of an academic job upon graduation. In spite of this information, applications remain high.[32]

When asked how they would explain this behavior on the part of potential students, departmental representatives said that each applicant seems to believe that he or she will be the exception to the general labor market pattern and will receive a satisfactory teaching position. In addition, many applicants state that no matter how bleak the outlook, graduate school is still the most desirable option they have. Also, students in the humanities do not appear to view graduate education in investment terms to the same degree as chemists, business administration majors, and engineers. Whatever the precise reasons, the fact remains that, in spite of the widely known labor market difficulties facing humanities Ph.D.'s, most of the departments we visited were not experiencing a shortage of applicants; in fact, their problem is to determine how many students to admit given the poor labor market prospects, yet faced with continuing applicant demand.

[32] The following note was reported in the September 1974 newsletter of the Council of Graduate Schools in the United States:

> The Modern Language Association has issued a survey of the employment status of Ph.D.'s in English and A.B.D.'s. The results are bleak. The M.L.A. survey indicates that no more than one-half of the above have "any realistic present expectations of an academic job in 1974-75."
>
> The results of the survey show that 510 Ph.D.'s and 551 A.B.D.'s were seeking employment, of these, 246 Ph.D.'s and 383 A.B.D.'s stated that they had no realistic hope of receiving a permanent or part-time teaching position in academe.
>
> Despite this trend, there is no significant decline in graduate enrollments according to English departments surveyed.

This problem requires elaboration. No faculty member enjoys having his or her graduate students experience great difficulty in finding a suitable job upon graduation. When this individual distress is linked to the grim projections of Ph.D. demand through the 1980's, the result is a powerful argument for reduced graduate enrollments. Countering this are two pressures, one philosophical and one based on self-interest. Virtually all faculty members believe advanced education is good in itself, and that qualified students should not be denied the opportunity to continue their education on the basis of labor market forecasts.[33] Secondly, university and department budgets are generally determined by enrollment levels, and graduate enrollments are often weighted heavily in state-funding formulae.[34] Furthermore, a sizable graduate enrollment is necessary if a wide range of advanced seminars is to be offered, and these are courses that faculty value most highly. Most English departments are struggling to reconcile these conflicting pressures in setting their admission and enrollment levels.

A related issue concerns the economic role of the graduate student in a humanities department such as English. Unlike the sciences, graduate students are not essential to the faculty member's own research; there are virtually no research assistantships in an English department. Graduate students do serve as teaching assistants, and in most state universities these assistantships are funded directly by the state as a cost of undergraduate instruction (in private universities, teaching assistantships are funded by the institution, also as a cost of undergraduate education). If graduate enrollments are cut substantially, then the regular faculty will have to do more undergraduate teaching and would have time to do so since fewer graduate seminars can be offered. Apart from the effect this shift would have on the cost of undergraduate instruction, below a certain graduate enrollment level a Ph.D. program could not be maintained. Departments differ in their assessments of the size of this "critical mass" required by a doctoral program, but they have an idea of where that level is for them, and this enters into the debate over enrollment levels.

We have discussed these issues at length because most of the departments we visited are reducing their graduate enrollments as a conscious policy decision. Because data on graduate enrollments in English are available only through 1971, we do not know how total enrollments have moved in recent years; however, if the site visit departments are representative, enrollments must be down. Two of the large departments visited had enrolled approxi-

[33] This point of view was also strongly endorsed by the National Board on Graduate Education in the report, *Doctorate Manpower Forecasts and Policy* (Washington, D.C.: National Academy of Sciences, 1973), pp. 1–5.

[34] A discussion of the incentive effects of these funding formulae is contained in David W. Breneman, *An Economic Theory of Ph.D. Production: The Case at Berkeley*, Ford Foundation Program for Research in University Administration, Paper P-8 (Berkeley: University of California, 1970).

mately 600 graduate students in the middle and late 1960's; both are below 400 now, with one aiming for 200 and the other uncertain, but still dropping. Smaller departments were making less dramatic reductions, but virtually all were cutting back to some degree. (One small department had seriously considered dropping the doctoral program two years ago because of the oversupply of Ph.D.'s, but the faculty were convinced not to do so by students who stressed the unique values of the smaller, less impersonal, program.)

Teaching assistantships are the principal source of financial support for graduate students in English, and many students are self-financing. In several of the departments we visited, undergraduate enrollments and majors have fallen sharply, and this has reduced the number of graduate assistantships. Several faculty members expressed concern that access to graduate work in English would increasingly be limited to those wealthy enough to pay their own way, and that this segregation by socioeconomic class would not be healthy for the discipline.

Many English faculty are searching for nonacademic outlets for their graduates, but we did not encounter any striking innovations responding to this need. A few departments are cultivating the community college market, particularly for in-service personnel, by offering Doctor of Arts programs in the evening.[35] Others are reinstating more composition courses in the hope that this will prove attractive to some employers, while many seem resigned to the prospect of declining graduate enrollments and more undergraduate teaching. Most English departments are not happy places these days, and, although the conditions seem ripe for change, no alternative model has emerged as yet.

PSYCHOLOGY

Trends in this discipline run counter to those in the other site visit fields, and the explanations are not completely obvious. We know from the previous chapter that graduate enrollments have increased significantly in psychology in recent years, but that enrollments in the top-rated departments have declined. We also know from the site visits that the presence of a clinical program in a department, and its degree of emphasis, has an important bearing on the economic behavior of the department. Table 37 provides still further information from the matched departments covered by the NSF surveys of graduate student support. In contrast with most physical science

[35] It should be noted that there are some special programs for the preparation of community college teachers of English in departments not included in the site visits. The list would include programs at the University of Massachusetts, Amherst; City College of the City University of New York; the University of Iowa; the University of Texas at Austin; and the University of Florida.

TABLE 37 Change in Type and Source of Full-time Graduate Student Support in 110 Doctorate-Granting Psychology Departments, FY 1968–FY 1973

Student Support	Psych Support Recipients, by Fiscal Year[a] 1968	1973	Percent Change
Type of Support			
Fellowship and traineeship	3,621	3,474	— 4
	43	33	
Research assistantship	1,383	1,257	— 9
	16	12	
Teaching assistantship	1,617	2,243	+39
	19	21	
Other	1,871	3,621	+94
	22	34	
TOTAL	8,492	10,595	+25
Source of Support			
Federal	4,072	3,720	— 9
	48	35	
Institution or State Government	2,769	3,671	+33
	32	35	
Self, loans, family	1,244	2,467	+98
	15	23	
Other	407	737	+81
	5	7	
TOTAL	8,492	10,595	+25

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students receiving that form of support in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

fields, over the 6-year period fellowships and traineeships declined only slightly and the number of federally-supported students fell by less than 10 percent. Teaching assistantships were up by almost 40 percent, while the number of self-supporting students doubled, with nearly 25 percent of the students in these departments self-financing in FY 1973. Can these various facts be combined into a coherent and accurate explanation of the forces bearing on the nation's psychology departments?

A first consideration is that the high-rated departments, with few exceptions, either do not offer clinical programs or have only a limited clinical emphasis, often with a research rather than a practitioner orientation. By contrast, in many of the lower rated departments, the clinical and counseling programs are dominant, and there is an explicit focus on turning out professional clinicians who will find employment outside of academe. In addition, the large majority of applicants nationally are interested in clinical programs rather than the more research-oriented subdivisions of psychology.

These two factors combine to explain why many students are attracted to departments that have relatively low Roose–Andersen ratings.

A second consideration is the difference in policies that various departments have with respect to student support. Several of the high-rated departments we visited stated that the department has traditionally limited enrollment to the number of students that can be given full financial support for at least four years. As funds for support have declined, these departments have simply cut back on new admissions. On the other hand, the lower rated departments we visited were either not firmly wedded to this policy or had never been affluent enough to adopt it; several of these departments were admitting (and enrolling) sizable proportions of their first-year students without support. We checked these site visit observations against the data from the NSF student support surveys; Table 38 reports by Roose–Andersen grouping the percentage of total full-time enrollment financed by self, loans, or family in FY 1973. These data indicate very clearly that the reduced enrollments in the highest rated departments reflects a self-imposed policy decision made by those departments. A substantial number of students are willing and able to finance their own graduate study in psychology (nearly 2,500 students were doing so in FY 1973), but were effectively being denied that opportunity in the highest rated departments. One can question whether these departments are acting in the best interests of the qualified students whom they reject because the department cannot ensure full financial support.

The difference in experimental *vs.* clinical orientation may help to explain the policy differences noted above. The expectation in the highest rated departments is that most graduates will follow an academic, research career, while the graduates of clinical programs are preparing more generally for careers as professional practitioners. It is much less common for students in professional degree programs to receive full financial support, and those psychology programs with a heavy clinical emphasis may be more closely allied

TABLE 38 Proportion of Total Full-Time Graduate Students in 110 Doctorate-Granting Psychology Departments Receiving Primary Support from Self, Loans, or Family, by Quality Category, Fiscal Year 1973

Roose–Andersen Rating	Percent Self-Supported
4.0–5.0	6
3.0–3.9	15
2.5–2.9	19
2.0–2.4	28
1.5–1.9	36
0.0–1.4	33
Not rated	26
TOTAL	23

SOURCE: Data from NSF Graduate Student Support Surveys.

to this tradition than to the tradition in scientific fields of providing full support.

By comparison with most other graduate fields, the problems facing psychology departments are minor. The numbers of applications for graduate admission dwarf those in all other fields; several of the site visit departments were receiving over 1,000 inquiries and several hundred completed applications for 20–30 positions. Only two departments out of 14 were experiencing serious enrollment and support problems, and these were both relatively low-rated departments—one private and one public—that did not have a clinical option. Both departments had limited funds for student support and were not strong enough academically to compete effectively for high talent students seeking the Ph.D. for a research career. These two departments were still able to enroll students without providing financial support, but the chairmen were clearly worried that the students would not be able to devote full time to their studies and expected several to drop out before completing the degree.

Job placement for new Ph.D.'s was becoming a problem for most departments, particularly those that stress preparation for research careers. The academic market was seen to be clearly weaker than that for nonacademic positions, and several departments reported that their research-oriented students were beginning to hedge their bets by taking some work in the clinical program. This search for more flexible training seems to be the major student response to the changing environment for the graduate-educated.

ECONOMICS

Of the five site visit fields, economics stands out as the one with the least apparent difficulties. Not one of the 14 departments expressed any serious concerns about enrollment levels, student support, or job placements. Change in federal policy toward graduate education has not affected this discipline to the degree that it has other fields because economics departments have never relied that heavily on federal support. As we have seen in the previous chapter, new Ph.D.'s in economics have had far less difficulty in the labor market than have graduates in the other four fields. Table 39 reports on trends in type and source of student support from the matched departments in the NSF surveys; the changes reported are minimal by comparison with other fields. Fellowships are down 25 percent, but other support levels were virtually unchanged. Self-support was up 25 percent but note that, even in FY 1968, 23 percent of the students in these departments were self-supporting, so the change does not represent a major break with past experience. Enrollments were down 8 percent; however, this is not attributable to any overriding cause, but rather to a multitude of reasons—often specific to a given department. In terms of the graduate program, the

TABLE 39 Change in Type and Source of Full-time Graduate Student Support in 80 Doctorate-Granting Economics Departments, FY 1968–FY 1973

Student Support	Econ Support Recipients, by Fiscal Year[a] 1968	1973	Percent Change
Type of Support			
Fellowship and Traineeship	1,906	1,436	−25
	35	29	
Research assistantship	686	653	− 5
	13	13	
Teaching assistantship	1,120	1,118	0
	21	22	
Other	1,719	1,774	+ 3
	31	36	
TOTAL	5,431	4,981	− 8
Source of Support			
Federal	1,057	783	−26
	19	16	
Institution or state government	2,336	2,093	−10
	43	42	
Self, loans, family	1,237	1,545	+25
	23	31	
Other	801	560	−30
	15	11	
TOTAL	5,431	4,981	− 8

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students receiving that form of support in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

general impression we gained from these visits was that the term "new depression in higher education" did not have much meaning to departments of economics.

With a few exceptions, another feature of the economics departments we visited was the intense awareness of the "pecking order" within the discipline and the strong drive on the part of lower rated departments to improve the department's standing. Several of the faculty in these departments were pleased that the academic labor market was softening, because this meant they could attract new Ph.D.'s from the "top" departments and strengthen their own departments. The way to improved standing in the profession is clearly perceived to be by maximizing the number of faculty publications, and as economists, administrators of these departments have employed some fairly straightforward incentive mechanisms. For example, one chairman

noted with pride that, although the department had produced only 1 publication between 1958 and 1968, 11 had been published between 1968 and 1971. The incentive system was simple: newly appointed assistant professors were initially given a split teaching load of two courses first semester, and three the second. If, after three years, no publications were forthcoming, the teaching load was increased to three and three, and the professor would be let go after one reappointment. On the other hand, if the professor had published, the teaching load would drop to two and two, and he or she would be retained. The chairman, a relatively young, aggressive person kept a precise record of his department's publication rate relative to other universities in the region, and argued that his department had surpassed most of its higher rated neighbors in the years since the publication of the Roose–Andersen report.

We posed the following question to a number of the lower rated departments: If 50 departments could adequately produce all the Ph.D. economists that society could employ, how could they justify the Ph.D. program in their institution in terms of rational resource allocation? Several of the chairmen agreed with the basic proposition that there were too many Ph.D. programs in existence; however, they also assured us that an up-to-date evaluation would easily place their department within the top 50. None of the departments we visited thought that a sound case could be made for eliminating their doctoral program.

Lest we leave the impression that economics departments share a monolithic orientation, one further example should be provided. One low-rated department was described to us as a rather deadly place. Promotion was based more on "fitting in" and not rocking the boat, very little research was carried on, and the Ph.D. program attracted largely regional residents of low academic quality. The department has been this way for at least a decade, but can sustain itself very satisfactorily by not changing. The occasional student who earns a Ph.D. either finds academic employment in obscure local colleges, or accepts employment with government agencies or private firms within the region. Although the department did not sound particularly healthy or attractive, it had clearly established itself in an "ecological niche" and was apparently well suited to the type of student it was serving. One feels it would be a mistake for this department to set out to become the Berkeley of that area, but what is disturbing is that there seems to be no alternative model that departments can follow to improve themselves. When a chairman speaks of raising the quality of a department, this means hiring people who publish. And yet, it may be that a department such as the one described would be better advised to develop a high-quality program for practitioners rather than attempt to turn out research scholars. This seems entirely feasible in a field such as economics, but no recognized standards seem to exist to guide the development of such a program. The question of how to improve the quality of such a program without turning it into a pale

imitation of established research departments accents the need for alternative. professionally acceptable models of graduate education.[36]

The principal program change we observed in the departments visited was an increase in terminal master's programs, often offered at night on a part-time basis to local residents. These are relatively costless to the departments and were begun, in part, because undergraduate enrollments in economics declined briefly in the late 1960's and the departments needed additional enrollments to maintain their budgeted faculty slots. That pressure is abating as undergraduate economics enrollments are increasing once again.

ELECTRICAL ENGINEERING

In no other discipline that we studied is the contrast between the highest rated and lowest rated departments so striking, and so totally contrary to the "Gresham's Law" hypothesis. Several of the lowest rated departments have a Ph.D. program for all practical purposes in name only, with few if any students and virtually no external funding, while the highest rated programs have weathered the recent difficult years for engineering in excellent shape, with enrollments and research support stable or expanding. The range in resource availability among the high and low-rated departments we visited is enormous; from 6 to 63 faculty, from virtually no external research funding to over $6 million annually, from 15–20 to 750–800 graduate applications annually, and from less than 10 to over 400 graduate students enrolled. If there is to be a culling out process in this discipline in the future, it is clear that the lower quality departments will be the losers.

Table 40 presents the aggregate shifts in type and source of graduate student support over the 6-year period, with data from the matched departments covered by the NSF surveys of graduate student support. A marked decline in federal support is obvious, principally as a reduction in fellowships and traineeships. The percentage decline in number of fellowships and traineeships by Roose–Andersen category over this period is reported in Table 41. The pattern of decline was such that the 4.0–5.0-rated departments had 21 percent of the fellowships and traineeships in FY 1968 and 31 percent in FY 1973. The 3.0–3.9-rated departments maintained a stable 37 percent of the total, while every other rated category had a declining share, with the exception of the non-rated departments, which increased slightly.

[36] This point is difficult to reconcile with another conclusion of this study, namely that we need to up-date the American Council on Education quality ratings of graduate programs. Perhaps these two conclusions cannot be reconciled as long as a single degree, the Ph.D., is awarded for programs with diverse orientations. Greater use of such professional degree titles as Doctor of Engineering, Doctor of Psychology, etc., for practitioner programs might solve this problem.

TABLE 40 Change in Type and Source of Full-Time Graduate Student Support in 95 Doctorate-Granting Electrical Engineering Departments, FY 1968–FY 1973

Student Support	Elec Engr Support Recipients, by Fiscal Year[a] 1968	1973	Percent Change
Type of Support			
Fellowship and traineeship	2,015	887	−56
	27	13	
Research assistantships	1,905	1,932	+ 1
	26	29	
Teaching assistantship	1,203	1,351	+12
	16	20	
Other	2,297	2,555	+11
	31	38	
TOTAL	7,420	6,725	− 9
Source of Support			
Federal	3,277	2,139	−35
	44	32	
Institution or state government	1,639	1,933	+18
	22	29	
Self, loans, family	1,245	1,936	+56
	17	29	
Other	1,259	717	−43
	17	10	
TOTAL	7,420	6,725	− 9

[a] *Number of students* is the first figure given, followed by *vertical percentage*, i.e., the proportion of students receiving that form of support in that year.
SOURCE: Data from NSF Graduate Student Support Surveys.

The increase in the number of students on self-support to nearly 30 percent of the total must be tempered by the recognition that a large proportion of the graduate students in electrical engineering are terminal master's

TABLE 41 Percentage Decline in Number of Fellowships and Traineeships in 95 Electrical Engineering Departments from FY 1968 to FY 1973, by Quality Category

Roose–Andersen Rating	Percent Decline
4.0–5.0	36
3.0–3.9	56
2.5–2.9	63
2.0–2.4	77
1.5–1.9	69
0.0–1.4	75
Not rated	48

SOURCE: Data from NSF Graduate Student Support Surveys.

candidates, often in 1-year programs. These M.S. candidates are included in the figures, but in many departments they do not receive financial support, such funds being reserved for doctoral candidates. Although some Ph.D. students are self-supporting, the numbers are far smaller than the figures in Table 40 might suggest.

Graduate enrollments in electrical engineering declined by 9 percent over the 6-year period studied (see Table 3, p. 21), and most faculty we interviewed thought this was largely a student response to the poor labor market of the early 1970's, rather than a function of the decline in student support. Several departments reported that good students graduating with B.S. degrees were nervous about job prospects and tended to accept employment if it were offered rather than continue their formal education. Some of the departments we visited actually had funds for student support going unclaimed for want of good applicants. On the other hand, several departments reported an upsurge in graduate applications this year, and most were relatively optimistic about the future. They pointed to increasing undergraduate enrollments in engineering, to the research stimulus their discipline was receiving from the energy crisis, and to a belief that the anti-technology sentiment of the late 1960's was waning. Although the academic market for Ph.D.'s was not expected to improve, corporate recruiters were back on campus in larger numbers and industrial placements were expected to increase.

The growing proportion of foreign graduate students was a source of concern to several departments. While total full-time enrollment in these matched departments decreased from 7420 to 6725 over the 6-year period, foreign student enrollments rose from 1622 to 2322, increasing from 22 percent to 35 percent of the total. During this period of declining U.S. citizen enrollments, departments were clearly relying on foreign students to keep enrollment from falling precipitously. The departments were worried by this trend for several reasons. First, in the public institutions, there was concern that state legislators would question the use of state tax dollars to subsidize the advanced education of large numbers of foreign students. Secondly, providing financial support for foreign students in a period of uncertain funding was a growing problem; several departments had begun to insist that the students have their own guaranteed source of funds before they could be admitted. Third, many foreign graduates hope to remain in this country after graduation, but employment opportunities had worsened for such students in recent years. Several departments indicated that they were cutting back foreign student admissions, and this is borne out by the aggregate NSF statistics on first-year foreign enrollments, which peaked in FY 1970 at 913, declining to 799 by FY 1973. As U.S. applications increase, it seems likely that many departments will substitute U.S. citizens for foreign student applicants.

It is also worth noting that, unlike many disciplines, engineering departments take their master's programs very seriously, for students and employers view the degree as having real value. Several departments in major cities are expanding their evening and part-time master's level course offerings, and many companies provide employees with release time and tuition payments for such course work. One of the site visit departments was offering graduate courses on videotape to industrial employees in off-campus centers. One of the leading departments had just begun a Doctor of Engineering option to the Ph.D. in order to provide training desired by some students and some employers. In a field such as this where many faculty have spent part of their own careers in industry, many of the criticisms of graduate education as being unresponsive to student and employer needs are simply not warranted.

GRADUATE DEANS

The role and influence of the graduate dean varied considerably among the institutions we visited. Many of the graduate deans have relatively little budget authority; they typically do not control allocation of faculty positions, teaching and research assistantships, or the institution's own research funds. Many do control the institution's own fellowship funds; in some institutions the graduate dean's office can influence the size of graduate enrollments, although in most universities this is still a departmental decision. In several of the universities visited, the principal activity of the dean's office is to keep records and to enforce university-wide policies regarding graduate degree programs. In general, most of the graduate deans in the visited institutions have very limited resources with which to influence departmental behavior; their principal resource is their skill in the art of persuasion.

Because of this limited budget authority, it is unrealistic to expect the dean's office to be a powerful force for change in graduate education. Furthermore, the departments can often block changes that deans hope to implement. A few examples gathered from the site visits are revealing on this last point.

At one major university, the Board of Regents had decreed that the university's fellowship funds should be distributed to graduate students on the basis of financial need rather than on academic merit alone. The graduate dean supported this policy and informed departments that his office would apply a needs test in awarding aid. This policy so outraged the chemistry department in that institution that the department completely withdrew from the university-wide competition for fellowship funds. The department felt that a needs test for graduate students was demeaning, and the faculty were able and willing to support students with the department's own funds

plus teaching assistantships. (Because teaching assistantships involve pay for service, stipend levels are not subject to variation based on financial need.)

The economics department in this same university was shocked when it received carbon copies of the letters announcing fellowship awards to some of its best applicants of as little as $500 plus tuition, and promptly drew on private departmental funds to supplement the dean's offers, bringing the total stipend offer to the nationally competitive level. The dean was upset both by the ability of individual departments to frustrate the new policy and by the evidence that so many departments around the country were not applying needs tests, hence putting his university at a competitive disadvantage (more on this subject below).

At another of the institutions visited, the graduate dean was actively committed to major change in graduate education. His opening comment to us was that graduate education as traditionally conducted was obsolete, and that universities had to begin educating for the twenty-first century. He had assembled five task forces to work on the issues of recruitment, placement, self-help through friends of the graduate school, future planning, and program evaluation. The recruitment task force was focusing on new clientele groups, including older persons, shut-ins, and women with families. The self-help task force was investigating the use of local, industrial talent to teach certain courses, and the future planning task force was examining the implications of the fact that most current graduate students would spend the bulk of their careers in the twenty-first century. The dean exuded such enthusiasm for the reforms under way that we went to the department visits with high expectations. The first two departments, chemistry and economics, made it clear that the dean had a struggle on his hands, for both departments had an unambiguous orientation toward the discipline and toward increased prestige, defined in the traditional manner. They were vaguely aware that the new graduate dean (he had been in office for six months) had been giving speeches about the need for change in graduate education, but this clearly had not affected them yet. A return visit to this university in two or three years would be most revealing.

We asked most deans about the effects of federal cutbacks on their graduate schools, and particularly about which cuts had been most damaging. Several deans cited the loss of the cost of education allowances that accompanied most federal fellowships as being particularly damaging, for these funds were apparently available as a discretionary source of income to the graduate school, and helped to finance other students.

Finally, we discussed the issue of merit *vs.* need in the awarding of support funds to graduate students. The Educational Testing Service has recently prepared a financial need analysis form for graduate and professional students, called the Graduate and Professional School Financial Aid Service (GAPSFAS). In addition to the applicant's section, there are separate (and

optional) sections for spouse and parents' income and assets. The use of this form as part of the application process for financial aid is extremely controversial in most universities; many faculty do not approve of need analysis for graduate students, and the request for data on parents' income is offensive to many students, faculty, and deans. Many believe that need analysis for graduate students is going counter to the national trend toward a lower age of majority and earlier financial independence from parents. There is also a serious implementation problem since many sources of graduate student support are not under the control of a central financial aid office. Individual faculty members often control the selection and support level for graduate research assistantships, with funds drawn from the professor's own grant, and teaching assistantships, as mentioned earlier, are not allocated on the basis of need. The combination of practical and philosophical concerns make this an issue of intense debate and disagreement on most campuses.

As one would expect under such circumstances, there is wide variation in the policies followed in the universities, but most institutions that we visited were not using the needs analysis. Many of the lower rated departments do not have large enough applicant pools to allow the luxury of applying a financal need analysis; in order to enroll the desired number of qualified students, these departments have to offer (or believe they have to offer) their largest stipends to their best applicants regardless of need. The high-rated departments have much larger applicant pools, but these departments compete intensely for the limited number of highly talented students, and an important part of the competition is financial, in the form of stipend offers. The only likely resolution of this competitive dilemma would be a cartel-like agreement among the large graduate schools to apply a common needs test uniformly, but even if the graduate deans agree to that, the problem of controlling those departments that have their own funds would remain. An early solution does not seem likely.

One final, overall impression that we received and which we found disturbing was the apparent absence in many of the universities visited of an active and effective process of internal evaluation of graduate programs. In a time of diminished resources, the existence of a process for discontinuing weak or ineffective programs, and reallocating resources to maintain strength where it currently exists and to encourage growth of new and promising areas would seem essential; yet we saw little evidence of such planning processes. This may be a further reflection of the lack of budgetary power in the graduate dean's office for, in those cases where there was an effective internal evaluation process, the dean either had substantial budget control through a dual administrative appointment or was closely tied to planning and budgeting through the university president's office. We are reluctant to speculate or generalize further on this subject, but it is clearly an important topic for further investigation.

4 Summary, Conclusions, and Implications of the Study

SUMMARY OF PRINCIPAL FINDINGS

Our investigation of trends in graduate enrollments, graduate student support, and first job placements of new Ph.D.'s in several academic disciplines over the 6-year period, FY 1968–FY 1973, together with site visits at fourteen universities, revealed the following information about the adjustment of graduate programs to the "new depression" in higher education:

1. Enrollment data in 13 of the 14 disciplines studied did not support the view that a "Gresham's Law of Ph.D. enrollments" had operated to produce a major shift in graduate enrollments from higher to lower rated programs. In its more extreme form ("low-quality departments driving out high-quality departments") the "Gresham's Law" hypothesis is simply inaccurate and misleading as a description of graduate enrollment trends in recent years. In several disciplines, some leading departments[37] did reduce enrollments in the early 1970's, but this appears to have been a one-time downward adjustment rather than the beginning of a trend. Although many of the non-rated departments did continue to expand over the period under study, their growth rate dropped significantly in later years. In the majority of disciplines studied, the result was a general stability in the percentage dis-

[37] As defined in the American Council on Education publication. *A Rating of Graduate Programs*, *op. cit.*

tribution of graduate enrollments among quality categories over this period of adjustment.

2. The cutbacks in federal support for graduate students have had a larger *absolute* impact on the highest rated departments because they are the largest departments and have the most federally supported students, but these departments have not suffered *disproportionately* relative to the others. Federal support for graduate students, although much diminished, was slightly more concentrated in leading departments in FY 1973 than in FY 1968.

3. Private universities enrolled a slightly smaller proportion of graduate students in the fields under study in FY 1973 than in FY 1968, but the highest rated graduate departments in private institutions actually increased their proportion of enrollments relative to comparably rated public university departments. In addition, over the 6-year period, there was very little change in the distribution of fellowships and traineeships, teaching assistantships, and research assistantships between public and private university departments.

4. The doctoral programs that are facing a genuine crisis of survival are primarily located in the smaller, less prestigious departments, often in poorly financed private universities and in the lesser known public institutions.

5. The financial stress and changing labor market conditions experienced by departments in the "Arts and Sciences" disciplines have not stimulated many major program changes. Most departments visited in the course of this study seem to be following what has been labeled elsewhere[38] as an "enclave" strategy. i.e., a conservative strategy designed to maintain the status quo. (One exception to this is occurring in some of the weaker departments that are searching for new ways to attract graduate students.) During the site visits we observed little evidence of leadership on the part of graduate faculty or administrators in pressing for a re-examination of the goals and purposes of the various graduate programs.

6. In those fields where doctoral enrollments have declined (chemistry, engineering, physics—the physical sciences generally) a drop in the number of qualified applicants based, in part, on discouraging labor market information seems as significant a cause, if not more significant, than the decline in fellowships and traineeships.

7. There is a clear differentiation in the labor markets served by the country's universities. Ph.D. recipients from the leading departments receive most of the new university positions and are, as a group, generally experiencing the least difficulty in job placement. Because the labor market is stratified, however, by both type of employer and geography, many graduates from the less prestigious departments have found employment while some graduates from the leading departments continue to search.

[38] See Stephen P. Dresch. *An Economic Perspective on the Evolution of Graduate Education* (Washington. D.C.: National Academy of Sciences, 1974), pp. 56–58.

8. Potential graduate students in the humanities and social sciences are less responsive as a group to labor market considerations in their decision-making than are potential students in the physical sciences and engineering. In spite of the bleak employment outlook facing new Ph.D.'s in the humanities and in many social sciences, applications in those graduate fields have remained strong, while there has been a pronounced drop in both applications and enrollments in the physical sciences and in engineering.

9. Statistical data suggest that a number of the newer doctoral programs that were not included in the 1969 American Council on Education survey of graduate program quality have attained characteristics typical of reasonably high-rated departments.

10. The majority of departments continue to allocate funds for graduate student support on the basis of academic merit rather than financial need.

IMPLICATIONS FOR POLICY AND FUTURE RESEARCH

The period covered by this study, academic years 1967–1968 through 1972–1973, spanned the final years of growth and prosperity in graduate education and the first few years of the transition to an era of slower growth and diminished resources. The abruptness of change in the environment of graduate education, including the sudden shift from a labor market of excess demand to one of excess supply, and the equally rapid turnaround in federal policy toward support for graduate students and for research, combined with the continued establishment of new doctoral programs, created a great deal of concern about the future health and development of graduate education. Numerous dire predictions were made, stressing the common theme of the destabilizing and potentially disastrous effects that changes in federal and state policies were having upon various aspects of graduate education. The statistical data we have examined in this study, however, point toward a remarkable stability and resiliency in the graduate schools viewed as a system; it is as if a large hand had borne down upon the universities rather evenly, lowering or modulating activity levels in several disciplines but not redistributing enrollments or resources among the institutions to any significant extent. That the *system* of graduate schools has displayed such a pronounced homeostatic tendency over this turbulent 6-year period is all the more remarkable when one realizes that the trends examined reflect thousands of individual decisions made by people who were in no position to have an overview of how these decisions would aggregate to shape the direction of that "system." A market economy relies upon the price system to guide the allocation of resources in an "optimal" fashion when decisions are decentralized, but the presence of an "invisible hand" within the university sector cannot be assumed. Yet, in terms of the variables included in this study—while the system may not have developed in an

"optimal" fashion (whatever that would be), neither has it gone in directions that are obviously undesirable and socially detrimental.

It would be premature to conclude from this study, however, that graduate education in the United States will necessarily continue to evolve in the next decade in a socially desirable fashion. Much will depend upon the policies of the states and of the federal agencies that exercise great leverage over graduate education and research. If the role of the federal government continues to diminish in relative importance, state policies will take on increased significance in determining the future shape and direction of graduate education. At least one astute observer has questioned whether the elite university can survive the current era of egalitarian sentiment,[39] and one can easily imagine that many state governments will show little interest in providing broad support for research and doctoral-level education in many disciplines. If the states fail to support excellence where it currently exists (including the provision of state funds to private universities) and instead disperse funds in a manner that levels qualitative differences, then the prospects for continued high-quality graduate programs will be severely diminished. The state role in support of graduate education and research is an area of high priority for further investigation.

Another implication of the study is the clear and pressing need for greater and more explicit differentiation of function among the various graduate programs in the United States. Analysis of Ph.D. placement patterns by quality level of producing institution indicates that different employment markets are being served by different universities; yet, the significance of this fact seems to have been generally ignored. For example, departments that place the vast majority of their graduates in 2-year or 4-year colleges or in nonacademic positions, might question whether a traditional, research-oriented Ph.D. program is the most suitable preparation for their graduates; one might expect these universities to be at the forefront in developing practice-oriented, professional degree programs such as the Doctor of Engineering, Doctor of Economics, Doctor of Psychology, or Doctor of Arts. With some notable exceptions, however, programs designed in the mold of the traditional Ph.D. are dominant at these universities. Both the declining market for research scholars and the diminishing resources available for graduate education point to the need for increased diversity in the mission of graduate programs; the country is not likely to support at the necessary level of excellence over 250 universities producing research scholars in the traditional disciplines.

A related implication is the need for a better understanding of the types of pressures or stimuli that are likely to produce desirable changes in grad-

[39] T. R. McConnell, "Can the Elite University Survive?," *The Research Reporter*, Vol. VIII, No. 2 (Berkeley: Center for Research and Development in Higher Education, 1973).

uate programs. The degree of financial stress experienced by most departments over the last several years has not been an effective source of innovation; if anything, the reverse has been the case. Since the faculty make most of the key program decisions, there is a limit to what graduate deans and other administrators can do by way of stimulating change, particularly if the faculty are opposed. This is a subject that should repay careful thought, discussion, and more experimentation at individual universities.

The quality of students enrolling in graduate school in the 1970's by comparison with the 1960's is another subject in need of research. The present study traced changes in the number and distribution of graduate students, but did not assess any shifts in student quality that may be occurring. While one might hope that the process of contraction experienced by many disciplines in recent years has not reduced the enrollment of the most able students, we cannot assume that to be the case. A companion study focused on enrollment trends by selected measures of student quality would be most valuable. It is entirely possible that many of the most talented students in recent years have shifted away from graduate school and into such professional schools as law, business, and medicine, and—if such is the case—this would be a proper concern for public policy.

A closely related and vitally important topic is the degree to which the quality of graduate education and research have suffered from the financial stringencies and uncertainties of recent years. Most organizations, universities included, develop some "fat" during years of prosperity and rapid growth. Much of this can be pared away without serious damage to the organization's essential functions as a first reaction to financial stress. At some point, however, the cuts go deeper and quality suffers; we need to know the degree to which the university's ability to perform research and graduate education of the highest quality has been impaired. Such a study must go beyond the comparative approach used here, and tackle the much more difficult problem of measuring and evaluating absolute changes in performance.

The issue of need *vs.* merit in the awarding of funds for graduate student support warrants further thought and discussion within the graduate community. The variety of current practices has produced a confusing and divisive situation for both students and faculty. Perhaps no uniform procedure can (or should) be adopted; however, a survey of current practices together with a conference to discuss the findings and areas of disagreement would be a worthwhile activity.

Finally, an updating of the American Council on Education quality ratings of graduate departments should be done so that those Ph.D. programs that were not rated in the 1969 survey can be evaluated. Although these ACE surveys are controversial, the ratings are essential for policy-related research of the type done in this study, and provide one of the few available benchmarks for assessing change. A repeat of the ACE survey need not preclude

attempts to develop more comprehensive, multidimensional ratings for use in counseling potential graduate students; however, for policy research that focuses on the total university system, a single-dimensional rating that allows departments to be grouped and rank-ordered is preferable. The fact that this type of rating has tended to encourage imitation and discourage innovation in Ph.D. programs in the past need not be a problem if a more explicit differentiation of purpose and function among doctoral programs can be achieved. As long as the Ph.D. degree is the dominant doctoral degree, the ACE ratings will reinforce the single, research-oriented model of doctoral-level education. If more departments develop professional degree programs, such as the Doctor of Engineering, however, then the ACE ratings would not pose a problem since professional programs would be evaluated separately by different criteria.

Appendix A

Analyses of Public/Private University Differentials in Graduate Enrollments and Type of Graduate Student Support

Of the 1201 matched departments included in the statistical analyses of this report, 468 (39 percent) are in private universities, but within each quality grouping, the proportion of private institutions varies considerably, as shown in Table A1. Private institutions tend to be disproportionately represented in the top quality groups, and much of the "Gresham's Law of Ph.D. Enrollments" discussion has been based on the belief that the leading private universities have made the largest enrollment cuts. Pertinent data for the 14 disciplines covered in this study are contained in Table A2, which reports the proportion of first-year and total full-time graduate students enrolled in private institutions in each quality category over the 6-year period.

TABLE A1 Proportion of Private University Departments in Each Quality Category (14 disciplines)

Roose–Andersen Rating	Percent Private Departments
4.0–5.0	60.9
3.0–3.9	52.2
2.5–2.9	41.4
2.0–2.4	31.4
1.4–1.9	32.7
0.0–1.4	46.8
Not rated	25.8
TOTAL	39.0

SOURCE: Data from NSF Graduate Student Support Surveys.

TABLE A2 Proportion of Full-time Graduate Students Enrolled in Private University Departments, in each Quality Category, by Year (14 disciplines)

Roose–Andersen Rating	Percent Enrollment, by Fiscal Year					
	1968	1969	1970	1971	1972	1973
First-year full-time						
4.0–5.0	51.1	50.9	51.1	49.6	51.9	52.8
3.0–3.9	39.1	37.3	38.7	37.0	37.6	37.9
2.5–2.9	32.3	34.2	31.1	30.7	32.3	30.8
2.0–2.4	29.5	28.0	27.7	28.1	26.0	22.7
1.5–1.9	30.4	30.6	30.6	30.8	31.1	30.5
0.0–1.4	43.7	46.5	42.2	41.9	41.1	35.3
Not rated	21.6	19.3	21.5	22.5	20.7	19.4
TOTAL	35.7	34.9	35.0	34.2	34.3	33.5
Total full-time						
4.0–5.0	50.3	50.2	51.5	50.9	50.9	51.2
3.0–3.9	39.7	38.4	38.6	37.3	36.6	37.3
2.5–2.9	34.2	33.7	32.0	31.2	31.1	30.9
2.0–2.4	27.4	27.9	27.4	26.9	26.8	25.3
1.5–1.9	31.3	32.3	33.4	32.8	33.2	32.2
0.0–1.4	39.3	41.2	39.0	38.1	37.8	35.4
Not rated	21.8	20.5	21.4	21.1	20.9	20.4
TOTAL	36.2	35.6	35.6	34.7	34.4	34.1

SOURCE: Data from NSF Graduate Student Support Surveys.

Looking initially at trends in first-year enrollments, we note that the departments in private universities did enroll a smaller proportion of first-year graduate students in FY 1973 than in FY 1968, a decline from 35.7 to 33.5 percent. The highest rated (4.0–5.0) private departments, however, increased their proportion of enrollments relative to public university departments in the 4.0–5.0 category. As Table A2 shows, private university departments experienced the greatest declines relative to the public universities in the 2.0–2.4 and 0.0–1.4-rated categories.

With respect to total full-time enrollments, private university departments in the highest rated category (4.0–5.0) did not experience a decline in enrollments relative to the top-rated public university departments; in fact, they increased their share slightly over the 6-year period.[1] Within these 14

[1] The enrollment numbers for these two groups were:

Departments rated 4.0–5.0	FY 1968	FY 1973
Public	7,111	6,359
Private	7,186	6,661

disciplines, private universities in the 4.0–5.0 category accounted for 9.0 percent of total full-time graduate enrollments in FY 1968 and 8.9 percent in FY 1973[2]—evidence that the highest rated private universities have not experienced a disproportionate enrollment decline with respect to all categories of Ph.D.-producing institutions. As Table A2 shows, the private universities in total did enroll a smaller proportion of graduate students in FY 1973 than in FY 1968 (a drop from 36 to 34 percent), but the decline is distributed throughout the quality categories below 4.0–5.0. Consequently, these enrollment data do not lend support to a "Gresham's Law" phenomenon based on a public/private differential.

The next set of tables shows how the private universities in the cohort have fared on each of the major types of support relative to the public universities. Table A3 reports the percentage of fellowships and traineeships from all sources of funding in each quality category in the private university departments. Over the six years, the 468 private departments slightly increased their proportion, from 48 percent in FY 1968 to 49 percent in FY 1973. There was very little change in the private university proportion in any quality group, indicating that these institutions have not experienced a more severe decline in the number of these awards that they have to offer than have comparable quality public university departments.

Table A4 reports the proportion of research assistantships in each quality category in private university departments over the 6-year period. In total, the private departments maintained an essentially stable percentage relative to the public departments; the top-rated private departments (3.0–5.0), however, did gain several percentage points with respect to comparable quality public institutions, while the lower rated private departments lost relatively.

[2] These percentages were computed from data not included in the table.

TABLE A3 Proportion of Total Fellowships and Traineeships in Private University Departments, in each Quality Category, by Year (14 disciplines)

Roose–Andersen Rating	Percent Fellowship Enrollment, by Fiscal Year					
	1968	1969	1970	1971	1972	1973
4.0–5.0	62.2	61.8	61.0	61.3	64.6	64.5
3.0–3.9	54.6	53.6	54.6	53.1	52.7	53.2
2.5–2.9	44.0	41.5	40.2	42.1	43.1	45.2
2.0–2.4	34.6	35.9	35.0	32.9	34.8	33.7
1.5–1.9	39.3	39.3	38.7	41.0	40.4	41.3
0.0–1.4	49.2	48.2	44.5	45.8	49.6	47.3
Not rated	25.0	23.8	25.8	26.8	26.7	25.3
TOTAL	48.0	47.2	47.3	47.4	48.5	49.2

SOURCE: Data from NSF Graduate Student Support Surveys.

TABLE A4 Proportion of Total Research Assistantships in Private University Departments, in each Quality Category, by Year (14 disciplines)

Roose–Andersen Rating	Percent RA Enrollment by Fiscal Year					
	1968	1969	1970	1971	1972	1973
4.0–5.0	47.0	47.5	49.2	49.3	51.2	53.6
3.0–3.9	34.4	34.2	34.1	36.0	36.4	38.0
2.5–2.9	34.9	33.5	34.5	31.3	32.3	31.7
2.0–2.4	23.7	22.1	22.6	20.2	20.7	17.7
1.5–1.9	24.2	26.4	26.8	26.4	27.0	24.7
0.0–1.4	27.3	35.4	32.9	31.6	35.9	26.9
Not rated	22.1	25.2	25.0	22.4	20.2	19.8
TOTAL	34.3	34.3	34.8	33.9	34.6	35.0

SOURCE: Data from NSF Graduate Student Support Surveys.

Finally, Table A5 presents data in the same format for teaching assistantships. Private universities do not rely on graduate student teaching assistants to the same degree as public universities; these data show that they have only one-fourth the number of such positions. This fraction has varied little over the six years, and the leading two groups of departments have been relatively stable with respect to their public counterparts. Only the 0.0–1.4 and the non-rated private departments have declined in relation to comparably rated public departments.

From this investigation we conclude that the private university departments did not lose ground relative to their public university peer departments in terms of the number of fellowships, teaching and research assistantships they can offer. The relative standing of public and private departments in our matched cohort is virtually the same in FY 1973 as it was six years earlier. The "Gresham's Law" hypothesis, if it is interpreted in public/private terms, is not supported by these analyses.

TABLE A5 Proportion of Teaching Assistantships in Private University Departments, in each Quality Category, by Year (14 disciplines)

Roose–Andersen Rating	Percent TA Enrollment, by Fiscal Year					
	1968	1969	1970	1971	1972	1973
4.0–5.0	39.8	38.9	40.9	39.5	46.4	40.1
3.0–3.9	23.8	23.2	24.2	23.5	24.1	23.0
2.5–2.9	27.3	28.3	27.8	27.2	26.3	25.4
2.0–2.4	21.3	22.0	21.5	20.7	21.4	20.1
1.5–1.9	25.8	26.3	26.6	25.2	25.4	24.7
0.0–1.4	32.3	30.7	30.1	29.9	28.5	27.4
Not rated	21.3	20.6	20.9	19.1	18.0	16.8
TOTAL	26.2	26.1	26.3	25.2	25.5	24.1

SOURCE: Data from NSF Graduate Student Support Surveys.

Appendix B NSF Survey of Graduate Science Student Support

NSF Form 727 October 1972

NATIONAL SCIENCE FOUNDATION
SURVEY OF GRADUATE SCIENCE STUDENT SUPPORT, FALL 1972
DEPARTMENTAL DATA SHEET

OMB No. 99-R0276
Approval expires
December 31, 1973

(NOTE: Before filling out please read the instructions on the reverse)

1 Name and address of institution

2 Science Department (or unit) covered by this data sheet

3 Person in Department (or unit) preparing this form Name

4 Highest degree program offered by Department (or unit) in Fall 1972 (CHECK ONLY ONE) Master's _(1) Doctorate (including MD) _(2)

Department Code (See NRC Listing)

5 Full time graduate science students enrolled for advanced degrees (M.S. and Ph.D.) receiving support of $1,200 or more in Fall 1972

TYPE OF SUPPORT	CITIZENSHIP		U.S. GOVERNMENT SOURCE (EXCLUDING LOANS)										NON-U.S. GOVERNMENT SOURCE					ALL SOURCES		
			AEC (a)	VET. ADM. (G.I. BILL) (b)	DOD (c)	HEW: NDEA (d)	HEW: PHS (NIH) (NIMH) (e)	HEW: Other (f)	NASA (g)	NSF (h)	Other U.S. Government (i)	Total U.S. Government (a-i) (j)	Instit. Institutional Support a/ (k)	Govt., Comm., and Family (l)	Other U.S. Sources b/ (m)	Foreign Sources (n)	Total Non-U.S. Sources (k-n) (o)	Total (j)+(o) (p)	First Year (q)	Beyond First (r)
Fellowships and Traineeships	U.S.	(1)																		
	Foreign	(2)																		
Graduate Research Assistantships	U.S.	(3)																		
	Foreign	(4)																		
Graduate Teaching Assistantships	U.S.	(5)																		
	Foreign	(6)																		
Other Types of Support	U.S.	(7)																		
	Foreign	(8)																		
All Types Total		(9)																		
Of line (9) how many are	Men	(10)																		
	Women	(11)																		

6 Full time graduate science students enrolled for advanced degrees in this department as of Fall 1971 complete columns (j), (o), (p), (q), and (r)

7 Part time graduate science students enrolled for advanced degrees (do not include "special" students)

FALL 1971			FALL 1972		
First Year (a)	Beyond First (b)	Total (c)	First Year (d)	Beyond First (e)	Total (f)

8 Postdoctorals and/or Research Associates

FALL 1971		FALL 1972	
Total (a)	Recent Doctorates (since 1967) (b)	Total (c)	Recent Doctorates (since 1968) (d)

a/ Include institutions and State and local governments

b/ Include support from nonprofit institutions, industry, and all other U.S. sources

Appendix C

Survey of Earned Doctorates

NSF Form 888 1972
OMB No 99 R0084
Approval Expires June 30 1974

This form is to be returned to the GRADUATE DEAN, for forwarding to Manpower Studies Branch, Office of Scientific Personnel, National Research Council, 2101 Constitution Avenue, Washington, D.C. 20418

Please print or type.

A. Name in full: (Last Name) (First Name) (Middle Name) (7-28)

B. U.S. Social Security Number (10-18) CR ( ) Cross Reference: Maiden name or former name legally changed

C. Permanent address through which you could always be reached: (Care of, if applicable)

(Number) (Street) (City)

(State) (Zip Code) (Or Country if not U.S.)

D. Date of birth. (19-43) (Month) (Day) (Year) Place of birth (44-45) (State) (Or Country if not U.S.)

E. Sex 1 [ ] Male 2 [ ] Female (46)

F. Marital status. 1 [ ] Married 2 [ ] Not married (including widowed, divorced) (47)

G. Citizenship 0 [ ] U.S. native 2 [ ] Non U.S., Immigrant (Permanent Resident)
1 [ ] U.S. naturalized 3 [ ] Non U.S., Non Immigrant (Temporary Resident) (48)
If Non U.S., indicate country of present citizenship (49-50)

H. Racial or ethnic group. (Check all that apply.) 0 [ ] White Caucasian 1 [ ] Black-Negro-Afro-American
2 [ ] American Indian 3 [ ] Spanish American Mexican-American Chicano
4 [ ] Puerto Rican American 5 [ ] Oriental 6 [ ] Other, specify (51-53)

I. High school last attended: (School Name) (City) (State) (54-55)

Year of graduation from high school: (56-57)

J. List in the table below all collegiate and graduate institutions you have attended including 2-year colleges. List chronologically, and include your doctoral institution as the last entry

Institution Name	Location	Years Attended From	Years Attended To	Major Field Use Specialties List Name	Major Field Use Specialties List Number	Minor Field Number	Degree (if any) Title of Degree	Degree (if any) Granted Mo	Degree (if any) Granted Yr

K. Enter below the title of your doctoral dissertation and the most appropriate classification number and field. If a project report or a musical or literary composition (not a dissertation) is a degree requirement, please check box. ☐ 48

Title

(Classify using Specialties List)

Number Name of field

(52-64)

L. Name the department (or interdisciplinary committee, center, institute, etc.) and school or college of the university which supervised your doctoral program:

(Department) (School) (65-80)

M. Name of your dissertation adviser: (please print) (8-20)

(Last Name) (First Name) (Middle Initial)

continued on next page

BEST COPY AVAILABLE

SURVEY OF EARNED DOCTORATES, Cont.

N. In the space in front of each source of support, indicate the approximate number of semesters you were supported by each of the listed sources during graduate school

21 NSF Fellowship
22 NSF Traineeship
23 NIH Fellowship
24 NIH Traineeship
25 NDEA Fellowship
26 Other HEW
27 AEC Fellowship
28 NASA Traineeship
29 GI Bill
30 Other Federal support (specify)
31 Woodrow Wilson Fellowship
32 Other U S national fellowship (specify)
33 University fellowship
34 Teaching Assistantship
35 Research Assistantship
36 Educational fund of industrial or business firm
37 Other institutional funds (specify)
38 Own earnings
39 Spouse's earnings
40 Family contributions
41 Loans
42 Other (specify)

O. Please check the space which most fully describes your status during the year immediately preceding the doctorate.

0 [ ] Held fellowship
1 [ ] Held assistantship
2 [ ] Held own research grant
3 [ ] Not employed
4 [ ] Part time employed

Full time Employed in (Other than 0, 1, 2)
5 [ ] College or university, teaching
6 [ ] College or university, non-teaching
7 [ ] Elem or sec school, teaching
8 [ ] Elem or sec school, non teaching
9 [ ] Industry or business
(10) [ ] Other (specify)

(12) [ ] Any other (specify) (43)

P. How many years (full time equivalent basis) of professional work experience did you have prior to the doctorate?
(include assistantships as professional experience) (44-45)

Q. U.S veteran status.
0 [ ] Veteran, or in service, dates of active duty from (year) to (year)
1 [ ] Non veteran
2 [ ] Not applicable (46 50)

[redacted]

R. How well defined are your postgraduation plans?
0 [ ] Have signed contract or made definite commitment
1 [ ] Am negotiating with a specific organization, or more than one
2 [ ] Am seeking appointment but have no specific prospects
3 [ ] Other (specify) (51)

[redacted]

T. If you plan to be on a postdoctoral fellowship, associateship, or traineeship —

What is the purpose?
0 [ ] To add experience in your present field (53)
1 [ ] To change to a field different from that of the doctorate (Please enter number of new field from Specialties List) (54 56)

What is the primary source of support?
0 [ ] U S Government
1 [ ] College or university
2 [ ] Private foundation
3 [ ] Nonprofit, other than private foundation
4 [ ] Other (specify) (57)

U. If you plan to be employed enter military service, or other —

What will be the type of employer?
0 [ ] 4 year college or university
1 [ ] Jr or community college
2 [ ] Elem or sec school
3 [ ] Foreign government
4 [ ] U S Government
5 [ ] State or local government
6 [ ] Nonprofit organization
7 [ ] Industry or business
8 [ ] Self employed
9 [ ] Other (specify) (58)

Indicate primary work activity with "1" in appropriate box, secondary work activity (if any) with "2" in appropriate box.
0 [ ] Research and development
1 [ ] Teaching
2 [ ] Administration
3 [ ] Professional services to individuals
5 [ ] Other (specify) (59 60)

In what field will you be working?
Please enter number from Specialties List (61-63)

V. What is the name and address of the organization with which you will be associated?

(Name of Organization)

(Street) (City State) (Or Country if not U S) (64 69)

[redacted]

W Please indicate, by circling the highest grade attained, the education of

		Elementary school	High school	College	Graduate		
your father	none	1 2 3 4 5 6 7 8	9 10 11 12	1 2 3 4	MA, MD PhD	Postdoctoral	(70)
your mother	none	1 2 3 4 5 6 7 8	9 10 11 12	1 2 3 4	MA, MD PhD	Postdoctoral	(71)
	0	1 2 3	4 5	6 7	8 9	(11)	

Signature Date completed (72 73)

98

Appendix D

Data Coverage of Rated and Non-Rated Departments

The principal data source for this study, the National Science Foundation Graduate Student Support Surveys, did not provide complete coverage of all doctoral-granting departments in the 14 disciplines examined. This appendix provides detailed information on the coverage of both rated[1] and non-rated departments included in the study.

Since the number of rated departments in each field is known precisely, there is no uncertainty about the degree of coverage; there are difficulties with the non-rated group, however, as this appendix will make clear.

Table D1 lists the total numbers of departments in each field covered by the American Council on Education Roose–Andersen survey and the number of departments for which data from the NSF Surveys of Graduate Student Support were available for the 6-year period, FY 1968–FY 1973. The published Roose–Andersen report did not reveal the number of departments rated 4.0–5.0 and 3.0–3.9, but instead aggregated the 3.0–5.0 departments, and did not report the number of institutions rated below 2.0. In keeping with this pattern, the departments have been aggregated into three rated categories: 3.0–5.0, 2.0–2.9, and 0.0–1.9.

As Table D1 indicates, the coverage of rated departments by field ranges from a high of 98.4 percent in chemistry to a low of 63 percent in sociology. The coverage is generally better in the physical sciences and in engineering than in the social sciences.

[1] Kenneth D. Roose and Charles J. Andersen. *A Rating of Graduate Programs* (Washington, D.C.: American Council on Education, 1970.

TABLE D1 Coverage of Rated Departments in Each of 14 Fields, by Three Aggregated Quality Categories

Roose–Andersen Rating	No. Departments Anthropology		No. Departments Chem Engineering		No. Departments Chemistry		No. Departments Civil Engineering		No. Departments Economics	
	Roose–Andersen[a]	Present Study	Roose–Andersen	Present Study	Roose–Andersen	Present Study	Roose–Andersen	Present Study	Roose–Andersen	Present Study
3.0–5.0	16	15	17	17	38	37	18	15	19	17
2.0–2.9	16	13	41	36	41	41	38	31	26	24
0.0–1.9	10	5	15	11	45	44	9	7	46	29
TOTAL	42	33	73	64	124	122	65	53	91	70
Percent rated departments included in present study	78.5		87.7		98.4		81.5		76.9	

Roose–Andersen Rating	No. Departments Elec Engineering		No. Departments Geography		No. Departments Geology		No. Departments Mathematics		No. Departments Mech Engineering	
	Roose–Andersen	Present Study	Roose–Andersen	Present Study	Roose–Andersen	Present Study	Roose–Andersen	Present Study	Roose–Andersen	Present Study
3.0–5.0	28	25	15	14	21	19	27	24	20	14
2.0–2.9	26	23	11	9	33	30	38	38	38	32
0.0–1.9	24	22	8	4	15	7	37	31	13	10
TOTAL	78	70	34	27	69	56	102	93	71	56
Percent rated departments included in present study	89.7		79.4		81.2		91.2		76.9	

TABLE D1 (Continued)

Roose–Andersen Rating	No. Departments Physics		No. Departments Political Science		No. Departments Psychology		No. Departments Sociology	
	Roose–Andersen	Present Study	Roose–Andersen	Present Study	Roose–Andersen	Present Study	Roose–Andersen	Present Study
3.0–5.0	30	29	22	21	32	28	21	18
2.0–2.9	39	39	22	15	44	35	25	18
0.0–1.9	44	41	30	17	34	26	27	10
TOTAL	113	109	74	53	110	89	73	46
Percent rated departments included in present study	96.5		71.6		80.9		63.0	

[a] Roose Andersen report.

For many of the text tables, aggregated data for the 14 disciplines were reported with all 4.0–5.0-rated departments summed, all 3.0–3.9-rated departments summed, and so forth. Coverage by rated category for these aggregated tables is reported in Table D2.

The most serious underrepresentation occurs in the 0.0–1.4-rated category, with 64.2 percent coverage in this study. This means that, had full coverage been available in all categories, the proportion of enrollment in the lowest rated group would probably have been larger in each of the six years than our tables show. If there is any bias in the 0.0–1.4-rated departments that did submit survey forms each year relative to those that did not, we suspect that bias is toward the stronger, and possibly larger, departments that were actively seeking NSF traineeships. (For the first five years, the survey was filled out as part of the traineeship application process.)

Determining the total number of non-rated, doctorate-granting departments in each of the 14 disciplines proved surprisingly difficult. To the best of our knowledge, there is no single authoritative and unambiguous source of information on the number of active doctoral programs in a given discipline. One cannot rely on university catalogues because they often list programs that are, in fact, not active. Nor can one use published reports on graduate enrollments as a guide, since such reports do not separate terminal master's enrollments from doctoral enrollments. A department that has offered a master's program for several years and then announces a new doctoral program may continue to enroll primarily master's students for several years thereafter.

These considerations led us to the conclusion that the best evidence of an active doctoral program is the production of at least one Ph.D. Three sources of information on degree production were examined, and each has deficiencies for our current purposes. The sources are: the U.S. Office of Education, Higher Education General Information Survey (HEGIS), *Earned Degrees*

TABLE D2 Coverage of Rated Departments for Aggregated 14 Fields by Quality Category

Roose–Andersen Rating	Total No. Roose–Andersen Departments	Total No. Departments in Present Study	Percentage Present Study/ Roose–Andersen
4.0–5.0	96	92	95.8
3.0–3.9	228	201	88.2
2.5–2.9	200	174	87.0
2.0–2.4	238	210	88.2
1.5–1.9	185	153	82.7
0.0–1.4	173	111	64.2
TOTAL	1,120	941	84.0

SOURCE: Roose-Andersen report and NSF Graduate Student Report survey.

Conferred;[2] The Council of Graduate Schools, *Graduate Programs and Admissions Manual*;[3] and the National Research Council, Doctorate Records File.

If one is concerned with departments as institutional entities, the HEGIS report, with the improved taxonomy adopted in FY 1970, is probably the best source since the forms for the survey were completed by official representatives of the universities and the report generally follows the institution's organizational structure. The major limitation is that data on earned degrees conferred are slow in being tabulated and reported; at this writing (Fall, 1974), the most recent data available are for FY 1971. The *Graduate Programs and Admissions Manual, 1973–1974* is more current, but coverage is not complete. Over 500 institutions offering graduate work responded to the survey, representing over 85 percent of graduate enrollment; several rated doctoral programs are missing from the survey however, as well as an unknown number of non-rated programs. Finally, the Doctorate Records File provides virtually complete coverage on Ph D. production, but the forms are filled out by individual doctorate recipients and are categorized by discipline rather than departmental code. Although there is reasonably close correspondence between the student's reported specialty and an academic department by the same name, the correspondence is by no means perfect. In particular, it is possible for there to be fewer academic departments in existence than a count from the Doctorate Records File might suggest.

Given these limitations, Table D3 reports the number of non-rated departments in each discipline included in this study, together with the number of non-rated departments reporting at least one doctorate produced in fiscal 1971 in the HEGIS report; at least one doctorate awarded in 1969–1972 as reported in the *Graduate Programs and Admissions Manual, 1973–1974*; and at least one doctorate awarded in FY 1972 in the Doctorate Records File. In addition, the number of non-rated departments that reported the existence of a doctoral program in the *Graduate Programs and Admissions Manual, 1973–1974*, whether or not a doctorate has ever been awarded, is also reported.

Of the various columns in Table D3, we believe the HEGIS data provide the best estimate of the number of active, non-rated, doctorate-granting departments, although the numbers are understated to some degree because the data are not current. Several more years will be required to determine whether the large number of departments that list doctoral programs become significant producers of Ph.D.'s.

[2] U.S. Office of Education, *Earned Degrees Conferred* (Washington, D.C.: U.S. Government Printing Office, published annually).

[3] Graduate Record Examinations Board and The Council of Graduate Schools in the United States, *Graduate Programs and Admissions Manual* (Princeton, New Jersey: Educational Testing Service, published annually).

TABLE D3 Coverage of Non-Rated Departments: Number of Non-Rated Departments Reported, by Source and Year (14 disciplines)

Discipline	No. Non-Rated Departments in Present Study	No. Non-Rated Departments Producing At Least 1 Ph. D			Non-Rated Departments, FY 1973–FY 1974 (GREB/CGS)[a]
		1969–1972 (GREB/CGS)[a]	FY 1971 (U.S.O.E.)[b]	FY 1972 (NRC/DRF)[c]	
Anthropology	6	20	12	20	29
Chemical Engineering	17	20	24	21	23
Chemistry	46	41	52	55	52
Civil Engineering	12	14	15	19	27
Economics	10	15	13	23	22
Electrical Engineering	25	24	31	28	35
Geography	7	11	10	13	14
Geology	11	17	14	30	24
Mathematics	27	31	31	40	37
Mechanical Engineering	23	25	29	29	33
Physics	37	37	42	38	45
Political Science	8	16	17	22	31
Psychology	21	33	37	53	48
Sociology	10	17	13	22	33
TOTAL	260	321	340	413	453

[a] Reported in Graduate Record Examination Board and Council of Graduate Schools. *Graduate Programs and Admissions Manual, 1973–1974* (Princeton, New Jersey: Educational Testing Service, 1973).

[b] U.S. Office of Education, *Earned Degrees Conferred. 1970–71* (Washington, D.C.: U.S. Government Printing Office. 1973).

[c] NRC Doctorate Records File

NATIONAL BOARD ON GRADUATE EDUCATION
PUBLICATIONS

Board Reports

1. *Graduate Education: Purposes, Problems and Potential*, November 1972, 18 pp.

2. *Doctorate Manpower Forecasts and Policy*, November 1973, 22 pp.

3. *Federal Policy Alternatives Toward Graduate Education*, March 1974, 127 pp.

Technical Reports

TR 1. *An Economic Perspective on the Evolution of Graduate Education*, by Stephen P. Dresch, March 1974, 76 pp.

TR 2. *Forecasting the Ph.D. Labor Market: Pitfalls for Policy*, by Richard Freeman and David W. Breneman, April 1974, 50 pp.

TR 3. *Graduate School Adjustments to the "New Depression" in Higher Education*, by David W. Breneman, with a *Commentary by the National Board on Graduate Education*, February 1975, 96 pp.

Other Publications

An Annotated Bibliography on Graduate Education, 1971–1972, October 1972, 151 pp.

"Comment" on the Newman Task Force Report on the Federal Role in Graduate Education, June 1973, 13 pp.