Projecting the Ph.D. Labor Market: NSF and BLS Disagree

The National Science Foundation (NSF) and Bureau of Labor Statistics (BLS) independently developed models to project the labor market for Ph.D.'s in 1985.* Although both project a surplus of Ph.D.'s in the sciences and engineering in 1985, they differ substantially in their estimates of the extent of that surplus. This raises the questions of why the projections are so different, what faith can be placed in such numbers, and what effects the projections will have on federal policy, university planning, and on career choices by students.

Incongruities between the projections by the NSF and the BLS occur in the estimates of both the supplies of and the demands for Ph.D.'s in 1985. The most dramatic differences are in the estimates of the surplus of Ph.D.'s in the life sciences, but in no field do the two groups agree in their projections. The NSF estimates in its "probable" model (NSF also has a "static" model, whose predictions it considers less likely to occur) that there will be 92,100 Ph.D.'s in the life sciences in 1985 but jobs in science-related areas for only 85,000 of them, which leaves a surplus of 7.7 percent. On the other hand, the BLS estimates a supply of 137,700 life science Ph.D.'s in 1985, a demand for 73,100 and thus a surplus of about 47 percent. The two groups claim they define "life sciences" in the same way. In most fields, the NSF's probable model leads to lower estimates of numbers of Ph.D.'s, numbers of jobs, and percent oversupply of Ph.D.'s than does the BLS model (Table 1).

**Projections of Science and Engineering Doctorate Supply and Utilization 1980 and 1985* (National Science Foundation, NSF 75-301, Washington, D.C., 1975); *Ph.D. Manpower: Employment, Demand, and Supply 1972–1985* (Department of Labor, Bureau of Labor Statistics, 1975, Bulletin 1860, Washington, D.C., 1975).

The NSF and the BLS are well aware of these differences in their projections and a representative of the NSF recently met with a representative of the BLS to try to analyze the causes of their disagreements. According to Joseph Cangialosi, who is preparing a report on this matter for the NSF, differences occur in all aspects of the models. For example, the BLS bases its projection of supplies of Ph.D.'s on estimates made by the Office of Education in 1973. The NSF developed its own demographic model to project supplies of Ph.D.'s. The BLS also assumes a smaller degree of "enrichment" or "upgrading" of jobs (the employment of Ph.D.'s in jobs which previously were not held by Ph.D.'s) will occur than does the NSF. And, as Charles Falk of the NSF points out, the NSF projections change markedly in response to changes in estimates of the amounts of job enrichment that will occur.

Cangialosi noticed that the NSF and the BLS even differ in their estimates of the number of social scientists actually employed in 1972. He found this surprising since both groups claim they obtained their data on 1972 employment from the National Academy of Sciences. However, the BLS assumes that there were 63,800 social scientists employed in 1972 and the NSF assumes there were 51,900 employed in 1972—a difference of 22.9 percent. The Academy backs up the NSF figures.

One major difference between the NSF's probable model and the BLS model is that the NSF gives double weight to the trends of the past 5 years in estimating future supplies of Ph.D.'s from trends of the past 12 years. According to the NSF's own analysis, this double weighting significantly decreases its estimate of the number of Ph.D.'s who will enter the job market in the future. The BLS model has no analogous treatment of recent trends.

The different estimates may also partly reflect the differing goals and constituencies of the two agencies, according to some critics. The NSF's primary constituency is the universities, many of whose leaders would rather not be told that there will be an "oversupply" of Ph.D.'s—they prefer to think that the economy would be "enriched" if more jobs were designated for Ph.D.'s. The BLS, on the other hand, may be more responsive to the perceptions of employers, many of whom lament that the universities are turning out too many narrowly trained doctorates when the employers need more versatile, less highly trained employees. One close observer of the situation says that the BLS chose to make its own projections—the first it has ever made of the Ph.D. labor market—because it was concerned that results from the NSF's continuing series of projections might reflect the fact that "the NSF is a vested interest group."

If projecting the future Ph.D. labor market were merely an academic exercise, there would be little cause for concern about the discrepancies between the NSF and the BLS results. However, these projections are, apparently, used by those who plan education policies and decide on research and development funding. According to Falk, the NSF estimates are known to, and likely used by, White House consultants, the Office of Management and Budget, and the National Science Board. David Breneman of the Brookings Institution believes that a previous NSF estimate of future Ph.D. surpluses undoubtedly played a role in the decision, during the Nixon Administration, to cut back federal support for graduate students.

Educational institutions also are said to use the NSF and BLS projections. Elinor Abramson of the BLS gives the example of an official at a university in Texas who used the BLS projections to justify his conviction that a particular Ph.D. program should not be initiated. Charles Kidd of the Association of American Universities believes that the NSF projections are considered by many graduate deans and chairmen of science departments when they de-

Table 1. Comparisons by the National Science Foundation and the Bureau of Labor Statistics of employment prospects for Ph.D.'s in 1985.

Field	Number of Ph.D.'s							
	National Science Foundation				Bureau of Labor Statistics			
	Supply	Demand	Surplus	Percent surplus	Supply	Demand	Surplus	Percent surplus
Physical sciences	85,200	76,000	9,200	**10.8**	118,700	91,700	27,000	**22.7**
Engineering	63,300	45,000	18,300	**28.9**	80,100	59,100	21,000	**26.2**
Mathematics	21,600	16,000	5,600	**25.9**	31,400	19,800	11,600	**36.9**
Life sciences	92,100	85,000	7,100	**7.7**	137,700	73,100	64,600	**46.9**
Social sciences	112,700	71,000	41,700	**37.0**	153,700	87,100	66,600	**43.3**

Congress Looks Harder at Cancer

Ever since President Nixon launched his crusade against cancer, the National Cancer Institute has enjoyed immensely increased budgets from Congress and the Administration with few hard questions asked. Cancer's privileged immunity may now be coming to an end. A few congressmen are beginning to question the priorities of the national cancer program. Their concerns are prompted by the recent upturn in the national cancer mortality rate, a growing alarm about environmental carcinogens, and a feeling that the National Cancer Institute should now be asked to show some results of the largesse thrust upon it.

Congress is by no means ready to mandate a major reordering of priorities. Last September, for example, an attempt by Senators Alan Cranston (D–Calif.) and Gaylord Nelson (D–Wis.) to take money away from the National Cancer Institute and distribute it to other members of the National Institutes of Health was defeated by a vote of 62 to 19. Nonetheless, the vote indicates a certain cooling of senatorial ardor from the days when Nelson was the only member to vote against the hubristically named Conquest of Cancer Act in 1971.

Early this month the House Intergovernmental Relations Subcommittee announced that it will inquire into the quality of research conducted by the National Cancer Institute. The subcommittee, which held an important review of the National Institutes of Health in the 1960's, also plans to look at the other institutes which have received budget increases, such as the National Heart and Lung Institute. Cancer, however, is first on its list.

"We have had 4 years of increased budgets for cancer, and we want to see what the American public is getting for its money," says committee staff member Gilbert Goldhammer. A chief interest with the committee is to know what the National Cancer Institute is doing about environmental carcinogens and how it is coordinating the actions of the other agencies involved in the area. The committee will also look at the institute's heavy investment in the role of viruses in cancer. "It sounds reasonable to assume that there must be a virus causation in humans," observes Goldhammer, "but why can't this be established after so many years of effort in the area? Is this a blind alley? We don't expect the National Cancer Institute to produce a magic cure from a hat, but we do want to know if they are on the right track."

The subcommittee staff will decide whether to recommend hearings after talks with National Cancer Institute director Frank Rauscher.

Another congressman to express opposition to the present priorities of the national cancer program is Representative David R. Obey (D–Wis.). Obey, a member of the House appropriations subcommittee that reviews the health budget, is a close friend of his fellow Wisconsinian and cancer critic Senator Nelson. In a recent newsletter to constituents, Obey argues that research funds have been misallocated, that prevention has been underemphasized, and enforcement efforts misdirected.

"Because Congress and the Administration have been engaging in a misguided political race to show who cares most about cancer, the budget for the National Cancer Institute has more than tripled in the last 5 years (from $233 to $743 million). But that growth in NCI's budget has been financed by strangling the budgets of other research institutes. . . ." A second problem, according to Obey, is that the regulatory agencies responsible for preventing human exposure to environmental carcinogens have been neglected in the rush to pour money into the NCI simply because it is labeled "cancer institute."

The position of the National Cancer Institute is that it is well aware of the existence of environmental carcinogens and is devoting an appropriate share of its resources to the problem. Just over $100 million, or 17 percent of its total budget, was spent on environmental carcinogenesis in 1974, director Rauscher told the Senate subcommittee on the environment. Rauscher accepts the widely quoted estimate that 60 to 90 percent of all cancer has an environmental cause. But according to James A. Peters, the institute's director for cancer cause and prevention, tobacco probably accounts for 40 percent of the cancer mortality, dietary factors may be responsible for 25 to 30 percent, and occupational factors for another 10 percent. This leaves only 10 to 15 percent attributable to environmental pollution. "Are we doing enough about environmental carcinogenesis?—We think we are," says Peters.—N.W.

cide what courses to teach, whether to gear graduate courses toward academic employment, and how many graduate students to admit, and by state legislators who allocate funds to universities.

Breneman claims that students generally consider advice of others, such as a professor, when deciding on graduate careers rather than going directly to projections of the future job market. However, if the professors obtain their ideas of future job markets for Ph.D.'s from NSF and BLS projections, these projections could indirectly influence students' decisions. The BLS explicitly hopes its projections will be used in this way when it states, in its report, that, from its estimates, "valuable insight can be obtained for planning careers, education and training."

Because the NSF and BLS projections are widely used, some critics contend that attempts should be made to incorporate more realistic assumptions into the models. For example, Breneman and his associate Richard Freeman of Harvard University point out that students in sciences and engineering react strongly to the job market when making career decisions, as exemplified by the market downturns in enrollments in graduate physics programs when the job market for physics Ph.D.'s became bleak. These investigators feel that the lack of explicit feedback mechanisms to account for this effect is a serious drawback of models such as those used by the NSF and the BLS.

Cognizant of the inevitable criticisms of projections, Falk and Abramson stress that people should look not at the numbers but at the trends that appear in the NSF and BLS results. Both models lead to projections of surplus Ph.D.'s, and Abramson contends that the projections should serve as a warning that past trends cannot be continued. However, others claim that if a policy-maker sees a projection of a 7.7 percent oversupply of life scientists in 1985, his course of action might be different from that selected if the projection is a 47 percent oversupply. Kidd, in fact, believes that people who see such disparities between the NSF and the BLS estimates are likely to ignore both projections.

Since the making of projections is such an inexact science, Breneman suggests that forecasters may be asking the wrong questions. Compared to labor markets, future college enrollments and needs for new faculty members can be predicted with far greater confidence; and, from demographics alone, it seems likely that few future Ph.D.'s will obtain academic employment. Such predictions could be used to encourage universities to train graduate students for careers in industry or in research and development firms and laboratories and to

move away from training students in narrow areas of specialization, Breneman believes.†

†Breneman expands on the problems involved in forecasting in *Outlook and Opportunities for Graduate Education* (National Board on Graduate Education, Washington, D.C., December 1975).

However, if for no reason other than to oil the machinery of bureaucratic decision-making, there is a demand for projections such as those made by the NSF and the BLS. The glaring differences between the two reports may, then, serve the useful purpose of exposing the projections for what they are, thereby leading users of the projections to look more closely at the underlying assumptions of the models. This may discourage users from placing blind faith in the numbers.—GINA BARI KOLATA

Brigham Young University: An Alternative R & D Style

During the expansionary heyday of higher education in the 1950's and 1960's, no aspiring university was complete without a progressively bigger and better science research and graduate education program funded primarily by the federal government. One exception has been Brigham Young University, whose budget is heavily underwritten by the (Mormon) Church of Jesus Christ of Latter-Day Saints (LDS). BYU, with more than 25,000 students, has gone through a period of growth and development in many ways typical of American higher education since World War II. But throughout this period, as a result of LDS attitudes, BYU, located in Provo, Utah, has sought to minimize dependence on support from federal agencies.

Independence has a price. BYU's attitude toward federal funding has limited its horizons as a research university. BYU has a relatively small graduate program—about 2000 students—and only about one in eight graduate students is in doctoral programs. BYU has no medical school nor is it strong in "Big Science" sectors—high energy physics, for example—which typically require large injections of federal funds.

Given BYU's spirit of abnegation toward federal funding, however, some of the research efforts at the university seem surprisingly ambitious. Two examples are research on synthetic diamonds and a fusion project (see box, page 366). As for BYU's place in the academic community, it seems to be a member in good standing of the usual scholarly and accrediting organizations and appears to be viewed by academics in other universities in the region as a solid, middle-quality, if somewhat exotic, place.

BYU recognizes that its policies on federal funding place it at a disadvantage with respect to research and has sought systematically to maximize its R & D program. In addition to relying on generous funding from the LDS church, the university has encouraged faculty to undertake outside research to a degree that is unusual today. Within the university, through a combination of cooperation and austerity, efforts are being made to compensate for the restrictions on federal R & D funding. BYU, in effect, is seeking to demonstrate an alternative to the federal model of research financing.

The attitudes which prompted BYU to cut down on federal research are deeply ingrained. They have roots in the value the Mormons place on self-reliance, reinforced by government persecution in the 19th century. The LDS church is conservative in its social and economic outlook. For example, since the 1930's it has taken a dim view of federal relief and welfare programs and has provided its own program of assistance for its members, strongly stressing self-help. At BYU the influence of the LDS church, reflected most obviously in a rigorous code of conduct and appearance for students, faculty, and staff, has made both campus life and the academic program differ from those at other universities. These differences inspired BYU to challenge federal regulations on sex discrimination (*Science*, 16 January). The church has been suspicious of federal aid to education at any level on the grounds that strings would inevitably be attached.

At BYU, federal R & D funding was never permitted to grow very large. The total of federal grants and contracts reached a peak of about $3.5 million in 1971 and was growing rapidly when a decision was made to cut back to a level of under $1.5 million, mostly in basic research funds.

BYU's criterion for accepting federal R & D grants and contracts is, so to speak, value for money. BYU president Dallin H. Oaks says that the aim is to provide research results which will help directly to meet national problems. An underlying assumption seems to be that, for a private, religiously based university, the less the reliance on federal support, the smaller the basis for federal intrusion.

Because BYU is an avowedly religious institution, outsiders often raise the question of the effect of church doctrine on teaching, particularly of evolutionary theory. Some BYU critics are convinced that Mormons believe in the literal truth of the Old Testament account of the creation and that this is reflected in teaching at BYU. When this question is raised, the answer from BYU faculty is that the Mormon church has no official stand on the mechanism of evolution and that BYU's teaching, textbooks, and reference books dealing with evolutionary theory are no different from those at most universities. They acknowledge that some Mormons, including members of the BYU faculty, take a fundamentalist view and that some students not in the sciences may therefore believe that the church has taken such a stand. One biology professor noted that this view is "founded firmly in the air." The latest doctrinal word from the church, which was pronounced in 1909, holds that Adam and Eve were "the first parents of the race," but leaves open the question of how humans evolved.

In the development of the research program at BYU, church doctrines have been less of a limiting factor than finding a substitute for federal funds, and BYU's R & D budget falls far below the budgets of many universities of comparable size. For example, the University of Utah, with a somewhat smaller enrollment, has a total operating budget of about $100 million. Utah's R & D budget is about $40 million, most of it federal money. The LDS church is secretive about its financial affairs, and budget figures for BYU are not made public. Fairly reliable estimates, however, put the BYU operating budget at little more than half the University of Utah budget. Informed sources at BYU estimated that with federal funding running at less than $1.5 million annually, the total BYU R & D effort is at about the $3.5 million level it had attained in the early 1970's with double the present federal support.

Current dollar figures may be somewhat misleading, however. Faculty members are